U.S. Army Corps
of Engineers

Galveston District
Southwestern Division

Corpus Christi Ship Channel, Texas
Channel Improvement Project

Volume II

Appendices

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APPENDIX A

SECTION 404(b)(1) EVALUATION

APPENDIX A

CORPUS CHRISTI SHIP CHANNEL, TEXAS, CHANNEL IMPROVEMENTS PROJECT

SECTION 404 (b) (1) EVALUATION

I. Project Description

a. Location

The study area for the Corpus Christi Ship Channel – Channel Improvements Project (CCSCCIP) encompasses Corpus Christi Bay, including the southern section of Redfish Bay and the northernmost section of the Laguna Madre, Nueces Bay, the lower Nueces River (12 miles), Tule Lake Channel, Viola Channel, La Quinta Channel, and the watershed surrounding these water bodies up to roughly ½ mile inland from all shorelines. The coastline of this area extends across Nueces and San Patricio counties and is adjacent to the cities of Corpus Christi, Portland, Ingleside by the Bay, and Port Aransas. The study area also includes the Gulf of Mexico to the end of the proposed channel and the offshore placement areas (PA). The existing authorized Federal navigation project consists of channels and turning basins suitable for oceangoing vessels, rubble-stone jetties, and a stone dike. The channel begins at deep water in the Gulf of Mexico about 4.3 miles offshore, passes through the jettied inlet, and extends about 21 miles westward to Corpus Christi. Continuing west, the channel extends about 8.5 miles through the harbor area before terminating at the Viola Turning Basin. The north and south jetties are 11,190 and 8,610 feet (ft) long and extend into the Gulf from San Jose and Mustang islands, respectively, and stabilize the natural inlet of Aransas Pass. The stone dike on San Jose Island connects with the north jetty and extends 20,991 ft up the island. The La Quinta Channel extends from the basin and mooring facilities at Ingleside Point, which is about half-way between the Gulf of Mexico and Corpus Christi, about 5.7 miles to La Quinta.

b. General Description

This Section 404 (b)(1) evaluation addresses the discharge of dredged or fill material into the waters of the United States. The objectives of the CCSCCIP include improvements to the efficiency and safety of the deep-draft navigation system, and maintenance or enhancement of the quality of the area's coastal and estuarine resources. Maintenance and enhancement of the area's coastal and estuarine resources are associated with potential for reduced accidents and oil spills; beneficial use of dredged material; minimization of effects to oyster beds, seagrasses, and other valuable habitats; and avoiding areas of known cultural resources. To achieve the objectives, the following is proposed: (1) deepen the Corpus Christi Ship Channel (CCSC) from –45 ft MLT to –52 ft MLT, plus advanced maintenance and allowable over-depth, which will extend the channel roughly 10,000 ft into the Gulf of Mexico; (2) widen the CCSC from Port Aransas to the Harbor Bridge from 400 - 500 ft to 530 ft; (3) extend the La Quinta Channel 7,200 ft at a depth of –39 ft MLT and a width of 300 ft and include a turning basin; and (4) add 200-ft wide barge shelves (–12 ft MLT) on both sides of the ship channel from La Quinta Junction to the Harbor Bridge. The Beneficial Uses Plan will create roughly 1,035 acres of potential shallow-water, unvegetated, and seagrass habitat, including emergent, intertidal and marsh habitat as well as 40 acres of open-bay, upland habitat. All of the beneficial uses are with new work material. Mitigation will be provided for the loss of 5 acres of seagrass and 40 acres of shallow-bay bottom less than –4 ft MLT, which will be removed during construction of the La Quinta Extension. New work from the offshore reach will be used beneficially to create two areas of topographic relief, while maintenance material from the offshore reach will be placed in an existing designated offshore placement site.

c. Authority and Purpose

A congressional resolution was adopted 1 August 1990 by the committee on Public Works and Transportation, U.S. House of Representatives, which authorized the U.S. Army Corps of Engineers (USACE) to review the reports on the Port Aransas-Corpus Christi Ship Channel, Texas (45-foot project) published as House Document 99, 90th Congress, Second Session, and other pertinent reports to determine the feasibility of deepening the CCSC system to accommodate large vessels, increase shipping efficiency, and enhance navigation safety. The Port of Corpus Christi Authority (PCCA), local sponsor of the existing channel system, began consideration of additional channel improvements upon the 1989 completion of the 45-ft-deepening project. The USACE completed the reconnaissance study in 1994, concluding that the benefits of channel improvements would be 2.5 times greater than the project cost. Thus began a feasibility study, for the CCSCCIP, to determine if the Federal navigation project is justified and to provide documentation needed to request Congressional authorization and funding for construction of the project. In 1999, the USACE and PCCA signed an agreement to conduct a Feasibility Study, including an Environmental Impact Statement (EIS). The project is being led by the USACE, but cost shared with PCCA .

d. General Description of Dredged or Fill Material

(1) General Characteristics of Material

New work material will be dredged to deepen the channel from the –56-foot isobath in the Gulf to the Inner Harbor. A complete description of the new work material and the existing maintenance material can be found in Sections 3.3.1 and 3.3.2 of the FEIS, respectively.

(2) Quantity of Material

Table 1 provides the quantities, by reach, of the new work and maintenance material expected from the preferred alternative.

Table 1. Quantities of New Work and Maintenance Dredged Material (MCY)

Reach	New Work Material	Maintenance Material (50 years)
Entrance Channel	4.337	62.0
Lower Bay	8.754	11.7
Upper Bay	14.419	82.2
Inner Harbor	6.916	24.1
La Quinta Channel	6.257	28.0
Barge Lanes	0.271	NA

(3) Source of Material

All dredged material will come from widening, deepening, and subsequent maintenance of the CCSC and the extension and maintenance of the La Quinta Channel.

e. Description of the Proposed Discharge

(1) Location

New work material from the outer half of the offshore reach (the Entrance Channel) will be used beneficially in an area that coincides with the designated Homeport ODMDS, referred to in this document as BU Site ZZ, and maintenance material will be placed in dredged material placement area 1 (PA 1) (EPA designated ODMDS) (see FEIS Figure 1-3). New work material from the inner half of the Entrance Channel and the Jetty Channel will be placed in beneficial use (BU) Site MN; from the Lower Bay in BU Sites I, R, and S; from the La Quinta Channel in BU Sites E and GH and to improve the levees at PA 13; from the Upper Bay in BU Sites R, S, CQ, and PAs 14a – 17b; and from the Inner Harbor in a series of upland confined placement areas (UCPAs). Maintenance material from the Jetty Channel will be placed in offshore PA 1 (ODMDS) and/or in PA 2, beneficially, if it is of the correct grain size; from the Lower Bay on Pelican Island and PAs 9 and 10; from the La Quinta Channel in PA 13; from the Upper Bay in PAs 10 and 14a – 17b; and from the Inner Harbor in a series of UCPAs. Other PAs that have been used in the past may be used in the future, as is discussed in the FEIS and the DMM/BU Plan (Appendix F). However, these are not scheduled for use with the present project, are covered under other EISs, and are not addressed here.

(2) Size

Creation of all of the in-bay BU Sites will cover roughly 935 acres of unvegetated deep-water bay bottom and 120 acres of upland. The area of the offshore BU Sites MN and ZZ depends on the exact placement methods and equipment but will probably be 1,590 acres of Gulf of Mexico bottom, depending on the height of the berms. All PAs are currently in use and are designated as such although this appendix discusses the calculations required to determine the adequacy of the size of PA 1 (Attachment 1).

(3) Type of Site and Habitat

All BU sites, except BU Sites E, MN, and ZZ, will be located in shallow unvegetated bay bottom. BU Site E will be located upland. BU Site MN will be located in 20-30 ft of water and BU Site ZZ will be located in approximately 50 ft of water. The maintenance PAs are currently being used to receive maintenance material from the CCSC and La Quinta Channel.

(4) Time and Duration of Discharge

The BU sites will be constructed during the widening and deepening of the CCSC, the creation of the barge lanes, and the extension of the La Quinta Channel. Maintenance will be ongoing.

f. Description of Disposal Method

Hydraulic pipeline dredges will be used inshore of the jetties. The Entrance Channel will be dredged with an ocean-going hopper dredge.

II. Factual Determinations

a. Physical Substrate Determinations

(1) Substrate Elevation and Slope

The completed elevation of most BU sites will be –1 to –2 ft MLT, to promote the growth of seagrasses. All BU Sites include breakwaters to an elevation of +6 ft MLT and most have fringes of dredged construction material around the inside of the breakwaters with a design elevation of around +2 MLT suitable for *Spartina* growth. Sites I and CG include interior islands to an elevation between +3 to +6 ft MLT, including an upland island +8 to +10 ft MLT in the southeast corner of Site I. Sites MN and ZZ, being topographic relief features, will likely have elevations around 6 ft above the bottom.

(2) Sediment Type

The new work material will range from mostly hard clay in the Inner Harbor and La Quinta Extension to mostly soft clays in the Upper Bay to medium to dense sand in the Lower Bays to very dense sand in the jetty reach of the Entrance Channel and dense clay in the outer portions of the Entrance Channel. The maintenance material is silt or sandy silt in the Inner Harbor, Lower Bay, and La Quinta Channel; fine or silty sand in the entrance channel; and a mixture of silt or sandy silt, fine or silty sand, and sand in the Upper Bay.

(3) Dredged/Fill Material Movement

The BU sites will be protected from erosion by breakwaters and islands and should be stabilized, in the long term, by seagrasses and *Spartina* and other estuarine organisms. The existing designated open-bay PAs are dispersive and the rest of the designated PAs are UCPAs, releasing no dredged material back into the environment, except small amounts of suspended solids. The offshore sites are dispersive, but BU Sites MN and ZZ are designed to provide bottom relief.

(4) Physical Effects on Benthos

Nonmotile organisms occurring in the sediments in the dredged areas will be placed in designated PAs or BU sites and will likely be buried. Benthos at the BU sites, existing designated open-bay PAs, and the offshore sites will be buried. However, the BU sites are designed to create more diverse and productive habitat than that presently existing in the open bay areas, resulting in benthos rapidly recovering to preplacement conditions (Ray and Clarke, 1999).

(5) Other Effects

None known.

(6) Actions Taken to Minimize Impacts

This project was fully coordinated with State and Federal resource agencies. Their recommendations were fully considered and described in the BU plan. Any unavoidable losses were mitigated. The BU sites, including the offshore sites, are expected to lead to an overall increase in the diversity and productivity of habitat in the project area.

b. Water Circulation, Fluctuation, and Salinity Determinations

(1) Water

The construction of the BU sites, the upland site, and dredging and placement operations are expected to have only minor, short-term impacts on water quality in the area. Impacts to water quality are discussed more fully in the FEIS.

(a) Salinity

Small reductions in salinity and small increases in tidal amplitude in the Bay are expected (FEIS section 4.1.2; Matsumoto, 2001). There will be no effect on Gulf salinity.

(b) Water Chemistry

Aside from a temporary increase in local suspended solids, no impacts are expected (FEIS Section 4.1.3).

(c) Clarity

There will be some temporary increase in local turbidity during dredging and placement operations. Water clarity is expected to return to normal background levels shortly after operations are completed.

(d) Color

Water immediately surrounding the construction area will become discolored temporarily due to disturbance of the sediment.

(e) Odor

The new work material is not expected to be anoxic, so there should be no odors associated with dredging and placement, nor are any expected from open bay placement. There may be a short period when foul odors are emitted by the dredged material contained in the UCPAs.

(f) Taste

No detectable impacts in the marine environment.

(g) Dissolved Gas Levels

No dissolved gas levels except, perhaps, minor amounts of hydrogen sulfide are expected.

(h) Nutrients

Nutrient levels may be slightly and temporarily elevated near the BU sites since new work material is very low in organics. Some maintenance material will be dredged along with the new work material.

(i) Eutrophication

Nutrients are not expected to reach levels high enough for periods long enough to lead to eutrophication of the surrounding waters.

(j) Others as Appropriate

None known.

(2) Current Patterns and Circulation

The BU sites, including breakwaters and islands, were not shown (Matsumoto, 2001) to significantly affect currents or circulation patterns.

(a) Current Patterns and Flow

No impacts are expected.

(b) Velocity

No impacts are expected.

(c) Stratification

No impacts are expected.

(d) Hydrologic Regime

No impacts are expected.

(3) Normal Water Level Fluctuations

Minimal effects are expected (FEIS Section 4.1.1; Matsumoto, 2001).

(4) Salinity Gradients

No impacts are expected.

(5) Actions That Will Be Taken to Minimize Impacts

No actions required.

c. Suspended Particulate/Turbidity Determination

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site

An increase in suspended particulates and turbidity levels is expected during dredging and placement operations of new-work and maintenance material and during creation of the BU sites. These are temporary and localized events.

(2) Effects on Chemical and Physical Properties of the Water Column

(a) Light Penetration

Turbidity levels will be temporarily increased during dredging and placement operations of new-work and maintenance material and during creation of the BU sites.

(b) Dissolved Oxygen

No adverse impacts to dissolved oxygen are expected.

(c) Toxic metals and organics

No adverse impacts are expected (FEIS Section 4.1.3).

(d) Pathogens

None expected or found.

(e) Aesthetics

The BU sites have been designed and coordinated with the resource agencies to minimize environmental impacts and reduce or eliminate adverse aesthetic qualities. The BU sites will provide biological diversity and beneficial values to recreational fishermen. BU site E is designed to provide a buffer that was requested by the citizens of the area.

(f) Others as Appropriate

None known.

(3) Effects on Biota

Approximately 935 acres of seagrass habitat will be created with the BU sites, which will benefit most of the estuarine species. These species depend on seagrasses at some time in their life cycle for protection, food, and as a nursery site. No other impacts are expected on photosynthesis, suspension/filter feeders, and sight feeders, except for temporary impacts from placement operations, which will temporarily increase the local turbidity levels.

(4) Actions Taken to Minimize Impacts

Construction and placement plans for the materials have been closely coordinated with the resource agencies to assure minimal impacts.

d. <u>Contaminant Determinations</u>

No increase in contaminant levels is expected during construction and placement operations. The potential for contaminants has been evaluated through chemical analyses, grain-size analyses, and some bioassays and bioaccumulation tests. All material designated for the purpose is considered acceptable for beneficial uses and routine maintenance operations by the USACE after close coordination with the RACT and CW.

e. <u>Aquatic Ecosystem and Organism Determinations</u>

(1) Effects on Plankton

Construction and placement operations are expected to have only minor temporary, local impacts on plankton from increased turbidity levels.

(2) Effects on Benthos

Project dredging, BU Site creation, and placement operations will bury roughly 935 acres of benthos. However, except for those lost during construction dredging, there will be quick recovery. Benthic organisms can migrate upward through placed material, if it not too thick. Plus, the BU sites will provide greater diversity of habitat and, therefore, likely a different but more diverse benthos than is presently found. Routine maintenance dredging and placement operations will continue to have the same impacts as described in previous NEPA documents.

(3) Effects on Nekton

Creation of the breakwaters and islands for and in the BU sites will limit or eliminate the use of the water column by nekton. However, creation of seagrass meadows will benefit the nekton in the long term. The topographic relief features, BU Sites MN and ZZ, are designed to promote fisheries habitat. Routine maintenance dredging and placement operations will continue to have the same impacts as described in previous NEPA documents.

(4) Effects on Aquatic Food Web

The estuarine and Gulf food web will benefit from greater productivity associated with creation of the BU sites. Reductions in primary productivity from turbidity would be localized around the immediate area of the construction and maintenance dredge operations and would be limited to the duration of the plume at a given site.

(5) Effects on Special Aquatic Sites

Aside from the 5 acres permanently lost, but mitigated for, there are no special aquatic sites to be affected by the proposed project. There are no coral reefs or riffle and pool complexes in the project impact area, mudflats will not be impacted, and wetlands will be protected by the breakwaters and created in the BU sites.

f. Proposed Disposal Site Determinations

(1) Mixing Zone Determination

Testing (see Section 4.1.3, FEIS) has demonstrated that adequate mixing exists to dilute the concentrations of effluents from the UCPAs. Because of the lack of contamination, mixing is not required elsewhere.

(2) Determination of Compliance With Applicable Water Quality Standards

Sediment analyses of new work material have been performed and testing of elutriates prepared with maintenance material has not demonstrated any violation of applicable water quality standards. The State of Texas has issued a water quality certificate for current maintenance dredging of the CCSC, indicating that water quality standards are being met.

(3) Potential Effects on Human Use Characteristics

(a) Municipal and Private Water Supply

The proposed project will not impact any municipal or private water supplies.

(b) Recreational and Commercial Fisheries

Recreational and commercial fishing in Corpus Christi Bay and the Gulf may be enhanced a result of the creation of the BU sites, which will enhance the marine food web. Local recreational fishermen requested BU Site CQ.

(c) Water Related Recreation

The project will improve overall safety of navigation traffic, which may improve water-related recreation. In addition, recreational fishing should be improved by enhancement of the marine food web from the creation of additional seagrass habitat in the BU sites.

(d) Aesthetics

The project is designed to minimize any adverse impacts to the environment and aesthetic qualities in the area.

(e) Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

No special sites will be impacted by the project.

(4) BU Site ZZ

See Attachment 2, which addresses the criteria required for ocean placement of dredged material under the Marine Protection, Research and Sanctuaries Act. Even though this site is a Section 404 beneficial use site, the material must still meet the requirements of 40 CFR 220 before it can be transported for ocean placement.

g. Determination of Cumulative Effects on the Aquatic Ecosystem

The project is expected to result in net benefits to the environment without adding to negative cumulative impacts in the aquatic ecosystem.

h. Determination of Secondary Effects on the Aquatic Ecosystem

No adverse significant secondary effects on the aquatic ecosystem should occur as a result of the recommended project, but secondary beneficial effects are expected from creation of the BU sites.

FINDINGS OF COMPLIANCE WITH
SECTION 404 (b) (1) GUIDELINES
FOR CORPUS CHRISTI SHIP CHANNEL – CHANNEL IMPROVEMENT PROJECT
CORPUS CHRISTI AND NUECES BAYS,
NUECES AND SAN PATRICIO COUNTIES, TEXAS

1. No significant adaptations of the Guidelines were made relative to the evaluation for this project.

2. The recommended plan is the result of evaluation of a preliminary array of 23 alternatives and thorough evaluation of six.

3. The recommended plan will not violate any applicable State or Federal water quality criteria or toxic effluent standards of Section 307 of the Clean Water Act.

4. The recommended plan will not adversely affect any State or Federally-listed threatened or endangered species or their critical habitat or violate any protective measures for any sanctuary.

5. The recommended plan will not result in adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The new BU sites will provide additional habitat for life stages of marine species and additional habitat for colonial waterbirds. There are no significant adverse impacts expected for the estuarine ecosystem diversity, productivity and stability, or recreational, aesthetic, and economic values.

6. Appropriate steps to minimize potential adverse impacts on the estuarine system include close coordination with State and Federal resource agencies during final design prior to construction to incorporate all valid suggestions. Impacts to seagrasses and shallow bay bottom habitat affected by channel widening, deepening, and expansion will be mitigated.

7. Based on the guidelines, the preferred alternative is specified as complying with the requirements of the Section 404(b)(1) guidelines.

Date: 31 May 2002

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ATTACHMENT

CALCULATION OF CAPACITY OF PLACEMENT AREA 1 (PA 1)

ATTACHMENT

CALCULATION OF CAPACITY OF PLACEMENT AREA 1 (PA 1)

The Offshore Ocean Dredged Material Disposal Site (ODMDS), PA 1, was designated by the EPA in 1989 (EPA 1989) to receive the maintenance material from the Corpus Christi Entrance Channel for the 45-foot project. Since PA 1 was designated based on a certain volume of maintenance material, the EPA required that a modeling effort be conducted to determine is there was sufficient capacity for the maintenance material from the proposed project. While the capacity of PA 1 is essentially infinite in the long term, there are restrictions on mounding that would have to be met for each dredging cycle. The limit is 5 feet and is set by the EPA/USACE ODMDS Management Plan for the Corpus Christi Ship Channel. If the capacity of PA 1 was insufficient to prevent unacceptable mounding, a new ODMDS would have to be designated by the EPA, or the existing PA 1 designation would have to be amended through EPA rulemaking, before maintenance dredging from the proposed project could be placed offshore. Since the source of the maintenance material from the proposed project is the same as the source of material from the 45-foot project, a re-evaluation of PA 1 was not needed if it had sufficient capacity. To make the capacity determination, the model MDFATE, prepared by the Waterways Experiment Station (WES) of the USACE, was used.

PA 1 is approximately 1.5 miles from shore at its closest point and is bounded by the following coordinates:

27°49'11" N, 97°01'09" W; 27°48'44" N, 97°00'20" W;
27°48'06" N, 97°00'48" W; 27°48'33" N, 97°01'36" W.

The water depth ranges from 32 to 50 feet and the bottom topography is flat. Annual shoaling has historically been around 955,000 cubic yards (cy). The size of PA 1 is 5,200 feet in the direction parallel with the CCSC and 4,450 feet perpendicular to the CCSC, for a total area of 0.83 square miles. It is shown on Figure 1-2 of the FEIS.

Four dredges were selected, based on the recommendation of the Galveston District because of past usage in the Entrance Channel. All were hopper dredges; two were split hull hopper dredges and two were bottom-door hopper dredges. Hopper capacity ranged from 2,500 cubic yards (cy) to 3,360 cy. Draft of the loaded dredges ranged from 20 feet to 30 feet. As noted above, the water depth ranges from 32 to 50 feet in PA 1, but since mounding was the limiting criterion, a uniform depth of 30 feet was used for the model. Water currents for a 2-month period in 2000 were supplied by the Conrad Blucher Institute for Surveying and Science, and averaged to provide the data on currents required by the model. Grain size data from measurements taken by the USACE were used for the sand, silt, and gravel content and each load was assumed to be 20% solids and 80% water.

MDFATE is so titled for Multiple Dump Fate and is one of the FATE series of models produced by WES, the others of pertinence here being STFATE (Short Term Fate) and LTFATE (Long Term Fate). MDFATE "predicts the geometry (height, side slope, and footprint) of dredged material mounds created by multiple placements of dredged material from hopper dredges or dump scows over time periods of weeks to months" (Clausner, et al., 2001). The model is designed to determine the mounding that will occur during and shortly after placement, by incorporation of a modified STFATE submodel, and over the longer term, by incorporation of a modified LTFATE submodel (Clausner, et al., 2001). However, when use of the model was attempted, it was discovered that MDFATE would not run for bottom-door hopper dredges, only for split-hull dredges and only for a single pass of placements, as discussed below.

Preliminary calculations indicated that a dredge with a capacity of 3,200 – 3,300 cy was needed. Those calculations are as follows:

> The total amount of maintenance material that would be dredged from the Entrance Channel was estimated for the 50-year project life to be 62 million cy (mcy). If it is assumed that the dredging frequency for the Entrance Channel is around three years, the maintenance material to be dredged, per dredging cycle, would be around 3.7 mcy. Based on the configuration of PA 1, using an 8-x-9 grid with 500-foot spacing and the capacity of the typical dredge, it was determined that roughly 71 dredge loads of maintenance material could be placed in PA 1 without overlap. One load at each grid point was designated as a dredging pass, and each pass with 71 dredge loads would allow placement of 52,394 cy of maintenance material. To place 3.7 mcy with 16 passes of 71 dredge loads per pass would require a dredge with a capacity of 3,275 cy.

Two split-hull hopper dredges had been recommended for the analysis, one with a capacity of 2,500 cy and the other with a capacity of 3,200 cy. Therefore, the model was run with the 3,200 cy dredge with 71 dredge loads per pass. As noted above, the model could not be made to run with multiple passes, so a single pass was modeled, for a time period of 45 days, and the cross sections of PA1 after that pass were graphed through the maximum mound (Figures 1 and 2). The cross sections were, of course, a series of peaks, where the dredge emptied, and valleys in between the peaks. The highest peak was 0.463 feet above the sea floor, and the highest valley near that peak was 0.083 feet above the seafloor (Figure 2). For multiple passes, a maximum mounding was calculated by assuming that placement was shifted slightly from pass to pass so the highest peak was placed in the highest nearby valley in the next pass, and so on until the 16 passes were complete. Conservatively assuming that no compaction would be caused by the overlying material from subsequent passes and that there would be no flow to smooth the mounding, the maximum height after the 16th pass was determined to be 4.4 feet above the seafloor. Therefore, mounding of less than 5 feet occurs during each cycle and the capacity of PA 1 is sufficient for the estimated amount of maintenance material to be dredged from the Corpus Christi Entrance Channel under the proposed project.

APPENDIX B

SEDIMENT AND WATER QUALITY TABLES

TABLE 3.2-1

DETECTED PARAMETERS IN THE HISTORIC DATA
ENTRANCE CHANNEL
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-J-84-01			CC-J-84-02			CC-J-84-03			CC-J-84-04			CC-J-90-01		
				Date:	6/28/1984			6/28/1984			6/28/1984			6/28/1984			3/15/1990		
				Channel Station:	0+00			50+00			100+00			150+00			0+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				78.43			71.09			72.70						97.30
Silt			%				3.76			6.79			9.65						2.70
Clay			%				17.81			22.12			17.65						
D50			mm				0.19			0.19			0.17						0.24
Oil & Grease	No ERL	mg/L	mg/kg	N/A	12.00	9.00	1230	15.00	8.00	930	18.25	6.00	5790	12.75	2.80	510			
As	8.2	ug/L	mg/kg	149	3.0	6.0	1.7	3.0	6.0	4.4	4.0	3.0	2.1	5.0	5.0	1.7	<2.0	<2.0	<1.0
Ba	No ERL	ug/L	mg/kg	N/A															
Cd	1.2	ug/L	mg/kg	45.62	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.0	<2.0	<0.1
Cr	81	ug/L	mg/kg	N/A	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.0	<10.0	<1.0
Cu	34	ug/L	mg/kg	13.5	<1.00	30.00	<5.00	<1.00	3.00	<5.00	4.00	<1.00	<5.00	2.00	<1.00	<5.00	<1.0	<1.0	<1.0
Pb	46.7	ug/L	mg/kg	133	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<5.0	<5.0	<1.0
Hg	0.15	ug/L	mg/kg	2.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.2	<0.2	<0.1
Ni	20.9	ug/L	mg/kg	118	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<5.0	<5.0	<1.0
Ag	1	ug/L	mg/kg	2															
Se	No ERL	ug/L	mg/kg	564													<2.0	<2.0	<0.5
Zn	150	ug/L	mg/kg	92.7	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<5.0	<5.0	2.4
TOC	No ERL	mg/L	mg/kg	N/A															
Total PCB	22.7	ug/L	ug/kg	10	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.5	<0.5	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.2
Chlordane	0.5	ug/L	ug/kg	0.09	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.02	<0.02	<0.2
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.5	<0.5	<5.0
Total PAH	4,022	ug/L	mg/kg	N/A													<5.0	<5.0	<0.5
Naphthalene	160	ug/L	ug/kg	N/A													<2.0	<2.0	<50.0
Acenaphthene	16	ug/L	ug/kg	N/A													<2.0	<2.0	<50.0
Fluoranthene	600	ug/L	ug/kg	N/A													<0.5	<0.5	<10.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A													<0.5	<0.5	<10.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A															
Total Petrol HC	No ERL	ug/L	mg/kg	N/A															
Total Phenols	No ERL	ug/L	mg/kg	N/A															
Total Volatile Sol	No ERL		%	N/A															
Total Sulfides	No ERL	mg/L	mg/kg	N/A															
Ammonia	No ERL	mg/L	mg/kg	N/A															

Source: USACE Database.

TABLE 3.2-1 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
ENTRANCE CHANNEL
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-J-90-02 3/15/1990 50+00			CC-J-90-03 4/4/1990 100+00			CC-J-90-04 4/4/1990 150+00			CC-J-90-05 4/4/1990 200+00			CC-J-90-DA1 4/4/1990 100+00			CC-J-99-03 1/28/1999 100+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				90.00			83.70			87.70			46.20			92.30			89.50
Silt			%				10.00			9.60			8.60			29.50			7.70			1.10
Clay			%							6.70			3.70			24.30						9.40
D50			mm				0.31			0.14			0.12			0.07			0.19			0.12
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0		<1.0	1.08	<1.00	1.56
Ba	No ERL	ug/L	mg/kg	N/A																30.6	36.5	27.00
Cd	1.2	ug/L	mg/kg	45.62	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0		<0.1	<0.10	0.31	<0.10
Cr	81	ug/L	mg/kg	N/A	<10.0	<10.0	<1.0	<10.0	<10.0	2.1	<10.0	<10.0	2.0	<10.0	<10.0	4.5	<10.0		<1.0	<1.00	1.00	4.12
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	20.0	<1.0		<1.0	<1.00	1.31	1.58
Pb	46.7	ug/L	mg/kg	133	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0		<1.0	<1.00	<1.00	1.89
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2		<0.1	<0.20	<0.20	0.20
Ni	20.9	ug/L	mg/kg	118	<5.0	<5.0	<1.0	<5.0	<5.0	2.0	<5.0	<5.0	2.1	<5.0	<5.0	4.2	<5.0		<1.0	1.60	<1.00	7.07
Ag	1	ug/L	mg/kg	2																<1.00	<1.00	<0.10
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0		<0.5	<1.00	<1.00	<0.20
Zn	150	ug/L	mg/kg	92.7	<5.0	<5.0	2.3	<5.0	<5.0	9.6	<5.0	<5.0	11.8	<5.0	<5.0	17.9	<5.0		2.4	2.70	1.40	15.5
TOC	No ERL	mg/L	mg/kg	N/A																<1.00	4.40	4830
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5		<5.0	<0.01	<0.01	<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02		<0.2	<0.10	<0.10	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02		<0.2	<0.14	<0.14	<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5		<5.0	<0.50	<0.50	<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.0		<0.5	<5.00	<5.00	<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0		<50.0	<2.00	<2.00	<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0		<50.0	<2.00	<2.00	<20.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5		<10.0	<0.50	<0.50	<20.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5		<10.0	<0.50	<0.50	<20.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A																<0.50	<0.50	<20.0
Total Petrol HC	No ERL	ug/L	mg/kg	N/A																	330	20.1
Total Phenols	No ERL	ug/L	mg/kg	N/A																		
Total Volatile Sol	No ERL		%	N/A																		0.93
Total Sulfides	No ERL	mg/L	mg/kg	N/A																		
Ammonia	No ERL	mg/L	mg/kg	N/A																100	1.58	

TABLE 3.2-1 (Concluded)

DETECTED PARAMETERS IN THE HISTORIC DATA
ENTRANCE CHANNEL
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-J-99-04 1/28/1999 150+00			CC-J-99-05 1/28/1999 200+00			CC-J-99-DA1 1/28/1999 150+00			CC-J-99-REF1 1/28/1999		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				48.30			36.60			99.90			52.70
Silt			%				21.50			30.40			0.10			11.30
Clay			%				30.20			33.00						36.00
D50			mm				0.07			0.04			0.21			0.08
Oil & Grease	No ERL	mg/L	mg/kg	N/A												
As	8.2	ug/L	mg/kg	149	<1.00	<1.00	2.48	<1.00	1.50	3.35	1.44		0.54	1.80	1.07	3.33
Ba	No ERL	ug/L	mg/kg	N/A	27.2	44.7	83.30	18.3	28.5	123.00	26.8		5.91	19.9	34.9	4.17
Cd	1.2	ug/L	mg/kg	45.62	<0.10	0.16	<0.10	<0.10	0.35	<0.10	0.10		0.16	0.12	0.67	<0.10
Cr	81	ug/L	mg/kg	N/A	<1.00	<1.00	9.54	<1.00	<1.00	12.75	<1.00		1.51	<1.00	<1.00	15.60
Cu	34	ug/L	mg/kg	13.5	<1.00	<1.00	4.28	<1.00	<1.00	6.85	<1.00		0.54	<1.00	<1.00	7.11
Pb	46.7	ug/L	mg/kg	133	<1.00	<1.00	3.83	<1.00	<1.00	5.18	<1.00		3.52	<1.00	<1.00	4.83
Hg	0.15	ug/L	mg/kg	2.1	<0.20	<0.20	<0.02	<0.20	<0.20	0.05	<0.20		0.04	<0.20	<0.20	0.04
Ni	20.9	ug/L	mg/kg	118	1.40	<1.00	8.15	<1.00	<1.00	12.65	<1.00		0.41	<1.00	<1.00	13.20
Ag	1	ug/L	mg/kg	2	<1.00	<1.00	0.17	<1.00	<1.00	<0.10	<1.00		<0.10	<1.00	<1.00	<0.10
Se	No ERL	ug/L	mg/kg	564	<1.00	<1.00	<0.20	<1.00	<1.00	<0.20	<1.00		<0.20	<1.00	<1.00	<0.20
Zn	150	ug/L	mg/kg	92.7	4.40	<1.00	31.4	1.45	<1.00	45.7	2.30		88.8	6.30	<1.00	47.5
TOC	No ERL	mg/L	mg/kg	N/A	<1.00	<1.00	11300	<1.00	<1.00	8365	<1.00		1560	<1.00	<1.00	7150
Total PCB	22.7	ug/L	ug/kg	10	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01		<1.00	<0.01	<0.01	<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10		<10.0	<0.10	<0.10	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14		<10.0	<0.14	<0.14	<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50		<50.0	<0.50	<0.50	<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00		<0.50	<5.00	<5.00	<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00		<20.0	<2.00	<2.00	<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00		<20.0	<2.00	<2.00	<20.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50		<20.0	<0.50	<0.50	<20.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50		<20.0	<0.50	<0.50	<20.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50		<20.0	<0.50	<0.50	<20.0
Total Petrol HC	No ERL	ug/L	mg/kg	N/A	110	270			765						350	
Total Phenols	No ERL	ug/L	mg/kg	N/A												
Total Volatile Sol	No ERL		%	N/A			1.26			0.90			0.69			1.21
Total Sulfides	No ERL	mg/L	mg/kg	N/A						9.4						
Ammonia	No ERL	mg/L	mg/kg	N/A	0.04	5.47	0.3		0.95	0.4				100	0.51	

TABLE 3.2-2

SUMMARY OF BIOASSAY DATA FOR MAINTENANCE MATERIAL (% Survival)
ENTRANCE CHANNEL
CORPUS CHRISTI SHIP CHANNEL

	Station:	C-1			C-2			C-3		
	Channel Station:	5+00			100+00			210+00		
Date	Organism	Liquid Phase	Suspended Particulate Phase	Solid Phase	Liquid Phase	Suspended Particulate Phase	Solid Phase	Liquid Phase	Suspended Particulate Phase	Solid Phase
1980*	*Cyprinodon variegatus*	100	80		100	93		90	70	
	Mysidopsis bahia	93	87		100	97		80	90	
	Palaemonetes pugio	97	100	100	100	93	98	100	93	99
	Mercenaria mercenaria			100			99			100
	Neris virens			100			100			99
1985**	*Cyprinodon variegatus*	--	100		87	97		100	100	
	Mysidopsis bahia	--	93		100	97		90	97	
	Palaemonetes pugio	--	97	--	100	100	92	100	93	91
	Mercenaria mercenaria			--			97			99
	Neris virens			--			80			90
1995***	*Ampelisca abdita*	N/A	N/A	86	N/A	N/A	89	N/A	N/A	85
	Palaemonetes pugio	N/A	N/A	99	N/A	N/A	98	N/A	N/A	100
	Neris virens	N/A	N/A	99	N/A	N/A	100	N/A	N/A	100

* SWRI (1980)
** EH&A (1985)
*** EH&A (1995)
-- Insufficient sample was collected from Station C-1 for LP and SPP bioassays.
N/A - Not Applicable, LP and SPP bioassays not included in Scope of Work,

TABLE 3.2-3

DETECTED PARAMETERS IN THE HISTORIC DATA
LOWER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-HL-88-01A			CC-HL-88-02A			CC-HL-88-03A		
				Date:	12/8/1988			12/8/1988			12/8/1988		
				Channel Station:	-36+00			-36+00			-32+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				81.3			97			96.2
Silt			%				4.6			1.5			1.9
Clay			%				14.1			1.5			1.9
D50			mm				0.13			0.14			0.18
Oil & Grease	No ERL	mg/L	mg/kg	N/A									
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0
Ba	No ERL	ug/L	mg/kg	N/A									
Cd	1.2	ug/L	mg/kg	45.62	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1
Cr	81	ug/L	mg/kg	N/A	<10.0	<10.0	1.60	<10.0	<10.0	<1.00	<10.0	<10.0	<1.00
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	1.50	<1.0	<1.0	<1.00	<1.0	<1.0	<1.00
Pb	46.7	ug/L	mg/kg	133	<5.0	<5.0	4.10	<5.0	<5.0	<1.00	<5.0	<5.0	<1.00
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
Ni	20.9	ug/L	mg/kg	118	<5.0	<5.0	1.50	<5.0	<5.0	<1.00	<5.0	<5.0	<1.00
Ag	1	ug/L	mg/kg	2									
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5
Zn	150	ug/L	mg/kg	92.7	<5.0	<5.0	8.3	<5.0	<5.0	2.7	<5.0	<5.0	2.7
TOC	No ERL	mg/L	mg/kg	N/A									
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A									
Aldrin	No ERL	ug/L	ug/kg	1.3									
Dieldrin	0.02	ug/L	ug/kg	0.71									
Heptachlor	No ERL	ug/L	ug/kg	0.053									
Hexachlorocyclohexane	No ERL	ug/L	ug/kg	0.16									
Ammonia	No ERL	mg/L	mg/kg	N/A									

Source: USACE Database.

TABLE 3.2-3 (Concluded)

DETECTED PARAMETERS IN THE HISTORIC DATA
LOWER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-HL-91-07			CC-HL-91-08			CC-HL-91-09		
				Date:	9/19/1991			9/19/1991			9/19/1991		
				Channel Station:	300+00			350+00			400+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				93.2			86.9			72.2
Silt			%				6.3			9.5			15.5
Clay			%				0.5			3.6			12.3
D50			mm				0.43			0.47			0.19
Oil & Grease	No ERL	mg/L	mg/kg	N/A									
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0
Ba	No ERL	ug/L	mg/kg	N/A									
Cd	1.2	ug/L	mg/kg	45.62	<2.0	<2.0	<0.1	<2.0	<2.0	0.20	<2.0	<2.0	0.70
Cr	81	ug/L	mg/kg	N/A	<10.0	<10.0	2.00	<10.0	<10.0	3.50	<10.0	<10.0	2.60
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	0.90	<1.0	<1.0	1.30	<1.0	<1.0	1.80
Pb	46.7	ug/L	mg/kg	133	<5.0	<5.0	<1.00	<5.0	<5.0	<1.00	<5.0	<5.0	<1.00
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
Ni	20.9	ug/L	mg/kg	118	<5.0	<5.0	1.20	<5.0	<5.0	2.30	<5.0	<5.0	1.90
Ag	1	ug/L	mg/kg	2									
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5
Zn	150	ug/L	mg/kg	92.7	<5.0	<5.0	6.2	<5.0	<5.0	11.1	<5.0	<5.0	7.6
TOC	No ERL	mg/L	mg/kg	N/A	17.70	16.60	<100	13.20	11.40	<100	12.50	9.70	<100
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A									
Aldrin	No ERL	ug/L	ug/kg	1.3									
Dieldrin	0.02	ug/L	ug/kg	0.71									
Heptachlor	No ERL	ug/L	ug/kg	0.053									
Hexachlorocyclohexane	No ERL	ug/L	ug/kg	0.16									
Ammonia	No ERL	mg/L	mg/kg	N/A									

TABLE 3.2-4

DETECTED PARAMETERS IN CONSTRUCTION SEDIMENTS
LOWER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	1			3			4			5			6		
				Date:	Mar-86			Mar-86			Mar-86			Mar-86			Mar-86		
				Channel Station:	447+50			521+70			458+30			375+40			311+50		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Marine Water Quality	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Oil & Grease	No ERL	ug/L	mg/kg	N/A	<0.2	11	26	<0.2	15	<14	0.2	13.0	18	<0.2	5.0	13	0.4	12.0	17
As	8.2	ug/L	mg/kg	149	1	<1	52.4	1	1	64.4	<1	1	11.9	2	<1	63.4	<1	<1	11.3
Cd	1.2	ug/L	mg/kg	45.62	2	<1	0.23	<1	3	1.21	<1	6	0.33	<1	<1	1.45	<1	13	4.14
Cr	81	ug/L	mg/kg	N/A	<10	<10	<6.3	<10	<10	6.31	<10	<10	<0.5	<10	<10	11.9	<10	<10	<0.5
Cu	34	ug/L	mg/kg	13.5	<1	1	6.24	2	3	8.34	2	<2	1.88	1	3	8.3	<1	<2	1.39
Pb	46.7	ug/L	mg/kg	133	<1	<2	6.8	2	3	9.59	2	<2	9.72	2	5	5.79	<1	4	3.17
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	0.087	0.3	<0.2	0.056	0.4	<0.2	0.153	<0.2	<0.2	0.017	<0.2	<0.2	0.066
Ni	20.9	ug/L	mg/kg	118	7	4	53.6	6	8	64.4	12	6	12.7	6	10	66.4	7	7	12.3
Zn	150	ug/L	mg/kg	92.7	10	6	25.7	8	8	36.3	9	9	10.6	13	8	47.1	4	30	11.2
TOC	No ERL	mg/L	mg/kg	N/A	4.5	212	15,000	5.2	86	14,000	3.1	133	500	1.9	83	11,000	6	57	1,000
Total Phenols	No ERL	ug/L	ug/kg	10	<50	<50	0.17	<50	<50	0.1	50	<50	0.34	<50	<50	<0.09	<50	<50	0.34

				Station:	7			8			9			10		
				Date:	Mar-86			Mar-86			Mar-86			Mar-86		
				Channel Station:	241+00			152+00			86+00			12+55		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Marine Water Quality	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Oil & Grease	No ERL	mg/L	mg/kg	N/A	<0.2	10.0	11	0.4	10.0	29	<0.2	4.0	40	<0.2	3.0	14
As	8.2	ug/L	mg/kg	149	<1	2	32.9	<1	<1	43.4	<1	4	7.32	<1	<1	27.9
Cd	1.2	ug/L	mg/kg	45.62	<1	<1	2.36	<1	<1	1.11	<1	<13	0.75	<1	2	1.13
Cr	81	ug/L	mg/kg	N/A	20	<10	5.01	<10	<10	9	20	<10	<0.5	<10	<10	<2.5
Cu	34	ug/L	mg/kg	13.5	2	2	2.84	<1	<3	6.86	<1	<4	1.9	<1	<1	3.68
Pb	46.7	ug/L	mg/kg	133	1	<3	3.37	<1	<2	4.49	<1	<1	3.61	<1	<2	4.19
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	0.084	1.3	<0.2	0.157	<0.2	<0.2	0.067	<0.2	<0.3	<0.009
Ni	20.9	ug/L	mg/kg	118	12	8	30.1	2	6	4.89	2	6	15.3	4	7	26.4
Zn	150	ug/L	mg/kg	92.7	9	9	16.5	9	18	26.3	4	6	7.21	8	19	18.2
TOC	No ERL	mg/L	mg/kg	N/A	3.5	313	6,000	2.4	84	9,000	2.8	36	3,000	2.4	103	4,000
Total Phenols	No ERL	ug/L	ug/kg	10	<50	<50	0.09	<50	<50	0.11	<50	<50	0.21	<50	<50	0.12

Source: U.S. Navy, 1986.
* Approximate

TABLE 3.2-5

SUMMARY OF BIOASSAY DATA FOR MAINTENANCE MATERIAL (% Survival)
LOWER BAY
CORPUS CHRISTI SHIP CHANNEL

	Station:	IB-1			IB-2			IB-3		
	Channel Station:	80+00			300+00			510+00		
Date	Organism	Liquid Phase	Suspended Particulate Phase	Solid Phase	Liquid Phase	Suspended Particulate Phase	Solid Phase	Liquid Phase	Suspended Particulate Phase	Solid Phase
1981	*Menidia beryllina*	93	97		97	97		97	93	
	Mysidopsis almyra	57	93		97	87		73	73	
	Palaemonetes pugio	100	97	95	97	90	97	93	97	96
	Mercenaria mercenaria			100			99			100
	Neris virens			84			86			87

Source: Tereco, 1981.

TABLE 3.2-6

DETECTED PARAMETERS IN THE HISTORIC DATA
LA QUINTA
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-L-85-01 4/23/1985 50+00			CC-L-85-02 4/23/1985 100+00			CC-L-85-03 4/23/1985 150+00			CC-L-85-04 4/23/1985 200+00			CC-L-85-05 4/23/1985 250+00			CC-L-85-06 4/23/1985 300+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				1.22												21.23			
Silt			%				82.75												64.8			
Clay			%				16.03												13.97			
D50			mm				0.011												0.016			
Oil & Grease	No ERL	mg/L	mg/kg	N/A	2.8	18.6	280.0	1.6	17.2	136.0	1.8	18.4	243.0	<1.0	16.6	120.0	1.6	20.2	160.0	1.2	17.2	200.0
As	8.2	ug/L	mg/kg	149	6.0	7.0	12.0	5.0	5.0	12.0	6.0	7.0	15.0	6.0	7.0	12.0	8.0	12.0	15.0	6.0	7.0	15.0
Ba	No ERL	ug/L	mg/kg	N/A																		
Cd	1.2	ug/L	mg/kg	45.62	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50
Cr	81	ug/L	mg/kg	N/A	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00	<10.00	7.90	<10.00	<10.00	5.10	<10.00	<10.00	5.90	<10.00	<10.00	6.90
Cu	34	ug/L	mg/kg	13.5	<1.00	<1.00	<5.00	<1.00	<1.00	<5.00	<1.00	<1.00	<5.00	<1.00	<1.00	<5.00	<1.00	<1.00	<5.00	<1.00	<1.00	<5.00
Pb	46.7	ug/L	mg/kg	133	<10.00	<10.00	6.00	<10.00	<10.00	6.00	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00
Hg	0.15	ug/L	mg/kg	2.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Ni	20.9	ug/L	mg/kg	118	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<20.00	<20.00	5.80	<20.00	<20.00	5.30	<20.00	<20.00	5.30	<20.00	<20.00	5.30
Ag	1	ug/L	mg/kg	2																		
Se	No ERL	ug/L	mg/kg	564																		
Zn	150	ug/L	mg/kg	92.7	<20.00	<20.00	26.5	<20.00	<20.00	7.6	<20.00	<20.00	29.0	<20.00	<20.00	21.8	<20.00	<20.00	26.1	<20.00	<20.00	23.3
TOC	No ERL	mg/L	mg/kg	N/A																		
Total PCB	22.7	ug/L	ug/kg	10	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50
Chlordane	0.5	ug/L	ug/kg	0.09	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00
Total PAH	4,022	ug/L	mg/kg	N/A																		
Naphthalene	160	ug/L	ug/kg	N/A																		
Acenaphthene	16	ug/L	ug/kg	N/A																		
Fluoranthene	600	ug/L	ug/kg	N/A																		
Benzo(a)pyrene	430	ug/L	ug/kg	N/A																		
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A																		
Ammonia	No ERL	mg/L	mg/kg	N/A		117.00	87.0		120.00	87.0		96.00	60.0		99.00	60.0		87.00	64.0		89.00	70.0

Source: USACE Database.

TABLE 3.2-6 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
LA QUINTA
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-L-90-01 12/20/1990 50+00			CC-L-90-02 12/20/1990 100+00			CC-L-90-03 12/20/1990 150+00			CC-L-90-04 12/20/1990 200+00			CC-L-90-05 12/20/1990 250+00			CC-L-90-06 12/20/1990 300+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				7.1			4.9			4.7			37			4.8			4.6
Silt			%				72.6			76.2			71.7			51.4			79.4			72.3
Clay			%				20.3			18.9			23.6			11.6			15.8			23.1
D50			mm				0.031			0.051			0.056			0.061			0.053			0.026
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0
Ba	No ERL	ug/L	mg/kg	N/A																		
Cd	1.2	ug/L	mg/kg	45.62	<2.0	<2.0	<0.10	<2.0	<2.0	<0.10	<2.0	<2.0	<0.10	<2.0	<2.0	<0.10	<2.0	<2.0	<0.10	<2.0	<2.0	<0.10
Cr	81	ug/L	mg/kg	N/A	<10.0	<10.0	3.30	<10.0	<10.0	4.00	<10.0	<10.0	3.30	<10.0	<10.0	3.10	<10.0	<10.0	4.50	<10.0	<10.0	5.40
Cu	34	ug/L	mg/kg	13.5	3.3	5.9	3.10	1.4	3.7	3.70	2.3	4.2	3.60	2.5	3.2	3.10	2.1	3.5	3.50	4.4	3.9	3.70
Pb	46.7	ug/L	mg/kg	133	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
Ni	20.9	ug/L	mg/kg	118	<5.0	13.8	8.30	<5.0	17.6	11.40	<5.0	12.6	11.40	<5.0	11.0	10.20	<5.0	38.0	12.80	<5.0	15.2	13.70
Ag	1	ug/L	mg/kg	2																		
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5
Zn	150	ug/L	mg/kg	92.7	<5.0	<5.0	18.8	<5.0	<5.0	17.3	<5.0	<5.0	14.2	<5.0	<5.0	18.9	<5.0	<5.0	22.3	<5.0	<5.0	22.0
TOC	No ERL	mg/L	mg/kg	N/A	9.50	14.90	<100	1.10	11.70	<100	1.10	14.50	<100	<1.00	9.30	<100	<1.00	10.90	<100	7.90	10.90	<100
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A																		
Ammonia	No ERL	mg/L	mg/kg	N/A																		

TABLE 3.2-6 (Concluded)

DETECTED PARAMETERS IN THE HISTORIC DATA
LA QUINTA
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-L-00-01			CC-L-00-02			CC-L-00-03			CC-L-00-04			CC-L-00-05			CC-L-00-06		
				Date:	5/25/2000			5/25/2000			5/25/2000			5/25/2000			5/25/2000			5/25/2000		
				Channel Station:	50+00			100+00			150+00			200+00			250+00			300+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				80.7			91.9			79.0			95.4			80.7			47.5
Silt			%				2.6			3.1			17.1			2.2			11.5			29.1
Clay			%				16.7			5.0			3.9			2.4			7.8			23.4
D50			mm				0.095			0.122			0.094			0.132			0.093			0.066
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149	<1.00	<1.00	1.72	3.25	<1.00	0.89	4.66	<1.00	0.92	3.74	<1.00	1.09	1.13	<1.00	0.84	<1.00	<1.00	1.68
Ba	No ERL	ug/L	mg/kg	N/A	49.1	54.2	30.9	58.8	68.9	21.6	60.3	62.9	17.5	58.9	61.9	3.73	58.4	61.3	15.8	61.8	57.2	51.8
Cd	1.2	ug/L	mg/kg	45.62	0.20	0.30	<0.10	0.60	0.30	<0.10	0.60	0.20	<0.10	0.80	0.10	<0.10	<0.10	0.30	0.16	<0.10	<0.10	0.20
Cr	81	ug/L	mg/kg	N/A	<1.00	<1.00	11.3	<1.00	<1.00	0.45	<1.00	<1.00	0.59	<1.00	<1.00	0.41	<1.00	<1.00	0.46	<1.00	<1.00	2.60
Cu	34	ug/L	mg/kg	13.5	<1.00	<1.00	1.37	<1.00	<1.00	0.50	<1.00	<1.00	0.93	<1.00	<1.00	0.40	<1.00	<1.00	0.77	<1.00	<1.00	2.52
Pb	46.7	ug/L	mg/kg	133	<1.00	<1.00	6.32	<1.00	<1.00	2.99	<1.00	<1.00	3.83	<1.00	<1.00	3.33	1.00	<1.00	4.11	<1.00	<1.00	8.62
Hg	0.15	ug/L	mg/kg	2.1	<0.20	<0.20	0.03	<0.20	<0.20	<0.02	<0.20	<0.20	0.02	<0.20	<0.20	<0.02	<0.20	<0.20	<0.02	<0.20	<0.20	<0.02
Ni	20.9	ug/L	mg/kg	118	<1.00	<1.00	1.12	<1.00	<1.00	0.51	<1.00	<1.00	0.60	<1.00	<1.00	0.61	<1.00	<1.00	0.55	<1.00	<1.00	3.16
Ag	1	ug/L	mg/kg	2	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10
Se	No ERL	ug/L	mg/kg	564	<1.00	2.87	<0.20	<1.00	2.24	<0.20	<1.00	1.37	0.28	4.41	1.88	<0.20	<1.00	<1.00	<0.20	2.33	<1.00	<0.20
Zn	150	ug/L	mg/kg	92.7	11.4	12.8	8.97	3.90	15.7	3.30	9.40	13.8	3.94	8.60	23.2	2.03	14.5	12.5	5.70	12.8	13.0	13.7
TOC	No ERL	mg/L	mg/kg	N/A	<1.00	<1.00	6850	<1.00	<1.00	2560	<1.00	<1.00	12800	<1.00	<1.00	4480	<1.00	<1.00	4750	<1.00	<1.00	4480
Total PCB	22.7	ug/L	ug/kg	10	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0

Source: USACE Database, 2000.

TABLE 3.2-7

SUMMARY OF BIOASSAY DATA FOR MAINTENANCE MATERIAL (% Survival)
LA QUINTA CHANNEL
CORPUS CHRISTI SHIP CHANNEL

	Station:	LQ-1		LQ-2		LQ-3	
	Channel Station:	65+00		150+00		280+00	
Date	Organism	Liquid Phase	Suspended Particulate Phase	Liquid Phase	Suspended Particulate Phase	Liquid Phase	Suspended Particulate Phase
1981	*Menidia beryllina*	60	97	93	97	87	90
	Mysidopsis almyra	67	83	73	77	87	80
	Palaemonetes pugio	90	67	93	97	97	97

Source: Tereco, 1982c.

TABLE 3.2-8

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-B-81-01 7/23/81 550+00			CC-B-81-02 7/23/81 600+00			CC-B-81-03 7/23/81 650+00			CC-B-81-04 7/23/81 700+00			CC-B-81-05 7/23/81 750+00			CC-B-81-06 7/23/81 800+00		
Parameter	ERL	Media Unit	Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%																			
Silt			%																			
Clay			%																			
D50			mm																			
Oil & Grease	No ERL	mg/L	mg/kg	N/A	2.10	<1.00	7,800	1.50	<1.00	1,900	2.60	<1.00	7,100	<1.00	<1.00	2,800	1,200	<1.00	9,000	<1.00	1.00	7,500
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0
Ba	No ERL	ug/L	mg/kg	N/A																		
Cd	1.2	ug/L	mg/kg	45.4	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	0.5
Cr	81	ug/L	mg/kg	1090	<10.0	<10.0	8.3	<10.0	<10.0	8.6	<10.0	<10.0	8.5	<10.0	<10.0	10.0	<10.0	<10.0	8.5	<10.0	<10.0	10.1
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	6.5	1.2	<1.0	6.5	1.3	<1.0	6.8	<1.0	<1.0	6.5	1.3	<1.0	6.0	1.1	<1.0	5.5
Pb	46.7	ug/L	mg/kg	133	<10.0	<10.0	22.0	<10.0	<10.0	27.0	<10.0	<10.0	22.0	<10.0	<10.0	24.0	<10.0	<10.0	17.0	<10.0	<10.0	25.0
Hg	0.15	ug/L	mg/kg	2.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ni	20.9	ug/L	mg/kg	118	<20.0	<20.0	7.0	<20.0	<20.0	8.0	<20.0	<20.0	6.0	<20.0	<20.0	6.0	<20.0	<20.0	6.0	<20.0	<20.0	8.0
Ag	1	ug/L	mg/kg	2																		
Se	No ERL	ug/L	mg/kg	564																		
Zn	150	ug/L	mg/kg	92.7	<20.0	<20.0	52.0	<20.0	<20.0	58.0	<20.0	<20.0	58.2	<20.0	<20.0	62.0	<20.0	<20.0	60.0	<20.0	<20.0	61.6
TOC	No ERL	mg/L	mg/kg	N/A																		
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
DDT	1.58	ug/L	ug/kg	0.13			<0.5			<0.5			<0.5			8.7			1.8			<0.5
Chlordane	0.5	ug/L	ug/kg	0.09	<0.05	<0.05	<1.0	<0.05	<0.05	<1.0	<0.05	<0.05	<1.0	<0.05	<0.05	<1.0	<0.05	<0.05	<1.0	<0.05	<0.05	<1.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Total PAH	4,022	ug/L	mg/kg	N/A																		
Naphthalene	160	ug/L	ug/kg	N/A																		
Acenaphthene	16	ug/L	ug/kg	N/A																		
Fluoranthene	600	ug/L	ug/kg	N/A																		
Benzo(a)pyrene	430	ug/L	ug/kg	N/A																		
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A																		
Aldrin	No ERL	ug/L	ug/kg	1.3	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Dieldrin	0.02	ug/L	ug/kg	0.71	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5
Heptachlor	No ERL	ug/L	ug/kg	0.053	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5
Hexachlorocyclohexane	No ERL	ug/L	ug/kg	0.16	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5
Ammonia	No ERL	mg/L	mg/kg	N/A	1.30	1.72	1,590.0	1.02	1.20	400.0	1.36	1.64	800.0	1.72	1.77	530.0	1.80	1.92	1,200.0	1.72	2.12	800.0

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-B-81-07 7/23/81 850+00			CC-B-81-08 7/23/81 900+00			CC-B-81-09 7/23/81 950+00			CC-B-81-10 7/23/81 1000+00			CC-B-81-11 7/23/81 1050+00			CC-B-83-11 1/12/83 1050+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%																			0.88
Silt			%																			74.54
Clay			%																			24.58
D50			mm																			0.006
Oil & Grease	No ERL	mg/L	mg/kg	N/A	2.00	<1.00	7,900	<1.00	<1.00	7,100	6.30	<1.00	330	<1.00	<1.00	6,000	4.20	<1.00	1,800	1.1	1.2	130.9
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	9.0	12.0	3.97
Ba	No ERL	ug/L	mg/kg	N/A																		
Cd	1.2	ug/L	mg/kg	45.62	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	0.5	<2.0	<2.0	0.5	<2.00	<2.0	<0.50
Cr	81	ug/L	mg/kg	N/A	<10.0	<10.0	6.5	<10.0	<10.0	8.1	<10.0	<10.0	9.0	<10.0	<10.0	8.4	<10.0	<10.0	9.5	<10.00	<10.0	6.87
Cu	34	ug/L	mg/kg	13.5	1.2	<1.0	5.0	<1.0	<1.0	5.5	<1.0	<1.0	5.6	<1.0	<1.0	5.7	<1.0	<1.0	6.4	<1.00	<1.0	6.57
Pb	46.7	ug/L	mg/kg	133	<10.0	<10.0	20.0	<10.0	<10.0	21.0	<10.0	<10.0	23.0	<10.0	<10.0	24.0	<10.0	<10.0	26.0	<10.00	<10.0	9.5
Hg	0.15	ug/L	mg/kg	2.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.1	<0.10
Ni	20.9	ug/L	mg/kg	118	<20.0	<20.0	5.0	<20.0	<20.0	9.0	<20.0	<20.0	9.0	<20.0	<20.0	5	<20.0	<20.0	5.0	<20.00	<20.0	5.10
Ag	1	ug/L	mg/kg	2																		
Se	No ERL	ug/L	mg/kg	564																		
Zn	150	ug/L	mg/kg	92.7	<20.0	<20.0	52.7	<20.0	<20.0	57.5	<20.0	<20.0	64.8	<20.0	<20.0	65.3	<20.0	<20.0	68.2	<20.0	<20.0	57.35
TOC	No ERL	mg/L	mg/kg	N/A																		
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.50	<0.5	<10.00
DDT	1.58	ug/L	ug/kg	0.13			<0.5			<0.5			<0.5			<0.5			<0.5	<0.02	<0.02	<0.50
Chlordane	0.5	ug/L	ug/kg	0.09	<0.05	<0.05	<1.0	<0.05	<0.05	<1.0	<0.05	<0.05	<1.0	<0.05	<0.05	<1.0	<0.05	<0.05	<1.0	<0.05	<0.05	<1.00
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.50	<0.5	<10.00
Total PAH	4,022	ug/L	mg/kg	N/A																		
Naphthalene	160	ug/L	ug/kg	N/A																		
Acenaphthene	16	ug/L	ug/kg	N/A																		
Fluoranthene	600	ug/L	ug/kg	N/A																		
Benzo(a)pyrene	430	ug/L	ug/kg	N/A																		
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A																		
Aldrin	No ERL	ug/L	ug/kg	1.3	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	0.6	<0.02	<0.02	0.8	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Dieldrin	0.02	ug/L	ug/kg	0.71	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5
Heptachlor	No ERL	ug/L	ug/kg	0.053	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5
Hexachlorocyclohexane	No ERL	ug/L	ug/kg	0.16	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5
Ammonia	No ERL	mg/L	mg/kg	N/A	1.80	1.86	1,060.0	1.77	1.77	100.0	1.64	1.90	430.0	1.63	1.80	200.0	1.65	1.86	360.0	<0.05	4.00	30.19

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-B-83-DA17B 1/12/83 970+00			CC-B-83-REF17B 1/12/83 970+00			CC-B-85-01 1/16/85 550+00			CC-B-85-02 1/16/85 600+00			CC-B-85-03 1/16/85 650+00			CC-B-85-04 1/16/85 700+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				3.63			7.89			10.26						0.18			
Silt			%				21.16			11.55			83.62						84.75			
Clay			%				75.21			80.56			6.12						15.07			
D50			mm				0.003						0.01						0.01			
Oil & Grease	No ERL	mg/L	mg/kg	N/A	<1.0		28.0	1.5		35.3	2.20	3.60	598.00	<1.00	2.80	526.00	1.40	3.00	675.00	<1.00	1.60	587.00
As	8.2	ug/L	mg/kg	149	10.0		4.64	9.0		3.37	6.00	14.00	2.50	8.00	16.00	1.60	8.00	15.00	3.30	7.00	9.00	3.10
Ba	No ERL	ug/L	mg/kg	N/A																		
Cd	1.2	ug/L	mg/kg	45.62	<2.00		<0.50	<2.00		<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50
Cr	81	ug/L	mg/kg	N/A	<10.00		7.49	<10.00		8.89	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00
Cu	34	ug/L	mg/kg	13.5	<1.00		7.49	<1.00		6.27	<1.00	<1.00	<5.00	<1.00	<1.00	<5.00	<1.00	<1.00	<5.00	<1.00	<1.00	<5.00
Pb	46.7	ug/L	mg/kg	133	<10.00		11.4	<10.00		10.0	<10.00	<10.00	<5.00	<10.00	<10.00	5.90	<10.00	<10.00	6.10	<10.00	<10.00	6.40
Hg	0.15	ug/L	mg/kg	2.1	<0.10		<0.10	<0.10		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Ni	20.9	ug/L	mg/kg	118	<20.00		6.18	<20.00		7.30	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00
Ag	1	ug/L	mg/kg	2																		
Se	No ERL	ug/L	mg/kg	564																		
Zn	150	ug/L	mg/kg	92.7	<20.00		77.76	<20.00		28.8	<20.00	<20.00	17.80	<20.00	<20.00	22.30	<20.00	<20.00	22.50	<20.00	<20.00	22.00
TOC	No ERL	mg/L	mg/kg	N/A																		
Total PCB	22.7	ug/L	ug/kg	10	<0.50		<10.00	<0.50		<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00
DDT	1.58	ug/L	ug/kg	0.13	<0.02		<0.50	<0.02		<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50
Chlordane	0.5	ug/L	ug/kg	0.09	<0.05		<1.00	<0.05		<1.00	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50		<10.00	<0.50		<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00
Total PAH	4,022	ug/L	mg/kg	N/A																		
Naphthalene	160	ug/L	ug/kg	N/A																		
Acenaphthene	16	ug/L	ug/kg	N/A																		
Fluoranthene	600	ug/L	ug/kg	N/A																		
Benzo(a)pyrene	430	ug/L	ug/kg	N/A																		
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A																		
Aldrin	No ERL	ug/L	ug/kg	1.3	<0.02		<0.2	<0.02		<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Dieldrin	0.02	ug/L	ug/kg	0.71	<0.02		<0.5	<0.02		<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5
Heptachlor	No ERL	ug/L	ug/kg	0.053	<0.02		<0.5	<0.02		<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5
Hexachlorocyclohexane	No ERL	ug/L	ug/kg	0.16	<0.02		<0.5	<0.02		<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5
Ammonia	No ERL	mg/L	mg/kg	N/A	0.07		5.75	0.07		3.87	0.08	2.34	72.00	0.12	2.00	118.00	0.11	2.38	59.00	0.16	2.07	57.00

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-B-85-05 1/16/85 750+00			CC-B-85-06 1/16/85 800+00			CC-B-85-07 1/16/85 850+00			CC-B-85-08 1/16/85 900+00			CC-B-85-09 1/16/85 950+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				0.27						0.46						0.19
Silt			%				81.76						82.48						85.92
Clay			%				17.97						17.06						13.89
D50			mm				0.01						0.01						0.01
Oil & Grease	No ERL	mg/L	mg/kg	N/A	1.40	3.00	900.00	<1.00	2.00	783.00	<1.00	<1.00	686.00	2.00	2.80	818.00	<1.00	3.60	520.00
As	8.2	ug/L	mg/kg	149	7.00	9.00	3.10	7.00	9.00	2.80	7.00	9.00	2.80	7.00	9.00	3.00	8.00	10.00	3.80
Ba	No ERL	ug/L	mg/kg	N/A															
Cd	1.2	ug/L	mg/kg	45.62	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50
Cr	81	ug/L	mg/kg	N/A	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00
Cu	34	ug/L	mg/kg	13.5	<1.00	<1.00	<5.00	<1.00	<1.00	<5.00	5.00	5.00	<5.00	<1.00	<1.00	<5.00	<1.00	<1.00	<5.00
Pb	46.7	ug/L	mg/kg	133	<10.00	<10.00	5.40	<10.00	<10.00	6.70	<10.00	<10.00	6.30	<10.00	<10.00	6.60	<10.00	<10.00	6.70
Hg	0.15	ug/L	mg/kg	2.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Ni	20.9	ug/L	mg/kg	118	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00
Ag	1	ug/L	mg/kg	2															
Se	No ERL	ug/L	mg/kg	564															
Zn	150	ug/L	mg/kg	92.7	<20.00	<20.00	21.80	<20.00	<20.00	22.60	<20.00	81.00	22.6	<20.00	<20.00	<5.00	<20.00	<20.00	24.50
TOC	No ERL	mg/L	mg/kg	N/A															
Total PCB	22.7	ug/L	ug/kg	10	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50
Chlordane	0.5	ug/L	ug/kg	0.09	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00
Total PAH	4,022	ug/L	mg/kg	N/A															
Naphthalene	160	ug/L	ug/kg	N/A															
Acenaphthene	16	ug/L	ug/kg	N/A															
Fluoranthene	600	ug/L	ug/kg	N/A															
Benzo(a)pyrene	430	ug/L	ug/kg	N/A															
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A															
Aldrin	No ERL	ug/L	ug/kg	1.3	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Dieldrin	0.02	ug/L	ug/kg	0.71	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5
Heptachlor	No ERL	ug/L	ug/kg	0.053	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5
Hexachlorocyclohexane	No ERL	ug/L	ug/kg	0.16	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5
Ammonia	No ERL	mg/L	mg/kg	N/A	0.16	2.39	160.00	0.16	2.01	90.00	0.16	1.50	64.00	0.13	2.61	78.00	0.16	2.26	83.00

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-85-10			CC-B-85-11			CC-B-85-DA15		
				Date:	1/16/85			1/16/85			1/16/85		
				Channel Station:	1000+00			1050+00			730+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%							0.78			
Silt			%							88.11			
Clay			%							11.11			
D50			mm							0.01			
Oil & Grease	No ERL	mg/L	mg/kg	N/A	1.50	3.00	750.00	1.60	2.80	865.00	2.00		783.00
As	8.2	ug/L	mg/kg	149	7.00	14.00	3.00	8.00	15.00	2.50	10.00		2.40
Ba	No ERL	ug/L	mg/kg	N/A									
Cd	1.2	ug/L	mg/kg	45.62	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00		<0.50
Cr	81	ug/L	mg/kg	N/A	<10.00	<10.00	<5.00	<10.00	<10.00	<5.00	<10.00		<5.00
Cu	34	ug/L	mg/kg	13.5	<1.00	<1.00	<5.00	<1.00	<1.00	<5.00	<1.00		<5.00
Pb	46.7	ug/L	mg/kg	133	<10.00	<10.00	6.60	<10.00	<10.00	6.60	<10.00		6.10
Hg	0.15	ug/L	mg/kg	2.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10		<0.10
Ni	20.9	ug/L	mg/kg	118	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<20.00		<5.00
Ag	1	ug/L	mg/kg	2									
Se	No ERL	ug/L	mg/kg	564									
Zn	150	ug/L	mg/kg	92.7	<20.00	<20.00	28.10	<20.00	<20.00	25.50	92.00		22.70
TOC	No ERL	mg/L	mg/kg	N/A									
Total PCB	22.7	ug/L	ug/kg	10	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.5		<10.00
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02		<0.50
Chlordane	0.5	ug/L	ug/kg	0.09	<0.05	<0.05	<1.00	<0.05	<0.05	<1.00	<0.05		<1.00
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<10.00	<0.50	<0.50	<10.00	<0.50		<10.00
Total PAH	4,022	ug/L	mg/kg	N/A									
Naphthalene	160	ug/L	ug/kg	N/A									
Acenaphthene	16	ug/L	ug/kg	N/A									
Fluoranthene	600	ug/L	ug/kg	N/A									
Benzo(a)pyrene	430	ug/L	ug/kg	N/A									
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A									
Aldrin	No ERL	ug/L	ug/kg	1.3	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02		<0.2
Dieldrin	0.02	ug/L	ug/kg	0.71	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02		<0.5
Heptachlor	No ERL	ug/L	ug/kg	0.053	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02		<0.5
Hexachlorocyclohexane	No ERL	ug/L	ug/kg	0.16	<0.02	<0.02	<0.5	<0.02	<0.02	<0.5	<0.02		<0.5
Ammonia	No ERL	mg/L	mg/kg	N/A	0.19	3.88	76.00	0.16	3.80	47.00	0.16		31.00

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-87-01			CC-B-87-02			CC-B-87-03			CC-B-87-04			CC-B-87-05			CC-B-87-06		
				Date:	3/31/87			3/31/87			3/31/87			3/31/87			3/31/87			3/31/87		
				Channel Station:	550+00			600+00			650+00			700+00			750+00			800+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				33.4						3.18						3.98			
Silt			%				51.73						73.46						68.43			
Clay			%				14.86						23.36						27.6			
D50			mm				0.03						0.01						0.01			
Oil & Grease	No ERL	mg/L	mg/kg	N/A	4.8	1.1	377.0	3.7	4.4	137.0	4.0	1.3	15.5	<1.0	1.0	342.0	6.2	4.7	428.0	2.0	2.1	175.0
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	2.00	<2.0	<2.0	1.80	<2.0	<2.0	1.80	<2.0	<2.0	1.90	<2.0	<2.0	1.80	<2.0	<2.0	2.00
Ba	No ERL	ug/L	mg/kg	N/A																		
Cd	1.2	ug/L	mg/kg	45.62	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1
Cr	81	ug/L	mg/kg	N/A	<10.0	<10.0	7.40	<10.0	<10.0	7.40	<10.0	<10.0	7.20	<10.0	<10.0	9.00	<10.0	<10.0	9.20	<10.0	<10.0	10.00
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	50.00	<1.0	<1.0	50.00	<1.0	<1.0	3.60	<1.0	<1.0	3.80	<1.0	<1.0	5.20	<1.0	<1.0	4.20
Pb	46.7	ug/L	mg/kg	133	<5.0	<5.0	6.00	<5.0	<5.0	6.00	<5.0	<5.0	5.80	<5.0	<5.0	6.10	<5.0	<5.0	4.60	<5.0	<5.0	6.70
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
Ni	20.9	ug/L	mg/kg	118	<5.0	<5.0	5.50	<5.0	<5.0	5.50	<5.0	<5.0	5.30	<5.0	<5.0	5.60	<5.0	<5.0	5.70	<5.0	<5.0	6.20
Ag	1	ug/L	mg/kg	2																		
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5
Zn	150	ug/L	mg/kg	92.7	87.2	41.0	25.2	71.8	76.9	26.2	138.0	30.8	25.5	128.0	71.8	30.2	262.0	56.4	32.9	185.0	46.2	34.6
TOC	No ERL	mg/L	mg/kg	N/A																		
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	1.5	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
Total PAH	4,022	ug/L	mg/kg	N/A	<2.5	<2.5	0.40	<2.5	<2.5	0.30	<2.5	<2.5	0.20	<2.5	<2.5	0.20	<2.5	<2.5	0.20	<2.5	<2.5	<0.2
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	4.5	<0.5	<0.5	2.5	<0.5	<0.5	4.1
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	1.4	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A																		

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-87-07			CC-B-87-08			CC-B-87-09			CC-B-87-10			CC-B-87-11			CC-B-87-DA14B		
				Date:	3/31/87			3/31/87			3/31/87			3/31/87			3/31/87			3/31/87		
				Channel Station:	850+00			900+00			950+00			1000+00			1050+00			670+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				0.97						1.48						1.36			
Silt			%				70.21						79.62						81.1			
Clay			%				28.81						18.9						17.54			
D50			mm				0.01						0.01						0.01			
Oil & Grease	No ERL	mg/L	mg/kg	N/A	1.6	<1.0	117.0	2.6	<1.0	334.0	1.6	<1.0	85.7	2.2	<1.0	24.0	1.7	<1.0	41.5	2.1		162.0
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	1.80	<2.0	<2.0	1.50	<2.0	<2.0	1.70	<2.0	<2.0	1.50		<2.0	1.90	<2.0		1.50
Ba	No ERL	ug/L	mg/kg	N/A																		
Cd	1.2	ug/L	mg/kg	45.62	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0		<0.1
Cr	81	ug/L	mg/kg	N/A	<10.0	<10.0	5.80	<10.0	<10.0	5.80	<10.0	<10.0	6.80	<10.0	<10.0	6.10	<10.0	<10.0	8.30	<10.0		4.00
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	4.90	<1.0	<1.0	4.90	<1.0	<1.0	40.00	<1.0	<1.0	4.10	<1.0	<1.0	5.30	<1.0		2.20
Pb	46.7	ug/L	mg/kg	133	<5.0	<5.0	5.90	<5.0	<5.0	5.90	<5.0	<5.0	5.50	<5.0	<5.0	4.90	<5.0	<5.0	8.40	<5.0		2.70
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2		<0.1
Ni	20.9	ug/L	mg/kg	118	<5.0	<5.0	7.20	<5.0	<5.0	7.20	<5.0	<5.0	6.80	<5.0	<5.0	4.50	<5.0	<5.0	5.10	<5.0		3.30
Ag	1	ug/L	mg/kg	2																		
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0		<0.5
Zn	150	ug/L	mg/kg	92.7	126.0	56.4	35.9	303.0	51.3	33.6	96.2	46.2	36.9	138.0	92.3	37.8	646.0	113.0	43.8	103.0		13.2
TOC	No ERL	mg/L	mg/kg	N/A																		
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5		<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02		<0.2
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02		<0.2
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5		<5.0
Total PAH	4,022	ug/L	mg/kg	N/A	<2.5	<2.5	0.20	<2.5	<2.5	0.20	<2.5	<2.5	<0.2	<2.5	<2.5	0.30	<2.5	<2.5	<0.2	<2.5		<0.2
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0		<50.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0		<50.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5	<0.5	2.0	<0.5	<0.5	5.9	<0.5	<0.5	4.6	<0.5	<0.5	6.1	<0.5	<0.5	3.4	<0.5		<10.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	1.6	<0.5	<0.5	<10.0	<0.5	<0.5	1.3	<0.5	<0.5	<10.0	<0.5		<10.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A																		

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-87-DA15B			CC-B-87-DA16A			CC-B-87-DA17B			CC-B-87-RF14B			CC-B-87-RF15B			CC-B-87-RF16A		
				Date:	3/31/87			3/31/87			3/31/87			3/31/87			3/31/87			3/31/87		
				Channel Station:	775+00			840+00			970+00			670+00			775+00			840+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%													24.58						41.41
Silt			%													53.85						43.24
Clay			%													16.14						15.13
D50			mm													0.02						0.02
Oil & Grease	No ERL	mg/L	mg/kg	N/A	<1.0		383.0	1.4		114.0	1.8		189.0	0.2	3.2	407.0	<1.0	2.6	353.0	1.8	4.4	245.0
As	8.2	ug/L	mg/kg	149	<2.0		2.10	<2.0		2.20	<2.0		2.30	<2.0	<2.0	2.90	<2.0	<2.0	2.60	<2.0	<2.0	2.40
Ba	No ERL	ug/L	mg/kg	N/A																		
Cd	1.2	ug/L	mg/kg	45.62	<2.0		<0.1	<2.0		<0.1	<2.0		<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1
Cr	81	ug/L	mg/kg	N/A	<10.0		6.00	<10.0		10.40	<10.0		9.20	<10.0	<10.0	11.60	<10.0	<10.0	9.40	<10.0	<10.0	6.60
Cu	34	ug/L	mg/kg	13.5	<1.0		3.80	<1.0		5.60	<1.0		5.20	<1.0	<1.0	5.50	<1.0	<1.0	5.70	<1.0	<1.0	50.00
Pb	46.7	ug/L	mg/kg	133	<5.0		6.10	<5.0		8.90	<5.0		9.30	<5.0	<5.0	8.80	<5.0	<5.0	9.40	<5.0	<5.0	8.00
Hg	0.15	ug/L	mg/kg	2.1	<0.2		<0.1	<0.2		<0.1	<0.2		<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
Ni	20.9	ug/L	mg/kg	118	<5.0		5.60	<5.0		7.90	<5.0		5.70	<5.0	<5.0	8.90	<5.0	<5.0	6.60	<5.0	<5.0	6.50
Ag	1	ug/L	mg/kg	2																		
Se	No ERL	ug/L	mg/kg	564	<2.0		<0.5	<2.0		<0.5	<2.0		<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5
Zn	150	ug/L	mg/kg	92.7	76.9		29.0	395.0		37.6	71.8		47.3	113.0	46.2	47.9	117.0	51.3	49.4	123.0	61.5	42.9
TOC	No ERL	mg/L	mg/kg	N/A																		
Total PCB	22.7	ug/L	ug/kg	10	<0.5		<5.0	<0.5		<5.0	<0.5		<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02		3.1	<0.02		<0.2	<0.02		<0.2	<0.02	<0.02	0.20	<0.02	<0.02	0.8	<0.02	<0.02	<0.2
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02		<0.2	<0.02		<0.2	<0.02		<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5		<5.0	<0.5		<5.0	<0.5		<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
Total PAH	4,022	ug/L	mg/kg	N/A	<2.5		<0.2	<2.5		<0.2	<2.5		<0.2	<2.5	<2.5	<0.2	<2.5	<2.5	<0.2	<2.5	<2.5	0.40
Naphthalene	160	ug/L	ug/kg	N/A	<2.0		<50.0	<2.0		<50.0	<2.0		<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0		<50.0	<2.0		<50.0	<2.0		<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5		<10.0	<0.5		<10.0	<0.5		1.3	<0.5	<0.5	3.3	<0.5	<0.5	<10.0	<0.5	<0.5	2.1
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5		<10.0	<0.5		<10.0	<0.5		<10.0	<0.5	<0.5	1.0	<0.5	<0.5	<10.0	<0.5	<0.5	1.3
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A																		

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

**DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL**

				Station: / Date: / Channel Station:	CC-B-87-RF17B 3/31/87 970+00			CC-B-88-11 2/24/88 1050+00			CC-B-89-01 12/19/89 550+00			CC-B-89-02 12/19/89 600+00			CC-B-89-03 12/19/89 650+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				12.74			1.18			22.3						8.6
Silt			%				61.82			73.53			40.6						46.9
Clay			%				24.88			25.29			37.1						44.5
D50			mm				0.01			0.01198			0.026						0.009
Oil & Grease	No ERL	mg/L	mg/kg	N/A	2.2	<1.0	313.0	1.22	2.08	161.41									
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	2.00	<2.0	<2.0	1.04	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0
Ba	No ERL	ug/L	mg/kg	N/A															
Cd	1.2	ug/L	mg/kg	45.62	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1
Cr	81	ug/L	mg/kg	N/A	<10.0	<10.0	9.60	<10.0	<10.0	12.14	<10.0	<10.0	7.90	<10.0	<10.0	6.40	<10.0	<10.0	4.90
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	5.50	5.6	3.0	4.13	<1.0	<1.0	3.20	<1.0	<1.0	4.60	<1.0	<1.0	2.80
Pb	46.7	ug/L	mg/kg	133	<5.0	<5.0	10.60	<5.0	<5.0	10.32	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
Ni	20.9	ug/L	mg/kg	118	<5.0	<5.0	8.20	45.6	49.8	5.36	<5.0	<5.0	4.10	<5.0	<5.0	4.60	<5.0	<5.0	3.50
Ag	1	ug/L	mg/kg	2															
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.5	<2.0	<2.0	<1.0	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5
Zn	150	ug/L	mg/kg	92.7	549.0	51.3	52.0	20.4	<5.0	39.84	<5.0	31.0	18.5	<5.0	29.0	33.0	7.0	26.0	23.5
TOC	No ERL	mg/L	mg/kg	N/A															
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
Total PAH	4,022	ug/L	mg/kg	N/A	<2.5	<2.5	0.20	<2.5	<2.5	<0.5	<2.5	<2.5	<0.5	<2.5	<2.5	<0.5	<2.5	<2.5	<0.5
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5	<0.5	1.4	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A															

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-89-04			CC-B-89-05			CC-B-89-06		
				Date:	12/19/89			12/19/89			12/19/89		
				Channel Station:	700+00			750+00			800+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%							1.5			
Silt			%							58.7			
Clay			%							39.8			
D50			mm							0.008			
Oil & Grease	No ERL	mg/L	mg/kg	N/A									
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0
Ba	No ERL	ug/L	mg/kg	N/A									
Cd	1.2	ug/L	mg/kg	45.62	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1
Cr	81	ug/L	mg/kg	1100	<10.0	<10.0	7.8	<10.0	<10.0	6.20	<10.0	<10.0	8.90
Cu	34	ug/L	mg/kg	16.27	<1.0	<1.0	3.80	<1.0	<1.0	2.70	<1.0	<1.0	4.90
Pb	46.7	ug/L	mg/kg	140	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
Ni	20.9	ug/L	mg/kg	119	<5.0	<5.0	4.70	<5.0	<5.0	3.70	<5.0	<5.0	5.50
Ag	1	ug/L	mg/kg	2.3									
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5
Zn	150	ug/L	mg/kg	98	<5.0	20.0	35.2	<5.0	45.0	27.0	<5.0	22.0	45.6
TOC	No ERL	mg/L	mg/kg	N/A									
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
Total PAH	4,022	ug/L	mg/kg	N/A	<2.5	<2.5	<0.5	<2.5	<2.5	<0.5	<2.5	<2.5	<0.5
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A									

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-89-07			CC-B-89-08			CC-B-89-09			CC-B-89-10			CC-B-89-11			CC-B-89-DA14		
				Date:	12/19/89			12/19/89			12/19/89			12/19/89			12/19/89			12/19/89		
				Channel Station:	850+00			900+00			950+00			1000+00			1050+00			668+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				6.2						1.7						0.6			16.4
Silt			%				83						87.1						60.1			39.3
Clay			%				10.8						11.2						39.3			44.3
D50			mm				0.017						0.009						0.008			0.009
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0		<1.0
Ba	No ERL	ug/L	mg/kg	N/A																		
Cd	1.2	ug/L	mg/kg	45.62	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0		<0.1
Cr	81	ug/L	mg/kg	N/A	<10.0	<10.0	7.90	<10.0	<10.0	9.90	<10.0	<10.0	5.70	<10.0	<10.0	4.50	<10.0	<10.0	4.80	<10.0		4.8
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	3.20	<1.0	<1.0	4.30	<1.0	<1.0	2.60	<1.0	<1.0	3.40	<1.0	<1.0	2.90	<1.0		2.80
Pb	46.7	ug/L	mg/kg	133	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0		<1.0
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2		<0.1
Ni	20.9	ug/L	mg/kg	118	<5.0	<5.0	2.50	<5.0	<5.0	6.60	<5.0	<5.0	4.00	<5.0	<5.0	3.90	<5.0	<5.0	3.50	<5.0		3.80
Ag	1	ug/L	mg/kg	2																		
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0		<0.5
Zn	150	ug/L	mg/kg	92.7	15.0	30.0	21.0	70.0	17.0	35.0	<5.0	25.0	30.2	<5.0	30.0	37.5	34.0	20.0	31.8	<5.0		23.2
TOC	No ERL	mg/L	mg/kg	N/A																		
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5		<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02		<0.2
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02		<0.2
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5		<5.0
Total PAH	4,022	ug/L	mg/kg	N/A	<2.5	<2.5	<0.5	<2.5	<2.5	<0.5	<2.5	<2.5	<0.5	<2.5	<2.5	<0.5	<2.5	<2.5	<0.5	<5.0		<0.5
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0		<50.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0		<50.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5		<10.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5		<10.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A																		

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-B-89-DA15 12/19/89 775+00			CC-B-89-DA16 12/19/89 838+00			CC-B-89-DA17 12/19/89 927+00			CC-B-89-REF14 12/19/89 668+00			CC-B-89-REF15 12/19/89 775+00			CC-B-89-REF16 12/19/89 838+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				29.7			30.5			44.6			55.9			32.9			41.6
Silt			%				27.2			30			26.4			21.5			21.9			19
Clay			%				43.1			39.5			29			22.6			45.2			39.4
D50			mm				0.011			0.025			0.061			0.094			0.011			0.043
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149	<2.0		<1.0	<2.0		<1.0	<2.0		<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0
Ba	No ERL	ug/L	mg/kg	N/A																		
Cd	1.2	ug/L	mg/kg	45.62	<2.0		<0.1	<2.0		<0.1	<2.0		<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1
Cr	81	ug/L	mg/kg	N/A	<10.0		8.80	<10.0		11.70	<10.0		<1.0	<10.0	<10.0	<1.0	<10.0	<10.0	7.20	<10.0	<10.0	8.20
Cu	34	ug/L	mg/kg	13.5	<1.0		5.30	<1.0		4.50	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.50	<1.0	<1.0	40.00
Pb	46.7	ug/L	mg/kg	133	<5.0		<1.0	<5.0		<1.0	<5.0		<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
Hg	0.15	ug/L	mg/kg	2.1	<0.2		<0.1	<0.2		<0.1	<0.2		<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
Ni	20.9	ug/L	mg/kg	118	<5.0		5.20	<5.0		3.60	<5.0		3.30	<5.0	<5.0	4.10	<5.0	<5.0	3.40	<5.0	<5.0	6.30
Ag	1	ug/L	mg/kg	2																		
Se	No ERL	ug/L	mg/kg	564	<2.0		<0.5	<2.0		<0.5	<2.0		<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5
Zn	150	ug/L	mg/kg	92.7	<5.0		46.6	<5.0		31.1	<5.0		9.7	<5.0	20.0	23.6	<5.0	20.0	37.5	<5.0	27.0	32.0
TOC	No ERL	mg/L	mg/kg	N/A																		
Total PCB	22.7	ug/L	ug/kg	10	<0.5		<5.0	<0.5		<5.0	<0.5		<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02		<0.2	<0.02		<0.2	<0.02		<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02		<0.2	<0.02		<0.2	<0.02		<0.2	<0.02	<0.02	<0.2	0.05	<0.02	<0.2	0.09	<0.02	<0.2
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5		<5.0	<0.5		<5.0	<0.5		<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.0		<0.5	<5.0		<0.5	<5.0		<0.5	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5
Naphthalene	160	ug/L	ug/kg	N/A	<2.0		<50.0	<2.0		<50.0	<2.0		<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0		<50.0	<2.0		<50.0	<2.0		<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5		<10.0	<0.5		<10.0	<0.5		<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5		<10.0	<0.5		<10.0	<0.5		<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A																		

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-89-REF17			CC-B-91-11			CC-B-94-11			CC-B-95-01			CC-B-95-02			CC-B-95-03		
				Date:	12/19/89			8/22/91			3/16/94			1/12/95			1/12/95			1/12/95		
				Channel Station:	927+00			1050+00			1050+00			550+00			600+00			650+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				11.4			33.3			38.8			35.8			19.7			17.1
Silt			%				34.5			38.1			16.5			58.1			55.6			61.8
Clay			%				54.1			28.6			44.7			6.1			24.7			21.1
D50			mm				0.003			0.056			0.009			0.068			0.049			0.056
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	1.4	<1.0	<0.50	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Ba	No ERL	ug/L	mg/kg	N/A							40.2	102.3	284.0	42.7	75.4	309.8	42.3	58.4	236.7	44.1	68.2	240.9
Cd	1.2	ug/L	mg/kg	45.62	<2.0	<2.0	<0.1	<2.0	<2.0	<0.10	<0.10	<0.10	<0.50	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cr	81	ug/L	mg/kg	N/A	<10.0	<10.0	9.60	<10.0	<10.0	5.50	3.0	6.6	16.70	<1.0	<1.0	19.10	<1.0	<1.0	18.12	<1.0	<1.0	17.70
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	5.30	<1.0	1.9	2.50	4.8	<1.0	13.60	<1.0	<1.0	9.08	<1.0	<1.0	9.85	<1.0	<1.0	10.53
Pb	46.7	ug/L	mg/kg	133	<5.0	<5.0	<1.0	<5.0	<5.0	5.30	<1.0	<1.0	13.70	<1.0	<1.0	7.07	<1.0	<1.0	7.34	<1.0	<1.0	8.29
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.05	<0.2	<0.2	<0.02	<0.2	<0.2	<0.02	<0.2	<0.2	<0.02
Ni	20.9	ug/L	mg/kg	118	<5.0	<5.0	5.60	<5.0	<5.0	2.70	<1.0	<1.0	10.40	<1.0	<1.0	10.37	<1.0	<1.0	10.08	<1.0	<1.0	10.34
Ag	1	ug/L	mg/kg	2							<1.0	<1.0	<0.50	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<1.00	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20
Zn	150	ug/L	mg/kg	92.7	<5.0	<5.0	49.0	14.0	30.0	15.9	<1.0	<1.0	99.1	<1.0	<1.0	66.39	<1.0	<1.0	71.16	<1.0	<1.0	78.49
TOC	No ERL	mg/L	mg/kg	N/A				10.60	14.20	<100	7.40	8.95	210.0	10.85	17.20	221.0	11.10	17.60	446.0	10.70	11.80	208.0
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.50	<0.50	<15.0	<0.50	<0.50	<5.0	<0.50	<0.50	<5.0	<0.50	<0.50	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.12	<0.12	<30.0	<0.12	<0.12	<10.0	<0.12	<0.12	<10.0	<0.12	<0.12	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.14	<0.14	<30.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.50	<0.50	<150.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.00	<5.00	<1.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<90.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<90.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.50	<0.50	<90.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.50	<0.50	<90.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A							<0.50	<0.50	<90.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-95-04			CC-B-95-05			CC-B-95-06			CC-B-95-07			CC-B-95-08		
				Date:	1/12/95			1/12/95			1/12/95			1/12/95			1/12/95		
				Channel Station:	700+00			750+00			800+00			850+00			900+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				5.4			12			8.4			13.4			12.5
Silt			%				77.7			55.1			69			65.7			76.7
Clay			%				16.9			32.9			22.6			20.9			10.8
D50			mm				0.055			0.053			0.046			0.053			0.055
Oil & Grease	No ERL	mg/L	mg/kg	N/A															
As	8.2	ug/L	mg/kg	149	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Ba	No ERL	ug/L	mg/kg	N/A	48.2	192.0	173.2	48.7	63.0	408.9	56.9	59.9	247.0	54.2	69.3	226.9	52.4	438.1	269.1
Cd	1.2	ug/L	mg/kg	45.62	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cr	81	ug/L	mg/kg	N/A	<1.0	<1.0	10.82	<1.0	<1.0	37.00	<1.0	<1.0	17.10	<1.0	<1.0	15.51	<1.0	<1.0	18.60
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	7.24	<1.0	<1.0	18.13	<1.0	<1.0	10.08	<1.0	<1.0	10.42	<1.0	<1.0	10.95
Pb	46.7	ug/L	mg/kg	133	<1.0	<1.0	7.20	<1.0	<1.0	20.67	<1.0	<1.0	11.77	<1.0	<1.0	10.06	<1.0	<1.0	10.36
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.02	<0.2	<0.2	<0.02	<0.2	<0.2	<0.02	<0.2	<0.2	<0.02	<0.2	<0.2	<0.02
Ni	20.9	ug/L	mg/kg	118	<1.0	<1.0	7.43	<1.0	<1.0	20.92	<1.0	<1.0	11.45	<1.0	<1.0	10.09	<1.0	<1.0	10.76
Ag	1	ug/L	mg/kg	2	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20
Zn	150	ug/L	mg/kg	92.7	<1.0	<1.0	50.96	<1.0	<1.0	157.9	<1.0	<1.0	81.25	<1.0	<1.0	80.30	<1.0	<1.0	92.73
TOC	No ERL	mg/L	mg/kg	N/A	12.85	13.65	173.0	14.70	7.80	354.0	6.75	6.10	214.0	8.45	9.95	213.0	8.85	20.90	265.0
Total PCB	22.7	ug/L	ug/kg	10	<0.50	<0.50	<5.0	<0.50	<0.50	<5.0	<0.50	<0.50	<5.0	<0.50	<0.50	<5.0	<0.50	<0.50	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.12	<0.12	<10.0	<0.12	<0.12	<10.0	<0.12	<0.12	<10.0	<0.12	<0.12	<10.0	<0.12	<0.12	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-95-09			CC-B-95-10			CC-B-95-11		
				Date:	1/12/95			1/12/95			1/12/95		
				Channel Station:	950+00			1000+00			1050+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				10.3			2.4			11.7
Silt			%				79.7			72.3			57.9
Clay			%				10			25.3			30.4
D50			mm				0.047			0.044			0.056
Oil & Grease	No ERL	mg/L	mg/kg	N/A									
As	8.2	ug/L	mg/kg	149	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Ba	No ERL	ug/L	mg/kg	N/A	51.2	59.0	252.8	50.3	64.9	264.5	52.0	146.2	260.4
Cd	1.2	ug/L	mg/kg	45.62	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cr	81	ug/L	mg/kg	N/A	<1.0	<1.0	21.53	<1.0	<1.0	17.23	<1.0	<1.0	17.01
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	11.13	<1.0	<1.0	11.04	<1.0	<1.0	11.65
Pb	46.7	ug/L	mg/kg	133	<1.0	<1.0	12.16	<1.0	<1.0	11.58	<1.0	<1.0	13.10
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.02	<0.2	<0.2	<0.02	<0.2	<0.2	<0.02
Ni	20.9	ug/L	mg/kg	118	<1.0	<1.0	11.54	<1.0	<1.0	10.14	<1.0	<1.0	10.17
Ag	1	ug/L	mg/kg	2	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20
Zn	150	ug/L	mg/kg	92.7	<1.0	<1.0	98.33	<1.0	<1.0	94.16	<1.0	<1.0	99.85
TOC	No ERL	mg/L	mg/kg	N/A	11.25	11.65	237.0	13.00	12.60	315.0	12.55	15.30	189.0
Total PCB	22.7	ug/L	ug/kg	10	<0.50	<0.50	<5.0	<0.50	<0.50	<5.0	<0.50	<0.50	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.12	<0.12	<10.0	<0.12	<0.12	<10.0	<0.12	<0.12	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-B-95-DA14 / 1/12/95 / 668+00			CC-B-95-DA15 / 1/12/95 / 775+00			CC-B-95-Ref14 / 1/12/95 / 668+00			CC-B-95-Ref15 / 1/12/95 / 775+00			CC-B-97-11 / 11/13/97 / 1050+00			CC-B-98-01 / 7/17/98 / 550+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				75.00			79.00			59.50			67.90			3.50			27.20
Silt			%				23.10			18.00			36.40			27.70			17.00			24.90
Clay			%				1.90			3.00			4.10			4.40			79.50			47.90
D50			mm				0.16			0.24			0.57			0.95			0.004			0.008
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149	<1.0		<0.10	<1.0		<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	5.66	<1.0	<1.0	2.92
Ba	No ERL	ug/L	mg/kg	N/A	46.9		213.8	50.7		104.2	45.8	58.2	151.4	53.9	52.5	221.1	49.9	60.1	294.0	66.0	72.6	271
Cd	1.2	ug/L	mg/kg	45.62	<0.1		<0.10	<0.1		<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	3.64	<0.1	<0.10	<0.10
Cr	81	ug/L	mg/kg	N/A	<1.0		8.69	<1.0		4.68	<1.0	<1.0	8.04	<1.0	<1.0	12.39	1.6	<1.0	23.2	<1.0	<1.0	13.10
Cu	34	ug/L	mg/kg	13.5	<1.0		5.02	<1.0		3.86	<1.0	<1.0	5.55	<1.0	<1.0	9.53	1.9	<1.0	13.3	<1.00	1.22	8.94
Pb	46.7	ug/L	mg/kg	133	<1.0		4.46	<1.0		4.78	<1.0	<1.0	2.61	<1.0	<1.0	5.62	<1.0	<1.0	12.1	<1.0	<1.0	5.24
Hg	0.15	ug/L	mg/kg	2.1	<0.2		<0.02	<0.2		<0.02	<0.2	<0.2	<0.02	<0.2	<0.2	<0.02	<0.2	<0.2	<0.02	<0.2	<0.2	0.05
Ni	20.9	ug/L	mg/kg	118	<1.0		4.75	<1.0		2.88	<1.0	<1.0	4.32	<1.0	<1.0	6.80	<1.0	<1.0	12.90	<1.0	<1.0	7.11
Ag	1	ug/L	mg/kg	2	<1.0		<0.10	<1.0		<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Se	No ERL	ug/L	mg/kg	564	<2.0		<0.20	<2.0		<0.20	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	0.47
Zn	150	ug/L	mg/kg	92.7	<1.0		35.74	<1.0		23.15	<1.0	<1.0	37.89	<1.0	<1.0	68.37	2.4	<1.0	101.0	13.3	3.6	50.1
TOC	No ERL	mg/L	mg/kg	N/A	8.95		147.0	5.10		118.0	16.60	14.50	118.0	10.40	16.25	130.0	<1.00	<1.00	69.8	<1.00	2.27	10100
Total PCB	22.7	ug/L	ug/kg	10	<0.50		<5.0	<0.50		<5.0	<0.50	<0.50	<5.0	<0.50	<0.50	<5.0	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.12		<10.0	<0.12		<10.0	<0.12	<0.12	<10.0	<0.12	<0.12	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14		<10.0	<0.14		<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50		<50.0	<0.50		<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00		<0.50	<5.00		<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.0		<30.0	<2.0		<30.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0		<30.0	<2.0		<30.0	<2.0	<2.0	<30.0	<2.0	<2.0	<30.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50		<30.0	<0.50		<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50		<30.0	<0.50		<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50		<30.0	<0.50		<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<30.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Total Petrol HC	No ERL	ug/L	mg/kg	N/A																<100	150	<5.00
Total Volatile Sol	No ERL		%	N/A																		1.45
Total Sulfides	No ERL	mg/L	mg/kg	N/A																		129.0
Ammonia	No ERL	mg/L	mg/kg	N/A																0.06	1.18	73.80

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-98-02			CC-B-98-03			CC-B-98-04			CC-B-98-05			CC-B-98-06			CC-B-98-07		
				Date:	7/17/98			7/17/98			7/17/98			7/17/98			7/17/98			7/17/98		
				Channel Station:	600+00			650+00			700+00			750+00			800+00			850+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				11.80			5.40			1.65			1.80			2.30			1.30
Silt			%				20.20			8.20			15.90			18.10			16.60			13.90
Clay			%				68.00			86.40			82.45			80.10			81.10			84.80
D50			mm				0.003			0.002			0.002			0.002			0.002			0.002
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149	<1.0	<1.0	3.66	<1.0	<1.0	3.45	<1.0	<1.0	4.21	<1.0	<1.0	4.86	<1.0	<1.0	5.43	<1.0	<1.0	4.10
Ba	No ERL	ug/L	mg/kg	N/A	67.5	72.0	233	65.6	69.1	153	73.1	72.3	261	71.2	95.7	260	71.2	215.0	249	72.5	108.0	253
Cd	1.2	ug/L	mg/kg	45.62	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	0.18	<0.1	<0.10	0.33	<0.1	<0.10	<0.10	<0.1	<0.10	0.38
Cr	81	ug/L	mg/kg	N/A	<1.0	<1.0	13.40	<1.0	<1.0	8.74	<1.0	<1.0	15.85	<1.0	<1.0	14.60	<1.0	<1.0	15.70	<1.0	<1.0	14.10
Cu	34	ug/L	mg/kg	13.5	<1.00	<1.0	10.50	<1.00	<1.0	7.64	<1.00	<1.0	11.00	<1.00	<1.0	10.30	<1.00	<1.0	11.80	<1.00	<1.0	10.60
Pb	46.7	ug/L	mg/kg	133	<1.0	<1.0	5.39	<1.0	<1.0	4.26	<1.0	<1.0	6.17	<1.0	<1.0	6.26	<1.0	<1.0	6.64	<1.0	<1.0	6.09
Hg	0.15	ug/L	mg/kg	2.1	<0.2	0.22	0.05	<0.2	<0.2	0.05	<0.2	<0.2	0.04	<0.2	<0.2	0.09	<0.2	<0.2	0.04	<0.2	<0.2	0.11
Ni	20.9	ug/L	mg/kg	118	<1.0	<1.0	7.52	<1.0	<1.0	4.73	<1.0	<1.0	8.69	<1.0	<1.0	7.44	<1.0	<1.0	9.45	<1.0	<1.0	8.70
Ag	1	ug/L	mg/kg	2	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Se	No ERL	ug/L	mg/kg	564	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20
Zn	150	ug/L	mg/kg	92.7	11.1	5.4	54.9	13.1	2.7	39.3	14.2	4.1	68.2	9.6	5.0	65.8	15.8	4.4	62.8	16.7	4.0	68.4
TOC	No ERL	mg/L	mg/kg	N/A	<1.00	<1.00	9460	<1.00	<1.00	10400	<1.00	<1.00	7370	<1.00	<1.00	11300	<1.00	<1.00	11300	<1.00	<1.00	17200
Total PCB	22.7	ug/L	ug/kg	10	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Total Petrol HC	No ERL	ug/L	mg/kg	N/A	<100	150	39.50	<100	220	<5.00	<100	<100	30.90	<100	<100	19.30	<100	120	<5.00	<100	<100	<5.00
Total Volatile Sol	No ERL		%	N/A			1.56			1.75			1.67			1.81			1.66			1.83
Total Sulfides	No ERL	mg/L	mg/kg	N/A			17.5			37.0			116.0			32.1			278.0			21.2
Ammonia	No ERL	mg/L	mg/kg	N/A	0.06	0.57	19.00	0.05	0.45	26.50	0.03	<0.03	21.35	<0.03	1.80	5.64	0.04	2.61	96.80	<0.03	0.75	24.80

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-98-08			CC-B-98-09			CC-B-98-10			CC-B-98-11			CC-B-98-PA14			CC-B-98-PA15		
				Date:	7/17/98			7/17/98			7/17/98			7/17/98			7/17/98			7/17/98		
				Channel Station:	900+00			950+00			1000+00			1050+00			668+00			775+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				1.10			2.10			1.60			0.70			30.7			14.4
Silt			%				12.90			29.80			20.60			12.80			23.8			46.1
Clay			%				86.00			68.10			77.80			86.50			45.5			39.5
D50			mm				0.002			0.002			0.002			0.002			0.016			0.032
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149	<1.0	<1.0	4.78	<1.0	<1.0	4.45	<1.0	<1.0	4.84	<1.0	<1.0	4.61	<1.00		3.47	<1.00		4.83
Ba	No ERL	ug/L	mg/kg	N/A	69.9	159.0	302	76.3	123.0	259	76.3	247.0	244	80.5	279.0	279	73.3		185	70.1		221
Cd	1.2	ug/L	mg/kg	45.62	<0.1	<0.10	0.39	<0.1	<0.10	0.45	<0.1	<0.10	4.04	<0.1	<0.10	0.59	<0.10		0.20	<0.10		0.23
Cr	81	ug/L	mg/kg	N/A	<1.0	<1.0	16.30	<1.0	<1.0	14.10	<1.0	<1.0	13.40	<1.0	<1.0	17.80	<1.0		9.57	<1.0		10.00
Cu	34	ug/L	mg/kg	13.5	<1.00	<1.0	10.50	<1.00	<1.0	10.20	<1.00	2.08	9.66	<1.00	<1.0	13.80	<1.00		7.76	<1.00		8.06
Pb	46.7	ug/L	mg/kg	133	<1.0	<1.0	7.29	<1.0	<1.0	6.29	<1.0	<1.0	6.00	<1.0	<1.0	7.58	<1.0		3.87	<1.0		4.15
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	0.11	<0.2	<0.2	0.13	<0.2	<0.2	0.10	<0.2	<0.2	0.13	<0.20		0.03	<0.20		0.06
Ni	20.9	ug/L	mg/kg	118	<1.0	<1.0	7.65	<1.0	<1.0	8.10	<1.0	<1.0	8.17	<1.0	<1.0	9.46	<1.00		6.14	<1.00		5.19
Ag	1	ug/L	mg/kg	2	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.00		<0.10	<1.00		<0.10
Se	No ERL	ug/L	mg/kg	564	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.00		<0.20	<1.00		<0.20
Zn	150	ug/L	mg/kg	92.7	7.5	3.2	72.7	13.0	3.1	74.7	8.3	4.3	69.0	12.1	3.4	97.6	18.2		40.4	16.1		47.3
TOC	No ERL	mg/L	mg/kg	N/A	<1.00	<1.00	18100	<1.00	<1.00	4990	<1.00	<1.00	12200	<1.00	<1.00	5360	<1.00		5270	<1.00		5440
Total PCB	22.7	ug/L	ug/kg	10	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01		<1.00	<0.01		<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10		<10.0	<0.10		<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14		<10.0	<0.14		<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50		<50.0	<0.50		<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00		<0.50	<5.00		<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00		<20.0	<2.00		<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00	<2.0	<20.0	<2.00		<20.0	<2.00		<20.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50		<20.0	<0.50		<20.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50		<20.0	<0.50		<20.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50		<20.0	<0.50		<20.0
Total Petrol HC	No ERL	ug/L	mg/kg	N/A	<100	<100	<5.00	<100	<100	66.20	<100	<100	<5.00	<100	<100	<5.00	<100		<5.00	<100		<5.00
Total Volatile Sol	No ERL		%	N/A			1.56			1.61			1.72			1.73			1.80			1.82
Total Sulfides	No ERL	mg/L	mg/kg	N/A			21.9			100.0			242.0			295.0			21.7			<10.0
Ammonia	No ERL	mg/L	mg/kg	N/A	<0.03	0.98	21.10	<0.03	<0.03	40.80	<0.03	<0.03	70.50	<0.03	2.43	81.30	0.05		12.00	<0.03		10.30

Source: USACE Database.

TABLE 3.2-8 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-98-PA16			CC-B-98-PA17			CC-B-98-REF14			CC-B-98-REF15			CC-B-98-REF16		
				Date:	7/17/98			7/17/98			7/17/98			7/17/98			7/17/98		
				Channel Station:	838+00			927+00			668+00			775+00			838+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				28.8			75.4			26.0			51.4			0.6
Silt			%				25.0			0.5			15.7			1.9			3.7
Clay			%				46.2			24.1			58.3			46.7			95.7
D50			mm				0.017			1.14			0.003			0.126			0.002
Oil & Grease	No ERL	mg/L	mg/kg	N/A															
As	8.2	ug/L	mg/kg	149	<1.00		3.82	<1.00		2.79	<1.00	<1.00	4.10	<1.00	2.86	3.16	<1.00	<1.00	4.03
Ba	No ERL	ug/L	mg/kg	N/A	74.4		189	72.2		136	69.5	77.7	226	77.6	73.0	224	70.7	79.1	264
Cd	1.2	ug/L	mg/kg	45.62	<0.10		0.23	<0.10		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.24	<0.10	<0.10	0.49
Cr	81	ug/L	mg/kg	N/A	<1.0		9.49	<1.0		8.76	<1.0	<1.0	12.90	<1.0	<1.0	11.50	<1.0	<1.0	16.70
Cu	34	ug/L	mg/kg	13.5	<1.00		7.03	<1.00		6.32	<1.00	<1.00	10.30	<1.00	<1.00	8.36	<1.00	<1.00	12.30
Pb	46.7	ug/L	mg/kg	133	<1.0		4.01	<1.0		3.93	<1.0	<1.00	4.88	<1.0	<1.00	4.97	<1.0	<1.00	7.25
Hg	0.15	ug/L	mg/kg	2.1	<0.20		0.06	<0.20		0.05	<0.20	<0.20	0.06	<0.20	0.41	0.05	<0.20	<0.20	0.08
Ni	20.9	ug/L	mg/kg	118	<1.00		5.65	<1.00		4.09	<1.00	<1.00	8.14	<1.00	<1.00	5.76	<1.00	<1.00	16.4
Ag	1	ug/L	mg/kg	2	<1.00		<0.10	<1.00		<0.10	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10
Se	No ERL	ug/L	mg/kg	564	<1.00		<0.20	<1.00		<0.20	<1.00	<1.00	<0.20	<1.00	<1.00	<0.20	<1.00	<1.00	<0.20
Zn	150	ug/L	mg/kg	92.7	18.8		50.6	14.1		37.4	14.2	4.2	58.8	12.2	3.9	58.8	16.6	2.7	82.5
TOC	No ERL	mg/L	mg/kg	N/A	<1.00		6990	<1.00		5910	<1.00	<1.00	10200	<1.00	<1.00	15700	<1.00	<1.00	16800
Total PCB	22.7	ug/L	ug/kg	10	<0.01		<1.00	<0.01		<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.10		<10.0	<0.10		<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14		<10.0	<0.14		<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50		<50.0	<0.50		<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00		<0.50	<5.00		<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.00		<20.0	<2.00		<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.00		<20.0	<2.00		<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50		<20.0	<0.50		<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50		<20.0	<0.50		<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50		<20.0	<0.50		<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Total Petrol HC	No ERL	ug/L	mg/kg	N/A	<100		21.30	<100		39.00	<100	<100	<5.00	<100	240	15.30	<100	790	49.40
Total Volatile Sol	No ERL		%	N/A			1.55			2.06			2.22			2.09			1.57
Total Sulfides	No ERL	mg/L	mg/kg	N/A			<10.0			<10.0			17.4			<10.0			44.4
Ammonia	No ERL	mg/L	mg/kg	N/A	0.05		13.70	<0.03		7.08	<0.03	0.20	7.88	<0.03	0.47	16.50	<0.03	0.46	134.00

Source: USACE Database.

TABLE 3.2-8 (Concluded)

DETECTED PARAMETERS IN THE HISTORIC DATA
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-B-98-REF17 7/17/98 927+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment
Sand			%				21.7
Silt			%				25.2
Clay			%				53.1
D50			mm				0.003
Oil & Grease	No ERL	mg/L	mg/kg	N/A			
As	8.2	ug/L	mg/kg	149	<1.00	<1.00	3.93
Ba	No ERL	ug/L	mg/kg	N/A	73.8	76.8	243
Cd	1.2	ug/L	mg/kg	45.62	<0.10	<0.10	0.27
Cr	81	ug/L	mg/kg	N/A	<1.0	<1.0	10.30
Cu	34	ug/L	mg/kg	13.5	<1.00	<1.00	7.82
Pb	46.7	ug/L	mg/kg	133	<1.0	<1.00	4.57
Hg	0.15	ug/L	mg/kg	2.1	<0.20	<0.20	0.07
Ni	20.9	ug/L	mg/kg	118	<1.00	<1.00	5.91
Ag	1	ug/L	mg/kg	2	<1.00	<1.00	<0.10
Se	No ERL	ug/L	mg/kg	564	<1.00	<1.00	<0.20
Zn	150	ug/L	mg/kg	92.7	12.4	3.4	55.5
TOC	No ERL	mg/L	mg/kg	N/A	<1.00	<1.00	7170
Total PCB	22.7	ug/L	ug/kg	10	<0.01	<0.01	<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.10	<0.10	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.14	<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00	<5.00	<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0
Total Petrol HC	No ERL	ug/L	mg/kg	N/A	<100	<100	<5.00
Total Volatile Sol	No ERL		%	N/A			1.85
Total Sulfides	No ERL	mg/L	mg/kg	N/A			<10.0
Ammonia	No ERL	mg/L	mg/kg	N/A	<0.03	<0.03	22.30

Source: USACE Database.

TABLE 3.2-9

SUMMARY OF BIOASSAY DATA FOR MAINTENANCE MATERIAL (% Survival)
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

	Station:	MT-1			MT-2			MT-3		
	Channel Station:	600+00			800+00			1000+00		
Date	Organism	Liquid Phase	Suspended Particulate Phase	Solid Phase	Liquid Phase	Suspended Particulate Phase	Solid Phase	Liquid Phase	Suspended Particulate Phase	Solid Phase
1982	*Menidia beryllina*	77	100		100	93		100	100	
	Mysidopsis almyra	60	90		93	70		100	90	
	Palaemonetes pugio	93	97	98	93	87	93	97	93	94
	Mercenaria mercenaria			99			100			100
	Neris virens			89			90			89

Source: Tereco, 1982a.

TABLE 3.2-10

DETECTED PARAMETERS IN THE HISTORIC DATA
INNER HARBOR
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-TB-83-01 1/12/1983 1100+00			CC-TB-83-02 1/12/1983 1150+00			CC-TB-83-03 1/12/1983 1200+00			CC-TB-88-01 2/24/1988 1100+00			CC-TB-88-02 2/24/1988 1150+00			CC-TB-88-03 2/24/1988 1200+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				0.38						2.29						40.29			
Silt			%				37.55						19.03						42.4			
Clay			%				62.07						78.68						17.31			
D50			mm				0.004						0.003						0.027405			
Oil & Grease	No ERL	mg/L	mg/kg	N/A	3.2	3.0	73.8	1.3	1.2	58.8	<1.0	2.2	75.5	1.05	1.87	214.02	3.61	2.25	63.09	2.89	2.39	160.18
As	8.2	ug/L	mg/kg	149	9.0	12.0	3.47	13.0	24.0	2.58	10.0	16.0	2.79	<2.0	<2.0	1.13	<2.0	<2.0	1.41	<2.0	<2.0	1.28
Ba	No ERL	ug/L	mg/kg	N/A																		
Cd	1.2	ug/L	mg/kg	45.62	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50	<2.00	<2.00	6.59	<2.00	<2.0	<0.1	<2.00	<2.0	<0.1	<2.00	<2.0	<0.1
Cr	81	ug/L	mg/kg	N/A	<10.00	<10.00	6.78	<10.00	<10.00	7.11	<10.00	<10.00	14.52	<10.00	<10.00	11.80	<10.00	<10.00	15.02	<10.00	<10.0	15.38
Cu	34	ug/L	mg/kg	13.5	<1.00	<1.00	6.49	<1.00	<1.00	6.61	<1.00	<1.00	12.65	6.0	1.6	4.24	6.4	3.6	6.56	7.6	1.8	6.39
Pb	46.7	ug/L	mg/kg	133	<10.00	<10.00	11.8	<10.00	<10.00	9.1	<10.00	<10.00	18.1	<5.0	<5.0	12.68	<5.0	<5.0	13.12	<5.0	<5.0	12.50
Hg	0.15	ug/L	mg/kg	2.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.2	<0.2	<0.10	<0.2	<0.2	<0.10	<0.2	<0.2	<0.10
Ni	20.9	ug/L	mg/kg	118	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	<20.00	<20.00	<5.00	50.8	47.4	4.05	44.0	49.0	3.94	42.0	50.6	4.04
Ag	1	ug/L	mg/kg	2																		
Se	No ERL	ug/L	mg/kg	564										<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0
Zn	150	ug/L	mg/kg	92.7	<20.00	<20.00	65.59	<20.00	<20.00	51.63	<20.00	<20.00	164.16	9.6	<5.0	45.12	15.2	<5.0	64.62	40.8	7.0	65.29
TOC	No ERL	mg/L	mg/kg	N/A	<0.50			<0.50			<0.50											
Total PCB	22.7	ug/L	ug/kg	10	<0.02	<0.50	<10.00	<0.02	<0.50	<10.00	<0.02	<0.50	<10.00	<0.5	<0.50	<5.0	<0.5	<0.50	<5.0	<0.5	<0.5	<5.0
DDT	1.58	ug/L	ug/kg	0.13	<0.05	<0.02	<0.50	<0.05	<0.02	<0.50	<0.05	<0.02	<0.50	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Chlordane	0.5	ug/L	ug/kg	0.09	<0.50	<0.05	<1.00	<0.50	<0.05	<1.00	<0.50	<0.05	<1.00	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Toxaphene	No ERL	ug/L	ug/kg	0.21		<0.50	<10.00		<0.50	<10.00		<0.50	<10.00	<0.5	<0.50	<5.0	<0.5	<0.50	<5.0	<0.5	<0.5	<5.0
Total PAH	4,022	ug/L	mg/kg	N/A										<5.0	<2.5	<0.5	<5.0	<2.5	<0.5	<5.0	<2.5	<0.5
Naphthalene	160	ug/L	ug/kg	N/A										<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Acenaphthene	16	ug/L	ug/kg	N/A										<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0
Fluoranthene	600	ug/L	ug/kg	N/A										<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A										<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A																		
Ammonia	No ERL	mg/L	mg/kg	N/A	5.20	0.11	41.30	7.70	0.10	81.04	11.00	0.13	44.84									

Source: USACE Database.

TABLE 3.2-10 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
INNER HARBOR
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-TB-91-01			CC-TB-91-02			CC-TB-91-03			CC-TB-94-01		
				Date:	8/22/1991			8/22/1991			8/22/1991			3/16/1994		
				Channel Station:	1100+00			1150+00			1200+00			1100+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				22.9			0.9			60.2			12.0
Silt			%				39.4			41.1			11.9			59.0
Clay			%				37.7			58.0			27.9			29.0
D50			mm				0.011			0.003			0.21			0.06
Oil & Grease	No ERL	mg/L	mg/kg	N/A												
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<1.0	<1.0	<0.50
Ba	No ERL	ug/L	mg/kg	N/A										44.9	86.4	169.0
Cd	1.2	ug/L	mg/kg	45.62	<2.00	<2.0	<0.1	<2.00	<2.0	<0.1	<2.00	<2.0	<0.1	<0.10	<0.10	<0.50
Cr	81	ug/L	mg/kg	N/A	<10.00	<10.0	5.30	<10.00	<10.0	6.30	<10.00	<10.0	10.60	2.2	3.3	16.00
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	3.40	<1.0	<1.0	3.20	<1.0	<1.0	6.70	2.8	<1.0	12.00
Pb	46.7	ug/L	mg/kg	133	<5.0	<5.0	7.50	<5.0	<5.0	6.30	<5.0	<5.0	7.80	<1.0	<1.0	19.00
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.10	<0.2	<0.2	<0.10	<0.2	<0.2	<0.10	<0.2	<0.2	<0.05
Ni	20.9	ug/L	mg/kg	118	<5.0	<5.0	2.30	<5.0	<5.0	2.60	<5.0	<5.0	3.20	<1.0	<1.0	10.00
Ag	1	ug/L	mg/kg	2										<1.0	<1.0	<0.50
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<1.00
Zn	150	ug/L	mg/kg	92.7	8.0	29.0	31.1	8.0	14.0	31.1	10.0	29.0	55.7	<1.0	<1.0	161.0
TOC	No ERL	mg/L	mg/kg	N/A	6.80	17.90	<100	8.30	21.90	<100	8.80	14.60	<100	1.25	1.25	244.0
Total PCB	22.7	ug/L	ug/kg	10	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.50	<0.50	<15.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.12	<0.12	<30.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.14	<0.14	<30.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.50	<0.50	<150.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.0	<5.0	<0.5	<5.00	<5.00	<1.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<90.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<50.0	<2.0	<2.0	<90.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.5	<0.5	24.0	<0.5	<0.5	16.0	<0.5	<0.5	128.0	<0.50	<0.50	<90.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.5	<0.5	<10.0	<0.5	<0.5	<10.0	<0.5	<0.5	80.0	<0.50	<0.50	<90.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A										<0.50	<0.50	<90.0
Ammonia	No ERL	mg/L	mg/kg	N/A												

Source: USACE Database.

TABLE 3.2-10 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
INNER HARBOR
CORPUS CHRISTI SHIP CHANNEL

				Station: Date: Channel Station:	CC-TB-94-02 3/16/1994 1150+00			CC-TB-94-03 3/16/1994 1200+00			CC-TB-94-04 3/16/1994 1250+00			CC-TB-94-05 3/16/1994 1300+00			CC-TB-94-06 3/16/1994 1350+00			CC-TB-94-07 3/16/1994 1400+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				19.4			59.7			78			53.3			30.5			58.7
Silt			%				56.9			19.4			16.9			36.6			50.6			29.7
Clay			%				23.7			20.9			5.1			10.1			18.9			11.6
D50			mm				0.055			0.129			0.263			0.145			0.044			0.144
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50	1.2	<1.0	<0.50	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50
Ba	No ERL	ug/L	mg/kg	N/A	47.0	40.4	127.0	51.5	100.0	157.0	53.5	36.8	109.0	60.5	202.0	327.0	91.6	61.9	381.0	49.7	68.4	86.0
Cd	1.2	ug/L	mg/kg	45.62	<0.10	<0.10	<0.50	<0.10	<0.10	<0.50	<0.10	<0.10	<0.50	<0.10	<0.10	<0.50	<0.10	<0.10	<0.50	<0.10	<0.10	<0.50
Cr	81	ug/L	mg/kg	N/A	<1.0	3.0	9.30	1.2	3.6	17.00	3.2	3.9	11.10	<1.0	4.4	19.70	<1.0	3.8	23.30	1.2	4.9	7.31
Cu	34	ug/L	mg/kg	13.5	3.1	<1.0	80.00	3.6	<1.0	16.00	2.9	<1.0	17.80	3.3	<1.0	114.00	3.3	<1.0	215.00	3.4	<1.0	20.30
Pb	46.7	ug/L	mg/kg	133	<1.0	<1.0	10.40	<1.0	<1.0	17.80	<1.0	<1.0	10.40	<1.0	<1.0	37.20	<1.0	<1.0	58.40	<1.0	<1.0	13.30
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.05	<0.2	<0.2	<0.05	<0.2	<0.2	<0.05	<0.2	<0.2	<0.05	<0.2	<0.2	<0.05	<0.2	<0.2	<0.05
Ni	20.9	ug/L	mg/kg	118	<1.0	<1.0	5.37	<1.0	<1.0	7.10	<1.0	<1.0	5.00	<1.0	<1.0	7.00	<1.0	<1.0	11.30	<1.0	<1.0	4.70
Ag	1	ug/L	mg/kg	2	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<1.00	<2.0	<2.0	<1.00	<2.0	<2.0	<1.00	<2.0	<2.0	<1.00	<2.0	<2.0	<1.00	<2.0	<2.0	<1.00
Zn	150	ug/L	mg/kg	92.7	<1.0	<1.0	61.1	<1.0	<1.0	122.0	<1.0	<1.0	102.0	<1.0	<1.0	302.0	<1.0	<1.0	517.0	<1.0	<1.0	125.0
TOC	No ERL	mg/L	mg/kg	N/A	1.00	<1.00	196.0	1.20	<1.00	819.0	1.00	<1.00	502.0	1.00	<1.00	681.0	9.90	9.45	592.0	7.25	7.90	187.0
Total PCB	22.7	ug/L	ug/kg	10	<0.50	<0.12	<15.0	<0.50	<0.12	<15.0	<0.50	<0.12	<15.0	<0.50	<0.12	<15.0	<0.50	<0.12	<15.0	<0.50	<0.12	<15.0
DDT	1.58	ug/L	ug/kg	0.13	<0.12	<0.14	<30.0	<0.12	<0.14	<30.0	<0.12	<0.14	<30.0	<0.12	<0.14	<30.0	<0.12	<0.14	<30.0	<0.12	<0.14	<30.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.50	<30.0	<0.14	<0.50	<30.0	<0.14	<0.50	<30.0	<0.14	<0.50	<30.0	<0.14	<0.50	<30.0	<0.14	<0.50	<30.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<5.00	<150.0	<0.50	<5.00	<150.0	<0.50	<5.00	<150.0	<0.50	<5.00	<150.0	<0.50	<5.00	<150.0	<0.50	<5.00	<150.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00	<2.0	<1.50	<5.00	<2.0	<1.50	<5.00	<2.0	<1.50	<5.00	<2.0	<1.50	<5.00	<2.0	3.54	<5.00	<2.0	<1.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<0.50	<90.0	<2.0	<0.50	<90.0	<2.0	<0.50	<90.0	<2.0	<0.50	<90.0	<2.0	<0.50	<90.0	<2.0	<0.50	<90.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50	<0.50	<90.0	<0.50	<0.50	144.0	<0.50	<0.50	115.0	<0.50	<0.50	362.0	<0.50	<0.50	146.0	<0.50	<0.50	<90.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	96.0	<0.50	<0.50	216.0	<0.50	<0.50	216.0	<0.50	<0.50	380.0	<0.50	<0.50	637.0	<0.50	<0.50	231.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50		<90.0	<0.50		<90.0	<0.50		<90.0	<0.50		<90.0	<0.50		<90.0	<0.50		<90.0
Aldrin	No ERL	ug/L	ug/kg	1.3																		
Dieldrin	0.02	ug/L	ug/kg	0.71																		
Heptachlor	No ERL	ug/L	ug/kg	0.053																		
Hexachlorocyclohexane	No ERL	ug/L	ug/kg	0.16																		
Ammonia	No ERL	mg/L	mg/kg	N/A																		

Source: USACE Database.

TABLE 3.2-10 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
INNER HARBOR
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-TB-94-08			CC-TB-94-09			CC-TB-94-10			CC-TB-97-01		
				Date:	3/16/1994			3/16/1994			3/16/1994			11/13/1997		
				Channel Station:	1450+00			1500+00			1550+00			1100+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				10.5			22.3			22.7			2.8
Silt			%				41.3			68.1			68.4			9.9
Clay			%				48.2			9.6			8.9			87.3
D50			mm				0.006			0.043			0.056			0.003
Oil & Grease	No ERL	mg/L	mg/kg	N/A												
As	8.2	ug/L	mg/kg	149	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50	1.5	<1.0	<0.50	<1.0	<1.0	5.86
Ba	No ERL	ug/L	mg/kg	N/A	46.8	29.0	121.0	56.8	42.7	176.0	52.6	97.6	152.0	47.0	102.0	287.0
Cd	1.2	ug/L	mg/kg	45.62	<0.10	<0.10	<0.50	<0.10	<0.10	<0.50	<0.10	<0.10	<0.50	<0.10	<0.10	3.77
Cr	81	ug/L	mg/kg	N/A	3.7	3.9	13.10	1.5	6.3	18.10	1.4	5.8	13.20	2.9	<1.0	20.9
Cu	34	ug/L	mg/kg	13.5	4.1	<1.0	14.00	3.1	<1.0	28.30	4.8	<1.0	30.40	1.7	<1.0	13.4
Pb	46.7	ug/L	mg/kg	133	<1.0	<1.0	18.00	<1.0	<1.0	15.00	<1.0	<1.0	11.00	<1.0	<1.0	14.3
Hg	0.15	ug/L	mg/kg	2.1	<0.2	<0.2	<0.05	<0.2	<0.2	<0.05	<0.2	<0.2	<0.05	<0.2	<0.20	0.07
Ni	20.9	ug/L	mg/kg	118	<1.0	<1.0	7.29	<1.0	<1.0	9.40	<1.0	<1.0	8.50	<1.0	<1.0	12.40
Ag	1	ug/L	mg/kg	2	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50	<1.0	<1.0	<0.10
Se	No ERL	ug/L	mg/kg	564	<2.0	<2.0	<1.00	<2.0	<2.0	<1.00	<2.0	<2.0	<1.00	<1.0	<1.0	<0.20
Zn	150	ug/L	mg/kg	92.7	<1.0	<1.0	227.0	<1.0	<1.0	214.0	<1.0	<1.0	172.0	5.3	1.9	105.0
TOC	No ERL	mg/L	mg/kg	N/A	4.65	6.85	281.0	1.35	8.95	420.0	1.00	12.10	248.0	<1	<1.00	62.6
Total PCB	22.7	ug/L	ug/kg	10	<0.50	<0.5	<15.0	<0.50	<0.5	<15.0	<0.50	<0.5	<15.0	<0.01	<0.01	<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.12	<0.12	<30.0	<0.12	<0.12	<30.0	<0.12	<0.12	<30.0	<0.10	<0.10	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.14	<30.0	<0.14	<0.14	<30.0	<0.14	<0.14	<30.0	<0.14	<0.14	<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<150.0	<0.50	<0.50	<150.0	<0.50	<0.50	<150.0	<0.50	<0.50	<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00	<5.00	<1.50	<5.00	<5.00	<1.50	<5.00	<5.00	<1.50	<5.00	<5.00	<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0	<2.0	<2.00	<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0	<2.0	<2.00	<20.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50	<0.50	<90.0	<0.50	<0.50	<90.0	<0.50	<0.50	<90.0	<0.50	<0.50	<20.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	276.0	<0.50	<0.50	211.0	<0.50	<0.50	223.0	<0.50	<0.50	<20.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	<90.0	<0.50	<0.50	<90.0	<0.50	<0.50	<90.0	<0.50	<0.50	<20.0
Aldrin	No ERL	ug/L	ug/kg	1.3												
Dieldrin	0.02	ug/L	ug/kg	0.71												
Heptachlor	No ERL	ug/L	ug/kg	0.053												
Hexachlorocyclohexane	No ERL	ug/L	ug/kg	0.16												
Ammonia	No ERL	mg/L	mg/kg	N/A												

Source: USACE Database.

TABLE 3.2-10 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
INNER HARBOR
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-TB-97-02			CC-TB-97-03			CC-TB-97-04			CC-TB-97-05			CC-TB-97-06			CC-TB-97-07		
				Date:	11/13/1997			11/13/1997			11/13/1997			11/13/1997			11/13/1997			11/13/1997		
				Channel Station:	1150+00			1200+00			1250+00			1300+00			1350+00			1400+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				5.6			38.6			10.6			74.9			52.7			37.0
Silt			%				33.4			11.3			25.5			17.8			28.2			49.6
Clay			%				61.0			50.1			63.9			7.3			19.1			13.4
D50			mm				0.005			0.005			0.003			0.161			0.078			0.031
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149	<1.0	<1.0	5.52	<1.0	<1.0	4.63	<1.0	<1.0	4.24	<1.0	<1.0	2.19	<1.0	<1.0	2.97	<1.0		3.02
Ba	No ERL	ug/L	mg/kg	N/A	48.5	138.0	285.0	48.8	98.2	403.0	49.2	94.3	81.7	50.5	53.3	109.0	51.5	53.4	180.0	50.1		150.0
Cd	1.2	ug/L	mg/kg	45.62	<0.10	<0.10	4.47	<0.10	0.24	4.54	<0.10	<0.10	2.47	<0.10	<0.10	2.40	<0.10	<0.10	4.25	<0.10		3.64
Cr	81	ug/L	mg/kg	N/A	2.0	<1.0	27.2	<1.0	<1.0	28.1	<1.0	1.3	14.9	<1.0	<1.0	14.7	<1.0	<1.0	14.5	<1.0		15.3
Cu	34	ug/L	mg/kg	13.5	2.2	<1.0	25.0	1.6	<1.0	14.1	1.4	<1.0	13.0	2.3	<1.0	27.2	2.2	<1.0	74.1	1.4		30.1
Pb	46.7	ug/L	mg/kg	133	<1.0	<1.0	19.1	<1.0	<1.0	9.3	<1.0	<1.0	10.7	<1.0	<1.0	15.3	<1.0	<1.0	26.2	<1.0		19.2
Hg	0.15	ug/L	mg/kg	2.1	<0.20	<0.20	0.11	<0.20	<0.20	0.06	<0.20	<0.20	<0.02	<0.20	<0.20	0.17	<0.20	<0.20	0.43	<0.20		0.30
Ni	20.9	ug/L	mg/kg	118	<1.0	<1.0	13.80	<1.0	<1.0	15.10	<1.0	<1.0	7.47	<1.0	<1.0	5.19	<1.0	<1.0	7.02	<1.0		8.19
Ag	1	ug/L	mg/kg	2	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0		<0.10
Se	No ERL	ug/L	mg/kg	564	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.0		<0.20
Zn	150	ug/L	mg/kg	92.7	6.4	<1.0	172.0	7.1	3.4	114.0	8.3	4.0	82.5	7.9	4.2	183.0	8.4	4.6	282.0	6.6		204.0
TOC	No ERL	mg/L	mg/kg	N/A	<1.0	<1.0	175.0	<1.0	<1.0	148.0	<1.0	<1.0	33.5	<1.0	<1.0	91.8	<1.0	<1.0	83.2	<1.0		139.0
Total PCB	22.7	ug/L	ug/kg	10	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01		<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10		<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14		<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50		<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	1.10	<5.00	<5.00	1.09	<5.00	<5.00	<0.50	<5.00		<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00		<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00		<20.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50	<0.50	140.0	<0.50	<0.50	<20.0	<0.50	<0.50	251.0	<0.50	<0.50	149.0	<0.50	<0.50	21.4	<0.50		33.1
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	56.3	<0.50	<0.50	<20.0	<0.50	<0.50	53.2	<0.50	<0.50	104.0	<0.50	<0.50	20.0	<0.50		26.2
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	56.3	<0.50	<0.50	<20.0	<0.50	<0.50	57.9	<0.50	<0.50	130.0	<0.50	<0.50	21.4	<0.50		38.8
Aldrin	No ERL	ug/L	ug/kg	1.3																		
Dieldrin	0.02	ug/L	ug/kg	0.71																		
Heptachlor	No ERL	ug/L	ug/kg	0.053																		
Hexachlorocyclohexane	No ERL	ug/L	ug/kg	0.16																		
Ammonia	No ERL	mg/L	mg/kg	N/A																		

Source: USACE Database.

TABLE 3.2-10 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
INNER HARBOR
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-TB-97-08			CC-TB-97-09			CC-TB-97-10		
				Date:	11/13/1997			11/13/1997			11/13/1997		
				Channel Station:	1450+00			1500+00			1550+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				25.4			24.8			17.4
Silt			%				40.8			31.9			53.7
Clay			%				33.8			43.3			28.9
D50			mm				0.006			0.005			0.006
Oil & Grease	No ERL	mg/L	mg/kg	N/A									
As	8.2	ug/L	mg/kg	149	<1.0	<1.0	3.08	<1.0	<1.0	2.63	<1.0	<1.0	3.74
Ba	No ERL	ug/L	mg/kg	N/A	51.4	186.0	162.0	51.5	418.0	130.0	51.6	85.8	126.0
Cd	1.2	ug/L	mg/kg	45.62	<0.10	0.20	4.19	<0.10	<0.10	3.32	<0.10	0.15	3.89
Cr	81	ug/L	mg/kg	N/A	<1.0	<1.0	19.4	<1.0	<1.0	15.6	<1.0	<1.0	15.5
Cu	34	ug/L	mg/kg	13.5	1.4	<1.0	30.0	<1.0	<1.0	24.7	<1.0	<1.0	32.4
Pb	46.7	ug/L	mg/kg	133	<1.0	<1.0	18.9	<1.0	<1.0	13.2	<1.0	<1.0	13.1
Hg	0.15	ug/L	mg/kg	2.1	<0.20	<0.20	0.21	<0.20	<0.20	0.10	<0.20	<0.20	0.10
Ni	20.9	ug/L	mg/kg	118	<1.0	<1.0	10.30	<1.0	<1.0	8.67	<1.0	<1.0	9.79
Ag	1	ug/L	mg/kg	2	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Se	No ERL	ug/L	mg/kg	564	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20
Zn	150	ug/L	mg/kg	92.7	5.9	<1.0	219.0	6.4	<1.0	169.0	4.0	<1.0	219.0
TOC	No ERL	mg/L	mg/kg	N/A	<1.0	<1.0	84.7	<1.0	<1.0	66.4	<1.0	<1.0	79.5
Total PCB	22.7	ug/L	ug/kg	10	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0	<0.14	<0.14	<10.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	44.5
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	26.9
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	41.3
Aldrin	No ERL	ug/L	ug/kg	1.3									
Dieldrin	0.02	ug/L	ug/kg	0.71									
Heptachlor	No ERL	ug/L	ug/kg	0.053									
Hexachlorocyclohexane	No ERL	ug/L	ug/kg	0.16									
Ammonia	No ERL	mg/L	mg/kg	N/A									

Source: USACE Database.

TABLE 3.2-10 (Cont'd)

DETECTED PARAMETERS IN THE HISTORIC DATA
INNER HARBOR
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-B-00-10			CC-B-00-10a			CC-B-00-10b			CC-B-00-10c			CC-B-00-10d			CC-B-00-11		
				Date:	11/21/00			11/21/00			11/21/00			11/21/00			11/21/00			11/21/00		
				Channel Station:	1000+00			1010+00			1020+00			1030+00			1040+00			1050+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				19.100			0.500			0.400			0.300			0.400			1.000
Silt			%				7.000			19.800			16.800			15.700			11.900			9.100
Clay			%				70.600			79.700			82.800			84.000			87.700			89.900
D50			mm				0.003			0.003			0.003			0.003			0.003			0.003
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149	<1.00	<1.00	7.34			9.90			8.48			8.74			8.83	<1.00	<1.00	8.90
Ba	No ERL	ug/L	mg/kg	N/A	55.10	62.00	77.20			137.00			210.00			209.00			224.00	57.70	60.90	212.00
Cd	1.2	ug/L	mg/kg	45.4	<0.10	<0.10	<0.10			<0.10			0.24			<0.10			<0.10	<0.10	<0.10	0.16
Cr	81	ug/L	mg/kg	1090	<1.00	<1.00	3.48			5.28			8.16			7.97			8.69	<1.00	<1.00	8.41
Cu	34	ug/L	mg/kg	13.5	<1.00	1.90	3.23			5.17			8.08			7.63			7.93	<1.00	<1.00	7.81
Pb	46.7	ug/L	mg/kg	133	<1.00	<1.00	24.30			21.90			19.30			20.00			20.60	<1.00	<1.00	20.40
Hg	0.15	ug/L	mg/kg	2.1	<0.20	<0.20	0.08			0.12			0.14			0.10			0.12	<0.20	<0.20	0.14
Ni	20.9	ug/L	mg/kg	118	<1.00	<1.00	2.49			3.87			6.04			6.35			6.39	<1.00	<1.00	6.37
Ag	1	ug/L	mg/kg	2	<1.00	<1.00	<0.10			<0.10			<0.10			<0.10			<0.10	<1.00	<1.00	<0.10
Se	No ERL	ug/L	mg/kg	564	<1.00	<1.00	1.37			1.29			1.08			0.88			0.75	<1.00	<1.00	1.00
Zn	150	ug/L	mg/kg	92.7	8.70	3.40	28.50			47.10			75.70			71.40			76.60	43.50	4.90	74.70
TOC	No ERL	mg/L	mg/kg	N/A	<1000	<1000	10900.00			10000.00			11000.00			11900.00			12300.00	<1000	<1000	14000.00
Total PCB	22.7	ug/L	ug/kg	10	<0.01	<0.01	<1.00			<1.00			<1.00			<1.00			<1.00	<0.01	<0.01	<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.10	<0.10	<10.0			<10.0			<10.0			<10.0			<10.0	<0.10	<0.10	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.14	<10.0			<10.			<10.			<10.			<10.	<0.14	<0.14	<10.
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<50.0			<50.0			<50.0			<50.0			<50.0	<0.50	<0.50	<50.0
Total PAH	No ERL	ug/L	mg/kg	N/A	<5.00	<5.00	<500			<500			<500			<500			<500	<5.00	<5.00	<500
Naphthalene	160	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0			<20.0			<20.0			<20.0			<20.0	<2.00	<2.00	<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0			<20.0			<20.0			<20.0			<20.0	<2.00	<2.00	<20.0
Fluoranthene	No ERL	ug/L	ug/kg	N/A		<0.50	<20.0			<20.0			<20.0			<20.0			<20.0	<0.50	<0.50	<20.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0			<20.0			<20.0			<20.0			<20.0	<0.50	<0.50	<20.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0			<20.0			<20.0			<20.0			<20.0	<0.50	<0.50	<20.0
TPH	No ERL		mg/kg		220.00	150.00	211.00			240.00			170.00			168.00			209.00	460.00	100.00	210.00
Ammonia	No ERL	mg/L	mg/kg	N/A	<0.03	1.32	37.90			81.00			110.00			97.30			111.00	<0.03	2.08	9608.00
Total Sulfide			mg/kg				16.20			214.00			201.00			73.10			91.50			272.00
% Total Solid			mg/kg				38.00			31.10			29.70			29.40			30.70			31.00
% Volatile Solid			mg/kg				1.71			1.59			1.63			1.45			3.22			2.91

Source: USACE Database.

TABLE 3.2-10 (Con't.)

DETECTED PARAMETERS IN THE HISTORIC DATA
INNER HARBOR
CORPUS CHRISTI SHIP CHANNEL

				Station: / Date: / Channel Station:	CC-B-00-11a 11/21/00 1060+00			CC-B-00-11b 11/21/00 1070+00			CC-B-00-11c 11/21/00 1080+00			CC-B-00-11d 11/21/00 1090+00			CC-B-00-PA17B 11/21/00 970+00, 2,500' S			CC-B-00-REF17B 11/21/00 970+00, 2,500' N		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				1.000			2.500			1.200			1.500			45.100			6.600
Silt			%				9.100			11.700			22.600			11.200			13.800			20.700
Clay			%				89.900			85.800			76.200			87.300			24.300			71.400
D50			mm				0.003			0.003			0.003			0.003			0.185			0.000
Oil & Grease	No ERL	mg/L	mg/kg	N/A																		
As	8.2	ug/L	mg/kg	149			8.50			6.43			7.23			7.46	<1.00		4.81	<1.00	<1.00	6.10
Ba	No ERL	ug/L	mg/kg	N/A			82.90			236.00			227.00			221.00	50.40		94.20	52.20	53.70	233.00
Cd	1.2	ug/L	mg/kg	45.4			0.25			0.24			0.27			0.24	<0.10		<0.10	<0.10	<0.10	0.22
Cr	81	ug/L	mg/kg	1090			3.06			7.35			8.44			8.02	2.00		3.06	<1.00	<1.00	6.66
Cu	34	ug/L	mg/kg	13.5			3.15			7.61			12.20			8.94	<1.00		3.24	<1.00	<1.00	6.57
Pb	46.7	ug/L	mg/kg	133			32.10			22.40			23.60			25.50	2.40		12.80	<1.00	<1.00	24.30
Hg	0.15	ug/L	mg/kg	2.1			0.11			0.10			0.08			0.11	<0.20		0.05	<0.20	<0.20	0.26
Ni	20.9	ug/L	mg/kg	118			1.97			5.35			6.86			6.38	<1.00		2.76	<1.00	<1.00	5.13
Ag	1	ug/L	mg/kg	2			<0.10			<0.10			<0.10			<0.10	<1.00		<0.10	<1.00	<1.00	<0.10
Se	No ERL	ug/L	mg/kg	564			1.56			1.37			1.55			1.63	<1.00		1.09	<1.00	<1.00	1.62
Zn	150	ug/L	mg/kg	92.7			30.70			68.30			87.20			81.40	6.10		27.90	8.10	3.10	65.20
TOC	No ERL	mg/L	mg/kg	N/A			11900.00			13100.00			20000.00			12000.00	<1000		9280.00	<1000	<1000	11300.00
Total PCB	22.7	ug/L	ug/kg	10			<1.00			<1.00			<1.00			<1.00	<0.01		<1.00	<0.01	<0.01	<1.00
DDT	1.58	ug/L	ug/kg	0.13			<10.0			<10.0			<10.0			<10.0	<0.10		<10.0	<0.10	<0.10	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09			<10.			<10.			<10.			<10.	<0.14		<10.	<0.14	<0.14	<10.
Toxaphene	No ERL	ug/L	ug/kg	0.21			<50.0			<50.0			<50.0			<50.0	<0.50		<50.0	<0.50	<0.50	<50.0
Total PAH	No ERL	ug/L	mg/kg	N/A			<500			<500			<500			<500	<5.00		<500	<5.00	<5.00	<500
Naphthalene	160	ug/L	ug/kg	N/A			<20.0			<20.0			<20.0			<20.0	<2.00		<20.0	<2.00	<2.00	<20.0
Acenaphthene	16	ug/L	ug/kg	N/A			<20.0			<20.0			<20.0			<20.0	<2.00		<20.0	<2.00	<2.00	<20.0
Fluoranthene	No ERL	ug/L	ug/kg	N/A			<20.0			<20.0			<20.0			<20.0	<0.50		<20.0	<0.50	<0.50	<20.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A			<20.0			<20.0			<20.0			<20.0	<0.50		<20.0	<0.50	<0.50	<20.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A			<20.0			<20.0			<20.0			<20.0	<0.50		<20.0	<0.50	<0.50	<20.0
TPH	No ERL						184.00			175.00			114.00			276.00	220.00		62.10	170.00	120.00	122.00
Ammonia	No ERL	mg/L	mg/kg	N/A			79.40			131.00			97.00			92.20	<0.03		2.79	<0.03	0.28	3.21
Total Sulfide			mg/kg				173.00			161.00			341.00			211.00			4.79			86.00
% Total Solid			mg/kg				32.00			33.60			29.60			31.90			64.50			40.80
% Volatile Solid			mg/kg				1.94			1.49			1.57			1.58			0.94			1.78

Source: USACE Database.

TABLE 3.2-10 (Concluded)

DETECTED PARAMETERS IN THE HISTORIC DATA
INNER HARBOR
CORPUS CHRISTI SHIP CHANNEL

				Station:	CC-TB-00-01			CC-TB-00-02			DUP CC-B-00-11		
				Date:	11/21/00			11/21/00			11/21/00		
				Channel Station:	1100+00			1150+00			1050+00		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				5.600			3.700			0.800
Silt			%				6.100			8.200			12.800
Clay			%				88.300			88.100			86.400
D50			mm				0.003			0.003			0.003
Oil & Grease	No ERL	mg/L	mg/kg	N/A									
As	8.2	ug/L	mg/kg	149	<1.00	<1.00	7.64	<1.00	<1.00	6.10	<1.00	<1.00	7.28
Ba	No ERL	ug/L	mg/kg	N/A	54.70	62.40	144.00	57.20	65.90	189.00	56.10	64.20	230.00
Cd	1.2	ug/L	mg/kg	45.4	<0.10	<0.10	0.12	<0.10	<0.10	0.16	<0.10	<0.10	0.23
Cr	81	ug/L	mg/kg	1090	<1.00	<1.00	5.58	<1.00	<1.00	9.11	1.80	<1.00	8.61
Cu	34	ug/L	mg/kg	13.5	<1.00	<1.00	6.65	<1.00	<1.00	12.80	<1.00	<1.00	9.19
Pb	46.7	ug/L	mg/kg	133	<1.00	<1.00	26.60	<1.00	<1.00	22.70	<1.00	<1.00	24.70
Hg	0.15	ug/L	mg/kg	2.1	<0.20	<0.20	0.14	<0.20	<0.20	0.12	<0.20	<0.20	0.12
Ni	20.9	ug/L	mg/kg	118	<1.00	<1.00	3.91	<1.00	<1.00	6.19	<1.00	<1.00	6.62
Ag	1	ug/L	mg/kg	2	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10
Se	No ERL	ug/L	mg/kg	564	<1.00	<1.00	1.77	<1.00	<1.00	1.64	<1.00	<1.00	1.68
Zn	150	ug/L	mg/kg	92.7	3.60	6.70	58.50	13.90	4.30	94.70	8.30	6.40	82.30
TOC	No ERL	mg/L	mg/kg	N/A	<1000	<1000	12700.00	<1000	<1000	11600.00	<1000	<1000	18000.00
Total PCB	22.7	ug/L	ug/kg	10	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00
DDT	1.58	ug/L	ug/kg	0.13	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0	<0.10	<0.10	<10.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.14	<0.14	<10.	<0.14	<0.14	<10.	<0.14	<0.14	<10.
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0	<0.50	<0.50	<50.0
Total PAH	No ERL	ug/L	mg/kg	N/A	<5.00	<5.00	<500	<5.00	<5.00	<500	<5.00	<5.00	<500
Naphthalene	160	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0	<2.00	<2.00	<20.0
Fluoranthene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0	<0.50	<0.50	<20.0
TPH	No ERL				200.00	130.00	105.00	200.00	180.00	160.00	180.00	170.00	197.00
Ammonia	No ERL	mg/L	mg/kg	N/A	<0.03	2.40	84.90	<0.03	2.47	87.50	<0.03	3.37	99.00
Total Sulfide			mg/kg				413.00			42.00			116.00
% Total Solid			mg/kg				30.50			30.50			29.80
% Volatile Solid			mg/kg				1.65			2.27			1.82

Source: USACE Database.

TABLE 3.2-11

DETECTED PARAMETERS IN THE HISTORIC DATA
GULF INTRACOASTAL WATERWAY
ACROSS CORPUS CHRISTI BAY

				Station:	GIC-CBB-83-01			GIC-CBB-83-02			GIC-CBB-83-03			GIC-CBB-83-DA 171		
				Date:	5/11/83			5/11/83			5/11/83			5/11/83		
				Channel Station:	0+000			5+000			10+000			3+000		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%							3.14						5.08
Silt			%							52.49						19.78
Clay			%							44.37						75.1
D50			mm							0.006						0.002
Oil & Grease	No ERL	mg/L	mg/kg	N/A	<1.0	<1.0	292.0	<1.0	<1.0	250.0	<1.0	1.5	76.0	<1.0		80.0
As	8.2	ug/L	mg/kg	149	7.5	14.0	3.5	9.0	14.0	2.29	7.8	20.0	<1.0	14.0		1.0
Ba	No ERL	ug/L	mg/kg	N/A												
Cd	1.2	ug/L	mg/kg	45.62	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0		<0.5
Cr	81	ug/L	mg/kg	N/A	<10.0	<10.0	7.14	<10.0	<10.0	5.35	<10.0	<10.0	<5.0	<10.0		<5.0
Cu	34	ug/L	mg/kg	13.5	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<1.0		<5.0
Pb	46.7	ug/L	mg/kg	133	<10.0	<10.0	<5.0	<10.0	<10.0	<5.0	<10.0	<10.0	<5.0	<10.0		<5.0
Hg	0.15	ug/L	mg/kg	2.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10		<0.10
Ni	20.9	ug/L	mg/kg	118	<20.0	<20.0	5.4	<20.0	<20.0	6.1	<20.0	<20.0	<5.0	<20.0		<5.0
Ag	1	ug/L	mg/kg	2												
Se	No ERL	ug/L	mg/kg	564												
Zn	150	ug/L	mg/kg	92.7	<20.0	<20.0	39.0	<20.0	<20.0	24.0	<20.0	<20.0	<5.0	<20.0		10.0
TOC	No ERL	mg/L	mg/kg	N/A												
Total PCB	22.7	ug/L	ug/kg	10	<0.50	<0.50	<10.0	<0.50	<0.50	<10.0	<0.50	<0.50	<10.0	<0.50		<10.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02		<0.50
Chlordane	0.5	ug/L	ug/kg	0.09	<0.05	<0.05	<1.0	<0.05	<0.05	<1.0	<0.05	<0.05	<1.0	<0.05		<1.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<10.0	<0.50	<0.50	<10.0	<0.50	<0.50	<10.0	<0.50		<10.0
Total PAH	4,022	ug/L	mg/kg	N/A												
Naphthalene	160	ug/L	ug/kg	N/A												
Acenaphthene	16	ug/L	ug/kg	N/A												
Fluoranthene	600	ug/L	ug/kg	N/A												
Benzo(a)pyrene	430	ug/L	ug/kg	N/A												
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A												
Aldrin	No ERL	ug/L	ug/kg	1.3	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02		<0.2
Dieldrin	0.02	ug/L	ug/kg	0.71	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02		<0.50
Heptachlor	No ERL	ug/L	ug/kg	0.053	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02	<0.02	<0.50	<0.02		<0.50
Hexachlorocyclohexane	No ERL	ug/L	ug/kg	0.16	0.09	0.09	<0.50	0.12	0.16	<0.50	0.09	0.10	<0.50	<0.02		<0.50
Ammonia	No ERL	mg/L	mg/kg	N/A	0.09	0.50	36.00	0.10	0.68	40.00	0.07	0.20	10.00	0.09		12.0

TABLE 3.2-11 (Concluded)

DETECTED PARAMETERS IN THE HISTORIC DATA
CORPUS CHRISTI BAY TO MUDFLATS
GULF INTRACOASTAL WATERWAY

				Station:	GIC-CBB-90-01			GIC-CBB-93-01			GIC-CBB-93-02			GIC-CBB-93-03		
				Date:	11/16/90			12/21/93			12/21/93			12/21/93		
				Channel Station:	10+000			0+000			5+000			10+000		
Parameter	ERL	Liquid Media Unit	Solid Media Unit	Texas Acute Marine Water Quality Standard	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand			%				86.8			61.4			85.5			90.6
Silt			%				8.0			28.1			11.5			3.6
Clay			%				5.2			10.5			3			5.8
D50			mm				0.205			0.132			0.191			0.177
Oil & Grease	No ERL	mg/L	mg/kg	N/A												
As	8.2	ug/L	mg/kg	149	<2.0	<2.0	<1.0	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50
Ba	No ERL	ug/L	mg/kg	N/A				50.1	74.3	153.00	52.7	71.8	75.19	52.3	64.4	31.79
Cd	1.2	ug/L	mg/kg	45.62	<10.0	<2.0	<0.10	<0.10	<0.10	<0.50	<0.10	<0.10	<0.50	<0.10	<0.10	<0.50
Cr	81	ug/L	mg/kg	N/A	<1.0	<10.0	1.0	<1.0	<1.0	6.70	<1.0	<1.0	3.30	<1.0	<1.0	1.60
Cu	34	ug/L	mg/kg	13.5	<5.0	<1.0	2.7	<1.0	<1.0	5.50	<1.0	<1.0	2.40	<1.0	<1.0	1.20
Pb	46.7	ug/L	mg/kg	133	<0.2	<5.0	<1.0	<1.0	<1.0	5.50	<1.0	<1.0	3.70	<1.0	<1.0	1.90
Hg	0.15	ug/L	mg/kg	2.1	<5.0	<0.2	<0.1	<0.2	<0.2	<0.05	<0.2	<0.2	<0.05	<0.2	<0.2	<0.05
Ni	20.9	ug/L	mg/kg	118	<5.0	<5.0	2.1	<1.0	<1.0	4.70	<1.0	<1.0	2.30	<1.0	<1.0	0.96
Ag	1	ug/L	mg/kg	2	<2.0			<1.0	<1.0	<0.50	<1.0	<1.0	<0.50	<1.0	<1.0	<0.50
Se	No ERL	ug/L	mg/kg	564	<5.0	<2.0	<0.5	<2.0	<2.0	<1.00	<2.0	<2.0	<1.00	<2.0	<2.0	<1.00
Zn	150	ug/L	mg/kg	92.7	<5.0	<5.0	5.9	<1.0	4.1	29.5	6.3	3.0	14.4	<1.0	9.2	6.9
TOC	No ERL	mg/L	mg/kg	N/A	1.00	1.00	<100	9.60	13.3	92.0	8.40	9.00	<100.0	9.60	12.7	<100.0
Total PCB	22.7	ug/L	ug/kg	10	<0.50	<0.50	<5.0	<0.50	<0.50	<15.0	<0.50	<0.50	<15.0	<0.50	<0.50	<15.0
DDT	1.58	ug/L	ug/kg	0.13	<0.02	<0.02	<0.2	<0.12	<0.12	<30.0	<0.12	<0.12	<30.0	<0.12	<0.12	<30.0
Chlordane	0.5	ug/L	ug/kg	0.09	<0.02	<0.02	<0.2	<0.14	<0.14	<30.0	<0.14	<0.14	<30.0	<0.14	<0.14	<30.0
Toxaphene	No ERL	ug/L	ug/kg	0.21	<0.50	<0.50	<5.0	<0.50	<0.50	<150.0	<0.50	<0.50	<150.0	<0.50	<0.50	<150.0
Total PAH	4,022	ug/L	mg/kg	N/A	<5.00	<5.00	<0.5	<5.00	<5.00	<1.50	<5.00	<5.00	<1.50	<5.00	<5.00	<1.50
Naphthalene	160	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0
Acenaphthene	16	ug/L	ug/kg	N/A	<2.0	<2.0	<50.0	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0	<2.0	<2.0	<90.0
Fluoranthene	600	ug/L	ug/kg	N/A	<0.50	<0.50	<10.0	<0.50	<0.50	<90.0	<0.50	<0.50	<90.0	<0.50	<0.50	<90.0
Benzo(a)pyrene	430	ug/L	ug/kg	N/A	<0.50	<0.50	<10.0	<0.50	<0.50	<90.0	<0.50	<0.50	<90.0	<0.50	<0.50	<90.0
Benzo(e)pyrene	No ERL	ug/L	ug/kg	N/A				<0.50	<0.50	<90.0	<0.50	<0.50	<90.0	<0.50	<0.50	<90.0

Source: USACE Database.

TABLE 3.3-1
SEDIMENT SAMPLE RESULTS (mg/kg)
LA QUINTA
CORPUS CHRISTI SHIP CHANNEL

SAMPLE #	Hg	Se	As	Ag	Al	B	Ba	Be	Cd	Cr	Cu
ERL	0.15	No ERL	8.2	1.0	No ERL	No ERL	No ERL	No ERL	1.2	81	34
CC 88 S	0.040	0.200	5.30	<2.0	16,500.0	13.0	398.0	1.10	<0.3	17.0	12.0
CC 99 S	0.054	<0.2	5.30	<2.0	19,500.0	17.0	872.0	0.94	<0.3	14.0	17.0
CC100 S	0.040	<0.2	3.80	<2.0	7,700.0	11.00	246.0	0.60	<0.3	8.3	6.4

SAMPLE #	Fe	Mg	Mn	Mo	Ni	Pb	Sr	Tl	V	Zn	%H20
ERL	No ERL	No ERL	No ERL	No ERL	20.9	46.7	No ERL	No ERL	No ERL	150	No ERL
CC 88 S	13,700	8,510	295.0	<2.0	13.0	18.00	89.3	<5.0	13.0	65.4	67.4
CC 99 S	13,500	6,740	244.0	<2.0	11.0	15.00	118.0	<5.0	19.0	71.6	43.0
CC100 S	7,130	4,640	261.0	<1.0	6.0	10.00	57.3	<5.0	9.3	37.0	46.1

Source: Barrera, et al., 1995.

TABLE 3.3-1 (Cont'd)
SEDIMENT SAMPLE RESULTS (mg/kg)
LOWER BAY
CORPUS CHRISTI SHIP CHANNEL

SAMPLE #	Hg	Se	As	Ag	Al	B	Ba	Be	Cd	Cr	Cu
ERL	0.15	No ERL	8.2	1.0	No ERL	No ERL	No ERL	No ERL	1.2	81	34
CC112 S	0.040	<0.2	5.00	<2.0	10,100	12.0	292.0	0.72	<0.3	11.0	7.7
CC123 S	0.020	<0.2	2.20	<2.0	4,350	3.0	209.0	0.30	<0.3	5.0	3.1
CC137 S	0.010	0.200	1.30	<2.0	1,560	<2.0	53.6	0.10	<0.2	3.0	1.1
CC147 S	0.040	<0.2	2.40	<2.0	6,310	5.0	314.0	0.36	<0.2	7.5	4.1
CC153 S	0.020	<0.2	1.30	<2.0	1,280	<2.0	237.0	0.10	<0.2	2.0	0.62
CC154 S	0.040	<0.2	3.80	<2.0	7,000	8.1	371.0	0.47	<0.2	8.2	4.5

SAMPLE #	Fe	Mg	Mn	Mo	Ni	Pb	Sr	Tl	V	Zn	%H2O
ERL	No ERL	No ERL	No ERL	No ERL	20.9	46.7	No ERL	No ERL	No ERL	150	No ERL
CC112 S	9,780	6,590	362.0	<2.0	9.0	13.0	72.0	<5.0	10.0	51.7	54.7
CC123 S	4,410	2,880	120.0	<1.0	5.5	5.0	61.7	<5.0	6.1	21.0	35.4
CC137 S	2,010	1,250	81.9	<1.0	2.0	<4.0	28.4	<4.0	2.9	10.0	25.3
CC147 S	6,350	3,880	149.0	<1.0	6.3	8.0	61.7	<4.0	7.4	31.9	31.7
CC153 S	1,650	1,330	71.1	<1.0	2.0	<4.0	154.0	<4.0	2.7	6.6	19.7
CC154 S	7,790	4,530	195.0	<1.0	7.0	8.00	53.8	<4.0	8.2	34.3	39.1

Source: Barrera, et al., 1995.

TABLE 3.3-1 (Cont'd)
SEDIMENT SAMPLE RESULTS (mg/kg)
UPPER BAY
CORPUS CHRISTI SHIP CHANNEL

SAMPLE #	Hg	Se	As	Ag	Al	B	Ba	Be	Cd	Cr	Cu
ERL	0.15	No ERL	8.2	1.0	No ERL	No ERL	No ERL	No ERL	1.2	81.0	34.0
CC 26 S	0.17	0.20	4.20	<2.0	14,100	15.0	402.0	1.0	0.7	15.0	10.0
CC 27 S	0.04	0.40	1.60	<2.0	5,120	6.0	118.0	0.35	<0.2	5.2	4.1
CC 32 S	0.14	0.30	4.60	<2.0	18,400	12.0	348.0	1.2	0.40	17.0	11.0
CC 40 S	0.12	<0.1	5.70	<2.0	17,400	17.0	349.0	1.1	<0.3	18.0	10.0
CC 49 S	0.06	0.20	5.60	<2.0	11,000	12.0	196.0	0.79	<0.2	11.0	8.8
CC 60 S	0.096	<0.1	6.20	<2.0	19,700	10.0	451.0	1.2	<0.3	18.0	11.0
CC 71 S	0.081	<0.1	7.50	<2.0	21,700	16.0	435.0	1.2	<0.3	19.0	11.0
CC 80 S	0.057	0.30	7.10	<2.0	12,300	7.7	539.0	0.91	<0.3	12.0	9.9
CC 90 S	0.03	0.30	2.30	<2.0	3,760	4.0	178.0	0.2	<0.2	4.3	3.2

SAMPLE #	Fe	Mg	Mn	Mo	Ni	Pb	Sr	Tl	V	Zn	%H2O
ERL	No ERL	No ERL	No ERL	No ERL	20.9	46.7	No ERL	No ERL	No ERL	150	No ERL
CC 26 S	11,900	7,250	244.0	<2.0	8.6	24.0	120.0	<5.0	11.0	**127.0**	50.5
CC 27 S	3,910	5,100	198.0	<1.0	2.0	10.0	818.0	<5.0	4.8	37.3	32.1
CC 32 S	14,700	8,860	234.0	<2.0	11.0	26.0	133.0	<5.0	13.0	**114.0**	55.7
CC 40 S	14,300	9,620	522.0	<2.0	10.0	25.0	106.0	<5.0	11.0	101.0	70.0
CC 49 S	10,200	7,160	285.0	<2.0	9.0	17.0	330.0	<5.0	8.8	58.6	44.6
CC 60 S	15,800	9,420	269.0	<2.0	12.0	24.0	102.0	<5.0	13.0	98.2	55.1
CC 71 S	16,800	11,600	281.0	<2.0	13.0	23.0	194.0	<5.0	17.0	92.8	50.9
CC 80 S	11,900	7,200	290.0	<2.0	9.9	18.0	159.0	<5.0	10.0	67.9	43.8
CC 90 S	3,880	2,380	95.1	<1.0	3.0	9.0	104.0	<5.0	5.3	21.0	26.5

Values in bold = sample was above TNRCC screening levels

Source: Barrera, et al., 1995.

TABLE 3.3-1 (Concluded)
SEDIMENT SAMPLE RESULTS (mg/kg)
INNER HARBOR
CORPUS CHRISTI SHIP CHANNEL

SAMPLE #	Hg	Se	As	Ag	Al	B	Ba	Be	Cd	Cr	Cu
ERL	0.15	No ERL	8.2	1.0	No ERL	No ERL	No ERL	No ERL	1.2	81.0	34.0
CC 1 S	0.072	0.4	2.6	<2.0	6,190	<2.0	104	0.39	0.83	8.8	9.9
CC 2 S	0.310	0.76	4.3	<2.0	19,200	11.0	148	1.2	3.1	18.0	15.0
CC 3 S	0.920	0.87	6.8	<2.0	19,600	18.0	1,530	1.1	4.6	23.0	52.3
CC 4 S	0.210	0.4	5.0	<2.0	21,000	12.0	310	1.2	0.89	24.0	18.0
CC 20 S	0.100	<0.1	2.2	<2.0	6,760	7.0	196.0	0.41	0.4	8.4	6.9
CC 21 S	0.140	<0.1	3.3	<2.0	7,170	8.6	245.0	0.45	0.89	19.0	12.0
CC 22 S	0.250	0.4	4.9	<2.0	25,400	17.0	375.0	1.3	1.0	31.0	32.9

SAMPLE #	Fe	Mg	Mn	Mo	Ni	Pb	Sr	Tl	V	Zn	%H2O
ERL	No ERL	No ERL	No ERL	No ERL	20.9	46.7	No ERL	No ERL	No ERL	150	No ERL
CC 1 S	5,050	3,240	170	<1.0	4.0	13.0	50.7	<5.0	7.7	93.1	42.0
CC 2 S	12,700	7,980	354	<2.0	10.0	29.0	71.1	<5.0	13.0	281.0	63.9
CC 3 S	12,900	7,320	391	<2.0	11.0	110.0	86.1	<5.0	20.0	645.0	60.6
CC 4 S	14,800	9,640	494	<2.0	11.0	32.0	103.0	<5.0	17.0	166.0	68.6
CC 20 S	5,580	3,460	106	<1.0	4.0	16.0	93.9	<5.0	7.3	67.6	36.8
CC 21 S	6,470	3,820	144	<1.0	4.0	74.0	92.8	<5.0	8.3	154.0	41.2
CC 22 S	17,900	9,250	280	<2.0	13.0	50.0	79.0	<5.0	18.0	206.0	58.3

Source: Barrera, et al., 1995.

TABLE 3.3-2

DETECTED PARAMETERS IN CONSTRUCTION SEDIMENTS
LOWER BAY/UPPER BAY/LA QUINTA EXTENSION
CORPUS CHRISTI SHIP CHANNEL

		Station:	C-60	C-60	C-67	C-71A	C-76	L-24	L-27	L-27	L-30	L-30
		Depth:	8-10	13-15	1	0-2	5	20	10	19	9	19
		Date:	5/21/00		5/25/00	6/2/00	6/5/00	6/1/00	6/1/00		6/2/00	
		Channel Station:	120+65		520+51	718+61	960+27	330+50	368+00		385+00	
Parameter	ERL	Units										
As	8.2	mg/kg	<0.001	2.9	3.8	4.0	2.9	2.2	6	2.2	7.1	4.8
Ba	No ERL	mg/kg	153	183	25.7	103	128	25.3	19.5	7.9	52.1	17.7
Cd	1.2	mg/kg	0.09	0.07	0.22	0.19	0.29	0.09	0.16	0.03	0.20	0.03
Cr	81	mg/kg	30.1	22.1	30	46.3	34.9	18.7	28.0	23.3	26.9	30.1
Cu	34	mg/kg	4.58	4.54	4.65	6.64	3.48	3.36	5.51	2.84	4.63	4.23
Pb	46.7	mg/kg	4.1	6.9	7.5	10.8	8.6	4.8	4.4	2.5	4.6	6.2
Hg	0.15	mg/kg	0.015	0.012	0.007	0.008	0.017	0.009	<0.005	<0.005	<0.005	0.007
Ni	20.9	mg/kg	11.0	4.41	5.53	8.18	6.71	7.00	6.03	6.28	6.54	7.47
Ag	1	mg/kg	<0.001	<0.001	<0.001	0.24	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Se	No ERL	mg/kg	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Zn	150	mg/kg	40.4	30.1	42.8	62.1	60.8	12.8	37.8	23.5	37.4	28.3
TOC	No ERL	wt %	7.8	8	9.5	6.6	8	10.5	4.0	8.1	8.2	10.7

* Sample depth is measured from the mudline.
Source: Fugro South, Inc., 2000.

TABLE 3.3-3

SUMMARY OF CHEMISTRY AND BIOASSAY DATA FOR CONSTRUCTION MATERIAL (% Survival)
INNER HARBOR
CORPUS CHRISTI SHIP CHANNEL

	Station: / Channel Station:	IC-1 1260+00		IC-2 1440+00		IC-3 1555+00	
Parameter	Texas Acute Marine Water Quality Standard	Water	Elutriate	Water	Elutriate	Water	Elutriate
Oil & Grease (ug/L)	N/A	<1000	2,890	<1000	1,000	<1000	1,120
As (ug/L)	149	80	51	61	47	76	61
Cu (ug/L)	13.5	10.8	1.0	1.0	1.0	1.1	1.0
Se (ug/L)	564	25.3	29.6	21.4	25.1	22.3	22.0
Zn (ug/L)	92.7	100	52	108	73	42	<20
Chlordane (ug/L)	0.09	0.06	<0.05	0.05	<0.05	0.06	<0.05
Date	Organism	Liquid Phase	Suspended Particulate Phase	Liquid Phase	Suspended Particulate Phase	Liquid Phase	Suspended Particulate Phase
1981	*Menidia beryllina*	100	100	97	97	100	100
	Mysidopsis almyra	97	97	100	97	87	93
	Palaemonetes pugio	100	100	93	93	93	93

Source: Tereco, 1982b.

APPENDIX C

BIOLOGICAL ASSESSMENT

Document No. 010049
PBS&J Job No. 440524

BIOLOGICAL ASSESSMENT FOR IMPACTS TO ENDANGERED AND THREATENED SPECIES RELATIVE TO THE CORPUS CHRISTI SHIP CHANNEL IMPROVEMENTS PROJECT IN NUECES AND SAN PATRICIO COUNTIES, TEXAS

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1.0 INTRODUCTION

1.1 PURPOSE OF THE BIOLOGICAL ASSESSMENT

This Biological Assessment (BA) is being prepared for the purpose of fulfilling the U.S. Army Corps of Engineer's (USACE) requirements as outlined under Section 7(c) of the Endangered Species Act (ESA) of 1973 as amended. The proposed Federal action requiring the assessment is the dredging of the Corpus Christi Ship Channel (including alternatives found in Section 1.2) in Nueces and San Patricio counties, Texas. Table 1 presents a list of Federally listed species addressed in this BA. For the purposes of this BA, the project area is defined as the area where the actual dredging will take place, proposed placement areas, and the proposed beneficial use sites where impacts might be expected.

In 1990, the U.S. Congress authorized the USACE to begin a reconnaissance study to investigate deepening the Corpus Christi Ship Channel system from the current 45 feet (ft) to 50 ft to accommodate large vessels, increase shipping efficiency and enhance navigation safety. The Port of Corpus Christi Authority (POCCA), local sponsor of the existing channel system, began consideration of additional channel improvements upon the 1989 completion of the 45-ft deepening project.

The USACE completed the reconnaissance study in 1994, concluding that the benefits of channel improvements would be 2.5 times greater than the project cost. In 1999, the USACE and the Port signed an agreement to conduct a Feasibility Study, including an Environmental Impact Statement (EIS). The project is being led by the USACE, but cost shared with the Port.

The Feasibility Study involves multidisciplinary studies determining the specific improvements needed and the benefit-cost ratios of various alternatives. Several technical workgroups involved in the Feasibility Study phase are defining scopes of work and reviewing the results of certain studies. Workgroups include the Regulatory Agency Coordination Team (RACT), Shoreline Erosion, Cumulative Assessment, Mitigation, Hydrodynamic and Salinity Modeling, Water and Sediment Quality, and Beneficial Uses. Several Federal and State regulatory agencies are participating in the workgroups. This BA is being prepared to assist the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) personnel in fulfilling their obligations under the ESA. An EIS is being prepared to address the impacts of the project.

1.2 DESCRIPTION OF THE PROPOSED ACTIONS

The study area for the Corpus Christi Ship Channel – Channel Improvements Project encompasses Corpus Christi Bay, including the southern section of Redfish Bay and the northern section of the Laguna Madre, Nueces Bay, the lower Nueces River (12 miles), Tule Lake Channel, Viola Channel, La Quinta Channel and the watershed surrounding these water bodies up to roughly 0.5 mile

TABLE 1

FEDERALLY ENDANGERED AND THREATENED SPECIES OF POTENTIAL OCCURRENCE IN THE CORPUS CHRISTI SHIP CHANNEL IMPROVEMENTS PROJECT AREA IN NUECES AND SAN PATRICIO COUNTIES, TEXAS[1]

Common Name	Scientific Name	Status[2]
South Texas ambrosia	*Ambrosia cheiranthifolia*	E
Slender rush-pea	*Hoffmannseggia tenella*	E
Kemp's ridley sea turtle	*Lepidochelys kempii*	E
Green sea turtle	*Chelonia mydas*	T
Loggerhead sea turtle	*Caretta caretta*	T
Hawksbill sea turtle	*Eretmochelys imbricata*	E
Leatherback sea turtle	*Dermochelys coriacea*	E
Brown pelican	*Pelecanus occidentalis*	E
Bald eagle	*Haliaeetus leucocephalus*	T/PDL
Whooping crane	*Grus americana*	E
Northern aplomado falcon	*Falco femoralis septentrionalis*	E
Piping plover	*Charadrius melodus*	T
Mountain plover	*Charadrius montanus*	PT
Eskimo curlew	*Numenius borealis*	E
Ocelot	*Leopardus pardalis*	E
Jaguarundi	*Herpailurus yagouaroundi*	E
West Indian manatee	*Trichechus manatus*	E

[1] According to U.S. Fish & Wildlife Service (FWS, 2000a).

[2] E Endangered; in danger of extinction.
T Threatened; severely depleted or impacted by man.
PT Proposed for listing as threatened.
T/PDL Currently classified as threatened but proposed for delisting in lower 48 states.

inland from all shorelines (Figure 1-1). The coastline of this area extends across Nueces and San Patricio counties and is adjacent to the cities of Corpus Christi, Portland, Ingleside by the Bay, and Port Aransas.

The Corpus Christi Ship Channel is located in Corpus Christi Bay on the southern portion of the Texas coast, 200 miles southwest of Galveston and 150 miles north of the mouth of the Rio Grande. This channel ranks seventh in the nation for tonnage shipped on oceangoing vessels, and in Texas only the Houston Ship Channel handles more tonnage.

The authorized Federal navigation project consists of channels and turning basins suitable for oceangoing vessels, rubblestone jetties, and a stone dike. The channel begins at deep water in the Gulf of Mexico about 4.3 miles offshore, passes through the jettied inlet, and extends about 21 miles westward to Corpus Christi. Continuing west, the channel extends about 8.5 miles through the harbor area before terminating at the Viola Turning Basin. The jetties are 11,190 and 8,610 ft long and extend into the Gulf from San Jose (formerly St. Josephs) and Mustang Islands, respectively, and stabilize the natural inlet of Aransas Pass. The stone dike on San Jose Island connects with the north jetty and extends 20,991 ft up the island. The La Quinta Channel extends from the basin and mooring facilities at Ingleside Point, which is about half-way between the Gulf of Mexico and Corpus Christi, about 5.7 miles to La Quinta.

The Corpus Christi Ship Channel – Channel Improvements Project initially began with 17 alternatives. These alternatives have been continually screened based on information developed from public outreach efforts and environmental, economic, and engineering studies. As of June 2001, the proposed alternatives include the following:

- Deepen the Corpus Christi Ship Channel from –45 ft mean low tide (MLT) to –52 ft MLT, plus advanced maintenance and allowable over-depth. No deepening of La Quinta Channel. Depths will be increased roughly 10,000 ft into the Gulf of Mexico to the –56-ft isobath.
- Widen the Corpus Christi Ship Channel from Port Aransas to the Harbor Bridge to 530 ft. (Existing widths are 500 ft between Port Aransas and La Quinta Junction and 400 ft between La Quinta Junction and the Harbor Bridge.)
- Extend the La Quinta Channel 7,200 ft at a depth of –40 ft MLT and a width of 300 ft and include a turning basin.
- Add 200-ft-wide barge shelves (-12 ft MLT) on both sides of the ship channel from La Quinta Junction to the Harbor Bridge. Shelf width measured from the toe of the widened and deepened ship channel. For most of the reach, no dredging would be required, only the addition of navigation aids.

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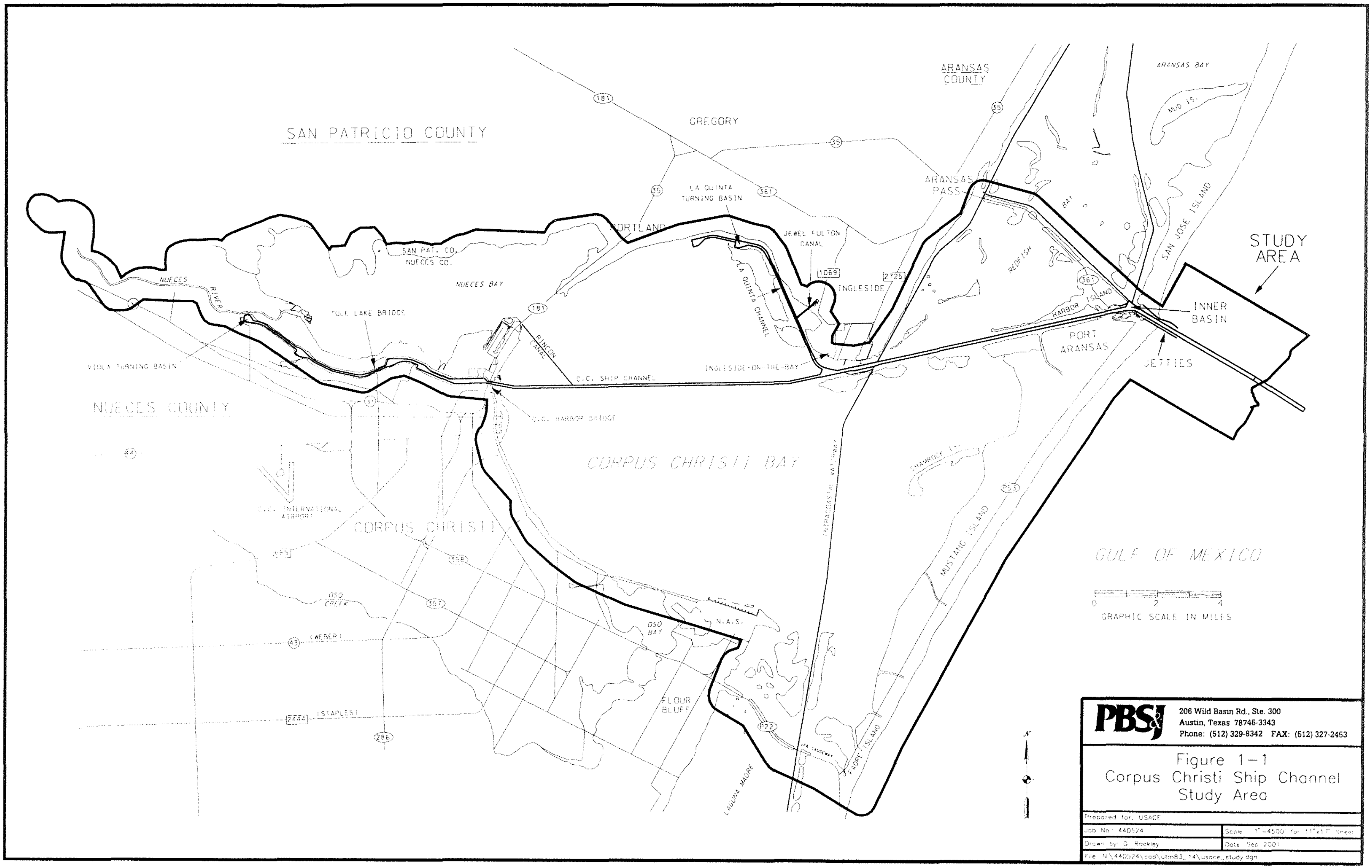

Figure 1-1
Corpus Christi Ship Channel
Study Area

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These alternatives have been screened and refined according to benefit-cost analyses, which take into account economic, construction, and environmental costs as compared to their benefits. The USACE and PCCA are prepared to have the Feasibility Study/EIS completed in 2002 to allow for project authorization by Congress in that year.

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2.0 IMPACT ASSESSMENT FOR LISTED SPECIES

To assess the potential impacts of the proposed project on endangered and threatened species, PBS&J personnel (1) conducted a literature review and searched for other scientific data to determine species distributions, habitat needs and other biological requirements; (2) interviewed recognized experts on the listed species, including local and regional authorities and Federal and State wildlife personnel; and (3) conducted an on-site inspection of the biological resources of the project area.

Significant literature sources consulted for this report include the FWS series on endangered species of the seacoast of the U.S. (National Fish and Wildlife Laboratories (NFWL), 1980), Federal status reports and recovery plans, and job reports of the Texas Parks and Wildlife Department (TPWD). A field survey of the project area was performed by PBS&J ecologists in August 2000.

2.1 SOUTH TEXAS AMBROSIA

South Texas ambrosia (*Ambrosia cheiranthifolia*), also known as south Texas ragweed, was Federally listed as endangered in August 1994 (50 CFR Part 17; 23 September 1994). Primary threats to the survival of this species include a low natural reproductive rate and destruction or disturbance of its habitat (FWS, 1987). Most of the deep clay soils occurring in south Texas that could support habitat for south Texas ambrosia have been converted into agricultural use. Known stands of this species occur in ROWs along highways and railways, where the species is subject to weed-control measures, including mowing and herbicide applications (Turner, 1983). In addition, introduced species such as buffalograss (*Cenchrus ciliaris*) and King Ranch bluestem (*Bothriochloa ischaemum* var. *songarica*) compete with south Texas ambrosia and other native plants.

South Texas ambrosia is known only from the southern tip of Texas and from Tamaulipas, Mexico (Correll and Johnston, 1970; Turner, 1983). It was first collected by J.L. Berlandier in San Fernando, Tamaulipas, Mexico, in 1835 (Turner, 1983), but it was not until 1859 that Gray described this species as new to science. Historically, south Texas ambrosia was known only from Kleberg, Nueces, Jim Wells, and Cameron counties in the U.S. and Tamaulipas in Mexico. Currently, the species occurs in Nueces, Kleberg, and Jim Wells counties (Poole et al., 2000). The status of the Mexican populations is unknown.

An erect, silvery to grayish-green, herbaceous perennial 4 to 12 inches tall, south Texas ambrosia is an inhabitant of open, clay-loam to sandy loam prairies and savannahs. It occurs in the Gulf coastal grassland in a vegetation type containing dominant shrubs typical of a local edaphic phase of the Tamaulipan brushland (e.g., species of acacia (*Acacia* spp.), Texas ebony (*Pithecellobium flexicaule*), and cenizo (*Leucophyllum frutescens*). Grasses typically occurring with south Texas ambrosia include perennials such as bluestems, paspalums (*Paspalum* spp.), and lovegrasses (*Eragrostis* spp.). South Texas ambrosia occurs in flat, deep, largely undisturbed clay soils or occasionally on wind-blown clay dunes along streams. Clay soils of extreme south Texas derived from the Beaumont clay series could be considered suitable for establishment of this species. Most known remnant populations are found along roadways, railways, and on disturbed sites (Lonard, 1987). South Texas ambrosia is difficult to detect because it is generally overtopped by grasses (Turner, 1983).

This species is not expected to occur in the project area due to the lack of suitable soils. No specimens of this species were encountered in the project area during PBS&J's field efforts and no impacts to this endangered plant are anticipated.

2.2 SLENDER RUSH-PEA

The slender rush-pea (*Hoffmanseggia tenella*) was Federally listed as endangered on 1 November 1985 (50 FR 45614) and is also listed by the State of Texas as endangered. The proposal to list the slender rush-pea as endangered used the correct spelling of the scientific name (*Hoffmanseggia tenella*) (49 FR 45884). The final rule for listing, however, used an incorrect spelling (*Hoffmannseggia tenella*) (40 FR 45614), which has been used in subsequent Federal and State documents. The slender rush-pea is known from only four populations in Kleberg and Nueces counties. It grows on calcareous, clayey soils in association with short and midgrasses such as buffalograss, Texas wintergrass (*Stipa leucotricha*), and Texas grama. Woody plants such as honey mesquite, huisache, huisachillo (*Acacia tortuosa*), granjeno, brasil (*Condalia hookeri*), retama, lotebush (*Zizyphus obtusifolia*), tasajillo (*Opuntia leptocaulis*), and pricklypear (*Opuntia* spp.) are also common at the known sites. The greatest threats to this species are conversion of coastal prairie habitat to other land uses, herbicide use, and competition from non-native grasses such as King Ranch bluestem, Kleberg bluestem (*Dichanthium annulatum*), and bermudagrass (*Cynodon dactylon*) (TPWD, 1997).

This species is unlikely to occur in the project area due to the lack of suitable soils and habitat. No impacts on the slender rush-pea are expected from this project.

2.3 KEMP'S RIDLEY SEA TURTLE

2.3.1 Reasons for Status

Kemp's ridley (*Lepidochelys kempii*) was listed as endangered throughout its range on 2 December 1970 (35 FR 18320). Populations of this species have declined since 1947, when an estimated 42,000 females nested in one day, to a total nesting population of approximately 1,000 in the mid-1980s. The decline of this species was primarily due to human activities including collection of eggs, fishing for juveniles and adults, killing adults for meat and other products, and direct take for indigenous use. In addition to these sources of mortality, Kemp's ridleys have been subject to high levels of incidental take by shrimp trawlers (FWS and NMFS, 1992; NMFS, 2000). The National Research Council's (NRC's) Committee on Sea Turtle Conservation estimated in 1990 that 86% of the human-caused deaths of juvenile and adult loggerheads and Kemp's ridleys resulted from shrimp trawling (Campbell, 1995). It is estimated that before the implementation of turtle excluder devices (TEDs) the commercial shrimp fleet killed between 500 and 5,000 Kemp's ridleys each year (NMFS, 2000). Kemp's ridleys have also been taken by pound nets, gill nets, hook and line, crab traps, and longlines.

Another problem shared by adult and juvenile sea turtles is the ingestion of manmade debris and garbage. Postmortem examinations of sea turtles found stranded on the south Texas coast from 1986 through 1988 revealed 54% (60 of the 111 examined) of the sea turtles had eaten some type of marine debris. Plastic materials were most frequently ingested and included pieces of plastic bags, styrofoam, plastic pellets, balloons, rope, and fishing line. Non-plastic debris such as glass, tar, and aluminum foil were also ingested by the sea turtles examined. Much of this debris comes from offshore oil rigs, cargo ships, commercial and recreational fishing boats, research vessels, naval ships, and other vessels operating in the Gulf of Mexico. Laws enacted during the late-1980s to regulate this dumping are difficult to enforce over vast expanses of water. In addition to trash, pollution from heavy spills of oil or waste products pose additional threats (Campbell, 1995).

Further threats to this species include collisions with boats, explosives used to remove oil rigs, and entrapment in coastal power plant intake pipes (Campbell, 1995). Dredging operations affect Kemp's ridley turtles through incidental take and by degrading the habitat. Incidental take of ridleys has been documented with hopper dredges, but not pipeline dredges. In addition to direct take, channelization of the inshore and nearshore areas can degrade foraging and migratory habitat through spoil dumping, degraded water quality/clarity and altered current flow (FWS and NMFS, 1992).

Sea turtles are especially subject to human impacts during the time the females come ashore for nesting. Modifications to nesting areas can have a devastating effect on sea turtle populations. In many cases, prime sea turtle nesting sites are also prime real estate. If a nesting site has been disturbed or destroyed, female turtles may nest in inferior locations where the hatchlings are less likely to survive, or they may not lay any eggs at all. Artificial lighting from developed beachfront areas often disorients nesting females and hatchling sea turtles, causing them to head inland by mistake, often with fatal results. Adult females also may avoid brightly lit areas that would otherwise provide suitable nesting sites (FWS, 1998).

Today, under strict protection, the population appears to be in the early stages of recovery. Approximately 6,000 Kemp's ridley nests were recorded on Mexican beaches during the 2000 nesting season (Shaver, 2000). The increase likely can be attributed to two primary factors: full protection of nesting females and their nests in Mexico, and the requirement to use TEDs in shrimp trawlers both in the U.S. and in Mexico (NMFS, 2000).

2.3.2 Habitat

Kemp's ridleys inhabit shallow coastal and estuarine waters, usually over sand or mud bottoms. Along the Texas coast, the following stranding information was recorded for Kemp's ridleys: 100 strandings in 2000, 115 strandings in 2001, and 93 strandings through September 2002 (Shaver, 2002). Adults are primarily shallow-water benthic feeders that specialize on crabs, especially portunid crabs, while juveniles feed on sargassum (*Sargassum* sp.) and associated infauna, and other epipelagic species of the Gulf of Mexico (FWS and NMFS, 1992). In some regions the blue crab (*Callinectes sapidus*) is the most common food item of adults and juveniles. Other food items include shrimp, snails, bivalves, sea urchins, jellyfish, sea stars, fish, and occasional marine plants (Pritchard and Marquez, 1973; Shaver, 1991; Campbell, 1995).

2.3.3 Range

Adults are primarily restricted to the Gulf of Mexico, although juveniles may range throughout the Atlantic Ocean since they have been observed as far north as Nova Scotia (Musick, 1979) and in coastal waters of Europe (Brongersma, 1972). Important foraging areas include Campeche Bay, Mexico, and Louisiana coastal waters.

Almost the entire population of Kemp's ridleys nests on an 11-mile stretch of coastline near Rancho Nuevo, Tamaulipas, Mexico, some 190 miles south of the Rio Grande. A secondary nesting area occurs at Tuxpan, Veracruz, and sporadic nesting has been reported from Mustang Island, Texas, southward to Isla Aquada, Campeche. There have been several isolated nesting attempts scattered from North Carolina to Colombia.

Because of the dangerous population decline at the time, a head-starting program was carried out from 1978 to 1988. Eggs were collected from Rancho Nuevo and placed into polystyrene foam boxes containing Padre Island sand so that the eggs never touched the Ranch Nuevo sand. The eggs were flown to the U.S. and placed in a hatchery on Padre Island and incubated. The resulting hatchlings were allowed to crawl over the Padre Island beaches into the surf for imprinting purposes before being recovered from the surf and taken to Galveston for rearing. They were fed a diet of high-protein commercial floating pellets for 7 to 15 months before being released into Texas (mainly) or Florida waters (Caillouet et al., 1995). This program has shown some results. The first nesting from one of these head-started individuals occurred at Padre Island in 1996, and more nestings have occurred since (Shaver, 2000).

2.3.4 Distribution in Texas

Kemp's ridley occurs in Texas in small numbers and in many cases may well be in transit between crustacean-rich feeding areas in the northern Gulf of Mexico and breeding grounds in Mexico. It has nested sporadically in Texas in the last 50 years. Nests were found near Yarborough Pass in 1948 and 1950, and in 1960 a single nest was located at Port Aransas. The number of nestings, however, has increased in recent years. In 1999, 16 confirmed Kemp's ridley nests were recorded in Texas and 12 nests were confirmed for 2000 (Shaver, 2000). Eight Kemp's ridley nests were found on the Texas coast in 2001, and 38 nests were found in 2002 (Shaver, 2002). Several of the ridley nests were from head-started individuals. Such nestings, together with the proximity of the Rancho Nuevo rookery, probably accounts for the occurrence of hatchlings and subadults in Texas. According to Hildebrand (1982, 1986, 1987), sporadic ridley nesting in Texas has always been the case. This is in direct contradiction, however, to Lund (1974), who believed that Padre Island historically supported large numbers of nesting Kemp's ridleys, but that the population became extirpated because of excessive egg collection.

2.3.5 Presence in the Project Area

Kemp's ridley has been recorded from Nueces County (Dixon, 2000) and from Corpus Christi Bay (Shaver, 2000). Thus, it is of potential occurrence in the project area.

2.3.6 Effects of the Project

If it occurs in the project area, Kemp's ridley could be negatively impacted by dredging activities during construction or by maintenance activities after construction. This species could be attracted to feeding opportunities at the proposed jetties, where it would be exposed to additional risks from boat traffic, contaminants, fishing activities, tangled fishing lines, and accumulated plastic detritus.

However, project impacts are temporary and local in nature. A pipeline dredge will be used in the bay and a hopper dredge will be used in the entrance channel. Sea turtles easily avoid pipeline dredges due to the slow movement of the dredge. Incidental take of sea turtles by hopper dredges is reduced by using draghead deflectors and scheduling offshore dredging during the winter months when sea turtles are most likely to be elsewhere in warmer waters. Also, an agreement between NMFS and USACE is in place and implemented regarding take of sea turtles with hopper dredges and the use of observers to document incidental take to ensure that significant impacts do not occur. Therefore, no significant adverse impacts are expected to sea turtles.

2.4 GREEN SEA TURTLE

2.4.1 Reasons for Status

The green turtle (*Chelonia mydas*) was listed on 28 July 1978 as threatened except for Florida and the Pacific coast of Mexico (including the Gulf of California) where it was listed as endangered (43 FR 32808). The greatest cause of decline in green turtle populations is commercial harvest for eggs and food. Other turtle parts are used for leather and jewelry, and small turtles are sometimes stuffed for curios. Incidental catch during commercial shrimp trawling is a continued source of mortality that adversely affects recovery. It is estimated that before the implementation of TED requirements, the offshore commercial shrimp fleet captured about 925 green turtles a year, of which approximately 225 would die. Most turtles killed are juveniles and subadults. Various other fishing operations also negatively impact this species (NMFS, 2000). Epidemic outbreaks of fibropapilloma or "tumor" infections recently have occurred on green sea turtles, especially in Hawaii and Florida, posing a severe threat. The cause of these outbreaks is largely unknown, but it could be caused by a viral infection (Barrett, 1996). Some scientists suspect this disease to be linked to environmental alteration of sea turtle habitat by pollution and contaminants (FWS, 1998). This species is also subject to various negative impacts shared by sea turtles in general.

2.4.2 Habitat

The green turtle primarily utilizes shallow habitats such as lagoons, bays, inlets, shoals, estuaries, and other areas with an abundance of marine algae and seagrasses. Individuals observed in the open ocean are believed to be migrants en route to feeding grounds or nesting beaches (Meylan, 1982). Hatchlings often float in masses of sea plants (e.g., Sargassum) in convergence zones. Coral reefs and rocky outcrops near feeding pastures often are used as resting areas. The adults are primarily herbivorous, while the juveniles consume more invertebrates. Foods consumed include seagrasses, macroalgae and other marine plants, molluscs, sponges crustaceans, and jellyfish (Mortimer, 1982; Green, unpubl. data).

Terrestrial habitat is typically limited to nesting activities, although in some areas, such as Hawaii and the Galápagos Islands, they will bask on beaches (Balazs, 1980; Green, unpubl. data). They prefer high energy beaches with deep sand, which may be coarse to fine, with little organic content. At least in some regions, they generally nest consistently at the same beach, which is apparently their natal beach (Meylan et al.,1990; Allard et al., 1994), although an individual might switch to a different nesting beach within a single nesting season (Green, unpubl. data).

2.4.3 Range

The green turtle is a circumglobal species in tropical and sub-tropical waters. In U.S. Atlantic waters, it is found around the U.S. Virgin Islands, Puerto Rico, and continental U.S. from Massachusetts to Texas. Major nesting activity occurs on Ascension Island, Aves Island (Venezuela), Costa Rica, and in Surinam. Relatively small numbers nest in Florida, with even smaller numbers in Georgia, North Carolina, and Texas (NMFS and FWS, 1991a; Hirth, 1997).

2.4.4 Distribution in Texas

The green turtle in Texas inhabits shallow bays and estuaries where its principal foods, the various marine grasses, grow (Bartlett and Bartlett, 1999). Its population in Texas has suffered a decline similar to that of its world population. In the mid- to late-nineteenth century, Texas waters supported a green turtle fishery. Most of the turtles were caught in Matagorda Bay, Aransas Bay, and the lower Laguna Madre, although a few also came from Galveston Bay. Many live turtles were shipped to places such as New Orleans or New York and from there to other areas. Others were processed into canned products such as meat or soup prior to shipment. By 1900, however, the fishery had virtually ceased to exist. Turtles continued to be hunted sporadically for a while, the last Texas turtler hanging up his nets in 1935. Incidental catches by fisherman and shrimpers were sometimes marked prior to 1963, when it became illegal to do so (Hildebrand, 1982).

Green turtles can still be found in these same bays today but in much-reduced numbers (Hildebrand, 1982). While green turtles prefer to inhabit bays with seagrass meadows, they may also be found in bays that are devoid of seagrasses. The green turtles in these Texas bays are mainly small juveniles. Adults, juveniles, and even hatchlings are occasionally caught on trotlines or by offshore shrimpers or are washed ashore in a moribund condition. Along the Texas coast, the following stranding information was recorded for green sea turtles: 90 strandings in 2000, 73 strandings in 2001, and 42 strandings through September 2002 (Shaver, 2002).

Green sea turtle nests are rare in Texas. Two green sea turtle nests were recorded in Texas in 2002. No green sea turtle nests were found on the Texas coast in 2001. A single nest occurred in 2000; no green sea turtle nests were recorded in 1999. In comparison, eight Kemp's ridley and three loggerhead nests were recorded in 2001 and 38 Kemp's ridley and one loggerhead nest were recorded in 2002 (Shaver, 2002). Green turtles, however, nest in Florida and in Mexico. Since long migrations of green turtles from their nesting beaches to distant feedings grounds are well documented (Meylan, 1982; Green, 1984), the adult green turtles occurring in Texas may either be at their feeding grounds or in the process of migrating to or from their nesting beaches. The juveniles frequenting the seagrass meadows of the bay areas may remain there until such time as they move to other feeding grounds or, perhaps, once having attained sexual maturity, return to their natal beaches outside of Texas to nest.

2.4.5 Presence in the Project Area

The green turtle has been recorded from Nueces County (Dixon, 2000) and has been recorded from Corpus Christi Bay (Shaver, 2000). It is of potential occurrence in the project area.

2.4.6 Effects of the Project

The green turtle, should it occur in the project area, could be negatively impacted by dredging activities during construction or by maintenance activities after construction. This species could be attracted to feeding opportunities at the proposed jetties and channel, where it would be exposed to additional risks from boat traffic, contaminants, fishing activities, tangled fishing lines, and accumulated plastic detritus. The channel might facilitate passage by the turtles between the open Gulf of Mexico and feeding areas in the seagrass beds of the Laguna Madre. It is not known what the long-range impacts the proposed project might have upon these seagrass beds related to salinity changes, tidal flow, scouring, increased boat activity, pollution, and dredging activities.

However, project impacts are temporary and local in nature. A pipeline dredge will be used in the bay and a hopper dredge will be used in the entrance channel. Sea turtles easily avoid pipeline dredges due to the slow movement of the dredge. Incidental take of sea turtles by hopper dredges is reduced by using draghead deflectors and scheduling offshore dredging during the winter months when sea turtles are most likely to be elsewhere in warmer waters. Also, an agreement between NMFS and USACE is in place and implemented regarding take of sea turtles with hopper dredges and the use of observers to document incidental take to ensure that significant impacts do not occur. Therefore, no significant adverse impacts are expected to sea turtles.

2.5 LOGGERHEAD SEA TURTLE

2.5.1 Reasons for Status

The loggerhead turtle (*Caretta caretta*) was listed as threatened throughout its range on 28 July 1978 (43 FR 32808). The decline of the loggerhead, like that of most sea turtles, can be attributed to overexploitation by man, inadvertent mortality associated with fishing and trawling activities, and natural predatation. The most significant threats to its population are coastal development, commercial fisheries, and pollution (NMFS, 2000).

2.5.2 Habitat

The loggerhead is found in the open seas as far as 500 miles from shore, but mainly over the continental shelf, and in bays, estuaries, lagoons, creeks, and mouths of rivers. It favors warm temperate and sub-tropical regions not far from shorelines. The adults occupy various habitats, from turbid bays to clear waters of reefs. Subadults occur mainly in nearshore and estuarine waters. Hatchlings move directly to sea after hatching, and often float in masses of sargassum. They may remain associated with sargassum for perhaps 3 to 5 years (NMFS and FWS, 1991b).

Commensurate with their use of varied habitats, loggerheads consume a wide variety of both benthic and pelagic food items, which they crush before swallowing. Conches, shellfish, horseshoe crabs, prawns and other crustacea, squid, sponges, jellyfish, basket starts, fish (carrion or slow-moving species), and even hatchling loggerheads have all been recorded as loggerhead prey (Rebel, 1974; Hughes, 1974; Mortimer, 1982). Adults forage primarily on the bottom, but also take jellyfish from the surface. The young feed on prey concentrated at the surface, such as gastropods, fragments of crustaceans, and sargassum.

Nesting occurs usually on open sandy beaches above high-tide mark and seaward of well developed dunes. They nest primarily on high-energy beaches on barrier islands adjacent to continental land masses in warm-temperate and sub-tropical regions. Steeply sloped beaches with gradually sloped offshore approaches are favored. In Florida, nesting on urban beaches was strongly correlated with the presence of tall objects (trees or buildings), which apparently shield the beach from city lights (Salmon et al., 1995).

2.5.3 Range

The loggerhead is widely distributed in tropical and subtropical seas, being found in the Atlantic Ocean from Nova Scotia to Argentina, Gulf of Mexico, Indian and Pacific oceans (although it is rare in the eastern and central Pacific) and the Mediterranean Sea (Rebel, 1974; Ross, 1982; Iverson, 1986). In the continental U.S., loggerheads nest along the Atlantic coast from Florida to as far north as New Jersey (Musick, 1979) and sporadically along the Gulf coast. In recent years a few have nested on barrier islands along the Texas coast.

2.5.4 Distribution in Texas

The loggerhead is considered to be the most abundant turtle in Texas marine waters, preferring shallow inner continental shelf waters and occurring only very infrequently in the bays. It is also the species most commonly sighted around offshore oil rig platforms and reefs and jetties. Loggerheads are probably present year-round but are most noticeable in the spring when one of their food items, the Portuguese Man-of-War, is abundant. Loggerheads constitute a major portion of the dead or moribund turtles washed ashore (stranded) on the Texas coast each year. The latest stranding information for loggerheads include 163 strandings in 2000, 165 strandings in 2001, and 101 strandings through September 2002 (Shaver, 2002). A large proportion of these deaths is due to the activities of shrimp trawlers where turtles are accidentally caught in the nets and drown and their bodies dumped overboard. Prior to 1977, no positive documentation of loggerhead nests in Texas existed (Hildebrand, 1982). Since that time, several nests have been recorded along the Texas coast. In 1999, two loggerhead nests were confirmed in Texas, while in 2000, five loggerhead nests were confirmed (Shaver, 2000). Like the worldwide population, the population of loggerheads in Texas has declined. Three loggerhead nests were found on the Texas coast in 2001, and one nest was found in 2002 (Shaver, 2002). Prior to World War I, the species was taken in Texas for local consumption and a few were marketed (Hildebrand, 1982). Today, even without protection, insufficient loggerheads exist to support a fishery.

2.5.5 Presence in the Project Area

The loggerhead has been recorded in Nueces County (Dixon, 2000) and from Corpus Christi Bay (Shaver, 2000). It is of potential occurrence in the project area.

2.5.6 Effects of the Project

The loggerhead, if it occurs in the project area, could be negatively impacted by dredging activities during construction or by maintenance activities after construction. This species could be attracted to feeding opportunities at the proposed jetties and channel, where it would be exposed to additional risks from boat traffic, contaminants, fishing activities, tangled fishing lines, and accumulated plastic detritus.

However, project impacts are temporary and local in nature. A pipeline dredge will be used in the bay and a hopper dredge will be used in the entrance channel. Sea turtles easily avoid pipeline dredges due to the slow movement of the dredge. Incidental take of sea turtles by hopper dredges is reduced by using draghead deflectors and scheduling offshore dredging during the winter months when sea turtles are most likely to be elsewhere in warmer waters. Also, an agreement between NMFS and USACE is in place and implemented regarding take of sea turtles with hopper dredges and the use of observers to document incidental take to ensure that significant impacts do not occur. Therefore, no significant adverse impacts are expected to sea turtles.

2.6 HAWKSBILL SEA TURTLE

2.6.1 Reasons for Status

The hawksbill turtle (*Eretmochelys imbricata*) was Federally listed as endangered on 2 June 1970 (35 FR 8495) with critical habitat designated in Puerto Rico on 24 May 1978 (43 FR 22224). The greatest threat to this species is harvest to supply the market for tortoiseshell and stuffed turtle curios (Meylan and Donnelly, 1999). Hawksbill shell (bekko) commands high prices (recently $225/kilogram (kg)). Japanese imports of raw bekko between 1970 and 1989 totaled 713,850 kg, representing more than 670,000 turtles. The hawksbill is also used in the manufacture of leather, oil, perfume, and cosmetics (NMFS, 2000).

2.6.2 Habitat

Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they are typically found at depths of less than 70 ft. Like some other sea turtle species, hatchlings are sometimes found floating in masses of marine plants (e.g., sargassum rafts) in the open ocean (NFWL, 1980). Hawksbills reenter coastal waters when they reach a carapace length of approximately 20 to 25 centimeters. Coral reefs are widely recognized as the resident foraging habitat of juveniles, subadults, and adults. This habitat association is undoubtedly related to their diet of sponges, which need solid substrate for attachment. Hawksbills are also found around rocky outcrops and high-energy shoals, which are also optimum sites for sponge growth. In Texas, juvenile hawksbills are associated with stone jetties (NMFS, 2000).

While this species is omnivorous, it prefers invertebrates, especially encrusting organisms, such as sponges, tunicates, bryozoans, mollusks, corals, barnacles, and sea urchins. Pelagic species consumed include jellyfish and fish, and plant material such as algae, sea grasses and mangroves, has also been reported as food items for this turtle (Carr, 1952; Rebel, 1974; Pritchard, 1977; Musick, 1979; Mortimer, 1982). The young are reported to be somewhat more herbivorous than the adults (Ernst and Barbour, 1972).

Terrestrial habitat is typically limited to nesting activities. They nest on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls. Typically, the sand beaches are low energy, with woody vegetation, such as sea grape (*Coccoloba uvifera*), near the waterline (NRC, 1990). The hawksbill is typically a solitary nester, which makes it harder to monitor nesting activity and success (NMFS, 2000).

2.6.3 Range

The hawksbill is circumtropical, occurring in tropical and subtropical seas of the Atlantic, Pacific, and Indian oceans (Witzell, 1983). This species is probably the most tropical of all marine turtles, although it does occur in many temperate regions. The hawksbill turtle is widely distributed in the Caribbean Sea and western Atlantic Ocean, with representatives of at least some life history stages regularly occurring in southern Florida and the northern Gulf of Mexico (especially Texas), south to Brazil (NMFS, 2000). In the continental U.S., the hawksbill nests only in Florida where it is sporadic at best (NFWL, 1980). However, a major nesting beach exists on Mona Island, Puerto Rico. Elsewhere in the western Atlantic, hawksbills nest in small numbers along the Gulf coast of Mexico, the West Indies, and along the Caribbean coasts of Central and South America (Musick, 1979).

2.6.4 Distribution in Texas

Texas is the only state outside of Florida where hawksbills are sighted with any regularity. Most of these sightings involve posthatchlings and juveniles, and are primarily associated with stone jetties. These small turtles are believed to originate from nesting beaches in Mexico (NMFS, 2000). Along the Texas coast, the following stranding information was recorded for hawksbills: 28 strandings in 2000, 30 strandings in 2001, and 45 strandings through September 2002 (Shaver, 2002).

2.6.5 Presence in the Project Area

The hawksbill has been recorded from Nueces County (Dixon, 2000) and from Corpus Christi Bay (Shaver, 2000). It is of potential, though unlikely, occurrence in the area to be dredged.

2.6.6 Effects of the Project

Because most of the sightings of the hawksbill sea turtle in the northern Gulf of Mexico occur at stone jetties, this species could occur near the jetties and bulkheads. If it occurs in the project area, it could be negatively impacted by dredging activities during construction or by maintenance activities after construction. This species could be attracted to feeding opportunities at the proposed jetties and channel, where it would be exposed to additional risks from boat traffic, contaminants, fishing activities, tangled fishing lines, and accumulated plastic detritus.

However, project impacts are temporary and local in nature. A pipeline dredge will be used in the bay and a hopper dredge will be used in the entrance channel. Sea turtles easily avoid pipeline dredges due to the slow movement of the dredge. Incidental take of sea turtles by hopper dredges is reduced by using draghead deflectors and scheduling offshore dredging during the winter months when sea turtles are most likely to be elsewhere in warmer waters. Also, an agreement between NMFS and USACE is in place and implemented regarding take of sea turtles with hopper dredges and the use of observers to document incidental take to ensure that significant impacts do not occur. Therefore, no significant adverse impacts are expected to sea turtles.

2.7 LEATHERBACK SEA TURTLE

2.7.1 Reasons for Status

The leatherback turtle (*Dermochelys coriacea*) was listed as endangered throughout its range on 2 June 1970 (35 FR 8495), with critical habitat designated in the U.S. Virgin Islands on 26 September 1978 and 23 March 1979 (43 FR 43688/43689 and 44 FR 17710/17712, respectively). Its decline is attributable to overexploitation by man and incidental mortality associated with commercial shrimping and fishing activities. Use of turtle meat for fish bait and the consumption of litter by turtles have also been mentioned as causes for mortality, the latter phenomenon apparently occurring when plastic is mistaken for jellyfish (Rebel, 1974). While nesting populations of leatherback sea turtles are especially difficult to discern because the females frequently change nesting beaches, current estimates are that 20,000 to 30,000 female leatherbacks exist worldwide. The major threat is egg collecting, although they are jeopardized to some extent by destruction or degradation of nesting habitat (NatureServe, 2000). Egg collecting is not currently a problem in Florida, but remains a problem in Puerto Rico and the U.S. Virgin Islands (NMFS and FWS, 1992). This species is probably more susceptible than other turtles to drowning in shrimp trawlers equipped with TEDs because adult leatherbacks are too large to pass through the TED exit opening. Because leatherbacks nest in the tropics during hurricane season, a potential exists for storm-generated waves and wind to erode nesting beaches, resulting in nest loss (NMFS and FWS, 1992).

2.7.2 Habitat

The leatherback turtle is mainly pelagic, inhabiting the open ocean, and seldom approaches land except for nesting (Eckert, 1992). It is most often found in coastal waters only when nesting or when following concentrations of jellyfish (TPWD, 2000), when it can be found in inshore waters, bays, and estuaries. It dives almost continuously, often to great depths.

Despite their large size, the diet of leatherbacks consists largely of jellyfish and sea squirts. They also consume sea urchins, squid, crustaceans, fish, blue-green algae, and floating seaweed (NFWL, 1980). The leatherback typically nests on beaches with a deepwater approach (Pritchard, 1971).

2.7.3 Range

The leatherback is probably the most wide-ranging of all sea turtle species. It is found in the Atlantic, Pacific and Indian oceans; as far north as British Columbia, Newfoundland, Great Britain and Norway; as far south as Australia, Cape of Good Hope, and Argentina; and in other water bodies such as the Mediterranean Sea (NFWL, 1980). Leatherbacks nest primarily in tropical regions; major nesting beaches include Malaysia, Mexico, French Guiana, Surinam, Costa Rica, and Trinidad (Ross, 1982). Leatherbacks nest only sporadically in some of the Atlantic and Gulf states of the continental U.S., with one nesting reported as far north as North Carolina (Schwartz, 1976). In the Atlantic and Caribbean, the largest nesting assemblages are found in the U.S. Virgin Islands, Puerto Rico, and Florida (NMFS, 2000).

The leatherback migrates further and ventures into colder water than any other marine reptile. Adults appear to engage in routine migrations between boreal, temperate, and tropical waters, presumably to optimize both foraging and nesting opportunities. The longest-known movement is that of an adult female that traveled 5,900 km to Ghana, West Africa, after nesting in Surinam (NMFS and FWS, 1992). During the summer, leatherbacks tend to be found along the east coast of the U.S. from the Gulf of Maine south to the middle of Florida.

2.7.4 Distribution in Texas

Apart from occasional feeding aggregations such as the large one of 100 animals reported by Leary (1957) off Port Aransas in December 1956, or possible concentrations in the Brownsville Eddy in winter (Hildebrand, 1983), leatherbacks are rare along the Texas coast, tending to keep to deeper offshore waters where their primary food source, jellyfish, occurs. In the Gulf of Mexico the leatherback is often associated with two species of jellyfish: the cabbagehead (*Stomolophus* sp.) and the moon jellyfish (*Aurelia* sp.) (NMFS and FWS, 1992). According to FWS (1981), leatherbacks never have been common in Texas waters. No nests of this species have been recorded for at least 60 years. The last two, one from the late 1920s and one from the mid-1930s, were both from Padre Island (Hildebrand, 1982, 1986). Along the Texas coast, the following stranding information was recorded for leatherbacks: 14 strandings in 2000, 6 strandings in 2001, and 17 strandings through September 2002 (Shaver, 2002).

2.7.5 Presence in the Project Area

While the leatherback has been recorded from Nueces County (Dixon, 2000), it is unlikely to occur in the project area.

2.7.6 Effects of the Project

Of the five species of sea turtles occurring in Texas waters, the leatherback is the species least likely to be affected by the proposed project because of its rare occurrence and pelagic nature.

However, project impacts are temporary and local in nature. A pipeline dredge will be used in the bay and a hopper dredge will be used in the entrance channel. Sea turtles easily avoid pipeline dredges due to the slow movement of the dredge. Incidental take of sea turtles by hopper dredges is reduced by using draghead deflectors and scheduling offshore dredging during the winter months when sea turtles are most likely to be elsewhere in warmer waters. Also, an agreement between NMFS and USACE is in place and implemented regarding take of sea turtles with hopper dredges and the use of observers to document incidental take to ensure that significant impacts do not occur. Therefore, no significant adverse impacts are expected to sea turtles.

2.8 BROWN PELICAN

2.8.1 Reasons for Status

The brown pelican (*Pelecanus occidentalis*) was listed as endangered throughout its foreign range on 2 June 1970 (35 FR 8495) and throughout its U.S. range on 13 October 1970 (35 FR 16047). Population declines were attributed largely to chlorinated hydrocarbon residues from the use of pesticides, such as DDT compounds (DDE, DDD and DDT), polychlorinated biphenyls (PCBs), dieldrin, and endrin which caused eggshell thinning; thus eggs became dessiccated and were more easily broken during incubation (NFWL, 1980). Other factors included human disturbance and loss of habitat due to commercial and residential development (FWS, 1995). Pelicans are large, heavy birds and easily flushed from the nest. Flushing exposes the eggs and young to predation, temperature stress and permanent abandonment by the parents.

A ban on the use of DDT in the U.S. in 1972, together with efforts to conserve and improve remaining populations, has led to increased numbers of brown pelicans. Populations in some areas have increased to historical breeding levels or above, with stable population numbers and productivity. The brown pelican has been delisted along the U.S. Atlantic coast and, in Florida and Alabama, along the Gulf coast. It remains endangered throughout the rest of its range, which includes Mississippi, Louisiana, Texas, California, Mexico, Central and South America, and the West Indies. In May 1998, the FWS announced its intention to either delist or downlist to threatened status numerous species, including the brown pelican (63 FR 25502-25512; 8 May 1998).

2.8.2 Habitat

Brown pelicans inhabit shallow coastal waters with water depths up to 80 ft (Palmer, 1962; NFWL, 1980; Fritts et al., 1983). They are rarely found inland and do not venture more than 20 miles out to sea except to take advantage of particularly good feeding situations (FWS, 1980). Distances of 61 miles from shore have been recorded (Fritts et al., 1983). Brown pelicans, which are colonial nesters, usually nest on undisturbed offshore islands in small bushes and trees, including mangroves, and in humid forests (NFWL, 1980; Guzman and Schreiber, 1987). Occasionally they nest on the ground. Preferred sites are those free from human disturbance, flooding and terrestrial predators such as raccoons. Brown pelicans utilize beaches, sandbars, sandspits, mudflats and even manmade structures such as piers, wharves, pilings, oil/gas platforms, and docks for loafing (NFWL, 1980).

2.8.3 Range

The brown pelican occurs along the Pacific coast of the Americas from southern British Columbia south to Cape Horn, and throughout the Atlantic, Gulf and Caribbean coastal areas from New Jersey south to eastern Venezuela. In North America, it occasionally ventures inland north to North Dakota, Ontario and Nova Scotia. Its breeding range is more restricted: along the Pacific coast from central California south to Chile, including the Galápagos Islands; and from North Carolina, south to eastern Venezuela, the West Indies, Greater Antilles, and Virgin Islands (American Ornithologists' Union (AOU), 1998).

In North America, two subspecies are recognized: the eastern brown pelican (*P. o. carolinensis*) ranging from North Carolina south through Florida and west to Texas, and the California brown pelican (*P. o. californicus*) in California (NFWL, 1980). For the eastern subspecies, the present range is the same as the historical one, but in reduced numbers. It became extirpated in Louisiana in 1966, but has since (beginning in 1968) been reintroduced from Florida. It has never been known to nest in Mississippi or Georgia (FWS, 1980; 50 FR 4938, 9 February 1985). Brown pelican colonies are known to occur on the east coast of Mexico off the eastern tip of the Yucatan Peninsula (Mabie, 1986, 1988).

While some migration occurs after nesting in both subspecies, many individuals overwinter close to their breeding grounds (FWS, 1980). Atlantic coast populations move southward in the fall, with most birds wintering in the U.S., particularly in Florida. Some birds, however, disperse to the Cuban coast (Clapp et al., 1982). Gulf coast birds tend to remain on the Gulf coast, although Texas and Louisiana birds have been recovered in Mexico and Cuba (Palmer, 1962; Clapp et al., 1982).

2.8.4 Distribution in Texas

Historically, the brown pelican was a common bird of the Texas Gulf coast with an estimated breeding population of 5,000 pairs residing in 17 colonies in 1918 (Mabie, 1990). By the 1960s, however, it was almost extirpated. In 1963, only 14 breeding pairs were recorded along the Texas coast; in 1964 no known nesting occurred (Mabie, 1986). The decline started during the 1920s and 1930s due to human disturbance (Oberholser, 1974), but has continued due to pesticide contamination (King et al., 1977; Mabie, 1986). Since the 1960s, the brown pelican has made a gradual comeback in Texas with an estimated 2,400 breeding pairs in 1995 (Campbell, 1995). Most of the breeding birds are found on Pelican Island in Corpus Christi Bay, Nueces County, and Sundown Island near Port O'Connor in Matagorda County. Smaller groups or colonies occasionally nest on Bird Island in Matagorda Bay, a series of older dredged material islands in West Matagorda Bay, Dressing Point Island in East Matagorda Bay, and islands in Aransas Bay (Campbell, 1995). No nesting sites are known from the lower Texas Coast. Although brown pelican colonies are not monitored every year, 1,100 pairs nested on Pelican Island in 2000, while on Sundown Island, 698 pairs nested in 2000 and 1,200 pairs nested in 1999 (FWS, 2000b).

2.8.5 Presence in the Project Area

In Texas, the brown pelican occurs from Chambers County to Cameron County (Campbell, 1995) and primarily along the lower and middle coasts. Occasional sightings are reported on the upper coast and inland to central, north-central, and eastern Texas (Texas Ornithological Society (TOS), 1995), usually on large freshwater lakes. Such occurrences are relatively uncommon. Pelican Island, a known nesting area for brown pelicans, is located in Corpus Christi Bay within the proposed project area.

2.8.6 Effects of the Project

This species is expected to forage in the project area or general vicinity. An active nesting colony occurs on Pelican Island within the proposed project area. A beneficial use site (BU Site Pelican) is proposed and located adjacent to and south of the channel, on the east side and south of Pelican Island. In the past, dredged maintenance materials have been placed on the south side of the island after coordination with the National Audubon Society (NAS) and allowed to flow out into the open water as a part of the ongoing rookery island enhancement, and this practice will continue. Rock revetment (1,500 ft) was placed on the northeast corner of the island in 1984 to protect that part of the island from erosion, but is has since been lost over the years to erosion flanking the rock.

There is a potential for young pelicans not fully fledged to be washing into the channel by large waves on the north side of the island if they wander around from the back side of the island or fall over the edge of the 10-ft bluff overlooking the beach. The USFWS and NAS have requested the USACE to armor the northeast corner of the island again to prevent erosion, but to pull the armoring away from the bluff and put it onto the beach or in the water. Additional requests include coordination with the USFWS and NAS on the location for placing dredged maintenance material and to delete and plans for fencing on the bluff to prevent young pelicans from falling over the edge.

The USACE will coordinate with the USFWS and NAS on the location and design of the armoring system during the design phase of the project. The USACE will determine the engineering feasibility of several armoring designs and the foundation conditions that could limit the armoring locations and present these to the USFWS. Also, the USACE will continue to coordinate the dredged material disposal locations on the island with the USFWS and NAS prior to disposal as it has in the past. Fencing will not be considered as a protection option for pelicans.

In addition to armoring the northeast corner of the island, approximately 2,200 linear ft of hydraulically filled embankment, protected by geotube and riprap, will extend bayward from the east end of the island. The purpose of this hydraulically filled embankment is to contain the dredged maintenance material flowing off the south side of the island to maintain an open-water channel between Pelican and Mustang Islands, thereby preventing land bridge access to Pelican Island from Mustang Island by predators. This embankment will also protect the island from shoreline erosion. This embankment alternative will be coordinated with the USFWS during the design phase, as well. Based on this analysis, the project is expected to have a beneficial impact on this endangered species.

2.9 BALD EAGLE

2.9.1 Reasons for Status

The bald eagle (*Haliaeetus leucocephalus*) was first granted legal protection with the Eagle Protection Act, passed on 8 June 1940 and amended 23 October 1972. The species was listed as endangered below the 40th parallel on 11 March 1967 (32 FR 4001) and later received protection under the Endangered Species Act of 1973. The legal status of the species was changed on 14 February 1978 (43 FR 6233) to endangered in the conterminous U.S. except for Washington, Oregon, Minnesota, Wisconsin, and Michigan, where it was designated as threatened (FWS, 1984). The bald eagle recovered sufficiently to be downlisted to threatened throughout its range and FWS has proposed to completely delist the species in the near future (64 FR 36453-36464; 6 July 1999).

Several factors have contributed to the decline of the bald eagle since the settling of North America. The primary factor in direct loss is shooting (Snow, 1981). Mortality through shooting, however, is on the decline. Between 1975 and 1981, 18% of the total reported mortalities were due to shooting, compared to 62% between 1961 and 1965 (FWS, 1984).

Historically, increase in human population has resulted in extensive alterations in land use. Because the eagles nest near water, increased recreation and other human use of water resources have had negative effects on the bald eagle. The greater use of boats, off-road vehicles, and snowmobiles, and increased development of waterfront property have severely altered eagle habitat (Snow, 1981). New wintering and non-nesting habitat, however, is now being created by the construction of reservoirs, which may also be used more in the future by nesting eagles, potentially resulting in a major redistribution of nesting (FWS, 1984).

Environmental contaminants are responsible for the greatest decline in eagle populations. Organochloride pesticides inhibit calcium metabolism, resulting in thin eggshells and, thus, reproductive failure. Since the use of DDT and other organochloride pesticides was banned in the U.S., the eagles have slowly recovered. Most populations of bald eagles appear to be producing young at a normal rate (FWS, 1984).

2.9.2 Habitat

The bald eagle inhabits coastal areas, rivers and large bodies of water. Water is the common feature of its nesting habitat (Green, 1985). Because fish and waterfowl comprise the bulk of the bald eagle's diet, nests of the species are seldom far from a river, lake, bay, or other water body. Nests are generally built in trees, and usually positioned so that a clear flight path exists to at least one side of the nest as well as providing excellent visibility, often with an unobstructed view of water. Nest trees may be in woodlands, woodland edges, or open areas, and are frequently the dominant or co-dominant trees in the area (Green, 1985). Nests on cliffs and rock pinnacles have been reported in parts of the U.S.; nests on manmade structures are rare.

Water is also an important element of the winter habitat, with eagles usually frequenting lakes and major river systems. Wintering bald eagles also use habitats with little or no open water, if rabbits, carrion, or other food items are regularly available (Green, 1985). Winter roosting sites may often be used by several eagles.

2.9.3 Range

The bald eagle ranges throughout North America. Two subspecies are currently recognized based on size and weight: the northern bald eagle (*H. l. alascanus*) and the southern bald eagle (*H. l. leucocephalus*), the former being larger and heavier than the latter. This delineation, however, is of questionable merit due to a continuous size gradient from north to south throughout the range; eagles in the central part of the U.S. are intermediate in size. The northern population nests from central Alaska and the Aleutian Islands, east through Canada, and in the northern states of the U.S. The southern population nests primarily in the estuarine areas of the Atlantic and Gulf coasts from New Jersey to Texas and the lower Mississippi Valley, northern California to Baja California (both coasts), Arizona and New Mexico (Snow, 1981). Wintering ranges of the two populations overlap. Many of the northern bald eagles migrate south for the winter and can even be found as far south as Texas.

The southern eagles tend to be more resident although there is some northward movement during the summer (Snow, 1981). The largest wintering group is in Alaska, where over 3,000 have congregated in the Chilkat Valley during the fall and winter months (Steenhof, 1978).

2.9.4 Distribution in Texas

The southern subspecies nests in Texas along the Gulf coast and on major inland lakes during the winter months, and migrates to more-northern latitudes during the summer. The 1999 bald eagle nesting survey identified 82 nesting territories Statewide, the southernmost being in Refugio, Goliad, Victoria, and Matagorda counties. Of these nesting territories, 64 were occupied and 47 nests fledged 73 young (Mitchell, 1999). The northern bald eagle nests in the northern U.S. and Canada during spring and summer, and migrates to the southern U.S., including Texas, during the fall and winter. Concentrations of wintering northern eagles are often found around the shores of reservoirs in Texas, with most wintering concentrations occurring in the eastern part of the State. In Texas, wintering bald eagles have been observed as far south as Cameron County (Oberholser, 1974; Mabie, 1990). They are considered to be a rare permanent resident in the Coastal Bend (Rappole and Blacklock, 1985)

2.9.5 Presence in the Project Area

No nests are known to occur in the project area, nor have any been reported from Nueces or San Patricio counties, the nearest known nest being in Refugio County (Mitchell, 1999). The checklist of birds of Mustang Island State Park does not list the bald eagle (Pulich et al., 1985), while the checklist of birds of Padre Island National Seashore (PINS) lists the bald eagle as rare in winter (Southwest Parks and Monuments Association (SPMA), 1990). If the bald eagle should occur in the project area, it would be only as a rare migrant or post-nesting visitor.

2.9.6 Effects of the Project

Given the infrequent occurrence of bald eagles in the general area, no impacts to this species are anticipated as a result of the project.

2.10 WHOOPING CRANE

2.10.1 Reasons for Status

The whooping crane (*Grus americana*) was Federally listed as endangered on 11 March 1967 (32 FR 4001). Critical habitat has been designated in Aransas, Calhoun, and Refugio counties in Texas, and includes the Aransas National Wildlife Refuge (NWR). Two experimentally introduced flocks are listed as experimental nonessential populations; in Florida (FR, 22 January 1993) and New Mexico (62 FR 38932). The main factors for the decline of the whooping crane were loss of habitat to agriculture, human disturbance of nesting areas, uncontrolled hunting, and collisions with power lines (NatureServe, 2000). Biological factors, such as delayed sexual maturity and small clutch size prevent rapid population recovery. Drought during the breeding season presents serious hazards to this species (Campbell, 1995). Whooping cranes are vulnerable to loss of habitat along their long migration route (NatureServe, 2000), along which they are still subject to cataclysmic weather events, accidental shooting, collision with power lines, and predators. They are susceptible to avian tuberculosis, avian cholera and lead poisoning (Campbell, 1995). Exposure to disease is a special problem when large numbers of birds are concentrated in limited areas, as often happens during times of drought.

While in Texas, the main population is at risk from chemical spills along the Gulf Intracoastal Waterway (GIWW), which passes through the center of their winter range (Campbell, 1995). The presence of contaminants in the food base is another potential problem on their wintering grounds (Oberholser, 1974), and a late season hurricane or other weather event could be disastrous to this concentrated population.

2.10.2 Habitat

Nesting habitat in Canada is freshwater marshes and wet prairies (NatureServe, 2000), interspersed with numerous potholes and narrow-wooded ridges. Whooping cranes use a variety of habitats during migration (Campbell, 1995). They feed on grain in croplands (Lewis, 1995), and large wetland areas are used for feeding and roosting. Riverine habitats, such as submerged sandbars, are often used for roosting. The principle winter habitat in Texas is brackish bays, marshes, and salt flats, although whooping cranes sometimes feed in upland sites characterized by oak mottes, grassland swales, and ponds on gently rolling sandy soils (Campbell, 1995).

Summer foods include large insect nymphs or larvae, frogs, rodents, small birds, minnows and berries. During the winter in Texas they eat a wide variety of plant and animal foods. Blue crabs, clams, and berries of Carolina wolfberry (*Lycium carolinianum*) predominate the diet. Foods taken at upland sites include acorns, snails, crayfish, and insects (Campbell, 1995).

2.10.3 Range

Whooping cranes were originally found throughout most of North America. In the nineteenth century, the main breeding area was from the Northwest Territories to the prairie provinces in Canada, and the northern prairie states to Illinois. A non-migratory flock existed in Louisiana, but is now extirpated. Whooping cranes wintered from Florida to New Jersey along the Atlantic Coast, along the Texas Gulf Coast, and in the high plateaus of central Mexico. They now breed in isolated, marshy areas of Wood Buffalo National Park, Northwest Territories, Canada. They winter primarily in the Aransas NWR and adjacent areas of the central Texas Gulf Coast (FWS, 1995). During migration they use various stopover areas in western Canada and the American Midwest.

Two experimental flocks have been established by incubating eggs and rearing the young in captivity before releasing them into the wild. Whoopers were introduced in Grays Lake NWR in Idaho in 1975; these birds winter at Bosque del Apache NWR in central New Mexico. This population is not successfully breeding and will become extirpated. Introduction of another flock to Kissimmee Prairie in Florida began in 1993. The Florida population will be non-migratory (NatureServe, 2000).

2.10.4 Distribution in Texas

The natural wild population of whooping cranes spends its winters at the Aransas NWR, Matagorda Island, Isla San Jose, portions of the Lamar Peninsula, and Welder Point on the east side of San Antonio Bay (NatureServe, 2000). The main stopover points in Texas for migrating birds are in the central and eastern panhandle (FWS, 1995).

2.10.5 Presence in the Project Area

Although the leeward side and interior of Padre Island could provide suitable winter habitat for whooping cranes, Nueces and San Patricio counties are outside the migration range of the whooping crane (FWS, 1995). The whooping crane in South Texas is generally restricted to the Aransas NWR in Aransas, Refugio, and Calhoun counties. This species is unlikely to occur in the project area.

2.10.6 Effects of the Project

No effects to the whooping crane are expected from this project.

2.11 NORTHERN APLOMADO FALCON

2.11.1 Reasons for Status

The northern aplomado falcon (*Falco femoralis septentrionalis*) was proposed for endangered status on 20 May 1985 (50 FR 20810). The listing was published as final on 25 February

1986 and the rule became effective on 27 March 1986 (51 FR 6686). Although reasons for the decline of the aplomado falcon are not known (Hector, 1987), habitat degradation due to brush encroachment is probably the main factor in the disappearance of this bird from the U.S. (Hector, 1983). Overcollecting of the falcons and their eggs may have contributed to the decline on a local basis (Hector, 1983, 1987). The NAS (comments published in the Federal Register, 51 FR 6686, 25 February 1986) identified the decline as being through the loss of open grassland habitat through overgrazing and other excessive range practices. Currently, the most serious threat is reproductive failure caused by continued use of organochlorine pesticides such as DDT and DDE in Latin America, which affect both the aplomado falcon and its prey species (Hector, 1983).

2.11.2 Habitat

Typical habitat of this species is open country, especially savannah rangeland and open woodland, containing scattered mesquites (*Prosopis* spp.), yuccas (*Yucca* spp.), oaks (*Quercus* spp.), and acacias (*Acacia* spp.) (Hector, 1983; 51 FR 6686, 25 February 1986; AOU, 1998). Open terrain with scattered trees (for nesting and observation perches), relatively low ground cover (less concealment for prey), an abundance of small- to medium-sized birds, and nesting platforms (e.g., stick nests or large bromeliads), particularly in yuccas and mesquites, are the habitat requirements for this bird (Hector, 1981; FWS, 1995). The preferred habitat of the aplomado falcon in southern Texas was coastal prairie with widely scattered mesquites and yuccas (Hector, 1987).

2.11.3 Range

The aplomado falcon is resident throughout much of Central and South America (AOU, 1998). Three subspecies are recognized: the northern aplomado falcon (*F. f. septentrionalis*) and two others (*F. f. femoralis* and *F. f. pichinchae*) (Hector, 1983). The subspecies *septentrionalis* historically occurred in southeastern Arizona, southern New Mexico, southern Texas, much of Mexico, the Pacific coast of Guatemala, and perhaps Nicaragua where it intergrades with *F. f. femoralis*. Highest nesting densities in the U.S. were formerly in New Mexico and Texas; today this bird is virtually absent from the U.S. (Homerstad, 1990) and nests regularly only in the coastal plains of eastern Mexico (Vera Cruz, Chiapas, Campeche and Tabasco) in the palm and oak savannah and is rarely seen outside this area (Hector, 1981, 1983).

2.11.4 Distribution in Texas

In Texas, the northern aplomado falcon formerly ranged from Cameron County northward to San Patricio County, and west from Ector and Midland counties to El Paso County (Oberholser, 1974). Around the turn of the century, the southeast corner of Cameron County was an important nesting area for the aplomado falcon, with over 100 nests being recorded (Hector, 1983). Other breeding records in Texas have come from Hidalgo, Kenedy, Brooks, Pecos, Ector and Midland counties, with the last nesting pair recorded from Brooks County in 1941 (Oberholser, 1974). Until recently, the last confirmed nesting in the U.S. was near Deming, New Mexico in 1952 (FWS, 1995). Since 1985, reintroduction efforts have been underway at several sites in south Texas in order to reestablish populations in the U.S. Reintroduction sites have included the Laguna Atascosa NWR and the King Ranch. These birds are hatched in California, flown to Texas at age 3 to 4 weeks, reared in hack boxes, and fed periodically following fledging. In 1995, a pair of these released birds successfully nested on a transmission line pole near Brownsville. In 1996 this same pair nested in a nearby mesquite, but the female and young were subsequently killed by a great horned owl (*Bubo virginianus*) (Anonymous, 1996).

2.11.5 Presence in the Project Area

No aplomado falcons were observed in the project area during PBS&J's field survey, and it is unlikely that this bird occurs there. Even if this species recovers sufficiently from its present decline and spreads into its former range, lack of suitable nesting habitat in the project area would preclude its occurrence there.

2.11.6 Effects of the Project

Because this falcon is not expected at present to occur in the project area, no impacts are anticipated.

2.12 PIPING PLOVER

2.12.1 Reasons for Status

The piping plover (*Charadrius melodus*) was Federally listed as endangered on 11 December 1985 for the Great Lakes watershed and was listed as threatened throughout the remainder of its range (50 FR 50726). The rule became effective on 10 January 1986. In 1986, an estimated 2,100 to 2,300 breeding pairs occurred in North America: 1,337 to 1,409 pairs in the northern Great Plains, 19 to 24 pairs in the Great Lakes, and 799 pairs along the Atlantic coast (Haig et al., 1987). Shorebird hunting during the early 1900s caused the first known major decline of piping plovers (Bent, 1929). Since then, loss or modification of habitat due to commercial, residential, and recreational developments, dune stabilization, damming and channelization of rivers (eliminating sandbars, encroachment of vegetation, and altering water flows), and wetland drainage have further contributed to the decline of the species (FWS, 1995). Additional threats include human disturbances through recreational use of habitat, and predation of eggs by feral pets (FWS, 1995).

2.12.2 Habitat

Piping plovers typically inhabit shorelines of oceans, rivers and inland lakes. Nest sites include sandy beaches, especially where scattered tufts of grass are present; sandbars; causeways; bare areas on dredge-created and natural alluvial islands in rivers; gravel pits along rivers; silty flats; and salt-encrusted bare areas of sand, gravel, or pebbly mud on interior alkali lakes and ponds. In the wintering grounds these birds utilize beaches, mudflats, sandflats, dunes, and offshore spoil islands (AOU, 1998; FWS, 1995). One of the most important wintering areas for this species, the Laguna Madre in Mexico, became unsuitable when its water level was stabilized for a fisheries lagoon. In Texas, an estimated 30% of wintering habitat had been lost over a 20-year period (50 FR 50726; 11 December 1985).

2.12.3 Range

The piping plover breeds on the northern Great Plains (Iowa, northwestern Minnesota, Montana, Nebraska, North and South Dakota, Alberta, Manitoba, and Saskatchewan), in the Great Lakes (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin and Ontario), and along the Atlantic coast from Newfoundland to Virginia and (formerly) North Carolina. It winters on the Atlantic and Gulf of Mexico coasts from North Carolina to Mexico, including coastal Texas, and, less commonly, in the Bahamas and West Indies (AOU, 1998; 50 FR 50726, 11 December 1985). Migration occurs both through the interior of North America east of the Rocky Mountains (especially in the Mississippi Valley) and along the Atlantic coast (AOU, 1998). Little is known about the migration routes of this species.

2.12.4 Distribution in Texas

The piping plover begins arriving to its post-breeding and wintering grounds in Texas in mid- to late-July. Haig and Oring (1985, 1987) found that early in the post-breeding season, piping plovers frequented beaches, but later tended to inhabit ephemeral sandflats along the backside of barrier islands. Observations of wintering piping plovers in Alabama did not indicate a seasonal preference between habitats, but that wintering plovers spent more than 85% of their time on sand flats or mudflats each month (Johnson and Baldassarre, 1988). Along the Texas coast, a correlation appears to exist between tidal height and habitat selection, with piping plovers actively feeding on tidal flats during periods of low tides, and on the Gulf beaches during high tides (Eubanks, 1991; Zonick, et al., 1998; Drake et al., 2000). Winter distribution studies along the Atlantic and Gulf coasts found piping plovers usually occurring in small, unevenly distributed groups along the coast; however, the sites with largest concentrations of plovers consisted of expansive sand flats or mud flats with sandy beach in close proximity (Nicholls and Baldassarre, 1990). Piping plover concentrations in Texas occur in the following counties: Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kleberg, Matagorda, Nueces, San Patricio and Willacy (FWS, 1988).

Several areas along the Texas coast have been identified by the FWS as essential wintering habitat for the piping plover. Essential wintering habitat for the piping plover provides the space and requisite resources necessary for the continued existence and growth of piping plover populations and consist of coastal beach, sandflat and mudflat habitats. Critical habitat has recently been designated in Texas (see below).

2.12.5 Presence in the Project Area

The piping plover is a regular migrant and winter resident along the lower Texas coast (Oberholser 1974; Haig and Oring, 1985, 1987; Haig and Plissner, 1993; TOS, 1995) and wintering birds have been reported along the length of the Texas coast. The checklist of birds of Mustang Island State Park lists the piping plover as a fairly common winter resident and a common migrant (Pulich et al., 1985). Piping plovers have been recorded from the project area (PBS&J, in-house data).

PBS&J conducted a piping plover survey in the Corpus Christi Bay project area between September 2000 and April 2001 (PBS&J, 2001). Survey protocol and sites were established during coordination with FWS and TPWD in August 2000. The four study sites, which were visited monthly, are shown in Figure 2-1. They are as follows: Oso Bay, Gulf Intracoastal Waterway (GIWW), Fish Pass, and Port Aransas. During the 8-month study, 1,687 piping plovers were recorded at the four study sites in 428.4 hours of observation, at a frequency of 3.9 birds per hour. The number of birds observed at the four study sites each month ranged from 131 in November 2000 to 473 in March 2001, while the number of piping plovers encountered per hour at the four sites ranged from 2.1 in September 2000 to 9.0 in March 2001. While many of these individuals were undoubtedly seen on more than one occasion, a minimum of 473 piping plovers utilized the four study sites during the 2000-2001 survey.

At the Oso Bay study site, 115 piping plovers were recorded in 64.4 hours of observation at a frequency of 1.8 birds per hour. The number of individuals ranged from 6 in November 2000 to 22 in September 2000, while the number of birds encountered per hour ranged from 1.0 for December 2000 to 4.2 for February 2001. Thus, a minimum of 22 piping plovers utilized the Oso Bay study site during the 2000-2001 survey.

Altogether, 652 piping plovers were recorded at the GIWW study site in 185.6 hours of observation at a rate of 3.5 birds per hour. The number of individuals at the GIWW site ranged from 27 in October 2000 to 182 in March 2001, while the number of birds encountered per hour ranged from 1.5 for October 2000 to 7.8 for March 2001. Thus, a minimum of 182 piping plovers utilized the GIWW study site during the 2000-2001 survey.

At the Fish Pass study site, 148 piping plovers were recorded during 122.8 hours of observation at a rate of 1.2 birds per hour. Apart from December 2000 when no piping plovers were recorded, the number of individuals ranged from 8 in November 2000 to 45 in March 2001, while the

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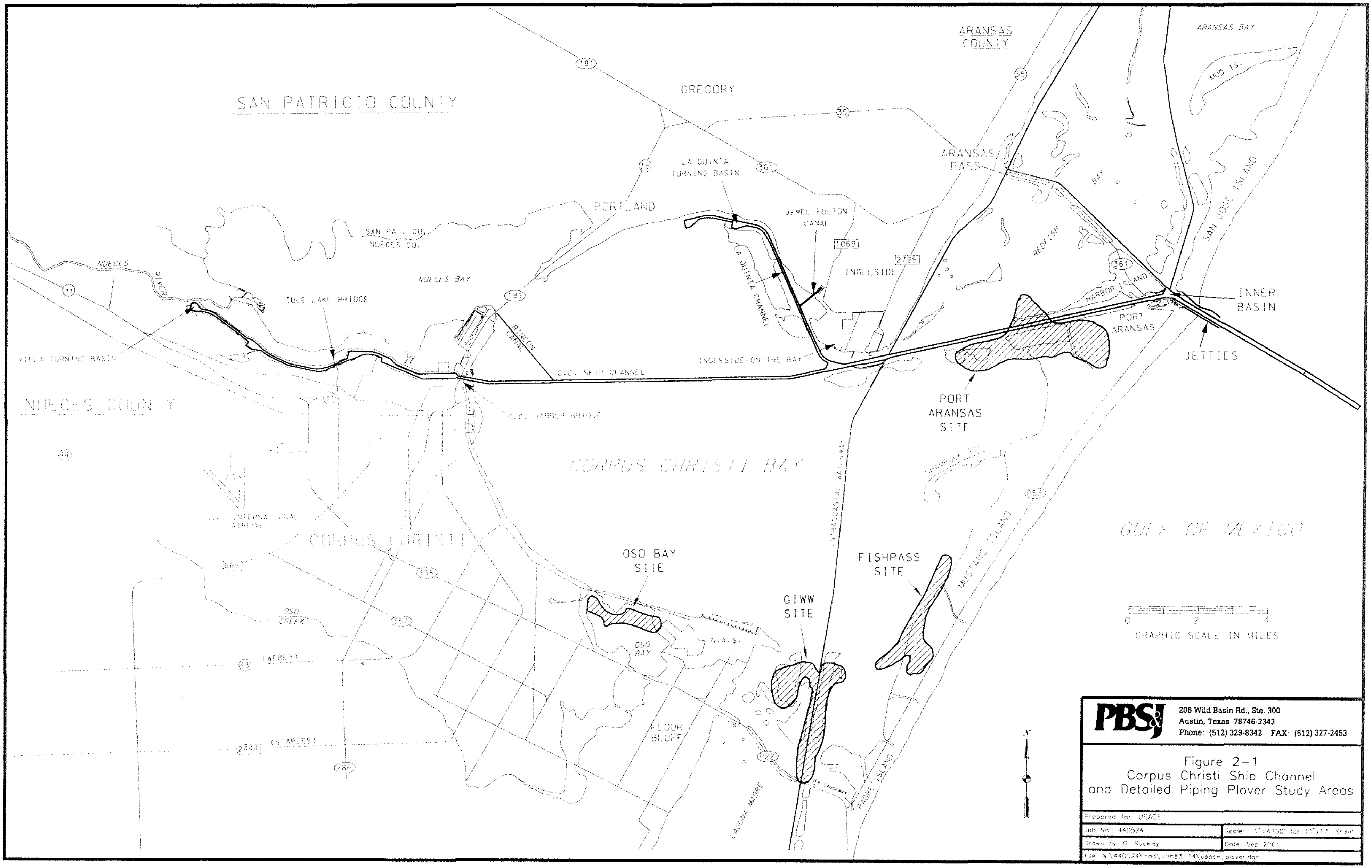

Figure 2-1
Corpus Christi Ship Channel
and Detailed Piping Plover Study Areas

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number of birds encountered per hour ranged from 0.6 for February 2001 to 3.4 for March 2001. Thus, at least 45 piping plovers utilized the Fish Pass study site. No surveys were conducted at the MBHC.

At the Port Aransas study site, 772 piping plovers were recorded during 55.6 hours of observation at a frequency of 13.9 birds per hour. The number of individuals ranged from 33 in December 2000 to 233 in March 2001, while the number of birds encountered per hour ranged from 4.8 for December 2000 to 38.2 for March 2001. Thus, a minimum of 233 piping plovers utilized the Port Aransas study site during the 2000-2001 survey.

2.12.6 Effects of the Project

The minor changes in salinity and tidal amplitude as a result of the project are not expected to have an impact on the piping plover. Impacts to other areas currently used by piping plover near the project will be eliminated by placing new work dredged material in leveed upland areas or in coordinated open-water beneficial use sites. Dredged maintenance material will be placed in existing PAs that are fully leveed or used beneficially to enhance other areas, such as nesting habitat for pelicans. Some beach nourishment may occur on San Jose Island via PA 2 which is designed to nourish the sand dune field near the jetty channel with the high sand content material from the jetty channel. However, this site is infrequently used and much of the sandy material remains in the dune field which is not piping plover habitat. Although some of the material can leave the semi-confined PA 2, it only flows onto a small area of the beach and replenishes this habitat as well. Placement of dredged materials in PA 6, located east of Pelican Island, will not affect adjacent critical habitat or piping plovers because the area is fully leveed. Based on these findings and the fact that any material reaching the critical habitat on San Jose Island is infrequent, temporary, and limited in size, the project is not expected to have any significant adverse impacts on the species and critical habitat for the piping plover is not expected to be significantly impacted as well.

2.13 MOUNTAIN PLOVER

2.13.1 Reason for Status

The mountain plover (*Charadrius montanus*) was proposed for listing as a threatened species on 16 February 1999 (64 FR 7587). It appears to be declining rapidly. One study indicated recent population declines of 50% to 89%. The breeding distribution has also contracted, with both peripheral populations disappearing and core populations going from widely distributed to only locally present. Early declines were probably at least partly related to market hunting. Historically, many mountain plovers nested in prairie dog towns (NatureServe, 2000), which have declined 98% in landscape coverage since 1900 (Summers and Linder, 1978)

Conversion of shortgrass prairie to agricultural land, primarily for winter wheat, has destroyed nesting habitat, as has planting of taller grasses in native prairie. In the last 25 years, farms on the western Great Plains have become larger and different crops have become more popular. Many farmers now grow extensive crops of millet and sunflower, ironically partially for the birdseed market. Fields for these crops remain fallow until early May, after most mountain plovers have begun nesting, and many nests are destroyed by cultivation activities. The plovers are likely to renest in these fields after planting, only to be forced to abandon all the nests when the crops become too tall for the birds to scan their surroundings for predators. This major shift in regional activity has created a reproductive sink for mountain plovers, and may explain the annual decline since 1966 (Knopf, 1996). Encroachment on native prairies by exotic species such as cheatgrass (*Bromus tectorum*), leafy spurge (*Euphorbia esula*), and knapweed (*Centaurea* spp.) may be a factor (NatureServe, 2000).

2.13.2 Habitat

The mountain plover, which actually avoids mountains, was originally named Rocky Mountain plover because the first specimens were taken within sight of that range. Instead, upland shortgrass plains and level plateaus of the western U.S. are its preferred summer haunts (Oberholser, 1974). Nesting areas are characterized by very short vegetation, and significant areas of bare ground (typically>30%), and flat or gentle slopes (<12%). Areas of moist ground are generally avoided, even for foraging. Non-breeding birds prefer short-grass plains and fields, plowed fields, sandy deserts (NatureServe, 2000), and sod farms (Knopf, 1996). They are attracted to heavily grazed annual grasslands and recent burns. Typical winter habitat in Texas is coastal prairies, alkaline flats, plowed fields, and bermudagrass fields (Oberholser, 1974). Mountain plovers are highly gregarious. Outside the breeding season they forage and roost in loose flocks of changing composition. Flock size may exceed 1,000 on the southern Great Plains in late summer. Mountain plovers may be attracted to cattle, sheep, and prairie dogs (NatureServe, 2000).

2.13.3 Range

The mountain plover's historical breeding range was northern Montana south to central New Mexico, western Texas, and western Oklahoma, with very low numbers in extreme southern Alberta and perhaps Saskatchewan. This species now breeds mainly in Colorado, Wyoming, and Montana. Recent sightings of birds in June and July in the vicinity of Saltillo, Nuevo Leon, may have been of breeding birds. The non-breeding range is central California, southern Arizona, and central and near-coastal Texas, south to southern Baja California and the northern mainland of Mexico to San Luis Potosi. The primary wintering grounds are now in the San Joaquin, Sacramento, and Imperial valleys of California (Knopf, 1996).

2.13.4 Distribution in Texas

The mountain plover is a rare summer resident in the high grasslands of the Trans-Pecos and in the northwest Panhandle. It is a rare migrant east to Delta County in the north and the Colorado River in central Texas. It is a rare to uncommon local winter resident on the coastal plains and inland from south Texas through the Edwards Plateau into the South Plains (TOS, 1995).

2.13.5 Presence in the Project Area

While the mountain plover has been recorded from Nueces County (Oberholser, 1974), it is most likely to occur in the agricultural areas away from the seashore. The mountain plover appears as an uncommon migrant on the checklist for birds of the Corpus Christi area (Audubon Outdoor Club of Corpus Christi (AOCCC), 1994), but is absent from checklists for Mustang Island State Park (Pulich et al., 1985) and PINS (SPMA, 1990). It is not expected to occur in the project area due to lack of suitable habitat.

2.13.6 Effects of the Project

The mountain plover is unlikely to occur in the project area and, thus, will not be impacted by the proposed project.

2.14 ESKIMO CURLEW

2.14.1 Reason for Status

The Eskimo curlew (*Numenius borealis*) was federally listed as endangered on 2 June 1970. It may be extinct; if not, it exists only in perilously low numbers. Only about 70 individuals have been seen anywhere in the last 60 years, and the last confirmed sighting of an Eskimo curlew was in Nebraska in 1987 (FWS, 1990a).

Eskimo curlews were extremely abundant in the nineteenth century and were subject to tremendous pressures from market hunting, especially after the demise of the passenger pigeon. They were held in high esteem as a food item, described by some as "the finest eating of any of our birds." Their abundance and tameness made supplying the demand an easy matter, and they were sold in restaurants and markets from Halifax to Buenos Aires. A pair of hunters on Cape Cod reportedly shot 5,000 curlews during the 1872 flight (Gollop et al., 1986). Market hunting for the Eskimo curlew flourished between 1860 and 1890, and was most intense during the late 1870s and 1890s in response to dwindling supplies of passenger pigeons (Gill et al., 1998).

Hunting was not the sole reason for the decline of the Eskimo curlew, for some population declines were noted several years before market hunting likely had significant impacts (Gill et al., 1998). This species was undoubtedly affected by habitat changes also. Over the last 125 years, a significant reduction has occurred in the amount and quality of habitat available to these birds along their migration routes. Urbanization and industrialization have impacted habitats on the Texas coast. Most of the grasslands used for spring migration feeding in the interior of North America have been converted to cropland. Most of the grassland on the pampas of Argentina have been converted to other uses and wet-meadow foraging habitat on Caribbean islands has been filled for tourism development. Pesticides and chemical contaminants are used widely in all but a few areas throughout the Eskimo curlew's range (FWS, 1990a).

Populations declined suddenly during the 1870s and by the 1890s they had effectively disappeared. Sightings during the first half of the twentieth century were very rare. Between 1945 and 1985, Eskimo curlews were reported in 23 different years, in numbers from 1 to 23 individuals (Gill et al., 1998).

The Eskimo curlew is a relatively long-lived bird with probably a low reproductive rate, and certainly a very long migration route on which it is exposed to a number of factors. Perhaps the most important of these factors, in conjunction with hunting pressures, was the conversion of native prairies to agriculture along its spring migratory route, along with the suppression of fires. These phenomena were related to the extinction of the Rocky Mountain grasshopper (*Melanoplus spretus*), whose localized population irruptions were important to migrating curlews.

The Eskimo curlew fed on various invertebrates, seeds and berries. Berries were the preferred food source during the boreal autumn before migration (Gill et al., 1998).

2.14.2 Habitat

The breeding habitat of the Eskimo curlew was treeless arctic and subarctic tundra (Gill et al., 1998). Non-breeding birds used a variety of habitats, such as grasslands, pastures, plowed fields, and, less frequently, marshes and mudflats (AOU, 1998). They favored headlands and hills within a few kilometers of the sea, and burned-over prairies and marshes were particularly attractive during migration. They roosted on beaches along the coast, but were rarely found near water in the midwestern states (Gollop et al., 1986)

2.14.3 Range

The Eskimo curlew was only known to have nested in a relatively small portion of treeless tundra in the Northwest Territories, Canada, but the nesting range may have extended across northern Alaska into Siberia. They wintered in southern South America, primarily Argentina. Their fall migration took them eastward across Canada to the northeastern U.S., then southward across the Atlantic to South America. In spring they traveled through Texas and the midwestern U.S. (Gill et al., 1998).

2.14.4 Distribution in Texas

The Eskimo curlew was formerly extremely abundant on the prairies of Texas, particularly in the middle portion of the State. It occurred in immense flocks until about 1875 and was observable in small flocks until about 1900 (Oberholser, 1974). The few records in recent years are from Galveston Island (TOS, 1995).

2.14.5 Presence in the Project Area

Although the Eskimo curlew was formerly common in the spring in the Coastal Bend (Rappole and Blacklock, 1985), it is not expected to occur in the project area due to its extreme rarity, if not total extinction, and the lack of recent local records.

2.14.6 Effects of the Project

The Eskimo curlew is highly unlikely to be impacted by this project due to the low probability of its occurrence in the area.

2.15 OCELOT

2.15.1 Reasons for Status

The ocelot (*Leopardus pardalis*) is listed as endangered throughout its present range (FWS, 1995, 2001). Habitat destruction and degradation due to brush-clearing has been the major cause for the population decline, but predator control activities and hunting have also contributed. In Central and South America, exploitation for the fur and pet trade is primarily responsible for population declines (NFWL, 1980; FWS, 1995).

2.15.2 Habitat

The ocelot occupies a variety of habitats throughout its neotropical range including tropical and subtropical forests, riverine forests, swampy savannahs, estuarine mangroves, rocky areas, and upland oak forests (NFWL, 1980; Tewes and Schmidly, 1987; Murray and Gardner, 1997). In Texas, however, ocelots inhabit dense, often thorny and impenetrable brush, mesquite-oak and oak forests, and partially cleared land (NFWL, 1980; Navarro, 1985). Tewes (1986) found honey mesquite, acacias, condalia (Condalia spp.), allthorn goatbush (Castella texana), granjeno, cenizo, and whitebrush (Aloysia texana) to be the dominant brush species of ocelot habitat in south Texas. Approximately 1.6% of the land area in south Texas now supports this type of habitat (Tewes and Everett, 1987).

Tewes and Everett (1987) classified ocelot habitat in Texas according to the amount of foliar canopy. Class A or optimal habitat was 95% canopy cover, Class B or suboptimal habitat was 75%

to 95% canopy cover, and Class C, with 75% or less canopy cover, was considered inadequate. The most critical habitat component is probably dense cover near the ground (<3 ft in height) (Tewes, 1986).

The ocelot is primarily nocturnal, although some diurnal activity has been recorded (Navarro, 1985; Tewes, 1986; Tewes and Schmidly, 1987). Navarro (1985) found ocelots in Texas to have two peaks of activity, one at about midnight and the other at daybreak. Ocelots feed on small and medium-sized mammals such as woodrats (*Neotoma* spp.), rabbits (*Sylvilagus* spp.), young deer (*Odocoileus* spp.), nutria (*Myocastor coypus*), birds, reptiles, amphibians, fish, insects and, in Latin America, spider monkeys (*Ateles* sp.), coatis (*Nasua nasua*), and agoutis (*Agouti* sp.) (Hall and Dalquest, 1963; Guggisberg, 1975; Navarro, 1985; Tewes and Schmidly, 1987; Emmons, 1988).

While breeding occurs throughout the year in the tropics, it occurs primarily in the fall (September through November) in Texas, although births have also been recorded in April, June, July and August. Den sites are usually well hidden and include dense, thorny scrub, caves, hollows in trees or logs, and grass tussocks (Petrides et al., 1951; Navarro, 1985; Tewes, 1986; Laack and Rappole, 1986, 1987a; Tewes and Schmidly, 1987). Gestation is 70 to 80 days. Litter size ranges from two to four, with two being the most common. The mother provides extended parental care to the young because it takes time for them to become proficient at capturing prey. Males are believed to contribute little to direct parental care (Tewes, 1986). Ocelots in the wild become sexually mature at 16 to 18 months (Schauenberg, 1979), but in captivity, maturity may be reached in as little as 10 to 12 months.

Navarro (1985) found that the average home range (the area which an animal occupies during its normal daily activities) for three male ocelots in south Texas was 2.5 square kilometers (km^2) (618 ac), and for one female was 2.1 km^2 (519 ac). Similarly, Twedt and Rappole (1986) reported home ranges of 3.5 km^2 (865 ac) and 1.2 km^2 (296 ac) for two male ocelots on Yturria Ranch in Willacy and Kenedy counties. However, Tewes (1986), using a much larger data base, found the average home range of south Texas ocelots to be 17.7 km^2 (4,372 ac) for males and 11 km^2 (2,717 ac) for females. The overall average for adults was 15.2 km^2 (3,754 ac). Although male ocelots had larger territories than the females and generally covered an extensive area in a short period, females used the home range more intensively (Tewes, 1986; FWS, 1990b). Tewes (1986) also determined that home ranges expanded in the winter and contracted in the summer. Both Navarro (1985) and Tewes (1986) found little overlap in the home ranges of adjacent males, but quite a considerable intersexual spatial overlap in the home ranges. Tewes and Schmidly (1987) and Navarro (1985) also found that the home ranges were closely aligned with the amount of suitable available habitat. At Laguna Atascosa NWR, for example, an increase in the ocelot population has resulted in smaller home ranges, two ocelots occupying an area that had previously supported only one (Tewes, 1988). Some individuals there currently inhabit areas as small as 80 ac (Tewes, 1988).

2.15.3 Range

Historically, the ocelot occurred in Arkansas, Arizona, southern California, and south through Central and South America to Peru, Uruguay and northern Argentina (Navarro, 1985). Today it ranges from Arizona and Texas through Central and South America to northern Argentina, but in reduced numbers (Tewes and Everett, 1987; Emmons, 1990; Murray and Gardner, 1997).

2.15.4 Distribution in Texas

The ocelot once occurred in the eastern, central and southern portions of Texas but currently only exists in the extreme south of the State (Davis and Schmidly, 1994). As a first step to determining the status of the ocelot in Texas, a clearinghouse for ocelot (and jaguarundi) sightings was established in October 1981 to coordinate reception and filing of reports. A total of 1,572 questionnaires was mailed to trappers to obtain additional information; of these, 472 (30%) were returned and 87 (6%) contained positive responses (Tewes and Everett, 1987). From these results, it appears that two significant populations of ocelots exist in south Texas. One population inhabits parts of Hidalgo, Starr, Cameron, and Willacy counties, and the other, Jim Wells, Live Oak, McMullen and Atascosa counties. Six or seven smaller populations may also occur. Based on studies of spatial patterns and densities of radio-collared ocelots, Tewes (1986) estimated that only 80 to 120 ocelots occur in Texas. Laack (1998) currently puts this number at 100. A population of approximately 30 to 40 ocelots occurs on the Laguna Atascosa NWR in Cameron County (Laack, 1998). One or two ocelots apparently occur at the Santa Ana NWR (Benn, 1997; Laack, 1998) and one pair of ocelots had territories near the Arroyo Colorado in Cameron County (Laack, 1998). Ocelots have been sighted at the NAS's Sabal Palm Grove Sanctuary (Homerstad, 1986); and at the Loma de Grulla complex north of Laguna Vista, at Moranco Blanco, and at Redhead Ridge (Tewes, 1987). Ocelot sightings have also been reported from the Lower Rio Grande Valley NWR. In addition, Laack and Rappole (1986, 1987a), Tewes (1987) and Homerstad (1987) have documented several other ocelot sightings in Cameron County. The closest ocelot population in Mexico is near San Fernando, approximately 100 miles south of the U.S.-Mexico border (Laack, 1998).

2.15.5 Presence in the Project Area

Ocelots are highly unlikely to occur in the project area due to the lack of suitable brushy habitat. Trapping studies conducted during the Navy Homeport Feasibility (U.S. Navy, 1986) provided no evidence of ocelots in the project area.

2.15.6 Effects of the Project

No impacts to the ocelot are expected from this project.

2.16 JAGUARUNDI

2.16.1 Reasons for Status

The jaguarundi (*Herpailurus yagouaroundi*) was listed by FWS as endangered on 14 June 1976 (41 FR 24064). Habitat loss and alteration due to brush-clearing activities, and human persecution are the main causes for the decline in jaguarundi populations (FWS, 1995).

2.16.2 Habitat

Habitat requirements in Texas are similar to those for the ocelot: thick, dense thorny brushlands or chaparral. Approximately 1.6% of the land area in south Texas is this type of habitat (Tewes and Everett, 1987). The thickets do not have to be continuous but may be interspersed with clear areas. Jaguarundis possibly show a preference for habitat near streams (Goodwyn, 1970; Davis and Schmidly, 1994). In South America, habitat includes high mountain forests, tropical forests, swamp forests, savannahs, overgrown pastures, and thickets (NFWL, 1980; Tewes and Schmidly, 1987).

The most common plants occurring in habitats in the Rio Grande Valley where the jaguarundi is known to occur are huisache, blackbrush acacia, prairie baccharis (*Baccharis texana*), chillipiquin (*Capsicum annuum*), lotebush, allthorn goatbush, Texas persimmon (*Diospyros texana*), coyotillo (*Karwinskia humboldtiana*), common lantana (*Lantana horrida*), berlandier wolfberry (*Lycium berlandieri*), javelinabrush (*Microrhamnus ericoides*), Texas pricklypear (*Opuntia lindheimeri*), retama, honey mesquite, cedar elm (*Ulmus crassifolia*), and lime pricklyash (*Zanthoxylum fagara*) (Goodwyn, 1970).

Jaguarundis have two distinct color phases, red and gray, although the latter phase has also been called blue. The phases are so distinct that at one time they were thought to be separate species, the red one being called *Felis eyra*. A third color phase, black, has also been reported, but apparently does not occur in Texas (Goodwyn, 1970).

Like the ocelot, the jaguarundi is primarily nocturnal, although some diurnal activity has been recorded. Jaguarundis are excellent climbers although they spend most of the time on the ground. Prey is largely birds, but bird eggs, rats, mice, rabbits, reptiles and fish are also taken (Goodwyn 1970; Tewes and Schmidly, 1987; Davis and Schmidly, 1994). Jaguarundis communicate by calls, of which 13 have been identified in captive animals. The largest repertoire occurs during the mating season (Hulley, 1976).

Little is known of jaguarundi reproduction in the wild. Den sites include dense thickets, hollow trees, spaces under fallen logs overgrown with vegetation, and ditches overgrown with shrubs (Tewes and Schmidly, 1987; Davis and Schmidly, 1994). Young have been born in March and August with possibly two litters per year. Usually a litter comprises 2 to 4 young, with litters being either all of one color phase or containing both the red and gray phases. Gestation (for captive jaguarundis) varies from 63 to 75 days (Goodwyn, 1970; Tewes and Schmidly, 1987; Davis and Schmidly, 1994).

2.16.3 Range

The jaguarundi historically occurred in southeast Arizona, south Texas, and Central and South America as far south as northern Argentina. Today this cat has a similar distribution, but in much reduced numbers, although it probably no longer occurs in Arizona (Tewes and Schmidly, 1987). The presence of jaguarundis in Florida is likely the result of human introduction (Nowak and Paradiso, 1983).

Four North American subspecies are recognized, of which two occur in the U.S.: *H. y. cacomitli* from southern Texas to central Vera Cruz, Mexico, and *H. y. tolteca* from southern Arizona, along the Pacific coast of Mexico, and inland to the Mexican Plateau (Goodwyn, 1970; NFWL, 1980).

2.16.4 Distribution in Texas

Tewes and Everett (1987) analyzed the records of a clearinghouse established in 1981 to coordinate reception and filing of reports of jaguarundis (and ocelots) in Texas. Many of the reports were solicited by sending out questionnaires to trappers. Jaguarundis were reported from central Texas and the upper Gulf coast as well as from south Texas. However, due especially to the lack of any tangible evidence such as road kills, most of the sightings in the first two areas are believed to have been of black feral house cats. Two dead jaguarundis were reported in Cameron County and one each in Willacy and Webb counties. Tewes (1987) and Tewes and Everett (1987) documented several other credible reports of jaguarundis in these three counties. One of these was of a road-killed male jaguarundi found near the junction of SH 4 and Farm-to-Market Road (FM) 511 (Kellers Corner) in Cameron County on 21 April 1986 (Tewes, 1987; Laack and Rappole, 1987b). While this was the last confirmed record of a jaguarundi in Texas (Laack, 1998), unconfirmed jaguarundi sightings in Hidalgo County include Bentsen Rio Grande State Park, Santa Ana NWR, Lower Rio Grande Valley NWR, Cimarron Country Club, Wimberley Ranch, and the Anacua Unit of the TPWD Las Palomas Wildlife Management Area (Prieto, 1990, 1991; Benn, 1997). Unconfirmed but reliable sightings of a jaguarundi occurred at the Sabal Palm Grove Sanctuary in Cameron County in 1988 (Anonymous, 1989). Recent jaguarundi sightings have been reported from the Santa Ana NWR for March 1998 (Santa Ana NWR data). Based upon sighting reports, personnel of the Santa Ana NWR suspect the presence of jaguarundis on the refuge (Benn, 1997).

Tewes and Everett (1987) concluded that until verifiable evidence of jaguarundis from central Texas and the upper Gulf coast was forthcoming, jaguarundi distribution in Texas should be considered as restricted to the Rio Grande Valley. The number of jaguarundis in Texas is unknown, but certainly less than that of ocelots.

2.16.5 Presence in the Project Area

Jaguarundis are extremely unlikely to occur in the project area due to the lack of suitable brushy habitat and the lack of any known populations in the area. Trapping studies conducted during the Navy Homeport Feasibility (U.S. Navy, 1986) provided no evidence that jaguarundis were in the project area.

2.16.6 Effects of the Project

No impacts to the jaguarundi are expected from this project.

2.17 WEST INDIAN MANATEE

2.17.1 Reason for Status

The West Indian manatee (*Trichechus manatus*) was listed as endangered on 2 June 1970 (35 FR 8495). The largest known human-related cause of manatee mortality in Florida is collisions with hulls and/or propellers of boats and ships. The second-largest human-related cause of mortality in Florida is entrapment in floodgates and navigation locks. Other known causes of human-related manatee mortality include poaching and vandalism, entrapment in shrimp nets and other fishing gear, entrapment in water pipes, and ingestion of marine debris (FWS, 1993). Hunting and fishing pressures were responsible for much of its original decline, as manatees were heavily hunted for meat, hides, and bones until they were nearly extirpated (FWS, 1995).

A prominent cause of natural mortality in some years in Florida is cold stress, and major die-offs associated with the outbreaks of red tide have occurred, where manatees appear to have died due to ingestion of filter-feeding tunicates that had accumulated the neurotoxin-producing dynoflagellates responsible for causing the red tide (FWS, 1993). The low reproductive rate and habitat loss make it difficult for manatee populations to recover.

2.17.2 Habitat

The manatee inhabits shallow coastal waters, estuaries, bays, rivers, and lakes. Throughout most of its range it appears to prefer rivers and estuaries to marine habitats, although manatees inhabit marine habitats in the Greater Antilles (Lefebvre et al., 1989). It is not averse to traveling through dredged canals or using quiet marinas. Manatees are apparently not able to tolerate prolonged exposure to water colder than 20°C. In the northern portions of their range during October through April they congregate in warmer water bodies, such as spring-fed rivers and outfalls from power plants. They prefer waters that are at least 1 to 2 m in depth; along coasts they are often in water 3 to 5 m deep. They usually avoid areas with strong currents (NatureServe, 2000).

Manatees are primarily dependent upon submergent, emergent, and floating vegetation, with the diet varying according to plant availability. They may opportunistically eat other foods such as acorns in early winter in Florida or fish caught in gill nets in Jamaica (O'Shea and Ludlow, 1992).

2.17.3 Range

The manatee ranges from the southeastern U.S. and coastal regions of the Gulf of Mexico, through the West Indies and Caribbean, to northern South America. U.S. populations occur primarily in Florida (NatureServe, 2000), where they are effectively isolated from other populations by the cooler waters of the northern Gulf of Mexico and the deeper waters of the Straits of Florida (Domning and Hayek, 1986).

2.17.4 Distribution in Texas

Manatees are extremely rare in Texas, although in the late 1800s they apparently were not uncommon in the Laguna Madre. Recent Texas records also include specimens from Cameron, Galveston, Matagorda, and Willacy counties (FWS, 1995). Davis and Schmidly (1994) describe a Texas record of a manatee found dead in the surf near the Bolivar Peninsula near Galveston. Manatees may travel great distances (200 km or more) along the coast or between islands (FWS, 1995).

2.17.5 Presence in the Project Area

Albert Oswald of the Texas State Aquarium spotted a manatee in the inlet between the Texas State Aquarium and the Lexington Museum on 23 September 2001. This is the third and probably most reliable sighting of the manatee in Corpus Christi Bay (Beaver, 2001).

2.17.6 Effects of the Project

While the West Indian manatee has been recently sighted in Corpus Christi Bay, such occurrences are rare. Should a manatee wander into the project area, the greatest threats to it would be from boat traffic or dredging operations. However, project impacts are temporary and local in nature and no significant adverse impacts are expected.

2.18 WHALES

Whales occur in offshore waters and will not be impacted by the proposed ship channel improvements.

2.19 SUMMARY

No Federally threatened or endangered species are expected to be significantly adversely impacted by the proposed ship channel improvements. The following species are unlikely to occur in the project area and, therefore, no impacts are expected: South Texas ambrosia, slender rush-pea, bald eagle, whooping crane, northern aplomado falcon, mountain plover, Eskimo curlew, ocelot, jaguarundi, and whales. No significant adverse impacts are expected for the following species: Kemp's ridley sea turtle, green sea turtle, loggerhead sea turtle, hawksbill sea turtle, leatherback sea turtle, piping plover, and West Indian manatee. The brown pelican will experience a beneficial impact from the project due to improvements to Pelican Island through beneficial use of dredged material.

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APPENDIX D

COORDINATION

SECTION 1:

FISH AND WILDLIFE COORDINATION

United States Department of the Interior

FISH AND WILDLIFE SERVICE

ECOLOGICAL SERVICES
C/O CCSU CAMPUS BOX 338
6300 OCEAN DRIVE
CORPUS CHRISTI, TEXAS 78412

September 6, 1994

Colonel Robert B. Gatlin
District Engineer
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Colonel Gatlin:

This Planning Aid Letter constitutes the Fish and Wildlife Service's (Service) initial comments and suggestions regarding the reconnaissance study initiated by the Galveston District, U.S. Army Corps of Engineers (Corps), in September 1993 on the potential for deepening and widening the Corpus Christi Ship Channel, Nueces County, Texas. The single plan of channel enlargement considered during the reconnaissance study, according to partial draft materials received from the Corps by FAXFORM on August 9, 1994, was to deepen the 45-foot-deep channel to 50 feet in its interior sections, and to widen it from 400 feet to 500 feet. The bar and jetty sections of the channel were planned to be deepened to 52 feet from 47 feet, and the existing outer bar channel was planned for an approximately 9,600-foot extension out to the 52-foot contour in the Gulf of Mexico.

This report was prepared under the authority of an in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). It has been prepared in cooperation with Texas Parks and Wildlife Department and National Marine Fisheries Service.

The Corps held a public workshop in Corpus Christi on March 30, 1994 to describe the reconnaissance study and to solicit public input. The Service attended that workshop, provided oral comments at that time, and took note of the specific input the Corps desired. Addressing the following five areas of input requested became the purpose for this planning aid letter's format and content:

1) Environmental, economic, and other resources in the study area that this study may impact;

2) Problems associated with current operation and maintenance of the channel or problems that may result from channel enlargement;

3) Problems not directly related to the ship channel which have the potential to be alleviated incidental to channel improvements;

4) Opportunities for the beneficial use of dredged material or environmental restoration; and

5) Other opportunities that a channel enlargement project may present that could improve the overall well-being of the study area.

The Nueces-Corpus Christi Bay Estuary and the impacts upon it by dredging projects are discussed at length in a series of previous planning aid letters, Fish and Wildlife Coordination Act Reports, Environmental Impact Statements

(EIS's), and supplements to these documents, over the last 20 years. The 40-Foot Project and the 45-Foot Project are this reconnaissance report's antecedents in detail as well as time, so very little remains to be discussed for the first time in this document. One additional action of major importance to the consideration of the 50-Foot Project, as it will be called hereinafter, has been the construction of Naval Station Ingleside, which has recently affected the dimensions of the Corpus Christi Ship Channel and some of its associated dredged material disposal areas. The Department of the Navy's (Navy) EIS on Gulf Coast Strategic Homporting describes these effects as well as provides the most recent background information on the project area's fish and wildlife resources.

What follows is a summation of the issues described and/or anticipated by the previous studies of enlargements of the Corpus Christi Ship Channel. As each resource issue is described, potential mitigatory and/or investigatory actions will be suggested. The issues generally fall into two categories: dredging impacts and dredged material disposal impacts.

EFFECTS OF DREDGING

A. Salinity intrusion. A well-known effect of the enlargement of deep draft channels connected to the sea is to increase the volume of seawater conducted into an estuary via density currents. This is of particular concern in the Nueces-Corpus Christi Bay system since reduction of freshwater inflows has been recently evaluated there and found to be linked to a reduction in the system's productivity. Under the current terms of the water rights permit governing the withdrawal of water from the Nueces River watershed, increases in the upper bay system's salinity above certain levels, no matter what the cause, would trigger mandatory fresh water releases into Nueces Bay, thus reducing the availability of such fresh water for direct consumption by the population and industries of the Texas Coastal Bend. Consequently, before deciding whether to proceed with this or any similar channel enlargement, proper hydrologic modeling should be conducted to predict the enlargement-related changes in Nueces Bay's salinity and the quantity of freshwater releases required to offset those changes. Quantification of these releases, and an analysis of the economic and environmental costs of the means (acquisition of water rights, construction of reservoirs and conveyance systems, etc.) to provide them, are essential to the making of an informed choice in this matter.

B. Storm tides. Enlarging the pass between San Jose and Mustang Island would tend to increase the volume of water than an approaching tropical storm or hurricane would force into Corpus Christi, Redfish, and Aransas Bays through that pass. This would mean a larger area of the coastal plain and the islands surrounding the bays would be inundated and subjected to wave action than had previously been the case with storms of comparable intensity, course, and duration. Temporary impacts to coastal habitats via erosion and salt intrusion would therefore be more widespread then they were historically. The expected increase in storm runnup should be calculated and an estimate made of the additional acreage of habitats and properties affected thereby.

C. Tidal prism. Normal astronomical and wind tides would also carry greater volumes through the 50-Foot Project's channel dimensions than were formerly possible, allowing both higher and lower tides than before to occur in the bays within a certain radius of the ship channel. This increase in the tidal prism may decrease the areal coverage of seagrasses and certain high marsh plants, while allowing an increase in the areal coverage of smooth cordgrass and black mangroves. The tradeoff would not occur evenly, for there are other environmental parameters than tidal influence which determine plant growth and survival. In general, the guild of wading birds would benefit, because the high bay salinities combined with the increased tidal prism would tend to increase the scope of unvegetated tidal flats. Ducks and fish dependent upon seagrass meadows or intertidal marshes for winter food or nursery areas would not be generally as well off as before, however.

D. Turbidity. Dredging always results in temporary suspension of particulates in the water column. If currents are not too strong, the scope and severity of the turbidity can be mitigated with silt curtains, but the currents from the Gulf of Mexico to at least the middle of Corpus Christi Bay are likely to make the use of silt curtains infeasible. Inside the Inner Harbor, the channel is naturally enclosed, and no additional benefit from silt curtains would be expected. However, the possibility of silt curtain deployment should be explored between the middle of the bay and entrance to the Corpus Christi Inner Harbor.

E. Resuspension of contaminated sediments. Certain sediments in the Inner Harbor and, to a lesser extent, the La Quinta Channel, have a history of contamination with heavy metals, some PCB's, and oil and grease. Some of the worst of these were removed during maintenance dredging and the completion of the 45-Foot Project and buried beneath relatively clean materials. Opportunities to continue this practice should be sought. For this reason, it is important that sediment core samples be taken at discrete depth intervals from the channel sides and bottom before it is enlarged, and that the samples obtained not be mixed before analysis. Otherwise, it will not be possible to recognize which sediments are "hot" and therefore candidates for segregation during the dredging process.

F. Migration of estuarine organisms. There has long been sought a dredging "window"; i.e., a period when the dredging in the channel segment through a tidal pass like that at Port Aransas would not coincide and potentially interfere with the pass' use by some migrating estuarine organism of major sport or commercial interest. In practice, however, the window never opens; something of major economic importance is continually in that channel reach. If a window does exist, it probably exists not for the fish, but for the fisherman, and not in the pass itself, but between Port Aransas and Ingleside Point. We refer to the seasonal shrimp fishery in the fall when shrimp trawlers congregate in this reach of the ship channel. The dredging activity should be scheduled to take this brief but economically significant event into account. Contact the Texas Shrimp Association representative in Aransas Pass for specific timing.

G. Sea turtle hibernation. Sea turtles have been known to hibernate during the winter on the bottoms of channels along the Florida to the South Carolina Atlantic Coasts. Although no report of similar behavior has been made for the Texas channels, all species of sea turtles are included on the Federal threatened or endangered lists and consequently should receive consideration during dredging. The Corps' and its dredging contractors should solicit and follow the National Marine Fisheries Service's instructions for conserving the turtles.

H. Brown Pelicans. The largest colony of nesting eastern brown pelicans in this state is found on Pelican Island, a.k.a. Disposal Areas 7 and 8. A species still listed as endangered in Texas, Louisiana and Mississippi, the eastern brown pelican feeds in the vicinity of the ship channel the year around. The dredging is most likely to have a negative effect on the pelican during the February through September nesting season when turbidity in the channel reach from Pelican Island to the near shore portion of the Gulf of Mexico is a critical factor in its ability to forage for its nestlings. This reach should therefore be dredged during other times of the year.

I. Dissolved Oxygen. Deep channels, particularly landlocked portions like the Inner Harbor, generally lack sufficient means for vertical mixing, have bottoms below the photic zone, and accumulate oxygen demanding sediments that together result in anoxic conditions in the lower parts of the water column. As a result, deep channels tend to lack productive bottom fauna and may at times contribute to fish kills. Practically speaking, however, there would probably be little difference in the habitat quality of the channel bottom in the Inner Harbor at its current depth of 45 feet and its condition at the depth of 50 feet. Both situations are/would be inimical to life.

EFFECTS OF FILLING

A. Disposal area capacities. The statuses of the capacities of the existing disposal areas associated with the Corpus Christi Ship Channel are not precisely known, but none of the 45-Foot Project confined disposal areas are believed to have sufficient capacity to hold 50 more years of maintenance material. The capacities of the disposal areas around Point Ingleside have already been exhausted by the deposition of materials from the dredging at Naval Station Ingleside. Without additional disposal areas or major increases in the capacities of the existing ones, the 50-Foot Project confined disposal areas would likewise have a less than 50-year maintenance life.

B. Competing uses for disposal areas. Disposal Area (DA) 4 on Harbor Island is the proposed site of the Safeharbor Project. Chosen in part because it is currently considered full, construction of the supertanker berths and oil-handling facilities for this project would eliminate any remaining potential DA 4 may have for future use in maintaining the ship channel. The Navy is also looking for an isolated berth with land and deepwater access to serve as a facility for detecting and cancelling the electrical fields of its anti-mine vessels. Possible locations for this facility include the La Quinta Channel. Depending upon its location, dredged material generated by this facility's construction and maintenance might be placed in DA 13. Finally, the Port of Corpus Christi Authority has historically made it a practice to permit, if not to promote, development within the disposal areas on the north side of the Inner Harbor. One such development currently under the Port Authority's consideration is the construction of the Northside Road Project, a highway that would extend west from the lift bridge along the shore of Nueces Bay. Depending upon its precise location and the amount of coordination between the two projects, the road might interfere with or enhance the capacity of the Inner Harbor's DA's for holding the 50-Foot Project's materials.

C. Enhancing existing disposal area capacities. DA 13's capacity was extended in the early 1980's by the availability of new work material from the enlargement of the Reynolds Metals docking area, and DA 1's levees in the Inner Harbor were enhanced similarly after bore samples were taken to relocate some of the material dredged during earlier channel deepening. The 50-Foot Project's initial dredging would provide millions of cubic yards (MCY) of virgin material for levee construction (an estimated 4.03 MCY at DA 6/Point of Mustang, 2.74 MCY at DA 13, and a total of 8.23 MCY at the Inner Harbor disposal areas). If not immediately used for raising levees, this virgin material should at least be deposited in such a manner as to facilitate finding and excavating it for this purpose later. The proposed North Shore Road might be constructed upon dewatered fill material dredged during the deepening of the Inner Harbor to 50 feet, thus maximizing the capacity of the disposal areas.

D. Contaminants. The Inner Harbor and, to a lesser extent, the La Quinta Channel, have historically contained maintenance material laced with varying amounts of PAH's, PCB's, and some heavy metals. Left exposed on the surface, these contaminants have ways of getting into the food chain. Levees should not be made of this material, lest it erode into bays. Erosion occurring during and subsequent to Hurricane Allen in 1980 allowed zinc-contaminated spoil to wash into the mouth of the Nueces River between dredging cycles, so levees containing such material should be maintained continuously to prevent failure, even after the maintenance dredging ceases. Even when contained, the prevailing winds blow the dried contents of the disposal areas into the bays, and vegetation growing on the surface of the maintenance material has been shown to take up the zinc in significant quantities, adding it directly to the food chain. The best way to handle contaminated material is to sample so as to locate it specifically, segregate it during dredging, place it within a continually contained disposal area, and cover it over with the cleanest dredged material available.

E. Return flows. Regardless of the chemical content of the dredged material, the effluent from the disposal areas should always be directed into the body of water from which the material was dredged. This minimizes the combined scope of the water quality impacts associated with the dredging and the release of the effluent. This would also help limit the impact to the surrounding habitats if effluent quality is poor, or if the release rate is too rapid, as, for example, when the dredged material escaped through the weir at the Port Mansfield disposal area earlier this summer.

F. Unconfined disposal areas. The unconfined disposal areas in Corpus Christi Bay between D.A. 13 and the Inner Harbor have not been historically associated with environmental effects more severe than temporary loss of infauna and turbidity of a more prolonged nature. Wave energy and depth in their vicinity apparently have precluded the formation of islands. Although these factors would also make their location engineeringly challenging, the paucity of long-term contained upland disposal alternatives weighs heavily in favor of exploring these uncontained disposal areas as locations for major beneficial uses projects. Potential goals would be to generate submerged or semi-emergent substrates for oyster reefs, seagrass beds or marshes. Besides the problems of depth and wave erosion, concerns to be addressed include avoidance of existing shell reefs and shrimping areas, effects on bay circulation, and consequences for navigation.

G. Bayward expansion of disposal areas. Past proposals to permanently enlarge existing disposal areas at the cost of diminishing the size of the bays and wetlands adjacent to them have met with almost uniform disapproval from the resource agencies, commercial fishermen and environmental groups. Examples include proposals to expand disposal areas into Tule Lake (40-Foot Project), Nueces Bay (45-Foot Project), and Corpus Christi Bay (Gulf Coast Strategic Homporting Project). Although there are many reasons for not decreasing the size of the estuary, the simplest and most comprehensive is that it results in an ecosystem-wide loss of productivity that is extremely difficult to offset. At a minimum, such loss requires in-kind and two-to-one mitigation, and experience has shown (e.g., the 200-acre wetland creation project attempted as a part of the 45-Foot Project's mitigation), that such mitigation is difficult to design, fund, and carry out.

None of these past proposals included the more recently developed beneficial uses programs that replace bay bottoms not with emergent land but with another aquatic habitat of hopefully higher value to the estuarine ecosystem. The Service believes of the examples given above, only the DA 13 area has sufficient potential for producing a higher value habitat to merit investigation of a beneficial uses of dredged material project. Tule Lake has a small but very diverse array of aquatic and wetland resources, while Nueces Bay provides an irreplaceable low salinity, soft-bottomed, detritus-rich fish and shellfish nursery. Corpus Christi Bay on the southwest side of DA 13 possesses a comparably less diverse and productive set of habitats, which might justifiably be converted to marsh, reef, or seagrass bed, provided there were no practicable, less damaging, upland confined alternatives.

H. Sharing disposal areas. One of the positive results of the controversy that arose over the Navy's proposal to expand DA 13 was the acquisition of its less-damaging alternative: an upland disposal site north of the La Quinta Channel. This site is as yet unused. As noted above, the Navy is seeking to construct a deep-draft berth somewhere nearby. Perhaps, if this berth were to be dredged along the La Quinta Channel, that dredging and the dredging for the 50-Foot Project could be accomplished simultaneously, thus reducing costs. Such a coordination of efforts would require a sharing of disposal areas, but again there may be an opportunity for mutual cost reductions. For example, if the Navy were to locate its facility at the west end of the La Quinta Channel, it would be most economical to dispose of the dredged material in the adjacent portion of DA 13, rather than to pump it to its own upland disposal site miles farther away.

The Corps could in exchange pump material from the reach of the La Quinta Channel nearest the Navy's upland site into that site instead of DA 13.

I. Pelican Island. Pelican Island and its expanding population of nesting pelicans owe a great deal to the successful integration of dredged material disposal activities and the habitat requirements of this species. The Corps has also enhanced the island with erosion protection for the sensitive woody vegetation on the island's northeastern portion where the pelican nesting has occurred most recently. Other nesting seabird species, particularly terns and skimmers, have benefited from the placement of maintenance material atop the herbaceous vegetation along the southern shores of the island. This deposition not only replaces the island itself about as fast as the prevailing winds wash it away, it also, albeit only for a few years, provides the unvegetated nesting substrate required by those particular birds. Potential beneficial uses of dredged material at DA's 7 and 8, which together form the distinctly double-lobed island, include stockpiling dredged material for intermittent spreading over the tern and skimmer nesting sites between the maintenance periods, which have historically been 8 years apart. Another possible beneficial use might be for the formation of marshes as wave buffers along most of the unarmored sections of the island's shorelines (one exception being the cove between island's lobes; this area already supports seagrasses and is heavily used by fledgling pelicans).

J. Long-term disposal solutions for the Inner Harbor. With little hope of subjecting Nueces Bay to future dredged material disposal without generating another controversial situation and subjecting the estuarine ecosystem to potentially irremediable adverse impacts, the planning for the 50-Foot Project should include another close examination of alternative long-term disposal areas for the Inner Harbor reach. These alternatives include but are by no means limited to the upland portions of the Nueces River Delta, the uplands north of ueces Bay, the open waters of Corpus Christi Bay (See F. above), and the undeveloped areas south and west of the Port of Corpus Christi. Another possible site may be that of a Corpus Christi subdivision near the Port's refinery district which may become a buffer zone between the City's populace and the refineries in the near future. All of these alternatives may be expensive, but for the sakes of the futures of the Port, the City, and Nueces Bay, they must be explored.

K. Other uses for fill material. Small bird nesting islands in the upper portion of Nueces Bay and near the Nueces Bay Causeway continue to need replenishment. The islands off Whites Point in the northern bay are the worst off and support precariously one of the few nesting colonies of roseate spoonbills, a state-protected species, found in the region. Unfortunately, the islands are remote and would not provide much disposal capacity. The two islands near the causeway are close enough to the Rincon Harbor to have received material from the maintenance of its entrance channel, and during the recent expansion of the causeway one of them received waste concrete from that activity as riprap. However, both could use additional fill, especially well-consolidated material.

Conclusion

This concludes our planning aid advice for the reconnaissance study on the enlargement of the Corpus Christi Ship Channel. We look forward to reviewing and commenting on subsequent documents from this planning activity. Please contact Johnny French at (512) 994-9005 if you have questions.

Sincerely,

Thomas E Grahl

THOMAS E. GRAHL
Acting Field Supervisor

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
c/o TAMU-CC, Campus Box 338
6300 Ocean Drive
Corpus Christi, Texas 78412

December 10, 2002

Dr. Terrell W. Roberts
Department of the Army
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Dr. Roberts,

Enclosed please find the final draft of the Fish and Wildlife Coordination Act Report for the Corpus Christi Ship Channel - Channel Improvement Project. This document fulfills the Fish and Wildlife Service obligation under the Military Interdepartmental Purchase Request #01-PL-006.

If you have any questions, please contact Clare Lee of our office at (361) 994-9005.

Sincerely,

Allan M. Strand

Allan Strand
Field Supervisor

U.S. Fish and Wildlife Service
Region 2

FISH AND WILDLIFE COORDINATION ACT REPORT

Corpus Christi Ship Channel, Texas

by

M. Clare Lee
Tom Shearer

U.S. Fish and Wildlife Service
Corpus Christi Ecological Services Field Office
Campus Box 338, 6300 Ocean Drive
Corpus Christi, Texas 78412

December 2002

INTRODUCTION

Regulatory Background:
The Rivers and Harbors Appropriations Act of 1938 (33 U.S.C. 540, and other U.S.C. sections; Chapter 535, June 20, 1938; 52 Stat. 802), provides for wildlife conservation to be given "due regard" in planning Federally authorized water resources projects. The Fish and Wildlife Coordination Act (16 U.S.C. 661-667e; the Act of March 10, 1934; Ch. 55; 48 Stat. 401), requires consultation with the Fish and Wildlife Service and State fish and wildlife agencies where the "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified" by any agency under a Federal permit or license. Consultation is to be undertaken for the purpose of "preventing loss of and damage to wildlife resources."

The Fish and Wildlife Coordination Act provides a basic procedural framework for the orderly consideration of fish and wildlife conservation measures to be incorporated into Federal and Federally permitted or licensed water development projects. The principal provisions of the Act include:

1. A statement of Congressional purpose that fish and wildlife conservation shall receive equal consideration with other project features;
2. Mandatory consultation with wildlife agencies with a view to achieving such conservation;
3. Full consideration by action agencies of the recommendations stemming from consultations;
4. Authority for action agencies to implement such recommendations as they find acceptable.

Project Background:
In 1922, President Warren G. Harding approved the Rivers and Harbors Appropriations Act that authorized construction of the Corpus Christi Ship Channel (CCSC). The State of Texas created the Port of Corpus Christi Authority (PCCA) in 1923, and it sponsored the dredging and construction that began in 1923. Opening of the City of Corpus Christi's deepwater port took place in 1926 (Handbook, 2001). The Corpus Christi Ship Channel has undergone several major improvements since it was originally dredged in 1926. The initial depth of the channel was 25 feet. Since then, the channel has been deepened four times. In 1989, the PCCA completed the most recent improvement to the Corpus Christi Ship Channel, a project that entailed dredging the Inner Harbor, a 9-mile segment, from a depth of 40 feet to 45 feet and enlarging the turning basins. As with most dredging projects, one of the greatest challenges was the placement of dredge material. The U.S. Army Corps of Engineers (USACE) presented the US Fish and Wildlife Service (Service) with five alternatives for placement. The alternatives included upland, non-tidal flat, and open water disposal sites. The Service evaluated these alternatives and made recommendations. An overview of the ecological resources in Nueces Bay along with Service

recommendations was included in the 1982 Fish and Wildlife Coordination Act report by French and Ramirez (1982). In addition to ranking the alternatives according to environmental impact, the Service recommended that no dredge material from the Inner Harbor be placed in Nueces or Corpus Christi Bays due to known historical contamination of the sediments and also that dredge disposal areas next to the Inner Harbor be designed to facilitate the return of supernatant fluids to the Inner Harbor itself and not to Nueces Bay. In 1994, additional deep-draft navigation improvements to the entire length of the channel were considered by the PCCA, the non-federal sponsor, and the USACE. This Fish and Wildlife Coordination Act report is intended as a supplement to the 1982 report (French and Ramirez 1982) as well as an assessment of the entire new project. According to the USACE, it will accompany the Final Environmental Impact Statement which is part of the Feasibility Report on the Corpus Christi Ship Channel-Channel Improvement Project (CCSCCIP). Comments received from the National Marine Fisheries (NMFS) Service and Texas Parks and Wildlife Department (TPWD) have been incorporated into this document.

Proposed Project Description
The US Army Corps of Engineers (USACE) and Port of Corpus Christi Authority (PCCA) evaluated the following alternatives during the Feasibility Study:

1) Deepen to 52 feet from the Gulf of Mexico to Viola Turning Basin and widen across Corpus Christi Bay

2) Deepen to 50 feet from the Gulf of Mexico to Viola Turning Basin and widen across Corpus Christi Bay

3) Widen only across Corpus Christi Bay

4) Deepen La Quinta Channel to 50 feet

5) Extend La Quinta Channel

6) Provide Barge Lanes across the Upper Bay in the Corpus Christi Bay

The USACE recommended and PCCA preferred alternatives for the CCSCCIP as of June 13, 2001 are described in the Preliminary Draft Environmental Impact Statement (PBS&J 2001) and reproduced below:

1) Deepen the CCSC from –45 feet MLT to –52 feet MLT, plus advanced maintenance and allowable over-depth. No deepening of La Quinta Channel. The deepened channel will extend roughly 10,000 feet into the Gulf of Mexico to the –56-foot isobath.

2) Widen the CCSC from Port Aransas to the Harbor Bridge to 530 feet. (Existing widths are 500 feet between Port Aransas and La Quinta Junction and 400 feet between La Quinta Junction

and the Harbor Bridge.)

3) Extend the La Quinta Channel 7,200 feet at a depth of –39 feet MLT and a width of 400 feet and include a turning basin.

4) Add 200-foot-wide barge shelves (-12 feet MLT) on both sides of the ship channel from La Quinta Junction to the Harbor Bridge. Shelf width measured from the toe of the widened and deepened ship channel. For most of the reach, no dredging would be required, only the addition of navigation aids.

Proposed Project Area:
Corpus Christi Bay covers approximately 320 sq km of open water (Texas Natural Resources Conservation Commission (TNRCC) 1996; currently Texas Center for Environmental Quality (TCEQ)), has an average bay depth of approximately 4 m (White et al. 1983), and an average salinity of 30 ppt (Shew et al. 1981). The area has a humid subtropical climate. The average annual rainfall is approximately 28 inches, although extremes due to tropical storm rainfall or droughts are not uncommon. Freshwater is provided to the bay by the Nueces River (via Nueces Bay) and by domestic and industrial TCEQ permitted outfalls which discharge into the bay. The TCEQ designated uses for Corpus Christi Bay waters are: contact recreation, exceptional quality aquatic habitat, and shellfish waters (Texas Water Commission 1996). With the exception of Mustang Island, Corpus Christi Bay is nearly surrounded by urban and industrial development. The bayshore includes urbanized areas with bulkheaded seawalls, industrial complexes, as well as fringe marshes, coastal prairies, and agricultural fields.

Fish and Wildlife Resources Without the Proposed Project
The Corpus Christi Bay system has been studied over the last 10 years by the Coastal Bend Bays & Estuary Program (CBBEP). The CBBEP area covers a twelve county area that includes three estuaries, the Mission-Aransas, Nueces (which includes Corpus Christi Bay), and the Upper Laguna Madre. The CBBEP has published several peer reviewed volumes that characterize the Coastal Bend Bay system in great detail. Corpus Christi Bay provides nursery, spawning and feeding grounds for an abundance of fish, shellfish, and wildlife. There are approximately 234 fish species in the Coastal Bend bays, 79 mammal species, and 117 reptile/amphibian species that inhabit the surrounding bayshore and barrier island habitats. It is estimated that approximately 494 species of birds migrate through or nest in the Coastal Bend area (Tunnell et al. 1996), and 23 species nest on existing dredged material placement areas. Federally-listed threatened and endangered species are found in and around Corpus Christi Bay, including the Kemp's ridley sea turtle (*Lepidochelys kempii*), piping plover (*Charadrius melodus*), and brown pelican (*Pelecanus occidentalis*). Habitat types include open bay bottom, seagrass beds, coastal marsh, hard substrate habitats, and tidal flats.

The CBBEP has identified threats to the bay system which include reduced freshwater inflow, habitat loss, water quality degradation, altered circulation due to dredging and channelization, declines in living resources, and man-made debris (CBBEP 1994). Coastal development, dredging activities, pollution and other factors may damage and impair habitats, and thereby reduce populations of estuarine wildlife. Nutrients, chemicals, metals, sediments, and other pollutants enter the bay waters from point and non-point urban, industrial and agricultural sources.

The area's commercial and recreational fishery and related recreational activities was estimated to generate $760,000,000 per year in 1987 (Jones et al. 1997). Because a large portion of the economics of the region is dependent upon the area's natural resources, it is essential to protect and maintain the estuarine habitats in the Corpus Christi Bay system.

Potential Impacts of Project

In the CBBEP Coastal Bend Bays Plan (TNRCC 1998), the Action Plan for Maritime Commerce and Dredging includes as goals:

1) Enhance maritime traffic safety while reducing the rate of maritime incidents from shipping, terminal operations, and marine pipelines

2) Ensure that all dredging activities are planned and conducted in ways that consider the cost effectiveness of the operation, while minimizing ecological impacts and maximizing the beneficial uses of dredged material.

With proper planning, it would be possible to minimize negative environmental impacts and maximize benefits to the bays regional economy. Parameters that may be affected by the proposed project include:

1. Changes in bay circulation.
2. Changes in bay salinity patterns.
3. Burial of bay bottom beyond the levees of proposed confined placement areas.
4. Increased bay turbidity during dredging, and subsequent resuspension due to erosion.
5. Release of toxic chemicals from the bay bottoms, and proliferations into the bay systems.
6. Reduced illumination levels at depth, and loss of photosynthetic biomass.
7. Burial of benthic organisms, including plants and animals.
8. Disturbance of adjacent colonial waterbird rookery islands.

Salinity intrusion was noted in the following excerpt from a previous Service Planning Aid Letter dated September 6, 1994 and the following recommendations were given at that time: "Salinity Intrusion. A well known effect of the enlargement of deep draft channels connected to the sea is to increase the volume of sea water conducted into an estuary via density currents. This is of particular concern in the Nueces-Corpus Christi Bay system since reduction of freshwater inflows has been recently evaluated there and found to be linked to a reduction in the system's productivity. Under the current terms of the water rights permit governing the withdrawal of water from the Nueces River watershed, increases in the upper bay system's salinity above certain levels, no matter what the cause, would trigger mandatory freshwater releases into Nueces

Bay, thus reducing the availability of such fresh water for direct consumption by the population and industries of the Texas Coastal Bend. Consequently, before deciding whether to proceed with this or any similar channel enlargement, proper hydrological modeling should be conducted to predict the enlargement-related changes in Nueces Bay's salinity and the quantity of freshwater releases required to offset those changes. Quantification of these releases, and an analysis of the economic and environmental costs of the means (acquisition of water rights, construction of reservoirs and conveyance system, etc.) to provide them are essential to making of an informed choice in this matter."

In addition, a monitoring and assessment program should be implemented to ensure that the predicted results of any hydrological models performed for salinity intrusion are verified. The monitoring and assessment program should work in collaboration with existing programs that monitor the Nueces Bay, such as the City of Corpus Christi's Nueces Bay Salinity Monitoring Project.

The Regulatory Agency Coordination Team (RACT) requested that a study be performed under the oversight of the Hydrodynamic and Salinity Modeling Workgroup to determine the effects of tidal elevation and salinity intrusion due to the channel improvement project. Results of the study (Matsumoto et al. 2001) indicate that tidal ranges would be minimal, increasing by approximately 0.04-0.06 feet in Corpus Christi and Nueces Bays and decreasing by a smaller range due to a negative effect in the northern adjoining bays within the system. Monthly average salinity, during dry periods, would increase by 0.1 ppt in Nueces Bay and by 0.1-0.4 ppt in Corpus Christi Bay. During normal periods, average salinity would decrease by up to 0.4 ppt and during wet periods, monthly average salinity would decrease by 3 to 4 ppt in Corpus Christi and Nueces Bay.

OPEN BAY BOTTOM AND BENTHIC ORGANISMS

Open-bay bottoms represent the largest estuarine habitat type along the Texas coast and play a key role in nutrient cycling and the production of the benthic community upon which higher trophic levels depend. The benthic community of Corpus Christi Bay is one of the most well studied of Texas estuaries (Figure 1). Quantification of the abundance and diversity of benthic organisms is dependent upon the depth, substrate and season in which the sample is taken. In Corpus Christi Bay, polychaetes are the dominant group followed by mollusks (Holland et al. 1975, Flint and Younk 1983). Holland et al. (1975) reported mean abundance of 5,000 benthic organisms/m^2 while Flint and Younk (1983) reported total abundances of 1,700 organism/m^2. Shoal areas were more diverse than channel areas. Castiglione (1983) found the density of molluscs in mud near the Inner Harbor of the Corpus Christi Ship Channel to be only 28 individuals/m^2, while densities in the proximity of the La Quinta Channel ranged from 150 to 1,000 individuals/m^2. Highest densities were noted in the spring. Armstrong (1987), in his review of benthic studies, reported peak abundances occurring in the winter and spring while minimum abundances were usually found in the late summer and fall. Peak species diversity occurred in the spring, and most recruitment by planktonic and benthonic larvae occur in the

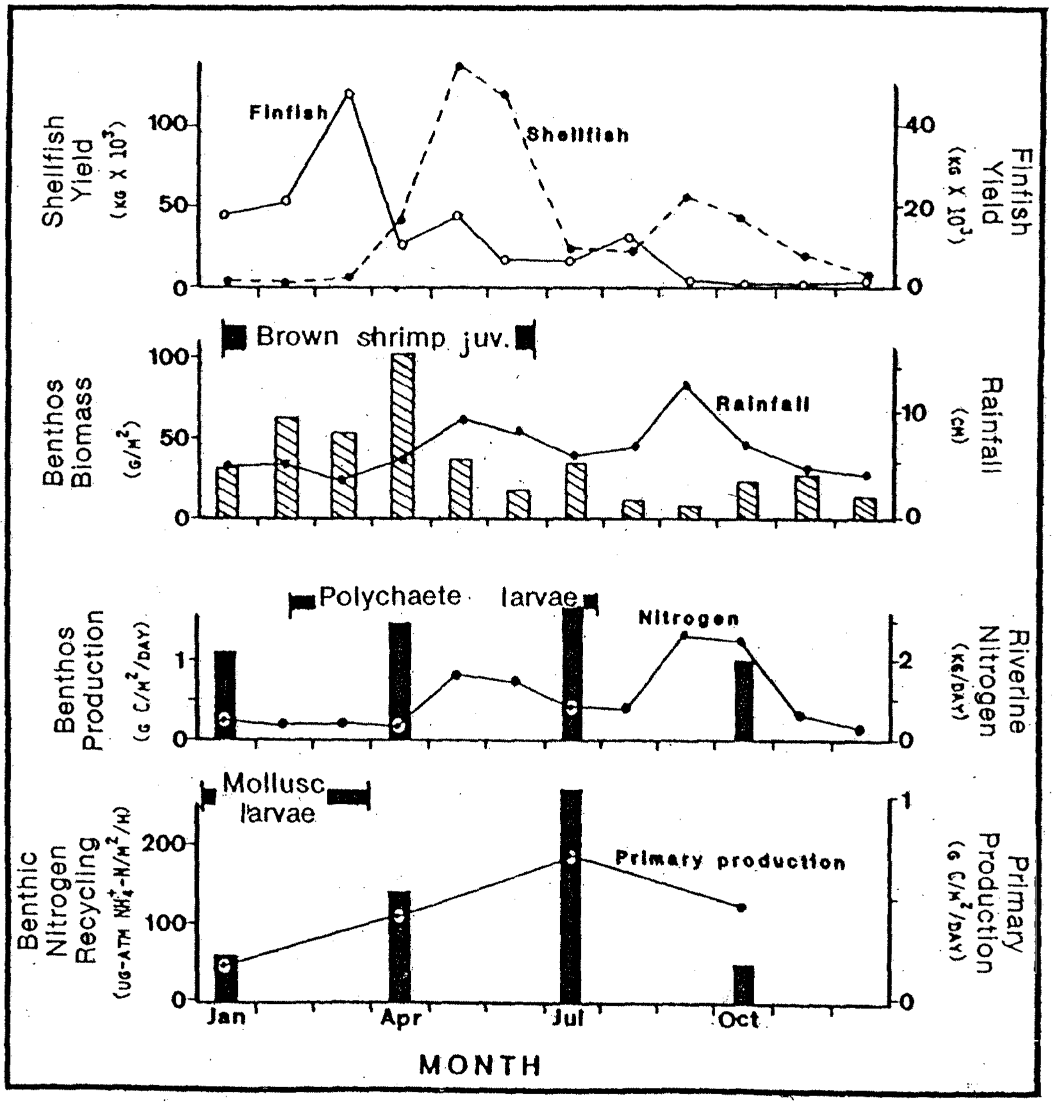

Figure 1. Multiyear data from the Corpus Christi Bay Estuary on fishery yields, benthic biomass, rainfall, benthic production, riverine nitrogen input, benthic nutrient regeneration, and phytoplankton production. Also shown are periods of peak brown shrimp (juvenile) and benthic larvae colonization. (Taken from Armstrong 1987).

winter, spring, and summer.

Summary of WES benthic recovery report

Open-water placement of dredged material results in the burial of benthos and a decline in productivity for estuarine-dependent fish and shellfish, as a result, efforts have been made to avoid this mode of disposal unless there are no other feasible alternatives available. Due to concerns over impacts to the benthic invertebrate community following open-water placement of maintenance materials, the USACE Waterways Experiment Station (WES) conducted a study to determine the recovery rates for Corpus Christi Bay (Ray and Clarke 1999). Sediment and infaunal samples were collected from five randomly located stations within each of eight placement sites and eight reference sites. Samples were taken prior to placement in August of 1995, near the end of placement, at six months, and at one year. Additional information obtained from sediment samples was sediment grain size and organic and calcium carbonate content. Another aspect of the study was the utilization of a sediment profiling camera system to obtain vertical cross-sectional imaging. These photographs provided information on depth of penetration, depth of dredged material, depth of redox potential, surface relief, presence of anoxic voids, feeding voids, and infaunal burrowing.

Benthic macroinvertebrate samples from reference areas were compared to those collected baywide and generally found to be similar to the study plots. Lowest biomass were found nearest the Laguna Madre and highest number of taxa were closer to the Corpus Christi Ship Channel. Results indicated that recovery time for placement areas was generally 1 year. For taxa richness and abundance, most sites recovered within six months to one year, recovery of biomass took longer with most sites requiring a full year; one site did not recover to pre-placement conditions within that time. For seven of the eight placement areas, species composition was recovered within a year with several sites recovering within six months; one site was not fully recovered by the end of one year. Recovery time would have been extended if placement had not been completed by early January. A major spring benthic recruitment period followed the dredging operations and placement, allowing for a shorter recovery period.

Impacts to Corpus Christi Bay

Although excavation and disposal both impact benthic communities, of the two, disposal is potentially more deleterious (Montagna et al. 1998). According to Maurer et al. (1986) impacts are less severe when depth of dredged material is <20-30 cm and when dredged materials that are similar in composition are deposited. A similar study in Galveston Bay (Ray et al. 1996) examined new work material placement which was considerably stiffer than the natural bay bottom and found the benthic recovery time to be approximately 72-88 weeks. The Corpus Christi Bay study by Ray and Clarke (1999) examined open-water placement areas receiving maintenance material which were < 30 cm deep. Although the new work materials in the upper bay reach of Corpus Christi Bay are reportedly soft, silty clay which is probably very similar to materials already in the placement areas, the new work that is proposed would most likely be stacked to a much greater depth than maintenance material. Greater depth of dredged material will most likely lengthen the amount of time for recovery beyond one year in some sites.

Holland et al. (1975) indicated that at one site in Corpus Christi Bay dredging operations had upset the benthic community and re-establishment took twenty months.

The Service estimates that new work material from the proposed project will initially cover a footprint of ~ 935 acres of bay bottom for the creation of beneficial use sites. This acreage represents a temporary loss with an expected net gain over time following initial creation. In addition, there are approximately 100 acres in each of the eight open water placement areas in Corpus Christi Bay for a total of 800 acres which will receive new work material followed by periodic placement of maintenance material throughout the life of the project. A sister study to the WES benthic recovery report was to have determined the dispersal pattern of deposited sediment in Corpus Christi Bay (Ray and Clarke 1999) but this study was never completed. The 800 acre figure does not include impacts to bay bottom outside of the placement footprint area where as much as 40% of the dredged material may migrate and cover an area three times larger than the placement area, as estimated by Bassi and Basco (1974). The increased turbidity may also result in further benthic burial. The combined acreage of the beneficial use sites and the open water sites is ~ 1735 acres (3,237,485 m^2) of impacted bay bottom or 1% of Corpus Christi Bay. Using the mean and standard deviation for the baywide abundances as given in Ray and Clarke (1999), it is estimated that between 3 and 38 billion benthic organisms would be impacted by the proposed project from the placement of new work material. Fish and shellfish are not able to recover as much prey from the placement areas as from natural bay bottom (Minello and Wooten 1994) during the benthic recovery period of up to one year, which translates into lost production.

The Service continues to discourage the practice of open-water disposal. In the event that better management alternatives are not implemented, the following recommendations may reduce the impacts to the Corpus Christi Bay system:

1) The PCCA and USACE should continue to evaluate Best Management Practices for dredging as new techniques and technologies are developed and should continually seek alternatives to open-water disposal.

2) Open-water placement activities for maintenance dredging should be completed during the summer and fall. The benthic recovery study by Ray and Clarke (1999) indicated that recovery would have taken longer than 1 year had dredging not been completed prior to the first recruitment period. This time frame would be least disruptive to the benthic community allowing for peak recruitment of benthic organisms occurring during late winter and early spring to colonize the placement areas as quickly as possible thereby reducing the recovery period. Since the new work dredging will require significantly more time than maintenance dredging, new work dredging should be completed without seasonal restrictions to allow the recovery process in the bay to proceed as quickly as possible.

3) Long-term impacts occur when repeated deposition of sediments alter benthic habitat resulting in the loss of foraging habitat for fish and shellfish species. Open-water placement

areas 16A, 16B, 17A, 17B have a dredging cycle every three years while PA 14A, 14B, 15A and 15B have a six-year dredging cycle. A three year frequency barely allows for the recovery of the benthic community and utilization by nekton. Steps should be taken to reduce the frequency of dredging. Longer dredge pipes should be utilized to place material farther away from the channel and towards the far end of the placement area in order to prevent shoaling and reduce the frequency of dredging.

SHALLOW BAY BOTTOM

The Mitigation Workgroup recommended that the PCCA and the USACE determine the amount of shallow water habitat that would be impacted in the project footprint. The mitigation workgroup determined that mitigation would only be required for impacts to shallow bay bottom habitat (areas less than or equal to -4'MLT) and seagrass beds. All the direct impacts to shallow water habitat will occur in the vicinity of La Quinta Channel extension. A total of 45 acres of shallow bay bottom habitat will be converted into deeper water habitat. Eight of the 45 acres are located along the south side of the proposed La Quinta Channel extension near DMPA 13. The remaining 37 acres of shallow water habitat are located farther west along the north side of the channel extension and the new turning basin area. Although 45 acres of impacts will occur to shallow water habitat, 935 acres of shallow marine habitat will be created as a result of the proposed beneficial use sites associated with this project.

SEAGRASS BEDS

Volumes have been written on the value of seagrass meadows in estuaries. Seagrass roots and rhizomes reduce erosion by consolidating the bay bottom. The seagrasses provide increased substrate for epiphytic organisms, and provide nursery and foraging areas for marine animals. These meadows are very productive in terms of carbon output, and are comparable to coral reefs. With the exception of the Laguna Madre, Redfish Bay and the adjacent Harbor Island contain the most pristine seagrass beds in Texas. During the period between 1958 and 1994, the Redfish Bay area lost a net total of 795 hectares of seagrass which was attributed primarily to construction of the Gulf Intracoastal Waterway and the resulting dredged material deposition and channel impacts (Pulich et al. 1997). Seagrass beds on the western shoreline of Mustang Island increased by 1319 hectares between 1958 and 1974 (Pulich et al. 1997) due to a rise in sea level which allowed expansion of seagrasses into submerged wind-tidal flats (White et al. 1978). An additional 18% increase was noted for Mustang Island between 1974 and 1994 (Pulich et al. 1997).

There are five species of seagrasses that occur within the Corpus Christi Bay area (Tunnell and Judd 2002):

Halodule beaudettei [= *wrightii*] (shoal grass),
Cymodocea [=*Syringodium*] *filiformis* (manatee grass),
Thalassia testudinum (turtle grass),

Halophila engelmanni, (clover grass), and
Ruppia maritima (widgeon grass).

Direct Loss of Seagrass

Seagrass occurs in the proposed La Quinta Channel Extension area along the south side of the extension near DMPA 13. There will be a direct loss of five acres of seagrass due to the construction of this project. The Service recommends that the direct loss of seagrass be compensated for on a 3:1 mitigation ratio. The fifteen acres of mitigation may occur in the beneficial use site GH if 70% coverage can be achieved after 3 years, 45% of which should be shoalgrass (*Halodule wrightii).* Transplant technique and procedures, as well as monitoring requirements and success criteria, should follow the "Mitigative Procedures/Conditions For Seagrass Transplanting Efforts" as stated in the DEIS and attached as an Appendix to this document.

Indirect Loss of Seagrass

Seagrass distribution in Corpus Christi, Nueces and Redfish Bays was mapped and compared for 1956/58, 1975, and 1994 using GIS techniques. The area with the greatest decline in seagrass occurred in the north Redfish Bay and Harbor Island areas. Seagrass loss and fragmentation in these areas was attributed to possible water quality problems associated with shoreline development, propeller scarring, and channel impacts (Pulich and Blair 1997). Channel impacts to seagrass result from re-suspension of dredged material by waves and currents, re-suspension of material during maintenance dredging, and changes in water circulation patterns due to newly formed islands. Reduction in light can reduce photosynthesis, causing seagrass losses over time. Impacts due to dredging have been noted up to 1.2 km away (Onuf 1994).

The proposed Corpus Christi Ship Channel project has the potential to impact the extensive seagrass beds existing near Dagger Island, Ingleside-On-The-Bay, and seagrasses that are adjacent to the proposed beneficial use site GH. These areas need to be monitored for indirect losses and restoration or mitigation implemented for any impacts.

BENEFICIAL USE PLAN FOR DREDGED MATERIALS

The PCCA and the USACE solicited beneficial use ideas from the general public through a series of public forums held in 2000 in Corpus Christi, Rockport, Port Aransas, Kingsville, and Ingleside. A list of 77 ideas was compiled. The PCCA and the USACE were then directed by the Beneficial Uses Workgroup to design a beneficial use plan for the workgroup to review. The resulting beneficial use plan, which is conceptual in design, includes five shallow, open water sites, one upland site, two offshore sites, and three shoreline protection areas (Figure 2).

The proposed beneficial use (BU) Site I, located adjacent to and north of the ship channel and south of Dagger Island, is a triangular-shaped 163 acre open water site. Rip-rap and geotubes will enclose the south and east sides. This BU site will include a high mound 8-10' MLT in the protected corner, smaller mounds in the interior, and a meandering channel through the northwest

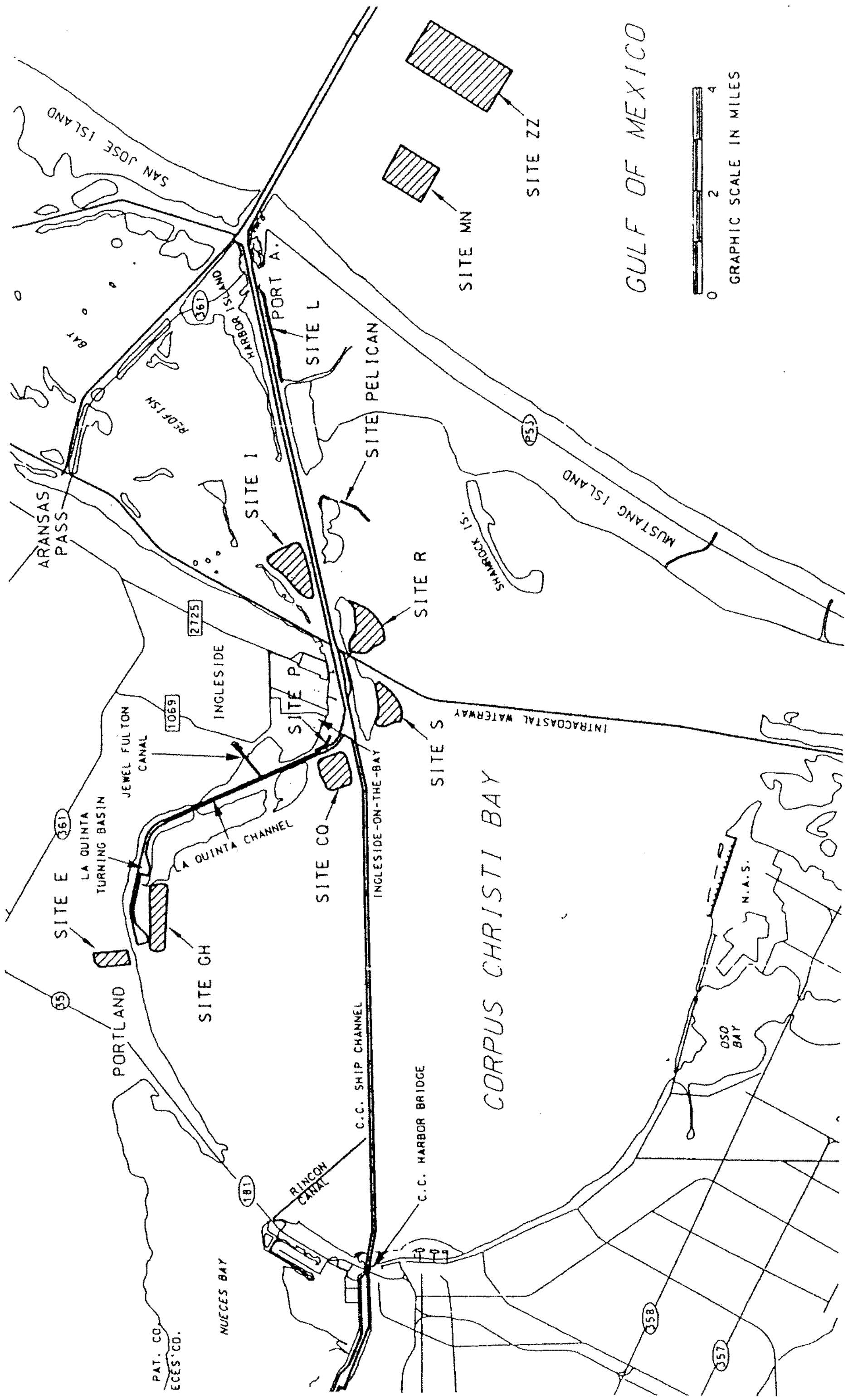

Figure 2. Beneficial use sites in the Corpus Christi Bay (taken from the DEIS, November 2001).

side. A fringe of *Spartina alterniflora* will be planted around the mounds including the perimeter of the largest mound. The Service is concerned that since the open north side of the BU site is not protected, it may allow sediments to migrate out of the BU site and into seagrass beds located east of Dagger Island. This is even more of a concern during storm or hurricane events. The Service therefore recommends that the seagrass beds near Dagger Island be monitored to determine if impacts are occurring and that the PCCA and the USACE continue to coordinate with the RACT and BUW on the final design of Site I in order to avoid impacts to seagrass beds. Monitoring should occur for a two year period following the initial creation of beneficial use Site I. If impacts result in seagrass loss, mitigation would be required.

The proposed beneficial use Site S, located on the bay side of PA10, is a triangular-shaped 121 acre shallow open watersite. Rip-rap and geotubes will extend out from the east side of PA10 and a portion of the west side to partially enclose the site.

The proposed beneficial use Site R, located on the bay side of PA9, is a triangular-shaped 201 acre shallow open water site similar to Site S. Rip-rap and geotubes will extend out from the south side of PA9 to partially enclose it.

The proposed beneficial use Site CQ, located northwest of the La Quinta Junction, is a rectangular 250 acre open water site. Rip-rap and geotubes will enclose three sides of the site with the open side facing Ingleside Point. A fringe of *S. alterniflora* will be planted inside the perimeter.

The proposed beneficial use Site GH, located at the end of the La Quinta Channel extension and adjacent to placement area 13, is a rectangular-shaped 200 acre shallow open water site. Rip-rap and geotubes will armor the south side. A fringe of *S. alterniflora* will be planted inside the perimeter.

Although over 900 acres of deep bay bottom habitat will be buried during construction of the beneficial use sites, these BU sites will result in the creation of protected shallow water habitat that should be suitable for seagrass growth. Approximately 26 acres of emergent marsh habitat will also be created within these BU sites. Although 15 acres of seagrasses will be planted into a BU site in order to mitigate the 5 acres of seagrass that will be impacted by the actual dredging project, the protected shallow water habitat created throughout all of the BU sites should allow for the natural colonization of seagrasses in these areas. Seagrass beds represent a more diverse habitat than shallow open water habitat and act as nursery areas and foraging grounds for a variety of commercially and recreationally important species. One upland beneficial use site E will form a visual barrier between the community of Portland and the La Quinta Gateway Project. This 100 acre beneficial use site is currently agricultural farmland so no impacts are expected. Gulf offshore areas MN and ZZ are open water disposal sites with a combined area of 1,590 acres. Material will be deposited in these Gulf sites to provide topographical relief.

Recommendations:

1) Specific beneficial use goals for the five shallow, open-water beneficial use sites (I, CQ, GH, S, and R) need to be established to clearly define expected benefits, and success criteria need to be outlined for determining when those goals have been met.

2) It is essential that the Beneficial Use Workgroup (BUW) be maintained to provide input and oversight throughout the life of the project and to implement adaptive management strategies to ensure that natural resources continue to be protected.

THREATENED AND ENDANGERED SPECIES

A number of Federally listed threatened and endangered species occur within the project area and are listed in Table 1.

Although little information is available regarding the distribution and abundance of sea turtles in Corpus Christi Bay, the Kemp's ridley has been documented in the bay as well as in the channel itself (Manzella and Williams 1992). Turbidity during dredging operations may reduce the ability of turtles to locate food but such effects should be short term. Impacts could occur due to hopper dredges which are fast moving and more of a danger to turtles than the slow moving hydraulic pipeline dredges. National Marine Fisheries Services should be consulted for potential impacts to sea turtles.

Piping plovers begin arriving in their wintering habitat on about July 15 and may remain in or near the proposed project area through May 15. Piping plovers feed on benthic organisms that live in exposed wet sand in wash zones, intertidal ocean beach, wrack lines, washover passes, mud, sand and algal flats, and shorelines of streams, ephemeral ponds, lagoons and salt marshes. They use beaches adjacent to foraging areas for roosting and preening. Small sand dunes, debris, and sparse vegetation within adjacent beaches provide shelter from wind and extreme temperatures. Threats to wintering populations include habitat loss and degradation due to coastal development, recreation, navigation, and dredging. Shoreline stabilization and replenishment projects have been contributors to this species decline (USFWS 1996).

Table 1. Threatened and endangered species of potential concern within the CCSC project area..

Common Name	Status	Scientific name
Brown pelican	E	*Pelecanus occidentalis*
West Indian manatee (=Florida)	E	*Trichechus manatus*
Hawksbill sea turtle	E	*Eretmochelys imbricata*
Kemp's Ridley sea turtle	E	*Lepidochelys kempii*
Leatherback sea turtle	E	*Dermochelys coriacea*
Piping plover	T/CH*	*Charadrius melodus*
Green sea turtle	T	*Chelonia mydas*
Loggerhead sea turtle	T	*Caretta caretta*

*Designated Critical Habitat

The Service requested that a survey for piping plovers be conducted in the project area. Nine sites were chosen by the Service and TPWD to be surveyed. The sites were grouped into four areas and according to the results, piping plover are utilizing all four areas surveyed (PBS&J 2001).

Piping plover critical habitat was designated on July 10, 2001 [66 FR 36038]. Critical habitat is a term used in the Endangered Species Act (ESA) that refers to specific geographic areas that contain habitat features essential for the conservation of a threatened and endangered species. Within the project area, there are several critical habitat units including TX-6, TX-7, TX-8, TX-9, TX-10, TX-11, TX-12, and TX-16. Units closest to the project footprint are TX-14, located on the backside of Mustang Island, and Unit TX-13 located on the northwest side of the bay at Sunset Beach. As a result, additional safeguards may be required to ensure that there would be no adverse impacts.

Numbers of brown pelicans declined to less than 100 birds on the Texas coast in the late 60's to early 70's but have rebounded to 2600 breeding pairs in 2000. The limiting factors are human disturbance and restricted nesting habitat. Brown pelicans nest on only a few islands along the Texas coast. More than half the Texas population nest on the central coast on either Sundown or Pelican Island. Pelican Island is located in the project area adjacent to the ship channel and many of the pelicans nest on the northeastern edge of the island that is most susceptible to wave action and the accompanying erosional effects from the ship channel. The Service recommends that shoreline protection plans for this island be reviewed by TPWD, Audubon Society, and the Service to ensure that the design enhances the island and minimizes adverse affects to the brown pelican population.

Consultation Process

The dredging of the Corpus Christi Ship Channel is considered a major construction activity and an Environmental Impact Statement (EIS) should be completed. By regulation, a biological assessment (BA) is prepared for "major construction activities" if listed species or critical habitat may be present in the action area. The BA should address all listed and proposed species found in the action area, not just those listed and proposed species that are likely to be affected. The purpose of the BA is to help the Federal agency make the determination of whether the proposed action is "likely to adversely affect" listed species and critical habitat.

If a Federal agency proposing an action determines that a proposed action "may affect" listed species or designated critical habitat, on-site, off-site, and/or result in "take" of a federally listed species, then they must either initiate formal section 7 consultation with the Service regarding the degree of impact and measures available to avoid or minimize adverse effects, or seek written concurrence from the Services (USFWS and NMFS) that the action "is not likely to adversely affect". "Take" is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. In addition to the direct take of an individual animal, habitat destruction or modification can be considered take, regardless of whether it has been formally designated as critical habitat, if it would result in the death or injury of wildlife by removing essential habitat components or impairing essential behavior patterns, including breeding, feeding or sheltering.

Section 7(a)(1) of the Endangered Species Act (ESA) requires Federal agencies to use their authorities to further the conservation of listed species. Section 7(a)(2) requires the Federal agency, the US Army Corps of Engineers, in this case, or its designated representative, to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any listed threatened or endangered species, or result in the destruction or adverse modification of designated critical habitat.

Section 7(d) of the ESA provides that, after initiation of consultation, the Federal Agency and any applicant shall make no irreversible or irretrievable commitment of resources. If the USACE or applicant makes a commitment of resources by beginning construction prior to any consultation with the Service, they may have eliminated any reasonable and prudent alternatives that would have allowed the USACE to comply with section 7(a)(2).

Destruction or adverse modification of critical habitat is defined as a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.

Two figures (Figures 3 and 4) outlining the informal and formal section 7 process are included to assist in the preparation of the necessary documents and scheduling time lines. The informal process should be used as a time for the Service and the USACE to work together to identify potential impacts to listed species and measures to avoid or minimize those impacts. Once initiated, the formal consultation process does have a regulated time schedule of approximately 135 days to issue a final biological opinion. Extensions can be permitted if agreed upon by both agencies.

On November 27, 2002, the Service outlined measures to avoid and minimize impacts to sea turtles, piping plover, and brown pelicans. Once the USACE has reviewed and agreed to implement the proposed measures, the Service believes we could concur with a conclusion of "not likely to adversely effect" listed species would be appropriate.

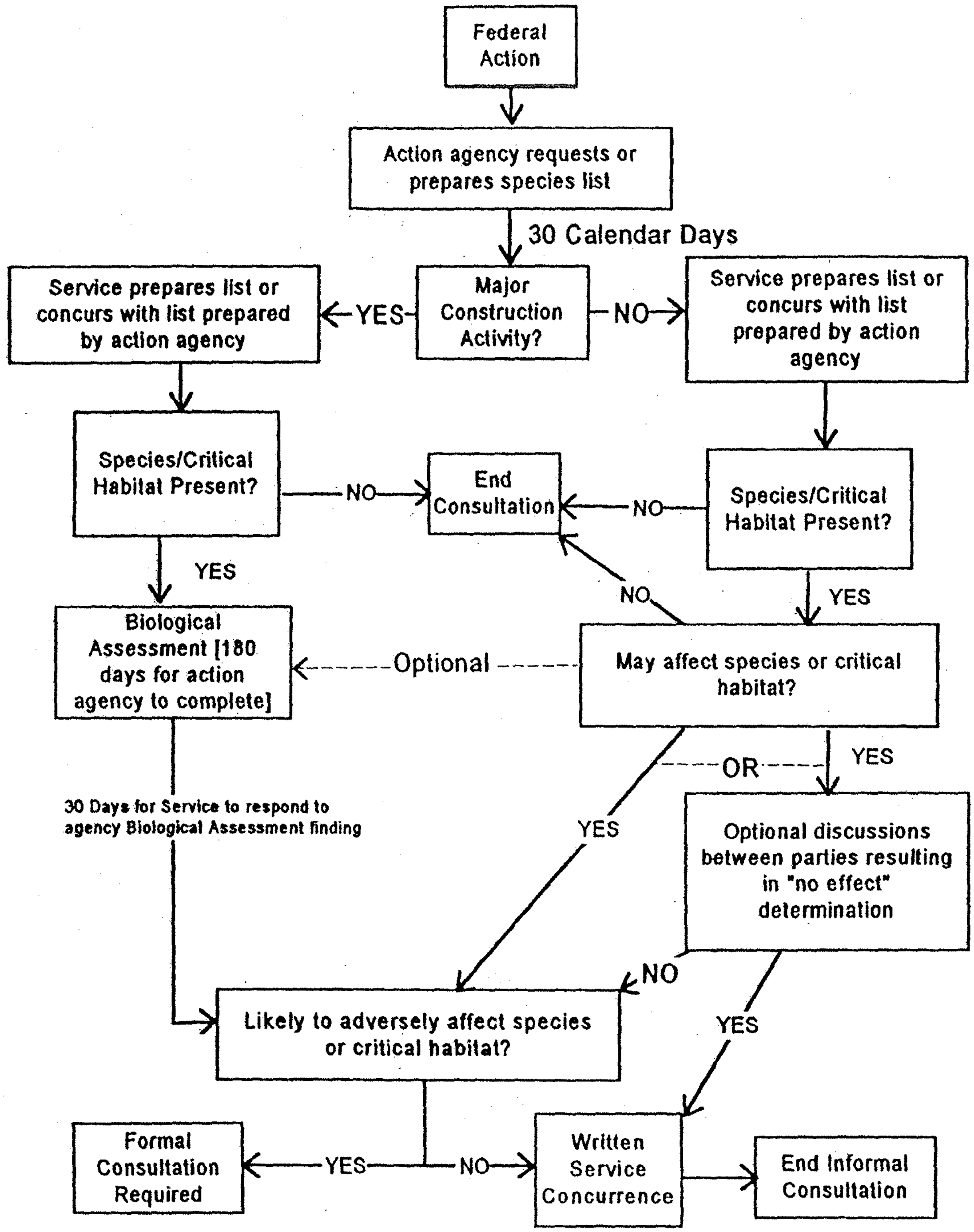

Figure 3. Informal consultation process.

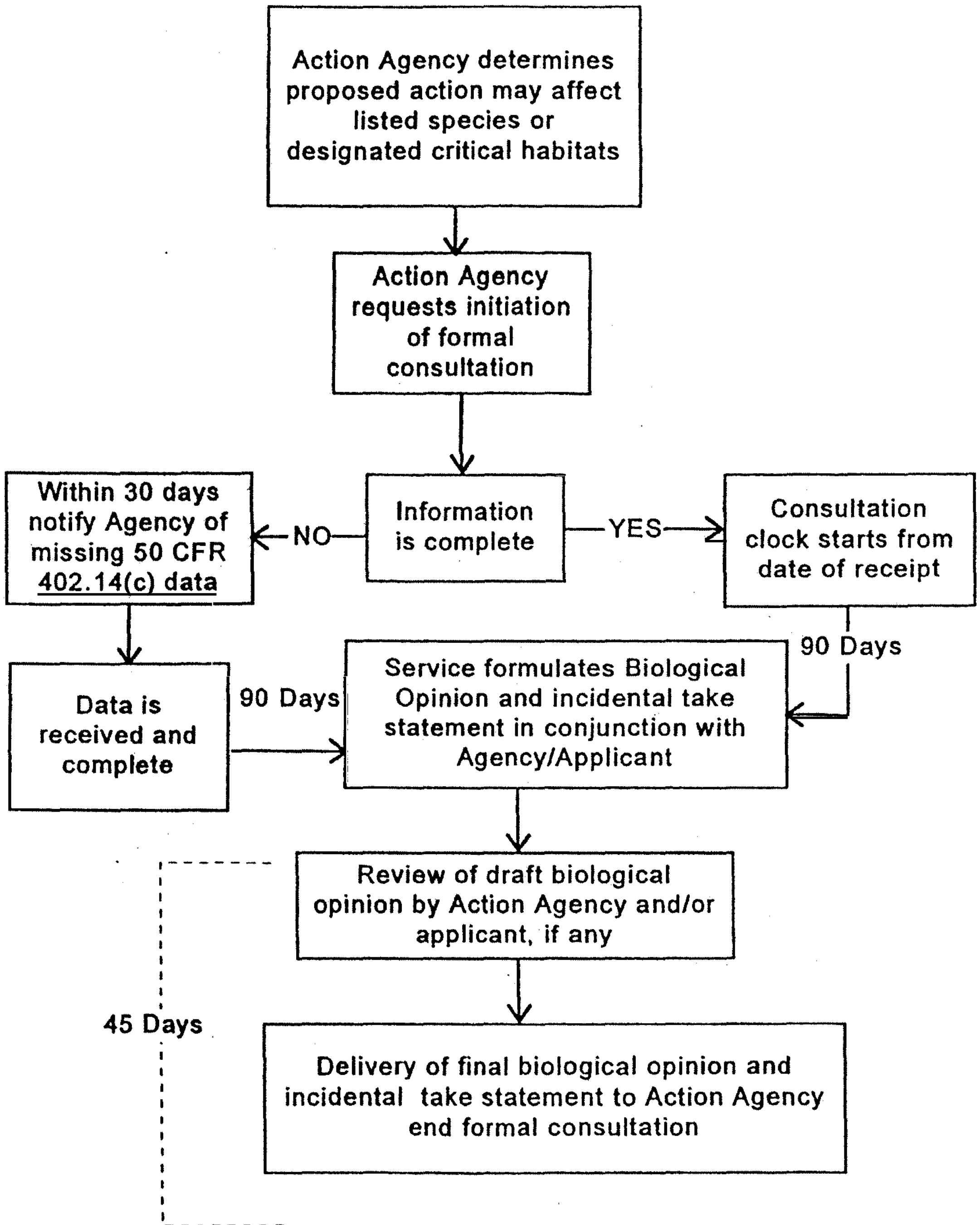

Figure 4. Formal consultation process.

SHORELINE EROSION

The RACT was concerned that completion of the project would allow deeper draft ships to be brought into the port. As a consequence, these ships would create larger wakes and stronger draw downs when passing through the channel, resulting in more shoreline erosion. In order to address this concern, the Port of Corpus Christi funded a modeling study (Pacific International Engineering 2001) to project rates of shoreline erosion with and without the project.

Factors included in the analyses were tidal current velocities, sea level changes, wind waves, vessel wakes, pressure fields effects, and channel morphology. Of these six factors it was concluded that only pressure fields and channel geomorphology would contribute to an accelerated rate of erosion beyond that expected under current conditions. Although vessel wakes contributed significantly to overall erosion in the Ingleside Cove area, post-project projections were lower due to the slightly smaller wakes that are created by deeper draft ships. Using the current fleet in a deeper channel would produce decreased pressure field effects. However, a deeper draft fleet will produce stronger effects and therefore more erosion but, theoretically, only at areas having a vertical bluff that are near the channel. These areas include Harbor Island, Mustang Island, Pelican Island, and Ingleside Point. Widening the channel will result in a reduction of the shallow bottom slope which would increase the impacts from waves and pressure fields causing a greater amount of erosion and landward bluff retreat. This channel slope stabilization effect has the greatest impact on Mustang and Harbor Islands, but Pelican Island, Cook's Island/Ingleside Cove, Dagger and Ransom Islands, and Ingleside Point will be affected as well. Shamrock Island is not expected to be affected by any of the erosion factors due to its distance from the channel. Without any shoreline stabilization, a greater amount of erosion is expected to occur over the 50-year life of the project than under existing conditions in some areas (Table 2).

Table 2. Percentage change in shoreline erosion expected post-project by two factors.

Area	Increase in erosion due to pressure field effects	Increase in erosion due to channel morphology
Harbor Island	17.2%	49.3%
Mustang Island	32%	65.1%
Pelican Island	32%	37.6%
Dagger and Ransom Islands	0%	31.8%
Cook's Island/ Ingleside Cove	0%	20.6%
Ingleside Point	17.2%	14.9%

To prevent the additional erosion from occurring, affected shorelines are proposed to be stabilized using additional dredged material, geotubes, stone, and rip-rap. The beneficial use Site P will be a rock breakwater to prevent further erosion of the shoreline at Ingleside-By-the Bay and also to provide protection to the seagrass beds that exist along that shoreline. Stone protection will be added to the existing shoreline of Mustang Island to prevent further erosion and protect the East Flats area. The beneficial use Site I is proposed to provide erosion protection for Dagger Island. The northeast end of Pelican Island has a high bluff that is eroding and is proposed to be stabilized with 1500' of protection. On the east side, a 5500 linear foot hydraulic fill embankment using geotube and riprap is proposed for protection

CONTAMINANT ASSESSMENT

To assess the suitability of both new work material and maintenance material from the Corpus Christi Ship Channel for beneficial use sites created by this project, the Regulatory Agency Coordination Team formed a subcommittee, the Contaminant Workgroup (CW). It was agreed to use the tiered approach, as described in the regulatory testing manual (USEPA/USACE 1991), to evaluate suitability for placement. Existing data that was reviewed and evaluated included Ward (1997), Barrera et al. (1995), Fugro (2000), USACE (2000), Carr et al. (1997), and U. S. Army Corps of Engineers maintenance material results for 1981, 1983, 1984, 1985, 1987, 1989, 1990, 1991, 1995, 1998, and 1999. Data for these documents were collected for a variety of purposes and therefore only those data pertinent to the channel project were considered. The USACE has divided the Corpus Christi Ship Channel into several reaches or segments for reporting purposes so these segments were used to facilitate discussion.

Sediment concentration levels were compared to sediment quality guidelines (SQG) contained in the National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Table (Buchman 1998). Long and Morgan (1990) first devised this weight-of-evidence approach to develop biological effects-based sediment quality guidelines. A large database consisting of effects and no effects lab and field studies was ranked by percentiles according to chemical concentration observed or predicted to be associated with biological effects. The chemical concentrations ranking in the lowest 10% were defined as the effects range low (ERL). The ERL represents an estimate of the chemical concentration below which no effects were observed. Although these guidelines have been revised a number of times, the major weakness is the disregard for additive or synergistic effects and the failure to account for food chain bioaccumulation. However, these guidelines were used only as an initial screening tool to indicate areas that might require further evaluation.

Entrance channel

The entrance channel is defined as the beginning of the channel in the Gulf of Mexico (310+00) to Harbor Island (Inner Basin). Only one ERL was exceeded; mercury (2.0 mg/kg) in 1999 for station 100+00. No other ERLs were exceeded. Oil and grease concentrations ranged from 510 to 5790 mg/kg in 1984 but the USACE did not include this parameter in later testing. Given the low incidence of ERL exceedances there is not a high concern for contamination in this reach.

Material will be placed in offshore placement areas in berms. Open ocean disposal of material is regulated by the Environmental Protection Agency (EPA) and future maintenance dredging should adhere to the tiered approach to evaluate suitability of material disposed off the Texas coast (USEPA/USACE 2001).

Lower Bay

This stretch of the Corpus Christi Ship Channel extends from Harbor Island (Inner Basin) to the La Quinta Junction. Maintenance material is used to renourish Pelican Island. Sediment is described by Fugro (2000) as alternating layers of sand/silty sand and clay. Only a few data points were available from the USACE maintenance material. Although no ERLs were exceeded in 1998 or 1991, the detection limits for acenaphthene and DDT were above the ERL. U.S. Navy construction material data (as provided in the DEIS) for nine samples collected at in 1986 indicated that eight of nine samples exceeded the ERL for arsenic (8.2 mg/kg) and ranged from 11.3 to 64.4 mg/kg, four of nine exceeded the ERL for cadmium (1.2 mg/kg) and ranged from 1.21 to 4.14 mg/kg, two just barely exceeded the ERL for mercury (0.15 mg/kg), five exceeded the ERL for nickel (20.9 mg/kg) and ranged from 26.4 to 66.4 mg/kg. The PCCA has indicated that the material tested by the Navy has since been dredged and placed in upland placement areas (D. Krams, pers. comm.). Fugro (2000) analyzed borings from two stations and four depths in the Lower Bay reach. Results showed that there were no ERL exceedances at these two stations for metals. Since there is a paucity of data available for this segment, and some of the data points exceeded the ERL by as much as eight times, this segment is an area of concern to the Service.

La Quinta Channel

This segment extends from the La Quinta Junction to the La Quinta Turning Basin and includes the 8000' proposed extension from the terminal end of the existing turning basin. Sediments are silty sands below stiff clays and sandy clays (Fugro 2000). USACE maintenance material testing results were available for 1985 and 1990. Arsenic concentrations exceeded the ERL (8.2 mg/kg) at six of six stations (12 to 15 mg/kg) in 1985 but was below detection limits in 1990. None of the PAHs exceeded the ERLs, however, the detection limit for acenapthene was higher than the ERL. Data from the Fugro (2000) borings included five samples from three stations at depths between 9 and 20 feet below mudline. Although none of the samples exceed the ERLs, one sample at the shallowest depth (9 feet) approached the ERL for arsenic.

Upper Bay

The Upper Bay segment extends from the La Quinta Junction to Beacon 82 near the Harbor Bridge and the mouth of the Inner Harbor. Sediments in this segment consist of soft marine clays overlying medium dense silty sands (Fugro 2000). Data from maintenance material was available for nine years between 1981 and 1998. For some years when dieldrin (1981, 1985), chlordane (1981, 1985, 1994, 1995, 1998) and DDT (1994, 1995, 1998) were included in the analysis, the detection limit was greater than the ERL. For all years since 1987, the detection limit for acenapthene was greater than the ERL, so any exceedances are unknown. The ERL for DDT (1.58 ug/kg) was exceeded at two stations in 1981 (8.7 ug/kg at 700+00 and 1.8 ug/kg at 750+00). Oil and grease concentrations ranged up to 9000 mg/kg but this parameter was discontinued in later years. In 1987, copper concentrations were 50.0 mg/kg at two stations and 40.0 mg/kg at one station, exceeding the ERL of 34 mg/kg. In this same year, a sample from a reference station also had a copper concentration of 50.0 mg/kg and a disposal area sample exceeded the DDT ERL. In 1989, copper exceeded the ERL at a reference station. Nickel and zinc slightly exceeded their respective ERLs at station 750+00 in 1995 and cadmium (3.64 mg/kg) exceeded the ERL at 1050+00 in 1997. In 1998 cadmium concentrations (4.04 mg/kg) exceeded the ERL (1.2 mg/kg) by four times at station 1000+00. Given the relatively few data points that exceed the ERLs over a twenty year period, this material would most likely be suitable for beneficial uses.

<u>Inner Harbor</u>
The Inner Harbor segment extends from Beacon 82 to Viola Turning Basin. This segment warrants the most concern due the amount of industry present and the known historical contamination. Ward and Armstrong (1997) compiled an extensive review of all retrievable data available for Corpus Christi Bay and surrounding bay systems to determine status and trends. The most contaminated area in Corpus Christi Bay was the Inner Harbor which has high concentrations of PCBs and PAHs. Metal concentrations are similar to Houston Ship Channel with the exception of zinc which is an order of magnitude higher (Ward and Armstrong 1997).

Based on previous studies, the majority of concern for contaminants is in the Inner Harbor and the tongue east of the mouth where sediments from the Inner Harbor may be transported. Due to this concern both new work and maintenance material should be placed in existing approved upland placement areas. Placement areas should be designed so that all decant water and runoff is returned to the Inner Harbor and not into Nueces Bay.

Recommendations:
1) All future maintenance dredged material should be evaluated according to the tiered approach (USEPA/USACE 1991); material should be analyzed for bulk chemistry and grain size with the results presented to resources agencies three months prior to dredging for a determination of disposal options.

2) All material deposited in confined disposal sites should be retained long enough to allow suspended sediments to settle and excess water to meet the Texas Center for Environmental Quality (TCEQ) water quality criteria for the receiving waterbody.

3) Upland disposal sites along the Inner Harbor should be designed so that all decant water is returned to the Inner Harbor and does not enter Nueces Bay.

OTHER RESOURCES

Colonial Waterbirds
Colonial waterbirds nest on several of the dredge placement areas and spoil islands within the Corpus Christi Ship Channel project site. The following is a description of the islands and their

bird use. The number following the name of the island denotes the Colonial Waterbird Census designation and the dredged material placement area (PA) designation if used.

Point of Mustang (614-183) PA6
This island is adjacent to the northwesternmost portion of Mustang Island. It was used sporadically by herons in the 1970's and 80's and by black skimmers and least terns, both ground nesters, in the early 1990s. Its proximity to the mainland makes it accessible to predators and therefore unlikely to be heavily utilized by nesting birds.

West Harbor Island (614-181)
This small island is located across the channel from Point of Mustang. It is utilized primarily by least terns, gull-billed terns, and black skimmers.

Pelican Island (614-184) PA 7 and 8
Pelican Island is a large u-shaped island located on the south side of the channel next to Point of Mustang. It is one of the three largest brown pelican rookeries in Texas and one of the most active rookeries on the central Texas coast. Almost 8000 pairs of colonial waterbirds comprising sixteen species nested on this island in 2001, 1000 pairs were brown pelicans.

Corpus Christi Spoil (614-185) PA 9 and 10
This island is located directly across the Corpus Christi Ship Channel from the Navy's Homeport at Ingleside. Least terns (160 pairs) and black skimmers (60 pairs) used this island in 2000. It is used by terns in greater numbers following the placement of new spoil (R. Gibbons, pers. comm.). The adjacent nearshore on the south side of these islands is proposed to be used as beneficial use Sites R & S and will contain new work material only; PA 10 will be used for periodic placement of maintenance material.

Ingleside Point (614-182)
Ingleside Point is a large island that was once part of the mainland prior to the dredging of the La Quinta channel. It was used as a dredge material placement area for some time and is now privately owned. Black skimmers, terns, and great blue herons have nested on the island sporadically throughout the years.

La Quinta Spoil Island (614-160), PA 13
This island is a long, narrow, levied spoil placement area that runs parallel to the La Quinta Channel. It was most active between 1978 and 1986. However, in the late 1990s a few pairs of herons and egrets nested on it.

Ransom Island/Ransom Spoil (614-103)
This colony consists of a large natural island with several small spoil islands nearby. Fifteen colonial waterbird species have nested on this group of islands over time until it was abandoned in 1987, most likely due to predators.

Shamrock Island (614-186)
Located on the east side of Corpus Christi Bay, this island was at one time connected to Mustang Island. It is an extremely productive bird rookery with over 10,000 pairs comprising seventeen species nesting in 2001. Due to its distance from the ship channel it is not likely to be affected by the Corpus Christi Ship Channel Project.

Islands may be periodically abandoned for a variety of reasons including predators, human disturbance, changes in vegetation, etc. It is important to prevent disturbance to all the islands during nesting season regardless of whether or not they were used the in the previous year to ensure that nesting habitat is still available. Therefore, the Service recommends that dredging operations in the vicinity of dredge spoil islands be coordinated with the Service and TPWD and that placement of dredge material be timed to allow the material to consolidate and provide habitat for ground-nesting species such as terns. Executive Order 13186 reinforces the responsibility of Federal agencies to protect migratory birds under migratory bird conventions such as the Migratory Bird Treaty Act (16 U.S.C. 703-711). Each Federal Agency has been tasked to develop and implement a Memorandum of Understanding (MOU) with the Service to promote the conservation of migratory bird populations. The drafting of these MOUs was targeted for Spring of 2002. However, until the MOUs have been finalized, the Service recommends that dredging operations in the vicinity of dredge spoil islands be coordinated with TPWD and the Service.

SUMMARY OF RECOMMENDATIONS

1) A monitoring and assessment program should be implemented to ensure that the predicted results of any hydrological models performed for salinity intrusion are verified. The monitoring and assessment program should work in collaboration with existing programs that monitor the Nueces Bay, such as the City of Corpus Christi's Nueces Bay Salinity Monitoring Project.

2) The PCCA and USACE should continue to evaluate Best Management Practices for dredging as new techniques and technologies are developed and should continually seek alternatives to open-water disposal.

3) Open-water placement activities for maintenance dredging should be completed during the summer and fall. The benthic recovery study by Ray and Clarke (1999) indicated that recovery would have taken longer than 1 year had dredging not been completed prior to the first recruitment period. This time frame would be least disruptive to the benthic community allowing for peak recruitment of benthic organisms occurring during late winter and early spring to colonize the placement areas as quickly as possible thereby reducing the recovery period. Since the new work dredging will require significantly more time than maintenance dredging, new work dredging should be completed without seasonal restrictions to allow the recovery process in the bay to proceed as quickly as possible.

4) Long-term impacts occur when repeated deposition of sediments alter benthic habitat resulting in the loss of foraging habitat for fish and shellfish species. Open-water placement areas 16A, 16B, 17A, 17B have a dredging cycle every three years while PA 14A, 14B, 15A and 15B have a six-year dredging cycle. A three year frequency barely allows for the recovery of the benthic community and utilization by nekton. Steps should be taken to reduce the frequency of dredging. Longer dredge pipes should be utilized to place material farther away from the channel and towards the far end of the placement area in order to prevent shoaling and reduce the frequency of dredging.

5) Transplant technique and procedures, as well as monitoring requirements and success criteria, for beneficial use site GH should follow the "Mitigative Procedures/Conditions For Seagrass Transplanting Efforts" as stated in the DEIS and attached as an Appendix to this document.

6) The proposed Corpus Christi Ship Channel project has the potential to impact the extensive seagrass beds existing near Dagger Island, Ingleside-On-The-Bay, and seagrasses that are adjacent to the proposed beneficial use site GH. These areas need to be monitored for indirect losses and restoration or mitigation implemented for any impacts.

7) Specific beneficial use goals for the five shallow, open-water beneficial use sites (I, CQ, GH, S, and R) need to be established to clearly define expected benefits, and success criteria need to be outlined for determining when those goals have been met.

8) It is essential that the Beneficial Use Workgroup (BUW) be maintained to provide input and oversight throughout the life of the project and to implement adaptive management strategies to ensure that natural resources continue to be protected.

9) Section 7 consultation under the Endangered Species Act needs to be completed with the USFWS and NMFS.

10) All future maintenance dredged material should be evaluated according to the tiered approach
(USEPA/USACE 1991); material should be analyzed for bulk chemistry and grain size with the results presented to resources agencies three months prior to dredging for a determination of disposal options.

11) All material deposited in confined disposal sites should be retained long enough to allow suspended sediments to settle and excess water to meet the Texas Center for Environmental Quality (TCEQ) water quality criteria for the receiving waterbody.

12) Upland disposal sites along the Inner Harbor should be designed so that all decant water is returned to the Inner Harbor and does not enter Nueces Bay.

13) Executive Order 13186 reinforces the responsibility of Federal agencies to protect migratory birds under migratory bird conventions such as the Migratory Bird Treaty Act (16 U.S.C. 703-711). Each Federal Agency has been tasked to develop and implement a Memorandum of Understanding (MOU) with the Service to promote the conservation of migratory bird populations. The drafting of these MOUs was targeted for Spring of 2002. However, until the MOUs have been finalized, the Service recommends that dredging operations in the vicinity of dredge spoil islands be coordinated with TPWD and the Service.

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APPENDIX

MITIGATIVE PROCEDURES/CONDITIONS FOR SEAGRASS TRANSPLANTING EFFORTS

1. After final construction of beneficial use Site GH and following a sediment conditioning time of at least 90 days, an appropriate location for the mitigation will be selected within the eastern portion Site GH, and the mitigation area will be planted with shoalgrass (*Halodule wrightii*). Prior to mitigation site selection or planting, a survey will be performed in the candidate mitigation site area to determine the topographic condition and elevation of the deposited material. If excessive relief is encountered then planting will occur after a subsequent survey indicates that the topographic relief, elevation and sediment stability is condusive to shoalgrass transplant survival. Prior to conducting planting, the USACE (the Federal sponsor) will coordinate the results of the survey(s) and sediment stablity appraisal(s) with the USACE, USFWS, TPWD, NMFS and the non-federal sponser.

   If the topographic and elevation survey or sediment stablity appraisal is determined to be unsuitable for seagrass growth, then the proper course of action will be taken after coordination has taken place. Agency recommendations may include allowing for additional site conditioning time prior to conducting a full scale planting of the site, relocation of the planting effort within the candidate mitigation area, grading of the area, or even conducting a pilot planting effort.

2. Transplant source areas will be identifed and applicable permits obtained from either the TPWD and/or GLO and/or private landowners. Staking of the approved transplant harvest areas will be in accordence with applicable permits.

3. Shoalgrass planting may be conducted between mid-March and mid-June, or between mid-September and mid-October. Plantings outside of these times will need to be coordinated between the USACE, USFWS, TPWD, NMFS and non-federal sponsor at least two weeks prior to commencement of those plantings. The transplanting technique will be coordinated with the USACE, NMFS, USFWS, TPWD and the non-federal sponsor when the specific location and configuration of the mitigation site is being established. Initial sholagrass planting shall be completed within one year of completion of the mitigation site or during the first suitable planting time following detemination that site is conducive to transplant survival. The location of the mitigation site will be marked by PVC pipe.

4. A planting unit will consist of live shoalgrass material contained in a three-inch-diameter plug. No more than three 3-inch plugs of source material per square yard will be obtained from the designated transplant source areas. Incidental damage to source areas will be avoided. Alternate harvest techniques may be considered but they will require prior coordination with USACE, NMFS, USFWS, TPWD and the non-federal sponsor and, as necessary, permitted through TPWD and/or TGLO and/or private landowners.

5. A transplant survival survey of the planted site will be conducted between 60 and 90 days after completion of the initial planting effort. Using acceptable survey methods, a minimum of 15 percent of all transplant units will be surveyed for the initial transplant survival survey. A written report detailing the survival results shall be submitted to the USACE within 30 days of survey completion. The report will be distributed by the USACE to the NMFS, TPWD, USFWS and non-federal sponsor. If at least 50percent survival is not achieved, then the resource agencies shall be consulted to determine if the site should be modified prior to initiating a replanting effort. If it is determined that site modifications are not necessary and that the site should be replanted, then replanting shall commence within 30 days (or within the next suitable planting period) once the agency-coordinated decision to replant the site has been made.

6. At least six transects will be established for the purposes of pre-construction, pre-plant plant elevation, or existing-bed condition surveys, and for post-planting monitoring surveys. The ends of each transect will be marked by PVC pipe. More transects may be established depending on the size or

shape of the site selected, the transplanting plan and/or planting schedule. A minimum of two transects outside of the mitigation site in nearby seagrass beds and a minimum of four transects which cross the mitigation site are to be established and surveyed. The number and configuration of transects within the planting area will be coordinated with the USACE, NMFS, USFWS, and TPWD and non-federal sponsor after the size and configuration of the mitigation site has been established.

7. All transects located within the mitigation site shall be surveyed post-planting, at 6 months, 1 year, 2 years, and 3 years to determine success of mitigation. To determine success, three samples will be taken at 10-foot intervals along the transects; one on the interval and one three feet to each side of the interval. Seagrass will be identified to species. Coverage of seagrasses will be to species and will be calculated by using the frequency of occurrence of live seagrass at each sample along the transect In addition to the percentage of vegetative cover, the monitoring surveys at all transects will note water depths (elevation) and any unusual sediment variations or other deposits.

8. If two years following planting the mitigation site is not as least 70 percent covered with shoalgrass, an additional planting effort will be made and those areas of the site not vegetated will be replanted to original specifications. The occurrence of manatee grass, if any, can be included in meeting the 70 percent coverage requirement.

9. The mitigation effort will be considered successful if the mitigation site is 70 percent covered by shoalgrass and/or manatee grass within three years following shoalgrass planting and if at least 48 percent of the total vegetative coverage is shoalgrass. If the mitigation is determined to be unsuccessful at the end of the three-year monitoring period, the federal sponsor will be required to consult with the USACE, NMFS, USFWS, TPWD and the non-federal sponsor in order to determine if corrective measures are warranted. If it is apparent that the site is unlikely to support seagrass vegetation then a detemination may be made to re-locate the mitigation project.

10. Some seagrasses currently exist nearby the proposed beneficial use Site GH. The survey of the transects established outside the mitigation area will be performed prior to constructing Site GH. The survey shall use a survey method similar to that used for the transects within the mitigation area and will also obtain information on the areal extent of the existing grassbeds. One purpose of the survey in the nearby seagrass beds is to obtain data to aid in the selection of the planting area within the mitigation site. This survey will be repeated within 30 days of completing construction of those portions of Site GH that could reasonably affect the existing nearby seagrass beds. If the survey results show that impacts have occurred to the existing seagrass beds, then the results will be provided within 30 days of completion of the survey to the USACE, TPWD, USFWS and NMFS and the non-federal sponsor. These agencies will be consulted in order to determine an appropriate course of action to restore and/or mitigate the impacts.

11. The federal sponsor will prepare monitoring reports detailing all required surveys. These monitoring reports will be submitted to the USFWS, TPWD, and NMFS and non-federal sponsor within 60 days of survey completion.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
c/o TAMU-CC, Campus Box 338
6300 Ocean Drive
Corpus Christi, Texas 78412

Carolyn Murphy
Chief, Environmental Section
Department of the Army
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston, TX. 77553-1229

Cons.# 2-11-03-I-0071

Dear Ms. Murphy:

This responds to your letter dated December 13, 2002, regarding measures presented by the U.S. Fish and Wildlife Service (Service) to the Corps of Engineers (COE) in a November 27, 2002 letter to avoid and minimize impacts to threatened and endangered species the Corpus Christi Ship Channel Improvements Project. We requested your review of the measures outlined and added to the Biological Assessment per a September 26, 2002 letter and additional measures after coordination with the Coastal Bends Bays and Estuary Program. We requested the COE inform the Service if the COE agreed to incorporate them into the proposed action. If the additional measure were acceptable, the Service could concur with your determination that the proposed project is not likely to adversely impact the brown pelican, piping plover and/or sea turtles.

The COE has reviewed the measures and have provided these comments:

1. All measures outlined to avoid and minimize impacts to sea turtles have been addressed in a recently completed Biological Opinion with the National Marine and Fisheries Service (NMFS). The COE has accepted the reasonable and prudent measures in the Biological Opinion and therefore, the Service is assured all measures will be incorporated into the project to fulfill their obligation under the Biological Opinion.

2. The COE has accepted each of the six measures listed for minimizing project impacts to the brown pelican and accepts the additional measure to avoid construction of the armoring and containment levee on Pelican Island during the nesting season from March 1 to September 1. Also, since there is only a small portion of the ship channel within 1,000 feet of the island the COE will coordinate any new-work dredging along this portion of the ship channel with the Service and the Coastal Bend Bay and Estuary Program prior to the nesting season to avoid disruption in the construction schedule and harrassment of brown pelicans.

3. For the piping plover the COE has reiterated that piping plover critical habitat will be avoided by placing new-work material in upland confined sites or in existing open-bay unconfined placement areas.

Therefore, with the acceptance of all measures, the Service can concur with the COE's determination that the Corpus Christi Chip Channel Improvements Project may affect, but is not likely to adversely affect Federally-listed species.

The Service thanks the COE for their cooperative efforts to protect listed species. If we can be of any further assistance, please contact Mary Orms at (361) 994-9005 or by email at mary_orms@fws.gov.

Sincerely,

Allan M. Strand

Allan Strand
Field Supervisor

cc:
Terry Roberts, COE, Galveston, TX

SECTION 2:

ENDANGERED SPECIES ACT CORRESPONDENCE

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, FL 33712
(727) 570-5312; Fax 570-5517

MAY 18 2001

F/SER3:TLG

Mr. Derek Green
Senior Staff Ecologist
206 Wild Basin Road - Suite 300
Austin, TX 78746

Dear Mr. Green:

In response to your letter dated May 8, 2001, enclosed is a list of species for the state of Texas that may be impacted by your proposed action to dredge the Corpus Christi Ship Channel in Nueces and San Patricio Counties, Texas. If you have any questions, please contact Eric Hawk, fishery biologist, at the telephone number listed above.

Sincerely,

Georgia Cranmore
Acting Regional Administrator for
Protected Resources

Enclosure

File: 1514-22 F.1 (TX)
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Endangered and Threatened Species and Critical Habitats under the Jurisdiction of the National Marine Fisheries Service

Texas

Listed Species	Scientific Name	Status	Date Listed
Marine Mammals			
blue whale	*Balaenoptera musculus*	Endangered	12/02/70
finback whale	*Balaenoptera physalus*	Endangered	12/02/70
humpback whale	*Megaptera novaeangliae*	Endangered	12/02/70
sei whale	*Balaenoptera borealis*	Endangered	12/02/70
sperm whale	*Physeter macrocephalus*	Endangered	12/02/70
Turtles			
green sea turtle	*Chelonia mydas*	Threatened[1]	07/28/78
hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	06/02/70
Kemp's ridley sea turtle	*Lepidochelys kempi*	Endangered	12/02/70
leatherback sea turtle	*Dermochelys coriacea*	Endangered	06/02/70
loggerhead sea turtle	*Caretta caretta*	Threatened	07/28/78

Species Proposed for Listing
None

Designated Critical Habitat
None

Proposed Critical Habitat
None

Candidate Species[2]	Scientific Name
Fish	
dusky shark	*Carcharhinus obscurus*
sand tiger shark	*Odontaspis taurus*
night shark	*Carcharinus signatus*
speckled hind	*Epinephelus drummondhayi*
saltmarsh topminnow	*Fundulus jenkensi*
jewfish	*Epinephelus itajara*
Warsaw grouper	*Epinephelus nigritus*

1. Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

2. Candidate species are not protected under the Endangered Species Act, but concerns about their status indicate that they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Habitat Conservation Division
4700 Avenue U
Galveston, Texas 77551-5997

December 13, 2001

Mr. Martin E. Arhelger
Vice President
PBS&J
206 Wild Basin Road, Suite 300
Austin, Texas 78746

Dear Mr. Arhelger:

As you requested in your letter dated November 16, 2001, the National Marine Fisheries Service has reviewed the preliminary Draft Environmental Impact Statement (PDEIS) for the Corpus Christi Ship Channel Improvement Project. We find the PDEIS to be well organized and written, presenting most of the information required in an Environmental Impact Statement (EIS). We offer the following comments for your consideration.

1. In the Table of Contents, add a new Subitem number 2.2.3 Other Alternatives and following the discussion of Subitem 2.2.2 Preferred Alternatives beginning on page 2-3, add a discussion of other alternatives considered but not implemented.

2. Page 7-0. Section 7.0 Consistency With Other State and Federal Regulations. Please add a consistency discussion of The Marine Mammal Protection Act.

The discussions of Essential Fish Habitat and of the project habitat as a whole are well written and detailed. We may have further comments as the EIS is further developed, but at this time we believe the PDEIS is very well done. Please call me at (409) 766-3699 if you have any questions regarding our recommendations.

Sincerely,

William B. Jackson
Fishery Management Specialist

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, FL 33702
(727) 570-5312; FAX 570-5517
http://caldera.sero.nmfs.gov

DEC - 5 2002

F/SER3:DK

Dr. Lloyd H. Saunders
Chief, Planning, Environmental and Regulatory Division
Galveston District, Corps of Engineers
Department of the Army
P.O. Box 1229
Galveston, TX 77553-1229

SUBJECT: Endangered Species Act Section 7 Consultation on the Corpus Christi Ship Channel Improvement Project

Dear Dr. Saunders:

This document represents the National Marine Fisheries Service's (NOAA Fisheries) biological opinion (Opinion) based on our review of the Corpus Christi Ship Channel Improvement Project to be conducted by the United States Army Corps of Engineers (COE), Galveston District and its effects on loggerhead turtles (*Caretta caretta*), Kemp's ridley turtles (*Lepidochelys kempii*), hawksbill turtles (*Eretmochelys imbricata*), green turtles (*Chelonia mydas*), and leatherback turtles (*Dermochelys coriacea*). This Opinion has been prepared in accordance with section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1536 *et seq.*). The NOAA Fisheries' consultation number for this action is F/SER/2002/00731. Please refer to this number in any future correspondence regarding this consultation.

This Opinion is based on information provided in a draft environmental impact statement and draft feasibility report prepared by the COE, received by NOAA Fisheries' Protected Resources Division on July 1, 2002, additional information provided via email by Paul Carangelo of the Port of Corpus Christi, published and unpublished scientific information on the biology and ecology of threatened and endangered marine species within the action area, and other sources of information. A complete administrative record of this consultation is on file at the NOAA Fisheries' Southeast Regional Office in St. Petersburg, Florida.

The Opinion states NOAA Fisheries' belief that the proposed action is not likely to jeopardize the continued existence of loggerhead, Kemp's ridley, green, hawksbill, or leatherback sea turtles. However, NOAA Fisheries anticipates incidental take of these species and has issued an Incidental Take Statement (ITS) pursuant to section 7 of the ESA. This ITS contains reasonable and prudent measures with implementing terms and conditions to help minimize this take.

Pursuant to the essential fish habitat consultation requirements of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)(2) and 50 CFR 600.905-.930, Subpart K), the NOAA Fisheries' Habitat Conservation Division (HCD) is being copied with this letter. The HCD biologist for this region is Rusty Swafford. If you have any questions about consultation regarding essential fish habitat for this project, please contact Mr. Swafford at (409) 766-3699.

If you have any questions, please contact Dennis Klemm, fishery biologist, at the number above or by e-mail at Dennis.Klemm@noaa.gov.

Sincerely,

Rolland A. Schmitten
Acting Regional Administrator

Enclosure

cc: F/PR3
F/SER42 - R. Swafford

File: 1514-22 f.1 Galveston COE
O:\section7\formal\Port of Corpus Christi BO.wpd

Endangered Species Act - Section 7 Consultation

Agency: United States Army Corps of Engineers, Galveston District

Activity: Corpus Christi Ship Channel Improvement Project

Consultation Conducted By: National Marine Fisheries Service, Southeast Regional Office (F/SER/2002/00731)

Date Issued:

Approved by:

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This document transmits the National Marine Fisheries Service (NOAA Fisheries), Southeast Regional Office, Protected Resources Division's biological opinion (Opinion) for the above referenced project. This Opinion is based on our review of the June 2002 Draft Feasibility Report and Draft Environmental Impact Statement (DEIS) for the Corpus Christi Ship Channel, Texas, Channel Improvement Project and its effects on marine mammals and sea turtles in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The DEIS along with a letter requesting consultation was received by NOAA Fisheries on July 1, 2002. A complete administrative record of this consultation is on file at the NOAA Fisheries SERO.

Consultation History

Informal consultation on the Corpus Christi Ship Channel, Channel Improvement Project was initiated in June 2002 by the Planning Division, Galveston District Corps of Engineers with the submittal of the BA that was prepared and incorporated as part of the Draft EIS that was transmitted June 28, 2002 and received July 1, 2002, pursuant to section 7 of the Act.

Additional information was received on September 6, 2002, from Paul Carangelo of the Port of Corpus Christi via e-mail. Mr. Carangelo sent a mock-up of a biological opinion including proposed action, conservation measures, and incidental take statement based upon the project parameters and results from past dredging projects to facilitate the completion of the Opinion.

BIOLOGICAL OPINION

I. Description of the Proposed Action

The action area (defined in 50 CFR 402.02 as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action") for this action is Corpus Christi Bay, Texas, and nearshore approaches to Corpus Christi Bay from about 6 miles offshore. The Galveston District Corps of Engineers (COE) proposes deepening of the Corpus Christi Shipping Channel (CCSC) from Viola Basin in the Inner Harbor to the end of the jetties in the Gulf of Mexico to

–52 ft from –45 ft mean low tide (MLT), plus advanced maintenance and allowable overdepth; deepening the remainder of the channel into the Gulf of Mexico to 54 ft (depths will be increased roughly 10,000 ft into the Gulf of Mexico to the –56 ft isobath); widening of the Upper bay and Lower Bay reaches (from Port Aransas to Harbor Bridge) to 530 ft (existing widths are 500 ft between Port Aransas and La Quinta Junction and 400 ft between La Quinta Junction and the Harbor Bridge); construction of 200-ft wide barge shelves (-12 ft MLT) on both sides of the ship channel from La Quinta Junction to the Harbor Bridge, across the Upper bay portion of the CCSC; and extending La Quinta Channel 7,200 ft to a depth of –40 ft MLT and a width of 400 ft and including a turning basin.

It is estimated that approximately 40 million cubic yards of new work would require seven separate dredging contracts to complete. Dredged material management incorporates the use of existing placement areas, as well as newly designated placement areas including several beneficial use (BU) sites. BU sites will be constructed to create several hundred acres of shallow water habitat throughout the bay system; environmental enhancement features consist of construction of two breakwaters to protect and enhance existing habitat. The proposed work is to be conducted by pipeline dredges in the bay, and hopper dredges in the entrance channel. The dredged new material from the entrance channel described in the June 2002 Draft Feasibility Report and Draft EIS consists predominantly of medium to dense sand and soft clay.

The COE proposes to use hopper dredges to deepen the Corpus Christi Ship Channel Entrance Channel. The Entrance Channel includes the Inner Basin, the Jetty Channel Reach, and the Outer Bar Reach including the extended portion. The length of the Entrance Channel from the landward end of the Inner Basin and including the proposed extension of the Outer Bar Reach into the Gulf of Mexico is approximately 7 miles. The proposed work will also widen an approximately 1000-foot portion of the Jetty Channel Reach from 600 to 700 feet and deepen the area as described above. The Outer Bar Reach width will be extended at the same 700-foot width as existing and deepened as described above. The action area includes an offshore site for the placement of dredged materials. The Dredged Material Placement Area 1 (PA 1, also referred to as ODMPA 1) has been used continuously for such purpose since at least 1940. Use of PA 1 for maintenance material has been previously coordinated under the September 22, 1995, Regional Biological Opinion (RBO) on Channel Maintenance Dredging Using a Hopper Dredge (RBO). Two beneficial use sites are also proposed for one-time use: BU 1 (also referenced as Site MN) and BU 10 (also referenced as Navy Homeport Site); both are in near proximity to PA 1.

Maintenance dredging of the Corpus Christi Ship Channel is conducted every 1.5 years by contract or government-owned hopper dredge and requires approximately 2 months. One loggerhead was lethally taken during clean-up in the entrance channel in September 1995 and 3 additional turtles, all loggerheads, were lethally taken in June 1999.

The Corpus Christi Ship Channel Entrance Channel has been divided into two separate sections for planning purposes: the inshore section from the approximate beginning of the landward end of the Inner Basin east to approximately ½ mile seaward from the end of the submerged portion of the Aransas Pass south jetty, the Jetty Reach Channel (JRC); and the nearshore section from approximately ½ mile seaward from the submerged end of the Aransas Pass jetties east to the seaward end of the extension channel in the Gulf of Mexico, referred to the Outer Bar Reach (OBR). Maintenance dredging of the present Entrance Channel and use of PA 1 using hopper dredges is covered under the 1995 RBO, and therefore any takes are counted against the ITS for that RBO. The proposed extension of the OBR begins approximately 2.6 miles offshore and ends about 4.6 miles offshore of the submerged end of the south jetty. NOAA Fisheries has determined that sea turtles may occur in the area of the OBR extension only as transients due to lack of structure to attract sea turtles or their prey species; however, hopper dredging in the JRC and OBR is likely to result in the taking of sea turtles, particularly loggerheads, and therefore, the OBR extension is included in this Opinion and incidental take statement. The COE will implement the following measures when hopper dredges are being used during new work dredging of the Corpus Christi Ship Channel Improvement Project JRC and OBR:

- One-hundred percent observer coverage by NOAA Fisheries-approved observers will be required. Additionally, while a hopper dredge is operating in the JRC and OBR, the COE and NOAA Fisheries will maintain close contact with the Sea Turtle Stranding and Salvage Network to determine whether beached sea turtles display evidence of impingement by the dredge.

- The COE expects to encounter soft clays and sands during new work dredging of the entrance channel and will use maintenance material dragheads. The maintenance draghead (sea turtle) deflector designed for use in soft sediments has been modified for use in hard virgin clay. It will be used for this project only if extensive areas of hard virgin clays are unexpectedly encountered unless the modified deflector results in substantially reduced production that will increase the amount of time the dredge will operate. The COE will inspect the appropriate draghead deflector prior to commencement of dredging to ensure that the selected deflector has been tailored appropriately for this project. Additionally, the COE will assess whether the dredge operator appears to be familiar with the operation of the applicable draghead deflector and will provide necessary training where appropriate. The COE will contact NOAA Fisheries to discuss any problems with the modified draghead deflector prior to authorizing removal during dredging of hard clay. If the modified draghead deflector proves unworkable in hard virgin clays encountered, the COE will discontinue dredging operations until an alternate solution has been agreed upon with NOAA Fisheries, such as having a contract trawler drag ahead of the hopper dredge to sweep the area clean of sea turtles.

- One-hundred percent overflow screening will be required and must be designed to maximize sampling of the dredged material. Additionally, modified inflow screening will be required. The draghead inflow screens should have 6- by 6-inch screening on the bottom and 4- by 4-inch screening on the top. If the dredge operator, in consultation with observers and any onboard COE or NOAA Fisheries personnel, determines that the draghead is clogging and reducing production substantially, the screens can be quickly modified to have 12- by 12-inch openings on the bottom and 8- by 8-inch openings on top. Clogging should be greatly reduced with these flexible options; however, further clogging may compel removal of the screening altogether. In past consultations NOAA Fisheries has agreed that these flexible options are necessary, since the need to constantly clear the screens will increase the time it takes to complete the project and therefore increase the exposure of sea turtles to the risk of impingement. Additionally, there are increased risks to sea turtles in the water column when the inflow is halted to clear screens, since this results in clogged intake pipes that may have to be removed from the bottom to discharge the clay.

- Sea turtle takes are most likely to occur during dredging of the JRC and OBR. These areas will be dredged during winter months (mid-November through mid-April), when sea turtle abundance is lowest.

- The COE will continue to coordinate with the COE's Waterways Experiment Station, the COE's South Atlantic Division, and dredge operators regarding additional measures to further reduce the likelihood of sea turtle takes. The diamond-shaped *pre-deflector*, or another promising design such as tickler chains or water jets, should be used wherever possible, as a means of alerting sea turtles that something is coming towards them before they encounter the deflecting draghead. Due to their experimental nature, use of pre-deflectors is not a requirement at this time.

II. Status of Listed Species and Critical Habitat

The following listed species under the jurisdiction of NOAA Fisheries are known to occur in waters of the Gulf of Mexico nearshore areas and bays in or near the action area.

Common Name	Scientific Name	Status
Sea turtles:		
Kemp's ridley	*Lepidochelys kempii*	E
Leatherback	*Dermochelys coriacea*	E
Hawksbill	*Eretmochelys imbricata*	E
Green	*Chelonia mydas*	E/T*
Loggerhead	*Caretta caretta*	T
Whales:		
Northern right	*Eubalaena glacialis*	E
Humpback	*Megaptera novaeangliae*	E
Sperm	*Physeter macrocephalus*	E
Fin whale	*Balaenoptera physalus*	E
Blue whale	*Balaenoptera musculus*	E
Sei whale	*Balaenoptera borealis*	E

* Green turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered. Due to the inability to distinguish between the populations away from the nesting beaches, green sea turtles are considered endangered wherever they occur in U.S. waters.

Of the listed species that may occur in the action area, only sea turtles are known to be taken by dredges. There are no documented takes of large whales by dredges. In addition, the proposed project will take place in Corpus Christi Bay and associated nearshore areas where large whales rarely occur. Based on this information, whales are not likely to be adversely affected by the proposed action and therefore, will not be considered further in this biological opinion. Summary information on the status and biology of the remaining species that may be affected by the proposed action is provided below.

There is no designated critical habitat for any listed species under the purview of NOAA Fisheries within the action area.

A. Species/critical habitat description

Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species in 1978. This species inhabits the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans, and within the continental U.S. it nests from Louisiana to Virginia. The major nesting areas include coastal islands of Georgia, South Carolina, and North Carolina, and the Atlantic and Gulf coasts of Florida, with the bulk of the nesting occurring on the Atlantic coast of Florida. Developmental habitat for small juveniles are the pelagic waters of the North Atlantic and the Mediterranean Sea.

There is no critical habitat designated for the loggerhead sea turtle.

Green Sea Turtle

Federal listing of the green sea turtle occurred on July 28, 1978, with all populations listed as threatened except for the Florida and Pacific coast of Mexico breeding populations which are endangered. The complete nesting range of the green turtle within the NOAA Fisheries Southeast Region includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands between Texas and North Carolina and at the U.S. Virgin Islands (U.S.V.I.) and Puerto Rico (NMFS and USFWS 1991a). Principal U.S. nesting areas for green turtles are in eastern Florida, predominantly Brevard through Broward counties (Ehrhart and Witherington 1992). Regular green turtle nesting also occurs on St Croix, U.S.V.I., and on Vieques, Culebra, Mona, and the main island of Puerto Rico (Mackay and Rebholz 1996, Díez pers. comm.).

Critical habitat for the green sea turtle has been designated for the waters surrounding Isla Culebra, Puerto Rico and its associated keys.

Kemp's Ridley Sea Turtle

The Kemp's ridley was listed as endangered on December 2, 1970. Internationally, the Kemp's ridley is considered the most endangered sea turtle (Zwinenberg 1977, Groombridge 1982). Kemp's ridleys nest in daytime aggregations known as arribadas, primarily at Rancho Nuevo, a stretch of beach in Mexico, Tamaulipas State. The species occurs mainly in coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean. Occasional individuals reach European waters (Brongersma 1972). Adults of this species are usually confined to the Gulf of Mexico, although adult-sized individuals sometimes are found on the Eastern Seaboard of the United States.

There is no designated critical habitat for the Kemp's ridley sea turtle.

Leatherback Sea Turtle

The leatherback was listed as endangered on June 2, 1970. Leatherbacks are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, and Indian Oceans; the Caribbean Sea; and the Gulf of Mexico (Ernst and Barbour 1972). Adult leatherbacks forage in temperate and subpolar regions from 71°N to 47°S latitude in all oceans and undergo extensive migrations between 90°N and 20°S, to and from the tropical nesting beaches. In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (see NMFS SEFSC 2001). Female leatherbacks nest from the southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are in French Guiana and Suriname (see NMFS SEFSC 2001).

Critical habitat for the leatherback includes the waters adjacent to Sandy Point, St. Croix, U.S.V.I.

Hawksbill Sea Turtle

The hawksbill turtle was listed as endangered under the ESA (1973), and is considered Critically Endangered by the International Union for the Conservation of Nature (IUCN) based on global population declines of over 80% during the last three generations (105 years) (Meylan and Donnelly 1999). Only five regional nesting populations remain with more than 1,000 females nesting annually (Seychelles, Mexico, Indonesia, and two in Australia) (Meylan and Donnelly 1999). Most populations are declining, depleted, or remnants of larger aggregations. Although hawksbills are subject to the suite of threats that affect other marine turtles, the decline of the species is primarily attributed to centuries of exploitation for tortoiseshell, the beautifully patterned scales that cover the turtle's shell (Parsons 1972).

Critical habitat for the hawksbill includes the waters around Mona and Monito Islands, Puerto Rico.

B. Life history

Loggerhead Sea Turtle

Mating takes place in late March-early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern U.S. Individual females nest multiple times during a nesting season, with a mean of 4.1 nests/nesting individual (Murphy and Hopkins 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2-3 years, but can vary from 1-7 years (Dodd 1988). Loggerhead sea turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7-12 years or more, but there is some variation in habitat use by individuals at all life stages. Turtles in this life history stage are called "pelagic immatures." Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length they begin to recruit to coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico.

Benthic immature loggerheads, the life stage following the pelagic immature stage, have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in northeastern Mexico. Large benthic immature loggerheads (70-91 cm) represent a larger proportion of the strandings and in-water captures (Schroeder et al. 1998) along the south and western coasts of Florida as compared with the rest of the coast, which could indicate that the larger animals are either more abundant in these areas or just more abundant within the area relative to the smaller turtles. Benthic immature loggerheads foraging in northeastern United States waters are known to migrate southward in the fall as water temperatures cool (Epperly et al. 1995, Keinath 1993, Morreale and Standora 1999, Shoop and Kenney 1992), and migrate northward in spring. Past literature gave an estimated age at maturity of 21-35 years (Frazer and Ehrhart 1985; Frazer et al. 1994) and the benthic immature stage as lasting at least 10-25 years. However, NMFS SEFSC (2001) reviewed the literature and constructed growth curves from new data, estimating ages of maturity ranging from 20-38 years and benthic immature stage lengths from 14-32 years.

Juveniles are omnivorous and forage on crabs, mollusks, jellyfish and vegetation at or near the surface (Dodd 1988). Sub-adult and adult loggerheads are primarily coastal and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

Green Sea Turtle

Green sea turtle mating occurs in the waters off the nesting beaches. Each female deposits 1-7 clutches (usually 2-3) during the breeding season at 12-14 day intervals. Mean clutch size is highly variable among populations, but averages 110-115. Females usually have 2-4 or more years between breeding seasons, while males may mate every year (Balazs 1983). After hatching, green sea turtles go through a post-hatchling pelagic stage where they are associated with drift lines of algae and other debris.

Green turtle foraging areas in the southeast United States include any neritic waters having macroalgae or sea grasses near mainland coastlines, islands, reefs, or shelves, and any open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (Hirth 1997, NMFS and USFWS 1991a). Principal benthic foraging areas in the region include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty 1984, Hildebrand 1982, Shaver 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957, Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon System, Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward counties (Wershoven and Wershoven 1992, Guseman and Ehrhart 1992). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs. Age at sexual maturity is estimated to be between 20 to 50 years (Balazs 1982, Frazer and Ehrhart 1985).

Green sea turtles are primarily herbivorous, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The post-hatchling, pelagic-stage individuals are assumed to be omnivorous, but little data are available.

Kemp's Ridley Sea Turtle

Remigration of females to the nesting beach varies from annually to every 4 years, with a mean of 2 years (TEWG 1998). Nesting occurs from April into July and is essentially limited to the beaches of the western Gulf of Mexico, near Rancho Nuevo in southern Tamaulipas, Mexico. The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season.

Juvenile/subadult Kemp's ridleys have been found along the Eastern Seaboard of the United States and in the Gulf of Mexico. Atlantic juveniles/subadults travel northward with vernal warming to feed in the productive, coastal waters of Georgia through New England, returning southward with the onset of winter to escape the cold (Lutcavage and Musick 1985, Henwood and Ogren 1987, Ogren 1989). In the Gulf, juvenile/subadult ridleys occupy shallow, coastal regions. Ogren (1989) suggested that in the northern Gulf they move offshore to deeper, warmer water during winter. Studies suggest that subadult Kemp's ridleys stay in shallow, warm, nearshore waters in the northern Gulf of Mexico until cooling waters force them offshore or south along the Florida coast (Renaud 1995). Little is known of the movements of the post-hatching, planktonic stage within the Gulf. Studies have shown the post-hatchling pelagic stage varies from 1-4 or more years, and the benthic immature stage lasts 7-9 years (Schmid and Witzell 1997). The TEWG (1998) estimates age at maturity to range from 7-15 years.

Stomach contents of Kemp's ridleys along the lower Texas coast consisted of a predominance of nearshore crabs and mollusks, as well as fish, shrimp and other foods considered to be shrimp fishery discards (Shaver 1991). Pelagic stage, neonatal Kemp's ridleys presumably feed on the available sargassum and associated infauna or other epipelagic species found in the Gulf of Mexico.

Leatherback Sea Turtle

Female leatherbacks nest from the southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic, with nesting occurring as early as late February or March. When they leave the nesting beaches, leatherbacks move offshore but eventually utilize both coastal and pelagic waters. Very little is known about the pelagic habits of the hatchlings and juveniles, and they have not been documented to be associated with the sargassum areas as are other species. Leatherbacks are deep divers, with recorded dives to depths in excess of 1,000 m (Eckert and Eckert 1989), but they may come into shallow waters if there is an abundance of jellyfish nearshore.

Although leatherbacks are a long-lived species (> 30 years), they are somewhat faster to mature than loggerheads, with an estimated age at sexual maturity reported of about 13-14 years for females, and an estimated minimum age at sexual maturity of 3-6 years, with 9 years reported as a likely minimum (Zug and Parham 1996) and 19 years as a likely maximum (NMFS SEFSC 2001). They nest frequently (up to 7 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and, thus, can produce 700 eggs or more per nesting season (Schultz 1975).

Leatherback sea turtles feed primarily on jellyfish as well as cnidarians and tunicates. They are also the most pelagic of the turtles, but have been known to enter coastal waters on a seasonal basis to feed in areas where jellyfish are concentrated.

Hawksbill Sea Turtle

The life history of hawksbills consists of a pelagic stage that lasts from the time they leave the nesting beach as hatchlings until they are approximately 22-25 cm straight carapace length (Meylan 1988, Meylan in prep.), followed by residency in developmental habitats (foraging areas where immatures reside and grow) in coastal waters. Adult foraging habitat, which may or may not overlap with developmental habitat, is typically coral reefs, although other hard-bottom communities and occasionally mangrove-fringed bays may be occupied. Hawksbills show fidelity to their foraging areas over periods of time as great as several years (van Dam and Díez 1998).

Hawksbills may undertake developmental migrations (migrations as immatures) and reproductive migrations that involve travel over hundreds or thousands of kilometers (Meylan 1999b). Reproductive females undertake periodic (usually non-annual) migrations to their natal beach to nest. Movements of reproductive males are less well known, but are presumed to involve migrations to the nesting beach or to courtship stations along the migratory corridor. Females nest an average of 3-5 times per season with some geographic variation in this parameter (see references on pp. 204-205 of Meylan and Donnelly 1999, Richardson et al. 1999). Clutch size is higher on average (up to 250 eggs) than that of green turtles

(Hirth 1980). Reproductive females may exhibit a high degree of fidelity to their nest sites. This, plus the tendency of hawksbills to nest at regular intervals within a season, make them vulnerable to capture on the nesting beach.

C. Population dynamics, status, and distribution

Loggerhead Sea Turtle

Loggerhead sea turtles occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans and are the most abundant species of sea turtle occurring in U.S. waters. Loggerhead sea turtles concentrate their nesting in the north and south temperate zones and subtropics, but generally avoid nesting in tropical areas of Central America, northern South America, and the Old World (Magnuson et al. 1990).

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. There are 5 western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29° N (approximately 7,500 nests in 1998); (2) a south Florida nesting subpopulation, occurring from 29° N on the east coast to Sarasota on the west coast (approximately 83,400 nests in 1998); (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida (approximately 1,200 nests in 1998); (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez 1990) (approximately 1,000 nests in 1998) (TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (approximately 200 nests per year) (NMFS SEFSC 2001). Natal homing of females to the nesting beach provides the barrier between these subpopulations, preventing recolonization with turtles from other nesting beaches.

Based on the data available, it is difficult to estimate the size of the loggerhead sea turtle population in the United States or its territorial waters. There is, however, general agreement that the number of nesting females provides a useful index of the species' population size and stability at this life stage. Nesting data collected on index nesting beaches in the United States from 1989-1998 represent the best data set available to index the population size of loggerhead sea turtles. However, an important caveat for population trends analysis based on nesting beach data is that this may reflect trends in adult nesting females but not reflect overall population growth rates. Given this caveat, between 1989 and 1998, the total number of nests laid along the U.S. Atlantic and Gulf coasts ranged from 53,014 to 92,182 annually, with a mean of 73,751. On average, 90.7% of these nests were from the south Florida subpopulation, 8.5% were from the northern subpopulation, and 0.8% were from the Florida Panhandle nest sites. There is limited nesting throughout the Gulf of Mexico west of Florida, but it is not known to which subpopulation the turtles making these nests belong.

The number of nests in the northern subpopulation from 1989 to 1998 was 4,370 to 7,887, with a 10-year mean of 6,247 nests. With each female producing an average of 4.1 nests in a nesting season, the average number of nesting females per year in the northern subpopulation was 1,524. The total nesting and non-nesting adult female population is estimated as 3,810 adult females in the northern subpopulation (TEWG 1998, 2000). The northern population, based on number of nests, has been classified as stable or declining (TEWG 2000). Another consideration adding to the vulnerability of the northern subpopulation is that NOAA Fisheries scientists estimate that the northern subpopulation produces 65%

males, while the south Florida subpopulation is estimated to produce 80% females (NMFS SEFSC 2001).

The southeastern U.S. nesting aggregation is of great importance on a global scale and is second in size only to the nesting aggregation on islands in the Arabian Sea off Oman (Ross 1979, Ehrhart 1989, NMFS and USFWS 1991b). The global importance of the southeast U.S. nesting aggregation is especially important because the status of the Oman colony has not been evaluated recently. It is located in an area of the world where it is highly vulnerable to disruptive events such as political upheavals, wars, catastrophic oil spills, and lack of strong protections (Meylan et al. 1995).

Ongoing threats to the western Atlantic populations include incidental takes from dredging, commercial trawling, longline fisheries, and gill net fisheries; loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and disease.

Green Sea Turtle

The vast majority of green turtle nesting within the southeast United States occurs in Florida. In Florida from 1989-1999, green turtle abundance from nest counts ranges from 109-1,389 nesting females per year (Meylan et al. 1995 and Florida Marine Research Institute Statewide Nesting 2001 Database, unpublished data; estimates assume 4 nests per female per year, Johnson and Ehrhart 1994). High biennial variation and a predominant 2-year re-migration interval (Witherington and Ehrhart 1989, Johnson and Ehrhart 1994) warrant combining even and odd years into 2-year cohorts. This gives an estimate of total nesting females that ranges from 705-1,509 during the period 1990-1999. It is important to note that because methodological limitations make the clutch frequency number (4 nests/female/year) an underestimate (by as great as 50%), a more conservative estimate is 470-1,509 nesting females in Florida between 1990 and 1999. In Florida during the period 1989-1999, numbers of green turtle nests by year show no trend. However, odd-even year cohorts of nests do show a significant increase during the period 1990-1999 (Florida Marine Research Institute Statewide Nesting 2001 Database, unpublished data).

It is unclear how greatly green turtle nesting in the whole of Florida has been reduced from historical levels (Dodd 1981), although one account indicates that nesting in Florida's Dry Tortugas may now be only a small fraction of what it once was (Audubon 1926). Total nest counts and trends at index beach sites during the past decade suggest that green turtles that nest within the southeast United States are recovering and have only recently reached a level of approximately 1,000 nesting females. There are no reliable estimates of the number of green turtles inhabiting foraging areas within the southeast United States, and it is likely that green turtles foraging in the region come from multiple genetic stocks. These trends are also uncertain because of a lack of data. However, there is one sampling area in the region with a large time series of constant turtle-capture effort that may represent trends for a limited area within the region. This sampling area is at an intake canal for a power plant on the Atlantic coast of Florida where 2,578 green turtles have been captured during the period 1977-1999 (FPL 2000). At the power plant, the annual number of immature green turtle captures (minimum straight-line carapace length < 85 cm) has increased significantly during the 23-year period.

Status of immature green turtles foraging in the southeast United States might also be assessed from trends at nesting beaches where many of the turtles originated, principally, Florida, Yucatán, and

Tortuguero. Trends at Florida beaches are presented above. Trends in nesting at Yucatán beaches cannot be assessed because of irregularity in beach survey methods over time. Trends at Tortuguero (ca. 20,000-50,000 nests/year) show a significant increase in nesting during the period 1971-1996 (Bjorndal et al. 1999).

The principal cause of past declines and extirpations of green turtle assemblages has been the over-exploitation of green turtles for food and other products. Although intentional take of green turtles and their eggs is not extensive within the southeast United States, green turtles that nest and forage in the region may spend large portions of their life history outside the region and outside United States jurisdiction, where exploitation is still a threat. Adult green turtles and immatures are exploited heavily on foraging grounds off Nicaragua and to a lesser extent off Colombia, Mexico, Panama, Venezuela, and the Tortuguero nesting beach (Carr et al. 1978, Nietschmann 1982, Bass et al. 1998, Lagueux 1998).

There are significant and ongoing threats to green turtles from human-related causes. Threats to nesting beaches in the region include beach armoring, erosion control, artificial lighting, and disturbance, which can be expected to increase with time. Pollution is known to have both direct (ingestion of foreign materials such as tar balls and plastics) and indirect (degradation of foraging grounds) impacts on green sea turtles. Foraging habitat loss also occurs as a result of direct destruction by dredging, siltation, boat damage, and other human activities. Green turtles are often captured and occasionally killed by interactions with fishing gear. Collisions with power boats and encounters with suction dredges have killed green turtles along the U.S. coast and may be common elsewhere where boating and dredging activities are frequent (Florida Marine Research Institute, Sea Turtle Stranding and Salvage Network Database). Threats from increasing incidences of disease, which may or may not have some relation to human influences, are also a concern. The occurrence of green turtle fibropapillomatosis disease was originally reported in the 1930s, when it was thought to be rare (Smith and Coates 1938). Presently, this disease is cosmopolitan and has been found to affect large numbers of animals in some areas, including Hawaii and Florida (Herbst 1994, Jacobson 1990; Jacobson et al. 1991).

Kemp's Ridley Sea Turtle

L. kempii has a very restricted distribution relative to the other sea turtle species. Data suggests that adult Kemp's ridley turtles are restricted somewhat to the Gulf of Mexico in shallow near shore waters, and benthic immature turtles of 20-60 cm straight line carapace length are found in nearshore coastal waters including estuaries of the Gulf of Mexico and the Atlantic, although adult-sized individuals sometimes are found on the Eastern Seaboard of the United States. The post-pelagic stages are commonly found dwelling over crab-rich sandy or muddy bottoms. Juveniles frequent bays, coastal lagoons, and river mouths.

Of the seven extant species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the Rancho Nuevo beaches (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the early 1970s, the world population estimate of mature female Kemp's ridleys had been reduced to 2,500-5,000 individuals. The population declined further through the mid-1980s. Recent observations of increased nesting suggest that the decline in the ridley population has stopped and the population is now increasing.

The TEWG (1998) identified three population trends in benthic immature ridleys. Benthic immatures are not yet reproductively mature but have recruited to feed in the nearshore benthic environment, where they are exposed to nearshore mortality sources that often result in strandings. Increased production of hatchlings from the nesting beach beginning in 1966 resulted in an increase in benthic ridleys that leveled off in the late 1970s. A second period of increase followed by leveling occurred between 1978 and 1989 as hatchling production was further enhanced by the cooperative program between the U.S. Fish and Wildlife Service and Mexico's Instituto Nacional de Pesca to increase the nest protection and relocation program in 1978. A third period of steady increase, which has not leveled off to date, has occurred since 1990 and appears to be due to the greatly increased hatchling production and an apparent increase in survival rates of immature turtles beginning in 1990, due in part to the introduction of turtle excluder devices (TEDs) in the U.S. and Mexican shrimping fleets. Adult ridley numbers have now grown, as shown in nesting increases at the main nesting sites in Mexico. Nesting at Tamaulipas and Veracruz increased from a low of 702 nests in 1985, to 1,930 nests in 1995, to 6,277 nests in 2000 (USFWS 2000). The population model used by the TEWG (1998) projected that Kemp's ridleys could reach the intermediate recovery goal identified in the Recovery Plan, of 10,000 nesters by the year 2020 if the assumptions of age to sexual maturity and age specific survivorship rates used in their model are correct.

The largest contributor to the decline of the ridley in the past was commercial and local exploitation, especially poaching of nests at the Rancho Nuevo site, as well as the Gulf of Mexico trawl fisheries. The advent of TED regulations for trawlers and protections for the nesting beaches have allowed the species to begin to rebound. Many threats to the future of the species remain, including interactions with fishery gear, marine pollution, foraging habitat destruction, illegal poaching of nests and potential threats to the nesting beaches from such sources as global climate change, development, and tourism pressures.

Leatherback Sea Turtle

Leatherbacks are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, Caribbean, and the Gulf of Mexico (Ernst and Barbour 1972). The leatherback is the largest living turtle and it ranges farther than any other sea turtle species, exhibiting broad thermal tolerances (NMFS and USFWS 1995). Genetic analyses of leatherbacks to date indicate that within the Atlantic basin significant genetic differences occur among St. Croix (U.S. Virgin Islands), and mainland Caribbean populations (Florida, Costa Rica, Suriname/French Guiana) and between Trinidad and the mainland Caribbean populations (Dutton et al. 1999) leading to the conclusion that there are at least three separate subpopulations of leatherbacks in the Atlantic.

Nest counts are the only reliable population information available for leatherback turtles. Recent declines have been seen in the number of leatherbacks nesting worldwide (NMFS and USFWS 1995). A population estimate of 34,500 females (26,200-42,900) was made by Spotila et al. (1996), who stated that the species as a whole was declining and local populations were in danger of extinction. Historically, it was due primarily to intense exploitation of the eggs (Ross 1979) but adult mortality has increased significantly from interactions with fishery gear (Spotila et al. 1996). The Pacific population is in a critical state of decline, now estimated to number less than 3,000 total adult and subadult animals (Spotila et al. 2000). The status of the Atlantic population is less clear. In 1996, it was reported to be stable, at best (Spotila et al. 1996), but numbers in the western Atlantic at that time were reported to be on the order of 18,800 nesting females. According to Spotila (pers. comm.), the western Atlantic population currently numbers about 15,000 nesting females, whereas current estimates for the Caribbean (4,000) and the eastern Atlantic, off Africa, (numbering ca. 4,700) have remained consistent with numbers reported by Spotila et al. in 1996.

The nesting aggregation in French Guiana has been declining at about 15% per year since 1987. From 1979-1986, the number of nests was increasing at about 15% annually. The number of nests in Florida and the U.S. Caribbean has been increasing at about 10.3% and 7.5%, respectively, per year since the early 1980s but the magnitude of nesting is much smaller than that along the French Guiana coast (see NMFS SEFSC 2001). In summary, the conflicting information regarding the status of Atlantic leatherbacks makes it difficult to conclude whether or not the population is currently in decline. Numbers at some nesting sites are up, while at others they are down.

Zug and Parham (1996) pointed out that the combination of the loss of long-lived adults in fishery-related mortality (especially entanglement in gear and drowning in trawls), and the lack of recruitment stemming from elimination of annual influxes of hatchlings because of intense egg harvesting, has caused the sharp decline in leatherback populations. Other important ongoing threats to the population include pollution, loss of nesting habitat, and boat strikes.

Hawksbill Sea Turtle

The hawksbill is a medium-sized sea turtle with adults in the Caribbean ranging in size from approximately 62.5 to 94.0 cm straight carapace length. The species occurs in all ocean basins although it is relatively rare in the Eastern Atlantic and Eastern Pacific, and absent from the Mediterranean Sea. Hawksbills are the most tropical of the marine turtles, ranging from approximately 30°N to 30°S. They are closely associated with coral reefs and other hard-bottom habitats, but they are also found in other habitats including inlets, bays and coastal lagoons. The diet is highly specialized and consists primarily of sponges (Meylan 1988) although other food items, notably corallimorphs and zooanthids, have been documented to be important in some areas of the Caribbean (van Dam and Díez 1997, Mayor et al. 1998, León and Díez 2000).

In the Western Atlantic, the largest hawksbill nesting population occurs in the Yucatán Península of Mexico, where several thousand nests are recorded annually in the states of Campeche, Yucatán, and Quintana Roo (Garduño-Andrade et al. 1999). Important but significantly smaller nesting aggregations are documented elsewhere in the region in Puerto Rico, the U.S. Virgin Islands, Antigua, Barbados, Costa Rica, Cuba, and Jamaica (Meylan 1999a). Estimates of the annual number of nests for each of these areas are of the order of hundreds to a few thousand. Nesting within the southeastern U.S. and U.S. Caribbean is restricted to Puerto Rico (>650 nests/yr), the U.S. Virgin Islands (~400 nests/yr), and, rarely, Florida (0-4 nests/yr)(Eckert 1995, Meylan 1999a, Florida Statewide Nesting Beach Survey database). At the two principal nesting beaches in the U.S. Caribbean where long-term monitoring has been carried out, populations appear to be increasing (Mona Island, Puerto Rico) or stable (Buck Island Reef National Monument, St. Croix, USVI) (Meylan 1999a).

E. Analysis of the Species Likely to be Affected

NOAA Fisheries believes that all five species of sea turtles may be potentially affected by the proposed action since all are susceptible to hopper dredge entrainment, and therefore, will further consider them in the remaining sections of this Opinion.

III. Environmental Baseline

This section contains an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, their habitat (including designated critical habitat), and ecosystem, within the action area. The environmental baseline is a snapshot of a species' health at a specified point in time and includes state, tribal, local and private actions already affecting the species, or that will occur contemporaneously with the consultation in progress. Unrelated Federal actions affecting the same species or critical habitat that have completed formal or informal consultation are also part of the environmental baseline, as are Federal and other actions within the action area that may benefit listed species or critical habitat.

The environmental baseline for this Opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species in the action area. The activities that shape the environmental baseline in the action area of this consultation generally fall into the following three categories: vessel operations, fisheries, and recovery activities associated with reducing those impacts. Other environmental impacts include effects of discharges, dredging, military activities, oil and gas development activities, industrial cooling water intake, aquaculture, recreational fishing, and marine debris.

A. Status of the species within the action area

The five species of sea turtles that occur in the action area are all highly migratory. NOAA Fisheries believes that no individual members of any of the species are likely to be year-round residents of the action area. Individual animals will make migrations into nearshore waters as well as other areas of the North Atlantic Ocean, Gulf of Mexico, and the Caribbean Sea. Therefore, the range-wide status of the five species of sea turtles, given in Section II above, most accurately reflects the species' status within the action area.

B. Factors affecting species environment within the action area.

As explained above, sea turtles found in the action area are not year-round residents of the area, and may travel widely throughout the Atlantic, Gulf of Mexico, and Caribbean Sea. Therefore, individuals found in the action area (Corpus Christi Bay and associated nearshore waters) can potentially be affected by activities anywhere else within this wide range.

Federal Actions

In recent years, NOAA Fisheries has undertaken several ESA section 7 consultations to address the effects of federally-permitted fisheries and other Federal actions on threatened and endangered species. Each of those consultations sought to develop ways of reducing the probability of adverse effects of the action on sea turtles. Similarly, recovery actions NOAA Fisheries has undertaken under the ESA are addressing the problem of take of sea turtles in the fishing and shipping industries. The following summary of anticipated sources of incidental take of turtles includes only those Federal actions which have undergone formal section 7 consultation.

Potential adverse effects from Federal vessel operations in the action area and throughout the range of sea turtles include operations of the Navy (USN) and Coast Guard (USCG), the Environmental

Protection Agency, the National Oceanic and Atmospheric Administration (NOAA), and the COE. NOAA Fisheries has conducted formal consultations with the USCG, the USN, and NOAA on their vessel operations. Through the section 7 process, where applicable, NOAA Fisheries has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. At the present time, however, they represent potential for some level of interaction.

In addition to vessel operations, other military activities including training exercises and ordnance detonation also affect sea turtles. Consultations on individual activities have been completed, but no formal consultation on overall USCG or USN activities in any region has been completed at this time.

The construction and maintenance of Federal navigation channels has also been identified as a source of turtle mortality. Hopper dredges move relatively rapidly (compared to sea turtle swimming speeds) and can entrain and kill sea turtles, presumably as the drag arm of the moving dredge overtakes the slower moving turtle. A RBO with the COE's South Atlantic Division has been completed for the southeast Atlantic waters. Consultation on a new RBO for the COE's Gulf of Mexico hopper dredging operations is currently underway.

The COE and Minerals Management Service (MMS) (the latter is non-military) oil and gas exploration, well development, production, and abandonment/rig removal activities also adversely affect sea turtles. Both of these agencies have consulted with NOAA Fisheries on these types of activities. A biological opinion on the impacts of seismic arrays for oil and gas exploration in the Gulf of Mexico is currently being developed.

Adverse effects on threatened and endangered species from several types of fishing gear occur in the action area. Efforts to reduce the adverse effects of commercial fisheries are addressed through the ESA section 7 process. Gillnet, longline, trawl gear, and pot fisheries have all been documented as interacting with sea turtles. For all fisheries for which there is a Federal fishery management plan (FMP) or for which any Federal action is taken to manage that fishery, impacts have been evaluated under section 7. Several formal consultations have been conducted on the following fisheries that NOAA Fisheries has determined are likely to adversely affect threatened and endangered species: American lobster, monkfish, dogfish, southeastern shrimp trawl fishery, northeast multispecies, Atlantic pelagic swordfish/tuna/shark, and summer flounder/scup/black sea bass fisheries. Formal consultation is currently underway for the calico scallop trawl fishery.

On June 14, 2001, NOAA Fisheries issued a jeopardy opinion for the Highly Migratory Species (HMS) fisheries off the eastern United States. The HMS Opinion found that the continued prosecution of the pelagic longline fishery in the manner described in the HMS FMP was likely to jeopardize the continued existence of loggerhead and leatherback sea turtles. This determination was made by analyzing the effects of the fishery on sea turtles in conjunction with the environmental baseline and cumulative effects. The environmental baseline section of the HMS opinion is incorporated herein by reference and can be found at the following NOAA Fisheries website:

http://www.nmfs.noaa.gov/prot_res/readingrm/ESAsec7/HMS060801final.pdf

The environmental baseline for the June 14, 2001, HMS Opinion also considered the impacts from the North Carolina offshore spring monkfish gillnet fishery and the inshore fall southern flounder gillnet fishery, both of which were responsible for large numbers of sea turtle mortalities in 1999 and 2000, especially loggerhead sea turtles. However, during the 2001 season NOAA Fisheries implemented an observer program that observed 100% of the effort in the monkfish fishery, and then in 2002 a rule was enacted creating a seasonal monkfish gillnet closure along the Atlantic coast based upon sea surface temperature data and turtle migration patterns. In 2001, NOAA Fisheries also issued an ESA section 10 permit with mitigative measures for the southern flounder fishery. Subsequently the sea turtle mortalities in these fisheries were drastically reduced. The reduction of turtle mortalities in these fisheries reduces the negative effects these fisheries have on the environmental baseline.

NOAA Fisheries has implemented a reasonable and prudent alternative (RPA) in the HMS fishery which would allow the continuation of the pelagic longline fishery without jeopardizing the continued existence of loggerhead and leatherback sea turtles. The provisions of this RPA include the closure of the Grand Banks region off the northeast United States and gear restrictions that are expected to reduce the by-catch of loggerheads by as much as 76% and leatherbacks by as much as 65%. Further, NOAA Fisheries is implementing a major research project to develop measures aimed at further reducing longline by-catch. The implementation of this RPA reduces the negative effects that the HMS fishery has on the environmental baseline. The conclusions of the June 14, 2001, HMS Opinion and the subsequent implementation of the RPA are hereby incorporated into the environmental baseline section of this Opinion.

Another action with Federal oversight which has impacts on sea turtles is the operation of electrical generating plants. Sea turtles entering coastal or inshore areas have been affected by entrainment in the cooling-water systems of electrical generating plants. Biological opinions have already been written for a number of electrical generating plants, and others are currently undergoing section 7 consultation.

State or Private Actions

Commercial traffic and recreational pursuits can have an adverse effect on sea turtles through propeller and boat strike damage. Private vessels participate in high speed marine events concentrated in the southeastern United States and are a particular threat to sea turtles, and occasionally to marine mammals as well. The magnitude of these marine events is not currently known. NOAA Fisheries and the USCG are in early consultation on these events, but a thorough analysis has not been completed.

Various fishing methods used in state fisheries, including trawling, pot fisheries, fly nets, and gillnets are known to cause interactions with sea turtles. Georgia and South Carolina prohibit gillnets for all but the shad fishery. Florida has banned all but very small nets in state waters, as has Texas. Louisiana, Mississippi, and Alabama have also placed restrictions on gillnet fisheries within state waters such that very little commercial gillnetting takes place in southeast waters, with the exception of North Carolina. Most pot fisheries in the Southeast are prosecuted in areas frequented by sea turtles.

Other Potential Sources of Impacts in the Environmental Baseline

A number of activities that may indirectly affect listed species include discharges from wastewater systems, dredging, ocean dumping and disposal, and aquaculture. The impacts from these activities are difficult to measure. Where possible, however, conservation actions are being implemented to monitor or study impacts from these elusive sources.

NOAA Fisheries and the USN have been working cooperatively to establish a policy for monitoring and managing acoustic impacts from anthropogenic sound sources in the marine environment. Acoustic impacts can include temporary or permanent injury, habitat exclusion, habituation, and disruption of other normal behavior patterns.

Conservation and Recovery Actions Shaping the Environmental Baseline

NOAA Fisheries implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial fisheries. In particular, NOAA Fisheries has required the use of TEDs in southeast U.S. shrimp trawls since 1989 and in summer flounder trawls in the mid-Atlantic area (south of Cape Charles, Virginia) since 1992. It has been estimated that TEDs exclude 97% of the turtles caught in such trawls. These regulations have been refined over the years to ensure that TED effectiveness is maximized through proper placement and installation, configuration (e.g., width of bar spacing), floatation, and more widespread use. Recent analyses by Epperly and Teas (1999) indicate that the minimum requirements for the escape opening dimensions are too small, and that as many as 47% of the loggerheads stranding annually along the Atlantic seaboard and Gulf of Mexico were too large to fit through existing openings. On October 2, 2001, NOAA Fisheries published a proposed rule to require larger escape openings in TEDs and is planning to publish a final rule in 2002.

In 1993 (with a final rule implemented 1995), NOAA Fisheries established a Leatherback Conservation Zone to restrict shrimp trawl activities from the coast of Cape Canaveral, Florida, to the North Carolina/Virginia border. This provides for short-term closures when high concentrations of normally pelagic-distributed leatherbacks are recorded in more coastal waters where the shrimp fleet operates. This measure is necessary because, due to their size, adult leatherbacks are larger than the escape openings of most NOAA Fisheries-approved TEDs.

NOAA Fisheries is also working to develop a TED which can be effectively used in a type of trawl known as a fly net, which is sometimes used in the mid-Atlantic and northeast fisheries to target sciaenids and bluefish. Limited observer data indicate that takes can be quite high in this fishery. A prototype design has been developed, but testing under commercial conditions is still necessary.

In addition, NOAA Fisheries has been active in public outreach efforts to educate fishermen regarding sea turtle handling and resuscitation techniques. As well as making this information widely available to all fishermen, NOAA Fisheries recently conducted a number of workshops with longline fishermen to discuss bycatch issues including protected species, and to educate them regarding handling and release guidelines. NOAA Fisheries intends to continue these outreach efforts and hopes to reach all fishermen participating in the pelagic longline fishery over the next one to two years. There is also an extensive network of Sea Turtle Stranding and Salvage Network participants along the Atlantic and Gulf of Mexico which not only collects data on dead sea turtles, but also rescues and rehabilitates any live stranded turtles.

IV. Effects of the Action

A. Factors considered and analyses for effects of the action

- **Water quality** impacts as a direct and indirect result of this project were considered. Impacts from sediment disturbance as a result of the proposed action are expected to be temporary, with suspended particles settling out within a short time frame. These sediment disturbance impacts will be minimal in nature and will not have a significant effect on sea turtles. Additionally, past sampling of water column and elutriate chemistry in various locations within the project area demonstrated that dredging is not likely to significantly impact water quality. Potential changes in salinity and tidal amplitude are expected to be minimal. NOAA Fisheries does not expect significant impacts to sea turtles as a result of water quality impacts related to this project.

- **Habitat loss** can potentially occur as a direct result of dredging and through disposal of dredged materials. There is no designated critical habitat under NOAA Fisheries jurisdiction in the Gulf of Mexico; therefore, critical habitat is not likely to be destroyed or adversely modified by the proposed action. Channel widening and deepening will modify existing sea bottom and modify available foraging habitat for sea turtles. Mitigation plans call for the creation of seagrass habitat and shallow water habitat to offset the loss of shallow water bay bottom. Although potential long term positive impact may occur due to creation of shallow water habitat from dredged material and development of marsh submerged aquatic vegetation, negative impacts will occur as a result of physical changes in the bay due to deposition of dredged material and change in hydrodynamics from creation of channels. Through recruitment and local migrations, finfish, crustaceans, and benthic invertebrates that sea turtles feed on are expected to eventually repopulate the affected area. Habitat loss impacts as a result of this project are expected to be minimal to sea turtles and will not have a significant effect on them.

- **Dredge entrainment** is a documented source of sea turtle mortality. NOAA Fisheries believes that hopper dredging conducted within state waters of the Gulf of Mexico–especially between April and November, or when water temperatures are above 12°C–is a high risk for taking sea turtles, especially Kemp's ridleys. Injuries sustained by sea turtles entrained in the hopper dredge dragheads are usually fatal. Consequently, NOAA Fisheries believes that seasonal dredging windows and observer monitoring requirements for hopper dredges are necessary to minimize lethal takes of listed sea turtle species that occur in inshore and nearshore Gulf waters. These dredging windows have been in effect since 1995 for the COE's Galveston and New Orleans districts, as well as in the COE's South Atlantic Division districts, and have proven effective in keeping sea turtle take levels below the limits established in their respective biological opinion's incidental take statements. Based upon information from past dredging work, other biological opinions, the specifics of this project, and the assumption that all terms and conditions specified in the ITS will be adhered to, NOAA Fisheries expects injury or mortality of **three (3)** Kemp's ridleys, **three (3)** green turtles, **one (1)** hawksbill, and **five (5)** loggerhead turtles annually as a result of hopper dredging associated with the proposed project.

B. Species' response to the proposed action

Based on the year-round presence of sea turtles in the action area, it can be expected that the proposed action involving hopper dredging may result in the entrainment of sea turtles. Such entrainment can be expected to result in mortality of the individuals captured by the draghead.

Recent satellite telemetry work funded by COE and conducted by NOAA Fisheries' Galveston Laboratory, demonstrates the nearshore occurrence of Kemp's ridleys near northern Gulf channels. Ridleys remained within 10 nautical miles of shore for greater than 95% of the observed time, with 90% of the observed locations within 5 nautical miles (Renaud, NOAA Fisheries Galveston Laboratory, pers. comm.). Movements out of northern Gulf waters in response to cooling temperatures occurred during December, and ridleys returned with warming waters in March.

Seasonal abundance of sea turtles utilizing nearshore waters of the northwest Gulf of Mexico varies with species and location. Green turtles within subtropical habitats of the Laguna Madre are the region's only year-round, nearshore occupant. Other species, especially the Kemp's ridley, are transient users of the coastal zone who venture toward tidal passes and into bays during May-August when food sources and other environmental factors are favorable. The May-August period has yielded over 80% of the sea turtle captures (N=516) recorded by Texas A&M researchers (Landry et al., 1997).

NOAA Fisheries believes that hopper dredging conducted in state waters, especially between April and November, or when water temperatures are above 12 degrees Celsius, is a high risk for taking sea turtles, especially Kemp's ridleys. Injuries sustained by sea turtles entrained in the hopper dredge dragheads are usually fatal. Seasonal and observer monitoring requirements for hopper dredges are necessary to minimize effects of these removals on Kemp's ridleys and other listed sea turtle species that occur in inshore and nearshore northern Gulf waters.

NOAA Fisheries has requested the COE, in previous and present hopper dredging consultations by Galveston and New Orleans Districts, to conduct studies on seasonal abundance of sea turtles in Gulf channels, and to continue research to develop improved ('turtle-friendly') dredge draghead designs. NOAA Fisheries has previously indicated to the COE, and again in this consultation (Conservation Recommendation No. 1), that such seasonal abundance studies or new designs of a more effective draghead (to exclude turtles), if substantiated by adequate scientific data, could form the basis for relaxing the seasonal restrictions and observer requirements listed in the Incidental Take Statement of this biological opinion. Any future requests by the COE to lessen the dredging restriction on this project, based on submissions of new sea turtle distribution, temperature and draghead design data, will be carefully considered by NOAA Fisheries at that time to ensure that, if restrictions are relaxed, listed sea turtles will not be jeopardized.

V. Cumulative Effects

Cumulative effects are the effects of future state, local, or private activities that are reasonably certain to occur within the action area or within the range of sea turtles. Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Within the action area, major future changes are not anticipated in the ongoing human activities described in the environmental baseline. The present, major human uses of the action area are expected to continue at the present levels of intensity in the near future. Listed species of turtles, however, migrate throughout the Atlantic Ocean and Gulf of Mexico and may be affected during their life cycles by non-Federal activities outside the action area.

Throughout the coastal Gulf of Mexico the loss of thousand of acres of wetlands is occurring due to natural subsidence and erosion, as well as reduced sediment input from the Mississippi River. Impacts caused by residential, commercial, and agricultural developments appear to be the primary causes of wetland loss in Texas.

Oil spills from tankers transporting foreign oil, as well as the illegal discharge of oil and tar from vessels discharging bilge water will continue to affect water quality in the Gulf of Mexico, including Texas inshore and nearshore waters. Cumulatively, these sources and natural oil seepage contribute most of the oil discharged into the Gulf of Mexico. Floating tar sampled during the 1970s, when bilge discharge was still legal, concluded that up to 60% of the pelagic tars sampled did not originate from northern Gulf of Mexico coast.

Marine debris will likely persist in the action area in spite of MARPOL prohibitions. In Texas and Florida, approximately half of the stranded turtles examined have ingested marine debris (Plotkin and Amos 1990; Bolten and Bjorndal 1991). Although fewer individual are affected, entanglement in marine debris may contribute more frequently to the death of sea turtles.

Coastal runoff and river discharges carry large volumes of petrochemical and other contaminants from agricultural activities, cities, and industries into the Gulf of Mexico. The coastal waters of the Gulf of Mexico have more sites with high contaminant concentrations than other areas of the coastal United States, due to the large number of waste discharge point sources. The species of turtles analyzed in this biological opinion may be exposed to and accumulate these contaminants during their life cycles.

Beachfront development, lighting, and beach erosion control all are ongoing activities along the Atlantic and Gulf coasts. These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, as conservation awareness spreads, more and more coastal cities and counties are adopting more stringent measures to protect hatchling sea turtles from the disorienting effects of beach lighting.

State-regulated commercial and recreational fishing activities in Atlantic Ocean and Gulf of Mexico waters currently result in the incidental take of threatened and endangered species. It is expected that states will continue to license/permit large vessel and thrill-craft operations which do not fall under the purview of a Federal agency, and issue regulations that will affect fishery activities. Any increase in recreational vessel activity in inshore and offshore waters of the Gulf of Mexico and Atlantic Ocean will likely increase the number of turtles taken by injury or mortality in vessel collisions. Recreational hook-and-line fisheries have been known to lethally take sea turtles. Future cooperation between NOAA Fisheries and the states on these issues should help decrease take of sea turtles caused by recreational activities. NOAA Fisheries will continue to work with coastal states to develop and refine ESA section 6 agreements and section 10 permits to enhance programs to quantify and mitigate these takes.

VI. Conclusion

After reviewing the current status of endangered green, leatherback, hawksbill, and Kemp's ridley sea turtles and threatened loggerhead sea turtles in the proposed action area, the environmental baseline, the effects of the proposed action, and the cumulative effects, it is NOAA Fisheries' biological opinion that the implementation of the proposed action, as described in the Proposed Action section of this Opinion, is not likely to jeopardize the continued existence of endangered green, leatherback, hawksbill, or Kemp's ridley sea turtles, or threatened loggerhead sea turtles. No critical habitat has been designated for these species within the action area; therefore, none will be affected.

Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary and must be undertaken by the COE so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The COE has a continuing duty to regulate the activity covered by this incidental take statement. If the COE fails to assume and implement the terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the COE must report the progress of the action and its impact on the species to NOAA Fisheries as specified in the incidental take statement. [50 CFR 402.14 (i) (3)]

Only incidental taking resulting from the agency action, including incidental takings caused by activities approved by the agency, that are identified in this statement and that comply with the specified reasonable and prudent alternatives, and terms and conditions, are exempt from the takings prohibition of section 9 (a), pursuant to section 7 of the ESA.

Amount or Extent of Anticipated Take

NOAA Fisheries foresees that hopper dredging activities in Corpus Christi Ship Channel Improvement Project navigation channels may result in the injury or mortality of loggerhead, Kemp's ridley, green and hawksbill turtles. While it is difficult to ascertain future take of sea turtles because of the inherent variability caused by seasonal, annual, and localized variations in sea turtle densities, and other factors, NOAA Fisheries bases the estimated anticipated take levels during new dredging (i.e. channel widening, deepening, and lengthening) on the following:

1. Previous sea turtle takes during Atlantic and Gulf of Mexico maintenance dredging, new work hopper dredging, and sand mining operations by the COE's New Orleans, Galveston, Jacksonville, Charleston, and Wilmington Districts, including dredging of southeastern U.S. channels, and Brazos Santiago Pass, Mansfield Channel, Aransas Pass, Freeport Channel, and Bolivar Roads Pass, Texas (see Appendix for tables summarizing previous hopper dredging takes in the Galveston District since the 1995 RBO);
2. The level of take anticipated in previous hopper dredging Opinions; and
3. COE adherence to recommended dredging windows and other terms and condition.

Therefore, pursuant to section 7(b)(4) of the ESA, NOAA Fisheries anticipates an annual incidental take as described below:

> For the Corpus Christi Ship Channel Improvement Project navigation channel reaches referred to in this Opinion and statement as the entrance channel nearshore Outer Bar Reach (OBR) including the extension of the Outer Bar reach, and the inshore Jetty Reach channel (JRC), the anticipated annual incidental take, by injury or mortality, of **three (3)** Kemp's ridleys, **three (3)** green turtles,

one (1) hawksbill, and **five (5)** loggerhead turtles, is set pursuant to section 7 (b) (4) and the ESA. This take level represents a total anticipated take per fiscal or calendar year for all channel deepening, lengthening, and widening by hopper dredge of the Corpus Christi Ship Channel Improvement Project. If the actual incidental take exceeds this level, reinitiation of formal consultation must immediately be requested. The above annual totals are for new work only. Any takes during maintenance dredging will be counted against the allowable take for the 1995 Gulf of Mexico maintenance dredging RBO (or the new RBO when finished).

Effect of the Take

NOAA Fisheries believes that the aforementioned level of anticipated take is not likely to appreciably reduce either the survival or recovery of hawksbill, Kemp's ridley, green, or loggerhead sea turtles in the wild by reducing their reproduction, numbers, or distribution, even if all incidental takes are from the same species. In particular, NOAA Fisheries does not expect activities associated with the proposed action, when added to ongoing activities affecting these species in the action area and cumulative effects, to affect sea turtles in a way that measurably or significantly reduces the number of animals born in a particular year (i.e., a specific age-class), the reproductive success of adult sea turtles, or the number of young sea turtles that annually recruit into the adult breeding population.

Reasonable and Prudent Measures

Regulations (50 CFR 402.02) implementing section 7 of the ESA define reasonable and prudent measures as actions the Director believes necessary or appropriate to minimize the impacts, i.e., amount or extent, of incidental take. The reasonable and prudent measures that NOAA Fisheries believes are necessary to minimize the impacts of hopper dredging in the Gulf of Mexico have been discussed with the COE, and have largely been incorporated in COE regulatory projects and COE civil works projects throughout the Gulf of Mexico (Mobile District projects excepted) and South Atlantic for almost a decade. These measures include use of temporal dredging windows, intake and overflow screening, use of sea turtle deflector dragheads, observer and reporting requirements, and sea turtle relocation/abundance trawling. The following terms and conditions are established to implement these measures, and to document incidental takes. Only incidental takes that occur while these measures are in full implementation are authorized. These restrictions remain valid until re-initiation and conclusion of any subsequent section 7 consultation.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the COE must comply, and require any of their contractors to comply, with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting and monitoring requirements. These terms and conditions are nondiscretionary.

1. Pipeline or hydraulic dredges must be used whenever possible between April 1 and November 30 in all Corpus Christi Ship Channel Improvement Project channels, since lethal takes of loggerheads have been documented using hopper dredges during summer months. The annual summary report, discussed below, must give a complete explanation of why alternative dredges were not used for dredging of channels during the April through November period.

2. Hopper dredging in the entrance channel JRC (the inshore section from the landward end of the Inner Basin to ½ mile seaward of the submerged end of the Aransas Pass jetties) and the OBR (the

nearshore section from ½ mile from the submerged end of the Aransas Pass jetties to the seaward end of the extension channel) shall be completed, whenever possible, between December 1 and March 31, when sea turtle abundance is lowest throughout Gulf coastal and inshore waters.

3. One-hundred percent observer coverage of hopper dredging operations by NOAA Fisheries-approved observers is required. The COE shall arrange for NOAA Fisheries-approved observers aboard hopper dredges to monitor the hopper spoil, screening, and dragheads for sea turtles and their remains, as appropriate. Observers shall be aboard hopper dredges whenever surface water temperatures are 12 degrees Celsius or greater, and between April 1 and November 30. Observer reports must be faxed to NOAA Fisheries' Southeast Regional Office (727-570-5517) within 24 hours of any sea turtle take observed. If no take is observed during December, observer coverage can be terminated until water temperature reaches 12 degrees Celsius or until April 1.

4. The COE shall maintain close communication with the Sea Turtle Stranding and Salvage Network (STSSN) state representative (contact information available at: http://www.sefsc.noaa.gov/seaturtleSTSSN.jsp) and NOAA Fisheries Galveston Laboratory in order to be advised of any sea turtle strandings in the project area that show possible signs of draghead impingement. This monitoring will give the COE and dredge operators an additional tool to know if they are taking sea turtles, enable them to better evaluate the effectiveness of the onboard observers and operations of the draghead deflector and pre-deflector, and provide additional information on sea turtle presence. This stranding data will be used to augment monitoring and for information purposes only. It will not count against the incidental take. The COE will provide NOAA Fisheries' Southeast Regional Office with quarterly reports summarizing beach observer reports of stranded sea turtles that may indicate draghead impingement.

5. During periods in which hopper dredges are operating and NOAA Fisheries-approved observers are not required (i.e., when surface water temperatures are less than 12 degrees Celsius, or between December 1 and March 31), the COE must:

   a. Advise inspectors, operators and vessel captains about the prohibitions on taking, harming, or harassing sea turtles, and the civil penalties that apply.

   b. Instruct the captain of the hopper dredge to avoid any turtles encountered while traveling between the dredge site and offshore disposal area, and to immediately contact the COE if sea turtles are seen in the vicinity.

   c. Notify NOAA Fisheries if sea turtles are observed in the dredging area, to coordinate further precautions to avoid impacts to turtles.

   d. Notify NOAA Fisheries immediately if a sea turtle is taken by the dredge.

6. When sea turtle observers are required on hopper dredges, in the areas and seasons that turtles may be present, 100% inflow screening of dredged material is required whenever possible, and 100% overflow screening is recommended. If conditions prevent 100% inflow screening, inflow screening may be reduced gradually, as further detailed in the following paragraph, but 100% overflow screening is then required. NOAA Fisheries must be consulted prior to the action and an explanation must be included in the dredging report.

The hopper's inflow screens should have 4-inch by 4-inch screening. If the COE, in consultation with observers and the draghead operator, determines that the draghead is clogging and reducing production substantially, the screens may be modified subsequently: mesh size may be increased to 6-inch by 6-inch, then 9-inch by 9-inch, then 12-inch by 12-inch openings. Clogging should be greatly reduced with these flexible options; however, further clogging may compel removal of the screening altogether, in which case effective 100% overflow screening is mandatory. The COE shall notify NOAA Fisheries beforehand if inflow screening is going to be reduced or eliminated, and provide details of how effective overflow screening will be achieved.

NOAA Fisheries agrees that these flexible graduated screening options are necessary, since the need to constantly clear the inflow screens will increase the time it takes to complete the project and therefore increase the exposure of sea turtles to the risk of impingement or entrainment. Additionally, there are increased risks to sea turtles in the water column when the inflow is halted to clear screens, since this results in clogged intake pipes that may have to be removed from the bottom to discharge the clay.

7. Every effort must be made to disengage dredging pumps when the dragheads are not firmly on the bottom to prevent impingement of sea turtles resting or feeding on the bottom, or in the water column. This precaution is especially important during the cleanup phase of dredging operations when the draghead frequently comes off the bottom and can suck in turtles resting in the shallow depressions between the high spots the draghead is trimming off.

8. The rigid sea turtle deflector draghead or the modified deflector draghead must be used on all hopper dredges operating in the Corpus Christi Ship Channel Improvement Project navigation channels. Other state-of-the-art designs will be considered for approval, prior to implementation, by NOAA Fisheries if shown to be of equal or greater effectiveness at excluding sea turtles.

9. Reporting: Observer reports of incidental take must be faxed to NOAA Fisheries Southeast Regional Office (727-570-5517) by onboard endangered species observers within 24 hours of any observed sea turtle take. A preliminary report summarizing the results of the dredging and any documented sea turtle takes must be submitted to NOAA Fisheries within 30 working days of completion of hopper dredging the entrance channel JRC or OBR. The report shall contain information on project location (specific channel/area dredged), start-up and completion dates, cubic yards of material dredged, problems encountered, incidental takes and sightings of protected species, mitigative actions taken, screening type (inflow, overflow) utilized, daily water temperatures, name of dredge, names of endangered species observers, percent observer coverage, and any other information the COE deems relevant.

   An annual report (based on either calendar or fiscal year) must be submitted to NOAA Fisheries summarizing hopper dredging results and documented incidental takes. Beach observer data provided by the STSSN or the Galveston Laboratory on stranded sea turtles showing evidence of draghead impingement should be included separately in the reach reports and yearly reports.

10. Relocation Trawling and Relative Abundance Trawling: Relocation trawling and relative abundance trawling in association with hopper dredging in the Corpus Christi Ship Channel Improvement Project navigation channels, conducted with NOAA Fisheries-approved endangered species observers, should be considered if: (a) takes are documented early in the project during a period in which large numbers of sea turtles may occur; (b) two or more turtles are taken in a 24-hour period;

(c) four or more turtles are taken per fiscal year of the project; (d) seawater temperatures are unseasonably warm; (e) large amounts of sea turtle prey species are being collected in the inflow screens; or (f) the authorized take limit for a particular species is close to being reached; (g) dredging is necessary outside the December 1 - March 31 window or when unseasonably warm temperatures exist during the window; (h) evidence exists indicating protected sea turtle species presence may be high; or (i) a combination of factors exists.

This Opinion authorizes the unlimited non-lethal, non-injurious take of sea turtles in association with assessment or relocation trawling deemed necessary by the COE to assess or temporarily reduce the abundance of these species prior to or during hopper dredging to reduce the possibility of lethal hopper dredge interactions, subject to the following conditions:

a. Trawl tow-time durations shall be limited to not longer than 30 minutes (doors in - doors out).

b. Turtles captured pursuant to assessment and relocation trawling shall be handled in a manner designed to ensure their safety and comfort.

c. Captured turtles shall be kept moist, and, whenever possible, shaded, until they are released.

d. Turtles shall not be kept longer than 12 hours prior to release and shall be released as far away as practicable from the dredge site.

e. All turtles shall be measured prior to release (standard carapace measurements including body depth and total length), and weighed when it is possible to do so safely.

f. All other tagging, external or internal sampling procedures (e.g., PIT tagging, blood letting, skin tag sampling, laparoscopies, gastric lavages, mounting satellite or radio transmitters, genetic sampling, etc.) for sea turtles are not permitted under this Opinion unless the observer holds a valid sea turtle research permit (pursuant to section 10 of the ESA, from the NOAA Fisheries Office of Protected Resources, Permits Division) authorizing the activity, either as the permit holder, or as a designated agent of the permit holder.

g. Any endangered species injured or killed during or as a consequence of relocation trawling shall count toward the project's incidental take quota. Minor skin abrasions resulting from trawl capture are considered "non-injurious."

NOAA Fisheries anticipates that no more than **three (3)** Kemp's ridleys, **three (3)** green turtles, **one (1)** hawksbill, and **five (5)** loggerhead turtles will be taken annually (lethal or non-lethal) as a result of this action (with the exception of relocation trawling, for which only lethal takes and serious injuries will be counted). The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If during the course of the action this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The COE must cease the permitted activity, immediately request initiation of formal consultation, provide an explanation of the causes of the taking, and review with NOAA Fisheries the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authority to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat to help implement recovery plans or to develop information.

(1) Channel-specific studies should be continued to identify the seasonal relative abundance of sea turtles within the Gulf channels. The dredging window and the associated observer requirements listed above may be adjusted (after consultation and authorization by NOAA Fisheries) on a channel specific basis, if (1) the COE can provide sufficient scientific evidence that turtles are not present or that levels of abundance are extremely low during other months of the year, or (2) the COE can identify seawater temperature regimes that ensure low abundance of sea turtles in coastal water, and can monitor water temperatures in a real-time manner.

(2) The Galveston District should continue to supplement the efforts of the South Atlantic Division and Waterways Experiment Station to develop possible modifications to existing dredges which might reduce or eliminate the take of sea turtles, as well as develop methods to minimize sea turtle take during "cleanup" operations when the draghead maintains only intermittent contact with the bottom. Some method that level the "peaks and valleys" created by dredging would reduce the amount of time dragheads are off the bottom. Valid, replicable studies to estimate the effectiveness of the rigid draghead deflector and modified draghead deflector should be conducted in concert with dredging activities using the deflector. NOAA Fisheries should be consulted regarding the development of a protocol for draghead evaluation test. This conservation recommendation, anticipating the necessity of testing the effectiveness of new draghead designs under carefully monitored conditions in channels where sea turtles are present, was listed in prior consultations conducted on channel dredging along the Atlantic coast and channel maintenance dredging in the New Orleans and Galveston Districts. If the COE can provide evidence that an engineering solution, such as the modified sea turtle deflecting draghead, is significantly effective at excluding sea turtles from hopper dredge entrainment, such information may also be considered in extending the dredging window

(3) NOAA Fisheries recommends that the Galveston District require that by the end of **2003** all dragheads on hopper dredges contracted by the COE for dredging projects in the Galveston District be outfitted with water ports located in the top of the dragheads or some other effective method to help prevent the dragheads from becoming plugged with sediments. When the dragheads become plugged with sediments, the dragheads are often raised off the bottom (by the dredge operator) with the suction pumps on, in order to take in enough water to help clear clogs in the dragarm pipeline. This increases the likelihood that sea turtles in the vicinity of the draghead will be taken by the dredge. Water ports located in the top of the dragheads may relieve the necessity of raising the draghead off the bottom to perform such an action, and reduce the likelihood of incidental take of sea turtles.

Reinitiation of Consultation

This concludes formal consultation on the Corpus Christi Ship Channel Improvement Project. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if (1) the amount or extent of taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the action that may affect listed species or critical habitat (when designated) in a manner or to an extent not previously considered, (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, the COE must immediately request reinitiation of formal consultation.

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Appendix. Summary of Takes by Hopper Dredges in the COE Galveston District since the 1995 RBO.

TABLE 1

MAINTENANCE DREDGING TURTLE TAKES BY FISCAL YEAR

Date Taken	Kemp's ridley	Loggerhead	Green	Hawksbill
Fiscal Year 1995				
Feb 19, 1995			1	
Feb 22, 1995			1	
Feb 26, 1995	1			
Aug 5, 1995	1			
Aug 31, 1995	1			
Sep 4, 1995	1			
Sep 16, 1995		1		
TOTAL FY 95	4	1	2	0
Fiscal Year 1996				
Oct 9, 1995		1		
Jun 28, 1996		1		
Jul 11, 1996		1		
Jul 13, 1996		1		
Jul 22, 1996		1		
TOTAL FY 96	0	5	0	0
Fiscal Year 1997				
Oct 13, 1996		1		
Mar 26, 1997	1			
Apr 29, 1997	1			
Jun 13, 1997		1		
TOTAL FY 97	2	2	0	0
Fiscal Year 1998				
TOTAL FY 98	0	0	0	0

Fiscal Year 1999				
Oct 29, 1998		1		
Feb 18, 1999			1	
Mar 2, 1999			1	
Jun 18, 1999		1		
Jun 19, 1999		1		
Jun 30, 1999		1		
TOTAL FY 99	0	4	2	0

Fiscal Year 2000				
Aug 10, 2000		1		
Aug 15, 2000		1		
TOTAL FY 00	0	2	0	0

Fiscal Year 2001				
TOTAL FY 01	0	0	0	0

Fiscal Year 2002				
Mar 18, 2002			1	
Mar 19, 2002			2	
Mar 20, 2002			1	
Aug 11, 2002		1		
TOTAL FY 02	0	1	4	0

TOTAL	6	15	8	0

TABLE 2

NEW-WORK DREDGING TURTLE TAKES BY FISCAL YEAR

Date Taken	Kemp's ridley	Loggerhead	Green	Hawksbill
Fiscal Year 1999				
Jan 4, 1999	1			
Sep 29, 1999			1	
TOTAL FY 99	1	0	1	0
Fiscal Year 2000				
TOTAL FY 00	0	0	0	0
TOTAL	1	0	1	0

TABLE 3

TURTLE TAKES BY PROJECT

Date Taken	Kemp's ridley	Loggerhead	Green	Hawksbill
Brazos Island Harbor				
Feb 19, 1995			1	
Feb 22, 1995			1	
Feb 26, 1995	1			
Apr 29, 1997	1			
Jun 13, 1997		1		
Feb 18, 1999			1	
Mar 2, 1999			1	
Mar 18, 2002			1	
Mar 19, 2002			1	
TOTAL	2	1	6	0
Corpus Christi Ship Channel				
Sep 16, 1995		1		
Jun 18, 1999		1		
Jun 19, 1999		1		
Jun 30, 1999		1		
TOTAL	0	4	0	0

TABLE 3

TURTLE TAKES BY PROJECT

Date Taken	Kemp's ridley	Loggerhead	Green	Hawksbill
Freeport Harbor				
Oct 9, 1995		1		
Jun 28, 1996		1		
Jul 11, 1996		1		
Jul 13, 1996		1		
Jul 22, 1996		1		
Oct 29, 1998		1		
Aug 10, 2000		1		
Aug 15, 2000		1		
TOTAL	0	8	0	0
Galveston Harbor and Channel /Houston-Galveston Navigation Channels				
Aug 15, 1995	1			
Aug 31, 1995	1			
Sep 4, 1995	1			
Jan 4, 1999	1			
Sep 29, 1999			1	
TOTAL	4	0	1	0
Matagorda Ship Channel				
Oct 13, 1996		1		
TOTAL	0	1	0	0
Sabine – Neches Waterway				
Mar 26, 1997	1			
Aug 11, 2002		1		
TOTAL	1	1	0	0
Port Mansfield Channel				
Mar 19, 2002			1	
Mar 20, 2002			1	
TOTAL	0	0	2	0

SECTION 3:

CULTURAL RESOURCES COORDINATION

March 31, 2000

Environmental Branch

James E. Bruseth, Ph.D.
Deputy State Historic
Preservation Officer
Texas Historical Commission
P.O. Box 12276
Austin, Texas 78711

Dear Dr. Bruseth:

The Galveston District, Corps of Engineers, and the Port of Corpus Christi Authority are currently conducting a feasibility study for proposed improvements to the Corpus Christi Ship Channel (CCSC) and the La Quinta Ship Channel (LQSC) and Turning Basin in Nueces and San Patricio Counties, Texas. With this letter, we would like to coordinate a draft scope of work for marine remote-sensing survey of submerged lands in Corpus Christi Bay and the Gulf of Mexico which may be affected by the project (Enclosure 1). Upland areas and open-bay placement areas which may be affected by the improvements are not fully identified at this time. They will be coordinated with your office at a later date.

This marine historic properties investigation is designed to cover impacts from the largest alternatives under study. For the CCSC, the largest alternative involves deepening the existing 40 mile-long channel from an authorized depth of 45 ft to 52 ft from the Corpus Christi Outer Bar channel to the Viola Turning Basin, and widening and deepening a 10-mile segment between the La Quinta Junction and Beacon 82 from the existing 400 ft to 550 feet. Placement areas for this construction have not yet been determined. For the LQSC, the largest alternative involves deepening the existing channel and turning basin from the currently authorized 45 ft to 50 ft and construction of a 1.4 mile 50-foot channel extension and new turning basin. The existing La Quinta placement area would be enlarged to contain material from channel and turning basin construction. The proposed alignments and survey areas are identified on the enclosed map (Enclosure 2).

A significant amount of archival research and marine remote-sensing survey have been conducted in the general project area in conjunction with our maintenance dredging program. All of this work was coordinated with your office and copies of the reports were furnished at that time. A list of the reports is provided in the reference section of the Scope of Work.

Four remote-sensing investigations (Hoyt, 1990; Hoyt and Schmidt, 1995; James and Pearson, 1991; Pearson and Simmons, 1995) have thoroughly investigated the jetty channel and, therefore, no additional survey from station -30+00 to +60+00 is recommended in conjunction with the proposed improvements. These surveys have documented the location of two shipwrecks adjacent to the south jetty. The remains of the *Utina* (41NU264), a wooden-hulled freighter constructed in 1920 by the Emergency Fleet Corporation, lie perpendicular to the channel at the eastern tip of the south jetty near Corps station 65+50. The results of archival research and mapping of the vessel's remains reported in Hoyt and Schmidt (1995) indicate that the wreck is not eligible for the National Register because of its extremely poor preservation. We concur with the report's recommendation and propose no further work in conjunction with the proposed project.

The remains of the *SS Mary* (41NU252, a shallow-draft sidewheel steamer built by the Morgan Steamship Line in 1866) lie on the plateau between the south jetty and the channel, extending down the channel's south slope near station +34+00. Based on extensive previous research and mapping (Hoyt, 1990; Pearson and Simmons 1995), the wreck has been determined eligible for National Register and listed as a State Archeological Landmark. In a letter dated June 7, 1994, your office accepted work done to date as data recovery for the on-going maintenance dredging of the jetty channel, but recommended avoidance of further impacts. In addition, your office asked that consultation be reopened should the *Mary* be threatened by channel widening or deepening. The currently proposed project to deepen the channel through this reach has the potential to adversely affect the *Mary*'s remains when deeper channel slopes slump to achieve equilibrium. However, inasmuch as the actual extent of impacts cannot be determined at this time, we recommend that consultation on the *Mary* be delayed until project dimensions are finalized in a recommended plan.

Historical/archival research has also documented the potential for additional significant historic shipwrecks in the Corpus Christi Bay area. The most significant of these are the Mexican war-era *Dayton* (a riverboat steamer built in 1835) and three Civil War-era shipwrecks (the sloop *Hanna*, the schooner *Elma*, and the steamer *A.Bee*). Because potentially significant shipwrecks could be impacted by the proposed improvements, the remote-sensing surveys have been designed to cover all new impact areas that have not been covered by prior investigations. The previous surveys covered the outer bar channel, the jetty channel, portions of the LQSC from station +55+00 to +130+00 and the CCSC from station 270+00 through 755+00. With the exception of the jetty channel, these surveys covered the authorized bottom width and the adjacent lower slopes of the channels, only. The upper channel slopes and top-of-cut were not surveyed. Therefore, we propose to survey a narrow impact zone on the upper slope and top-of-cut in CCSC and LQSC project areas where only deepening is proposed. For the channel segment across Corpus Christi Bay where both deepening and widening are proposed, we designed the survey area to account for all areas impacted by the

TEXAS HISTORICAL COMMISSION

The State Agency for Historic Preservation

GEORGE W. BUSH, GOVERNOR

JOHN L. NAU, III, CHAIRMAN

F. LAWERENCE OAKS, EXECUTIVE DIRECTOR

April 5, 2000

Ms Carolyn Murphy
Chief, Environmental Branch
US Army Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Re: Project review under Section 106 of the National Historic Preservation Act of 1966 and the Antiquities Code of Texas
Proposed Scope of Work, Marine Remote-Sensing Survey for Historic Properties, Corpus Christi Ship Channel Improvements and La Quinta Channel Improvements and Extension, Corpus Christi Bay, TX, Nueces and Aransas Counties.
COE-VD

Dear Ms Murphy:

Thank you for your correspondence describing the above referenced project. This letter serves as comment on the proposed federal undertaking from the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission. As the state agency responsible for administering the Antiquities Code of Texas, these comments also provide recommendations on compliance with state antiquities laws and regulations.

The review staff, led by State Marine Archeologist Steve Hoyt, has completed its review. The proposed Scope of Work for the project is adequate to address concerns about submerged archaeological resources within the project area. The only suggestion we might provide is to add a digital recording fathometer to the minimum remote-sensing equipment suite. Bathymetric data correlated to magnetic data helps to evaluate the latter through assessment of sensor-to-source distance.

We look forward to further consultation with your office and hope to maintain a partnership that will foster effective historic preservation. Thank you for your cooperation in this federal and state review process, and for your efforts to preserve the irreplaceable heritage of Texas. **If you have any questions concerning our review or if we can be of further assistance, please contact Steve Hoyt at (512) 463-7188.**

Sincerely,

Steven D Hoyt
for
F. Lawerence Oaks, State Historic Preservation Officer

May 9, 2001

Environmental Section

James E. Bruseth, Ph.D.
Deputy State Historic
Preservation Officer
Texas Historical Commission
P.O. Box 12276
Austin, Texas 78711

Dear Dr. Bruseth:

The Galveston District, Corps of Engineers, and the Port of Corpus Christi Authority are currently conducting a feasibility study for proposed improvements to the Corpus Christi Ship Channel (CCSC) and the La Quinta Ship Channel (LQSC) and Turning Basin in Nueces and San Patricio Counties, Texas. A marine remote-sensing survey of submerged lands and close-order survey of potentially significant anomalies which may be affected by the project have been completed. Draft letter reports describing the results of these surveys are provided as Enclosures 1 and 2. We would like to coordinate a scope of work for additional survey and diver assessments at this time. The results of the proposed investigations will be incorporated into one comprehensive report which includes all the marine survey and assessment investigations conducted in conjunction with this feasibility study.

Eight open-water areas in Corpus Christi Bay and the Gulf of Mexico have been proposed for the beneficial use of dredged material in conjunction with this project (Enclosure 3). The scope of work provides for remote-sensing survey of six beneficial use (BU) areas (sites CQ, I, P, PI, R and S) in proximity to McGloin's Bluff and Ingleside, an area which historical research has identified as having high potential for the occurrence of significant historic shipwrecks. The most significant of these are the Mexican War-era *Dayton* (a riverboat steamer built in 1835) and three Civil War-era shipwrecks (the sloop *Hanna*, the schooner *Elma*, and the steamer *A. Bee*). No survey is proposed for two BU sites – site GH and site MN. Eighty percent of site GH was surveyed during the initial marine survey of areas proposed for navigation improvements (see Enclosure 1). Because no potentially significant anomalies were recorded by this survey and the Texas Historical Commission's (THC) shipwreck database contained no indication of a wreck in the area, no survey is proposed in the remaining 20%. Site MN is located 6,500 ft offshore south of the south jetty. It consists of a 2,050 ft x 15,850 ft area running parallel to the shoreline in 30+ feet of water. A hopper dredge will deposit dredged material in various locations within this larger area in an effort to restore sediment to the littoral drift and encourage sand replenishment of nearby beaches. In verbal coordination of this site and disposal methods, the State Marine Archeologist determined that no survey would be necessary because of the low potential for wrecks in the area.

The scope of work proposes diver assessments of nine anomalies determined to possess signatures similar to those of historic shipwrecks by the close-order survey reported in Enclosure 2. The letter report identifies 12 such anomalies in the affected area of proposed channel improvements. Two of these (M 12 and M13) are associated with M38. Investigation of M38, the most promising of the three anomalies, will constitute investigation of all three. No further field investigation of M2, the anomaly formerly identified as the *Utina*, is proposed. Two previous diver assessments have retrieved sufficient information to determine that the remains of this wreck are extremely fragmentary and unlikely to yield significant historical data. Discovery of another wreck on the south side of the jetty outside the area of potential effects, reported in Enclosure 2, has cast doubt on the previous identification of this wreck as the *Utina*. For this reason, limited local historical research and informant interviews are proposed in an effort to better identify the M2 remains.

We request your review and comment on the draft Scope of Work. Further consultation will be initiated as the results of these investigations are received and project planning proceeds. If you have any questions, please contact Ms. Janelle Stokes at 409/766-3039.

Sincerely,

Carolyn Murphy
Chief, Environmental Section

Enclosures

CF w/o encls:
CESWG-PE-P, Mr. Heinly
CESWG-PE-E, Ms. Stokes
CESWG-PE-E, Mr. Roberts

CF with encls:

Mr. Bob Gearhart
PBS&J
206 Wild Basin Road, Suite 300
Austin, TX 78746-3343

SECTION 4:

PUBLIC INVOLVEMENT

Port of Corpus Christi
Channel Improvement Project
Public Involvement

The Port of Corpus Christi (Port) initiated a pro-active public outreach program to ensure that the public, resource agencies, industry, local government, and other interested parties were informed about the project and that any concerns were identified and addressed.

The Port and the Coastal Bend Bays & Estuaries Program (CBBEP) worked together on the issue of beneficial uses of dredged materials. The CBBEP's work plan had identified the need for public involvement and comment on potential beneficial uses of dredged materials. The Port contracted with CBBEP during 2000 to conduct public outreach on this issue, combining it with the Port's public outreach program for the Channel Improvement Project. As a result, there was extensive public outreach on this particular topic throughout the CBBEP program area. In these resulting meetings, the public in areas not directly affected by the Channel Improvement Project, such as Rockport and Kingsville, were briefed on project plans.

The public outreach program included newsletters, public meetings, special interest group meetings, and other outreach. Summaries of each of these are outlined below.

Newsletters

A series of newsletters was sent to individuals and organizations throughout the Corpus Christi Bay area, including local residents and businesses, port industries, community groups, city and county officials, and people who previously attended meetings on this project. The mailing list was expanded in 2000 to include individuals throughout the CBBEP area. Copies of all the newsletters are contained in Appendix A-1.

The first newsletter was mailed in July 1998. This newsletter discussed the elements and benefits of the proposed project and outlined issues already identified for the feasibility study investigation. It also gave a background and timeline for the project and announced the first public meeting.

The second newsletter was mailed in August 1999. It identified initial alternatives to be evaluated, outlined the project elements, and gave a brief history of the project.

In May 2000, a third newsletter was mailed to approximately 1,100 people. It gave a brief project background and discussed the proposed improvement alternatives, selected project studies, and the potential for beneficial uses of dredged materials. It also announced two public meetings scheduled in May 2000.

The fourth newsletter, mailed in November 2000 to approximately 1,300 people, announced the public meeting in December 2000 and gave a detailed update of the project's progress. It discussed the more refined project improvement alternatives and the results of several project studies. It also listed the beneficial use ideas that had been submitted by the public to date.

The April 2001 newsletter was mailed to approximately 1,300 people and announced the Corp's recommended plan and the proposed Dredged Material Management/Beneficial

Uses (DMM/BU) plan. It gave an update on several project studies and announced a public meeting scheduled for April 2001.

The Port also publishes a quarterly newsletter, *Channels International*, which serves as a means to update the public, port-related industries, and other businesses on various activities at the Port. Several articles have been written in *Channels International* regarding this project. The most recent, published in the fall of 2001, is included in Appendix A-1.

Additional newsletters will be produced as needed throughout the life of this project to ensure continuing, pro-active public outreach.

Public Meetings

Numerous public meetings have been held to update the public on the project as it has progressed and to solicit their input. To announce each meeting, newspaper advertisements were placed in local newspapers and press releases were sent to various media. Attendees were encouraged to comment at the meetings and to submit written comments.

March 30, 1994

During the reconnaissance phase of this study, the U.S. Army Corpus of Engineers (Corps) held a public workshop in Corpus Christi to describe the reconnaissance study and to solicit public input on the proposed project. A letter from the U.S. Fish and Wildlife Service regarding this meeting is included in Appendix A-2.

July 15, 1998

The first meeting was held in Corpus Christi. Approximately 130 people attended. The presentation included information on the history of the channel, trends in the shipping industry, specifics of the widening, deepening, and extension elements of the project, an outline of the federal project authorization process, and an overview of issues which had already been identified for inclusion in the feasibility study. The meeting also gave the public the opportunity to give input on what issues should be addressed in the feasibility study.

This meeting was announced in a newsletter that was mailed in July 1998 and in notices published in several local newspapers. Coastal Bend Bays Foundation members were also notified by letter by their organization. Newspaper articles appeared in the Corpus Christi Caller Times on July 26, the Port Aransas South Jetty on July 9, the Aransas Pass Progress on July 15, and the Coastal Bend Sun on July 11. A summary of this meeting and the newspaper articles are included in Appendix A-2.

August 19, 1999

This meeting was held at the Omni Bayfront Hotel in Corpus Christi. The meeting was sponsored by the Port and the U.S. Army Corps of Engineers (Corps) and served as the required Public Scoping Meeting as part of the Feasibility Study. The presentation included information on the history of the channel, specifics of the widening, deepening, and extension elements of the project, the outline of the federal authorization process, the 17 alternatives proposed to be studied, the elements and final determination of the reconnaissance study, and the various studies included in the feasibility study. The meeting also gave the public the opportunity to present views, opinions, and recommendations to the Port and Corps concerning the project. This meeting was announced to over 750 individuals, agencies, organizations, and news media. A summary of this meeting is included in Appendix A-2.

May 15, 2000

This meeting was held at the Conrad Blucher Institute at Texas A&M University - Corpus Christi. Approximately 30 people attended. The presentation included information on the existing system, the proposed improvements, an outline of the federal project authorization process, and examples of beneficial uses of dredged material. The public was encouraged to comment on possible beneficial uses of dredged material that would result from the project.

This meeting was announced in a newsletter that was mailed in May 2000 and in several local newspapers, including the Corpus Christi Caller Times on May 11 and 15, the Portland News on May 4 and 11, the Ingleside Index on May 11, the Aransas Pass Progress on May 10, and the Coastal Bend Sun on May 11. A summary of this meeting is included in Appendix A-2.

May 17, 2000

This meeting was held in Ingleside On The Bay. Thirty-six people attended this meeting. The presentation included information on the existing system, the proposed improvements, an outline of the federal project authorization process, and examples of beneficial uses of dredged material. The public was encouraged to comment on possible beneficial uses of dredged material that would result from the project.

This meeting was announced in a newsletter that was mailed in May 2000 and in several local newspapers, including the Corpus Christi Caller Times on May 11 and 15, the Portland News on May 4 and 11, the Ingleside Index on May 11, the Aransas Pass Progress on May 10, and the Coastal Bend Sun on May 11. A summary of this meeting is included in Appendix A-2.

September 15, 2000

This meeting was held at the University of Texas Marine Sciences Institute (UT-MSI) in Port Aransas. Twenty-one people attended this meeting. The presentation included information on the existing system, the proposed improvements, an outline of the federal project authorization process, and examples of beneficial uses of dredged material. This meeting was directed toward the scientific community, and they were encouraged to comment on possible beneficial uses of dredged material that would result from the project.

This meeting was announced in the Port Aransas South Jetty on September 14, and flyers were sent to UT-MSI for posting around campus. A summary of this meeting is included in Appendix A-2.

<u>October 10, 2000</u>
This meeting was held at the Kingsville Chamber of Commerce in Kingsville. Two people attended this meeting. The presentation included information on the existing system, the proposed improvements, an outline of the federal project authorization process, and examples of beneficial uses of dredged material. Attendees were encouraged to comment on possible beneficial uses of dredged material within the Coastal Bend Bays & Estuaries Program area.

This meeting was announced in the Kingsville Record on October 4 and 8, and flyers were posted in various placed around Kingsville, including the campus of Texas A&M University - Kingsville, the Kleberg County Courthouse, and the Kingsville Chamber of Commerce. A summary of this meeting is included in Appendix A-2.

<u>October 11, 2000</u>
This meeting was held in the Rockport Community Building in Rockport. Three people attended this meeting. The presentation included information on the existing system, the proposed improvements, an outline of the federal project authorization process, and examples of beneficial uses of dredged material. Attendees were encouraged to comment on possible beneficial uses of dredged material within the Coastal Bend Bays & Estuaries Program area.

This meeting was announced in the Rockport Pilot on October 4 and 7, the Aransas Pass Progress on October 4 and 5, and the Ingleside Index on October 4 and 5. Flyers were mailed to several local businesses and individuals for posting. A summary of this meeting is included in Appendix A-2.

<u>December 6, 2000</u>
This meeting was held in Corpus Christi at the Solomon P. Ortiz International Center. Thirty-six people attended this meeting. The presentation included a comprehensive project overview, a report on hydrodynamic and salinity modeling, and options for the Dredged Material Management/Beneficial Uses (DMM/BU) plan. The public was encouraged to comment on the DMM/BU plan.

This meeting was announced in a newsletter that was mailed in November 2000 and in several local newspapers, including the Rockport Herald on November 30, the Flour Bluff Sun on December 2, the Coastal Bend Sun on November 25 and December 2, and the Corpus Christi Caller Times on November 22, December 3, 4, and 5. At least two local television stations reported on the meeting during their regular 10:00 PM news. A summary of this meeting is included in Appendix A-2.

April 25, 2001

This meeting was held in Corpus Christi at the Solomon P. Ortiz International Center. Forty-five people attended this meeting. The presentation included the plan recommended by the U.S. Army Corps of Engineers and the Dredged Material Management/Beneficial Uses (DMM/BU) plan. The public was encouraged to comment on these plans.

This meeting was announced in a newsletter that was mailed in April, in the Corpus Christi Caller Times on April 22, the Flour Bluff Sun on April 14, and the Coastal Bend Sun on April 14. Newspaper articles appeared in the Corpus Christi Caller Times on April 24 and April 27 and in the Coastal Bend Sun on April 28. At least one television station reported on the meeting during their regular 10:00 PM news. A summary of this meeting and the newspaper articles are included in Appendix A-2.

Future Meetings

As required in the NEPA process, a public meeting will be held following the completion of the draft Environmental Impact Statement. Additional public meetings or small group meetings will be held if the level of interest so dictates or if interested parties so request.

Examples of the notices advertising the meetings, some of the newspaper stories, and comment forms are included in Appendix A-2.

Special Interest Group Meetings

In addition to the general public meetings, many meetings have been held with special interest groups. Examples of these meetings are described below, and selected summaries are included in Appendix A-3.

La Quinta Trade Gateway Project

Several meetings have been held on the La Quinta Trade Gateway project. These meetings addressed that project, as well as the Channel Improvement Project, and resulted in the beneficial use idea of an upland dredged material placement area site that would be used as a berm separating the La Quinta Trade Gateway property from the North Shore Country Club.

A meeting, held on January 7, 1999, briefed San Patricio County Judge Josephine Miller and Texas State Representative Judy Hawley on the project.

Another meeting, held on May 26, 1999, was a special meeting of the Commissioners of the Port of Corpus Christi. The public was invited to attend and speak about the project. The announcement of this meeting is included in Appendix A-3.

Port of Corpus Christi
Channel Improvement Project
Public Involvement

San Patricio County
The Port staff met with county officials at their County Commissioners meeting on October 6, 1997, to discuss various projects at the Port including the deepening project.

Coastal Coordination Council
The Port made a presentation to the Coastal Coordination Council (CCC) on May 13, 1998, to inform the group of the status of the project. A letter transmitted from the CCC regarding this meeting is included in Appendix A-3.

Corpus Christi Bay National Estuary Program
The Port made a presentation to the Corpus Christi Bay National Estuary Program (CCBNEP) at their annual Bay Summit on April 27, 1998, to inform the group of the status of the project. A summary of the presentation is included in Appendix A-3.

Corpus Christi Beach Association
The Port was invited to attend the April 20, 2000, meeting and discuss the project. Approximately 25 people attended the meeting. The presentation included a description of the effort to authorize a major navigation feature, the goals of the Port in this project, and the beneficial uses opportunities associated with the project. The audience was encouraged to ask questions and make comments about the project. A summary of this meeting is included in Appendix A-3.

Gulf of Mexico Fishery Management Council
The Port was invited to attend the September 19, 2000, Texas Habitat Protection Advisory Panel meeting. Approximately 11 people attended the meeting. The presentation included information on the existing system, the proposed improvements, an outline of the federal project authorization process, and examples of beneficial uses of dredged material. Attendees were encouraged to comment on possible beneficial uses of dredged material that would result from the project.

Coastal Bend Guides Association
The Port was invited to attend the October 3, 2000, meeting and discuss the project. Eighteen people attended the meeting. The presentation included information on the existing system, the proposed improvements, an outline of the federal project authorization process, and examples of beneficial uses of dredged material. Attendees were encouraged to comment on possible beneficial uses of dredged material that would result from the project.

The Port was invited to return for a second meeting on February 6, 2001, to update the group on the project. Twenty-nine people attended the meeting. The presentation included a summary of the status of the project and various studies, providing detail on those studies related to dredged materials management. The draft Dredged Materials Management/ Beneficial Uses (DMM/BU) plan was reviewed in detail. Attendees were encouraged to comment on the draft DMM/BU plan. Summaries of these meetings are included in Appendix A-3.

<u>Coastal Bend Bays Foundation</u>
The Port was invited to attend the January 8, 2001, meeting and discuss the project. Twenty-five people attended this meeting. The presentation included the project alternatives, study results to date, and the draft Dredged Materials Management/ Beneficial Uses (DMM/BU) plan. Attendees were encouraged to comment on the draft DMM/BU plan. A summary of this meeting is included in Appendix A-3.

<u>Ingleside Point Conservation Commission</u>
The Port was invited to attend the January 23, 2001, meeting and discuss the project. Approximately 20 people attended this meeting. The presentation included a review of the channel project, the project alternatives, and the draft Dredged Materials Management/Beneficial Uses (DMM/BU) plan. Attendees were encouraged to comment on the draft DMM/BU plan. A summary of this meeting is included in Appendix A-3.

<u>Port Industries</u>
The Port made a presentation to the Port Industries group on March 27, 2001. The presentation included an update of the project.

<u>Naval Station Ingleside</u>
The Port staff met with the base commander and staff to discuss the project on October 16, 2001.

<u>Commission of the Port of Corpus Christi</u>
A number of presentations have been made to the Port Commission updating them on this project. A full presentation was presented on April 10, 2001, that included background information about the channel system, the studies that were underway, estimated construction costs, and benefits including economic projections and transportation cost savings.

<u>Coastal Bend Environmental Conference</u>
The Port made a presentation at the 9th Annual Coastal Bend Environmental Conference on October 26, 2001. The presentation included background information about the existing channel system, the proposed improvements, the planning efforts undertaken to address engineering and environmental studies performed, and the proposed Dredged Materials Management/Beneficial Uses (DMM/BU) Plan. The overview for this presentation is included in Appendix A-3.

Numerous other special interest group meetings have been held with various organizations such as the Waterway Users (Fall 1999 and Spring 2001), Port Advisory Council (January 17, 2001 and May 16, 2001), Port Aransas Rotary Club (October 1999), Corpus Christi Downtown Rotary Club (December 1999), and the Corpus Christi Chapter of the National Audubon Society (May 2, 2001).

Other Outreach

Various other forms of outreach were utilized during this project. They included early regulatory agency coordination, Regulatory Agency Coordination Team (RACT)/ Workgroup meetings, individual contacts, a toll-free 800 number, Spanish voice mailbox, web site posting, press releases, and comment forms.

Early Regulatory Agency Coordination

The Port hosted several early meetings with regulatory agencies such as U.S. Fish and Wildlife Service, National Marine Fisheries Service, Texas Natural Resource Conservation Commission, Texas Water Development Board, Texas Parks and Wildlife Department, and Texas General Land Office. The purpose of these meetings was to allow regulatory agencies to participate and provide guidance in project planning, to recommend studies to evaluate environmental effects, and to assist in development of beneficial use alternatives or mitigation plans. The first meeting was held in May 1998. A summary of this meeting is included in Appendix A-3.

RACT/Workgroup meetings

Several technical groups were formed to assist the project managers during the Feasibility Study phase of the project. The Regulatory Agency Coordination Team (RACT) provides guidance and wise counsel on matters relating to the evaluation of environmental impacts for this project. Members of the RACT include the Port, U.S. Army Corps of Engineers, National Marine Fisheries Services, U.S. Fish and Wildlife Services, U.S. Environmental Protection Agency, Texas Parks and Wildlife Department, Texas Natural Resource Conservation Commission, Texas Railroad Commission, Texas Water Development Board, Texas Department of Transportation, and Texas General Land Office.

The Workgroups include Shoreline Erosion, Cumulative Assessment, Mitigation, Hydrodynamic and Salinity Modeling, Water and Sediment Quality (Contaminants), and Beneficial Uses. Each workgroup focuses on specific environmental issues of the project. They have helped define the scopes of work for certain studies and have reviewed study results. Members of these workgroups include the same state and federal regulatory and permitting agencies as the RACT.

Thirty-eight meetings have been held with the RACT and various workgroups to date. Summary minutes are kept of all RACT and Workgroup meetings and routinely distributed to members for review and approval. A table of Workgroup meetings and meeting dates is included in Appendix A-4.

1. Public Meeting Summary Report

A total of approximately 130 people attended the public meeting, filling the Council Chambers of the Corpus Christi City Hall. Among those attending were:

Josephine Miller, San Patricio County Judge
Gordon Porter, San Patricio Commissioner
Kirt Emerick, Portland Councilman
Glen Martin, Port Aransas Mayor
Tommy Brooks, Port Aransas City Manager
Elizabeth Nesbit, Coastal Coordination Council member

DRAFT

Bill Dodge, Port Commission Chairman
Bernard Paulsen, Port Commissioner
Ruben Bonilla, Port Commissioner

George Alcala, Bob Bass and Frank Garcia, U.S. Army Corps of Engineers

Also attending were representatives of citizen & environmental interest groups ~~and~~ state and federal natural resource agencies. Media attending included KIII and KZTV representatives.

PRESENTATION
John LaRue, Port Authority executive director, opened the session noting that the proposed project can be viewed as having four componets. The first is a barge shelf which PCCA is already working on. It will allow the barges to get out of the main channel and will provide ~~a~~ much safer ~~environment~~ navigation in the deep part of the channel. The second component is widening the channel across Corpus Christi Bay which is also a safety issue because ships are getting wider and it is important to maintain a safe distance between passing vessels. The third element is extension of La Quinta Channel to serve the property purchased by PCCA in early 1998 (long known as the Tenneco tract). The fourth component is to deepen the entire channel system from 45' to 50' to enhance efficiency and maintain the region's competitive position.

Mr. LaRue said that the meeting was not being held to meet any regulatory requirement, rather that it was a port authority effort to encourage public involvement at the beginning of the planning process. He stressed that it would be a listening session for the Port Authority and Corps representatives present. He said the coming planning effort will be a very open process and that the July 15th meeting was the first part of that process.

Mr. LaRue noted that many of those signing in were from Ingleside-on-the-Bay and had indicated they were present to express their concern about an application by Mr. Kenneth Berry to the Corps of Engineers for permits regarding an island across La Quinta Channel from Ingleside-on-the-Bay. LaRue explained that the Port Authority has no regulatory authority regarding Mr. Berry's application and has no greater role than does any other member of the public. Mr. Berry's proposed project is not in any way a part of the 50-Foot Project, nor does it have anything directly to do with the existing channel.

David Krams, P.E., project engineer, and Paul Carangelo, project environmental coordinator, presented a project overview using a series of slides and graphics which are included as an appendix to this report. They provided information on the history of the channel, trends in the shipping industry, specifics of the widening, deepening and extension elements of the 50-Foot Project proposal, an outline of the federal project authorization process, and an overview of issues which had already been identified for inclusion in the Feasibility Study and Environmental Impact Statement.

The public meeting was held to gather public input on issues that should be addressed in the Feasibility Study/EIS, and to hear opinions on which issues may be more important to the public.

Issues and ideas raised in comments during the public input session include the following:

- Comprehensive chemical analysis of dredge material constituents.
- Open water material placement alternatives including containment and stabilization.
- Possible creation of bird nesting islands at open water placement sites.
- Future private or industrial use of dredge material placement sites, particularly islands.
- Impacts of material placement on access to oil and gas wells.
- Beneficial uses of dredge material.
- Wakes and other affects of increased ship traffic.

- Use of interdisciplinary teams in study of issues. Involvement and participation of those conducting studies. The weight and consideration given to agency input. ?

- Public participation in the study process. Providing forums to deliver information to interested private citizens.

- Geographical boundaries of the study area and risk assessments.

- Safety criteria and levels in ship traffic evaluation. Comparisons for off-shore lightering and other liquid cargo delivery systems. SPM ?

- Traffic controls on ship and barge traffic. Importance and priority of separating barge and ship traffic.

- Potential increases in storm surge.

- Shoreline erosion.

- Environmental damage to fishery resources, seagrass beds, other habitats.

- Other ports with 50-foot channels and their problems.

- The need to include the cost of the proposed La Quinta Channel extension in estimating cost benefit.

- A geological fault near La Quinta Channel.

- ~~Additional~~ Project cost of mitigation ~~projects.~~

- Impacts of primary and secondary growth encouraged by the project.

- Industrialization of area and conflict with residential or natural areas.

- Procedures for handling toxic waste and hazardous materials.

- Current and future Liquid Natural Gas cargoes.

Summary of Beneficial Uses Public Forums
Corpus Christi Ship Channel - Channel Improvement Project

Monday, May 15, 2000
Texas A&M University – Corpus Christi
Blucher Institute

Attendees were:

- Dana Cheney, JFK Group
- J.W. Howell, Nueces River Authority
- Brooke Sween-McGloin, McGloin & Sween
- Patrick McGloin, McGloin & Sween
- Jim Shiner, Shiner, Moseley & Associates
- Robert Corrigan, Coastal Bend Bays & Estuaries Program
- Nolan Rhodes, Resident
- Bryan Davis, Parsons Brinkerhoff
- Danny Garcia, Coastal Refining & Marketing
- Frank Garcia, US Army Corps of Engineers
- Johnny French, US Fish & Wildlife Services
- Paula Sales, Texas Department of Transportation
- Pat Suter, Resident
- Bob Wallace, Coastal Bend Bays & Estuaries Program
- Manuel Freytes, Texas General Land Office
- Alan Mategoursky, Parsons Brinkerhoff
- Ajmer Kular, Govind & Associates
- Jim Bonner, CBI, Texas A&M University, Corpus Christi
- Frank Brogan, Port of Corpus Christi Authority
- Commissioner Gordon Porter, San Patricio County
- Leah Olivarri, Olivarri & Associates
- Kelly Billington, Olivarri & Associates
- David Krams, Port of Corpus Christi Authority
- Greg Brubeck, Port of Corpus Christi Authority
- Paul Carangelo, Port of Corpus Christi Authority
- Mary Perez, Texas Department of Transportation
- Pat Veteto, RVE Engineering
- Ray Allen, Coastal Bend Bays & Estuaries Program
- Jim Tolan, Texas Parks & Wildlife Department

The meeting began at 6:00 P.M. with Paul Carangelo from the Port of Corpus Christi Authority (Port) greeting attendees and expressing his thanks for their attendance. Mr. Carangelo introduced other Port staff Greg Brubeck, Frank Brogan, and David Krams, Frank Garcia from the US Army Corps of Engineers, and San Patricio County Commissioner Gordon Porter.

Mr.Carangelo reviewed the agenda for the evening and informed the audience that the Port and the Coastal Bend Bays and Estuaries Program (CBBEP) had joined forces to make the identification of beneficial uses a joint effort.

Mr. Carangelo asked Ray Allen of the CBBEP to speak briefly on the joint venture. Mr. Allen said that the CBBEP and the Port had the same objective and that it was only natural for them to join together. The joint effort project has a little bit larger scope, but it will lead to an outcome that will be applicable to both CBBEP and the Port.

Mr. Carangelo then asked David Krams to describe the existing system and explain the proposed improvements. Mr. Krams said most people in the audience had a pretty good idea of the current system and so reviewed the system very quickly. The Entrance Channel is 47' deep and 700' wide. The Corpus Christi Ship Channel is 45' deep and 400' wide. La Quinta Channel is 45' deep and 400' wide, and the Corpus Christi Inner Harbor is 45' deep.

Mr. Krams also noted that the proposed Channel Improvement Project is a Federal Project, with the U.S. Army Corps of Engineers (Corps) as lead and the Port as local sponsor. The project began with the local sponsor's decision to pursue the project. It was then sent to Congress for approval to investigate. After Congressional approval, the first part of a two-phase planning process began with a Reconnaissance Study by the Corps. That study was completed in 1994. The second phase, Feasibility Study and Environmental Impact Statement, is currently underway. It began with a cost sharing agreement signed in June 1999. If the results of the Feasibility Study find there is no national benefit or interest, then the project is dead. On the other hand, if the results show there is national interest or benefit, then it is sent to Congress for authorization and funding, then to engineering and design, construction, and finally operation and maintenance. The Feasibility Study is expected to be completed within three years.

Mr. Krams said there were three basic elements to the proposed Channel Improvement Project – widening the channel across the Corpus Christi Bay and adding barge shelves, deepening the entire ship channel system to 50- or 52-feet, and extending the La Quinta Ship Channel and adding a turning basin for the proposed container terminal facility.

Mr. Carangelo thanked Mr. Krams and stated that this was an open process. The Port is interested in public comment and input and they have sought and continue to urge early participation. In addition, there has been intensive state and federal regulatory agency involvement since 1999.

Mr. Carangelo then identified the existing Dredge Material Placement Areas (DPMAs) east of the Inner Harbor. These DMPAs are located along both sides of the main channel in the open water of the Corpus Christi Bay and on the islands just south of the main channel between Live Oak Peninsula and Port Aransas. There are also DMPAs in the Inner Harbor Reach along both sides of the Inner Harbor.

Mr. Carangelo explained that seen from a global approach, the beneficial uses of dredged material include engineered, agricultural, and environmental applications. Examples of engineered uses include land creation and land development uses such as levees, landfill capping, and strip mine reclamation, as well as dredged material reuse like construction quality materials, manufactured soils (building products), and commercial and industrial facilities. Examples of agricultural uses of dredged material include aquaculture use of confined placement sites and topsoil.

Mr. Carangelo said the most popularly recognized of the three types of beneficial uses of dredged materials were environmental uses. Examples of environmental uses include marsh wetland creation and restoration, aquatic and marine habitat enhancement (reef structures, seagrass beds, unvegetated shallow water habitat, and emergent mudflats habitat), gulf beach and bay beach nourishment, terrestrial habitats (rookery islands and recreational destinations and parks), shoreline erosion control, near shore sediment management (underwater berms/capping), and thin layering (ecological stimulation).

Mr. Carangelo then turned the meeting over to Leah Olivarri, who introduced the guidelines for the public input. She said that the purpose of the meeting was to solicit ideas and perceptions on Beneficial Uses of Dredged Materials. The Port wanted to know how the public would like to see the dredged material used beneficially. She also asked that the focus of comments be on potential beneficial uses of dredged material. All input will be fully considered and greatly appreciated. Ultimately, there would be formal public and agency scrutiny through the NEPA process.

Ms. Olivarri asked the audience to literally take markers to paper and come to the front to draw on the map, exactly what they wanted to see. She also noted that comment forms were handed out and the public was encouraged to write their comments down on those as well. Comments could be submitted now or mailed in later.

Jim Shiner noted there was an ongoing need for sand on the south end of the north side of Shamrock Island and suggested that the Port consider using dredged material for beach renourishment of Shamrock Island.

Commissioner Gordon Porter asked if there was a cost analysis going on along with this part of the study. Mr. Carangelo said yes, there was, but they were still looking for all ideas no matter how large or small. Commissioner Porter then suggested dredged material be used as shoreline protection at Conn Brown Harbor and for commercial development enhancement north of Conn Brown Harbor.

Pat Suter noted the shoreline erosion that is happening at Ingleside On The Bay and asked about open water placement areas and how much dredged material was slipping back down. Mr. Carangelo spoke about the benthic recovery study and a sister study on the fate of dredged materials placed in open water. The benthic recovery study indicates that benthic community recovery was complete within one year of placement. The dredged material fate study was in preparation.

Dana Cheney asked about the Port's long-term dredging plans. Mr. Carangelo said the maintenance material is rather soupy, so the virgin new work materials will probably be used to build structures like levees. Ms. Cheney suggested that the Port stay away from Nueces Bay because it is so shallow and is a long distance from the area being dredged and also suggested that they add marshes to the back side of the islands along the ship channel (Pelican Island, et al.) and renourish the back sides of Mustang Island as well.

Pat Veteto suggested some of the dredged material be used to protect the downtown Corpus Christi area. Five million cubic yards could be used to build a land barrier in front of the seawall. This could give a $15 million benefit. Raise the existing break wall to 15 feet and put a beach in front of it. Mr. Veteto also presented the Port with a color drawing of his suggested plan. The proposed plan would include a 32-acre festival site, 10-acre marina, 15-acre resort hotel, 23-acres for commercial development, 15-acre amusement park, 11-acre amphitheatre, and a lagoon.

Brooke Sween-McGloin supported Mr. Veteto's idea and said it was good for the City's economic development. The idea has lots of merit and could have a big impact on this community.

Bob Wallace asked where the material goes during a storm and high tides. Mr. Veteto replied that they would have to have a good containment system.

Johnny French cautioned the group on the issue of fresh water inflows and said there was a possibility of project delay if there was dredged material placement in Nueces Bay for the intended purpose of maximizing fresh water inflows. His concern was that the modeling effort required might be too complex to resolve in a timely manner.

Ray Allen suggested using dredged material for rookery islands in Nueces Bay and enhancing the Nueces Bay area with habitat creation.

Pat Suter suggested the Port take a look at raising the current dredged material placement areas in the open bay to right below the water level, or above it, since shallow water was likely more biologically productive than the current practice.

Commissioner Gordon Porter suggested dredged material to support seagrass around the backside of the existing dredged material islands, as opposed to placement in open areas because of wind, tides, etc.

J.W. Howell suggested they are attempting to reverse the anticipated potential effects of hydrology and the natural phenomenon of the shoreline building on the north side and eroding on the south side. Mr. Howell suggested the Port extend La Quinta Island with dredged material from the La Quinta Extension to protect the La Quinta Channel Extension and extend the proposed berm into the water to protect habitat on Portland banks.

Commissioner Porter suggested they could connect all this area with a cul-de-sac but warned of potential damage to the circulatory system. He reminded the audience of the disaster of Sunset Lake and said they could create a water exchange or break and it might work.

Danny Garcia asked if the natural buildup would create a berm anyway. He suggested the Port build something like the sandbars or some other natural extension buildup.

Mr. Howell suggested they create wetlands on the backside of the La Quinta Island Extension.

Ray Allen asked if the Port was considering the purchase of the Reynolds Metals property. Frank Brogan said no.

Robert Corrigan asked about a prioritization of all these ideas. Mr. Carangelo said they have to look at the texture of the material, pumping, engineering and geo-technical studies involved, and that the RACT plans to combine mitigation and the Dredged Material Management Plan (DMMP). Cost will also be a factor in setting priorities for beneficial uses of dredged material for the Corpus Christi Ship Channel - Channel Improvement Project.

Ms. Sween-McGloin asked how much dredged material is 40 million cubic yards. Mr. Brogan answered it was approximately 1,000 acres, 27 feet tall +/-.

Patrick McGloin asked if someone was pushing for a proposal of use for dredged material which was not environmentally or economically appropriate within the context of the decision-making process for the Corpus Christi Ship Channel - Channel Improvement Project, or any other dredging project, how might they be able to earmark dredged material from the project for these uses.

Nolan Rhodes answered Mr. McGloin saying anyone who can get an individual permit for these other uses in a timely manner and has funds to pay for the cost involved, and be vociferous should be pushing for these beneficial uses.

There were no written comments handed back to us at the close of the meeting.

Two written comments were mailed back to us, both from Paul Carangelo, coastal resident. The first was to create high and low marsh and open water habitat east of the east groin on North Beach. Use appropriate wave dissipation structures seaward and dredged or other suitable material for habitat development fill. This proposal could also include increase hydrologic-tidal connectivity to existing wetlands on the east end of North Beach adjacent to and south of SH 181. Potential for enhanced recreational benefits/use.

The second comment was to create (restore) black skimmer nesting habitat in the Upper Laguna Madre directly south of the Kennedy Causeway across the ICWW from Marker 37. The existing skimmer nesting area is unfortunately located along the shoulder of the Kennedy Causeway and is heavily impacted. Nesting success typically is nil. The proposal is to place suitable material on existing, eroded placement islands on a regular basis to maintain the land suitable for use by skinners and other tern species.

Summary of Beneficial Uses Public Forums
Corpus Christi Ship Channel - Channel Improvement Project

Wednesday, May 17, 2000
Ingleside On The Bay
Ingleside Beach Club

Attendees were:

- Virginia Hargrove, Resident
- Cynthia Pearl, IPCC
- June Hardy, Resident
- David Dear, Citgo Refining
- Jim Morgan, Resident
- Marcie Counter, IPCC
- Charles Counter, IPCC
- Wayne Jewell, Resident
- Patt Watson, Resident
- Corra Ward, Resident
- Delano Lockhart, Resident
- Don Vance, Resident
- James Rio, Resident
- Phil McMulin, Resident
- Scott Pearl, Resident
- Carole Lawson, Resident
- Patty Miller, Resident
- Marcella Saathoff, Resident
- Joel Cue, Resident
- Paul Carangelo, Port of Corpus Christi Authority
- Greg Brubeck, Port of Corpus Christi Authority
- David Krams, Port of Corpus Christi Authority
- Leah Olivarri, Olivarri & Associates, Inc.
- Kelly Billington, Olivarri & Associates, Inc.
- Frank Garcia, US Army Corps of Engineers
- Howard Gillespie, Resident
- April Gillespie, Resident
- Katie Hatch, Resident
- Skip Hatch, Resident
- Jaime Adame, AGM
- Doug Defratus, Medicine Shop
- Jay Masterson, Masterson Suites & Studios
- Keith Reignier, Bahia Marina
- Carol Reignier, Bahia Marina
- Ray Allen, Coastal Bend Bays & Estuaries Program
- Vicki Allen, Corpus Christi Resident
- Pat Hunt, Coastal Bend Guides Association
- Berry Rowland, Council IOTB
- Janice Arnsdorff, Index
- Dick Endman, Resident

The meeting began a few minutes after 6:00 P.M. with Paul Carangelo from the Port of Corpus Christi Authority (Port) greeting attendees and expressing his thanks for their attendance. Mr. Carangelo introduced other Port staff Greg Brubeck and David Krams and Frank Garcia from the US Army Corps of Engineers.

Mr. Carangelo reviewed the agenda for the evening and informed the audience that the Port and the Coastal Bend Bays and Estuaries Program (CBBEP) had joined forces to make the identification of beneficial uses a joint effort.

Mr. Carangelo asked Ray Allen of the CBBEP to speak briefly on the joint venture. Mr. Allen said that the CBBEP and the Port had the same objective and that it was only natural for them to join together. The joint venture project has a little bit larger scope, but it will lead to an outcome that will be applicable to both CBBEP and the Port.

Mr. Carangelo then asked David Krams to describe the existing system and explain the proposed improvements. Mr. Krams said most people in the audience had a pretty good idea of the current system and so reviewed the system very quickly. The Entrance Channel is 47' deep and 700' wide. The Corpus Christi Ship Channel is 45' deep and 400' wide. La Quinta Channel is 45' deep and 400' wide, and the Corpus Christi Inner Harbor is 45' deep.

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Mr. Krams said there were three basic elements to the proposed Channel Improvement Project – widening the channel across the Corpus Christi Bay and adding barge shelves, deepening the entire ship channel system to 50- or 52-feet, and extending the La Quinta Ship Channel and adding a turning basin for the proposed container terminal facility.

Mr. Krams then asked if there were any questions up to this point. One individual asked what the reasons were for deepening and widening the channel. Mr. Krams responded that there were several reasons, including better accommodation of existing fleet and large vessels, increasing of shipping efficiency, and enhancement of navigation safety.

Greg Brubeck added that the process is expensive. It's about a $6.5 million three-year project. They want to study all alternatives. If there is a successful feasibility study, they will have the option to construct in stages, a little at a time.

Another individual asked if the ships going into the La Quinta Channel were getting larger.

Mr. Krams said La Quinta Channel is only going to be 300' wide. There are no plans to widen La Quinta Channel; deepening was under study. There will not be passing traffic because it was designed for one-way traffic.

One gentleman asked during the simulation studies, how much would this [deepening and widening the channel] increase the storm surge? Mr. Carangelo said there are a number of environmental and engineering studies that are ongoing. One of those is the Hydrodynamic and Salinity Modeling Study. That study will investigate the change in tidal amplitude, if any, or the change in circulation, if any, as a result of changing the dimensions of the channel.

Mr. Krams added they hope to be finished with that study by the end of this year. The gentleman then asked if the results would be published. Mr. Carangelo replied that they would be published because it was important not only to coastal residents, but also to understanding the effects to the natural environment. There are a lot of shallow flats all around the area and they are both used by endangered species and valuable habitats like marshes. If the water came up too high and flooded those flats permanently so the animals could not get to them, then that could be a negative. Similarly, it may either increase one area for more growth of wetland plants which could be positive, or may cause light not to penetrate deep enough possibly causing problems for seagrass.

Mr. Carangelo went on to say the ship simulation study is a computer program based on real information from the channel – the currents, the winds – and real ships. These simulations are analogous to those simulations performed by the US Navy and the US Air Force and commercial airlines. The modelers actually hire our own pilots, from Corpus Christi, to run the simulations in Vicksburg, Mississippi using different vessels, different kinds of engines, different kinds of equipment on those vessels, and under different current and wind conditions. It is a very good simulation of exactly what these pilots will be doing.

Someone asked if the deepening and widening was being done to relieve the problem of Harbor Bridge? Mr. Krams said in the Reconnaissance Study it was found that the deepening is to better utilize the existing fleet. The Port gains that much more benefits, transportation cost savings, from those vessels. If a vessel is coming in with more cargo, it is going to be drafting out deeper and the top of the ship will still be just a bit shorter than the bridge. The height of the bridge is a separate issue that can affect other marine traffic.

Ms. Olivarri asked Mr. Krams to explain about lightering. Mr. Krams explained the process as transferring of oil off very large ships unloaded offshore to smaller ships, which transfer it to the docks. He said they could potentially reduce the amount of times a vessel would lighter and the number of vessel trips in and out of the channel.

Someone asked if they had studied the proposed increase in shipping traffic. Mr. Krams said the ship simulation study would take the largest, regularly used vessel. Mr. Carangelo added that there will also be a study looking at the effect of all environmental conditions as well as ship traffic on shoreline erosion. That will look at what nature is doing with water level and tide and what kind of energy it is putting on these shorelines, looking at sea level rise and any kind of natural phenomenon as well as the energy that comes from ships as they pass by. They will be accounting for ships passage and the number. If, for example, only 25% of the erosion is coming from the ships, then we can look at that and say any additional ships would generate that much more incremental erosion.

A woman asked if they would take into consideration anything that might be added in the future, like the jetties on Berry Island, when they do the studies in La Quinta Channel. Mr. Krams said they can either put it in the model or leave it out, but they were not going to study the effects of the jetty if it is there and if it is not there. Mr. Carangelo said because of the cost of running model simulations, you try to change model scenarios as little as possible, trying to reasonably model the ones you want to look at and these are the ones with the best indications that they will become a reality. The woman then asked whose decision it was to include that in the model. Mr. Carangelo said that determination has not yet been made and that the Port and the Corps would ultimately make that decision. She noted that the permit has been approved. Mr. Brubeck said they were aware of that approval and stated it seems like the audience wants to see this included in the model. Mr. Krams suggested that they, as a group, write a letter to the Port requesting that action, so it could be presented to the Corps and the Work Group to include that.

Mr. Carangelo and Mr. Krams asked that they move along through the rest of the presentation then continue with comments and suggestions. He said because of the economics of this project, there would probably not be feasible to construct a beneficial uses project in the Upper Laguna Madre. However, it does not mean that the CBBEP won't use that suggestion if an opportunity in the Upper Laguna Madre exists. This isn't just for the Port. There will be an overall inventory prepared of these ideas that will be used in future projects as well.

Mr. Carangelo then turned the meeting over to Leah Olivarri. Ms. Olivarri noted that the focus is on the beneficial uses of dredged material, but there were a few people who had comments earlier that didn't get to speak.

One gentleman asked if, after construction, would the existing permits have to be re-permitted or reassessed. Mr. Frank Garcia said they try and address what is projected for the next 50 years. They put in all concerns as best as they can forecast, and once the study is done, then they can not go back and remodel. Mr. Carangelo added there is a Work Group called the Cumulative Impacts Assessment Work Group. It is very difficult to try to identify which projects should be identified in a cumulative impacts assessment. The Work Group had to come up with a series of criteria to count or manage those projects. When you have a special type of project, or one you are not sure will ever happen, there is no way those can be quantified.

Ms. Olivarri noted that it would be very important for interested parties to fill out their comment forms or write letters so they can get back in touch to say why they did or did not include things like the jetty at Berry Island. Mr. Carangelo added that part of their mission is to provide feedback to comments.

A gentleman asked if anyone had identified how many permits have been approved in the study area. Mr. Garcia said that if it was necessary, they could get that information and those permits would be looked at to determine if these are reasonably foreseeable future projects. Those that were determined to be reasonably foreseeable future projects would be considered as being added into the Cumulative Impact Study.

Someone else asked if a permit has lapsed and they reapply for the permit and it interferes with the CIP, would the Corps accept that reapplication. Mr. Garcia said that they probably would not accept that permit as is. It would probably need to be modified.

David Dear, representing Citgo, said they are very excited about the renovations that the Port and Corps are taking to handle this dredged material. He said the cost of the dredging is shared by the Port and the Corps and asked how the is Port going to recoup it's cost. He also suggested that the Port talk to its customers to see if it will actually reduce costs. Mr. Brubeck said this is a very expensive project, roughly $150 million. They cannot afford to do it all at once. This project will be done in stages, reinvesting their profits back into the community. He also said they might be able to get the federal government to contribute to this project.

Mr. Carangelo added that the Port is soliciting a partner for the container terminal facility. The partners will be significantly contributing to the container terminal project. There are lots of ways money comes in; it is not just strictly out of current users of the channels.

One gentleman asked for clarification on the fact that the Port would not build the container terminal without commitment from these companies. Mr. Brubeck said this was a separate study. They have received several letters of interest. In the next couple of months, they hope to have partnership with one of them. In the next year, a market analysis will be done. All this has to be done before investments are made.

A woman noted that one possible beneficial use would be shoreline stabilization around the bay.

Mr. Brubeck noted that we held a similar meeting in Corpus Christi at the University just two days ago, the turnout here was much greater than in Corpus Christi, and there were several suggestions given there.

A woman asked about the extra salinity from deepening and widening. Mr. Carangelo said that was being studied by the Hydrodynamic and Salinity Modeling Work Group and noted that a lot of times we actually get our fresh (or less saline) water from the sea.

A man suggested a series of bars between the ship channel and the existing flats to cut down on wake and waves. He said when the ships come through, they create a wave that hits against the side of the island and are large enough to flip a John Boat. He suggested that if there were a series of underwater reefs to break that wave action up, maybe that would reduce the wave energy. Mr. Carangelo said that is a concept that could be used. The same concept could also possibly be used around Dagger Island.

Another man suggested that would not work because the waves would just push those bars flat again and the waves would come through.

Someone suggested that the dredged material be used as road base for Joe Fulton International Trade Corridor and also as renourishment of North Beach.

A gentleman asked in reference to item S-20 on Ingleside On The Bay, what type of erosion protection did the Port have in mind along Bayshore Drive. In three years, there may not be a Bayshore Drive. Ms. Olivarri responded that this list was generated from information that the CBBEP got from different people including Ingleside On The Bay residents and other sources, and were not necessarily from the Port. He suggested that they build bulkheads around Bayshore Drive.

Ms. Olivarri added that there are funds available to communities for erosion through the State that have nothing to do with the Port of Corpus Christi. She suggested they think about applying for the funds and because there is a matching requirement, passing a bond or something to address that issue.

An audience member suggested that there needs to be a series of "geo-tubes" parallel along Bayshore Drive to break up the water, similar to what they did at the Mine Warfare Property.

One gentleman suggested a driver's education class for the pilots. He noted that a lot of these problems (shoreline erosion) are due to speeding pilots.

Another gentleman suggested enhancing the La Quinta area with seagrass.

Ms. Olivarri said one suggestion that came out of the meeting in Corpus Christi was to extend the La Quinta Island to protect the channel and maybe increase the berm area there to also help protect that side of the Live Oak Peninsula.

A gentleman said that might not be a bad idea. It could also help save on maintenance dredging.

A gentleman said there is an erosion problem, and he is not an expert. He is afraid that the Port may come back and say they gave residents a chance to say what they wanted and because they did not know what all they could do, and thus they did not get what they needed. Mr. Carangelo said the whole idea here is concepts. If the Port can incorporate their needs into this project, they will do everything they reasonably can to incorporate those. Mr. Krams noted that this meeting is focusing on Beneficial Uses. There is a Work Group dedicated to shoreline erosion. One of the areas they are looking at closely is Ingleside On The Bay.

A woman said that when their children or grandchildren are out playing in the water right outside the building and they see a ship coming into Corpus Christi, they have to get the children far out of the water because of the undertow. If there is a ship coming into La Quinta, they nearly drown. She said the erosion is tremendous.

A man suggested that they dredge a new channel to the west of the existing dredged placement island along La Quinta the terminal site on La Quinta Channel. Mr. Krams said that it was not economically feasible to do that. It would more than double the cost of the project.

A gentleman asked for clarification that widening the channel would allow for ships to pass one another. Mr. Krams said yes and that one of the benefits to widening may reduce the propagation of waves that hit this area.

A woman said that when the boats cross now at the point out in front of Ingleside On The Bay, it causes huge waves. Mr. Krams said that the ships are waiting to cross at that point, because that is their first opportunity and they probably want to take advantage of that. Widening the entire channel would allow them to pass at many other places.

A man asked what the chance was of slowing the ships down. Mr. Krams said that they would probably start that discussion tomorrow. He noted that he was distressed to learn this evening that someone called the Harbor Master about this and said they were laughed at. There may be a very simple solution to this by giving notice to the pilots. They will begin to address the problem of ship speed immediately.

Mr. Brubeck added that with the new technology that is coming out now, they may have better control and by widening the reach across the bay, it would help safety and reduce speed.

A woman asked if there was a control to determine where those ships pass. Mr. Brubeck said that because of meetings like this, and listening to people's concerns, they will go back and focus on operational things they can do to alleviate these problems.

A woman asked for clarification of improvements to La Quinta Channel. Mr. Brubeck said that the Reconnaissance Study showed that there was no benefit to deepening or widening that channel. The Port will do another study to confirm that deepening is not advantageous, but the major planned improvement is extension of this channel.

A woman brought up the Wildlife Refuge in Ingleside Cove and voiced her concern for seagrass and habitat protection in that area. Mr. Carangelo noted that there had been a beneficial use suggestion previously identified for increasing seagrass and marsh in that area.

A gentleman noted that there are a lot of people that use that cove for their boats during big storms and hurricanes. They would miss that if it were filled up. Mr. Carangelo said that the purpose of meeting like this is to identify possible beneficial uses sites and to identify possible conflicts.

A man asked if any other Ports in the US have done projects like this recently. Mr. Carangelo said that yes, Houston has done this and they are currently in the construction phase and will create over 4200 acres of wetland habitat using dredged material over the next 50 years. They will create over 230 million cubic yards of dredged material over the life of the project. There were other major port projects in Savannah, Norfolk, and Baltimore, and also smaller projects have been done successfully.

A woman suggested there are always new Port faces in meetings like these and wondered if current projects had available resources to see what was done in the past. Mr. Carangelo said that he has been here since 1973 and was one of the first people in Texas to use dredged material in environmental uses. The Port is trying to take the expertise of people like himself and others and draw on those lessons learned in the past. Ms. Olivarri noted that the Port's relationship with the CBBEP will also help in this area.

The woman noted that she hoped this information would be available to the City of Corpus Christi because they seemed to not know anything about this project at their meeting. She asked that a database be created to make this available to everyone for future projects.

Ms. Olivarri mentioned that 1500 newsletters were mailed out about this project, of which 40-50 people at the City received those same newsletters.

Mr. Carangelo urged her and other people like her to participate with the work of the CBBEP.

She also asked about a buyout plan as a buffer zone. Mr. Carangelo said that no, there is not a buyout plan.

A gentleman asked if there ever was or is currently discussion of buying, using, or acquiring the Berry Island property. Mr. Brubeck said that the island was created when the La Quinta Channel was dug. It belonged to Larry Baker. The Port, for a number of years, had the right to deposit dredged material on the island. That is why the island has gotten about twice as big as it was when the channel was dug. Right after they finished Naval Station Ingleside, the government put a lot of dredged material on the island. At that point, Larry Baker asked the Port to terminate their right to deposit dredged material on the island and they agreed. The island was eventually bought by Mr. Berry. It is a possibility that maybe the Port needs to buy the island. Several years ago, the Port had an opportunity to buy the island, but they have not had discussions about that since, to his knowledge.

We received four written comments before we left Ingleside On The Bay. They are as follows.

Jay Masterson requested to receive the PowerPoint presentation via e-mail and noted that she was willing to help with outreach in the Aransas Pass/Rockport area.

Wayne Jewell noted erosion control on Bayshore Drive and the speed of ships at Ingleside on the Bay.

Howard Gillespie requested a copy of PowerPoint Presentation via e-mail and suggested the inclusion of Berry Island jetty on the simulation model.

Karen Schniepp requested a copy of PowerPoint Presentation via e-mail and suggested the inclusion of Berry Island jetty on the simulation model as well as bulkhead on Ingleside Cove area in the hydro model.

We received one written comment by mail from Keith & Carol Regnier of Bahia Marina, Ingleside On The Bay. They proposed that the dredged material be used as protection to prevent the deep-water basin [La Quinta] from silting. They also proposed dredged material be used for the creation of u-shaped coves, like Ingleside Cove, to plant seagrass and create wildlife habitat. They noted that these coves should be for drift fishing only, and that nothing touches the grass (no wading, no anchoring), i.e., nurseries. They noted these uses of the dredged material would be beneficial for wildlife and would be economical for the Port because of their proximity to the proposed dredged area. They also noted that “DMPA’s should NEVER be used for industrial use!”

Summary of Beneficial Uses Meeting
University of Texas – Marine Sciences Institute
September 15, 2000

Friday, September 15, 2000
Port Aransas
UTMSI Auditorium

Attendees who signed the sign in sheet were:

- Dan Roper, Student, TAMU-CC
- Glenn Martin, Mayor, City of Port Aransas
- Michael Smith, UTMSI
- Dr. Paul Montagna, UTMSI
- Cynthia Faulk, UTMSI
- Kim Halbrook, TGLO
- John Keller, UTMSI
- Dr. Liz Smith, TAMU-CC
- Meris Sims, TAMU-CC
- Tom Brooks, City Manager, City of Port Aransas
- Wayne Gardner, UTMSI
- Heather Alexander, UTMSI
- Carolyn Chancellor, Airport & Channel Corp.
- Cameron Pratt, UTMSI
- Jack Arnold, UTMSI
- Scott Holt, UTMSI

There were other attendees who did not sign in.

Representatives from the Port, CBBEP, and Olivarri & Associates, Inc. were:

- David Krams, Port of Corpus Christi
- Paul Carangelo, Port of Corpus Christi
- Leo Trevino, CBBEP
- Tim Landers, EPA
- Leah Olivarri, Olivarri & Associates
- Kelly Billington, Olivarri & Associates

The meeting began at 3:45 PM with Dr. Paul Montagna greeting attendees and introducing Paul Carangelo. Dr. Montagna noted Mr. Carangelo's work for UTMSI between 1973 and 1979 and that he has performed a lot of work on seagrasses and vegetated habitats.

Mr. Carangelo said this meeting provided a unique opportunity for the Port of Corpus Christi (Port) and the Coastal Bend Bays and Estuaries Program (CBBEP). Because the Port has the Channel Improvement Project, they are looking at the Beneficial Uses of Dredged Material. The CBBEP, in their Estuary plan, identified maximizing Beneficial Uses of Dredged Material. The CBBEP was going to start an outreach program to begin contacting people about their ideas and potential projects. The Port was going to start an outreach program similarly to get ideas and comments from the public in regard to the Ship Channel Project. So, instead of having two programs trying to reach the same audience, the Port and CBBEP joined together to collectively solicit ideas. The Port is a contractor to the CBBEP to obtain the information. Once that information is obtained, Olivarri & Associates, Inc. will prepare a report that will be used as needed by the Port's Channel Improvement Project and the CBBEP.

Mr. Carangelo introduced David Krams (Port) and Leah Olivarri and Kelly Billington (Olivarri & Associates, Inc.). He asked Mr. Krams to talk about the existing system of the ship channel and the proposed improvements to the ship channel.

Mr. Krams said the existing system is about 38 nautical miles in length. The Entrance Channel is 47' deep and 700' wide. The main Ship Channel is 45' deep and 400' wide. La Quinta Channel is 45' deep and 400' wide, and the Corpus Christi Inner Harbor is 45' deep.

Mr. Krams noted that the proposed Channel Improvement Project is a federal project, with the U.S. Army Corps of Engineers (Corps) as the lead and the Port as the local sponsor. The project began with the local sponsor's decision to pursue the project. It was then sent to Congress for approval to investigate. After Congressional approval, the first part of a two-phase planning process began with a Reconnaissance Study by the Corps. That study was completed in 1994. The second phase, Feasibility Study and Environmental Impact Statement, is currently underway. It began with a cost sharing agreement signed in June 1999. If the results of the Feasibility Study find there is no national benefit or interest, then the project is dead. On the other hand, if the results show there is national interest or benefit, then it is sent to Congress for authorization and funding, then to engineering and design, construction, and finally operation and maintenance. The Feasibility Study is expected to be completed within three years.

Mr. Krams said there were three initial alternatives to the proposed Channel Improvement Project. The first is widening the channel across the Corpus Christi Bay and adding barge shelves. The ship simulation study has been complete. It has been determined that if the channel is deepened, the optimum is widening to 530-feet. The second alternative is deepening the entire ship channel system to 50- or 52-feet. This will be a phased project, meaning the Port may be authorized to deepen to 52-feet, but may only deepen to 50-feet. The third alternative is to extend the La Quinta Ship Channel and adding a turning basin for the proposed container terminal facility.

Mr. Carangelo thanked Mr. Krams and introduced Leo Trevino (CBBEP) and asked him to speak about the coordination effort between the Port and CBBEP. Mr. Trevino said their participation in this process is to develop a list of beneficial uses of dredged material that may result from this and other projects in the estuary area. He thanked attendees for their participation in this process. He also introduced Tim Landers (USEPA) who is the sponsor for their part of this project.

Mr. Carangelo stated that this is an open process. The Port and CBBEP are interested in public comment and input and have sought and continue to urge early participation. There has been intensive state and federal regulatory agency involvement since 1999. There have been a number of workgroups set up for the purpose of assisting the Port with developing the Environmental Impact Statement (EIS) and the Dredged Material Management Plan (DMMP). There have been a number of feasibility study public meetings and updates, and Beneficial Uses Public Forums. This is the third such Beneficial Use public meeting of the five or more planned. Previous meetings were held at TAMU-CC Blucher Institute and Ingleside On The Bay. Others will be held in the Rockport and Kingsville areas.

Mr. Carangelo identified the existing Dredge Material Placement Areas (DPMAs). Some DMPAs are located along both sides of the main channel in the open water of the Corpus Christi Bay and on the islands just south of the main channel between Live Oak Peninsula and Port Aransas. There are also DMPAs in the Inner Harbor Reach along both sides of the Inner Harbor.

Mr. Carangelo explained that seen from a global perspective, the beneficial uses of dredged material include engineered, agricultural, and environmental applications. Examples of engineered uses include land creation and land development uses such as levees, landfill capping, and strip mine reclamation, as well as dredged material reuse like construction quality materials, manufactured soils (building products), and commercial and industrial facilities. Examples of agricultural uses of dredged material include aquaculture use of confined placement sites and topsoil.

The most popularly recognized of the three types of beneficial uses of dredged materials are environmental uses. Examples of environmental uses include marsh wetland creation and restoration, aquatic and marine habitat enhancement (reef structures, seagrass beds, unvegetated shallow water habitat, and emergent mudflats habitat), gulf beach and bay beach nourishment, terrestrial habitats (rookery islands and recreational destinations and parks), shoreline erosion control, near shore sediment management (underwater berms/capping), and thin layering (ecological stimulation).

Mr. Carangelo turned the meeting over to Leah Olivarri. She said that the purpose of the meeting was to solicit ideas and perceptions on Beneficial Uses of Dredged Materials. The Port's focus is on the Channel Improvement Project and the materials that can be used from that project. The CBBEP's focus is the entire estuary area. Ms. Olivarri noted handouts that included a map and corresponding list of suggested beneficial uses of dredged material that have been compiled from surveys by the CBBEP and previous public meetings held by the Port and CBBEP. Paul Carangelo had also added some others based on his knowledge and experience.

Tom Brooks asked if this list was directed more towards dredged material resulting from the Channel Improvement Project or from projects across the board. Ms. Olivarri said if the deepening and widening does occur, those materials would probably be used for beneficial uses in the main ship channel area. However, this process of generating a list of beneficial uses encompasses the entire estuary area for the CBBEP.

Mr. Brooks asked how one got on the list to become a recipient of dredged material. Mr. Krams said as far as federal dredging goes, you have to talk to the Corps. Let them know what you are interested in and ask if you can become a local sponsor for a particular project. Currently, the City of Corpus Christi is interested in dredged material for Corpus Christi Beach. The Corps has already identified that area as a potential placement site for dredged material. The City is meeting with the Corps to coordinate that effort. Mr. Carangelo agreed and added that one should get their ideas out there and become committed to being a local sponsor. Mr. Trevino added that the Corps plans their dredging activities far in advance, and it is a good idea to get those commitments in early to the Corps. Mr. Krams noted the Corps holds an annual dredging conference where they outline their projects for the next 2 years. Ms. Olivarri added that the reason the CBBEP is doing this is so they can send this list of ideas back to the Corps, and hopefully they can then use it in their process.

Someone asked if there is any vision of how you will decide on which ideas are good ones and which are not. Mr. Carangelo said that would not be part of their particular effort but there are methods of doing cost estimates and other tests to determine the success of a project.

Dr. Montagna said this product should be reviewed to take a big picture and see what ideas are good ones and which conflict with others.

Someone asked if anyone has looked at how building islands like Pelican Island affect the flow of water in and out of the Corpus Christi Bay. Mr. Carangelo said they have performed a Hydrodynamic and Salinity Model of the existing system. The Texas Water Development Board has already done some work on this subject. The Channel Improvement Project will perform Hydrodynamic and Salinity Modeling of the existing footprint. In addition, they will model the footprint of the proposed dredged material management alternatives including beneficial uses of dredged material.

Someone said Mr. Carangelo spoke about the possibility of capping contaminated areas with new dredged material. He asked if all the material in the bottom of the ship channel was uncontaminated. Mr. Carangelo said this is a sensitive area because some people think "contaminated" is anything that has gone above what God has done. Others think it is only when you get ecological impairment from man-caused pollution. The ship channel has been intensively evaluated. The Corps does routine sampling throughout the area. Historically, there has been a problem with contamination in the Inner Harbor. Some of that contamination has migrated out and ended up in Nueces Bay. By in large, the sediments in Corpus Christi Bay are in pretty good shape.

Kim Halbrook asked if there was any data on what types of material are available and in what quantities. Mr. Krams said in general, the reach across the upper bay is composed of very fine silts. The area out toward the entrance channel, the reach to Ingleside, and the La Quinta Channel is mostly silty sands. The area west of the Harbor Bridge also has good sands. There are potentially 25 million yards of new work material from the CCSC-CIP and about 3 million yards of maintenance material each year.

Carolyn Chancellor said they currently pay to have their channel (Piper Channel) dredged routinely and their placement area is getting full. She asked who was responsible for removing and disposing the material. Mr. Carangelo said it is their responsibility to dredge it, but they could make arrangements with the Port to place that material in another area. Greg Brubeck is the contact person at the Port for making those arrangements. He also stated they may want to contact the Corps about availability in their placement areas.

Dr. Smith asked how far away from the ship channel are they looking at to use the dredged material. Mr. Carangelo said that beyond two or two and one-half miles they have to use boosters, so that is the limit at this time.

Someone asked if there was a possibility that there are some contaminated areas that might be dredged during this project and if so, what is the plan for that material. Mr. Carangelo said if the question he was referring to "hot spots", then they know where those hot spots should be – mostly in the Inner Harbor area. Sediments don't change all that much unless there is a spill or midnight dumping. If unacceptable levels of contamination are found, it could be sequestered in a designated area and will be capped with uncontaminated material.

Dr. Montagna said there should be a filter for these ideas to sort out the good ones from the bad ones. He suggested considering the "First, do no harm" theory and suggested placing dredged material on the beach as nourishment. He said because the concept of beneficial use is not always beneficial, we should consider the ideas only if there is a net gain. For example, storm protection and beach nourishment both have a clear net gain. He suggested ranking these ideas. Ms. Olivarri said the project's goal is to solicit beneficial use ideas from the public. After the ideas are compiled, the scientific community needs to assist in the evaluation of what are good ideas and what are not, and then go back to the public to tell them why they believe this. But that is outside the scope of this project. It may be something that the CBBEP needs to take on later. She asked Dr. Montagna who he would suggest be the people that review this list. Dr. Montagna said the Scientific and Technical Advisory Committee (STAC) would be a good place to start.

Ms. Halbrook said a list like this is very important for brainstorming.

Mr. Trevino said the CBBEP has been recognized by the ICT (Interagency Coordination Team) for the Upper Laguna Madre, and they are open to listening to the CBBEP about suggested beneficial uses. CBBEP will also make this information available to Texas Parks & Wildlife.

Someone said it is very important to develop a mechanism to determine what is a "true" beneficial use – which are detrimental, which are neutral.

Someone asked if all the material could fit in the existing containment areas. Mr. Krams said during the Reconnaissance Phase, it was determined that all possible dredged material from the CCSC-CIP could be placed in existing placement areas used by the existing 45-foot project.

Someone asked if a 55-foot depth was necessary for container ships. Mr. Carangelo said there have been many analyses on the draft needs for the container fleet. Some ships in the container fleet will be drafting the 55-foot depths. However, most ships will be drafting much less than that. There is a large fleet that can traverse even the existing channel depth.

Someone asked if the potential impact of a storm coming through the channel has been evaluated. Mr. Krams said there is a storm surge analysis that will be performed.

Several attendees commented that their ideas for beneficial uses were already included in the list.

One written comment was received at the conclusion of the meeting. Kim Halbrook, Texas GLO, wrote "I am glad that beneficial uses of dredge material is an option these days. The fact that so many meetings are occurring in our area is a sign that we are moving in the right direction. Great presentation as well as information."

Summary of Beneficial Uses Meeting
Kingsville
October 10, 2000

Tuesday, October 10, 2000
Kingsville Chamber of Commerce

The Port of Corpus Christi Authority (Port) and the Coastal Bend Bays & Estuaries Program (CBBEP) held a public meeting in Kingsville on Tuesday, October 10, 2000.

Attendees were:

- Butch Thompson, King Ranch
- Frank Salinas, Kingsville Resident

Port and CBBEP representatives who attended were:

- Paul Carangelo, Port
- David Krams, Port
- Leo Trevino, CBBEP
- Leah Olivarri, Olivarri & Assoc.
- Kelly Billington, Olivarri & Assoc.

The presentation began with Paul Carangelo thanking Mr. Thompson and Mr. Salinas for attending. He introduced David Krams (Port), Leo Trevino (CBBEP), Leah Olivarri (Olivarri & Associates, Inc.), and Kelly Billington (Olivarri & Associates, Inc.) He asked Mr. Trevino to talk about the CBBEP.

Mr. Trevino said the CBBEP is a non-profit organization. Their goals and objectives are to protect the natural resources and ensure a high quality of life in a 12 county area (McMullen, Live Oak, Bee, Refugio, Aransas, Duval, Jim Wells, San Patricio, Nueces, Kleberg, Kenedy, and Brooks Counties.) The CBBEP is a relatively new organization, as it is only a couple of years old. Prior to the CBBEP being organized, a group called the Corpus Christi National Estuary spent five years studying the area and determining the areas needs, resources, and endangered areas. From that work, the CBBEP Base Plan was created. The Base Plan is a blueprint of sorts, in that it gives ideas about what resources are available and how they might be managed.

The purpose of this meeting is to focus on the beneficial uses of dredged material. There are many different projects in our area that require routine maintenance dredging. It is the CBBEP's goal to ensure that that material is used in the most beneficial way possible. The Intercoastal Waterway (ICWW) is dredged periodically and some of that material may be used beneficially in this area.

Mr. Carangelo said the Port is in the process of studying improvements for the Corpus Christi Ship Channel. In that project, they are trying to identify potential beneficial uses of dredged material associated with that project. The CBBEP has identified maximizing beneficial uses of dredged material in their Estuary plan. The CBBEP was going to start an outreach program to begin contacting people about their ideas for dredged material and potential projects. Similarly, the Port was going to start an outreach program to get ideas and comments from the public in regard to the Ship Channel Project. So, instead of having two programs trying to reach the same audience, the Port and CBBEP joined together to collectively solicit ideas.

The Port is a contractor to the CBBEP to obtain the information. Once that information is obtained, Olivarri & Associates, Inc. will prepare a report that will be used as needed by the Port's Channel Improvement Project and the CBBEP.

This meeting is one in a series of five meetings on the beneficial uses of dredged material throughout the area. Previous meetings have been held at the Blucher Institute at Texas A&M University in Corpus Christi, Ingleside On The Bay, and The University of Texas Marine Sciences Institute in Port Aransas. Another meeting will be held tomorrow night in Rockport.

Mr. Carangelo asked Mr. Krams to speak about the existing system of the ship channel and the proposed improvements to the ship channel. Mr. Krams said the existing system is about 38 nautical miles in length. The Entrance Channel is 47' deep and 700' wide. The main Ship Channel is 45' deep and 400' wide. La Quinta Channel is 45' deep and 400' wide, and the Corpus Christi Inner Harbor is 45' deep.

Mr. Krams noted that the proposed Channel Improvement Project is a federal project, with the U.S. Army Corps of Engineers (Corps) as the lead and the Port as the local sponsor. The project began with the local sponsor's decision to pursue the project. It was then sent to Congress for approval to investigate. After Congressional approval, the first part of a two-phase planning process began with a Reconnaissance Study by the Corps. That study was completed in 1994. The second phase, Feasibility Study and Environmental Impact Statement, is currently underway. It began with a cost sharing agreement signed in June 1999. If the results of the Feasibility Study show there is national interest or benefit, then it is sent to Congress for authorization and funding, then to engineering and design, construction, and finally operation and maintenance. The Feasibility Study is expected to complete within three years.

Mr. Krams said there are three general improvements to the proposed Channel Improvement Project. The first is widening the channel across the Corpus Christi Bay and adding barge shelves. The second alternative is deepening the entire ship channel system to 50- or 52-feet. The third alternative is to extend the La Quinta Ship Channel and adding a turning basin for the proposed container terminal facility.

Mr. Carangelo stated that there is approximately 25-30 million cubic yards of new work material and 150 million cubic yards, over a 50-year period, of maintenance material that could result from this project. He identified the Port's existing Dredge Material Placement Areas (DPMAs.) Some are located along both sides of the main channel in the open water of the Corpus Christi Bay and on the islands just south of the main channel between Live Oak Peninsula and Port Aransas. There are also DMPAs in the Inner Harbor Reach along both sides of the Inner Harbor.

Mr. Carangelo explained that seen from a global perspective, the beneficial uses of dredged material include engineered, agricultural, and environmental applications. Examples of engineered uses include land creation and land development uses such as levees, landfill capping, and strip mine reclamation, as well as dredged material reuse like construction quality materials, manufactured soils (building products), and commercial and industrial facilities. Examples of agricultural uses of dredged material include aquaculture use in confined placement sites and topsoil.

The most popularly recognized of the three types of beneficial uses of dredged materials are environmental uses. Examples of environmental uses include marsh wetland creation and restoration, aquatic and marine habitat enhancement (reef structures, seagrass beds, unvegetated shallow water habitat, and emergent mudflats habitat), gulf beach and bay beach nourishment, terrestrial habitats (rookery islands and recreational destinations and parks), shoreline erosion control, near shore sediment management (underwater berms/capping), and thin layering (ecological stimulation.)

The Port and CBBEP are interested in public comment and input and have sought and continue to urge early participation. There has been intensive state and federal regulatory agency involvement since 1999. There have been a number of workgroups set up for the purpose of assisting the Port with developing the Environmental Impact Statement (EIS) and the Dredged Material Management Plan (DMMP.) There have been a number of feasibility study public meetings and updates, and Beneficial Uses Public Forums.

Mr. Carangelo turned the meeting over to Leah Olivarri. Ms. Olivarri said that the purpose of the meeting was to solicit ideas and perceptions on beneficial uses of dredged materials for the entire estuary area. These ideas will not automatically be done just because they are on a list, but it will prevent project managers from having to start a square one to decide what to do with the dredged material resulting from their project.

Verbal comments that were received were:

- Several years ago the Corps approached the King Ranch to acquire land from the ranch for the placement of dredged material resulting from the maintenance dredging of the ICWW. TPWD stepped in and took members of the King Ranch to a Port Lavaca ranch to show them the benefits of dredged material placement on land as a way to assist growth of vegetation and there was nothing there. The concern of the King Ranch is they still have not seen any agricultural benefits of dredged material placement in this area. If there were some documented positive agricultural uses that would apply, then worth pursuing.
- The rookery islands are great and would like to see more.
- Spray dredged material into the Laguna Madre to stimulate seagrass growth.
- Stabilize/restore waste lands on the mainland adjacent to the Lower Laguna Madre in Kenedy County.
- Beach nourishment or enhancement, shoreline protection near Loyola Beach. The residents near Kaufer Park are building a seawall to protect from erosion.

There were no written comments received at the meeting. Mr. Carangelo thanked the attendees and adjourned the meeting.

Summary of Beneficial Uses Meeting
Rockport
October 11, 2000

Wednesday, October 11, 2000
Rockport Community Building

The Port of Corpus Christi Authority (Port) and the Coastal Bend Bays & Estuaries Program (CBBEP) held a public meeting in Rockport on Wednesday, October 11, 2000.

Attendees were:

- Dan Gill
- Wilson McBride
- Thomas Blazek

Port and CBBEP representatives who attended were:

- Paul Carangelo, Port
- Leo Trevino, CBBEP
- Kelly Billington, Olivarri & Assoc.
- David Krams, Port
- Leah Olivarri, Olivarri & Assoc.

The presentation began with Paul Carangelo thanking Mr. Gill, Mr. Blazek, and Mr. McBride for attending. He introduced David Krams (Port), Leo Trevino (CBBEP), Leah Olivarri (Olivarri & Associates, Inc.), and Kelly Billington (Olivarri & Associates, Inc.) He asked Mr. Trevino to talk about the CBBEP.

Mr. Trevino said the CBBEP is a non-profit organization. Their goals and objectives are to protect the natural resources and ensure a high quality of life in a 12 county area (McMullen, Live Oak, Bee, Refugio, Aransas, Duval, Jim Wells, San Patricio, Nueces, Kleberg, Kenedy, and Brooks Counties.) The CBBEP is a relatively new organization, as it is only a couple of years old. Prior to the CBBEP being organized, a group called the Corpus Christi National Estuary spent five years studying the area and determining the areas needs, resources, and endangered areas. From that work, the Coastal Bend Bays Plan was created. The Coastal Bend Bays Plan is a blueprint of sorts, in that it gives ideas about what resources are available and how they might be managed.

The purpose of this meeting is to focus on the beneficial uses of dredged material. There are many different projects in our area that require routine maintenance dredging. It is the CBBEP's goal to ensure that that material is used in the most beneficial way possible. The Intercoastal Waterway (ICWW) is dredged periodically and some of that material may be used beneficially in this area.

Mr. Carangelo said the Port is in the process of studying improvements for the Corpus Christi Ship Channel. In that project, they are trying to identify potential beneficial uses of dredged material associated with that project. The CBBEP has identified maximizing beneficial uses of dredged material in their Estuary plan. The CBBEP was going to start an outreach program to begin contacting people about their ideas for dredged material and potential projects. Similarly, the Port was going to start an outreach program to get ideas and comments from the public in regard to the Ship Channel Project. So, instead of having two programs trying to reach the same audience, the Port and CBBEP joined together to collectively solicit ideas. The Port is a contractor to the CBBEP to obtain the information. Once that information is obtained, Olivarri & Associates, Inc. will prepare a report that will be used as needed by the Port's Channel Improvement Project and the CBBEP.

This meeting is the last in a series of five meetings on the beneficial uses of dredged material throughout the area. Previous meetings have been held at the Blucher Institute at Texas A&M University in Corpus Christi, Ingleside On The Bay, The University of Texas Marine Sciences Institute in Port Aransas, and in Kingsville.

Mr. Carangelo asked Mr. Krams to speak about the existing system of the ship channel and the proposed improvements to the ship channel. Mr. Krams noted that the proposed Channel Improvement Project is a federal project, with the U.S. Army Corps of Engineers (Corps) as the lead and the Port as the local sponsor. The project began with the local sponsor's decision to pursue the project. It was then sent to Congress for approval to investigate. After Congressional approval, the first part of a two-phase planning process began with a Reconnaissance Study by the Corps. That study was completed in 1994.

The second phase, Feasibility Study and Environmental Impact Statement, is currently underway. It began with a cost sharing agreement signed in June 1999. If the results of the Feasibility Study show there is national interest or benefit, then it is sent to Congress for authorization and funding, then to engineering and design, construction, and finally operation and maintenance. The Feasibility Study is expected to complete within three years.

Mr. Krams said the existing system is about 38 nautical miles in length. The Entrance Channel is 47' deep and 700' wide. The main Ship Channel is 45' deep and 400' wide. La Quinta Channel is 45' deep and 400' wide, and the Corpus Christi Inner Harbor is 45' deep. There are three general improvements to the proposed Channel Improvement Project. The first is widening the channel across the Corpus Christi Bay and adding barge shelves to 530-feet. The second alternative is deepening the entire ship channel system to 50- or 52-feet. The third alternative is to extend the La Quinta Ship Channel and add a turning basin for the proposed container terminal facility. In March 1998, the Port purchased approximately 1,000 acres of adjacent to Reynolds Metals to build a container terminal. They are currently in negotiations with several large container companies and this alternative is contingent upon an agreement with one of these companies.

Mr. Carangelo said it is the goal of the Port to get the Channel Improvement Project into the Water Resources Development Act (WRDA) 2002. There are a lot of environmental studies going on and it is a very high intensity project.

Mr. Carangelo explained that seen from a global perspective, the beneficial uses of dredged material include engineered, agricultural, and environmental applications. Examples of engineered uses include land creation and land development uses such as levees, landfill capping, and strip mine reclamation, as well as dredged material reuse like construction quality materials, manufactured soils (building products), and commercial and industrial facilities. Examples of agricultural uses of dredged material include aquaculture use in confined placement sites and topsoil.

The most popularly recognized of the three types of beneficial uses of dredged materials are environmental uses. Examples of environmental uses include marsh wetland creation and restoration, aquatic and marine habitat enhancement (reef structures, seagrass beds, unvegetated shallow water habitat, and emergent mudflats habitat), gulf beach and bay beach nourishment, terrestrial habitats (rookery islands and recreational destinations and parks), shoreline erosion control, near shore sediment management (underwater berms/capping), and thin layering (ecological stimulation.)

Mr. Carangelo turned the meeting over to Leah Olivarri. Ms. Olivarri said that the purpose of the meeting was to solicit ideas and perceptions on beneficial uses of dredged materials for the entire estuary area. These ideas will not automatically be done just because they are on a list, but it will prevent project managers from having to start a square one to decide what to do with the dredged material resulting from their project.

Verbal comments that were received were:

- Shoreline erosion and stabilization on Live Oak Peninsula, especially in Copano Bay.
- Renourish the public beach in Rockport.
- Enhance rookeries.
- Enhance nesting sites at Little Bay.
- Create wetlands as exchange for other wetlands on property adjacent to Hwy 35 (Cove Harbor) to expand Aransas Navigation District.

There were no written comments received at the meeting. Mr. Carangelo thanked the attendees and adjourned the meeting.

Summary of Public Meeting
December 6, 2000

The Port of Corpus Christi held a public meeting on Wednesday, December 6, 2000 at 6:00 P.M. in the Nueces Room of the Solomon P. Ortiz International Center, 402 Harbor Drive, in Corpus Christi. The purpose of this meeting was to update the public on the status of the Channel Improvement Project.

The meeting had two parts: the first was a comprehensive project overview presented by Paul Carangelo and David Krams, Port of Corpus Christi. The second was a presentation of the hydrodynamic and salinity modeling presented by Gary Powell, Texas Water Development Board, and a presentation of the beneficial uses/dredged material management (BU/DMM) options presented by Paul Carangelo, Port of Corpus Christi.

Attendees were:

- Kari Jecker, PBS&J
- Terry Roberts, Corps of Engineers
- Greg Brubeck, Port of Corpus Christi
- Leslie Enriquez, Ch. 28 Univision
- Nolan Rhodes, resident
- Alan Dinn, CC Water Shore
- Frank Brogan, Port of Corpus Christi
- Gary Powell, Texas Water Development Board
- Norma Urban, resident
- Daniel, Michael & Mary Birt, Boy Scout Troop 164
- Dana Cheney, JFK Group
- Dave Michaelson, Port of Corpus Christi
- Mark Fisher, Texas Natural Resource Conservation Commission
- Frank Beck, City of Corpus Christi
- Jim Shiner, Shiner, Moseley & Associates
- Peter Davidson, City of Corpus Christi Marina
- Bill Dodge, Chairman, Port Commission
- Paul Carangelo, Port of Corpus Christi
- Kelly Billington, Olivarri & Associates, Inc.
- Johnny French, US Fish & Wildlife
- Martin Arhelger, PBS&J
- Mike Jansky, Environmental Protection Agency
- David Dear, Citgo
- Mark Meunier, Kiewit
- Pat Veteto, RVE, Inc.
- Tom Rodino, Shiner, Moseley & Assoc.
- Barbara Dorf, Texas Parks & Wildlife, Coastal Fisheries
- J. Goldston, Goldston Engineering
- Jay Reining, Legal Department, City of Corpus Christi
- Jaime Adame, Kiewit/Gulf Marine
- Ray Newby, Texas General Land Office
- David Ondrias, City of Corpus Christi, Parks and Recreation
- John Phillips, International Resource Group
- Mark Avelar, Morehead, Dotts & Associates
- Leo Trevino, Coastal Bend Bays & Estuaries Program
- David Krams, Port of Corpus Christi
- Leah Olivarri, Olivarri & Associates, Inc.

Summary of Public Meeting
December 6, 2000

Mr. Bill Dodge, Chairman of the Port Commission, welcomed the public to the meeting. He said the purpose of the meeting is to update the public on the status of the Channel Improvement Project. This is the fourth meeting of this partnership with the US Army Corps of Engineers. This study is being done at a cost of $6.9 million. The Port Commission and Staff have been very busy working on a number of fronts to diversify our Port to either remain competitive or grow competitive in a number of different non-traditional lines. The Channel Improvement Project effort is considered critical, not just to the current competitiveness, but also to the future competitiveness of the Port of Corpus Christi. Tonight's briefing continues a series of public briefings that have been held over the past few months, most recently in August 1999 and May 2000. Another public briefing is tentatively scheduled for February or March 2001. The Port plans to complete this project in time for authorization through WRDA (Water Resources Development Act) 2002.

Comprehensive Project Overview Summary

Mr. Paul Carangelo, Project Environmental Coordinator, thanked Mr. Dodge and reviewed the agenda. The meeting is set up in two parts. The first part is a comprehensive overview of all elements of the project followed by a question and answer session. Part two will be a more detailed briefing on Hydrodynamic and Salinity Modeling and Beneficial Uses/Dredged Material Management Options that are being considered for this project. Part two will be followed by another question and answer session. There are also comment forms available in the agenda packets.

Mr. Carangelo introduced Mr. David Krams, Senior Project Engineer. He reviewed the existing channel system. There are a total of 35 miles of deep draft navigation channel that begins in the Gulf of Mexico. From the Gulf through the Port Aransas jetties the channel is about 500-feet wide. There is an eight-mile reach from Port Aransas to La Quinta Junction near Ingleside. Across the Corpus Christi Bay, there is about 10 miles of 400-feet wide channel to the Harbor Bridge. Finally, there is eight-miles of Inner Harbor to the west of the bridge. The Port of Corpus Christi is currently authorized to 45-feet through all of those reaches.

Now, the Port of Corpus Christi is studying six alternatives. Originally, there were seventeen alternatives and those have been narrowed down to six. They are:

1. Widen existing 400-foot wide channel across Corpus Christi Bay between Ingleside and the Harbor Bridge to 530-feet;
2. Add barge lanes across Corpus Christi Bay;
3. Extend La Quinta Channel approximately 8,000-feet and add a turning basin at the proposed La Quinta Trade Gateway;
4. Deepen the entire Corpus Christi Ship Channel system to 52-feet, from the Gulf of Mexico to Viola Turning Basin, and widen across Corpus Christi Bay;
5. Deepen the entire Corpus Christi Ship Channel system to 50-feet, from the Gulf of Mexico to Viola Turning Basin, and widen across Corpus Christi Bay;
6. Deepen La Quinta Channel to 50-feet.

Summary of Public Meeting
December 6, 2000

This is a federal process, lead by the Corps. We are in the second phase of a two-phased planning process. The first phase was Reconnaissance, which was completed in 1994. This was a quick initiative study by the Corps to determine whether there was federal interest to proceed into a more detailed Feasibility Study. We are about midway through the Feasibility Study and are seeking authorization under WRDA (Water Resources Development Act) 2002.

There are various socio-economic, environmental, and engineering studies that are a part of this project. Economic studies that have been completed include:

- Channel Widening Benefits
- Channel Deepening Benefits
- Multi-port Analysis for La Quinta
- Tonnage Forecasts
- Vessel Fleet ForecastsCommodity Specific Vessel Forecasts

Deepening benefits are constrained by existing and projected trading ports and routes. Some users of our port will be coming from a port that has shallower water that we have. However, the draft analysis did show that we would be able to derive benefits from 75% of crude imports, 50% of petroleum imports, 40% of petroleum exports, and 8% of grain exports. We will also be evaluating how the deepening will affect offshore transfer of crude (lightering).

Widening benefits will be derived from reductions in delays caused by vessel meeting restrictions. There are various meeting restrictions that are self-imposed by the pilots including combined beam width restrictions and combined draft restrictions. Widening increases safety and reduces delays, which result in transportation cost savings.

Preliminary economic results show recommend deepening of the Corpus Christi Ship Channel to 50-feet or 52-feet with widening to 500-feet or 530-feet. Results for La Quinta show justification for the extension at its current depth of 45-feet although deepening of that reach may not be economically justified.

There have been many engineering and environmental studies going on. They include:

- Ship Simulation
- Geo-technical Analyses
- Dredge Quantities
- Shoaling Studies
- Cultural Resources
- Dredge Material Placement Plan
- Shoreline Erosion
- Hydrodynamic and Salinity Modeling
- Pipelines
- Living Resources Trends
- Species-Habitat Database
- Water and Sediment Quality

- Beneficial Uses of Dredge Material
- Mitigation Alternatives
- Ballast Water Management
- Spill Control Strategies
- Cumulative Impacts
- Endangered Species
- Marine and Estuarine Resources

The Corps performed the ship simulation study. It is a real-time ship simulator. Actual Aransas and Corpus Christi Pilots participated in the study. The simulator modeled the entire reach of the channel, including channel meetings and turning basins. They also included a Barge Shelf Analysis with a video survey of existing practices to make recommendations on the addition of barge shelves. Recommendations included widening across the Corpus Christi Bay to 530-feet, widening across the Lower Bay Reach (La Quinta Junction to Port Aransas) to 530-feet, widen a portion of the entrance channel to 700-feet, and widen La Quinta extension to 400-feet.

Geo-technical analyses have been completed. A review of existing borings was completed to determine the types of materials that will be removed from the project areas. In general, the materials across Corpus Christi Bay and offshore are soft clay, stiff clay in the Inner Harbor and La Quinta extension, and sand in Lower Bay and La Quinta Channel. These material characteristics determine costs related to dredging, any suitable use for beneficial uses, Slope Stability Analysis, and suitability of use as levee and beneficial use construction.

The amount of material that will be available is dependent on the alternatives that are chosen. There are approximately:

- 5-6 million cubic yards of new material available from widening across Corpus Christi Bay;
- 300,000 cubic yards of new material available from creating barge shelves;
- 7 to 8 million cubic yards of new material available from the La Quinta extension;
- 10 to 15 million cubic yards of new material available from the extended entrance to the La Quinta Junction;
- 7 to 10 million cubic yards of new material available from deepening across Corpus Christi Bay;
- 3 to 5 million cubic yards of new material available from deepening the Inner Harbor; and
- 3 to 4 million cubic yards of new material available from deepening La Quinta Channel.

Total available new work material is between 5 and 50 million cubic yards.

A shoaling study was done to determine the amount of material that would need to be removed during the 50-year life of this project. Historical records were reviewed and sampling was done.

Comprehensive Project Overview Questions & Answers

David Dear said in the Houston Ship Channel Project, they widened first and are now going back to add barge shelves. Citgo thinks widening the Channel and adding the barge shelves are most important and want to make sure that Corpus Christi does not make that same mistake, widening without barge shelves.

Paul Carangelo said the Port is taking note of the lessons learned from other projects. The barge shelves have always been a component of all the alternatives being considered. As a nuance of the way the study monies and processes go forward, the barge shelves are actually broken out as a separate component, but they are always there for every option. The Port is very focused on that component.

David Krams added that the current practice is to use the existing beacons that are 800-feet apart. The barges are already using this area as a barge shelf. The Port recognizes the importance of that.

David Dear asked where the funding comes from to relocate pipelines. Paul Carangelo said the relocation of pipelines is the subject of state and federal court action at this time. Current practice is that the owner of the pipeline is considered responsible for that relocation.

Peter Davidson said the DMPA areas south of the Ship Channel impede access to the Corpus Christi Marina, which causes problems and impedes navigation. Coming in from Port Aransas, boats have to be careful of draft to avoid the spoil areas coming into the marina. He asked if the Port had any evaluations of what could be done in the future.

Paul Carangelo said this was interesting to learn because the Port was not familiar with that problem. He thanked Mr. Davidson for bringing this problem to the Port's attention. It has been a standard practice throughout history for the Port to use those areas. At this time, they have not considered it a problem because they have not been aware of that until now. Oddly enough, some people have suggested the Port put dredge material there to renourish Sunfish Island. This may be a conflict of ideas. DMPA 17D typically receives very soft clay and consolidation in that area goes back very quickly to its original depths. David Krams added that depth is eight feet.

Greg Brubeck suggested the Port meet with the Marina as soon as possible to address these issues.

David Dear asked if the deepening would be all the way up the Inner Harbor. Paul Carangelo said, "Yes."

Greg Brubeck noted the Port's schedule for the recommended economic plan is early next year. Paul Carangelo added that is why the Port is planning another update meeting in the spring.

Frank Brogan asked if there is any need to widen at the entrance channel, near Port Aransas. David Krams said there is a transition from 600-feet to 720-feet in that area. WES recommended they widen that area because the ships have to swing wide to make the turn.

David Ondrias said he was a newcomer to the area and will be working with the Water Shore Advisory Committee at the City. He just moved here from Houston and has some familiarity with the Houston Ship Channel Project. He was interested to know if, at the outset, there were private interests of smaller channels that wanted to become part of this project or if it has been an issue at all.

Paul Carangelo said that was a somewhat thorny issue. The short answer is no, but there have been some ideas tendered for other dredging and waterfront development projects. These ideas will be presented as part of the beneficial uses forum.

David Ondrias said he was asking this question from the standpoint of Federal, State, and City government working together for substantial improvements. He asked if the Port was still open to the idea of having a dedicated channel to the Marina.

Paul Carangelo asked that the Port and the City meet to discuss this. Greg Brubeck will be the point of contact to arrange this meeting. There have been some proposals tendered to the Port in the past, but have been complicated for this project to address because they have their own set of issues that have to be dealt with. Leah Olivarri noted that the Corps might have limitations on this issue, too.

Nolan Rhodes said if the Port does have the opportunity, they should look into this. It is also important to look into the fact that the harbor at the Marina was originally dug to 20-feet, in some places 26-feet. Today, it is 6- to 7-feet. At some point in the near future, the City has to go through the planning and environmental impacts of dredging that material. If it could be included in this project, even though it is not the Port's obligation, that is something to think about. Maybe the Port could solicit help from the City.

Paul Carangelo said his job is to get a project for the Port and he is going to very jealously guard that timeline. However, given the resources between the two parties, they can think through the best way to do that. Greg Brubeck added that the Port's focus is the authorized federal channel. These discussions are not part of that definition. That doesn't mean that we cannot talk about them, but realize that it is outside the scope of what the Port has embarked on.

Hydrodynamic and Salinity Modeling Summary

Gary Powell said there was a RACT (Regulatory Agency Coordination Team) meeting about a month ago where TWDB presented animations that showed the circulation and salinity patterns in this estuary under current conditions and then repeated that with wet and dry years with the maximum development plan for the Channel Improvement Project. The interesting thing about that is the difference between the current conditions and the proposed improvements is almost nothing. For example, the difference in tidal elevation was .06 - .08 feet. It does not appear that anything that has been proposed for this project would have any profound effects. The bay is very healthy. In fact, this system has tendency for very high salinity. The ship channel actually diminishes the stressful periods because it improves the ocean circulation.

The salinity effect is mostly already here. The improvements show a change of about two parts per thousand over the entire range of the bay. There were some areas that seemed to have enhanced recovery. One was the area of the Nueces Bay near the Nueces River Delta. There was a structure that was suggested be placed in that area in the maximum development plan to see what the impact would be. It turns out that salinities were greatly improved by "trapping" the fresh water fronts. They reside longer in the Nueces Bay before they are washed out to the Corpus Christi Bay.

There is continued modeling going on. We are still working to look at dredged material and three-dimensional stratification. The animations will be available on the TWDB website, www.twdb.state.tx.us.

Beneficial Uses/Dredged Material Management Options Summary
The presentation is attached to serve as summary notes.

Beneficial Uses/Dredged Material Management Options Questions & Answers
Jay Reining asked if the Port was dredging the Inner Harbor deep enough to get all the contaminated material. Paul Carangelo said the idea of contamination is in the eye of the beholder. Because this is an industrialized channel, it has always been suspect to contamination.

Greg Brubeck added that when the Port went from 40- to 45-feet, they accomplished essentially what Mr. Reining was asking about. All of those sediments that might have been considered contaminated were captured. None of the sediments that have come from the channel have violated any thresholds. They have just had trace amounts. All suspect materials that were removed during the 45-foot project were placed in upland confined areas and capped.

Paul Carangelo said because of the history of the Corpus Christi Ship Channel, it is a textbook case for zinc contamination. He noted his disagreement with the Ward report, because he used some dated information. Many of the materials that were placed in upland confined sites and capped were later sold. There was no trace of contamination.

Greg Brubeck said the current plan is to continue placing all the material from the Inner Harbor into upland confined sites because it is simply not worth the effort.

Paul Carangelo added that it is not on a chemical basis, but on an environmental basis, that the Port has made that decision and the Workgroup agrees.

Dave Michaelson asked if in Option 3A, the deepening stops at Beacon 82. Paul Carangelo said option 3 is actually to deepen all the way through the system. Because the materials west of Beacon 82 are going to go to upland placement sites and materials east of Beacon 82 are going to other areas, they decided to separate Option 3 into two parts to show the separation of materials.

David Dear asked how many more years of capacity was available for maintenance material. Paul Carangelo said they have additional capacity that was not there during the 45-foot project. The Port purchased the Tule Lake area, the Driscoll Foundation, and have added significant capacity. The idea of a 50-year project life is to think of a major navigation project as a generational improvement. We can continue to raise levee heights, but still get that capacity even with diminishing sites.

David Dear asked if the Port had received interest expressed by industry to dredge their berths if the channel is deepened. Paul Carangelo said when they do these studies, they accommodate for the material as if the user was going to dredge their berths to that depth also. David Krams added that the Port must account for the additional materials and the cost of bringing that facility to proper depths.

To further answer the question about capacity, Greg Brubeck said the Port makes very conservative assumptions. David Krams added the Port has a better understanding of the numbers now and are still refining those estimates.

Frank Brogan asked if they factored in any opportunities for selling dredge material. Paul Carangelo said they have not accounted for that, although it has been identified as a beneficial use. Given the yardage requirements available, they would just get the benefits of the sale and improving the capacity and save the long-term costs. There is no requirement that he knows of where the Port would have to account for that.

POCCA Channel Improvement Project
Summary of Public Meeting
Wednesday, April 25, 2001

The Port of Corpus Christi Authority (Port) and US Army Corps of Engineers (Corps) held an informational public meeting at 6:00 PM on Wednesday, April 25, 2001 in the Nueces Room of the Solomon P. Ortiz International Center.

Attendees were:

- Pat Suter, Sierra Club
- Fuat Sezer, Kiewit Offshore Services
- Allan Hayes, Shiner Moseley & Assoc.
- Gabrielle Grunkemeyer, Nueces River Authority
- Susan Stone, Stone Earth Sciences
- Robert Roberts, A&C Corporation
- Jay Masterson, Masterson Fabrication
- Ann Melton, Par-Mel Printers
- David Dear, Citgo
- Jim Shiner, Shiner Moseley & Assoc.
- Mark Pattillo, US Army Corps of Engineers
- Sarah Hudlow, Ingleside Resident
- Tom Hall, Coastal Bend Guides Association
- Bob Heinly, US Army Corps of Engineers
- Bobby Nedbalek, San Patricio EDC
- David Jensen, Texas A&M University - Corpus Christi
- Chuck Rushing, FUGRO
- Judy McQueen, Sherwin Alumina
- Hugo Bermudez, PI Engineering
- David Krams, Port of Corpus Christi
- Eddie Arnold, Aransas Pass Resident
- Scott Cheney, Kiewit Offshore Services
- Leah Olivarri, Olivarri & Associates
- Laurie Valenta, Olivarri & Associates
- Steve Williams, Resident
- Laura Elder, Caller-Times
- Bill Kopecky, Coastal Bend Sun
- Michael Berry, Bay, Ltd.
- Kenneth Rice, US Fish & Wildlife Services
- Wayne Clayborne, US Coast Guard
- Rusty Rusteberg, Channel 10
- Clayton Poenish, Ingleside Resident
- Louis Adams, Aransas Corpus Christi Pilots Association
- Leo Trevino, Coastal Bend Bays & Estuaries Program
- Marie Pattillo, US Army Corps of Engineers
- R.L. Jenkins, Portland Resident
- Jay Reining, City of Corpus Christi
- Pat Parr, League of Women Voters
- David Mayo, San Patricio EDC
- Tom Posey, FUGRO
- David Jones, Sherwin Alumina
- Vladimir Shepsis, PI Engineering
- Greg Brubeck, Port of Corpus Christi
- Paul Carangelo, Port of Corpus Christi
- Pauline Clarke, League of Women Voters
- Carolyn Chancellor, Airport & Channel Corp.
- Kelly Billington, Olivarri & Associates

POCCA Channel Improvement Project
Summary of Public Meeting
Wednesday, April 25, 2001

I Welcome and Introductions

Greg Brubeck welcomed the attendees to the meeting.

II Presentation of the Corps' Recommended Plan

David Krams introduced Bob Heinly, Paul Carangelo, Vladimir Shepsis, Hugh Burmudez, Gary Powell, Leah Olivarri, Kelly Billington, and Laurie Valenta. Mr. Krams reviewed the agenda, noting the presentation would be broken into two segments. The first presentation, given by Mr. Krams, would be the Corps' recommended plan followed by a question and answer session. The second presentation, given by Mr. Carangelo, would outline the proposed Dredged Materials Management/Beneficial Uses (DMM/BU) Plan and would also be followed by a question and answer session. Mr. Krams also noted there would be time at the end of the presentations for general questions and comments from the public.

Mr. Krams reviewed the existing channel system and noted the history of the channel deepening. The current channel system has several limitations. First, the current 45-foot depth may not be sufficient for future use. Second, proposed Port facilities on the La Quinta Channel lack deep-water access. Third, the channel across Corpus Christi Bay is narrow. It was because of these limitations that the Port requested the following improvements to the system:

- Deepen to 50-feet,
- Extend La Quinta Channel, and
- Widen channel to 500-feet and add barge shelves.

Mr. Krams said vessel sizes are increasing and therefore are able to transport more cargo. With a deeper, wider channel and the addition of barge shelves, these vessels can reduce costs and improve safety. An extension of the La Quinta Channel would allow access to the site of the proposed La Quinta Trade Gateway.

This is a federal planning process lead by the Corps. The Port is the local sponsor. They are currently involved in the second part of a two-phase planning process to determine the feasibility of the project and to develop an Environmental Impact Statement. A cost/share agreement was signed between the Port and Corps in June 1999, for $6.7 million. The process will take approximately 36 months to complete.

Many engineering and environmental studies have taken place. Some of these include ship simulation, geotechnical quantities, shoreline erosion, and hydrodynamic and salinity modeling. Other studies include water and sediment quality, beneficial uses of dredged material, mitigation alternatives, and endangered species.

Initially, 17 alternatives were identified for this project. These alternatives were screened and narrowed down to six alternatives:

- Deepen Corpus Christi Ship Channel to 52-feet,
- Widen Corpus Christi Ship Channel to 530-feet and add barge shelves,
- Extend channel entrance 10, 000 feet and deepen,
- Extend La Quinta Channel 7,200-feet, and
- No deepening of La Quinta Channel.

A benefit-cost analysis was performed on all six alternatives, which resulted in the Corps' recommended plan. The Corps' plan formulation included: an estimate of initial construction and operation/maintenance costs for various alternatives; a projection of future transportation cost savings or benefits for each alternative; a calculation of the benefit-cost ratios and net benefits of each alternative, and the resulting recommended plan.

Initial construction costs included the cost of dredging, levee construction, bank stabilization, pipeline relocation, and engineering and construction maintenance. The Corps' total estimated cost for construction is $192 million, of which approximately $50 million is allocated for pipeline relocation and $100 million for dredging.

The Corps' economic analyses included: tonnage/vessel fleet forecasts; channel deepening benefits like lightering, direct shipments, and lightening; channel widening benefits; and the benefit-cost analysis and recommended plan. Tonnage forecasts revealed an annual growth of one to four percent per year through 2056. Average annual deepening benefits are estimated at over $44 million at 52-feet depths. Average annual widening benefits are estimated at approximately $900,000.

III Question and Answer Session on Corps' Recommended Plan

Jim Shiner commented he was surprised there were not enough benefits to deepen La Qunita Channel. Mr. Krams responded saying the existing industries along that channel barely use the 45-foot depths. If another industry were here that would utilize deeper depths, it might affect the benefits.

Pat Suter asked to whom the benefits accrue. Mr. Krams said these are transportation cost savings. Industries that contract these ships to bring in cargo are the ones that will benefit.

Ms. Suter asked what benefit is there to the Port. Mr. Krams observed that this is a federal channel, so the federal government mandates the Port make shipping lanes as competitive as possible. That is why a reconnaissance study was performed; to see if it is really in the government's interest to pursue this study.

The Port is trying to keep Corpus Christi in the lead. Several other Texas ports are considering deepening their ports. Corpus Christi is not unique anymore, however, it has the advantage in that it only needs to be extended two miles instead of the fifteen required by other ports.

Ms. Suter asked if the docking fees were by ship or by tonnage. Mr. Krams said the Port charges docking fees by tonnage. Mr. Brubeck added that the deeper channel would facilitate more tonnage and more dockage revenue.

Ms. Suter asked what effects this project will have on the Harbor Bridge. Mr. Krams said the deeper channel would allow vessels to draft deeper, therefore increasing the clearance at the bridge.

David Mayo responded that the widening of the channel is important because if there were a collision in the bay, it would be catastrophic. Mr. Krams agreed and added that was difficult to put a price tag on.

Mr. Mayo asked if the recommended plan was going to be done in part or in whole. Mr. Krams said it is all one package. Mr. Heinly added the National Economic Development (NED) benefits were considered. They are trying to get the best benefits for the entire nation. If the Port decided to widen only, there may not be enough benefit for it to be supportable for the nation.

Mr. Mayo asked if the La Quinta Channel extension would be an additional phase. Mr. Krams said because it is in the feasibility study phase, we have to ask Congress to authorize as big a project as possible. That is not to say that it would all be constructed at one time, it may be phased. It depends on available funding.

Judy McQueen asked if the Port looked at current utilization. Mr. Krams responded yes. Ms. McQueen then asked if we were alleviating some of the burden of other Texas ports. Mr. Krams replied this study did not go into that, because of already existing infrastructure. Mr. Brubeck added that the Port of Corpus Christi is one of three such projects in Texas. There is no fighting over cargo at this point as Corpus Christi cargos differ from other Texas ports.

Someone in the audience asked what the timeline was for this project. Mr. Krams said they are planning for authorization in the Water Resources Development Act 2002 (WRDA 2002).

IV Presentation of DMM/BU Plan

Mr. Krams introduced Paul Carangelo, who presented the DMM/BU update. Mr. Carangelo reviewed the information that would be covered in this presentation and noted a question and answer session would follow. He noted the purpose of

APPENDIX D

COORDINATION

this presentation was to present the recommended DMM/BU Plan to the public and provide an opportunity for public comment.

Mr. Carangelo said the key finding in the 1994 Reconnaissance Report with regard to dredged material management planning was that the existing placement sites could accommodate all the dredged material resulting from this project. This plan incorporates beneficial uses for several reasons: it is a federal, state, and Port policy; there is the potential to yield net positive environmental benefits; beneficial uses can be done potentially at similar costs; and there is great public acceptance.

The DMM/BU Plan integrates engineering studies, environmental studies, and public input. The proposed project is environmentally sound. This proposal was developed by and agreed to by state and federal regulatory agencies, has involved the public throughout, and has long-term environmental benefits.

The new work dredging would result in approximately 41 million cubic yards (CY) of material. The maintenance work would result in approximately 3.5 million CY per year.

The proposed placement plan includes:

- A breakwater and +/- 200 acres of unvegetated and vegetated submerged and emergent habitat at the west end of Dredge Material Placement Area 13 (DMPA 13), across from the La Quinta Channel Extension.
- A +/- 130-acre buffer zone on the west side of the proposed La Quinta Trade Gateway property.Shoreline and vegetated habitat for Ingleside On The Bay.Three +/- 175 to 200 acre sites with breakwater and vegetated and unvegetated submerged habitat near the La Qunita Junction.Shoreline protection for Pelican Island and Port Aransas.A breakwater and +/- 200 acre vegetated and unvegetated emergent, shallow, and deep-water habitat just east of Dagger Island.A submerged feeder berm for the Port Aransas Beach.And, continued placement of existing DMPAs, including the Inner Harbor and offshore sites.

Mr. Carangelo said there is still much work ahead. A draft Feasibility Report and draft Environmental Impact Statement (EIS) are scheduled for completion in fall 2001. The Corps' will hold a public meeting in fall 2001. The final EIS is scheduled for completion in February 2002 for inclusion in the Water Resources Development Act (WRDA) 2002.

V Question and Answer Session on DMM/BU Plan

Mr. Mayo asked when mitigation would begin for this project. Mr. Carangelo replied now that the proposed plan has been identified, the impacts of the model would be evaluated. This is where mitigation takes place. However, they have taken great care to avoid mitigation issues thus far. He stated it was his guess that because they were creating more habitats, there would be little or no mitigation.

Mr. Mayo asked if there would be dredged material placed on shore. Mr. Carangelo said some material would be placed in existing confined placement areas. For example, inner harbor material will be placed in upland confined areas.

Mr. Mayo asked if there was no concern about contaminants. Mr. Carangelo said the Inner Harbor has a legacy of contamination, so the workgroup has determined that any of the new work or maintenance material would be placed in upland confined sites even though there have been no significant findings of contamination. It was noted that The Clean Water Act is working and maintenance dredging helps. Mr. Brubeck added that there are trace amounts of some contaminants found throughout the channel, but because of management, it is not a huge problem. When the channel was dredged from 40-feet to 45-feet, the material was placed in an upland confined placement area and capped.

David Jones asked how the $110 million non-federal amount would be raised. Mr. Carangelo replied the funds would be based on the revenue from the dockage and tariff revenues the Port receives. He stressed the fact that the Port is self-sufficient. Mr. Krams added that $50 million is estimated for pipeline relocations, which will be borne by pipeline owners.

Someone in the audience asked how they proposed to generate the required federal funds without a fight. Mr. Carangelo said there is always a fight for money, but if the community agrees that this is an important project then there is a better chance for funding. He added that the Port has a strong past of obtaining necessary funding. Mr. Heinly added that there are no negatives to date regarding funding. There is only a question of building as fast as you can or allowing the Port to slow down its timetable to ensure funds are generated. He also noted that the almost four to one ratio the Port has for this project is a strong indication that they will receive necessary funding in appropriate time.

Tom Hall said he is concerned about the area filling in between Pelican Island and Placement Plan Option J. They call this area the East Flats. It is disturbing the fresh water flows in this area. They are losing the fish hatchery here. Mr. Carangelo said there is a conflict in this area because some people like to fish there. Others are only concerned about the birds on Pelican Island. This conflict will be addressed, in depth, in the next modeling scenario.

Anne Milton said she thought that the area mentioned in Public Comment #61 was wetlands. Mr. Carangelo said these were just general ideas gathered from the public. The Port is not considering this as an option in the DMM/BU Plan.

David Jensen asked what type of armored levees would be constructed in this plan. Mr. Carangelo explained they would be rocks and large boulders similar to those used in current shoreline protection. Mr. Krams added they cold be likened to the Marina jetties.

Someone in the audience asked what the plan was for the area to the west of the La Quinta Trade Terminal property. Mr. Carangelo said the plan for this area is a 130-acre, elevated buffer zone to protect neighbors to the west from sound and visual distractions. The buffer would be a one-time placement area and may become a park or recreation destination.

Eddie Arnold noted dredge activity drives birds away from Pelican Island. He suggested only dredging that area when the birds had migrated. Mr. Carangelo reassured him that they would calendar restraints into consideration when dredging that area. Ms. Suter affirmed they have been careful of calendar limitations in the past.

David Dear asked if the Houston/Galveston project had any impact on shipping during that project's construction. Mr. Krams answered he did not know about Houston, but the Corpus Christi Port's dredging contract stipulates that the dredge gets out of the way of ships. The pilots give the dredge a heads up with plenty of lead way to move. One audience member noted that the Houston Ship Channel has been shut down for pipeline relocation, but had not had any problems with dredging as far as he knew.

Someone in the audience asked if the Corpus Christi Port Industries were behind this project. Mr. Krams said they have been kept abreast of the progress and, in general, were supportive of the project.

There were no additional comments. One written comment was received at the meeting. Michael Berry asked David Krams to call him to discuss costs; including the cost of dredging from dock to channel; and the cost to dispose dredged materials from this area.

The meeting adjourned at 8:00 PM.

Olivarri & Associates has received three written comments in the mail, to date:

Fuat Sezer and Scott Cheney wrote, "Thank you very much for the meeting to inform people about the latest developments. Kiewit Offshore is developing a new offshore fabrication facility at the intersection of Jewel Fulton Canal and La Quinta Channel. We have a 3,600-foot long water frontage along the La Quinta Channel. It is very important for us to widen and deepen the La Quinta Channel to the same water depth and width as the CCSC. We will be constructing and transporting large floater structures, which will require every bit of water depth and width available in the ship channel. Please reconsider the widening of the La Quinta Channel. Thank you."

Robert B. Roberts wrote, "I serve on the Board of Directors of the Airport and Channel Corporation at Island Moorings, Port Aransas. We are responsible for the maintenance and upkeep of Piper Channel. Please keep me informed."

Chuck Rushing wrote, "Has a deep draft anchorage been considered for inside the bay? Consider discussing benefits with shipping lines and port industries versus costs of initial and maintenance dredging. A good location might be on the south side of the bay crossing channel, just west of La Quinta Channel and Dredge Material Placement Area "R".

Corpus Christi Beach Association
April 20, 2000

David Krams and Paul Carangelo met with the Corpus Christi Beach Association on April 20, 2000. The Association meets on the third Thursday of each month at 4:00 PM at the Breakers Condominium on North Beach. Betty Black is the current President and Paul and David were invited by Dearl Lance, member. Paul and Dearl met recently at the Texas Beach Association meeting in Houston, Texas where they are both members.

Paul Carangelo provided the audience of about 25 with copies of the August 1999 newsletter on the CCSC-CIP. Paul's briefing described the effort to authorize a major navigation feature; described the goals of the PCCA in the CCSC-CIP; and described BU opportunities associated with the project. David and Paul answered various questions about the CCSC-CIP.

The audience learned about the Rincon federal assumption and dredging schedule for 2000 and the possible use by the COE for the feeder berms for CC beach and for the bird rookery. They also learned about the upcoming BU forums. The association was interested in whether the materials from the CCSC-CIP might be suitable for CC beach. They made no mention about ship wakes and related damage. They were interested in future updates from the Port on the project. Dearl Lance will contact Paul from time to time to invite the Port for the update. The presentation with Q&A lasted about 35 minutes.

Summary of Beneficial Uses Meeting
Coastal Bend Guides Association
October 3, 2000

Tuesday, October 3, 2000
George's Restaurant, Flour Bluff

Representatives from the Port, CBBEP, and Olivarri & Associates, Inc. met with the Coastal Bend Guides Association at their regularly scheduled monthly meeting. CBGA Members in attendance were:

- Marvin Engel
- Don Miller
- Willard Allen
- Jerry Wellman
- Richard Gamewell
- Mark Lyons
- Barry Badders
- Ralph Elliott
- Warren Hart
- Don McTee
- W.A. Mayer
- Frank Duxstead
- Don Hand
- Randall Roquette

Presenters included:

- David Krams, Port of Corpus Christi
- Paul Carangelo, Port of Corpus Christi
- Leah Olivarri, Olivarri & Associates
- Kelly Billington, Olivarri & Associates

The presentation began with Captain Mark Lyons introducing Paul Carangelo. Mr. Carangelo thanked Capt. Lyons and the CBGA for allowing the Port and CBBEP to talk with them and gather input on the beneficial uses of dredged material. He introduced David Krams (Port) and Leah Olivarri and Kelly Billington (Olivarri & Associates, Inc.).

Mr. Carangelo said the Port is in the process of studying improvements for the Corpus Christi Ship Channel. In that project, they are trying to identify potential beneficial uses of dredged material. The CBBEP also identified maximizing beneficial uses of dredged material in their Estuary plan. The CBBEP was going to start an outreach program to begin contacting people about their ideas for dredged material and potential projects. Similarly, the Port was going to start an outreach program to get ideas and comments from the public in regard to the Ship Channel Project. So, instead of having two programs trying to reach the same audience, the Port and CBBEP joined together to collectively solicit ideas.

The Port is a contractor to the CBBEP to obtain the information. Once that information is obtained, Olivarri & Associates, Inc. will prepare a report that will be used as needed by the Port's Channel Improvement Project and the CBBEP. He asked Mr. Krams to talk about the existing system of the ship channel and the proposed improvements to the ship channel.

Mr. Krams said the existing system is about 38 nautical miles in length. The Entrance Channel is 47' deep and 700' wide. The main Ship Channel is 45' deep and 400' wide. La Quinta Channel is 45' deep and 400' wide, and the Corpus Christi Inner Harbor is 45' deep.

Mr. Krams noted that the proposed Channel Improvement Project is a federal project, with the U.S. Army Corps of Engineers (Corps) as the lead and the Port as the local sponsor. The project began with the local sponsor's decision to pursue the project. It was then sent to Congress for approval to investigate. After Congressional approval, the first part of a two-phase planning process began with a Reconnaissance Study by the Corps. That study was completed in 1994. The second phase, Feasibility Study and Environmental Impact Statement, is currently underway. It began with a cost sharing agreement signed in June 1999. If the results of the Feasibility Study show there is national interest or benefit, then it is sent to Congress for authorization and funding, then to engineering and design, construction, and finally operation and maintenance. The Feasibility Study is expected to be completed within three years.

Mr. Krams said there are three general improvements to the proposed Channel Improvement Project. The first is widening the channel across the Corpus Christi Bay and adding barge shelves. The second alternative is deepening the entire ship channel system to 50- or 52-feet. The third alternative is to extend the La Quinta Ship Channel and adding a turning basin for the proposed container terminal facility.

Mr. Carangelo stated that there is approximately 25-30 million cubic yards of new work material and 150 million cubic yards, over a 50-year period, of maintenance material that could result from this project. He identified the Port's existing Dredge Material Placement Areas (DPMAs). Some are located along both sides of the main channel in the open water of the Corpus Christi Bay and on the islands just south of the main channel between Live Oak Peninsula and Port Aransas. There are also DMPAs in the Inner Harbor Reach along both sides of the Inner Harbor.

Mr. Carangelo explained that seen from a global perspective, the beneficial uses of dredged material include engineered, agricultural, and environmental applications. Examples of engineered uses include land creation and land development uses such as levees, landfill capping, and strip mine reclamation, as well as dredged material reuse like construction quality materials, manufactured soils (building products), and commercial and industrial facilities. Examples of agricultural uses of dredged material include aquaculture use of confined placement sites and topsoil.

The most popularly recognized of the three types of beneficial uses of dredged materials are environmental uses. Examples of environmental uses include marsh wetland creation and restoration, aquatic and marine habitat enhancement (reef structures, seagrass beds, unvegetated shallow water habitat, and emergent mudflats habitat), gulf beach and bay beach nourishment, terrestrial habitats (rookery islands and recreational destinations and parks), shoreline erosion control, near shore sediment management (underwater berms/capping), and thin layering (ecological stimulation).

The Port and CBBEP are interested in public comment and input and have sought and continue to urge early participation. There has been intensive state and federal regulatory agency involvement since 1999. There have been a number of workgroups set up for the purpose of assisting the Port with developing the Environmental Impact Statement (EIS) and the Dredged Material Management Plan (DMMP). There have been a number of feasibility study public meetings and updates, and Beneficial Uses Public Forums. Previous meetings were held at TAMU-CC Blucher Institute, Ingleside On The Bay, and in Port Aransas at UT-MSI. Others will be held in the Rockport and Kingsville areas.

Mr. Carangelo turned the meeting over to Leah Olivarri. She said that the purpose of the meeting was to solicit ideas and perceptions on Beneficial Uses of Dredged Materials. The Port's focus is on the Channel Improvement Project and the materials that can be used from that project. The CBBEP's focus is the entire estuary area. Ms. Olivarri noted handouts that included a map and corresponding list of suggested beneficial uses of dredged material that have been compiled from surveys by the CBBEP and previous public meetings held by the Port and CBBEP.

Verbal suggestions included:

- Waterfront development and beach nourishment and development in Aransas Pass at the old LDR facility, close to the Shrimporee Festival site, just west of Hampton's Landing.
- Concern for the boat wakes that might increase with the widening and deepening of the ship channel and increased ship traffic and how that will affect the current erosion problem on the north side of the bay.
- Slowing down the ships as they pass through La Quinta Junction, as the wakes the boats leave continue to erode the north side of the bay, in particular Ingleside On The Bay near the La Quinta Junction and Redfish Bay.
- Placement in open water DMPAs to reduce erosion at Ingleside Point.
- Pump it inland. Don't want sands and silt clouding the water.
- Shoreline protection behind Pelican Island.
- There are two spoil islands that are very good fishing areas in Rockport Cut. Would like to see more of those.
- More islands in the middle of Corpus Christi Bay.
- Concern with the circulation of the bay system.
- More seagrasses/seagrass protection in Redfish Bay.
- The weed bed areas at the La Quinta junction have good fishing. Additional areas similar to that would be good.
- Concern that more nesting areas will bring more predators.

Two written responses were received.

- Captain Mark Lyons suggested adding to the DMPA islands in order to reduce erosion at the Ingleside Point. Also, extending break waves to reduce shoreline erosion. He also noted at the west degauzing facility there is a high bank off the Welder property that might be taken out by the Navy. He would like to see other places like this. Relocation.
- Jerry Wellman wrote, "At the old LD Richards Barge Area adjacent to New Park – Trailer Park Pier at old Aransas Pass Airport – near Hampton's Landing. Remove all old barges and put in fill sand for a beach. Tie it to the Park and

Trailer Park with a boardwalk over habitat area, marsh area. Add a good boat dock with drive up dining, etc."

Summary of Channel Improvement Project Update at
Coastal Bend Guides Association Meeting
February 6, 2001

The Port of Corpus Christi Authority (Port) presented their Channel Improvement Project (CIP) update to 25 members of the Coastal Bend Guides Association (CBGA) at their regularly scheduled meeting on Tuesday, February 6, 2001 at the Olde Time Grille in Aransas Pass.

Paul Carangelo summarized the status of the CIP and various studies, providing detail on those related to dredged materials management. The draft dredged materials management/beneficial uses (DMM/BU) plan was reviewed in detail.

CBGA members in attendance were:

- Larry Ebest
- Mike Murphee
- Jerry Timmins
- George Herzog
- Walter Meier
- Art Weiss
- John Day
- Don McTee
- C.B. "Rusty" Haire
- Lloyd Dreyer
- Marvin Landers
- Terry Tracy
- Marvin Sessler
- Barry Badders
- Mark Lyons
- Kevin McCoy
- Jack Nelson
- Tom Hall
- Bill Haines
- Don Miller
- Jerry Wellman
- Don Hand
- Mark Rochester, III
- Richard Gamewell
- Joel Pruitt

Questions and comments from the CBGA members follow.

Q: How far will the La Quinta extension reach? Will there be a turning basin? What is the extension for? How can silting be prevented in that area?

A: Mr. Carangelo said the proposed extension of La Quinta would extend 8,000-feet past its current location. A new turning basin will be added at the end of the extension. It is for the proposed Container Terminal Facility that is planned for the land the Port owns between the Reynolds Plant and North Shore Country Club. There are several options being considered at this time to prevent silting in that area. We will discuss these options when we talk about the draft concept dredged materials management plan later in this presentation.

Q: How much material will result from the La Quinta extension?

A: Mr. Carangelo said the La Quinta extension at minus 45 foot would generate seven to eight million cubic yards of dredge material.

Q: What are the dimensions of the La Quinta extension? Will the existing La Quinta Channel be widened? How close will it come to the shoreline?

A: Mr. Carangelo said the extension is proposed to 45-feet deep and 400-feet wide. There will be no changes to the existing La Quinta Channel. The berthing area for the container facility will come close to the shoreline. The extension channel will be at about the same distance from the shoreline as the existing channel in the area near Reynolds and there would be a turning basin like the one at Reynolds.

Q: How deep is the existing Reynolds Channel?
A: Mr. Carangelo said that by Reynolds Channel you mean the La Quinta Channel and that is 45-feet deep; the Reynolds dock is a 45-foot dock.

Q: How deep is the area now where the proposed channel extension will be placed? Has that area been tested for toxins? That is a big area of concern because of the Reynolds plant.
A: Mr. Carangelo said the current water depth of that area is between six and ten feet. An extensive study of the shoaling rate has been performed in that area and has been included in the proposed amounts of available materials. Sediment quality for contaminants has been checked there, and the area is actually very clean.

C: It is hard to believe that after 30 years there is no toxicity in that area.
A: Mr. Carangelo said the information we have is new and is the best we can get. We have also assembled and reviewed prior data collected in the same area in the past. If you want to get a more hands-on view of that data, we can arrange to meet and discuss it. It is very important information and we are willing to pass that information along to you.

Q: Would Site C be an island?
A: Mr. Carangelo said that Site C would be a submerged shallow flat from knee to chest deep with, possibly, a U-shaped breakwater like structure to protect it and the shoreline at Ingleside Point from wind waves and ship and vessel wakes. It would be shallow enough to grow sea grasses and receive light. The design is still in the idea stage at this point but to determine cost for the concept design. . The Beneficial Uses Workgroup will assist development of the best way to do this and we will seek further public input on the design before we move too far along.

Q: Site C is proposed as 175 acres. Is the old Ingleside Point Island the same size?
A: Mr. Krams said the Ingleside Point Island is actually closer to 210 acres.

Q: How is the entrance channel [at Port Aransas} dredged?
A: Mr. Carangelo said a hopper dredge typically dredges the entrance channel.

Q: About six years ago, material was placed on Pelican Island but there was no containment, so it all ran off the backside of the island. What does this do to the sea grasses?
A: Mr. Carangelo said the conservation interests request that kind of maintenance material placement for certain types of birds that nest there. There was a time that people thought unconfined dredged material placement was bad and, in some

instances when it destroyed areas like seagrass flats or reef structure, it can be. So, a lot of people wanted it all placed on uplands or into confined placement areas. Now, people are seeing that they have created some good things by mistake with unconfined placement and have begun shifting their practice to begin using it for habitat creation and enhancement. Pelican Island is this kind of practice. The seagrass that occurs at pelican are in the cove between the two lobes and are unaffected by this activity; the addition of sediment to form sandbars may be providing it protection from wave attack.

C: The run off of that material on Pelican Island causes the passage through Pelican Island and Point of Mustang to close up. The shrimpers have a hard time getting through there because it is so shallow on a low tide.

A: Mr. Carangelo said this is a concern that the Port was not aware of that issue. The public's concerns should be heard and that is why we are here tonight.

C: Mr. Carangelo noted that ideas from the meeting with the CBGA in October 2000 are included on the beneficial uses list (numbers 53 through 61) and were considered in the development of the draft plan. He referred the attendee to the materials and handouts.

Q: What is the timeline for this project?

A: Mr. Carangelo said they are looking for authorization through the Water Resources Development Act (WRDA) 2002. Construction could begin within one year following authorization if finances are available.

Q: What is the timeline for the La Quinta extension?

A: Mr. Krams said the La Quinta extension is dependent on securing a container terminal partner and the development schedule of the Container Terminal partner. It should take six to eight months to dredge the extension, depending on the contractor's schedule.

Q: How long will the entire [CCSCCIP] project take to complete?

A: Mr. Krams said it will probably be phased construction and the timing depends on financing and other variables. That question has not been answered yet because it is still a little too early, but an estimated time frame would be five to seven years.

C: You will be stressing the system for a long time.

Q: How far from the shoreline will the La Quinta extension be?

A: Mr. Carangelo said 300-1,000 feet off the beach, similar to the zone between the existing La Quinta channel and the Reynolds and Oxychem area.

C: Dredging kills fishing until the dredging is complete. How much material are you going to put in the bay?

A: Mr. Carangelo said maybe 3.5 million cubic yards of new work material would be placed into the bay. The material would be placed the several sites outlined tonight.

Q: There are 20 miles across the open bay with a predominant southeast wind seven months out of the year. A row of islands would stop the erosion at Portland.

A: Mr. Carangelo said they agree. The proposed structures would be five to six feet above the water with low marsh and submerged flats behind them for shallow water habitat.

Q: When the project is complete, how long will it take for the sea grasses to grow and the fish to move in?

A: Mr. Carangelo said once dredged material is placed in an area, benthic recovery begins almost immediately and the fish move in to prey on these burrowing animals like worms and crabs. If seagrasses are planted and survive it would take one to three years for them grow in. If seagrasses are not planted, there is typically a very high rate of natural colonization of shoal grasses, especially if the areas are protected from wind and waves. If the sea grasses are not planted and are allowed to colonize naturally, it could take three to six years.

Q: Is planting part of the project?

A: Mr. Carangelo said there would probably be a plan to plant in some areas and not in others.

Q: If seagrass is being destroyed in an area, you have to account for that.

A: Mr. Carangelo said yes, they have to mitigate for impacts to sensitive environments like grassbeds. On the far western end of La Quinta, there is a grass bed there. We would have to mitigate for that; however, we are planning to create much more sensitive habitat that would be lost. We have not yet selected a plan so we do not know yet what might be impacted. But we the proposal would create about 800-1000 acres of new shallow water habitat by converting primarily deep-water bay bottom.

Q: What can be done about ship speeds?

A: Mr. Carangelo said anyone that has a complaint should call the Aransas Pilots Association and talk to Bill Parish. Mr. Parish is the President of the Aransas Pilots Association.

Q: Who polices the dredging? You can watch leaks that last for days, then there are dead fish everywhere. On one occasion, we called Beau Hardegree (TPWD) and he came out and saw what was happening. He made a phone call and it was fixed immediately.

A: Mr. Carangelo said public activism is the way to get things done.

Q: Is there a "hot line" that we could call in instances like these?

A: Mr. Krams said the Corps is in charge of the dredging. He suggested calling the local Corps office at 884-3385 and reporting dredging problems when they occur. Mr. Carangelo added the COE project managers do not want these leaks to occur, but they need to know that it is happening. By your activism, we can make sure that this work is done properly.

At the end of the meeting, Mr. Krams clarified that the time frame he mentioned of five to seven years was for all the phases of the entire project. He did not mean to imply that actual dredging would be continuous during this period.

Summary of Channel Improvement Project Update at
Coastal Bend Bays Foundation Meeting
January 8, 2001

The Port of Corpus Christi Authority (Port) presented the Channel Improvement Project update to the Coastal Bend Bays Foundation (CBBF) at their regularly scheduled monthly meeting on Monday, January 8, 2001. David Krams and Paul Carangelo presented the project alternatives, study results to date, the beneficial use project with the Coastal Bend Bays & Estuaries Program (CBBEP), and discussed a detailed presentation on the draft Dredged Material Management/Beneficial Uses (DMM/BU) plan.

CBBF members in attendance were:

- Manuel Freytes, GLO
- Greg Brubeck, PCCA
- Terry Cody, TPWD
- Harry Martin, CBBF Member
- Frank White, CBLT
- Lois Huff, CBBF Member
- Rebecca Brooks, Naismith Eng.
- Robert Moore, OxyChem
- Patrick McGloin, McGloin & Sween
- Ty Harris, TAES
- Bob Wallace, CBBEP
- Richard Gonzales, New American Marketing
- Rebecca Brooks, NEI
- Cal Jennings, CCA
- Philippe Tissot, CBI
- Kirk Cammarata, TAMU-CC
- Henry Hildebrant, CBBF Member
- Teresa Carrillo, CBBF
- Frank Kelly, CBI
- Jim Bonner, CBI
- Brooke Sween-McGloin, McGloin & Sween
- Leo Trevino, CBBEP
- Jay Reining, City of Corpus Christi

Questions and comments from the CBBF members regarding the draft concept DMM/BU plan follow.

Q: Regarding benthic recovery, is there a significant difference in the numbers and composition of species in the disposal areas and non-disposal areas along the ship channel?

A: Mr. Carangelo said he couldn't authoritatively speak to the specific number of species involved, but in the placement areas the grain size is coarser because of the shell that winnows out after placement. It is that textural difference that causes the difference in the numbers of individuals of the species found in comparing the placement sites to the reference sites. He stated it was his understanding that the species composition was very similar between areas but the abundance of the species differed between areas. There is a lot of excellent data on this subject and you are welcome to review it.

Q: Where is the information located?

A: Mr. Carangelo said the benthic recovery study could be found on the WES web site. It is a very large file, but the Port has hard copies available, upon request. Mr. Brubeck suggested the Port try to get a link to the data on the Port site. Mr. Krams added there is also an interactive site at TWDB for the hydrodynamic modeling for the bay system. The Port will also try to get a link to that data on their site as well.

Q: Has the Port considered the re-dredging of Packery and the impacts of the hydrology to the bay system? Will the Packery project increase the dredging levels?

A: Mr. Carangelo said Packery Channel has been included in the hydrodynamic and salinity model, at the request of the Corps. There is such a minor effect from a small project like Packery because the Ship Channel dominates all the flows in and out of our bay system.

Q: How will the slight change of a tidal amplitude (a total 0.06 - 0.08 feet) impact the food source for shoreline birds?

A: Mr. Carangelo said these changes referred to are the extreme values at certain points throughout the whole bay system, the values at the majority of areas were even less. The values of 0.06 – 0.08 feet is the total amplitude, so these are really minor changes, 0.03-0.04 feet at the top and the bottom. He noted the resource agencies have acknowledged this is a minor/no effect/no change situation. He stated that the real big changes to our bay system happened when the original 26-foot deep channel was opened back in the 190's through Turtle Cove connecting CC Bay to the Aransas Pass inlet..

Q: After deepening and widening the channel, there will possibly be increased ship speed, and therefore, increased wake resulting in shoreline erosion. This is a concern. Was this considered as part of the hydrodynamic and salinity modeling?

A: Mr. Carangelo said it was not part of the hydrodynamic and salinity modeling. However, it was included in the shoreline erosion study. Pacific International Engineering is looking at the ship sizes of today and of the future (to see if the typical vessel size using the channel will change) as well as ship speed, in relation to potential effect on shoreline erosion. The Port is very concerned about excessive speed in the Channel. If someone feels they need to report a problem, please call the Aransas Pilots and report the complaint. The pilots have a legal obligation to operate at sufficient speed to maintain safe steerage.

Q: If you widen and deepen, it will reduce the current in the ship channel. Does the model pick this up?

A: Mr. Carangelo said yes, the shoreline erosion model does pick this up. When the channel is widened, there is also an opportunity to dissipate the draw down effect, which occurs more prominently in a narrower channel. Pacific International Engineering is doing this work. That model and the resulting data will be available on their web site when completed.

Q: Who are different players in this project?

A: Mr. Carangelo said the players are the Port of Corpus Christi Authority, U.S. Army Corps of Engineers (including WES), PBS&J, Pacific International

Engineering, and Texas Water Development Board. Mr. Krams players also include said the technical Workgroups are also a very significant part of this project and are comprised of many regulatory agencies including Texas Parks and Wildlife, Texas General Land Office, EPA, TxDOT, US Fish and Wildlife, National Marine Fisheries Services, Texas Railroad Commission, and TNRCC. Another key player is the public.

Q: Are any conservation groups or other public concerned groups directly involved in the Workgroups?

A: Mr. Carangelo said there was no direct public "at the table" participation in the Workgroups at this time. However, the Port continues to provide extensive opportunities for public involvement and feedback through other avenues, like this meeting. There will also be a great opportunity for public involvement when the Draft EIS is prepared.

Q: Are the piping plover and their habitat an issue?

A: Mr. Carangelo said piping plover are an issue that is being considered in the context of critical habitat. There is an extensive piping plover survey underway throughout the project area. This issue is part of the threatened and endangered species studies.

Q: What is involved in the shoreline erosion studies?

A: Mr. Krams said the first task was to develop a GIS footprint of erosion. The second task is to look at the existing conditions and the percent contributions to shoreline erosion. Finally, model scenarios will be run to show effects.

C: Texas Parks and Wildlife is interested in creating islands up into south Redfish Bay for shallow sea grass habitat.

A: Mr. Carangelo said that has been evaluated as part of this project. The proposed beneficial uses plan reflects that idea and will be discussed further in this meeting.

Q: What study has been done so far to result in the decision to place dredge material in open water areas in Corpus Christi Bay (Option No. 1, Site A, B, C)?

A: Mr. Carangelo said no final decision has been made at this time. These management practices are being evaluated because of several factors including economics and environmental benefits. The proposed placement would primarily occur within existing dredge material placement sites. Mr. Brubeck added that the material available in that reach of the channel is very different than other areas. Mr. Carangelo said the material is very soft clay material and is extremely hard to hard to build with. In addition, the benthic recolonization studies have shown that any negative effects are temporary and spatially limited.

Q: How much public input will go into the final decision of identifying the most beneficial use?

A: Mr. Carangelo said there has been considerable public input and there will continue to be more public input solicited for this project than ever before for a navigation project in the Corpus Christi Bay area. The Port has gone well beyond the required amount of public input for such projects. The public has a lot of authority and power and will hold us responsible. We hope to settle on the vision for this project before the EIS is completed. We know we cannot please everyone, or meet all objectives totally, but we are trying to keep as many people – the public - involved throughout this process as possible.

Q: At what time can the public review and comment on Workgroup activity?

A: Mr. Carangelo said this meeting is an opportunity for that. This draft plan was developed through the Workgroups, however, the public input and ideas obtained over the last several months has been extensively incorporated into the Workgroup's product. At the public meeting planned for sometime in March or April of this year there will be yet another opportunity, even with the focus to discuss the results of the economic analysis. Mr. Krams added that it is better to get the public input early, often and now so that it is a part of the Corps' economic analysis. The Corps does not require this much public involvement, but it is the Port's position that the public must be involved from the beginning of the project, through the end, and beyond. Mr. Carangelo said the Port and the CBBEP went to the public to solicit beneficial use ideas. Many of these ideas were incorporated into this draft concept plan.

Q: When the Estuary Program process first began, we received an anonymous call from the Corps in Washington. They wanted do a very large geo-textile tube demonstration project with our fine silts where we would actually build a 50-year container out in the bay and over time, fill it with fine silt material. Will that kind of venture work here?

A: Mr. Carangelo said anything that is built in the middle of the bay is difficult due the materials and the economics. The geo-textile bag technology you refer to work best when filled with sandy material or even stiff clay material. When soft clay materials are used, it's more like a liquid and it takes more effort to fill the tubes because they have to be strained, and the bags do not perform well even if they are filled with that type material. They do have appropriate applications.

Q: Can you use mitigation for the loss of sea grasses to do projects other than sea grass? Is it viable?

A: Mr. Carangelo said we should be able to do that, but the regulatory agencies have to agree to it.

Q: Is the Mitigation Workgroup considering beneficial uses options along with their mitigation work?

A: Mr. Carangelo said the Mitigation Workgroup is not involved in the development of the beneficial use options, although there may be members of the Mitigation Workgroup that are also participants in the Beneficial Uses Workgroup. The

Mitigation Workgroup is likely to use the traditional project approach and look at the entire project, including the beneficial use footprint. They should determine impacts to existing habitats pre-project, even though the beneficial use/created habitat may be of a higher value habitat than that which existed before the project.

Q: What is the schedule for the economics portion of this project?
A: Mr. Carangelo said the results of the alternatives screening should be received by the second week of February.

Q: When will the EIS be complete?
A: Mr. Carangelo said the draft EIS is expected to be complete in the fall of 2001.

Q: Can we get copies of this presentation?
A: Mr. Carangelo said copies could be available, but noted this is a work in progress and therefore, is ever-changing. It is best to be involved in the next public meeting, which is planned for March or April.

Summary of Channel Improvement Project Update at
Ingleside Point Conservation Commission Meeting
January 23, 2001

The Port of Corpus Christi Authority (Port) presented their Channel Improvement Project update to the Ingleside Point Conservation Committee (IPCC) at their regularly scheduled meeting on Tuesday, January 23, 2001. David Krams and Paul Carangelo reviewed the channel project, presented the project alternatives, and discussed the draft DMM/BU plan.

IPCC members in attendance were:

- Rhoda & Don Poenisch
- Jay Loyetta Masterson
- Skip & Katie Hatch
- Steven Carion
- Keith & Carol Regnier
- Cindy Davis
- Janice Arnsdorff
- Billie & Clayton Poenisch
- Ann Hubby
- Marcella Arnsdorff
- Phil & Sherri McMullin
- Cynthia Foster
- Marie Counter
- Sarah Hudlow

There were other persons in the meeting that did not sign in or identify themselves.

Questions and comments from the IPCC members follow.

Q: In looking at the contributions to erosion, are you taking note of the constant rate of ships? They do not travel at the speeds they are supposed to. They travel much faster.

A: Mr. Carangelo said they are modeling the ships speed at 10 knots. Ship speed was monitored in several areas, including at a station in Ingleside Cove Sanctuary. Actual speeds of ships tracked ranged from about 8 to 12 knots.

Q: Does the model include the bulkheading and back filling that is going on at Berry's Island or does the model have the original land?

A: Mr. Carangelo said the model shows Berry's Island as it is proposed. He noted that in modeling, anything three-foot deep or shallower is considered dry land because mathematically it has the same effect on hydrodynamics. The small change in shoreline position will not affect the modeling. The hydrodynamic and salinity model is quite refined but a difference in 60-feet of shoreline will not affect the model or the quality of the output. The shoreline erosion study focused on specific areas of concern like Pelican Island, Ingleside Point, and others. That study is working to separate out the proportionate affects of shoreline erosion from the various conditions, and sources of energy, potentially causing erosion.

C: There were lots of birds on the island just off our property when we first came here thirty years ago. The island across the channel has grown and there are not as many birds as there were. Also, there are a greater number of shells appearing on the beach. Something is happening. In the last five years, larger shells have been appearing.

C: That shows they have just come back to this area and are reproducing. That is good.

C: We cannot catch fish as big as we used to and there are no crabs anymore.

A: Mr. Carangelo said the water and sediment quality has actually improved over the last 20 to 30 years in the bay and throughout the nearby areas.

C: You can see the water breaking when the ships come by. The waves do not slow down one bit when they hit this beach.

A: Mr. Carangelo said that is why we think Site C or Q should help. It is an attempt to reduce the waves coming across Corpus Christi Bay, from whatever source, from impacting the shoreline here. Site c or Q would be a partially submerged island with stone protection on the channel facing, high wave energy sides. It will mostly be underwater with shallow and sea grass habitat.

Q: Can you explain what a geotube is?

A: Mr. Carangelo said it is big tube or sausage shaped fabric bag made out of woven polyethylene or polypropolyene fabric that is may be six or eight feet in diameter. The geotube is hydraulically filled with sand or another suitable material. He said an example of a geotube is at the Navy degaussing facility west of Jewel Fulton Canal. The Navy put geotubes there to create seagrass habitat. They are used in submergent or above water settings, and can be used to protect shorelines and to contain dredged material. Geotubes are not as good as hard structures like armor rock for long-term performance. But they have appropriate applications in various settings such as with environmental projects. Mr. Krams added that geotubes are becoming more common. It is a fairly low cost, effective option.

C: Mr. Krams noted this meeting was scheduled to give the people in this area the opportunity to tell the Port what they think of the draft DMM/BU plan and the specific site proposals. He urged the IPCC members to provide them with feedback on these sites.

Q: Site Q makes this part of the channel a narrow environment. Will that have an adverse affect on our shoreline?

A: Mr. Carangelo said we have found that the current velocities within the channel itself are not enough to mobilize that sediment in the channel. That source of energy by itself does not cause erosion. Any kind of structure like Option Q should help dissipate, block and absorb the wave energies. The reflected wave is typically much smaller and of less energy than the original. Mr. Krams added that the ships are another aspect of this. The wave that is created by the ship pressure field is really in the channel prism itself. As the ship passes through, the draw down creates the wave. The channel's shape determines how the waves dissipates and impacts the shoreline. The smaller the channel, the less the wave dissipates and the more erosion. Site Q would not block the water flows away from the channel and pressure fields will be able to spread out through the large area between Q and Berry Island.

Q: If Site Q is effective, is Site P necessary? There is not much room between the existing shoreline and the slope of the channel. How close would the geotube be to the existing shoreline?

A: Mr. Krams said Site P was proposed specifically for protecting the shoreline in this area. Mr. Carangelo said the geotubes would be close to the shoreline in certain areas such as down near the existing sheet pile bulkhead west near La Quinta Channel, but would also lie on the outer edges of the sea grass beds and thus be at a distance from the shoreline on the eastern end.

Q: How do boats know where to go if geotubes are installed?

A: Mr. Carangelo said there could be markers placed at the 50-foot gaps between the geotubes.

Q: We need to conserve the shoreline here. Not too many years ago, you could drive your boat and trailer to the end of the Beach Club property and turn back onto the beach. The Beach Club has lost two acres of land. Can material be placed on that beach? Will a geotube placed in front of the beach make the beach fill in itself?

A: Mr. Carangelo said trucked in material could be placed on the beach as a beneficial use renourishment. A geotube by itself may not do much good because may be no adequate supply of sand to fill in behind it.

Q: Over the last 20 years, the tail on Berry's Island has grown by about 400-500 yards. Where does that material come from?

A: Mr. Carangelo said the tail on Berry's island is coming from material eroding from the front of the island. There is quite a bit of sand in that area.

Q: Mr. Krams asked if they generally liked the idea of the geotubes, Site P?

A: There was general agreement from the group that the Site P was a good idea.

C: The sea grass beds are washing away. Even if Option Q were there, corrosive surges would wash away the waterfront. The surges come in over the bulkheads now in certain circumstances. Geotubes or anything else that can break the surge and protect our shoreline in that area is good.

C: Option Q would also help wind wave erosion.

Q: How long would the geotubes be?

A: Mr. Krams said they are costing a 2,800-foot geotube. The idea is for a total length of 3,000-foot with the 50 –75 foot gaps in between 500-foot geotube sections.

C: Mr. Carangelo noted that funding might be available to IOB through the GLO grant program. The Coastal Erosion Response Planning Act has helped many communities get necessary funding. Mr. Carangelo suggested the community begin looking for these types of grants for beach nourishment, bulkhead repairs, shoreline and habitat protection, etc.

Q: What do they attribute the higher water level to?
A: Mr. Carangelo said the increasing higher water levels we have experienced over the last few decades could be attributed to a general warming trend, which could be due to natural variability of climate.

C: The little yellow boats do the most damage.

Q: What would be the elevation of Site Q?
A: Mr. Carangelo said it would be mostly knee to waist to neck deep water and possibly some partially emergent up to five or six feet associated with the shore protection.

One comment form was received. Katie Hatch wrote, "Option 3A – Site Q is a good idea only if done one time – not for maintenance dredging. Site P – same map, if it would protect grasses – good idea. Maybe add sand/shell to beach at end of Beach Club."

Title: Dredged Materials Management/Beneficial Use Plan for the CCSC Channel Improvement Project

Presenters: David L. Krams, PE and Paul D. Carangelo, REM, Port of Corpus Christi Authority

Overview: The Port of Corpus Christi Authority is seeking authorization to construct the Corpus Christi Ship Channel Channel Improvement Project (CCSCCIP). The CCSCCIP, which is in the feasibility study phase, is a federal navigation project which proposes to deepen and widen the existing 45 foot MLT CCSC to 52 feet MLT and 530 feet respectively, construct barge lanes on both sides of the CCSC in the open bay reach, and extend the La Quinta Channel about 7200 feet west at a depth of 40 foot MLT. The CCSC will also be extended into the Gulf of Mexico approximately 10,000 feet to the 56 foot contour. Approximately 43 million cubic yards of new work material will be dredged during construction. Over the 50 year project life, about 150 million cubic yards will be maintenance dredged.

The feasibility study required a broad suite of complex investigations in order to understand the environmental effects of the proposal on the Corpus Christi Bay estuary. The presentation will provide a general overview of the planning efforts undertaken to address the numerous engineering and environmental studies necessary to plan and authorize the project. Details of the proposed dredge materials management – beneficial use plan (DMM/BU plan) will be provided.

A significant volume of the new work material is proposed for use to create or enhance aquatic coastal habitats. The proposed DMM/BU plan would result in the creation of approximately 1000 - 1200 acres of high value shallow water habitat in Corpus Christi Bay, and approximately 1700 acres of additional beneficial uses sites in the Gulf of Mexico. The development of the plan was the result of an extensive and open public involvement process in addition to continuous intensive coordination with numerous state and federal regulatory agency personnel.

A draft environmental impact statement is in preparation and should be available for public comment in late 2001.

SECTION 5:

PUBLIC COMMENTS

TEXAS HOUSE OF REPRESENTATIVES
GENE SEAMAN
STATE REPRESENTATIVE, DISTRICT 32
Aransas, Calhoun, Jackson & Nueces Counties

December 11, 2001

Colonel Leonard Waterworth
Department of the Army
Galveston District Corps of Engineers
P O Box 1229
Galveston, Texas 77553-1229

Re: Corpus Christi Ship Channel – Channel Improvement Project

Dear Colonel Waterworth:

Proposed improvements to the Corpus Christi Ship Channel are important to the continued growth and development of the Coastal Bend area as a major Texas deepwater port facility. As commercial and international trade increases in importance for Texas, it is critical that the Port of Corpus Christi has the ability to meet the volume of increased trade with improved transportation facilities. Improvements to the ship channel will allow the Coastal Bend region to fully benefit from new trade opportunities.

I support the proposal to widen and deepen the Corpus Christi Ship Channel and to make other improvements as proposed in the feasibility study for this project. These improvements will ensure that the Port of Corpus Christi provides a safe and efficient facility that can handle navigation traffic as it increases in both size and volume. These improvements to the ship channel will ensure increased trade at the Port of Corpus Christi and sustain future economic growth for the entire region and Texas.

If you have any questions, please feel free to contact me at 361-994-1996. Thank you for your time and attention to this important issue.

Sincerely,

Gene Seaman

Gene Seaman
State Representative
District 32

cc: John LaRue, Port of Corpus Christi

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District Office: 2222 Airline, Suite A9 • Corpus Christi, Texas 78414 • (361) 994-1996 Fax (361) 991-6578 E-mail: gene.seaman@house.state.tx.us
Committees: Economic Development • Insurance

Corpus Christi
Regional Economic Development Corporation

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Suite 1300 South
Corpus Christi TX 78401

Phone 361-882-7448
Fax 361-882-9930
www.ccredc.com

December 13, 2001 FW ~~[illegible]~~ 2 Jan 02

Colonel Leonard D. Waterworks
Department of the Army
P.O. Box 1229
Galveston, TX 77553-1229

Dear Colonel:

Please accept this letter as our letter of support for the proposed widening and deepening of the Corpus Christi Ship Channel. As you are aware, Corpus Christi has a long history of being one of the safest and cleanest ports in the world. This has been achieved while continuing to grow the Port into one of the nations busiest ports.

Along with providing much of the United States with fuel and chemicals, the Port of Corpus Christi also provides the Regional with over 50,000 jobs, making it the largest economic engine in the South Texas. The jobs provided by the industries dependent on the Port tend to be very high wage and are quickly becoming very high tech.

If we are to insure the future of the region it is imperative that we both widen and deepen the Corpus Christi Ship Channel, the economic prosperity and the environmental quality of the region depend on it.

Thanks you for you consideration of this matter.

Sincerely yours,

Ronald R. Kitchens, CED
President / CEO

Corpus Christi Chamber of Commerce

November 29, 2001

COL. Leonard Waterworth
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Dear COL. Waterworth:

The Corpus Christi Chamber of Commerce would like to express support of the Channel Improvement Project that proposes the deepening of the Corpus Christi Ship Channel from 45 feet to 50 feet in order to accommodate larger vessels, increase shipping efficiency, and enhance navigation safety. It is our understanding that after nearly two years of study, the Corps has recommended improvements that include:

- Widening the Corpus Christi Ship Channel across Corpus Christi and Redfish Bays to 530 feet;
- Deepening the Corpus Christi Ship Channel from 45 to 52 feet;
- Adding 200 feet wide barge shelves along both sides of the channel across Corpus Christi Bay;
- And extending La Quinta Channel approximately 7200 feet at a depth of 40 feet.

The Corpus Christi Chamber of Commerce recognizes that the Corpus Christi Ship Channel improvement project will produce positive socioeconomic impacts to the region. It is projected to have a high benefit-to-cost ratio with an average of $40 million in annual benefits over the next 50 years. These benefits will surely include increased employment and revenue for the Port as well as the business community throughout the region.

We encourage your support of moving this project forward to reality.

Sincerely,

Tom Niskala

Tom Niskala, President / CEO

P.O. Box 640 • Corpus Christi, Texas 78403
Phone: (361) 881-1800 • Fax: (361) 888-5627 • www.corpuschristichamber.org

City of Port Aransas

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December 6, 2001

Colonel Leonard D. Waterworth
Department of the Army
Galveston District Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

RE: Comments relating to the Corpus Christi Ship Channel, Channel Improvement Project

Dear Colonel Waterworth:

The City of Port Aransas has had concerns, for many years, about shoreline erosion along the Corpus Christi Ship Channel, within the corporate limits of our city. One of our concerns has been the contemplated additional adverse erosion as a result of widening and deepening of that channel.

For the past eight or nine years, I have had periodic discussions with representatives of the Port of Corpus Christi Authority (POCCA) about the possible widening and deepening of the channel. POCCA representatives have always been cooperative in sharing information with me.

In recent years, the POCCA has worked with the City of Port Aransas toward resolving the shoreline erosion issue along the ship channel. They have joined as a partner with the City to include providing funds to assist in resolving the shoreline erosion. I anticipate the continued support of the Port of Corpus Christi Authority in continuing years to resolve the erosion issue in its entirety.

The Port Authority has become a good neighbor to the City of Port Aransas. As a result, the City does not have the concerns about the widening and deepening of the Corpus Christi Ship Channel as it has in prior years. At this time, I see no reason that the City of Port Aransas will have any objections to the widening and deepening of the Corpus Christi Ship Channel.

Sincerely,

THE CITY OF PORT ARANSAS

Tommy M. Brooks

Tommy M. Brooks
City Manager

TMB:pg

cc: John LaRue, Executive Director
Port of Corpus Christi Authority
P.O. Box 1541
Corpus Christi, Texas 78403

CHAMBER OF COMMERCE

December 13, 2001

Colonel Leonard D. Waterworth
Department of the Army
Galveston District Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Colonel Waterworth:

Laredo, Texas, is the most important inland port on the U.S.-Mexico border. It accounts for 40 percent of the total value of overland merchandise trade between the U.S. and Mexico. In 2000 alone, the Laredo Port of Entry accounted for $84.2 billion in total imports and exports. Shipments moving through this port increased by 30 percent from the previous year.

As the next phase of NAFTA takes effect, we contemplate continued growth in international rail and truck cargo crossings. Laredo and Webb County are working hard to meet this challenge; yet, we realize that coordinated development of the region is vital to assure orderly growth. The Port of Corpus Christi will play a vital role in this development. Already the Texas Department of Transportation has approved the expansion of the Laredo-Corpus Christi corridor (U.S. 59 - 44), to allow for a faster and safer connection between these two cities. It is imperative that the port also prepare for expanded and more efficient service and prepare itself for the needs of the new century.

We support the proposed channel improvements as outlined in the study conducted by the U.S. Army Corps of Engineers. We believe this to be not only a benefit to the city of Corpus Christi but to the South Texas region as a whole.

Thank you.

Sincerely,

Miguel A. Conchas
President/CEO

xc John La Rue, Executive Director, Port of Corpus Christi Authority

ACCREDITED
CHAMBER OF COMMERCE
CHAMBER OF COMMERCE OF THE UNITED STATES

P.O. BOX 790 • 2310 SAN BERNARDO • LAREDO, TEXAS 78042-0790 • PHONE (956) 722-9895 • FAX (956) 791-4503
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BPU Reynolds, Inc.
SHERWIN ALUMINA, LP

P. O. Box 9911 • Corpus Christi, Texas 78469-9911
Telephone (361) 777-2326 FAX (361) 777-2666

December 13, 2001

Colonel Leonard D. Waterworth
Department of the Army
Galveston District Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Re: Corpus Christi Ship Channel - Channel Improvement Project

Dear Sir:

Our industrial operation on the LaQuinta Channel typically handles a volume of 100 ships each year to provide raw materials for processing and product for our major customers in Canada.

We are very supportive of the initiative to extend the LaQuinta Channel to enhance subsequent responsible development of the vanishing deep-water access industrial property along the Gulf Coast.

We would also be a benefactor of the initiative to widen the Corpus Christi Ship Channel to 530 feet across Corpus Christi Bay and the construction of 200-foot wide barge lanes across Corpus Christi Bay. Prevailing winds and our proximity to this main channel makes us particularly vulnerable to a marine incident as well other cities along the north side of Corpus Christi Bay.

We would defer comment on the deepening of Corpus Christi Ship Channel to those industries primarily served by this resource.

Finally, as a board member of the Corpus Christi Bays and Estuary Program representing industry it is noted that beneficial use of dredge spoils is very much included in the scope of this substantial project.

Respectfully,

SHERWIN ALUMINA, L.P.

Frank N. Newchurch, III

Frank N. Newchurch, III
Plant Manager

FNN:cs

CC: Mr. John LaRue, Executive Director
Port of Corpus Christi Authority
P.O. Box 1541
Corpus Christi, Texas 78403

(ShipChannelImpProject/Stone)

EQUISTAR

Equistar Chemicals, LP
1501 McKinzie Road
P.O. Box 10940
Corpus Christi, Texas 78460-0940
Phone: 512.242.8000
Fax: 512.242.8051

December 18, 2001

Colonel Leonard D. Waterworth
Department of the Army
Galveston District Corps of Engineers
P.O. Box 1229
Galveston TX 77553-1229

Dear Colonel Waterworth:

As Plant Manager of Equistar Chemicals, LP, Corpus Christi Complex, I would like to express my support for the Port of Corpus Christi's channel improvement project. In particular, Equistar should benefit from the widening of the barge lanes since this can reduce shipping delays and increase safety. Although there is no immediate benefit for Equistar expected from the deeper channel, it is recognized that this is a project focused on the long term economic development of the area for which Equistar remains supportive.

Sincerely,

Plant Manager

MDW/dgg

CC: John LaRue, Port of Corpus Christi Authority

DEC 1 9 2001

HARDY McCULLAH/MLM ARCHITECTS, INC.

December 17, 2001

Department of the Army
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Dear Sirs:

I would like to address a current project in which you are currently involved. I have several concerns, but desire to address the following.

Proposition: That current plans for widening and deepening the Corpus Christi ship channel include solving the problem of sand deposition at the intersection of the Corpus Christi ship channel and Piper channel at Island Moorings in Port Aransas. Such deposition is, for the most part, caused by the movement of large vessels transitting the ship channel. Since larger vessels will transit when this planned project is completed, this problem will get worse if not corrected.

Points:

1. We have been told that the agencies involved are not concerned with wake damage. At the same time these same agencies are going to spend millions to build rock jetties to protect birds and sea grass from wake damage. It seems that damage suffered by people is a poor third to grass and birds. This is particularly galling to residents of Island Moorings since the cost to mitigate our problem would be less than one per cent of the total cost for this project.

2. Monetary and lifestyle damage is being suffered by the residents of Island Moorings due to the sand deposition in the mouth of Piper channel. It should occur to the current planners of this project that we are part of the program.

3. The people living in Island Moorings would like to see some effort to solve this problem addressed in the planning stages.

A response would be appreciated.

Sincerely,
HARDY MCCULLAH/MLM ARCHITECTS, INC.

H W McCullah

Hardy McCullah, A.I.A.
284 Marina Drive
Port Aransas, TX 78373

cc: Ron Cone
356 Blue Heron
Port Aransas, TX 78373

Ray Rump
322 Blue Heron
Port Aransas, TX 78373

12221 Merit Drive
Suite 280
Dallas, TX 75251
Phone: 972-385-1900
Fax: 972-385-1937
hardy1@airmail.net

Fort Worth Office
Metro: 817-577-1270

F:\OFFICE\GUYS\HARDY\MARINA12 17L

DEC 1 9 2001

MONTE N. SWETNAM
420 MARINA DRIVE
PORT ARANSAS, TEXAS
78373

December 15, 2001

Olivarri & Associates, Inc.
719 South Shoreline Drive, Suite 200
Corpus Christi, Texas 78401

Re: Corpus Christi Ship Channel
Improvement Project

Gentlemen:

I have lived, or kept a boat, in Island Moorings since 1990. Until the last few years, the Piper Channel, which serves the community and co-located marina, has provided safe and reliable marine access to the Corpus Christi Ship Channel (CCSC) and points beyond. This access required no more than routine, periodic maintenance by the community to remain functional.

During the past few years, however, shipping tonnage has increased substantially in the CCSC along with activity at the Port of Corpus Christi. Problems in maintaining the Piper Channel at its intersection with the CCSC have increased in apparent lockstep. In order to maintain a viable waterway, the community has dramatically increased their dredging activities and has installed geotube and sheet pile breakwaters to mitigate the damage caused by the increased shipping activity. Regardless of the community's diligent maintenance, the Piper Channel now provides only three feet of depth at its entrance. In addition, bank erosion within the same general stretch of the CCSC has resulted in a major bulkheading project to be undertaken by the city of Port Aransas. All of this, plus untold damage to the marine environment, has resulted from the increased shipping in the CCSC and its accompanying hydraulic erosion.

Given this background, it seems unconscionable that the Port of Corpus Christi, or any other entity, would consider deepening the CCSC or in any way increasing the number or tonnage of ships using the waterway. Instead, immediate steps should be taken to mitigate the existing problems. Only when these problems are solved should the thought of facilitating increased traffic be entertained. One has only to stand at the shoreline as a large ship passes to observe the tons of sand which are swept along with its wake; eroding shorelines, filling channels and destroying wetlands.

I ask that any environmental assessment of the proposed improvements to the CCSC examine in detail the damage to the environment and related facilities caused by the existing channel as well as the potential for even more significant problems caused by the desired changes.

Very truly yours,

Monte N. Swetnam

Monte N. Swetnam

cc: Port of Corpus Christi
CCSC-CIP
P.O. Box 1541
Corpus Christi, TX 78403

✓Dept. of the Army
Galveston District
Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Environmental Protection Agency
Region 7
Fountain Place, 12th. Floor, Suite 1200
1445 Ross Avenue
Dallas, TX 75202-2733

Airport and Channel Corporation
1305 South Alister
Port Aransas, TX 78373
Attn: Bob Roberts

DEC 2 1 2001

Richard L. Daerr
2475 Underwood St. #267
Houston, Texas 77030-3535

19 December 2001

Olivarri & Associates Inc
719 S. Shoreline Blvd.,Suite 200
Corpus Christi, Texas 78401

RE: Wake Damage to Piper Channel

Gentlemen and Ladies:

I have owned property for a number of years at Island Moorings. A major cost each year born by the owners of property at Island Moorings has been damage caused to Piper Channel by the wake of large vessels transiting the Corpus Christi ship channel. Since inception the homeowners and Marina have spent well in excess of $1 million dealing with this problem created by the wake damage. As the widening and deepening of the ship channel is being contemplated, out problem needs to be addressed as part of the ship channel project, as it will only get worse as the ship channel project is completed. I agree with the proposition presented to you by some of my neighbors at Island Moorings, namely:

Proposition: That current plans for widening and deepening the Corpus Christi ship channel include solving the problem of sand deposition at the intersection of the Corpus Christi ship channel and Piper channel at Island Moorings in Port Aransas. Such deposition is, for the most part, caused by the movement of large vessels transiting the ship channel. Since larger vessels will transit when this planned project is completed, this problem will get worse if not corrected.

Points:

1. Island Moorings owners have been told that the Agencies involved with the ship channel project are not concerned with the wake damage to Piper channel. Yet it is our understanding that these same Agencies contemplate spending millions of dollars to build rock jetties to protect birds and sea grass from wake damage. Surely wake damage to individual property owners deserves the same consideration.
2. It would be much better to solve this wake damage problem in the process of dealing with the expansion of the ship channel than subsequent legal proceeding that may have to be initiated by the Island Moorings owners to protect themselves from the damage to

Piper channel and to protect their individual property interest caused by the wake damage to Piper channel.

This is an important problem that affects a lot of people. I appreciate you taking the time to consider it.

Best Regards,

Richard L. Daerr

CC: Corpus Christi Port Authority
Corps of Engineers/Galveston District

Anderson-Beale
31 Hackberry Lane
Houston, Texas 77027-5603
Home Phone 713 621-1488

DEC 2 1 2001

December 18, 2001

To: Olivarri & Associates	U.S. Corps of Engineers	Port of Corpus Christi
719 Shoreline Dr., Suite 200	PO Box 1229	CCSC-CIP
Corpus Christi, TX 78401	Galveston, TX 77553	PO Box 1541
		Corpus Christi, TX 78403

Subject: Damage to Piper Channel in Corpus Christi Ship Channel

We are property owners in Island Moorings Subdivision, Port Aransas, Texas, at 458 Blue Heron Drive. We understand that the Corpus Christi Port Authority is currently in the planning stages of a project to deepen and widen the ship channel from Port Aransas to Corpus Christi. We understand the importance of this project, but are concerned about the on-going damage to Piper Channel from ships passing through the Ship Channel. We were very surprised to hear that this issue was not addressed at the Corps of Engineers meeting on November 29, even though it affects an entire community.

We urge your organizations to include in your construction and feasible studies, a realistic plan to address the depositions damage to Piper Channel. As you are aware, Piper Channel is the only entrance to Island Moorings, a subdivision which generates considerable tax base for Nueces County and the local communities, both Port Aransas and Corpus Christi. The channel is already suffering extreme silting and erosion from ship traffic, and continued damage to the channel from deeper and wider ships will ultimately depress property values, reduce tax revenue and adversely affect a vibrant community.

We look forward to hearing your plans.

Sincerely,

Michelle Beale

Dick Anderson

Dick Anderson and Michelle Beale

cc: Nueces County Judge and Commissioners

DEC 2 1 2001

December 16, 2001

Olivarri & Associates, Inc
719 S. Shoreline Blvd., Suite 200
Corpus Christi, Texas, 78401

Dear Sirs:

RE: Deepening and Widening of Corpus Christi Ship Channel

I fear that I have missed the deadline for these comments to be included in the EIS, however, I request that you consider my concerns for this project.

The maintenance of the Piper Channel at the Corpus Christi Ship Channel intersection has always been a financial burden on our property owners. I believe that our maintenance cost increases over the last five years can be directly correlated to increased ship traffic bound for the Port of Corpus Christi over this same time period. Surely, the deepening and widening of the ship channel will exacerbate an already untenable problem, due to the increased draft and displacement of the transit vessels.

I respectfully request that any plan to alter the Corpus Christi Ship Channel consider and mitigate the damage which is caused to our spur channel by each passing vessel.

The city of Port Aransas has successfully accessed Federal Monies to defend the erosion of its real estate along the ship channel. Unfortunately, these monies are not available to individual property owners. We must rely, therefore, on your sound engineering, planning, and judgment to mitigate our loss.

Thank you in advance for your thoughtful consideration.

Ronald J Skewis

Ronald J. Skewis
361 Bahia Mar
Port Aransas, Texas, 78373

Tel. (361)749-3303
E-Mail skewis4@2fords.net

CC: Corpus Christi Port Authority
Army Corps of Engineers

JAN 0 9 2002

Monte N. Swetnam
420 Marina Drive
Port Aransas, Texas
78373

January 7, 2002

Mr. David L. Krams, P.E.
Senior Project Engineer
The Port of Corpus Christi
P.O. Box 1541
Corpus Christi, TX 78403

Re: Piper Channel Issues

Dear Mr. Krams:

Thank you for your letter of January 3, 2002. It was quite thorough and informative and I appreciate your time and effort to respond in such a manner.

You and I can find much to agree on concerning the Piper Channel (PC) and the existing operation of the Corpus Christi Ship Channel (CCSC). Unfortunately, there are some significant differences in the manner in which either of us would deal with the existing problems. To suggest that the City of Port Aransas and the residents of Island Moorings should support any plan that would "though not expected to be noticeable ... slightly increase (the erosive effect) with the construction of the Channel Improvement Project" is wrong. Until the Port of Corpus Christi Authority (PCCA) moves to remedy the problems its actions have already created, nothing should be done which would permit them to exacerbate the situation.

As part of the immediate action that the PCCA should undertake, I suggest the following:

1. Significantly reduce the speed of any large displacement vessel transiting the Port Aransas / Ingleside reach thereby reducing the hydraulic surge associated with their passage. Provide tugboats or other support as needed.
2. Bulkhead the same area to stop the ongoing destruction of shoreline and environment.
3. Recognize that economic development for Corpus Christi cannot come at the expense of the surrounding communities and then become proactive in mitigating these problems.

While not a member of the Airport & Channel Committee, I would like to express my thanks for the courtesy that the PCCA has shown them and their representatives. I sincerely hope that a way can be found for the two entities to work together to solve their respective problems. The PCCA must know however, that the problems which currently exist at the junction of the PC and the CCSC have a significant economic impact on the property owners of Island Moorings and the City of Port Aransas: we cannot allow them to persist.

You indicated that you might attend the Island Moorings Homeowners Meeting on January 19th. I suspect it would be time well spent if you were able to do so. I look forward to meeting you at that time.

Best regards,

Monte N. Swetnam

Cc: Department of the Army
Galveston District
Corps of Engineers
POB 1229
Galveston, TX 77553-1229

Mr. Tom Brooks, City Manager
City of Port Aransas
710 W Avenue A
Port Aransas, TX 78373

Airport and Channel Corporation
1305 South Alister
Port Aransas, TX 78373

Ron Cone via e-mail

Carolyn Chancellor via e-mail

DEC 17 2001

Box 530
Port Aransas, Texas 78373
December 14, 2001

Department of the Army
Galveston District
Corps of Engineers
P. O. Box 1229
Galveston, Texas 77553-1229

Gentlemen:

I have been a property owner in Island Moorings subdivision, a development in Port Aransas abutting the Corpus Christi Ship Channel, since 1985. Throughout the time that I have resided in Island Moorings the traffic in the ship channel has created a serious silting/erosion problem in Piper Channel leading into the Island Moorings development. It is my understanding that planning is underway to deepen the Corpus Christi Ship Channel in order to accommodate more and larger ships bound for the Port of Corpus Christi, with the result that greater damage would then be done to the entrance to Piper Channel unless steps are taken to address the erosion problem. As a property owner directly affected by the resultant devaluation of my property I am deeply concerned about this.

It has come to my attention that a Corps of Engineers meeting was held recently and that the issue of a correction of the Piper Channel erosion problem was not considered. Since all parties involved in the plan to deepen the Corpus Christi Ship Channel have been made aware of the Piper Channel erosion issue I am mystified as to why this matter was not addressed as a part of the improvement project.

I am very concerned that the proposed improvements to the Corpus Christi Ship Channel will result in even graver damage to Piper Channel, and that this would ultimately affect the value of my home. I strongly urge all involved in the planning of the proposed improvements to address a solution to the Piper Channel erosion issue without delay.

Thank you for your immediate attention to this matter.

Sincerely,

Jo Leta Gavit

Jo Leta Gavit

Olivarri & Assoc. Inc.
719 S. Shoreline Blvd., Ste 200
Corpus Christi, Tx. 78401

To whom it may concern,

Proposition: That current plans for widening and deepening the Corpus Christi ship channel include solving the problem of sand deposition at the intersection of the Corpus Christi ship channel and Piper channel at Island Moorings in Port Aransas. Such deposition is, for the most part, caused by the movement of large vessels transitting the ship channel. Since larger vessels will transit when this planned project is completed, this problem will get worse if not corrected.

Points:

1. We have been told that the agencies involved are not concerned with wake damage. At the same time these same agencies are going to spend millions to build rock jetties to protect birds and sea grass from wake damage. It seems that damage suffered by people is a poor third to grass and birds. This is particularly galling to residents of Island Moorings since the cost to mitigate our problem would be less than one per cent of the total cost for this project.

2. Monetary and lifestyle damage is being suffered by the residents of Island Moorings due to the sand deposition in the mouth of Piper channel. It should occur to the current planners of this project that the cost of future litigation due to wake damage would be much more than fixing the problem during construction. The only real winners would be attorneys.

3. In short the people living in Island Moorings would like to see some effort to solve this problem at the best time to solve the problem, namely, during construction.

Thanking you in advance,

Ray Rump
PO Box 177 [322 Blue Heron Dr.]
Port Aransas Tx. 78373

CC: Corpus Christi Port Authority
Corps of Engineers

December 13, 2001

DEC 17 2001

Olivarri & Associates
719 S. Shoreline Dr., ste. 200
Corpus Christi, Texas 78401

To whom it may concern:

PROPOSITION: That current plans for widening and deepening the Corpus Christi ship channel includes solving the problem of sand deposition at the intersection of the Corpus Christi ship channel and Piper channel at Island Moorings in Port Arkansas. Such deposition is, for the most part, caused by the movement of large vessels transiting the ship channel. Since larger vessels will transit when this planned project is completed, this problem will get worse if not corrected

POINTS: 1. We have been told that the agencies involved are not concerned with wake damage. At the same time these same agencies are going too spend millions to build rock jetties to protect birds and sea grass from wake damage. It seems that damage suffered by people is a poor third to grass and birds. This is particularly galling to residents of Island Moorings since the cost to mitigate our problem would be less than one per cent of the total cost for this project.

2. Monetary and lifestyle damage is being suffered by the residents of Island Moorings due to the sand deposition in the mouth of Piper channel. It should occur to the current planners of this project that the cost of future litigation due to wake damage would be much more than fixing the problem during construction. The only real winners would be the attorneys.

3. In short the people living in Island Moorings would like to see some effort to solve this problem at the best time to solve the problem, namely, during construction.

Thanking you in advance,

Jim & Shirley Holland
P.O. Box 1713 (413 Piper Blvd.)
Port Aransas, Texas 78373
361-749-4977

CC: Corpus Christi Port Authority
Corps of Engineers

JAN 17 2002

A. A. JUD SCHROEDER
CHAIRMAN OF THE BOARD

January 2, 2002

Port of Corpus Christi Authority
CCSC-CIP
P.O. Box 1541
Corpus Christi, TX 78403

LANCER

Gentlemen,

It is my understanding that the Port of Corpus Christi Authority together with the Corps of Engineers is planning to deepen and widen the ship channel from Port Aransas to Corpus Christi. As a resident of Island Moorings, I cannot support such a plan unless it provides for a permanent solution to the Piper Channel problem. More and larger ship channel traffic will complete the destruction that is currently taking place due to existing traffic. Not only does the traffic damage the Piper Channel but also the flats and grass adjoining the Piper Channel.

Your and your clients use of the ship channel is the cause of the damage to Piper Channel. I believe you should fix the problem now or at the least commit to fixing the problem during the construction stage of widening and deepening the ship channel.

I would appreciate a reply regarding my comments and request for repair of the damage to Piper Channel.

Sincerely,

Jud Schroeder

Jud Schroeder

cc: Olivarri & Associates
719 S. Shorline Dr. Suite 200
Corpus Christi, Tx 78401

Dept. of the Army Galveston District
Corps of Engineers
P.O. Box 1229
Galveston, Tx 77553-1229

Planning Section
Galveston District,
Corps of Engineers
PO Box 1229
Galveston, TX 77553-1229

November 16, 2001

Dear Sir,

I am writing to object to plans for the beneficial use of dredged material west of the CCSC/La Quinta Channel intersection located by Ingleside on the Bay. This area receives considerable recreational use by sail boats, shrimpers, sports fishermen, jet skis, and windsurfers. Many boats leave the nearby marina and cut across the proposed spoil placement area as a shortcut across the bay. Placement of dredged material would necessitate all boats having to stay in the channel and travel a longer distance.

I am an avid windsurfer and sail from Ingleside on the Bay about 80 days a year. The proposed breakwaters for the beneficial use site would eliminate my use of the site since windsurfers basically are made to sail perpendicular to the wind with little maneuverability to sail around barriers. All my other sailing options require more than twice the driving time and would greatly cut down on my ability to get in a sailing session after work. About 6 people sail at this location, including private residents launching from their homes along the water. I must stress the importance of this site to my quality of life - this matter is of utmost importance to me.

Although the proposed beneficial use site is designed to improve fishery values, the success of this proposal is not certain. I have talked to fisheries biologists and they question whether the material will stay in place and how vegetation might respond in the substrate. I think it is wrong to eliminate current recreational users of a site in only the hopes of making improvements for others. I have expressed these same concerns to Paul Carangelo.

I hope you will consider other dredge material placement options and NOT use the area west of the CCSC/La Quinta Channel intersection. I am also concerned that the La Quinta extension will create additional dredge material volumes in future years and there is already a shortage of dredge material sites. Planners should provide a 100-year plan with associated costs for placement of dredged material to fully assess the proposed channel extension.

Thank you.

Tom Stehn

Tom Stehn
1613 S. Saunders
Aransas Pass, TX 78336
(h) 361-758-2354

STATE of TEXAS
HOUSE of REPRESENTATIVES

CAPITOL OFFICE
P.O. BOX 2910
AUSTIN, TEXAS 78768-2910
TELEPHONE (512) 463-0512
FAX (512) 463-8388

DISTRICT OFFICE
P.O. BOX 541
PORTLAND, TEXAS 78374
TELEPHONE (361) 643-4755
FAX (361) 643-2704

THE STATE OF TEXAS

Judy Hawley
STATE REPRESENTATIVE

COMMITTEES:
TRANSPORTATION, VICE CHAIR
ENERGY RESOURCES
HOUSE ADMINISTRATION

December 7, 2001

Colonel Leonard Waterworth
Department of the Army
Galveston District Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Re: Corpus Christi Ship Channel - Channel Improvement Project

Dear Colonel Waterworth:

I was unable to attend your meeting on November 29, 2001 to update the public on the status of the Feasibility Study for proposed improvements to the Corpus Christi Ship Channel. I strongly support this project and the economic and environmental benefits that have been identified throughout this study process and request that this letter be included with project documentation.

The Port of Corpus Christi and allied industries are vital to the economic stability of this area and the entire state of Texas. Deepening the channel to 52-feet from the Gulf of Mexico to the Viola Turning Basin, widening the channel across Corpus Christi Bay, constructing barge lanes across the Corpus Christi Bay and extending the La Quinta Channel from the existing channel westward will ensure that commercial navigation is safely and efficiently served. The extension of La Quinta is also critical to the development of the La Quinta Cargo Terminal, which is important for the future of the Port and our region.

I appreciate the efforts that have been made to reduce environmental impacts and the proposed beneficial use of dredged material to develop shallow water habitat. This project has developed into a win-win proposition the environment and commercial interests and can serve as a model for mutual benefit.

Sincerely,

Judy Hawley

Judy Hawley
District 31
cc: John LaRue, Port of Corpus Christi

Texas House of Representatives

Vilma Luna
DISTRICT 33

December 7, 2001

Leonard D. Waterworth
Department of the Army
Galveston District Corps of Engineers
P O Box 1229
Galveston, Texas 77553-1229

Dear Colonel Waterworth:

Re: Corpus Christi Ship Channel – Channel Improvement Project

Please consider this letter to indicate my support for proposed improvements to the Corpus Christi Ship Channel. These improvements are important to the continued growth and development of this area as a major Texas deepwater port. As commercial and international trade increases in importance for Texas, it is critical that transportation facilities be improved to allow us to fully benefit from opportunities that will come to this area.

The economic and environmental benefits that have been identified throughout the study process show it to be a project that will improve navigational safety and efficiency and utilize dredged material in a beneficial manner for development of shallow water habitat.

I strongly support this project and appreciate your consideration Should you have any questions, or if I may be of any assistance, please feel free to contact my Capitol office at (512) 463-0484.

Sincerely,

Vilma Luna

Vilma Luna
vl/lr

CC: John LaRue, Executive Director
Port of Corpus Christi

P.O. BOX 2910
AUSTIN, TEXAS 78768-2910
512-463-0484
FAX NO. 512-463-8090

Committees:
House Administration (Vice-Chair)
Economic Development
Appropriations

4525 GOLLIHAR, SUITE 200
CORPUS CHRISTI, TEXAS 78411-2931
361-854-9816
FAX NO. 361-852-0665

TEXAS HOUSE OF REPRESENTATIVES

P.O. Box 2910
Austin, Texas 78768-2910
(512) 463-0462
Fax (512) 463-9545
E-mail: jaime.capelo@house.state.tx.us

P.O. Box 23065
Corpus Christi, Texas 78403
(361) 882-2277
Fax (361) 882-2881
E-mail: bert.quintanilla@house.state.tx.us

JAIME CAPELO

December 10, 2001

Colonel Leonard D. Waterworth
Department of the Army
Galveston District Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Colonel Waterworth:

I write you in support of the proposed deepening of the Corpus Christi Ship Channel from its present 45 feet to 52 feet from the Gulf of Mexico to Viola Turning Basin. The Port of Corpus Christi and the Corps of Engineers have been studying this project since 1990.

The proposal offers economic, safety and environmental benefits to the region by accommodating larger vessels into the Port of Corpus Christi, widening the navigation lanes for increased maneuverability, reducing waiting times and allowing for the utilization of the La Quinta Terminal, a containerized cargo facility proposed for the channel on Port property in San Patricio County. The beneficial reuse of the dredged material to increase marine habitat offers the opportunity to increase the important ecological tourism in the area. This is a very important project for the continued economic growth in the region.

Thank you for your consideration. Please feel free to contact me for additional support for the channel deepening project.

Sincerely,

Jaime Capelo

Jaime Capelo

CC: John LaRue

THE STATE OF TEXAS

Nueces County
District 34
Public Health◊Judicial Affairs

SAN PATRICIO COUNTY

JOSEPHINE W. MILLER
County Judge
Courthouse, Room 109
400 West. Sinton Street
Sinton, Texas 78387
Office: 361/364-6120
Fax: 361/364-6118

December 17.2001

Colonel Leonard Waterworth
Department of the Army
Galveston District Corps of Engineers
P O Box 1229
Galveston, Texas 77553-1229

Re: Corpus Christi Ship Channel - Channel Improvement Project

Dear Colonel Waterworth:

I would like to express my support for the Channel Improvement Project that proposes to deepen and widen the Corpus Christi Ship Channel and provide other improvements to this important navigation corridor. This project is vital to the continued growth and development of this region as a vital link in the commercial and international trade infrastructure for Texas.

Of special interest to San Patricio County is the proposal to extend La Quinta Channel. This extension will allow for the utilization and development of La Quinta Terminal providing new jobs and spurring increased revenue for communities and businesses throughout the region.

We also appreciate the beneficial uses that have been identified for dredged material. The proposal to develop significant shallow water habitat at several locations throughout the Corpus Christi Bay system and the proposals to protect existing habitat are models for effective use of these materials.

Sincerely,

Josephine Miller

Josephine Miller
Judge of San Patricio County

Copy to: John LaRue, Executive Director
Port of Corpus Christi
(P O Box 1541 - Corpus Christi 78403)

RUBÉN HINOJOSA
15TH DISTRICT, TEXAS

COMMITTEES:
EDUCATION AND THE WORKFORCE
SUBCOMMITTEES:
EDUCATION REFORM
21ST CENTURY COMPETITIVENESS

FINANCIAL SERVICES
SUBCOMMITTEES:
CAPITAL MARKETS, INSURANCE, AND GOVERNMENT-SPONSORED ENTERPRISES
DOMESTIC MONETARY POLICY, TECHNOLOGY, AND ECONOMIC GROWTH
FINANCIAL INSTITUTIONS AND CONSUMER CREDIT

Congress of the United States
House of Representatives
Washington, DC 20515–4315

WASHINGTON OFFICE:
1535 LONGWORTH HOUSE OFFICE BUILDING
WASHINGTON, DC 20515
PHONE: (202) 225–2531
FAX: (202) 225–5688
E-MAIL ADDRESS
REP.HINOJOSA@MAIL.HOUSE.GOV

DISTRICT OFFICE:
311 NORTH 15TH
MCALLEN, TX 78501
PHONE: (956) 682–5545
FAX: (956) 682–0141

BEEVILLE OFFICE:
107 S. ST. MARY'S
BEEVILLE, TX 78102
PHONE: (361) 358–8400
FAX: (361) 358–8407

January 3, 2001

Colonel Leonard D. Waterworth
Department of the Army
Galveston District Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Colonel Waterworth:

I am inquiring about the status of the Corpus Christi Ship Channel Improvement Project. I have learned that the Army Corps of Engineers has been working with the Port of Corpus Christi since 1990 to investigate the possibility of deepening the Corpus Christi Ship Channel. The channel improvements will undoubtedly improve the marine safety and efficiency of the area by enabling the Port of Corpus Christi to accommodate larger vessels, increase shipping efficiency, and reduce waiting time. Along with these benefits, this project will prove instrumental in generating jobs and revenue for the region and help ensure that the area is a major participant in commercial and international trade.

I thank you in advance for your attention to this request. If you should have questions regarding the nature of my inquiry, please do not hesitate to contact me or my McAllen District Office for clarification at (956) 682-5545. Thank you in advance for your immediate attention to this request.

Sincerely,

Rubén Hinojosa

Rubén Hinojosa
Member of Congress

RH:ms

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, FL 33702
(727) 570-5312; FAX (727) 570-5517

F/SER3:EGH

JUL -5 2002

Lloyd H. Saunders, Ph.D.
Chief, Planning, Environmental
and Regulatory Division
Galveston District Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Dear Dr. Saunders:

This responds to your June 28, 2002, letter; Draft Feasibility Report and Draft Environmental Impact Statement for the Corpus Christi Ship Channel, Channel Improvement Project, June 2002 ("Draft EIS"); and Biological Assessment for Impacts to Endangered and Threatened Species Relative to the Corpus Christi Ship Chanel Improvements Project in Nueces and San Patricio Counties, Texas (BA). Your letter requested concurrence with the Corps of Engineers' (COE) BA determination of "not likely to adversely effect," or alternatively, preparation of a National Marine Fisheries Service (NOAA Fisheries) biological opinion on any potential adverse effects of Galveston District's proposed Channel Improvement Project, Corpus Christi Ship Channel (CCSC), Texas, to federally listed species under NOAA Fisheries purview. This letter continues formal coordination between our agencies pursuant to section 7 of the Endangered Species Act (ESA), first initiated on May 18, 2001, for this project. We have assigned consultation number F/SER/2002/00731 to this proposed action; please refer to it in future correspondence on this project.

NOAA Fisheries has evaluated the Draft EIS and May 2002 BA prepared by PBS&J submitted as Appendix C of the document. The selected plan includes deepening of the CCSC from Viola Basin in the Inner Harbor to the end of the jetties in the Gulf of Mexico to -52 ft from -45 ft mean low tide (MLT) plus advanced maintenance and allowable overdepth; deepening of the remainder of the channel into the Gulf of Mexico to 54 ft (depths will be increased roughly 10,000 ft into the Gulf of Mexico to the -56 ft isobath); widening of the Upper Bay and Lower Bay reaches (from Port Aransas to the Harbor Bridge) to 530 ft (existing widths are 500 ft between Port Aransas and La Quinta Junction and 400 ft between La Quinta Junction and the Harbor Bridge); construction of 200-ft wide barge shelves (-12 ft MLT) on both sides of the ship channel from La Quinta Junction to the Harbor Bridge, across the Upper Bay portion of the CCSC; and extending the La Quinta Channel 7,200 ft to a depth of -40 ft MLT and a width of 400 ft and include a turning basin. It is estimated that approximately 40 million cubic yards of new work material would require seven separate dredging contracts to complete. Dredged material management incorporates the use of existing placement areas, as well as newly designated placement areas including several beneficial use (BU) sites. BU sites will be constructed to create several hundred acres of shallow water habitat throughout the bay system. The environmental restoration portion of the selected plan consists of the construction of two breakwaters to protect and enhance existing habitat. The work is estimated to begin in April 2003 and be completed by January 2008.

The BA states that the proposed work to be conducted by pipeline dredges (in the bay) and hopper dredges (in the entrance channel) is unlikely to have any significant adverse impacts on any Federally listed threatened or endangered species under NOAA Fisheries purview because: "Sea turtles easily avoid pipeline dredges due to the slow movement of the dredge. Incidental take of sea turtles by hopper dredges is reduced by using draghead deflectors and scheduling offshore dredging during the winter months when sea turtles are most likely to be elsewhere in warmer waters. Also, an agreement between National Marine Fisheries Service and U.S. Army Corps of Engineers is in place and implemented regarding take of sea turtles with hopper dredges and the use of observers to document incidental take to ensure that significant impacts do not occur."

Our comments will address the potential adverse effects of the action on endangered or threatened species (Kemp's ridley, green, loggerhead, and leatherback sea turtles) under NOAA Fisheries purview from the potential use of a hopper dredge, since NOAA Fisheries has previously determined that use of pipeline or clam shell type dredges is unlikely to adversely affect the above-listed species. However, the potential for lethal take of sea turtles by hopper dredges, even with sea turtle deflector dragheads in place, is well documented. Hopper dredges equipped with deflector dragheads routinely kill sea turtles during maintenance dredging activities in Federal navigation channels on the Atlantic Seaboard and the Gulf of Mexico. Therefore, NOAA Fisheries disagrees with the COE's determination of potential effects to listed species.

Potential adverse effects of hopper dredges on the above-listed species have already been analyzed, and an incidental take authorized, by the NOAA Fisheries September 22, 1995, Regional Biological Opinion (RBO) to the COE's Galveston and New Orleans Districts on maintenance dredging of navigation channels in Texas and Louisiana using hopper dredges. That opinion analyzed hopper dredging effects on sea turtles and included non-discretionary reasonable and prudent measures, and implementing terms and conditions, to minimize potential interactions with these Federally-listed marine species. The RBO includes, as a reasonable and prudent measure to minimize adverse effects to sea turtles, a hopper dredging window (i.e., hopper dredging shall be conducted from December 1-March 31, whenever possible). The RBO also states that pipeline or hydraulic dredges must be used whenever possible between April 1 and November 30.

NOAA Fisheries does not foresee any impacts of hopper dredging that have not already been considered and previously addressed in the RBO; however, the RBO addressed only maintenance dredging and did not consider new dredging projects, including widening and deepening such as proposed in this action. Therefore, any takes associated with new (non-maintenance) work such as the proposed action must be authorized by another biological opinion, such as was prepared for the Houston-Galveston Navigation Channels project.

The information provided in the Draft EIS and BA appears sufficient for the Service to complete its biological opinion. Section 7 allows NOAA Fisheries up to 90 days to conclude formal consultation with your agency, and an additional 45 days to prepare our biological opinion (unless we mutually agree to an extension). Therefore, our anticipated biological opinion completion date is 135 days from the date of this letter. The ESA requires that after initiation of formal consultation the Federal action agency make no irreversible or irretrievable commitment of resources that limits future options. This practice ensures agency actions do not preclude the formulation and implementation of reasonable and prudent alternatives that avoid jeopardizing the continued existence of endangered or threatened species or destroying or modifying their critical habitats.

Pursuant to the essential fish habitat consultation requirements of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)(2) and 50 CFR 600.905-.930, Subpart K), the NMFS Habitat Conservation Division (HCD) is being copied with this letter. The HCD biologist for this region is Mr. Rusty Swafford. If you have any questions about consultation regarding essential fish habitat for this project, please contact Mr. Swafford at 409/766-3699 or by e-mail at Rusty.Swafford@noaa.gov.

We appreciate the opportunity to comment on this project and work with the COE to ensure the protection of threatened and endangered species under NOAA Fisheries purview, and to help the COE fulfill its mandate under the ESA. The Protected Resources Division biologist assigned to conduct this consultation is Mr. Dennis Klemm. Please contact Mr. Klemm or Mr. Eric Hawk at 727/570-5312 if you have any questions or if we may be of assistance.

Sincerely,

Georgia Cranmore
Assistant Regional Administrator
for Protected Resources

cc: F/SER42 - Rusty Swafford; F/PR3

o:\section7\informal\corpus christi channel improvement project.wpd
File: 1514-22 f.1. COE Galveston District

SPARR & BREWSTER, INC.
ATTORNEYS AT LAW

RICHARD A. SPARR, JR.

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July 16, 2002

Dr. Terrell Roberts
Department of the Army
Galveston District
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Dr. Roberts:

Please allow this to be my public comment on the Draft Environmental Impact Statement ("DEIS") and the Draft Feasibility Report ("DFR") for the proposed improvements to the Corpus Christi Ship Channel.

It is my understanding that the purpose of the this project is to improve the efficiency and safety of the port's navigation system while protecting the **quality (emphasis added)** of the coast on the estuarine resources then I must have missed the point since the channel between the entrance to the jetties and the Port Aransas Marina have not been addressed.

You are no doubt aware that the City of Port Aransas objected to these proposals
because of the continued shoreline erosion caused by the deepening of the ship channel and 1
the wake of ships. Now that you are participating in the addition of bulkheading along Charlie's Pasture the City's concerns are not of the magnitude that they were previously. However, what the Port Aransas City Manager Tom Brooks failed to point out is that the
widening of the ship channel, the increased ship channel traffic, and the speeds by which 2
the ships go through the channel are causing erosion in the neighborhood located between the Pilot's house and the UT Marine Science Center Marina and Cline's Landing Condominium adjacent to the Port Aransas City Marina. There is a neighborhood subdivision where people live called the Port Aransas Private Marina. Approximately 13 houses front the channel and constantly have to deal with erosion problems occurring because of the ship traffic and the lack of any bulkhead along this beach front. The private residents have done everything they could to protect their property but due to the increased ship traffic, the size of the wakes deepening of the channel and your proposal to deepen the channel again making the waves ever increasing this will be a losing battle.

I am starting to represent a group of the homeowners who are concerned about your proposal and the damage it will cause to their beach and ultimately the roadway that allows them to get to their residence.

In the past we have done what we can to solidify and fortify our bulkheads but approximately 275 feet of the shoreline is unprotected. Concrete stones have been placed to protect and allow for the buildup of soils that can be groomed to protect the homes from rising water and ship wakes. Unfortunately the ship wakes constantly wear away, and reduce and erode the soil that is native to this area.

I find no where in the comments and proposals any indication of taking care of these private land owners who are just as entitled to protection as the City of Port Aransas is. I am somewhat surprised that the City of Port Aransas was not concerned about its residents who are tax paying citizens and who have equal rights and standings as the City of Port Aransas.

The purpose of our letter is to see if you or anyone within the study has addressed
this strip of land and these private homeowners. 2

I think a meeting could accomplish the following goals:

1. Add appropriate bulk heading along the strip of land that is unprotected as is being done in Charlie's Pasture and/or

2. Slow down **all** ships coming through the channel so that they do not create the 4 to 6 foot waves that erode the soil every time a ship goes through the channel and/or

3. Place concrete in a similar manner to try to protect and limit soil erosion in the area of the channel.

These homeowners cannot stand by and watch the continued erosion. In just a few more feet the erosion will take down their street and they will not be able to get to their residence.

I invite you to meet with me at a time that is convenient for you to walk through this project and develop a project and plan that will address the private homeowners' and
taxpayers' needs. Obviously the jetties are fortified by rocks and this does not cause a 3
problem. The same thing with the Port Aransas public marina all the way down to Charlie's Pasture which you have now addressed. Ours seems to be a forgotten area and one that has not been addressed.

More importantly is the speed by which ships are going through the channel and the
deepening of the channel causing the acceleration of erosion. The individuals that I have 4
talked to have said that the traffic has increased over the years and the depth of the vessels

going through has increased because of their increased size. Thus, there is an ever increasing amount of wave action and the height of the waves causing beach erosion.

I look forward to your input and thoughts on this matter.

Sincerely,

Richard A. Sparr, Jr.

RAS/jl

Mr. Richard A. Sparr, Jr.
Sparr & Brewster, Inc.
1313 N.E. Loop 410, Suite 100
San Antonio, Texas 78209

RESPONSE TO COMMENTS

Comment No.	Response
1	The reach of shoreline at the area known as Charlie's Pasture at the County Pier in Port Aransas was protected this past year with a concrete sheetpile bulkhead. The bulkhead project was a cost shared, Texas General Land Office – Coastal Erosion Planning and Response Act (CEPRA) project between the City of Port Aransas and the State of Texas. The Port of Corpus Christi (the non-Federal Sponsor for the proposed CCSCCIP), not the USACE, participated with the City of Port Aransas in the sponsor funding for the CEPRA project. The project included shoreline erosion protection on both the north and south sides of the channel. As part of the CCSCCIP, erosion protection is proposed for the south side of the channel west of last year's CEPRA bulkhead project.
2	During the three-year study for the CCSCCIP Feasibility Study that included a significant amount of public outreach and solicitation of comments and concerns (including Port Aransas specifically), no concerns/comments were raised for this reach of channel. This letter is the first mention of any potential shoreline erosion damage to this private property. Results from the outreach initiative helped develop the scope of work for a Shoreline Erosion Study that was used to identify any possible changes in erosion controlling forces and effects of these changes from the proposed CCSCCIP. The CCSCCIP will not cause an increase in the number of vessels using the channel, relative to the No Action (present condition) alternative. For the CCSCCIP Feasibility Study, this particular reach of shoreline was not "addressed" with respect to shoreline erosion because no concerns had been voiced during numerous public meetings.
3	On August 30, 2002, representatives from the Port of Corpus Christi Authority met with Mr. Richard Sparr at his residence at 350 Private Road A, Port Aransas, Texas. Mr. Sparr reiterated the concerns addressed in the letter and was seeking assistance to create long-term shoreline protection in front of his and his adjacent property along the Entrance Channel. It was evident steps (placement of fill, rock and concrete rubble) have been made to protect the shoreline in this reach. An eroding shoreline bluff exists in a portion of the unbulkheaded area forward of a well maintained, approximately 20 foot wide, grassy area in front of the private road leading to the houses. The Federal navigation project process and schedule was reviewed and, during discussions, it was determined that it was the responsibility of the property owners and not the Federal Government to protect privately owned lands. The shoreline erosion protection along and west of Charlie's Pasture in Port Aransas proposed for the CCSC-CIP is a multi-functional Ecosystem Restoration feature of CCSC-CIP project designed as

	protection for hundreds of acres of sensitive environmental habitat and not designed as protection of private property. Though it is the responsibility of the private property owners to protect their lands, it was suggested and recommended that, if the owners wanted assistance, there are programs and opportunities available to them. The permitting process was explained and various programs and opportunities were described and discussed including the CEPRA program and requests for cost sharing with their local government.
4	Vessel operators and the harbor pilots on board to assist in navigating the channels determine the necessary travel speed for safe passage. According to the Shoreline Erosion Study, vessel speed is one component that affects the size of the waves and pressure fields that are created from passing ships. Other components include vessel characteristics and channel and shoreline shape. Proposed channel improvements in this reach include widening on the opposite side of the channel from the subject property. This improvement should actually reduce the pressure field effects of deep draft vessels passing this private property. It was also determined during the Shoreline Erosion Study for this project that there are numerous causes controlling erosion, including sea level rise, wind generated waves, pressure field effects, vessel wakes, storms, and geomorphologic channel conditions. Although this area was not specifically studied, projections in nearby, similar areas indicated only a potential slight increase in the contribution to erosion from the proposed project because of pressure field effects (2% and 5% increase – for shorelines along Harbor and Mustang Island). The analysis assumed no shore protection existed in the area. Because of the projected increase in throughput at the Port of Corpus Christi, the increase in ship traffic is projected to continue with or without the channel improvement project. However, with the project, the number of vessels trips will be less than without the project. See the Economic Appendix.

Monte N. Swetnam
420 Marina Drive
Port Aransas, Texas
78373

August 7, 2002

Environmental Section
Department of the Army
Galveston District, Corps of Engineers
P. O. Box 1229
Galveston, Texas 77553-1229

Re: Corpus Christi Ship Channel
Channel Improvement Project

ARMY CORPS OF ENGINEERS:

I am writing in response to the recently published Feasibility Study and Environmental Impact Statement for the Corpus Christi Ship Channel - Channel Improvement Project (PROJECT). It is my considered opinion that the PROJECT is not needed at this time or in the foreseeable future, is not fiscally responsible and will have a significant negative environmental impact.

From a need standpoint, the Houston Ship Channel handles three times as many ships (6,600 vs. 2,060) and twice as much total tonnage (191 million short tons vs. 83 million short tons) as the Corpus Christi Ship Channel and does it with a channel that is shallower and narrower (40' x 400' vs. 45' x 500 - 600'). In fact, after the current improvements to the Houston Ship Channel, it will only be equivalent to the existing Corpus Christi facility. What possible need is there to improve a facility that is already
better than one which far exceeds it in utilization? Also, there is no reported evidence 1
that cargoes have been lost or diverted from the Port of Corpus Christi because of channel inadequacies. With all of the refineries operating at or near capacity, additional volumes of crude oil will not be required for import nor will additional volumes of refined product be available to export. The Sherwin Alumina plant is struggling to stay in business and can't be depended on to expand capacity. Agriculture has peaked in the region and the recently completed refrigerated warehouse can't seem to get off the
ground. In short, there is no compelling evidence that the existing channel is not 2
sufficient for the needs of Corpus Christi and South Texas for many years into the future.

In terms of fiscal responsibility, why would one spend money to enlarge a channel to
permit larger ships when the Port of Corpus Christi will continue to be ship size 3
constrained by the Harbor Bridge and the Tule Lake Lift Bridge? Why would one
enlarge the Channel when many of the ships that visit the port come from harbors and 4
channels that are themselves size constrained (71% foreign trade)? Why would one
spend money for an enlarged channel when the Port of Houston does much more with 5
less? Additionally, why should the U. S. Taxpayer pay to dredge a channel to improve
the value of property for the Port of Corpus Christi (Tenneco property) instead of the
Port paying for it? Finally, how are the monetary returns that the Corps Feasibility 6

Study proposes in their study to be realized? Are they in the form of tolls paid to the U. S. Government? Are they in the form of additional taxes that the users and the Port pay to the U. S. Government? Are they simply a subsidy to private companies that may or 7
may not pass on the benefit to their customer? There are many questions that can be asked and few, if any, answers provided by the Corps of Engineers study.

In terms of environmental impact, a recent Associated Press news article (*Corpus Christi Caller Times* 7/22/02), stated that unregulated foreign ships are "a major source of pollution and there are few answers on how to solve the problem". The *Houston Chronicle* states that "these ships comprise the fastest-growing unregulated source of air pollution in the nation". In Houston, these ships "each year emit 273,000 tons of 8
nitrogen oxide, a key contributor to smog". As we all know, Corpus Christi has periodic problems with air quality. Could these unregulated ships push the Corpus Christi area into non-attainment? What is the Corps environmental assessment of any increased air pollution that will result from their projected increase in shipping? <u>They don't even mention it!</u>

Finally, there is the question of safety. The Aransas-Corpus Christi Pilots (ship) feel that the existing Corpus Christi Ship Channel is too narrow for ships to pass. This begs the question of how the Houston Pilots handle three times more ship traffic in an even narrower channel. Are they more skillful, more careful or just lucky? Do the Aransas-Corpus Christi Pilots have a problem of their making by navigating the channel at too 9
great a speed (a practice which, at the very least, has caused extensive shoreline erosion)? The perceived passing problem is apparently not a new complaint by the Pilots for a mooring area was built near Ingleside as part of the 1968 channel deepening to eliminate the need for ships to pass. How well does it work? <u>It doesn't</u> because "shippers would rather wait offshore and time their entrance... rather than go through the trouble and expense to get tug assistance to moor and wait with a pilot on board..." (USACE Feasibility Report). This all sounds a bit petty to the writer but I agree that the best and most economical answer to the perceived problem is simply a matter of scheduling the passage of ships through the channel.

It is not my intent to argue that there is no merit in the proposed PROJECT; the barge shelves in the Upper Bay and the shoreline protection to prevent further ship-wake erosion are certainly of value. However, public money to dredge a channel (La Quinta) to improve certain land values for the quasi-private Port of Corpus Christi is wrong. 10
Public money to improve a channel which is already better than the existing channel at Houston (and will continue to be better than Houston's even after Houston's current improvements are completed) is also wrong. Now is not the time for this project: come back in another twenty years.

Very truly yours,

Monte N. Swetnam

Monte N. Swetnam

Mr. Monte N. Swetnam
420 Marina Drive
Port Aransas, Texas 78373

RESPONSE TO COMMENTS

Comment No.	Response
1	Specific research was not conducted to determine if cargoes have been diverted or lost due to Corpus Christi Ship Channel "inadequacies"; however, the USACE recognizes competition between ports and realizes that one port can be substituted for another. As the cost of using a port increases, it is expected that some traffic should shift to other ports and conversely, as the cost of using a port declines, it is expected that traffic currently routed through a competing port would shift to the port in question. Theoretically, the demand for a project is typically derived as the difference between the least cost transportation cost routings. Refineries in both Houston and Corpus Christi are operating at high rates and each provides feedstock to specific regional refineries. In cases of established ports and refinery infrastructure systems, the assumption of long-term price inelasticity is usually reasonable. The Corpus Christi Ship Channel has had a 45-foot operating depth since the early nineties and while they experienced short-term increases in Houston tonnage between 1999-2000, the 1991-2000 average annual rates of growth for both Corpus Christi and Houston is 5 percent. The 1981-2000 average annual growth rates for both ports were 4 percent. Growth rates during the nineteen eighties between the two ports were also comparable. The economic efficiencies that increase in channel depths would provide could very well result in diversions between ports but this phenomena will be less likely for established cargoes such as petro-chemicals. Modifications to some existing port facilities will be necessary to realize benefits, including dock enhancements and access dredging, and these costs have been included in the average annual costs. The port also expects to create additional facilities in response to the channel improvement project. Existing refrigerator facilities are nearing capacity and the PCCA is considering construction of an additional refrigerated warehouse. Also, the extension of the La Quinta Channel would allow the port to utilize existing land for the construction of a new container terminal. Some facilities will require no modifications, such as the Sherwin Alumina plant and others on the existing La Quinta Channel, as no modifications are proposed for that portion of the channel.
2	The USACE analysis demonstrated that there are cost savings from loading the existing fleet of vessels more fully. The additional cargo transported per trip is expected to reduce the per ton delivery costs. Determination of the percentage of tonnage and vessels that could carry more cargo was made based on discussions with Corpus Christi shippers and world port depth. Benefits were calculated for the portion of tonnage that could take advantage of the proposed deepening. The transportation savings were compared to the project cost and this comparison showed that benefits for the channel-deepening project exceeded the cost. In its economic analysis, the USACE is tasked with determining National

Mr. Monte N. Swetnam
420 Marina Drive
Port Aransas, Texas 78373

	Economic Development (NED) benefits and costs. NED benefit is defined as contributions to national economic development that result in increases in the value of national outputs of goods and services. The NED benefit analysis procedures provide the basis for evaluating Federal investment in all types of water resources projects. The Federal interest in projects to improve navigation is derived from the commerce clause of the Constitution. Federal interest in a project depends on whether it provides benefits to the public by facilitating commerce.
3	For this project configuration we were able to identify over $53 million in annual benefits while the average annual cost of construction would be just over $18 million. A majority of these benefits are realized with channel deepening of the Corpus Christi Ship Channel and Inner Harbor. Vessels that travel to the Port of Corpus Christi from other ports, whose depths range anywhere from 20 to almost 90 feet, will be able to enter the channel fully laden in most cases. Also, because a deeper channel will allow the existing ship fleet to be more heavily laden, vessel size is not expected to increase, thus insuring that the Harbor Bridge and Tule Lake Lift Bridge will not restrict petroleum and bulk cargo vessel transit. Container ships using the proposed terminal at the La Quinta Channel extension would not be affected by the Harbor Bridge or Tule Lake Lift Bridge.
4	The project benefits were calculated for vessels coming from ports that were not constrained. For this reason, benefits were not calculated for total tonnage. Depths of other ports are found in Table 19 and 25 in the Economic Appendix (Appendix G).
5	The WES ship simulation analysis, along with pilot input, was used to determine the width recommendations for both the Corpus Christi Ship Channel and the Houston Ship Channel. The Houston Ship Channel is being widened to 530 feet, the same as proposed for the Corpus Christi Ship Channel.
6	Comment noted. Please see response to comment #2 and # 7.
7	Benefits associated with the proposed channel improvement project are identified as contributions to national economic development (NED), which are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the Nation. The Economic Appendix details the expected benefits and relates them to project cost.
8	We expect fewer total ships in the with project future condition than the without project future. See the Economic Appendix. Therefore air quality is not expected to change as a result of the project. . A NEPA document for permitting the proposed container terminal will describe the air quality impacts of construction and operation of the new ship berthing and land based facilities and traffic. .
9	See comment #5. The widening of the channel, as well as the construction of barge lanes, would create benefits through a reduction in delays and an increase in safety by allowing two-way ship traffic in the channel system

	while barge traffic will be able to operate away from large ship traffic. This would reduce the potential for accidents and spills, as a majority of the commodities passing through the port are petro-chemical in nature.
10	Thank you for your comments

THE PORT OF CORPUS CHRISTI

Department of Engineering Services

August 8, 2002

Project. No. 98012A

Colonel Leonard D. Waterworth
District Engineer
Department of the Army, Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Subject: Corpus Christi Ship Channel, Texas Channel Improvement Project Draft Feasibility Report and Draft Environmental Impact Statement for the Corpus Christi Ship Channel, Texas Channel Improvement Project, June 2002

Dear Colonel Waterworth:

The Port of Corpus Christi Authority staff has the following comments on the subject.

Syllabus

Page 1, 3rd Paragraph, last sentence:
Last sentence states that the Selected Plan has two breakwater "environmental restoration" features. The features actually consist of two different types of protection: a "offshore" breakwater and a shoreline revetment. Both features will protect and enhance existing habitats. 1

FEASIBILITY REPORT

Figure 1: Title block refers to "50-foot Project" though the Table of Contents lists this figure as the "52-Foot Project".
The figure supplied is for the existing Corpus Christi Ship Channel, which is the 45-foot Project. The Channel Improvement Project, the focus of the FR and the DEIS, was in the congressional resolution adopted August 1, 1990 by the Committeee on Public Works, House of Representatives that authorized study for improvements to the CCSC was originally referred to as the "50-foot Project". However, as correctly stated in the Syllabus, the project is now referred to as the "Corpus Christi Ship Channel – Channel Improvement Project". 2

Page 7, Socioeconomic Considerations:
PCCA notes this section does not mention the military or medical field as being part of the broad base economy of Corpus Christi. 3

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Page 9, 1st paragraph:
The last sentence refers to the project area being geographically divided into three segments
and then refers to Figure1. This infers that these segments would be delineated or labeled on 4
the figure, and they are not.

Page 9 and Table 1 on page 10:
Note that the text descriptions of the channel reach dimensions do not all match those listed 5
in the table.

Page 11, 1st paragraph:
First sentence should read, "A <u>Regulatory</u> Agency Coordination Team (RACT)", instead of 6
"A Resource Agency Coordination..."

Page 47, 2nd sentence on page:
Sentence should be corrected from: "The RACT, Beneficial Use Workgroup and
Contaminant Workgroup have..." to <u>"The RACT, Beneficial Use, and Contaminant</u> 7
<u>Workgroups have</u>..." Note that all three groups listed are CCSCCIP Workgroups.

Page 50, Inner Harbor paragraph:
Last sentence should include the listing of placement area IH-PA 3C in order to be consistent 8
with the DEIS, the DMMP, and the remainder of the report.

Page 51, 7th sentence:
Sentence should be corrected to read that the <u>Mitigation Workgroup</u>, not the Beneficial Use
Workgroup, developed the 3:1 mitigation ratio. 9

Page 54, Entrance Channel paragraph, 6th sentence:
Sentence states the channel will be extended to the 54' contour. This contradicts the
remainder of the report that states the channel will be extended to the –56' contour. 10

Page 55, Inner Harbor paragraph, 2nd sentence:
Sentence states that this reach will have 2 feet of advanced maintenance. Actually, the inner 11
harbor will have varying amounts of advanced maintenance from 1' to 6'.

Page 59, Division of Plan Responsibilities/Cost Sharing Requirements:
The cost sharing provided only generally describes the project. The final cost sharing 12
responsibilities by reach and depth will be negotiated for the Project Cooperation Agreement
between the Federal Government and the Port of Corpus Christi Authority.

Page 61, Table 19 and page 62, Table 20:
Appears that the value for Non-Federal Cost for Real Estate should be distributed differently. 13
For the CCSC, Real Estate costs should include the value of IH PA 6 and Suntide; and for La
Quinta, the costs should include the value of La Quinta Buffer Zone property. The tables
should be adjusted accordingly.

Pages 66 to 73:
Bulleted items are understood to be subject to negotiation for the Project Cooperation Agreement between the Federal Government and the Port of Corpus Christi Authority. 14

Plates 1, 2,3,4:
The DMPA labels for the Inner Harbor should be preceded with the designation (IH) to make consistent with the text (Page 43. Upland Confined Placement Plan) 15

Plate 1:
The Tule Lake Placement Area designation should be corrected to IH PA 6 not PA 7. 16

Plates 4, 5, and 6:
Please note that it is difficult to read that the area within the dark hash lines with stippling represents the proposed barge shelves and not exclusively for the proposed widening in this reach. 17

Plate 6:
The area labeled Placement Area No. 11 should be labeled instead "Berry Island". PA 11 no longer exists; the former PA has reverted to private ownership. 18

Plate 7:
Placement Area 9, located just north of BU Site R, should be labeled. 19

Plate 7:
Placement Area 8, constituting the western lobe of Pelican Island, and Placement Area 7, constituting the eastern lobe of Pelican Island, should be labeled accordingly. 20

Plate 8:
The placement area labeled "Placement Area No. 3" should be label PA 4. PA 3 no longer exists and was previously located at the current location of Robert's Park adjacent to the municipal marina in Port Aransas, Texas. 21

Plate 8:
This plate should show the location of PA 5 on Mustang Island, south from BU Site L. 22

Plate 12:
Reference and label of "Proposed Available Tract for Placement Area" in the middle of site of the PCCA's proposed container terminal should be deleted. 23

Plate 13:
Reference and label of "Placement Area No. 12" northwest of the Jewel –Fulton Canal should be deleted. 24

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Page DEIS-iv, SUMMARY, Preferred Plan section:
The summary of the preferred plan should include the description of the GNF of the La Quinta Channel Extension and should read something like - "The preferred plan includes the extension of La Quinta Channel approximately 7400 feet at a width of 400-feet and to a depth of –39-foot MLT". This action is clearly described elsewhere in the Feasibility Report and the DEIS as an element of the proposed action but it is not described in the Summary. 25

Figure 1-1:
The referenced Figure 1-1 in the text and listed in the DEIS Table of Contents as "Corpus Christi Ship Channel Study Area" is missing. Pages DEIS-3 and DEIS-7 appear to be copies of the same Figure 1-2. 26

Page DEIS-200:
Under the paragraph listing the projects that are not in foreseeable future or did not have documents available, the region referred to should be "Region "L" not "Region "N". Region "L" is for the San Antonio region. Region "N" is for the Coastal Bend Regional Water plan that is described as included in the reasonably foreseeable actions section. 27

Pages DEIS-202 and 203, Table 5.1-1:
Please note there are a few corrections or updated revisions to be made to the draft entries under the Joe Fulton International Trade Corridor column. Under **MITIGATION/BENEFITS*,** Upland Habitat, NI to 1.1 ac; Bay Bottom Habitat, no change; Shallow Water Habitat, NI to 5.2 ac. 28

Pages DEIS-202 and 203, Table 5.1-1:
Please note there are a few corrections or updated revisions to be made to the draft entries under the La Quinta Gateway Project column. Starting with **RESOURCE IMPACTS** these are: Topography/Bathymetry, 32 acres to NI; Shore/Beach/Dunes, 0.7 statue mile to 1.8 acres; Salt Marsh 1.7 ac to 2.1 ac; Flats, no change; Open Water, 32 acres; Oyster Reef, no change; Upland Wetlands, NI; Shallow Bay Habitat, 27.5 to 27.1; Gulf of Mexico Bottom, no change; Terrestrial Habitat, 295 ac (excludes cropland) to 245 ac (excludes 869 ac cropland); Submerged Aquatic Vegetation, 2.9 ac to 2.4 ac; Essential Fish Habitat, 32.1 to 31.6 ac. 29

Under **MITIGATION/BENEFITS*** these are: Upland Habitat, no change; Bay Bottom Habitat, no change; Shallow Water Habitat, NI to 27.1; Submerged Aquatic Vegetation, 8.6 to 7.2; and Wetlands, 5.3 to 5.9. 30

Pages DEIS-208 to 217, Section 5.4 RESULTS: 31
Changes to Table 5.1-1 should also be reflected in 5.4 RESULTS, as applicable.

Page DEIS-205, Section 5.2.4, La Quinta Gateway Project, 2nd paragraph: 32
In order to be consistent, the first sentence should state the terminal would have a 295-acre marine terminal instead of a 245-acre marine terminal.

Page DEIS-229, Section 8, 2nd paragraph:
In the 7th sentence it states that a "series of newsletters was also sent to people who attended meetings on the project". To better capture the public involvement and coordination performed for this project, the sentence should have read: "A series of newsletters was sent to approximately 1,300 people or organizations in the area, including those who attended meetings or expressed an interest in the project or could potentially be interested in the project." 33

Page DEIS-248:
The Shiner, Moseley and Associates, Inc., Carter and Burgess, Inc., and Olivarri and Associates, Inc. citation should be corrected to the following since the DEIS uses revised information from: Shiner Moseley Associates, Inc, (2001). Environmental assessment for the proposed Joe Fulton International Trade Corridor from IH 37 to US 181, Nueces County Texas July. The citation provided should replace the citation for the obsolete draft EA dated April 2001. 34

APPENDIX D, COORDINATION

There appears to be pages missing from the letter dated March 31, 2000 from Galveston District to Texas Historical Commission. 35

Please note for clarification only that the coordination effort provided in the DEIS represents a part of the record of public involvement and agency coordination that took place during the Feasibility Study. The PCCA has 6, 4-inch binders of detailed meeting summaries on the approximately 40 CCSCCIP Workgroup meetings, 11 public forums, 4 public meetings, 3 scoping and/or public hearings and numerous individual interest group presentations and meetings, three newsletters and numerous newspaper articles published in dailies throughout the region. The project sponsors are very proud of this effort and the PCCA shall continue to keep the public informed and involved throughout construction and operation. The PCCA believes the project has been made possible due to the participation and commitment of the people in the community. 36

With regard to agency participation, the DEIS is clear on the coordination involvement however, we would like to provide for the record a list of the personnel of the various agencies that participated in the various CCSCCIP Workgroups. (See attached list of Agency Workgroup Participants) 37

APPENDIX F

Page F-29, Paragraph 4.5.7:
Tule Lake Placement Area should be referenced as IH PA 6 not PA7. 38

APPENDIX H

Appendix 5:
BU Site L should be labeled on Plate C-13; and on Plate F-42, Tule Lake placement area should be labeled as IH PA 6 not as DMPA-7 (TULE LAKE). There is no DMPA 7 in the Inner Harbor. 39

ADDITIONAL COMMENTS

The net positive benefits due to the recommended DMM/BU plan are much larger and more significant than described in the DEIS. For example, the PCCA fully intends to use the created beneficial use Site GH for mitigation related to impacts to estuarine resources associated with construction of the slip and docking facility for the La Quinta Container Terminal. 40

A significant resource management problem that regulatory agencies and permit applicants constantly address in this region is the lack of available or suitable areas to locate and perform mitigation and/or habitat enhancement activities. The implementation of the CCSCCIP DMM/BU plan will provide several hundred acres of beneficial use sites where such actions can be conducted. Clearly, the created beneficial use sites should be readily adoptable and available in the earliest years following initial construction for mitigation plantings or habitat management actions that may be required by other permitted water dependent actions in the bay system. Ultimately, as these sites mature and become invaded by seagrass vegetation, they may become less readily amenable to alternative uses or mitigation; however, that does not diminish the value for the described purposes. The PCCA will work closely with persons and with local, state and federal agencies who may seek to lease these areas from the PCCA for mitigation plantings and habitat enhancement to maximize the beneficial use potential of the sites. 41

Several possible developmental activities not described in the DEIS, such as channels to access existing oil and gas production facilities may need to occur within the created beneficial use sites. However, simply because they are not specifically included, they should not later be considered incompatible with the resource management opportunities provided by the creation of the beneficial use sites. Clearly any proposal to conduct a separate developmental activity is expected to be addressed on an individual permit basis. 42

Thank you for the opportunity to comment on the Draft Feasibility Report and DEIS.

Sincerely,

John P. LaRue,
Executive Director

Cc: Frank C. Brogan, PCCA
Greg W. Brubeck, PCCA
David L. Krams, PCCA
Paul D. Carangelo, PCCA
Lloyd H. Saunders, Ph.D. Chief, Planning, Environmental and Reg. Div., USACE-Galv.
Dr. Terrell Roberts, USACE-Galveston
Robert Heinly, USACE-Galveston

Corpus Christi Ship Channel - Channel Improvement Project

Workgroup Participants

1998 - present (May 14, 2002)

Texas Parks and Wildlife Department
Smiley Nava
Jim Tolan
Mary Ellen Vega
Beau Hardegree
Kay Jenkins

U. S. Fish and Wildlife Service
Johnny French
Clare Lee
Tom Schultz
Tom Shearer
Pat Clements
Mary Orms

National Marine Fisheries Service
Bill Jackson
Rusty Swafford

Texas Natural Resource Conservation Commission
Bruce Moulton
Mark Fisher
Rene Mariscal
Chris Caudle
Robert Burgess

Texas Department of Transportation
Raul Cantu
Amy Link
Melissa Gabriel
Paul Douglas
Scott Sullivan

Texas Railroad Commission
Mary McDaniel
Don Gault
Bill Meyer

U. S. Environmental Protection Agency
Mike Jansky
Monica Young
Tim Landers

Texas General Land Office
Ray Newby
Tom Calnan
Kim Halbrook
Heidi Wadzinski

Texas Water Development Board
Gary Powell
Junji Matsumoto
Barney Austin
Mark Wetzel

Coastal Bend Bays and Estruary Program
Leo Trevino

Pacific International Engineering
Vladimir Shepsis
Hugo Bermudez

Olivarri and Associates
Leah Olivarri
Kelly Billington

PBS&J
Martin Arhelger
Gary Galbraith
Kari Jecker
Kathy Calnan

Port of Corpus Christi Authority
Greg Brubeck
David Krams
Paul Carangelo
Stacey Bryant
Sandy Escobar

U. S. Army Corps of Engineers
Frank Garcia
Bob Bass
Bob Heinly
Terry Roberts
Carolyn Murphy
Rob Hauch

U. S. Army Corps of Engineers
Gary Ray - WES
Doug Clark - WES
Carl Anderson
Wade Williams
Carlos Tate
Jon Plymale
John McManus

U. S. Army Corps of Engineers
Dale Williams
Rick Medina
Rao Vemulakonda - WES
Ed Reindl
Mike Kieslich
George Alcala

Mr. John P. Larue
Executive Director
The Port of Corpus Christi
222 Power Street
Corpus Christi, Texas 78401

RESPONSE TO COMMENTS

Comment No.	Response
1	Text will be revised.
2	Text will be revised.
3	Text will be revised.
4	Reference to the figure at this location has been removed. It is cited in several other locations throughout the report.
5	The text and table have been modified so that the numbers are correct.
6	Text will be revised.
7	Text will be revised.
8	Text will be revised.
9	Text will be revised.
10	The paragraph will be modified to clarify that dredging in that location will be to –54 feet with 2 feet of advanced maintenance, and will extend to the 56-foot contour.
11	Text will be revised to remove reference to a specific amount of advanced maintenance.
12	Comment noted.
13	Tables will be adjusted to update non-Federal cost share appropriately.
14	Comment noted.
15	Text will be revised.
16	Text will be revised.
17	Comment noted.
18	Text will be revised.
19	Text will be revised.
20	Text will be revised.
21	Text will be revised.
22	Text will be revised.
23	Text will be revised.
24	Text will be revised.
25	Text will be added to the summary.
26	The correct figure will be in the FEIS.
27	According to Water for Texas - 2002 (Texas Water Development Board, January 2002), the State of Texas Regional Water Planning Area N refers to the Coastal Bend Planning Group.
28	Text will be revised.
29	Text will be revised.
30	Text will be revised.
31	Table will be revised according to changes in document.
32	Text will be revised.
33	Text will be revised.
34	Text will be revised.
35	The letter will be complete.

36	Comment noted. The FEIS will note that there was other communication with the public that is not part of this official record. There were a large number of documents available and the most pertinent documents were chosen to make the EIS less cumbersome.
37	The Agency Workgroup Participants list will be included in the FEIS as Table 1.6-1 in Section 1.6.
38	Text will be revised.
39	Text will be revised.
40	The La Quinta Container Terminal is not a part of the project, therefore the net positive benefits may be larger, but are difficult to measure. See comment #41.
41	Any mitigation efforts for future projects (non-federal or federal projects, other than USACE projects) in these BU sites will be handled under the USACE's permit application process.
42	See comment #1 in the response to the Texas General Land Office.

AUG 2 1 2002

COASTAL BEND ENVIRONMENTAL COALITION
P.O. BOX 3512 Corpus Christi, 78404

... 3 2002

August 9, 2002

Department of the Army
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Re: Corpus Christi Ship Channel Improvements

Dear Sirs:

The Environmental Coalition appreciates this opportunity to comment on the DEIS on the channel improvement proposed for the Port of Corpus Christi. We wish to complement the persons who have studied and prepared this document and believe that they have done an admirable job on all sections of the project except the reach between the La Quinta Channel and the harbor bridge. It is this section of the project that we will address here. 1

The methods of spoil disposal (dredged material from both the construction and maintenance dredging procedures) seem to us to be just a continuation of the old procedures of the past where the material is deposited along the channel. This practice appears to be simply an insurance policy for the maintenance workers as the material will quickly slither back into the channel. This practice continues to create problems in the bay and also in Laguna Madre. 2

If the COE and the Port of Corpus Christi insist on performing the disposal of the dredge material in this manner, we suggest that specifications be written to the effect that the delivery of the material be as far from the channel as possible within each of the eight sites. We believe that by using this suggestion, the Port would save considerable money from dredging needs becoming necessary at less frequent intervals and the silting would therefore be diminished in the area of the bay nearest the channel. 3

We would like to see a comparison of costs of the creation of a spoil island close to the channel in this reach for the disposal of the dredged material within some form of containment with the usual dumping of the material along side of the channel and the costs of continual maintenance dredging.. While initially more expensive, we 4

believe that this would bring a long term solution to the disposal problem and would create a beneficial use of the material by creating a nesting island for the birds.

Thank you for the opportunity to comment on this DEIS.

Sincerely,

Patricia H. Suter

Patricia H. Suter, President
Chairman, Coastal Bend Sierra Club

Ms. Patricia H. Suter
Coastal Bend Environmental Coalition
P.O. Box 3512
Corpus Christi, Texas 78404

RESPONSE TO COMMENTS

Comment No.	Response
1	Thank you for your comment.
2	Comment noted.
3	As explained in the DEIS, all construction material from the Entrance Channel, the Lower Bay reach, and the La Quinta Channel (except for some stockpiling) will be used to create new BU sites. Additionally, construction material from a portion of the Upper Bay will be used for the creation of BU sites (DEIS Section 2.3.2). Table 1.7-1 provides data on each of the BU sites, all of which will be created with construction material, and the sites total 935 acres. Section VII of the FR notes that due to the silty nature of the construction material from the rest of the Upper Bay reach, this material is not suitable for beneficial uses. The USACE has already implemented your suggestion to place the material as far away from the channel as possible (within the limits of the designated PAs), as noted in Section 4.1.5 of Appendix F to the DEIS: "...in an effort to improve management practices at those open-water sites and possibly reduce dredging frequency,...the dredge pipes will be placed at the back limits of the designated placement sites to release dredged material as far from the channel as possible." It will take time to determine if this practice does lead to a reduction in shoaling rates and frequency of dredging.
4	Dredged material in this reach (both new work and maintenance and in the proposed placement areas) consists primarily of very soft, gray clay from the existing bay/channel bottom to the proposed dredge depths. The estimated cost for the new work dredging proposed in the DEIS for the Upper Bay reach is approx. $30 Million including contingencies. The total estimated operation and maintenance cost to maintain the Upper Bay reach for the 50 year life of the Recommended Alternative, based on the USACE's estimate of 16 dredging cycles (about once every 3 years) with contingencies is approximately $140 to $150 million. The creation of an UCPA in the bay, which is fully contained to hold all anticipated new work and maintenance material for the Upper Bay reach for 50 years (without the cost to perform and place the maintenance dredging described above), would be approximately $200 to $300 million. Based on USACE estimated shoaling quantities, a 25% bulking factor, and no expected consolidation of the maintenance dredge material or the underlying soil/bay bottom, a hypothetical UCPA could be created by two (2) approximately 2,000 acre sites each (a total of 4000 acres or 6.25 square miles) either contained with a rock rubble mound breakwater-like structure or a steel sheet pile structure that would extend approximately 6 feet above the waterline.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

AUG 9 2002

Lloyd H. Sanders, Ph.D.
Chief, Planning, Environmental
and Regulatory Division
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Dear Dr. Sanders:

In accordance with our responsibilities under Section 309 of the Clean Air Act (CAA), the National Environmental Policy Act (NEPA), and the Council on Environmental Quality's Regulations for Implementing NEPA, the Environmental Protection Agency (EPA) Region 6 Office in Dallas, Texas, completed its review of the Draft Environmental Impact Statement (DEIS) on the Corpus Christi Channel Improvements Project, Corpus Christi and Neuces bays, Neuces and San Patricio counties, Texas, dated June 2002.

EPA has rated the DEIS as **LO, Lack of Objections**. Our classification will appear in the *Federal Register* according to EPA's responsibility under Section 309 of the CAA, to inform the public of our views on proposed Federal actions. 1

Correction or clarification of certain items would help to strengthen the Final EIS and the enclosed comments on the DEIS more clearly identify these suggested areas. Please send our office five copies of the Final EIS when it is sent to the EPA, Office of Federal Activities, EIS Filing Section, South Ariel Rios Bldg. (Room 7220), 1200 Pennsylvania Ave, N.W., Washington, D.C. 20004. If you have any questions, please contact Joe Swick at (214) 665-7456.

Sincerely yours,

Robert D. Lawrence

Robert D. Lawrence, Chief
Office of Planning and
Coordination (6EN-XP)

Enclosure

Corpus Christi Ship Channel Improvement Project
Draft EIS Comments

1. In reference to the TWDB report (Matsumoto et al., 2001) used to estimate
the risk of altering the hydrodynamics of the bays system, the Final EIS would be 2
strengthened by clarifying this study in more detail, including the study design,
assumptions, and conclusions.

2. In lieu of actual surveys of the coverage of seagrasses, the Final EIS would be
strengthened by clarifying that the potential impacts to seagrasses, based on assumptions 3
from areal coverage of seagrasses in the project area and water depth, are conservative
and worst case.

3. In reference to Tier 1 analyses using existing data to evaluate environmental
effects of dredged material disposal and comparisons to sediment screening guidelines,
the Final EIS should clarify that sediment samples from the proposed project will be 4
collected and analyzed according to Inland Testing Manual protocols.

4. The document states that sites will be suitable for seagrass colonization,
however, this process will rely upon natural recolonization instead of plantings. The
Final EIS would be strengthened by clarifying if this process would be initiated by
planting seagrasses to jump start and enhance the natural recolonization, which is 5
expected to occur over time. If plantings are not considered feasible, this should be
clarified in the Final EIS as well as the potential for success from only the natural
recolonization of seagrasses.

5. We suggest revising Table 3.2-12 in the Final EIS, since the following species
were listed as non-indigenous marine species and they are generally recognized as widely
distributed in Gulf estuaries, including Corpus Christi Bay: spotted seatrout, sheepshead 6
minnow, gulf killifish, Atlantic croaker, black drum and red drum.

6. Section 7.8 (page DEIS-226) in the Final EIS should be clarified to reflect that
all construction material destined for disposal in the Gulf has been evaluated using the 7
CWA 404(b)(1) guidelines (Appendix A), and that all maintenance material is proposed
for placement at the existing ODMDS, subject to evaluation using the ocean dumping
environmental criteria.

Mr. Robert D. Lawrence
United States Environmental Protection Agency
Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

RESPONSE TO COMMENTS

Comment No.	Response
1	Thank you for your support.
2	NEPA states that an EIS should use references to the extent possible to avoid being encyclopedic. However, the report is available upon request should anyone require more detailed information.
3	Comment will be included.
4	Comment will be included.
5	Seagrass planting is not considered for all BU sites because ~~of~~ the existing seed bank and vegetative propagule supply in the area is considered sufficient to initiate colonization within a few months to a year, depending on site location, the season the site is completed, and the sediment stabilization-consolidation time needed to support colonization. The natural colonization process is a common phenomena observed by seagrass biologists in the project area. The BU sites are designed to create a platform that seagrass can colonize. Seagrass plantings for all sites are not part of the recommended plan and were not analyzed in the cost-benefit analysis.
6	Table 3.2-12 will remain unchanged since the information cited is from the Gulf of Mexico Program.
7	Comment noted. All materials have been evaluated and Section 7.8 will be clarified.

Coastal Bend Bays & Estuaries Program, Inc.
1305 N. Shoreline, Suite 205, Corpus Christi, Texas 78401 • 361-885-6202 • 361-883-7801 (fax)

August 12, 2002

Department of the Army
Galveston District, Corps of Engineers
Attn: Environmental Section
P.O. Box 1229
Galveston, Texas 77553-1229

Re: Corpus Christi Ship Channel, Texas - Channel Improvement Project, Draft EIS

Dear Dr. Saunders

Coastal Bend Bays & Estuaries (CBBEP) has reviewed the draft EIS for the Corpus Christi Ship Channel – Channel Improvement Project. The Channel Improvement Project purposes to deepen and widen the Corpus Christi Ship Channel. The result of the project will provide improved barge and ship traffic. As part of the work, the plan proposes to use material from the dredging beneficially to enhance areas by creating shallow water and emergent island habitats.

CBBEP is in support of the proposed project as it meets several objectives of the Bays Plan. Specifically, the project will result in improved maritime safety, Bays Plan objective MC1 (to support construction of the barge shelves on both sides of the ship
channel). The construction of the shelves will provide a greater safety margin relative to 1
potential collusions, which are a cause of inadvertent releases of undesirable material to the bays and surrounding waters. Additionally, the project addresses Bays Plan objective D-1 (establish a proactive beneficial uses group to maximize the beneficial use of dredged material).

Should you have any questions or if I may be of further assistance, you may contact me by telephone at 361 885-6244 or email ltrevino@cbbep.org.

Respectfully,

Leo B. Trevino

Leo B. Trevino
Director – Project Implementation

Coastal Bend Bays & Estuaries Program, Inc.
1305 N. Shoreline, Suite 205
Corpus Christi, Texas 78401

RESPONSE TO COMMENTS

Comment No.	Response
1	Thank you for your comments.

Texas General Land Office

David Dewhurst
Commissioner

Stephen F. Austin Building

1700 North
Congress Avenue

Austin, Texas
78701-1495

512-463-5001

August 12, 2002

Dr. Lloyd H. Saunders
Chief, Planning, Environmental and Regulatory Division
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

RE: Comments on the Corpus Christi Ship Channel – Channel Improvement Project Draft Environmental Impact Statement (DEIS)

Dear Dr. Saunders:

The Texas General Land Office (GLO) appreciates the opportunity to comment on the DEIS for the Corpus Christi Ship Channel (CCSC) Channel Improvement Project (CIP). The following comments reflect issues that have been raised in Regulatory Agency Coordination Team (RACT) and associated workgroup meetings held with state and federal resource agencies as well as in previous GLO consultation with the Port of Corpus Christi and U.S. Army Corps of Engineers – Galveston District (USACE).

Beneficial Use of Dredged Material

Corpus Christi Bay, including the CCSC project area, is an area of active oil and gas production. Revenue generated from petroleum development and the leasing of state-owned mineral lands in the area is deposited into the Permanent School Fund (PSF) to help fund the education of the school children of Texas. Some of the Beneficial Use (BU) sites, as currently designed and proposed in Corpus Christi and Redfish bays, may complicate and increase the cost of accessing and developing PSF lands for future mineral exploitation. Applicable laws and restrictions already complicate development in the areas of the proposed BU sites as drilling activities are prohibited in the vicinity of existing navigation channels and dredged waterways, and the GLO does not want to make it more complex and difficult than it is already.

The proposed BU sites of greatest concern are sites "CQ," "GH," "S," and "R." The size of these sites and their proximity to the navigation channels, with respect to the mainland shore, would obstruct access to
known oil and gas deposits. The remaining BU sites do not appear to 1
pose substantial obstruction to mineral access as current directional drilling technology can most likely compensate for the decreased surface access.

Construction of no additional BU sites would be the ideal alternative concerning future development of PSF minerals. However, realizing that environmental and economic interests need to be considered while retaining flexibility in the future development of state-owned minerals, there are several options that can be pursued to ensure those PSF assets can be developed in the future without undue complication. These options include:

1. Maintaining keyhole channels, as originally proposed in the development of the BU plan, into sites "CQ," "S," and "R" that can be used in the future without mitigation if development is done in environmentally sound ways using state-of-art technical processes.

2. Designating emergent parts of present or future islands to use as drill sites without substantial mitigation if development is done in environmentally sound ways using state-of-art technical processes.

3. Ensuring a series of drill sites on the mainland shore in the vicinity of sites "CQ,'"GH," "S," and "R."

A BU plan, with minor design modifications, for the CCSC CIP can be implemented to ensure that future development of state-owned minerals can proceed without accruing additional costs for access and mitigation than would occur under existing conditions. The GLO intends to be an active participant in the further development of a detailed BU plan for the CCSC CIP that meets the best interest of all stakeholders involved.

Shoreline Erosion

The Port of Corpus Christi's effort to analyze the causes of shoreline erosion in the project area and identify future erosion impacts expected to result from the proposed project has been excellent. The CCSC CIP Shoreline Erosion Study prepared by Pacific International Engineering indicates that shoreline erosion associated with vessel wakes and vessel pressure-field effects is a significant environmental impact near some portions of the existing CCSC project. It also appears that shoreline erosion will continue to be a deleterious environmental effect of the project in the future if not properly addressed by the project sponsors as part of the CIP. To that end, we recommend that shoreline erosion be listed and discussed as an individual item under DEIS Section 3.0 - Affected Environment and Section 4.0 – Environmental Consequences. 2

Overall, the RACT process has been very successful. The GLO looks forward to working with the Port of Corpus Christi and USACE in the successful planning and implementation of the CCSC CIP. Please contact me at 512/475-3624 or by email at ray.newby@glo.state.tx.us if you need any additional information regarding this matter.

Sincerely,

Ray Newby by [signature]

Ray Newby
Texas General Land Office

RN:kh

cc: Texas Parks and Wildlife Department
Texas Natural Resource Conservation Commission
U.S. Fish and Wildlife Service
National Marine Fisheries Service

Mr. Ray Newby
Texas General Land Office
1700 North Congress Avenue
Austin, Texas 78701-1495

RESPONSE TO COMMENTS

Comment No.	Response
1	The BU plan in the DEIS is conceptual and was prepared under the guidance of the BU Workgroup, which included a GLO representative. Each BU site was designed as a multipurpose site for environmental enhancement. The final site location and design plan for each BU site will be prepared during the Plans & Specifications phase under the continued guidance of the BU Workgroup. All concerns of each workgroup member will be addressed at that time and incorporated in the final BU plan to the maximum extent practicable. However, providing and maintaining "keyhole channels" in some of the BU sites represents an additional construction and maintenance cost that may not be necessary if there is no mineral development at these sites. At this time, it is preferable to deal with future minerals development in a BU site through the permitting process with BU Workgroup review, rather than attempt to provide a mitigation-free work area at each BU site.
2	Shoreline erosion is discussed in Section 4.3. The technical subject is best summarized in this section and refers the reader to the study. NEPA states that an EIS should use references to the extent possible to avoid being encyclopedic.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
c/o TAMU-CC, Campus Box 338
6300 Ocean Drive
Corpus Christi, Texas 78412

August 12, 2002

Lloyd H. Saunders, Ph.D.
Chief, Planning, Environmental and Regulatory Division
Department of the Army
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553

Dear Dr. Saunders:

This responds to your request for review of the Draft Feasibility Report and Draft Environmental Impact Statement (DEIS) dated June 2002 for the Corpus Christi Ship Channel, Channel Improvement Project. A copy of the DEIS dated June 2002 was received by the U.S. Fish and Wildlife Service on June 26, 2002. In reviewing the DEIS, the Service notes that many of the comments dated December 19, 2001 that were submitted for the November 2001 Preliminary DEIS have not been addressed. These comments are re-iterated below along with additional comments.

Section 1.4.2, Environmental, page DEIS-9: The Service notes that Federally listed threatened or endangered species are not included in this section although issues that directly relate to these species are included, such as shoreline erosion, which could affect the brown pelican nesting island and/or erosion of tidal flats used by wintering piping plovers. Also, dredging methodologies selected for the CCSP-CIP could potentially affect sea turtles in the bays. The Service recommends that Endangered Species be included as an "area of concern" with the other fish and wildlife issues noted in this section. 1

Section 1.6, NON-FEDERAL SPONSOR AND COORDINATION, DEIS-12: The Service is very concerned that the "beneficial" aspects of the Beneficial Use (BU) sites have not been documented. The benefits of a BU site should, in the assessment of the Service, provide gains to the system other than as a convenient, low-cost disposal site. The Service strongly recommends that such documentation should include detailed descriptions of how each site would provide an improvement to the existing conditions, as well as a monitoring plan, which will track each site's development and attainment of the specific site-related goals selected to characterize the benefits of each site. Although the Service agrees that the Beneficial Uses Workgroup (BUW) should remain organized and active throughout the life of the project, the appropriate function of the BUW would be to review monitoring reports provided by POCC and USACE, and the proponents of the project as well as to provide recommendations. 2

Section 1.7 RESOURCE MANAGEMENT ACTIONS, Site CQ, DEIS-16: The Service is aware that the Department of the Navy may have some concerns regarding the use of BU Site CQ and the potential increase in Bird Aircraft Strike Hazards (BASH) resulting from the design and construction of this site. The development of a detailed assessment relating to the "benefits" of this site should assess the BASH issue in light of the expected use by birds. Given what has been observed elsewhere regarding the temporal nature of geotubes, the Service recommends that this also be addressed more specifically. The EIS should outline expected life of the geotubes and the approach to be taken for their short-term and long-term maintenance. 3

DEIS-16, Site P: Development of a monitoring plan for this site is paramount in determining the success of this structure in protecting adjacent seagrasses. 4

DEIS-16, Site I: The Service has not been provided convincing evidence that the design and configuration of this BU would be unaffected by degrading forces from ship channel traffic, and that the material, proposed for placement on the west side, would remain in the site. Again, a rigorous monitoring plan would identify unanticipated changes in the site and perhaps indicate corrective actions that may be needed to avoid secondary impacts to the sensitive and extremely productive Redfish Bay system. 5

DEIS-17, Sites R and S: According to the DEIS, for sites R and S, the project provides for the deposition of new work dredged material to create shallow water habitat. Information is not provided concerning how this material represents a net gain for the Corpus Christi Bay system as currently the bay bottom at these BU's is not damaged or degraded in any way. Additionally, the BASH issue referenced for Site CQ may also need to be assessed for Site S. 6

DEIS-17, Pelican Island: The Service recommends that all of the proposed work at Pelican Island and anticipated impacts of this work be incorporated into the Biological Assessment as a component of the consultation for the CCSP-CIP, including cumulative effects from the construction of Site I. In addition, the Service notes that Pelican Island riprap and geotube decreased from 5500 feet of protection in PDEIS to 2200 feet in the DEIS. Justification for the reduction of protective barriers at this site should be clarified. 7

Assuming that the design for the 1500 feet of armoring on the northeast corner for the 45-foot project was appropriate, the Service recommends that the DEIS evaluate the on-going maintenance needs for this feature and develop a better maintenance schedule so that the site will not be degraded due to expected increases in traffic and/or ship size. 8

DEIS-18, Site L: The Service recommends that all of the proposed work at Site L and anticipated impacts of this work be incorporated into the Biological Assessment as a component of the consultation for the CCSP-CIP with regards to the federally listed, threatened, piping plover (*Charadrius melodus*). 9

DEIS-18, Sites ZZ and MN: The DEIS does not explain how the topographical relief created at the sites would enhance the marine ecosystem. 10

Section 2.3.2, Preferred Alternative, DEIS-27: The Service recommends that use of PA6, PA7,
and PA8 and anticipated impacts of this work be incorporated into the Biological Assessment as 11
a component of the consultation for the CCSP-CIP.

Section 3.3.1, Surficial Sediments, DEIS-45: The DEIS states that the U.S. Navy (1987) data 12
indicated ERL exceedances for arsenic (8 out of nine stations by as much as eight times),
cadmium (4 stations), and mercury (2 stations) in the Lower Bay reach. If the material has since
been dredged and removed, the Service recommends identifying the placement of that material.
Section 3.5.1, Finfish and Shellfish, DEIS-58, last paragraph: If information pertinent to the
CCSC-CIP was discovered as part of the Environmental Benefits Determination (EBD) for the
Packery Channel Feasibility Study, then that EBD should be included in the CCSC-CIP EIS as 13
an appendix. Where information from that EBD has been used in the environmental
consequences section of the CCSC-CIP EIS, specific references to the EBD should be included.

Section 3.6.2.2, Birds, Table 3.6-1 and DEIS-73, paragraph 2: The Interior Least Tern protection
as endangered is restricted to populations found in the "interior" of the United States. In Texas,
the least tern, within 50 miles (80 km) of the Gulf Coast is not included in this protection under
the Endangered Species Act. All least terns are; however, protected under the Migratory Bird
Treaty Act and the take of these birds, nests, and eggs is prohibited. The responsibilities of 14
Federal Agencies to protect migratory birds have been reinforced by Executive Order 13186.
The least tern is only one of several species of migratory birds which nest along the coast, very
likely within portions of the footprint of the CCSP-CIP. Methodologies to avoid impacts to
nesting migratory birds will need to be addressed in the EIS.

Section 3.6.2.4 Mammals, DEIS-77: The Service recommends that the Marine Mammal 15
Stranding Network also be consulted for information on and records of sightings for manatees in
the CCISP-CIP project area.

Section 3.6.2.5 Reptiles, DEIS-79, last paragraph add: The Texas diamondback terrapin is the 16
only turtle in the world entirely restricted to estuarine habitat, where it lives in coastal marshes,
tidal mudflats, and tidal creeks.

The Service recommends coordination with Ms. Kim Holbrook with regards to the potential for 17
impacts of the CCISP-CIP to the Texas diamondback terrapin.

Section 4.1.1, DEIS-141, Water Exchange and Inflows: The Service recommends that the DEIS 18
address the affect on water exchange in the study area with the dredging of Packery Channel.

Section 4.4.1, DEIS 147, Finfish and Shellfish: The Service is concerned that in the discussion
of turbidity effects, no distinction is made between the types of sediment being dredged (is the 19
material dominantly sandy or silt) nor in the various placement options used for dredging (open
bay, upland enclosed with a weir to the bay etc.).

A discussion is needed comparing the differences in turbidity as it relates to construction 20

assesses the anticipated type of material to be placed, and identifies whether the material is new
work (one time placement) or maintenance material (periodic placement). This type of 20
assessment in the EIS would provide for the reader a more accurate picture of anticipated
turbidity effects for specific BUs and PAs.

Section 4.4.3, DEIS- 150 Aquatic Communities: The Service would like for the DEIS to clarify
the choice in referencing data from Mobile Bay, Alabama over data from another closer bay
system such as Galveston Bay. In other words, what characteristics of Mobile Bay are more like 21
Corpus Christi and Nueces Bays, than another bay system, such as Galveston Bay for which
there is current data on suspended sediments?

Section 4.4.4, Essential Fish Habitat, DEIS-152, paragraph 2: The Service recommends that the last sentence of this paragraph be revised as follows:

> On the other hand, construction of the preferred alternative will have more beneficial than
> detrimental impacts since, for example, the BU sites are strategically placed to prevent 22
> shoreline erosion and preserve and create potential seagrass habitat. The site-by-site plan
> for each BU will characterize the habitat goals, and the monitoring plan will document
> the environmental gains to the Nueces Bay or Corpus Christi Bay system.

Section 4.6.1 Hazardous Material impacts to the Existing Environment from Project Activities,
DEIS-162, paragraph 4. The DEIS states that carbon tetrachloride and perchloroethane from 23
groundwater seepage could potentially be impacting the sediment in the La Quinta channel. The
results for the chemical analyses should be cited.

Section 4.3.2.1 Salt Marshes/Estuarine Shrublands/Sand Flats/Mud Flats/Algal Mats, DEIS-146,
paragraph 2: Indicates that the CCSCCIP would "slightly increase shoreline erosion rates", if so, 24
why the need for 9,000 linear feet of shoreline protection? The Service recommends that
shoreline erosion rates be more specifically characterized in the EIS.

Section 4.4.5.1 Dredging/Construction Activities: In paragraph the DEIS states that "Several
studies (Hartley and Fisher, 1936; Stott, 1936; Doan, 1942; and Jermolajev, 1958) briefly
mention the tendency of turbidity to concentrate food species such as small fish associated with
plankton near the surface where birds may prey upon them. However, the feeding efficiency of 25
pelagic birds does not appear to be significantly affected by water opacity." At least two of the
citations in refer to studies in fjords that are not relevant to conditions in Corpus Christi Bay,
therefore, the Service suggests either leaving out this sentence or referencing more recent or
more relevant sources.

The DEIS does not state that the dredging activities will be coordinated and timed to avoid
impacts to rookery islands. As previously noted, birds utilizing the rookery islands are protected
under the Migratory Bird Treaty Act and the take of these birds, nests, and eggs is prohibited.
As stated previously, the responsibilities of Federal Agencies to protect migratory birds have 26
been reinforced by Executive Order 13186. Methodologies to avoid impacts to nesting birds
utilizing the rookery islands and in other proposed placement areas will need to be addressed in
the DEIS.

Section 4.3.2.1 Salt marshes/Estuarine Shrublands/Sand Flats/Mud Flats/Algal Flats, DEIS-145-
146: The statement in the DEIS that the "decrease in the number of vessels in the project area
would reduce the potential for erosion of some of the PAs with rookeries" does not account for
the need for shoreline protection measures proposed for the CCSP-CIP. Unless that decrease in
erosion is contingent upon the proposed shoreline protection measures. This needs to be 27
clarified in the DEIS. Current effects are currently due to wind-generated waves and sea level
rise according to the PIE (2001) report. However the DEIS does not adequately address erosion
due to deeper draft vessels compared to vessels currently using the channel or the effects of
additional numbers of vessels using the proposed La Quinta extension.

Section 4.6.1, <u>Hazardous Material Impacts to the Existing Environment from Project Activities,</u>
DEIS-162: The DEIS states that the proposed project could affect the existing pipelines across
the CCSC, but does not assess the potential impacts related to the mandatory relocation of the
referenced 63 pipelines that cross the project area of the CCSP-CIP, nor how the relocations 28
would be timed or phased to minimize the potential for accidental spills related to those
relocations.

Section 4.11, ANY ADVERSE ENVIRONMENTAL IMPACTS WHICH CANNOT BE
AVOIDED SHOULD THE PREFERRED ALTERNATIVE BE IMPLEMENTED, DEIS-191:
The DEIS states that the BU sites will provide higher value habitat, but there is no assurance in 29
the DEIS that higher value habitat will occur in the BU sites, only potential habitat is being
created. This point should be clarified and any methodology to establish the habitat gains at the
BU sites should be included in monitoring plans for each site.

Section 5.1.1 <u>Cumulative Impact Assessment Methodology,</u> DEIS 200, paragraph 2: Is "Region 30
Plan Prepared for Region "N" referencing the State of Texas Regional Water Plan? The Service
recommends that this be clarified in the DEIS.

Section 5.2 REASONABLY FORESEEABLE FUTURE ACTIONS, DEIS-201: Although the
DEIS does not so state, the Service recommends that prior to the publication of the final EIS for
the CCSP-CIP, an attempt be made to verify and update published documents, and other features
of the referenced 'Reasonably Foreseeable Future Actions' in order to refine Section 5.4
RESULTS which describes their anticipated interaction with the CCSP-CIP project. For
example, Section 5.4.2.8 Circulation/Tides contains the following statement:

31

> Changes in circulation will occur with the opening of Packery Channel.

An up-to-date version of the Packery Channel project plan, or U.S. Army Corps of Engineers
Public Notice, should afford the opportunity to assess the impacts on currents/tides in Corpus
Christi Bay in conjunction with the CCSP-CIP.

Section 5.1.2.1, Individual Project Evaluation and Table 5.1-1, Cumulative Impacts, DEIS- 201- 32
203: Cumulative impacts combines existing and proposed projects and their impacts; these need
to be distinguished individually and reflected in the totals. This table should also reflect accurate
amounts of habitat created and not proposed. For example, the ten acre seagrass mitigation

requirement for the Mine Warfare Center of Excellence has not to date been achieved.

Appendix G, H and I are not listed in Table of Contents. 33

We thank you for allowing us to comment. If there are any further questions please contact Clare Lee or Pat Clements at (361) 994-9005.

Sincerely,

Patricia Bacak-Clements

for Allan M. Strand
Field Supervisor

cc: Paul Carangelo, PCCA, Corpus Christi, TX
Terry Roberts, USACE, Galveston, TX
Bill Jackson, NMFS, Galveston, TX
Smiley Nava, TPWD, Corpus Christi, TX
Raul Cantu, TXDOT, Austin, TX
Mark Fisher, TNRCC, Austin, TX
Mary McDaniel, RRC, Austin, TX
Ray Newby, GLO, Austin, TX
Mike Jansky, EPA, Dallas, TX
Lee Harbison, Naval Station Ingleside, Ingleside, TX

Mr. Allan M. Strand
United States Department of the Interior
Fish and Wildlife Service
Ecological Services
c/o TAMU-CC, Campus Box 338
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Corpus Christi, Texas 78412

RESPONSE TO COMMENTS

Comment No.	Response
1	Section 1.4 addresses problems, needs, and public concerns that were identified through coordination and public meetings. Federally listed threatened or endangered species are an area of concern; however, these species were not identified during public meetings. Therefore, endangered species are not included in this section, but are addressed in the document in Section 4.5.
2	The RACT and the other CCSCCIP Workgroups provided guidance and wise counsel on matters relating to the evaluation of environmental impacts of this project. A list of members, including FWS, NMFS, and TPWD, is found in Section 1.6 of the DEIS. The BUW agrees with the assessment of the FWS, that a BU site would provide a net environmental gain for the ecosystem. The BU sites proposed are not "convenient, low-cost disposal sites". In fact, a higher cost would be accrued to configure the sites in open water, armor them, and place dredged material in the proposed configurations of BU sites. It is anticipated the UCPA would be cheaper since they are upland and already have levees and water control structures in place, but there is not sufficient capacity for all of the material without increasing the size of the PAs. The proposed BU sites are conceptual and were discussed during BUW and RACT meetings. BUW and RACT members recognized that individuals define value of a habitat differently, and therefore, no particular value was given. However, there was consensus among BUW and RACT members that all proposed BU sites would potentially provide higher value habitat than existing conditions. Documentation of detailed descriptions and a monitoring plan of specific site-related goals for each BU site will not be provided in the FEIS. The USACE tries to use dredged material in a beneficial manner for the environment. This material is clean and could provide beneficial habitat such as emergent marsh and seagrass nursery habitat for marine organisms. In addition, members of the BUW and RACT listened to the public for ideas on how best to use these materials beneficially and determined the proposed BU sites were multipurpose for the benefit of the human and physical environment. Site-specific use of material will be discussed during development of plans and specifications prior to construction for each reach, but the USACE and PCCA have no plans to conduct monitoring for BU sites.
3	The PCCA met with the Naval Air Station and the Naval Station Ingleside to explicitly state the preferred alternative and there were no issues of concern. In addition, no letters of concern were received. Expected, geotube life is 15 years, with armoring. The FWS has not

	objected to the use of geotubes for other BU sites, for example, Shamrock Island.
4	Monitoring plans and site-specific use of material will be discussed during development of plans and specifications prior to construction for each reach.
5	Currents were monitored between Site I and Dagger Island under extreme tide conditions. Pacific International (PI) Engineering performed a feasibility level design of the shoreline protection system for the BU Site I. The plan view and cross-sectional configuration of the Site I shore protection system were developed based on comments received from the BUW and a coastal engineering analysis summarized in the CCSC CIP Shoreline Erosion Study dated January 2001. The feasibility level design of the shoreline protection system for the BU Site I was developed in a two-step process. The first step was to determine the location and extent in plan view of the shoreline protection system. The second step was to develop a cross-section for the structure that would be stable under the physical conditions and forces expected at the site after channel improvements. The alignment and extent of the shore protection system on the western side of BU Site I were chosen to minimize wind wave erosion to ~~of~~ the site. Wind wave modeling was used to determine the extent of the shore protection to the north and to develop wind wave parameters such as wave height and period for the design of the cross section. Additionally, the shore protection resulted in benefits to the stabilization of Dagger Island from wave impacts from southeasterly to easterly winds. The cross-sectional design for the eastern side of the site consists of a 30ft circumference geotube with a crest height of +5ft. The design includes a rock toe to prevent undermining. The toe protection incorporates a rock size gradation with a 1,000lb maximum and extended to an elevation of –3ft. This rock is stable for design wave heights of 2.5 to 3.0 feet for a 3- to 4-second period (PI Engineering, January 2001). This protection system is designed to withstand daily wave attack from the southeasterly to easterly winds. The alignment and extent of the shoreline protection system along the southern portion of BU Site I were chosen to prevent erosion of the site due to pressure field effects induced by deep draft vessel passage. Pelican Island, south of the BU Site I, provides protection for the site from wind waves. In addition, the pressure field effects were found to be the dominating design condition along the southern portion of BU Site I. The cross-sectional design for the southern side of the site consists of a

	30-ft circumference geotube built to an elevation of –2ft and adjoining rock dike with a crest elevation to +5ft. The rock dike is designed with a crest width of 4ft and a front face slope of 1V on 2H on the channel side. The rock was sized to assure the stability of the structure under pressure field effects produced by deep draft vessels (PI Engineering, January 2001). It was determined that a rock size gradation with a 2,200lb maximum should be used. This rock size is stable for design conditions that would be created by deep-draft vessels 920 feet long by 174 feet wide, drafting 47 feet of water, and moving at a speed of 10 knots. Based on PI Engineering experience, the material proposed for placement on the west side of BU Site I, behind the shoreline protection structure, should remain fairly stable under pressure field effects. However, further and more detailed pressure field modeling, usually performed during the final design phase, should give a good indication to the fate of the sediment and whether adjustments to the western end of the south shoreline protection system are required. Overall, the feasibility level design performed by PI Engineering for the shoreline protection system of the BU Site I takes into consideration all major factors known to be contributing to the erosion of the land features adjacent to the CCSC (PI Engineering, January 2001). During final design, most of the structure geometrical parameters should be analyzed further to assure the stability of the shoreline protection system and thus the material to be placed at the site.
6	See comment #2 and #3.
7	The proposed work at Pelican Island was the best plan for brown pelicans and shoreline protection within a quiet zone. Additional information has been added to the BA and provided to the FWS and the project team will work with the FWS and Audubon Society during development of plans and specifications prior to construction for that reach. The reduction in the length of the protective barriers is a correction of a typographical error due to a graphical misrepresentation.
8	Maintenance is only added to this site on an as-needed basis, in consultation with PCCA, FWS, and the National Audubon Society. We expect fewer total ships in the with project future condition than the without project future. See the Economic Appendix.
9	No impacts to the piping plover are anticipated at Site L. A meeting was held with the FWS in August 2000 to establish survey protocol and sites. Site L was not included in the survey area determined by the FWS.
10	Topographical relief created offshore has been recommended as beneficial for other projects such as Galveston and Sabine Pass, especially by NMFS. Again, it was the consensus of the BUW and RACT, including FWS representatives, which recommended this as a

	beneficial use of dredged material.
11	Placement Area 6 is not critical habitat for the piping plover nor is it used by the brown pelican, and therefore is not in the BA. Critical Habitat Map Unit TX-14 is located south and east of PA 6. PA 7 and PA 8 are currently included in the BA.
12	The dredged material was placed in the Navy Upland Placement Area east of Dupont and north of Kiewit.
13	The paragraph discussing the EBD was an error and has been deleted.
14	The interior least tern will be removed from Table 3.6-1 and the text. The purposes and mandates of E.O. 13186 are clearly presented and direct Federal agencies to initiate an MOU. It requires no mandatory action by Federal agencies prior to the initiation of the MOU, and in fact, states that "the MOU shall recognize that the agency may not be able to implement some elements of the MOU until such time as the agency has successfully included them in each agency's formal planning process...including public participation and NEPA analysis." The Corps cannot agree to preconditions that are not part of the MOU as mandated by E.O. 13186, such as avoiding a PA that may or may not be used for nesting. The Corps and PCCA can contact the USFWS and TPWD to coordinate a management plan, such as location of pipeline route or access corridor, to reduce, if not eliminate, impacts to birds that might nest at a site projected for use in a dredging contract. However, it would be difficult to avoid using a PA for a long period of time (bird nesting and sediment consolidation window) without jeopardizing a long construction schedule. This plan (avoidance during nesting season) may be more viable during maintenance dredging operations for a completed project when long construction schedules are not involved and if that is part of the MOU.
15	On page DEIS-77, manatee information as recent as 2001 is cited. No stranding information was listed for manatees on the Marine Mammal Stranding Network website. http://www.tmmsn.org/research/PresentsPubs.html
16	The sentence has been added to the text.
17	No impacts are anticipated to the habitat of the Texas diamondback terrapin.
18	Water exchange in the study area, both with and without CCSCCIP, was modeled with the proposed Packery Channel included. The following sentence will be added to the end of the second paragraph in Section 4.1.1: "Based on the recommendation of the Hydrodynamic and Salinity Modeling Workgroup, the Cumulative Impact Workgroup and the RACT, the study included the opening of Packery Channel and modifications to the JFK causeway."
19	Page DEIS-148, paragraph 3 states the type of construction and maintenance materials. DEIS-15, Table 1.7-1 lists type of material to be used at each BU site. Details on the placement of dredged material

	would be determined during development of plans and specifications prior to construction for each reach. Best management practices will be part of the plans and specifications. Downward directed pipes and deflectors will likely be used within the designated open water Placement Areas. Section 4.1.5 of Appendix F to the DEIS notes that "...in an effort to improve management practices at those open-water sites and possibly reduce dredging frequency...the dredge pipes will be placed at the back limits of the designated placement sites to release dredged material as far from the channel as possible."
20	All BU sites would be created with one time placement of new work material. Anticipated turbidity effects would be temporary and only suitable material will be used. Placement of maintenance material would follow a USACE maintenance plan in upland confined placement areas that would not create turbidity effects in the bay.
21	Data from Mobile Bay, Alabama was chosen for data reference because it is a classic reference on dredged material and turbidity. Suspended sediment in water acts similarly in all estuarine systems; therefore, this reference is pertinent and has been included in all of the EISs for estuarine systems along the Texas coast that the FWS has reviewed.
22	Comment noted. Site-specific use of material will be discussed during development of plans and specifications prior to construction for each reach. See Comment #2.
23	DEIS-81, paragraph 3, includes citations for the chemical analyses. NEPA states that an EIS should use references to the extent possible to avoid being encyclopedic.
24	The shoreline protection is proposed to protect habitats as an enhancement feature of the proposed plan, not compensation or mitigation. Shoreline erosion rates were not determined by PIE 2001. Shoreline erosion under existing conditions was compared to the preferred alternative and is discussed on DEIS-146.
25	Comment noted. Sentence is omitted.
26	See comment #14.
27	This phrase cannot be found in Section 4.3.2.1. The closest statement to the one quoted in this comment is found in Section 4.5.2.2: "A decrease in the number of vessels in the area and the erosion protection features there may reduce the potential for erosion of the Pelican Island brown pelican rookery." The actual sentence from the DEIS needs no clarification. The DEIS does address erosion due to deeper draft vessels on DEIS-147 since PIE, 2001b, does include deeper draft vessels in the analysis.
28	It will be the responsibility of the pipeline owners to remove the pipelines at their cost or cost-share it with the local sponsor. A removal/relocation schedule has not been coordinated at this time. However, the project cannot proceed at the pipeline locations until they are removed. The owners are expected to use best management practices to avoid

	hazardous material releases during the removal operation.
29	This statement is based on the conclusions of the agency personnel, including FWS, which attended the numerous BUW Workshops and RACT meetings. However, the sentence has been revised to state that BU sites will "potentially provide…"
30	"Region Plan Prepared for Region N" is referring to the State of Texas Regional Water Planning Area N, or the Coastal Bend Planning Group. The text will be revised.
31	The EIS does include information about impacts on currents and tides from the CCSCCIP project. The model used for this project included Packery Channel.
32	Comment noted. Changes to the text will be made that some mitigation is proposed.
33	These appendices are not part of the DEIS and are, therefore, not listed in the DEIS Table of Contents.

TEXAS PARKS & WILDLIFE

19 August, 2002

Carolyn Murphy, Chief
Environmental Branch
U.S. Army Corps of Engineers
P.O. Box 1220
Galveston, TX 88553-1229

Dear Ms. Murphy:

This letter is in response to the request for comments concerning the Draft Feasibility Report (DFR) and the Draft Environmental Impact Statement (DEIS) for the Corpus Christi Ship Channel (CCSC), Texas, Channel Improvement Project dated June 2002. The proposed project involves the deepening and widening of the channel from the Gulf of Mexico to the end of the Corpus Christi Inner Harbor, Nueces County, Texas.

For the past two years, Texas Parks & Wildlife Department (TPWD) staff has participated in Regulatory Agency Coordination Team (RACT) meetings and work groups with other state and federal natural resource agencies, the Port of Corpus Christi Authority (PCCA), and U.S. Army Corps of Engineers (USACE). The team provided information and discussed potential environmental concerns associated with the project. TPWD has reviewed the DFR and the DEIS and offers the following information.

The Primary Purpose of the Study

The primary purpose of the project, as identified in the DFR and DEIS, is to allow for a more effective, safe and efficient use of the waterway. The project will reportedly eliminate major problems that contribute to inefficiencies on the waterway including current depth and width, requirements for one-way ship traffic and would provide shelves for the safe passage of barges and smaller vessels. In addition, the PCCA performed studies to determine the economic viability of a new container terminal and turning basin at the northwest end of the current La Quinta Channel and included a 50 year maintenance plan for dredge material placement in the proposed project plans.

<u>Direct Habitat Impacts and Mitigation</u>

Survey results indicate that bay bottom within the project area with water depths to -4 ft MLT comprise approximately 45 acres, of which only 5 acres of SAV (Submerged Aquatic Vegetation) would be directly impacted by the project. These 5 acres are within the La Quinta Channel extension. The planting of 15

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acres of seagrass within Beneficial Use site GH will be conducted as mitigation for the direct loss for the 5 acres of SAV during project construction, a ratio of 3 to 1. (DEIS Chapter 4.3.1). Staff does not have any comments on the mitigation 1
plan except to emphasize that mitigative procedures and measures, described in the Conditions for Seagrass Transplanting Efforts(DEIS-193 to 195), must be followed, monitoring of the mitigation site must be conducted and that stated success criteria should be achieved.

Preferred Alternative Plan

Of the twenty-three alternative project plans developed in the Initial Plan Formulation Phase and presented in DEIS-22, the preferred alternative plan recommended by the USACE and preferred by the PCCA includes the following: deepening the CCSC from Viola Basin to the end of the jetties to 52 feet; deepening the remainder (Gulf of Mexico portion) to 54 feet; widening of the Upper Bay and Lower Bay reaches to 530 feet, construction of barge lanes across 2
the Upper Bay portion of the CCSC; extension of the La Quinta Channel, and deepening La Quinta Channel to 39 feet. Regarding the last preferred alternative, DEIS-25 states that the La Quinta Channel will be extended to a length of 7400 feet beyond its current limits. Delete the reference of 39 feet on page DEIS-22, or correct the statement to reflect that the depth of the proposed extension to be 39 feet.

Dredge Material Management Plan

The DFR and the DEIS indicate that eleven sites are proposed for new habitat development (actually alteration) and/or protection. The amount of new work material from deepening channel below the current authorized depth will generate approximately 16.7 million cubic yards (mcy) of new dredge material. This new material is proposed for placement in two offshore sites, one upland site, and five open water sites. The upland site placement (proposed at the container terminal) will total about 120 acres. Open water sites total about 935 acres of unvegetated deep-water bay bottom (pages DFR-44 to 46, DEIS-12 to 18 and A-10). Coordination with the RACT for beneficial use (BU) proposals of this material was an important aspect of this project and options to provide greater benefits other than the currently authorized upland or open bay disposal of the dredge material at existing Placement Areas (PA's). Comments on beneficial uses are further discussed in the following section.

Beneficial Use Sites

Several beneficial use sites are proposed and referenced in the DFR and DEIS. Staff's recommendations to the BU plan include:

- Staff recommends the RACT BU workgroup continue meeting to review 3
  project designs and coordinate development of the proposed BU sites.

TPWD recommends that the BU work group continue serve in its original function of reviewing and assessing project designs, work proposals, reviewing or recommending additional models, and reviewing final plans 3
for construction. In addition, the BU workgroup should be involved in the development of a monitoring regime used to evaluate the project impacts of all BU sites.

Staff recommends that monitoring be conducted to assure that minimal or no impacts result from the BU plans, particularly where placement may alter water patterns and affect shallow water habitats or shorelines. Monitoring can verify DFR and DEIS statements describing the positive aspects of the project. For example, page A-10 states that 900 acres of seagrass habitat (compared to the 935 acres previously mentioned) will be 4
created by new BU sites, a 94 % increase in SAV of previously unvegetated deep bay bottoms. Also, page A-8 states that BU sites were not shown to affect currents or circulation patterns according to TWDB studies. Therefore the creation of BU sites CQ and I should not erode or impact shorelines, fringe seagrass habitats, or emergent marshes. If these targets are not actually known or accurate, staff recommends that these statements be revised or removed from the DFR or DEIS.

Regarding the BU plan, the DFR and DEIS identifies 5 five open water placement sites for the new work material: BU sites GH, CQ, I, R and S. Of these, only BU site GH would be monitored as required as a mitigation site. This site will be 5
planted with seagrasses and monitored to determine if mitigation for project impacts is successful. TPWD recommends that monitoring be done on all BU sites in order to truly access their beneficial use.

BU Site I

BU site I presents major concerns to Department staff. This site is described as a 163 acre area located between Dagger Island and the CCSC. As described in the DEIS and DFR, a primary benefit derived from developing BU site I, other than the disposition of dredge material, is the creation of emergent habitat and potential areas for colonization of SAV. In addition, BU site I may provide shoreline protection for Dagger Island, potentially reducing wind generated currents erosion effects. Department staff has recently met with the PCCA and their consultants to address clarification of our concerns of this site. During the meeting, some modeling, which was not available during the early part of the 6
project planning, was introduced to address staff's concerns. These models included wave refraction-diffraction and velocity and circulation changes. Errors and deficiencies in these models did not adequately answer questions.

TPWD is always supportive of Beneficial Use Sites when there is a clear understanding that an overall benefit will be derived. In the case of BU site I, TPWD believes that not all issues concerning the benefits and potential detrimental effects have been adequately addressed. If the following concerns can adequately be addressed prior to the project implementation, the Department would be supportive of BU site I, otherwise, our best option would be to recommend BU site I not be part of the project.

Staff questions include the following:

- Can BU site I adequately reduce wind driven erosive effects on Dagger Island and if so, can these be adequately measured?
- What effects will BU site I have on the ship wake pressure field?
- Will sediment runoff from BU site I affect adjacent SAV?
- Will altered current patterns caused by BU site I, combined with other proposed dredge material disposal sites, increase erosion of shorelines along the southern end of Redfish Bay?
- Will the described colonization by SAV occur in BU site I? 7
- Will the social and economic benefits derived from the creation of BU site I surpass those currently derived from commercial shrimping activities, commercial and recreational crabbing, and recreational fishing in the site location?
- Why does the DFR and DEIS not include a monitoring plan to determine if the desired positive effects are achieved?
- Who will be the responsible party for developing a corrective plan and a source of funding if the described or predicted benefits are not achieved?

Staff Recommendations

TPWD recommends that:

- Models be created to address questions on water circulation changes and their potential impacts. For example, the wave refraction-diffraction model should take into consideration the effect of wind created waves on the entire southern area of Redfish Bay and a model should be developed to demonstrate the area of influence and effect of ship wake pressure to nearby shorelines and circulation patterns
- A monitoring regime be developed to document changes in shoreline, SAV survival, and sediment movement. As part of this recommendation, PCCA should continue to meet with the RACT BU workgroup so that monitoring, reporting and other needs can be clearly defined. TPWD will continue to serve in the BU workgroup and provide recommendations for monitoring. Aerial photography has already been expressed as one type of monitoring. 8
- A plan be developed to address any unexpected changes in shoreline erosion, SAV abundance and distribution, and bottom alterations. Plan should also list parties responsible for developing and implementing corrective measures and obtaining appropriate funding.

- Chapter 3 of the DEIS, Affected Environment, reviews habitat types within the project. Department staff wishes to comment on the conversion of deep bay bottom habitat to one of a shallow bay bottom as proposed at BU site I. While there is no estimate of the current value of deep bay bottoms, or it is one of undetermined value, staff wishes to convey that this is an area which is used for crabbing, recreational sports fishing, and trawling for bay shrimpers. Staff's comment is that there is no apparent problem identified with those deep bay bottom habitats which would need corrective action at the proposed site of the BU site. As previouly recommended, a monitoring plan for BU sites is important to determine the benefits or impacts of proposed project actions where there are no apparent problems associated with an area. 8

Other General Comments

DFR-51 – "All existing aquatic areas that have depths suitable for seagrass transplantation are already vegetated." Because there are numerous factors which determine where seagrasses establish themselves, and their seasonal variability particularly with shoalgrass, this statement is not entirely accurate. Recommend that this statement be removed. 9

DFR-59 – Below "Ecosystem Restoration Features", replace NED for NER. 10

TPWD staff appreciates the opportunity to comment on the DFR and DEIS for the Corpus Christi Ship Channel, Texas, Channel Improvement Project. Staff looks forward to discussing any issues or comments presented in this letter. If you have any questions, contact Ismael "Smiley" Nava at (361) 825-3242 or Rollin MacRae At (512) 389-4639.

Sincerely

Larry D. McKinney, Ph.D., Senior Director
Aquatic Resources

Cc:

U.S. Fish and Wildlife Service, Corpus Christi
Texas Parks & Wildlife Department
National Marine Fisheries Service, Galveston, Texas
Texas General Land Office, Austin, Texas
Texas Natural Resource Conservation Commission, Austin, Texas

Dr. Larry D. McKinney
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744-3291

RESPONSE TO COMMENTS

Comment No.	Response
1	Comment noted. A monitoring plan to document achievement of success criteria is included in the EIS and will be followed.
2	The La Quinta Channel is currently maintained at 45 feet. The statement on DEIS-22 states the extension will be dredged to 39 feet and is correct. Therefore, the statement will not be changed. The confusion about depths appears to be in your quotation of our statement on DEIS-22, which is incorrect. Please re-read the statement on page DEIS-22 and you will see it is correct.
3	The BUW will continue meeting to review site-specific use of material during development of plans and specifications for the BU sites prior to construction for each reach of the project.
4	Seagrass mitigation will be monitored according to DEIS-193 to 195. No additional monitoring of BU sites would be authorized by the Federal project at this time. However, this issue may be revisited during the project design phase and additional meetings of the BUW. BU sites are expected to provide a benefit to the ecosystem, based on the conclusions of the BUW and the RACT. The dredged material to be used in the BU sites is clean and could provide beneficial habitat, such as emergent marsh and seagrass nursery for marine organisms. In addition, members of the BUW and RACT listened to the public for ideas on how best to use these materials beneficially and determined the proposed BU sites would be multipurpose for the benefit of the human and natural environment. Site-specific use of material will be discussed during development of plans and specifications prior to construction for each project reach. The BUW will continue to follow the sites through the construction and operations phases. Any erosion as a result of a CCSC-CIP BU would be evident without monitoring. The PCCA would support renovation of any eroded areas being addressed separate from the CIP as a CEPRA. Any change in protective breakwaters would be found in post construction elevation and maintenance activities. Page A-10 will be revised to state 935 acres of seagrass habitat.
5	Please see the response to Comment #4.
6	Comment noted. Issues will be discussed during development of plans and specifications prior to construction of BU Site I.
7	Comment noted. As you stated in your comment #6, PCCA and TWDB met with your staff to address their concerns with the latest model information. As discussed, the hydrodynamic model indicated very little change to the water patterns or erosive current velocities as a result of constructing the BU Site I. Unfortunately, the results of these state-of-the-art models used to predict impacts associated with BU Site I did not alleviate their concerns. Based on the decision of the RACT and BUW, we will proceed with plans to construct the site. In coordination with the BUW we will continue engineering design development including tasks to

	address, for example, TPWD staff concerns during the preparation of construction plans and specifications for site construction and await the results of later observations on any unforeseen impacts of the site on the surrounding area before determining remedial actions during the operations phase.
8	The RACT and the other CCSCCIP Workgroups provided guidance and wise counsel on matters relating to the evaluation of environmental impacts of this project. A list of members, including FWS, NMFS, and TPWD, is found in Section 1.6 of the DEIS. The Mitigation Workgroup (MW) concluded the plan to convert deep water to shallow water was an impact that did not require mitigation; the BUW believed that the plan would provide a net environmental gain for the ecosystem. The proposed BU sites are conceptual and were discussed during BUW and RACT meetings. BUW and RACT members recognized that individuals define value of a habitat differently, and therefore, no specific value was given. All proposed BU sites would potentially provide higher value habitat, especially as potential nursery habitat for the fish, shrimp, and crabs that are sought by the sports and commercial interests. Documentation of detailed descriptions and a monitoring plan of specific site-related goals for each BU site will not be provided in the FEIS, however, in coordination with the BUW a monitoring regime to document changes may be developed. The USACE tries to use dredged material in a beneficial manner for the environment. This material is clean and could provide beneficial habitat such as emergent marsh and seagrass nursery for marine organisms. In addition, members of the BUW and RACT listened to the public for ideas on how best to use these materials beneficially and determined the proposed BU sites were multipurpose for the benefit of the human and physical environment. The BU plan was presented at numerous public meetings and is widely supported. Site-specific use of material will be discussed during development of plans and specifications prior to construction for each reach.
9	The statement will be revised to "All existing aquatic areas that currently have conditions suitable for seagrass growth are already vegetated."
10	Text will be revised.

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

August 22, 2002

Mr. Loyd Saunders
Galveston District CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Attn: Terrell Roberts

Re: USACE Corpus Christi Ship Channel Improvement Project, Corpus Christi, Texas

Dear Mr. Roberts:

The U.S. Army Corps of Engineers (Corps) is seeking 401 certification on a channel modification of the Corpus Christi Ship Channel(CCSC). The proposed plan includes the following: deepening the CCSC from the current maintained depth of 45 feet to a depth of 52 feet from the Aransas Pass Jetties westward 21 miles to the Viola Turning Basin, the widening of the channel to 530 feet through the bay, the addition of 12 foot deep 200 foot wide barge lanes on either side of the 530 foot channel for 9.6 miles in the upper bay, the dredging of the Outer Bar channel nearly 3 miles to the 54 foot isobath, and an 39 foot deep by 7,400 foot long extension of the La Quinta Channel. All channels will be dredged with a 2 foot over-depth. The project is projected to produce 41 million cubic yards (mcy) of new work material, and 208 mcy of maintenance material over the 50 year life of the project. Dredge material suitable for beneficial use will be used to create the following features: creation of 935 acres of shallow water habitat, creation of 15 acres of submerged aquatic vegetation (as mitigation), creation of 26 acres of marsh, construction of 26,400 linear feet of rock breakwater, creation of 1,590 acres of offshore topographic relief, construction of 120 acres of upland buffer, construction of 7,500 feet of rock revetment, protection of 45 acres of submerged aquatic vegetation, protection of an existing bird island, and protection of over 400 acres of wetlands. Dredge material not deemed suitable for beneficial use will be placed in eight existing confine upland sites, one offshore open water site, and eight open water sites.

In response to the Draft Feasibility and Draft Environmental Impact Statement dated June, 2002, the Texas Natural Resource Conservation Commission (TNRCC) has the following concerns about the project plans submitted. These concerns will need to be addressed before an individual 401 1 certification can be completed. Other comment letters, as well as responses to this letter, may raise other issues that will need to be addressed before a water quality certification can be made.

1. The plan mentions eight open water placement areas, as well as several beneficial use sites, in the bay where management practices to limit suspended solids are not addressed. While these areas cannot be strictly controlled like containment facilities, the addition of best management practices are encouraged to minimize impacts of suspended particulates. Please supply plans that deal with suspended solids at all placement and beneficial use areas in the bay. 2

2. Hydrodynamic, and salinity modeling demonstrated that tidal amplitude may increase up to 0.06 feet due to the project. While the value of this measurement is small, and the accuracy of the model not estimated, the tidal range of the system is currently only 0.7 feet. Therefore, the projected increase in tidal range is about 9%. The effect of increasing the tidal range by this amount is unknown, but may produce tidal currents that would erode sensitive areas. Likewise, the salinity projections are a reduction of 4ppt, or nearly 13 to 15% depending on location. This is less likely to be a concern since the bay historically was fresher, and continues to have a trend towards increasing salinity. Please provide estimates of the projected effects that the changes in these physical variables will have on the biota of the bay system. 3

The TNRCC looks forward to receiving and evaluating other agency or public comments during or after the comment period. Please provide any agency comments, public comments, as well as the applicant's comments, to Mr. Robert Burgess of the Water Quality Division MC-150, P.O. Box 13087, Austin, Texas 78711-3087. Mr. Burgess may also be contacted by phone at (512) 239-3163, or by e-mail at *rburgess@tnrcc.state.tx.us*.

Sincerely,

Mark Fisher, Manager
Water Quality Assessment Section
Water Quality Division
Texas Natural Resource Conservation Commission

MF/RB/emh

Mr. Mark Fisher
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

RESPONSE TO COMMENTS

Comment No.	Response
1	An individual 401 certification is not requested. The USACE is invoking Section 404(r) as is explained on DEIS-225.
2	Site-specific management of the material will be discussed by the BUW during development of plans and specifications prior to construction for each reach. Best management practices will be part of the plans and specifications. Downward submerged pipes and deflectors will be used at the extreme ends of designated open water Placement Areas. Section 4.1.5 of Appendix F to the DEIS notes that "...in an effort to improve management practices at those open-water sites and possibly reduce dredging frequency,...the dredge pipes will be placed at the back limits of the designated placement sites to release dredged material as far from the channel as possible."
3	To determine the projected change in tidal currents due to the preferred plan, a computer modeling study was performed. A relatively large tide was selected to simulate the higher tidal currents. The tide modeled was for a gulf shore tide of nearly 3-ft which corresponded to a 2.3-ft tide at Port Aransas and a 1-ft tide in Corpus Christi Bay. Tidal ranges with this magnitude occurred less than 10% of the time during the model years 1993 and 1994. The physical effect of changes in tidal currents are projected to be very minor for a relatively large tide and can be expected to be even less significant during normal or average tidal conditions. The principal findings from the report on the modeling were as follows. The peak velocity in the Corpus Christi Ship Channel will increase by a range of 0.1 to 0.3 fps from Port Aransas to La Quinta Junction. The peak velocity will increase by 0.05 fps in the ship channel at mid Corpus Christi Bay and 0.01 fps near the upper end of the ship channel. In the open Corpus Christi Bay, the peak velocity will increase by 0.06 fps in the north and 0.01 fps in the south. The existing dredged material placement area near the proposed shallow water habitat Site-CQ will experience a velocity decrease of 0.1 fps. At other placement areas, the peak velocity will increase by a range of 0.05 to 0.1 fps. The flow pattern of the currents will be affected by the habitat Site-CQ. Inside the shallow-water-habitat BU sites, the peak velocity will be much smaller, ranging from 0.01 fps to 0.08 fps, because of their enclosure by breakwater structures. In summary, the projected changes in tidal current velocities are very minor with the most notable changes occurring within the CCSC. Open bay and shallow water areas are projected to generally have less than 0.1 fps increases in currents.

Mr. Mark Fisher
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

According to the TWDB, there is "no biological significance in the very small salinity differences projected because none of the salinity levels are near the absolute tolerance limits for survival, growth, and reproduction of the marine species using this estuarine area."

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
9721 Executive Center Drive N.
St. Petersburg, Florida 33702

August 29, 2002

Colonel Leonard D. Waterworth
District Engineer, Galveston District
Department of the Army, Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Colonel Waterworth:

The National Marine Fisheries Service (NOAA Fisheries) has reviewed the Draft Environmental Impact Statement (EIS) and Feasibility Report for the Corpus Christi Ship Channel, Texas, Channel Improvement Project dated June 2002. The proposed project is to deepen the Corpus Christi Ship Channel to 52 feet deep, widen it to 530 feet and extend the La Quinta Ship Channel by 7,200 feet.

Representatives from the NOAA Fisheries have participated on the Resource Agency Task Force in formulating a beneficial use of dredged material plan. If properly constructed, monitored, and managed the project should provide an overall net benefit living marine resources, Federally managed fishery species and their associated Essential Fish Habitat (EFH). Therefore, we have no EFH Conservation Recommendations to provide regarding the proposed channel improvements. We have the following comments concerning the adequacy of the Draft EIS:

Section 3.0 Affected Environment

Section 3.5.1.3 Essential Fish Habitat - The proposed project area has been identified by the Gulf of Mexico Fishery Management Council as EFH for postlarval, juvenile, and subadult red drum, brown shrimp and white shrimp, adult Spanish mackerel and juvenile pink shrimp. Therefore, all references to other species, such as stone crab which is only managed off the west coast of Florida 1
(defined as stone crab fishery area restrictions under 50CFR Part 654.23(b)(1)(i)), should be eliminated from the EFH assessment in the Final EIS.

Section 4.0 Environmental Consequences

Section 4.4.4 Essential Fish Habitat - Rock breakwaters/revetment will be utilized at Beneficial Uses Sites CQ, GH, I, L, P, R and S. In addition, rock breakwaters and geotubes will be used at Pelican Island. All of these structures will convert estuarine water column and estuarine mud 2
bottoms to rock and uplands. These impacts should be characterized, quantified and discussed in this section of the Final EIS. Additionally, an unquantified area in Site I will be pumped to an 8-10

feet above sea level for a bird rookery. This will convert estuarine water column and estuarine mud to terrestrial bird habitat. This impact to EFH needs to be addressed in the Final EIS.

If we may be of further assistance, please contact Mr. Rusty Swafford of our Galveston Facility at (409) 766-3699.

Sincerely,

Rusty Swafford

for

Andreas Mager, Jr.
Assistant Regional Administrator
Habitat Conservation Division

Ms. Andreas Mager, Jr.
National Marine Fisheries Service
Southeast Regional Office
9721 Executive Center Drive N.
St. Petersburg, Florida 33702

RESPONSE TO COMMENTS

Comment No.	Response
1	Text has been revised.
2	Impacts that can be quantified, in addition to the creation of 935 acres of shallow-water habitat in formerly deep water, will be added to the discussion in Section 4.4.4. Thus, this section will be revised to include discussion of the detrimental impacts to EFH from these items, as well as the beneficial impacts to EFH.

Texas Department of Transportation

P O BOX 149217 • AUSTIN, TEXAS 78714-9217 • (512) 486-5000

September 11, 2002

Dr. Terrell Roberts
Galveston District, Corps of Engineers
P. O. Box 1229
Galveston, Texas 77553-1229

FILE: TPP (M)
(512) 416-2349

Re: Corpus Christi Ship Channel – Channel Improvements Project

Dear Dr. Roberts:

The Texas Department of Transportation (TxDOT) has received and reviewed the draft Feasibility Report and Environmental Impact Statement for improving the navigation channel in Corpus Christi Bay. Improvements to the ship channel will facilitate the movement of goods and provide the ability for the Port of Corpus Christi to meet future commercial and international trade needs of Texas. These improvements will assist in providing an efficient and environmentally safe port facility well into the future.

1

In reviewing the draft Environmental Impact Statement, TxDOT was pleased to note the efforts of the port to beneficially use dredged material, when affordable opportunities existed. It is very apparent that the port has developed an ambitious and well coordinated beneficial use plan while maintaining a high benefit to cost ratio.

TxDOT supports the Port of Corpus Christi's Channel Improvement Plan and the associated dredged material management plan. These documents were developed in consultation with various interagency entities and resulted in a comprehensive, well-planned project that, when constructed, will aid in meeting the future transportation needs of the state.

If you have any questions, please call Raul Cantu, Jr., P.E., at (512) 416-2344.

Sincerely,

James L. Randall

James L. Randall, P.E.
Director, Transportation
Planning and Programming

cc: David Casteel, Corpus Christi District Engineer, TxDOT
Raul Cantu, Jr., P.E., Transportation Planning and Programming Division, TxDOT

Mr. James L. Randall, P.E.
Texas Department of Transportation
P.O. Box 149217
Austin, Texas 78714-9271

RESPONSE TO COMMENTS

Comment No.	Response
1	Thank you for your support of the project.

TEXAS PARKS & WILDLIFE

COMMISSIONERS

KATHARINE ARMSTRONG
CHAIRMAN, AUSTIN

ERNEST ANGELO, JR.
VICE-CHAIRMAN, MIDLAND

JOHN AVILA, JR.
FORT WORTH

JOSEPH B.C. FITZSIMONS
SAN ANTONIO

ALVIN L. HENRY
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DONATO D. RAMOS
LAREDO

KELLY W. RISING, M.D.
BEAUMONT

MARK E. WATSON, JR.
SAN ANTONIO

LEE M. BASS
CHAIRMAN-EMERITUS
FORT WORTH

ROBERT L. COOK
EXECUTIVE DIRECTOR

November 25, 2002

Colonel Leonard D. Waterworth
District Engineer
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston TX 77553-1229

Re: Corpus Christi Ship Channel Project

Dear Colonel Waterworth:

Your letter of October 29, 2002 addressed issues raised in our response to the DEIS for the Corpus Christi Ship Channel Project in our letter of August 19, 2002. Specifically, Department staff was concerned about the potential generation of erosive currents by proposed Beneficial Use Site I, and the need for monitoring of the project components.

The modeling that had been done relative to Beneficial Use Site I appeared to be less than conclusive by our staff review, and the possibility of damaging erosion and sedimentation was a serious concern. Similarly, staff believes that monitoring of the project components for success and any needed upgrades or remediation is essential to the positive outcome that our staffs have worked for the last two years.

Your letter expressed the commitment to continue to work with both the Resource Agency Coordination Team and the Beneficial Uses Workgroup to assure that the project is completed in accordance with the plan outlined in the DEIS, and to address and remedy any significant problems that arise from a mutually agreed-upon monitoring plan. The Department is satisfied that our cooperative working relationship will continue and will assure that the public interest is served.

The Department appreciates your positive approach to these issues and commits to working with you and your staff to resolve any problems that arise.

Sincerely,

Larry D. McKinney, Ph.D.
Senior Director for Aquatic Resources

cc: Jeb Boyt, Coastal Coordination Council
Mark Fisher, TCEQ
Smiley Nava, TPWD, Corpus Christi

APPENDIX E

COMPLIANCE WITH THE TEXAS COASTAL MANAGEMENT PROGRAM

APPENDIX E
TEXAS COASTAL MANAGEMENT PROGRAM (CMP)
COMPLIANCE WITH GOALS AND POLICIES

INTRODUCTION

The Texas Coastal Management Program (TCMP) was submitted to NOAA for review pursuant to §306 of the Federal Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451 et seq. The Office of Ocean and Coastal Resource Management approved the TCMP in 1996. Federal approval of the TCMP requires that Federal actions occurring within the TCMP boundary be consistent with the goals and polices of the TCMP. To show compliance, Federal agencies responsible for these actions must prepare a consistency determination and submit it to the State for review. This consistency determination for channel improvements was prepared in accordance with the TCMP. Details of the project, as well as environmental impacts, are presented in the FEIS and will be referenced in this determination.

IMPACTS ON COASTAL NATURAL RESOURCE AREAS

Several of the Coastal Natural Resource Areas (CNRAs) listed in 31 TAC §501.3 are found reasonably close to the areas discussed in this FEIS. A short description of each CNRA near the project and of methods to minimize or avoid potential impacts is provided below.

Waters of the Open Gulf of Mexico

Dredged maintenance materials will be placed in the open Gulf of Mexico in PA 1 and dredged construction material will be placed in BU Site ZZ (the designated Navy Homeport ODMDS) and BU Site MM. PA 1 is an open water placement area located southeast of the Gulf end of the Mustang Island Jetty for the Entrance Channel at Port Aransas. This site was officially designated as an ocean PA as required by §103 of the MPRSA of 1972. An EIS that described the alternatives evaluated was prepared for this designation.

Waters Under Tidal Influence

The entire project is located in a region which experiences tidal influence. Dredging and placement activities represent a minimal impact because the release of suspended solids is minimized according to requirements of the State §401 Certification. Current dredging practices are found in the Consistency Determination for La Quinta Channel (USACE and PCCA, 1999a) and Corpus Christi Ship Channel (USACE and PCCA, 1999b). Use of long established, designated PAs will minimize adverse effects on CNRAs in the project area.

Submerged Lands

The areas immediately adjacent to the project alignment, as well as the open water placement areas, are characterized as submerged land. Impacts to these areas are minimized by placement of dredged material into the historically used placement areas. BU sites will cover submerged lands; however, this placement will benefit coastal ecology.

Coastal Wetlands

No significant expanse of wetlands is located in close proximity to this project except for the uppermost segment of the Inner Harbor reach, and to a lesser extent, some sparse fringing marshes in Redfish Bay. Some scattered saltmarsh and black mangrove marshes exist to the east of Harbor Island, but the most significant wetlands in the vicinity are located near Tule Lake and in the Nueces River delta. These are in close proximity to the channel from the Tule Lake Turning Basin to the Viola Turning Basin. The placement areas in this vicinity are totally confined, and mitigation for any impacts to the wetlands has been completed. Continued use of confined placement areas will prevent further impacts to wetland areas.

Submerged Aquatic Vegetation

This navigation project is located near areas characterized as having large expanses of seagrasses. Impacts to seagrasses are minimized or avoided by placing dredged material into leveed upland sites or other historically used placement areas in the deeper waters of the bay. Impacts to seagrasses will be mitigated at a 3:1 ratio. Fifteen acres of seagrass will be created for impacts to 5 acres of seagrass.

Tidal Sand and Mud Flats

Some of the areas adjacent to the project alignment are adjacent to areas of tidal sand or mud flats. These areas may be frequently flooded and may contain algal mats. Impacts to these areas are minimized or avoided by placing dredged material into leveed upland sites or other historically used placement areas in the deeper waters of the bay

Oyster Reefs

Several significant oyster reefs exist in Corpus Christi Bay. The nearest is Long Reef, which is approximately 3,000 feet away from PA 13. PA 13 is a confined upland site, and the effluent discharge is returned to La Quinta Channel. Therefore, adverse impacts to oyster resources are not expected to occur as a result of dredging and dredged material placement operations.

Hard Substrate Reefs

There are no naturally occurring hard substrate formations in the vicinity of the project. The closest rock outcrop is located just north of the City of Aransas Pass and is crossed by the GIWW. The closest serpulid worm reefs are located farther south in the Laguna Madre and Baffin Bay.

Coastal Barriers

Four coastal barrier areas occur in the vicinity of the project. Two of the areas extend north along San Jose Island (T08 and T08P) and the other two are located on or near the lower part of Mustang Island (TX-15P and TX-17P). San Jose Island and Mustang Island are located north and south, respectively, of Aransas Pass through which the Entrance Channel traverses. San Jose Island is undeveloped while Mustang Island is highly developed for tourism and recreation, including the City of Port Aransas. Neither island currently is experiencing a great deal of erosion. PA 2 is located on San Jose Island adjacent to the north jetty. This PA is partially confined by dunes and levees. The dredged material placed there is predominately sand, helping to protect and nourish this barrier island. Furthermore, precautions are exercised to preserve existing dunes during dredge pipeline placement and discharge operations. Based on this information, adverse impacts to these coastal barriers are not expected to occur as a result of dredging and dredged material placement operations.

Coastal Shore Areas

Coastal shore areas are within 100 feet landward of the high water mark on submerged land. These resource areas function as buffers, protecting upland habitats from erosion and storm damage and adjacent marshes and waterways from water quality degradation. This type of area is located at the Entrance Channel, where the channel traverses Aransas Pass to the Gulf of Mexico. PA 2 is located within a coastal shore area on San Jose Island adjacent to the north jetty. This PA is partially confined by dunes and levees. The dredged material placed there is predominately sand, helping to protect and nourish this shore area. Furthermore, precautions are exercised to preserve existing dunes during dredge pipeline placement and discharge operations. Therefore, adverse impacts to coastal shore areas are not expected to occur as a result of dredging and dredged material placement operations.

Gulf Beaches

Gulf beaches border the Gulf of Mexico and extend inland from the line of mean low tide to the natural line of vegetation. Aransas Pass, through which the Entrance Channel passes, traverses a Gulf beach area. San Jose Island, to the north, is undeveloped. Mustang Island, to the south, is highly developed for tourism and recreation, including the City of Port Aransas. Little erosion is occurring along the beaches in this area; PA 2 is located on San Jose Island adjacent to the north jetty that adds material to this beach. This PA is partially confined by dunes and levees. The dredged material placed there is predominately sand, helping to protect and nourish this beach area. Furthermore, precautions are exercised to preserve existing dunes during dredge pipeline placement and discharge operations. Therefore, adverse impacts are not expected to occur as a result of dredging and dredged material placement operations.

Critical Dune Areas

The Gulf beaches on both sides of Aransas Pass can be characterized as having active sand dune systems. PA 2 is located on San Jose Island adjacent to the north jetty and is partially confined by dunes and levees. The dredged material placed there is predominately sand, helping to protect and nourish this area. Furthermore, precautions are exercised to preserve existing dunes during dredge pipeline placement and discharge operations. Therefore, adverse impacts to dune areas are not expected to occur as a result of dredging and dredged material placement operations.

Special Hazard Areas

Special hazard areas are areas designated by the administrator of the Federal Insurance Administration under the National Flood Insurance Act as having special flood, mudslide, and/or flood-related erosion hazards. Much of the project area qualifies as special hazard areas on the Flood Insurance Rate Maps. Project dredging and placement activities do not affect these low-lying areas because dredging is within and adjacent to the existing channel and disposal is within contained PAs in upland sites and approved BU sites in open waters.

Critical Erosion Areas

These areas are those Gulf and bay shorelines that are undergoing erosion and are designated by the Commissioner of the General Land Office under Texas Natural Resources Code, §33.601(b). Only one critical area of erosion is designated in the project vicinity and is located west of Port Aransas on the south side of the CCSC. It extends west from near the Nueces County Fishing Pier for about 5,844 feet to Piper Channel. An evaluation of erosion protection using bank armoring without dredged material for this area is discussed in Section 1.7 of the FEIS.

Coastal Historic Areas

These areas consist of sites listed or eligible for the NRHP and SALs. Compliance with the TCMP regarding coastal historic areas is accomplished through procedures established by Section 106 of the National Historic Preservation Act of 1965 (NHPA), as amended. These coastal historic sites, as well as non-coastal historic sites, are discussed in Section 3.8 of the FEIS, with impacts discussed in Section 4.7.

Coastal Preserves

This natural resource includes only State lands and parks. There are no designated Texas Coastal Preserves located in the vicinity of the CCSCCIP. However, there are two State-owned lands in the general project area. Mustang Island State Park is located within Coastal Barrier Resource Unit TX-15P, and a small area known as Redhead Pond Wildlife Management Area is located on the mainland side of the Laguna Madre south of the Kennedy Causeway. Based on their distance from the project channel, impacts are not expected to occur from dredging or material placement operations. Although not considered a preserve, Nueces Bay, located adjacent to the Inner Harbor reach, was designated as a State Sanctuary in 1979 by the Texas Legislature (Senate Bill No. 335, 66th Legislature) due to its importance as a shrimp nursery area. All of the placement areas in the immediate vicinity are entirely confined; therefore, this sanctuary is not expected to be impacted by dredging or material placement operations.

COMPLIANCE WITH GOALS AND POLICIES

The following goals and policies of the TCMP were reviewed for compliance.

§501.14(j) – Dredging and Dredged Material Disposal and Placement

§501.14(h) – Development in Critical Areas

§501.15 – Policy for Major Actions

Compliance with §501.14(j) – Dredging and Dredged Material Disposal and Placement

Appendix E provides a summary of actions designed to comply with the specific requirements of §501.14(j)(1)-(6). Paragraph (7) of the section discusses emergency dredging procedures and is not applicable to the project at this time. Paragraph (8) discusses the mining of shell, marl, gravel, and mudshell and is not applicable to the Federal navigation project. Paragraph (9) is not applicable to the Corps of Engineers.

Compliance with §501.14(h) – Development in Critical Areas

Dredging of the La Quinta Channel will result in the loss of five acres of a critical area, submerged aquatic vegetation. This impacted area will be mitigated by the creation of 15 acres of seagrasses.

Compliance with §501.15 – Policy for Major Actions

This project involves action subject to §505.11 and constitutes a major action. Therefore, a Federal EIS is required under NEPA, 42 USC, §4321, et seq. Both State and Federal agencies involved with the CCSCCIP have met and coordinated on the identification and mitigation of project impacts and beneficial uses of dredged material. The purpose of this appendix to the FEIS is to demonstrate that the CCSCCIP is consistent with the TCMP.

ENVIRONMENTAL BENEFITS AND POTENTIAL FOR BENEFICIAL USES

The CCSCCIP will provide a safer and more efficient navigation system and provide the materials for creation of beneficial use sites in Corpus Christi Bay and Redfish Bay.

The TCMP considers dredged material from dredging projects in commercially navigable waterways a potentially reusable resource that must be used beneficially when economically feasible (§501.14(j)(4)(A-C)). The CCSCCIP is a dredging project and is being dredged for commercial navigation. The estimated amount of dredged material generated by the project would be 41 mcy of new work material, and approximately 208 mcy of maintenance material over the next 50 years. New work material (16.7 mcy) will be utilized to create two offshore sites, one upland site, and five open-water sites as described in Section 1.7 of the FEIS.

CONSISTENCY DETERMINATION

The project addressed in this FEIS has been reviewed for consistency with the goals and policies of the TCMP. CNRAs in the project area are identified and evaluated for potential impacts from activities associated with the project. It is determined that these activities will not adversely impact the CNRAs. Based on this analysis, the USACE and PCCA find that the project discussed in the FEIS of the CCSCCIP is consistent with the goals and policies of the TCMP to the maximum extent practicable.

Attached is a summary of actions designed to comply with the specific requirements of §501.14(j)(1)-(6).

ATTACHMENT

COMPLIANCE WITH GOALS AND POLICIES - SECTION 501.14(J)(1)-(6)

COMPLIANCE WITH GOALS AND POLICIES - SECTION 501.14(J)(1)-(6)
DREDGING AND DREDGED MATERIAL DISPOSAL AND PLACEMENT
CORPUS CHRISTI SHIP CHANNEL
IMPROVEMENT PROJECT, TEXAS
ENVIRONMENTAL IMPACT STATEMENT

All new work material will be placed in Beneficial Use areas described in Section 1.7 of the FEIS. Maintenance material will continue to be placed in placement areas described in the Consistency Determination for La Quinta Channel and Corpus Christi Ship Channel for The Texas Coastal Coordination Council, July 10, 1999. Therefore, this appendix refers only to the dredging and placement of new work material in Beneficial Use areas and new work dredging in the Inner Harbor.

Section 501.14(j) Dredging and Dredged Material Disposal and Placement

(1) Dredging and the disposal and placement of dredged material shall avoid and otherwise minimize adverse effects to coastal waters, submerged lands, critical areas, coastal shore areas, and Gulf beaches to the greatest extent practicable. The policies of this subsection are supplemental to any further restrictions or requirements relating to the beach access and use rights of the public. In implementing this subsection, cumulative and secondary adverse effects of dredging and the disposal and placement of dredged material and the unique characteristics of affected sites shall be considered.

Compliance: The Beneficial Use of dredged material to establish high quality fish and wildlife habitat through development of shallow-water, marsh, and submerged aquatic vegetation (SAV) and shoreline and SAV protection may have some effect on submerged lands of the Gulf of Mexico and Corpus Christi Bay, such as temporarily burying benthic organisms and increasing turbidity in the designated placement areas. However, these sites will be created only with new work material that has been tested and found not to contain harmful pollutants.

(A) Dredging and dredged material disposal and placement shall not cause or contribute, after consideration of dilution and dispersions to violation of any applicable surface water quality standards established under subsection (f) of this section.

Compliance: For all sites, adequate dilution and dispersion occurs so as not to violate applicable surface water quality standards (EIS Section 4.1.3).

(B) Except as otherwise provided in subparagraph (D) of this paragraph, adverse effects on critical areas from dredging and dredged material disposal or placement shall be avoided and otherwise minimized, and appropriate and practicable compensatory mitigation shall be required, in accordance with subsection (h) of this section.

Compliance: No critical areas are affected by the location of the Beneficial Use sites. The Beneficial Use sites are created to enhance habitat for fish and wildlife through the development of SAV, marsh, and other estuarine habitat. Therefore, adverse effects are minimized or avoided at these sites.

(C) Except as provided in subparagraph (D) of this paragraph, dredging and the disposal and placement of dredged material shall not be authorized if:

(i) there is a practicable alternative that would have fewer adverse effects on coastal waters, submerged lands, critical areas, coastal shore areas, and Gulf beaches, so long as that alternative does not have other significant adverse effects;

<u>Compliance</u>: Placement of new work material in existing placement areas might have fewer effects, but would offer no enhancement to the environment. Therefore, Beneficial Use sites are practicable alternatives that would have beneficial effects for the estuarine ecosystem.

(ii) all appropriate and practicable steps have not been taken to minimize adverse effects on coastal waters, submerged lands, critical areas, coastal shore areas, and Gulf beaches; or

<u>Compliance</u>: All practicable steps have been taken to minimize adverse affects on these resources.

(iii) significant degradation of critical areas under subsection (h)(1)(G)(v) of this section would result.

<u>Compliance</u>: No critical areas are affected by the use of the Beneficial Use sites; therefore no significant degradation would result.

(D) A dredging or dredged material disposal or placement project that would be prohibited solely by application of subparagraph (C) of this paragraph may be allowed if it is determined to be of overriding importance to the public and national interest in light of economic impacts on navigation and maintenance of commercially navigable waterways.

<u>Compliance</u>: For all sites, application of subparagraph (C) does not prohibit the use of the sites. Dredging is necessary to prevent economic impacts on navigation and to maintain the commercially navigable CCSC system. Widening and deepening the channel is necessary to increase navigational safety.

(2) Adverse effects from dredging and dredged material disposal and placement shall be minimized as required in paragraph (1) of this subsection. Adverse effects can be minimized by employing the techniques in this paragraph where appropriate and practicable.

<u>Compliance</u>: Adverse effects of dredging and disposal as described in this EIS have been minimized as described under "Compliance" for paragraph (1) of this subsection.

(A) Adverse effects from dredging and dredged material disposal and placement can be minimized by controlling the location and dimensions of the activity. Some of the ways to accomplish this include:

(i) locating and confining discharges to minimize smothering of organisms;

(ii) locating and designing projects to avoid adverse disruption of water inundation patterns, water circulation, erosion and accretion processes, and other hydrodynamic processes;

(iii) using existing or natural channels and basins instead of dredging new channels or basins, and discharging materials in areas that have been previously disturbed or used for disposal or placement of dredged material;

(iv) limiting the dimensions of channels, basins, and disposal and placement sites to the minimum reasonably required to serve the project purpose, including allowing for reasonable overdredging of channels and basins, and taking into account the need for capacity to accommodate future expansion without causing additional adverse effects;

(v) *discharging materials at sites where the substrate is composed of material similar to that being discharged;*

(vi) *locating and designing discharges to minimize the extent of any plume and otherwise control dispersion of material; and*

(vii) *avoiding the impoundment or drainage of critical areas.*

Compliance: Creation of Beneficial Use sites will provide high quality fish and wildlife habitat in the form of tidal shallow-water, marsh, SAV, and other estuarine habitats.

(B) *Dredging and disposal and placement of material to be dredged shall comply with applicable standards for sediment toxicity. Adverse effects from constituents contained in materials discharged can be minimized by treatment of or limitations on the material itself. Some ways to accomplish this include:*

(i) *disposal or placement of dredged material in a manner that maintains physicochemical conditions at discharge sites and limits or reduces the potency and availability of pollutants;*

(ii) *limiting the solid, liquid, and gaseous components of material discharged;*

(iii) *adding treatment substances to the discharged material; and*

(iv) *adding chemical flocculants to enhance the deposition of suspended particulates in confined disposal areas,*

Compliance: Sediments to be dredged from the Corpus Christi Ship Channel have been tested for a variety of chemical parameters of concern to resource agencies since the 1970s. EPA, USFWS, and TNRCC have reviewed these data and have not found any issues of concern except in the Inner Harbor. All material from the Inner Harbor will be place in upland, confined placement areas. These sediments are fully contained so that contaminants are not reintroduced into the estuarine ecosystem. A summary of these reports are included in the EIS.

(C) *Adverse effects from dredging and dredged material disposal or placement can be minimized through control of the materials discharged. Some ways of accomplishing this include:*

(i) *use of containment levees and sediment basins designed, constructed, and maintained to resist breaches, erosion, slumping, or leaching;*

(ii) *use of lined containment areas to reduce leaching where leaching of chemical constituents from the material is expected to be a problem;*

(iii) *capping in-place contaminated material or, selectively discharging the most contaminated material first and then capping it with the remaining material;*

(iv) *properly containing discharged material and maintaining discharge sites to prevent point and nonpoint pollution; and*

(v) *timing the discharge to minimize adverse effects from unusually high water flows, wind, wave, and tidal actions.*

Compliance: All sites created by this project have been designed to meet this requirement. Sediments of concern from the Inner Harbor will go to upland, confined placement areas.

(D) Adverse effects from dredging and dredged material disposal or placement can be minimized by controlling the manner in which material is dispersed. Some ways of accomplishing this include:

(i) where environmentally desirable, distributing the material in a thin layer;

(ii) orienting material to minimize undesirable obstruction of the water current or circulation patterns;

(iii) using silt screens or other appropriate methods to confine suspended particulates or turbidity to a small area where settling or removal can occur;

(iv) using currents and circulation patterns to mix, disperse, dilute, or otherwise control the discharge;

(v) minimizing turbidity by using a diffuser system or releasing material near the bottom;

(vi) selecting sites or managing discharges to confine and minimize the release of suspended particulates and turbidity and maintain light penetration for organisms; and

(vii) setting limits on the amount of material to be discharged per unit of time or volume of receiving waters.

Compliance: All of the sites minimize or avoid adverse effects to the greatest extent practicable. In addition, the Beneficial Use sites minimize or eliminate any adverse effects by placing rock breakwaters or levees around the dredged materials on site and raising islands to decrease erosion. These sites are also designed to minimize negative effects on circulation patterns and surrounding habitats. Submerged discharge points will be used to disperse the material across the designated area. The offshore site meets this requirement by disposing the material beneficially across the area.

(E) Adverse effects from dredging and dredged material disposal or placement operations can be minimized by adopting technology to the needs of each site. Some ways of accomplishing this include:

(i) using appropriate equipment, machinery, and operating techniques for access to sites and transport of material, including those designed to reduce damage to critical areas;

(ii) having personnel on site adequately trained in avoidance and minimization techniques and requirements; and

(iii) designing temporary and permanent access roads and channel spanning structures using culverts, open channels, and diversions that will pass both low and high water flows, accommodate fluctuating water levels, and maintain circulation and faunal movement.

<u>Compliance</u>: All sites in this project meet this requirement. Contracts will be written to ensure compliance with all standards.

(F) Adverse effects on plant and animal populations from dredging and dredged material disposal or placement can be minimized by:

(i) avoiding changes in water current and circulation patterns that would interfere with the movement of animals;

(ii) selecting sites or managing discharges to prevent or avoid creating habitat conducive to the development of undesirable predators or species that have a competitive edge ecologically over indigenous plants or animals;

(iii) avoiding sites having unique habitat or other values including habitat of endangered species;

(iv) using planning and construction practices to institute habitat development and restoration to produce a new or modified environmental state of higher ecological value by displacement of some or all of the existing environmental characteristics;

(v) using techniques that have been demonstrated to be effective in circumstances similar to those under consideration whenever possible and, when proposed development and restoration techniques have not yet advanced to the pilot demonstration stage, initiating their use on a small scale to allow corrective action if unanticipated adverse effects occur;

(vi) timing dredging and dredged material disposal or placement activities to avoid spawning or migration seasons and other biologically critical time periods; and

(vii) avoiding the destruction of remnant natural sites within areas already affected by development.

<u>Compliance</u>: Beneficial use sites meet these requirements. Cutterhead dredging does not affect spawning or migration and is not limited to certain seasons. However, the Beneficial Use of materials at PA 7 and PA 8 is limited to certain seasons to avoid adverse effects on bird nesting. Hopper dredging is also limited to the cooler months, where possible, when sea turtle activity and abundance is lowest. These dredges employ turtle observers to document any turtles that become entrained by the dragheads.

(G) Adverse effects on human use potential from dredging and dredged material disposal or placement can be minimized by:

(i) selecting sites and following procedures to prevent or minimize any potential damage to the aesthetically pleasing features of the site, particularly with respect to water quality;

(ii) selecting sites which are not valuable as natural aquatic areas;

(iii) timing dredging and dredged material disposal or placement activities to avoid the seasons or periods when human recreational activity associated with the site is most important; and

(iv) *selecting sites that will not increase incompatible human activity or require frequent dredge or fill maintenance activity in remote fish and wildlife areas.*

<u>Compliance</u>: Beneficial use sites will contribute significantly to the human use potential and enjoyment of Corpus Christi Bay. The sites will create an estuarine environment of high habitat quality for fish and wildlife. This will attract recreational fisherman and bird watchers.

(H) *Adverse effects from new channels and basins can be minimized by locating them at sites:*

(i) *that ensure adequate flushing and avoid stagnant pockets; or*

(ii) *that will create the fewest practicable adverse effects on CNRAs from additional infrastructure such as roads, bridges, causeways, piers, docks, wharves, transmission line crossings, and ancillary channels reasonably likely to be constructed as a result of the project; or*

(iii) *with the least practicable risk that increased vessel traffic could result in navigation hazards, spills, or other forms of contamination which could adversely affect CNRAs;*

(iv) *provided that, for any dredging of new channels or basins subject to the requirements of §501.15 of this title (relating to Policy for Major Actions), data and information on minimization of secondary adverse effects need not be produced or evaluated to comply with this subparagraph if such data and information is produced and evaluated in compliance with §501.15(b)(1) of this title (relating to Policy for Major Actions).*

<u>Compliance</u>: The La Quinta Channel extension and turning basin and the Entrance Channel extension are the only new channels and basins proposed in this EIS. All identifiable adverse effects have been minimized and unavoidable impacts have been mitigated. All other new work dredging will be in existing ship channels.

(3) *Disposal or placement of dredged material in existing contained dredge disposal sites identified and actively used as described in an environmental assessment or environmental impact statement issued prior to the effective date of this chapter shall be presumed to comply with the requirements of paragraph (1) of this subsection unless modified in design, size, use, or function.*

<u>Compliance:</u> No existing upland, confined placement areas are being modified with new work material, except for some levee enhancement.

(4) *Dredged material from dredging projects in commercially navigable waterways is a potentially reusable resource and must be used beneficially in accordance with this policy.*

<u>Compliance:</u> All new work material from this project, except from parts of the Upper Bay and all of the Inner Harbor, is being used beneficially for aquatic, shoreline protection, and upland wildlife habitat creation.

(A) *If the costs of the Beneficial Use of dredged material are reasonably comparable to the costs of disposal in a non-beneficial manner, the material shall be used beneficially.*

(B) *If the costs of the Beneficial Use of dredged material are significantly greater than the costs of disposal in a non-beneficial manner, the material shall be used beneficially unless it is demonstrated that the costs of using the material beneficially are not* *reasonably proportionate to the costs of the project and benefits that will result. Factors that shall be considered in determining whether the costs of the Beneficial Use are not reasonably proportionate to the benefits include, but are not limited to:*

(i) *environmental benefits, recreational benefits, flood or storm protection benefits, erosion prevention benefits, and economic development benefits;*

(ii) *the proximity of the Beneficial Use site to the dredge site; and*

(iii) *the quantity and quality of the dredged material and its suitability for Beneficial Use.*

(C) *Examples of the Beneficial Use of dredged material include, but are not limited to:*

(i) *projects designed to reduce or minimize erosion or provide shoreline protection;*

(ii) *projects designed to create or enhance public beaches or recreational areas;*

(iii) *projects designed to benefit the sediment budget or littoral system;*

(iv) *projects designed to improve or maintain terrestrial or aquatic wildlife habitat;*

(v) *projects designed to create new terrestrial or aquatic wildlife habitat, including the construction of marshlands, coastal wetlands, or other critical areas;*

(vi) *projects designed and demonstrated to benefit benthic communities or aquatic vegetation;*

(vii) *projects designed to create wildlife management areas, parks, airports, or other public facilities;*

(viii) *projects designed to cap landfills or other waste disposal areas;*

(ix) *projects designed to fill private property or upgrade agricultural land, if cost-effective public Beneficial Uses are not available; and*

(x) *projects designed to remediate past adverse impacts on the coastal zone.*

Compliance: All new work dredged material, except from parts of the Upper Bay and all of the Inner Harbor, covered under this EIS will be used beneficially.

(5) *If dredged material cannot be used beneficially as provided in paragraph (4) (B) of this subsection, to avoid and otherwise minimize adverse effects as required in paragraph (1) of this subsection, preference will be given to the greatest extent practicable to disposal in:*

(A) *contained upland sites;*

(B) *other contained sites; and*

(C) *open water areas of relatively low productivity or low biological value.*

Compliance: All new work dredged material, except from parts of the Upper Bay and all of the Inner Harbor, covered under this EIS will be used beneficially.

(6) *For new sites, dredged materials shall not be disposed of or placed directly on the boundaries of submerged lands or at such location so as to slump or migrate across the boundaries of submerged lands in the absence of an agreement between the affected public owner and the adjoining private owner or owners that defines the location of the boundary or boundaries affected by the deposition of the dredged material.*

<u>Compliance</u>: Construction of Beneficial Use sites is designed to prevent impacts to adjoining private lands.

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1229
GALVESTON, TEXAS 77553-1229

REPLY TO ATTENTION OF:

June 28, 2002

Environmental Section

Ms. Diane Garcia
Council Secretary
Coastal Coordination Council
P.O. Box 12873
Austin, Texas 78711-2873

Dear Ms. Garcia:

Pursuant to §506.20, Consistency Determination for Federal Agency Activities and Development Projects of the Texas Coastal Management Program (TCMP), I am submitting the enclosed Consistency Determination for improving the Corpus Christi Ship Channel and extending the La Quinta Ship Channel in Nueces and San Patricio Counties, Texas. Also, please incorporate by reference the Draft Environmental Impact Statement (EIS) for this project titled, "Corpus Christi Ship Channel – Channel Improvements Project, Corpus Christi and Nueces Bays, Nueces and San Patricio Counties, Texas," that was enclosed separately. The consistency determination may also be found in the Draft EIS as Section 6.0.

The project has been extensively coordinated with the public and State and Federal resource agencies throughout the planning phase and during preparation of the Draft EIS. The agencies, Port of Corpus Christi Authority, and Corps of Engineers have reviewed the project for consistency with the goals and policies of the TCMP. Coastal Natural Resource Areas in the project area are identified and evaluated for potential impacts from project activities, including development of shallow-water estuarine habitats in beneficial use sites created with new-work dredged material.

Based on this analysis and comments received during public coordination and resource agency review of several early versions of the Draft EIS, no changes to the Consistency Determination are deemed necessary. Therefore, the enclosed Consistency Determination and the duplicate copy in Section 6.0 is considered to be the final version.

Please take the appropriate action concerning this determination. If you have any questions, please contact Dr. Terrell Roberts at (409) 766-3035.

Sincerely,

Lloyd Saunders

Lloyd H. Saunders, Ph.D.
Chief, Planning, Environmental
and Regulatory Section

Enclosures

1.0 COMPLIANCE WITH TEXAS COASTAL MANAGEMENT PROGRAM

1.1 INTRODUCTION

The Texas Coastal Management Program (TCMP) was submitted to NOAA for review pursuant to §306 of the Federal Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451 et seq. The Office of Ocean and Coastal Resource Management approved the TCMP in 1996. Federal approval of the TCMP requires that Federal actions occurring within the TCMP boundary be consistent with the goals and polices of the TCMP. To show compliance, Federal agencies responsible for these actions must prepare a consistency determination and submit it to the State for review. This consistency determination for channel improvements (see Section 2.0) was prepared in accordance with the TCMP, Final EIS, dated August 1996. Details of the project, as well as environmental impacts, are presented in previous sections of this DEIS and will be referenced in this determination.

1.2 IMPACTS ON COASTAL NATURAL RESOURCE AREAS

Several of the Coastal Natural Resource Areas (CNRAs) listed in 31 TAC §501.3 are found reasonably close to the areas discussed in this DEIS. A short description of each CNRA near the project and of methods to minimize or avoid potential impacts is provided below.

1.2.1 Waters of the Open Gulf of Mexico

Dredged maintenance materials will be placed in the open Gulf of Mexico in PA 1 and dredged construction material will be placed in BU Site ZZ (the designated Navy Homeport ODMDS) and BU Site MM. PA 1 is an open water placement area located southeast of the Gulf end of the Mustang Island Jetty for the Entrance Channel at Port Aransas. This site was officially designated as an ocean PA as required by §103 of the MPRSA of 1972. An EIS that described the alternatives evaluated was prepared for this designation.

1.2.2 Waters Under Tidal Influence

The entire project is located in a region which experiences tidal influence. Dredging and placement activities represent a minimal impact because the release of suspended solids is minimized according to requirements of the State §401 Certification. Current dredging practices are found in the Consistency Determination for La Quinta Channel (USACE and PCCA, 1999a) and Corpus Christi Ship Channel (USACE and PCCA, 1999b). Use of long established, designated PAs will minimize adverse effects on CNRAs in the project area.

1.2.3 Submerged Lands

The areas immediately adjacent to the project alignment, as well as the open water placement areas, are characterized as submerged land. Impacts to these areas are minimized by placement of dredged material into the historically used placement areas. BU sites will cover submerged lands; however, this placement will benefit coastal ecology.

1.2.4 Coastal Wetlands

No significant expanse of wetlands is located in close proximity to this project except for the uppermost segment of the Inner Harbor reach, and to a lesser extent, some sparse fringing marshes in Redfish Bay. Some scattered saltmarsh and black mangrove marshes exist to the east of Harbor Island, but the most significant wetlands in the vicinity are located near Tule Lake and in the Nueces River delta. These are in close proximity to the channel from the Tule Lake Turning Basin to the Viola Turning Basin. The placement areas in this vicinity are totally confined, and mitigation for any impacts to the wetlands has been completed. Continued use of confined placement areas will prevent further impacts to wetland areas.

1.2.5 Submerged Aquatic Vegetation

This navigation project is located near areas characterized as having large expanses of seagrasses. Impacts to seagrasses are minimized or avoided by placing dredged material into leveed upland sites or other historically used placement areas in the deeper waters of the bay. Impacts to seagrasses will be mitigated at a 3:1 ratio. Fifteen acres of seagrass will be created for impacts to 5 acres of seagrass.

1.2.6 Tidal Sand and Mud Flats

Some of the areas adjacent to the project alignment are adjacent to areas of tidal sand or mud flats. These areas may be frequently flooded and may contain algal mats. Impacts to these areas are minimized or avoided by placing dredged material into leveed upland sites or other historically used placement areas in the deeper waters of the bay

1.2.7 Oyster Reefs

Several significant oyster reefs exist in Corpus Christi Bay. The nearest is Long Reef, which is approximately 3,000 feet away from PA 13. PA 13 is a confined upland site, and the effluent discharge is returned to La Quinta Channel. Therefore, adverse impacts to oyster resources are not expected to occur as a result of dredging and dredged material placement operations.

1.2.8 Hard Substrate Reefs

There are no naturally occurring hard substrate formations in the vicinity of the project. The closest rock outcrop is located just north of the City of Aransas Pass and is crossed by the GIWW. The closest serpulid worm reefs are located farther south in the Laguna Madre and Baffin Bay.

1.2.9 Coastal Barriers

Four coastal barrier areas occur in the vicinity of the project. Two of the areas extend north along San Jose Island (T08 and T08P) and the other two are located on or near the lower part of Mustang Island (TX-15P and TX-17P). San Jose Island and Mustang Island are located north and south, respectively, of Aransas Pass through which the Entrance Channel traverses. San Jose Island is undeveloped while Mustang Island is highly developed for tourism and recreation, including the City of Port Aransas. Neither island currently is experiencing a great deal of erosion. PA 2 is located on San Jose Island adjacent to the north jetty. This PA is partially confined by dunes and levees. The dredged material placed there is predominately sand, helping to protect and nourish this barrier island. Furthermore, precautions are exercised to preserve existing dunes during dredge pipeline placement and discharge operations. Based on this information, adverse impacts to these coastal barriers are not expected to occur as a result of dredging and dredged material placement operations.

1.2.10 Coastal Shore Areas

Coastal shore areas are within 100 feet landward of the high water mark on submerged land. These resource areas function as buffers, protecting upland habitats from erosion and storm damage and adjacent marshes and waterways from water quality degradation. This type of area is located at the Entrance Channel, where the channel traverses Aransas Pass to the Gulf of Mexico. PA 2 is located within a coastal shore area on San Jose Island adjacent to the north jetty. This PA is partially confined by dunes and levees. The dredged material placed there is predominately sand, helping to protect and nourish this shore area. Furthermore, precautions are exercised to preserve existing dunes during dredge pipeline placement and discharge operations. Therefore, adverse impacts to coastal shore areas are not expected to occur as a result of dredging and dredged material placement operations.

1.2.11 Gulf Beaches

Gulf beaches border the Gulf of Mexico and extend inland from the line of mean low tide to the natural line of vegetation. Aransas Pass, through which the Entrance Channel passes, traverses a Gulf beach area. San Jose Island, to the north, is undeveloped. Mustang Island, to the south, is highly developed for tourism and recreation, including the City of Port Aransas. Little erosion is occurring along the beaches in this area; PA 2 is located on San Jose Island adjacent to the north jetty that adds material to this beach. This PA is partially confined by dunes and levees. The dredged material placed there is predominately sand, helping to protect and nourish this beach area. Furthermore, precautions are exercised to preserve existing dunes during dredge pipeline placement and discharge operations. Therefore, adverse impacts are not expected to occur as a result of dredging and dredged material placement operations.

1.2.12 Critical Dune Areas

The Gulf beaches on both sides of Aransas Pass can be characterized as having active sand dune systems. PA 2 is located on San Jose Island adjacent to the north jetty and is partially confined by dunes and levees. The dredged material placed there is predominately sand, helping to protect and nourish this area. Furthermore, precautions are exercised to preserve existing dunes during dredge pipeline placement and discharge operations. Therefore, adverse impacts to dune areas are not expected to occur as a result of dredging and dredged material placement operations.

1.2.13 Special Hazard Areas

Special hazard areas are areas designated by the administrator of the Federal Insurance Administration under the National Flood Insurance Act as having special flood, mudslide, and/or flood-related erosion hazards. Much of the project area qualifies as special hazard areas on the Flood Insurance Rate Maps. Project dredging and placement activities do not affect these low-lying areas because dredging is within and adjacent to the existing channel and disposal is within contained PAs in upland sites and approved BU sites in open waters.

1.2.14 Critical Erosion Areas

These areas are those Gulf and bay shorelines that are undergoing erosion and are designated by the Commissioner of the General Land Office under Texas Natural Resources Code, §33.601(b). Only one critical area of erosion is designated in the project vicinity and is located west of Port Aransas on the south side of the CCSC. It extends west from near the Nueces County Fishing Pier for about 5,844 feet to Piper Channel. An evaluation of erosion protection using bank armoring without dredged material for this area is discussed in Section 1.6.

1.2.15 Coastal Historic Areas

These areas consist of sites listed or eligible for the NRHP and SALs. Compliance with the TCMP regarding coastal historic areas is accomplished through procedures established by Section 106 of the National Historic Preservation Act of 1965 (NHPA), as amended. These coastal historic sites, as well as non-coastal historic sites, are discussed in Section 3.8 of this DEIS, with impacts discussed in Section 4.7.

1.2.16 Coastal Preserves

This natural resource includes only State lands and parks. There are no designated Texas Coastal Preserves located in the vicinity of the CCSCCIP. However, there are two State-owned lands in the general project area. Mustang Island State Park is located within Coastal Barrier Resource Unit TX-15P, and a small area known as Redhead Pond Wildlife Management Area is located on the mainland side of the Laguna Madre south of the Kennedy Causeway. Based on their distance from the project channel, impacts are not expected to occur from dredging or material placement operations. Although not considered a preserve, Nueces Bay, located adjacent to the Inner Harbor reach, was designated as a State Sanctuary in 1979 by the Texas Legislature (Senate Bill No. 335, 66th Legislature) due to its importance as a shrimp nursery area. All of the placement areas in the immediate vicinity are entirely confined; therefore, this sanctuary is not expected to be impacted by dredging or material placement operations.

1.3 COMPLIANCE WITH GOALS AND POLICIES

The following goals and policies of the TCMP were reviewed for compliance.

- §501.14(j) – Dredging and Dredged Material Disposal and Placement
- §501.14(h) – Development in Critical Areas
- §501.15 – Policy for Major Actions

1.3.1 Compliance with §501.14(j) – Dredging and Dredged Material Disposal and Placement

Appendix E provides a summary of actions designed to comply with the specific requirements of §501.14(j)(1)-(6). Paragraph (7) of the section discusses emergency dredging procedures and is not applicable to the project at this time. Paragraph (8) discusses the mining of shell, marl, gravel, and mudshell and is not applicable to the Federal navigation project. Paragraph (9) is not applicable to the Corps of Engineers.

1.3.2 Compliance with §501.14(h) – Development in Critical Areas

Dredging of the La Quinta Channel will result in the loss of five acres of a critical area, submerged aquatic vegetation. This impacted area will be mitigated by the creation of 15 acres of seagrasses.

1.3.3 Compliance with §501.15 – Policy for Major Actions

This project involves action subject to §505.11 and constitutes a major action. Therefore, a Federal EIS is required under NEPA, 42 USC, §4321, et seq. Both State and Federal agencies involved with the CCSCCIP have met and coordinated on the identification and mitigation of project impacts and beneficial uses of dredged material. The purpose of this portion of the DEIS is to demonstrate that the CCSCCIP is consistent with the TCMP.

1.4 ENVIRONMENTAL BENEFITS AND POTENTIAL FOR BENEFICIAL USES

The CCSCCIP will provide a safer and more efficient navigation system and provide the materials for creation of beneficial use sites in Corpus Christi Bay and Redfish Bay.

The TCMP considers dredged material from dredging projects in commercially navigable waterways a potentially reusable resource that must be used beneficially when economically feasible (§501.14(j)(4)(A-C)). The CCSCCIP is a dredging project and is being dredged for commercial navigation. The estimated amount of dredged material generated by the project would be 41 mcy of new work material, and approximately 208 mcy of maintenance material over the next 50 years. New work material (16.7 mcy) will be utilized to create two offshore sites, one upland site, and five open-water sites as described in Section 1.7.

1.5 CONSISTENCY DETERMINATION

The project addressed in this DEIS has been reviewed for consistency with the goals and policies of the TCMP. CNRAs in the project area are identified and evaluated for potential impacts from activities associated with the project. It is determined that these activities will not adversely impact the CNRAs. Based on this analysis, the USACE and PCCA find that the project discussed in the DEIS of the CCSCCIP is consistent with the goals and policies of the TCMP to the maximum extent practicable.

Appendix E provides a summary of actions designed to comply with the specific requirements of §501.14(j)(1)-(6).

17 Jun 02

Date

Leonard D. Waterworth

Leonard D. Waterworth
Colonel, U.S. Army Corps of Engineers
District Engineer

Coastal Coordination Council

P.O. Box 12873 ♦ Austin, Texas 78711-2873 ♦ (512) 463-5385 ♦ FAX (512) 475-0680

November 25, 2002

Colonel Leonard D. Waterworth
District Engineer, Galveston District
U. S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

RE: Consistency Agreement, Corpus Christi Ship Channel – Channel Improvement Project

Dear Colonel Waterworth:

Pursuant to 31 TAC §506.28(b), the Coastal Coordination Council (Council) issues this Consistency Agreement for the Corpus Christi Ship Channel – Channel Improvements Project (Project), a federal development project by the U.S. Army Corps of Engineers (COE).

The COE established an interagency coordination group whose duties included advising the COE on the consistency of the Project. The interagency coordination group included among its members a minimum of three Council members from natural resource agencies or their representatives. The COE adopted the interagency coordination group's consensus position on consistency and submitted it to the Council on September 25, 2002, incorporating by reference the consistency determination for the Project that had been prepared and circulated for public comment along with the draft environmental impact statement for the Project.

Therefore, the Council accepts and adopts the consistency determination for the Project as submitted by the COE and issues this Consistency Agreement under 31 TAC §506.28(b), in lieu of Council review under 31 TAC §506.26.

Sincerely,

David Dewhurst

David Dewhurst
Commissioner, General Land Office
Chair, Coastal Coordination Council

APPENDIX F

DREDGED MATERIAL MANAGEMENT AND BENEFICIAL USE PLAN

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1.0 PURPOSE

The purpose of the Dredged Material Management/Beneficial Use Plan (DMM/BU PLAN) is to guide the Federal and non-Federal sponsors in the placement of material to be dredged from the Corpus Christi Ship Channel – Channel Improvement Project (CCSCCIP) for the 50-year life of the project. This DMM/BU PLAN will apply to both construction and maintenance dredging.

The DMM/BU PLAN was developed by the U.S. Army Corps of Engineers (USACE), Galveston District; the Port of Corpus Christi Authority (PCCA), the non-Federal sponsor; and the Regulatory Agency Coordination Team (RACT), whose members are listed in Section 1.6 of the FEIS. The DMM/BU PLAN includes both the creation of beneficial use (BU) sites with construction material, a limited use of maintenance material for BUs, and modification of existing practices for the rest of the maintenance material.

2.0 CCSCCIP DESCRIPTION

2.1 PROJECT CHANNELS

The proposed deepening and widening project is 37.3 miles long and consists of 5 main reaches of channel: the Entrance Channel (offshore) reach, Lower Bay reach, Upper Bay reach, the Inner Harbor reach, and the La Quinta Channel Extension (figures 1-2 and 1-3 of the FEIS). The project also includes adding barge shelves along both sides of the improved ship channel traversing Corpus Christi Bay. No widening or deepening is proposed for the La Quinta Channel. The improvement that is proposed for La Quinta Channel is extending it a distance of 7,200 feet with a 1,200-foot turning basin at the end. The channel extension will be 300 feet wide at an authorized depth of –39 feet MLT.

2.2 INNER HARBOR REACH

The Inner Harbor reach is 51,150 feet long. It begins at Sta. 1050+00 in Corpus Christi Bay and ends at Sta. 1561+50 at the Viola Turning Basin (see Plates C-1 through C-5 in the Feasibility Report). The required depth of the channel will range from –53 to –58 feet, and its bottom width will vary from 300 to 450 feet. The turning basins in the channel will range in width from 545 to 1,200 feet. Channel side slopes in this reach will be 1 vertical on 2 horizontal (1V on 2H).

2.3 UPPER BAY REACH

This channel reach is 51,000 feet long. It begins at Sta. 540+00 and ends at Sta. 1050+00, near the City of Corpus Christi (see Plates C-5 through C-10 in the Feasibility Report). The required depth of the channel will range from –54 to –58 feet MLT and its bottom width will be 530 feet. Channel side slopes will be 1V on 3H.

2.4 LOWER BAY REACH

This channel reach is 52,745 feet long. It begins at Sta. 12+55, near the junction of the Entrance Channel, and crosses Redfish Bay, ending at Sta. 540+00, near Port Ingleside (see Plates C-10 through C-15 in the Feasibility Report). The required depth of the channel will be –54 feet MLT and its bottom width will be 530 feet. Channel side slopes will be 1V on 3H.

2.5 ENTRANCE CHANNEL

This channel reach is 34,782 feet long. It begins at offshore Sta. 310+00 (at the 56-foot depth contour) and ends at Sta. –37+82 in the Inner Basin at Port Aransas (see Plates C-15 through C-18 in the Feasibility Report). The channel will have a required depth range of –54 to –56 feet MLT and bottom widths ranging from 600 to 700 feet in the channel, and 1,280 to 1,395 feet in the turning basin. Channel side slopes will be 1V on 10H beyond Sta. 72+50 and 1V on 3H shoreward.

Barge shelves, each 200 feet wide as measured from the bottom limit of the widened channel, flank both sides of the channel through the bay reach. The barge shelves will extend from Sta. 540+00 (near the La Quinta Junction) to Sta. 1050+00 (near Beacon 82).

2.5.1 Barge Shelves

Barge Shelves, each 200 feet wide as measured from the bottom limit of the widened channel, will flank both sides of the channel through the bay reach. The barge shelves will extend from Sta. 540+00 (near the La Quinta junction) to Sta. 1050+00 (near Beacon 82).

2.5.2 La Quinta Channel Extension

The La Quinta Channel extension will be 7,248 feet in length and will begin at Sta. 309+52 in the La Quinta Channel and end at Sta. 382+00, as shown on Drawing C-19 in the Feasibility Report. The channel extension will be dredged to a required depth of 41 feet plus one or two feet of allowable overdepth, having a bottom width of 300 feet in the channel and bottom widths ranging from 583 to 1,447 feet in the turning basin. Channel side slopes will be 1V on 2H.

3.0 GEOTECHNICAL INVESTIGATIONS

The level of geotechnical engineering performed for this report is fully sufficient to substantiate the recommended plan. Additional investigations and analyses, briefly outlined in Section 4.4, in accordance with ER 1110-2-1150, Appendix C-4, will be performed during both the Pre-construction Engineering and Design (PED) and Construction General phases of the project, and documented in a Design Documentation Report before each feature is constructed.

3.1 REFERENCES

The following documents comprise part of this appendix and are available for independent examination. They are referenced in the text where applicable.

"Channel Scour and Methods of Assessment of Their Stability," by T.S. Mirtskhulava, Kolos Publishing House, 1967. E. Razmyv Rusel I Metodica Otsenki ih Ustoichivosti.

"Corpus Christi Ship Channel Improvement, Shoreline Erosion Study, Task 2," prepared for the PCCA by Vladimir Shepsis of Pacific International Engineering, Inc., January 2001.

"Corpus Christi Ship Channel, Mustang and Harbor Islands Shoreline Stabilization Projects, Texas," prepared for the Texas General Land Office by Pacific International Engineering, Inc., November 2000.

Engineering Regulation (ER) 1110-2-1150 – "Engineering and Design - Engineering and Design for Civil Works Projects," Appendix C-4 – "Content of Engineering Appendix to Feasibility Report," August 31, 1999.

"River Training Techniques, Fundamentals, Design and Applications," by Przdwjiski, Blazejewaski, and Pilarczyk, A.A. Balkema, Rotterdam, 1980.

3.2 SUBSURFACE INVESTIGATIONS

3.2.1 Project Channels

Soil borings were taken at 317 separate locations along the entire reach of the project channels, extending into the Gulf of Mexico to Offshore Sta. 325+00. The locations of the borings are shown on Plates C-1 through C-18 in the Feasibility Report. Corresponding logs of the borings are shown on Plates F-1 through F-2 in the Feasibility Report. The subsurface soils were classified in accordance with American Society for Testing Materials (ASTM) Standard D 2487-00 – "Standard Classification of Soils for Engineering Purposes" (Unified Soil Classification System). Other relevant information, such as moisture contents, unit dry weights, dry density, liquid limits, and plastic limits are included on the plotted logs of borings.

3.2.2 Existing Upland Placement Areas

Supplement No. 2 to Design Memorandum No. 1 for the Corpus Christi Ship Channel, Texas 45-Foot Project, entitled "Nueces Bay / South Shore Plan" indicates that there were a total of 30 soil borings taken between 1968 and 1981 to investigate foundation conditions for IH-PAs 1, 2, 3, 7 and 8. The report provides a layout and logs of borings, revealing the foundation conditions for these areas. Since the foundation conditions have changed over the years, and will change during the implementation of this project, no additional soil borings were taken for this report. Instead, the existing levees will be used to contain the new work material, which will profoundly change the foundation conditions of the levee for future levee raisings. Therefore, soil borings for these upland sites will be deferred until completion of new work dredging, so that accurate foundation conditions may be ascertained. The same concept will apply for PA 13. PA 10 will be used to contain 2.8 mcy over the next 50 years. Therefore nominal levee raisings will be required periodically and no future levee design is anticipated. Fifty-eight (58) soil borings were taken at Mustang Island (PA 6) during 1989 for the plans and specifications to construct a turning basin and docking area at Ingleside. This information was used to design the existing levee; therefore, it is not necessary to include this information in this report. In addition, current plans for use of this area to contain 2.7 mcy of new work material are not expected to require additional foundation investigations for this area.

3.2.3 Proposed Beneficial Use Placement Areas, Shore Protection, and Breakwater

Seven (7) soil borings were taken in the vicinity of BU Site I, BU Site R, BU Site S, BU Site CQ and BU Site Pelican. The logs of borings are shown on Plate F-28 in the Feasibility Report.

3.2.4 Remaining Project Features

Subsurface investigations for the remaining project features, including all open-water placement areas, the proposed breakwater near Ingleside-on-the-Bay (BU Site P), the proposed habitat protection at Pelican Island (BU Site Pelican), and the proposed erosion protection near the Mustang Island flat (BU Site L) have not yet been undertaken. For the purpose of this report, the foundation conditions were considered similar to the conditions at adjacent beneficial use locations. The subsurface investigation work will be deferred until final design of the features.

3.3 DREDGED MATERIAL DESCRIPTION

3.3.1 Dredged Material Quantities

3.3.1.1 New Work Quantity

The total quantity of new work material to be dredged in conjunction with the proposed channel improvements is 40.7 mcy, as presented in Table F-1. The quantities were determined by calculating the average end area for each improved cross-sectional template cut into the existing channel and multiplying it by the length between cross sections.

3.3.1.2 Maintenance Material Quantity

The quantity of maintenance material to be removed over the 50-year project life is estimated to be 208.0 mcy, as presented in Table F-2. This quantity was determined by reviewing maintenance dredging contracts within the project area for the last 20 years and applying an incremental increase in dredging due to the widened and deepened channel. The ERDC modeled different variations of a widened and/or deepened channel, and made predictions as to the increase in maintenance volumes per reach. These modeling results were used to predict shoaling rates for the 52-foot x 530-foot channel.

3.3.2 Dredged Material Classification

Dredged material to be removed from the channel deepening and widening, where applicable, was classified by reach for the design of both existing and new beneficial use placement areas. Soil classifications were generally in accordance with Table B-2 of ER 1110-2-1300. These classifications are used by the dredging industry and dredge estimators to classify the material being dredged. They are correlated to the average in-place density of soils, and are described as mud and silt, loose sand, compacted sand, and stiff clay. For the purpose of this report, the material having in-place densities in the range of 1,400 grams per liter (g/l) to 1,600 g/l was considered to be soft, silty sands or soft, sandy / silty clays. Materials having in-place densities around 1,700 to 1,900 g/l were considered to be loose sand or shell. Stiff clays were assumed for clays having in-place densities greater than 2,000 g/l. Very dense sands were assumed for sands having in-place densities greater than 2,300 g/l. Finally, medium dense sands were assumed for sands having in-place densities below 2,300 g/l. Soil borings were plotted on the cross sections in each reach of channel to be dredged and the quantity of each material type was calculated using a percentage of the total cross-sectional area. The average end-area method of quantity calculations was used to determine the volume of each material type. The results of

TABLE F-1

NEW WORK MATERIAL VOLUMES *

From Station	To Station	Soft, Soft Silty, Soft Sandy Clay	Stiff to Hard Clay	Loose Sand and Shell	Dense to Medium-Dense Sand	Very Dense Silty Sand	Total Volume (cy)
Entrance Channel							
310+00	150+00	2,246,988	0	0	300,044	48,533	2,595,565
150+00	50+00	382,738	0	24,946	317,464	539,456	1,264,604
50+00	-37+82	0	0	0	98,336	378,646	476,982
		2,629,726	0	24,946	715,844	966,635	4,337,151
Lower Bay							
12+55	180+00	927,023	127,672	22,247	1,190,605	434,427	2,701,974
180+00	340+00	164,571	2,956	353,422	1,150,581	550,470	2,222,000
340+00	540+00	398,159	452,223	286,814	1,495,235	1,197,630	3,830,061
		1,489,753	582,851	662,483	3,836,421	2,182,527	8,754,035
Upper Bay, Including Barge Shelves							
540+00	620+00	1,481,287	297,066	0	837,968	23,134	2,639,455
620+00	830+00	5,059,494	75,760	0	776,407	0	5,911,661
830+00	880+00	1,113,036	0	0	211,797	0	1,324,833
880+00	1030+00	3,496,881	0	0	421,046	0	3,917,927
1030+00	1050+00	623,261	0	0	1,388	0	624,649
		11,773,959	372,826	0	2,248,606	23,134	14,418,525
Inner Harbor							
1050+00	1172+00	543,938	1,112,742	0	260,284	243,115	2,160,079
1172+00	1320+00	91,576	1,313,297	12,352	205,064	346,599	1,968,888
1320+00	1460+00	54,399	1,164,115	0	283,729	47,857	1,550,100
1460+00	1561+00	166,462	806,979	0	21,482	242,262	1,237,185
		856,375	4,397,133	12,352	770,559	879,833	6,916,252
La Quinta							
309+51	382+00	198,658	3,402,510	135,688	2,519,921	0	6,256,777
		198,658	3,402,510	135,688	2,519,921	0	6,256,777
					Total, New Work Dredging		40,682,740

* Excluding 271,000 cy from the barge lanes.

TABLE F-2

50-YEAR MAINTENANCE MATERIAL VOLUMES

From Station	To Station	Very Soft to Soft Clay	Silt or Sandy Silt	Fine or Silty Sand	Sand	Total Volume (cy)
Entrance Channel						
310+00	150+00	0	0	35,000,000	0	35,000,000
150+00	50+00	0	0	24,500,000	0	24,500,000
50+00	-37+82	0	0	2,500,000	0	2,500,000
		0	0	62,000,000	0	62,000,000
Lower Bay						
12+55	180+00	0	0	0	0	0
180+00	340+00	0	0	0	3,500,000	3,500,000
340+00	540+00	0	0	8,200,000	0	8,200,000
		0	0	8,200,000	3,500,000	11,700,000
Upper Bay, Including Barge Shelves						
540+00	620+00	0	9,700,000	0	0	9,700,000
620+00	830+00	0	30,000,000	0	0	30,000,000
830+00	880+00	0	7,400,000	0	0	7,400,000
880+00	1030+00	0	29,400,000	0	0	29,400,000
1030+00	1050+00	0	5,700,000	0	0	5,700,000
		0	82,200,000	0	0	82,200,000
Inner Harbor						
1050+00	1172+00	0	21,000,000	0	0	21,000,000
1172+00	1320+00	0	1,000,000	0	0	1,000,000
1320+00	1460+00	0	1,100,000	0	0	1,100,000
1460+00	1561+00	0	1,000,000	0	0	1,000,000
		0	24,100,000	0	0	24,100,000
La Quinta						
12+74	309+51	0	18,500,000	0	0	18,500,000
309+51	382+00	0	9,500,000	0	0	9,500,000
		0	28,000,000	0	0	28,000,000
				Total, 50-Year Maintenance Dredging		208,000,000

these calculations are shown by channel reach in Table F-1. Historical shoaling data were used to classify the materials by reach for the future (50-year) maintenance disposal. This information is provided in Table F-2.

3.3.3 Placement Plans

Placement plans are required to ensure that there will be sufficient capacity within the designated placement areas to contain both new work material from construction of the improved channels, and maintenance (shoal) material from repeated dredging of the channel to maintain the project depths over a 50-year period.

3.4 FOUNDATION DESIGN

3.4.1 Project Channels

The existing CCSC will be deepened and widened along its present alignment. Channel widening is prescribed only for the Lower and Upper Bay reaches, and for "spot" widening in the Entrance Channel and in the Inner Harbor Channel reach. Therefore, empirical knowledge and available subsurface soil information were used in the channel side slope stability analyses.

3.4.1.1 Entrance Channel

The side slopes will be 1V on 10H from Sta. 72+50 to Sta. 310+00. No slope stability analysis was necessary for this reach. Channel side slopes will be 1V on 3H from Sta. 72+50 through the Inner Basin at Port Aransas. The channel has been designed to ensure that the top of cut of the existing channel is not compromised. As such, the deepening will control the bottom cut for the new turning basin dimensions. Soil borings in the vicinity indicate the deepening will occur in a layer of very dense silty sand. Factor-of-safety computations for cohesionless material of this type indicate typical values of about 1.7 for a 1V on 3H side slope. Therefore, stability analyses are not necessary for this reach.

3.4.1.2 Lower Bay Reach

"After Dredging," or as-built cross sections, dated January 1974, were reviewed to determine whether it was necessary to analyze the stability of the slopes due to the proposed deepening and minimal widening from 500 to 530 feet. Logs of soil borings were plotted on the cross sections at the locations they were taken, allowing visual verification of existing side slopes cut through various in situ material. The borings revealed that foundation soils were consistently stiff clays or medium to very dense silty sands at depths between –40 and –50 feet MLT. In addition, the cross sections revealed that the after-dredging cut lines at the toe of the existing channel generally extended well past the required template width. When the deepened and widened template in this reach was compared to the cross sections of the existing channel, the side slopes of the proposed deepened channel side slopes either matched or fell within the existing slope lines. Sections adjacent to known infrastructure and land features were studied to ensure that the new top of cut did not affect he integrity of these land features. According to the plan drawings, existing improvements include docks on the north bank and breakwaters on the south bank near Sta. 20+00, a ferry landing on the south bank near Sta. 40+00, bulkheads on both sides of the bank near Sta. 50+00, hopper dredge docks on the south bank near Sta. 60+00, and a pier on the north bank near Sta. 470+00. Therefore, these cross sections were singled out for closer examination. The cross sections showed that the deepening at the south banks of Sta. 20+00, 40+00 and 50+00, and 60+00, and at the north banks of Sta. 20+00, 50+00, and 470+00 will occur in a layer of stiff to very stiff clayey sand and medium to very dense silty sands. The sections show the existing bank cuts are 1V on 3H or slightly steeper. It can be concluded, therefore, that maintaining the existing channel widths in this reach at a required depth of −54 feet MLT will not affect the stability of nearby land features caused by failure of the side slopes.

3.4.1.3 Upper Bay Reach

This reach of channel will be widened equally on both sides of the channel to 530 feet from its present 400-foot width. Soil borings taken in this reach show a bay bottom consisting of very soft organic clays and silts. This material is not satisfactory for use as construction material and will be disposed of in the existing open water placement areas. A 200-foot wide barge shelf, as measured from the toe of the improved channel, will be constructed along each side of the channel. The barge shelves will be constructed and maintained to an authorized depth of −12 feet MLT. Only a modest amount of dredging will be necessary to achieve this depth since the existing bay bottom flanking the ship channel is already about −11 to −12 feet MLT. Most of the material likely to be encountered in dredging the barge shelves will be soft organic clays and silts.

3.4.1.4 Inner Harbor Reach

Recent hydrographic cross sections of the inner harbor reach were plotted with soil boring information superimposed on the proposed deepened channel template, in order to aid in the determination of which areas might be susceptible to slope failure due to the deepening of the channel. In general, the excavation of the new work materials will be confined to deepening of the existing channel template from 45 to 52 feet. Examination of the cross sections indicates that, in most cases, the existing side slopes will not be affected by the deepening. However, before preparing plans and specifications for the contract work, it will be necessary to obtain bank-to-bank surveys, along with supplemental soil foundation data to ensure that, should the deepening require cutting of the existing bank side slopes, new slope stability analyses should be undertaken. The existing foundation information available in this reach consists of soil borings taken in past years. Accompanying soil reports have not been located in project files and as a result, the available information is not sufficient to accurately predict how the 1 on 2 cut slope will perform after deepening is completed. In addition, the hydrographic surveys that were taken were incomplete, since they were not tied in with land surveys from shallow water to the bank, and beyond. Therefore, assumptions regarding the soil strength as well as presumed bank lines and heights were used to conduct the side slope analyses. After inspection of the cross sections for the entire reach, several channel stations were selected for analysis of the new cut slope, including cross sections at Sta. 1545+00, 1490+00, 1300+00 and 1100+00. Generally, the factors of safety ranged from about 1.6 to 1.9 for deep failures at the toe, due to deepening. Some of the soil borings did indicate a thin stratum of soft clay material present at depths of 17 to 20 feet below the assumed ground surface at some sections. This indicates that, depending upon the actual bank configuration, it is possible that localized slope failures may occur in this stratum, if new bank cuts are required. Therefore, more accurate information will be required for the preparation of plans and specifications to ensure that bank failures will not be encountered in areas where existing structures or roads are adjacent to the bank. Should bank failures be predicted to occur, design measures will be taken to prevent damage to existing topography.

3.4.1.5 La Quinta Channel Extension

The La Quinta Channel extension will be constructed in very firm foundation soils similar to those in the existing channel. An inspection of the existing channel side slopes shows that banks are stable on side slopes at least equal to those proposed for the channel template for the extension. Therefore, stability analyses were not considered necessary for this reach.

3.4.2 Existing Upland Placement Areas

The existing upland placement areas have been used before and their containment levees can be raised sufficiently to place all the new work material. A typical perimeter levee section is shown on Plate F-41 in the Feasibility Report. Since much of the materials to be dredged from the Inner Harbor reach will be stiff clays and dense sands, the material will "stack" and the containment will be used mostly for discharge of the supernatant from the dredging operations. To extend the life of these existing areas to contain maintenance material for the 50-year life of the project, it is proposed to place the stiff clay material along the inside slope of the entire existing perimeter embankment and stack the material to elevations higher than the existing levee. This will serve to displace soft material to the inside of the placement area, while at the same time providing a large base of material to serve as a firm foundation and a source of borrow for future raising of the embankment over a 50-year period. This dredging operation will require constant field inspection to ensure that the dredge pipeline is continually advanced in order to place material along the entire length of the perimeter levee. This will probably raise the unit cost of dredging for these reaches, but is absolutely necessary to ensure the integrity of the 50-year dredged material management plan.

3.4.2.1 IH-PA 1

New work material from Sta. 1080+00 to Sta. 1125+00 will be deposited into IH-PA 1. Approximately 800,000 cy of material will be excavated and disposed of from this reach of channel. Soil borings taken in the channel indicate that approximately 90 percent of the material that will be encountered in the deepened portion of this channel reach will consist of stiff, lean clays. In addition, the borings indicate that the material in the channel reach beginning at Sta. 1090+00 and ending at Sta. 1125+00 consists mostly of clay will be suitable to ring the perimeter levee of the placement area, the length of which is 17,860 LF. The amount of satisfactory clay available for placement along the inside levee slope should approximate 720,000 cy. Assuming a loss of about 30 percent, it is expected that about 70 percent of the clay volume, or about 504,000 cy can be placed along the perimeter levee. This translates to about 28 cy of material per linear foot of perimeter levee that will be placed along the inside slope of the perimeter levee. For a sense of perspective, this amount of material equates to a clay mound about 12 to 15 feet high, with a 20-foot wide crown, along the inside of the current perimeter levee.

3.4.2.2 IH-PA 2 (Rincon Placement Area)

New work material from Sta. 1125+00 to Sta. 1172+00 will be deposited into IH-PA 2. Approximately 900,000 cy of material will be excavated and disposed of from this reach of channel. Soil borings taken in the channel indicate that approximately 75 percent of the material that will be encountered in the deepened portion of this channel reach will consist of stiff, lean clays. In addition, the borings indicate that the material in the channel reach beginning at Sta. 1125+00 and ending at Sta. 1150+00 consists mostly of clay that will be suitable to ring the perimeter levee of the placement area, the length of which is 14,286 LF. The amount of clay available for placement along the inside levee slope should approximate 675,000 cy. Assuming a loss of about 30 percent, it is expected that about 70 percent of the clay volume, or about 472,500 cy, can be placed along the perimeter levee. This translates to about 33 cy per linear foot of perimeter levee that will be available for future embankment raising.

3.4.2.3 IH-PA 3A (South Shore)

New work material from Sta. 1172+00 to Sta. 1246+00 will be deposited into IH-PA 3A. Approximately 1.0 mcy of material will be excavated and disposed of from this reach of channel. Soil borings taken in the channel indicate that approximately 65 percent of the material that will be encountered in the deepened portion of this channel reach will consist of stiff, lean clays. In addition, the borings indicate that the material in the channel reach beginning at Sta. 1180+00 and ending at Sta. 1220+00 consists mostly of clay that will be suitable to ring the perimeter levee of the placement area, the length of which is 18,298 LF. The amount of clay available for placement along the inside levee slope should approximate 650,000 cy. Assuming a loss of about 30 percent, it is expected that about 70 percent of the material volume, or about 455,000 cy, can be placed along the perimeter levee. This translates to about 25 cy per linear foot of perimeter levee that will be available for future embankment raising.

3.4.2.4 IH-PA 3B (South Shore)

New work material from Sta. 1246+00 to Sta. 1320+00 will be deposited into IH-PA 3B. Approximately 1.0 mcy of material will be excavated and disposed of from this reach of channel. Soil borings taken in the channel indicate that approximately 40 percent of the material that will be encountered in the deepened portion of this channel reach will consist of stiff, lean clays. The predominant material that will be encountered will be dense sand. In addition, the borings indicate that the material in the channel reach beginning at Sta. 1260+00 and ending at Sta. 1280+00 consists mostly of clay that will be suitable to ring the perimeter levee of the placement area, the length of which is 13,322 LF. The amount of clay available for placement along the inside levee slope should approximate 400,000 cy. Assuming a loss of about 30 percent, it is expected that about 70 percent of the material volume, or about 280,000 cy, can be placed along the perimeter levee. This translates to about 21 cy per linear foot of perimeter levee that will be available for future embankment raising.

3.4.2.5 IH PAs 4 and 5

IH PA 4 and PA 5 are privately owned, upland, confined PAs, roughly 120 and 172 acres in size, respectively. Although privately owned and last used during the deepening of the 45-foot project, they are potentially available for use through an agreement with the land owner or by navigational servitude. They are not scheduled for use during the CCSCCIP construction or maintenance but, as noted, are available if required.

3.4.2.6 IH-PA 6 (Tule Lake)

New work material from Sta. 1320+00 to Sta. 1460+00 will be deposited into IH-PA 6. Approximately 1.6 mcy of material will be excavated and disposed of from this channel reach. Soil borings taken in the channel indicate that approximately 65 percent of the material that will be encountered in the deepened portion of this channel reach will consist of stiff, lean clays. The predominant material that will be encountered will be dense sand. In addition, the borings indicate that the material in the channel reach beginning at Sta. 1330+00 and ending at Sta. 1360+00 consists mostly of clay that will be suitable to ring the perimeter levee of the placement area, the length of which is 16,825 LF. The amount of clay available for placement along the inside levee slope should approximate 1.04 mcy. Assuming a loss of about 30 percent, it is expected that about 70 percent of the material volume, or about 728,000 cy, can be placed along the perimeter levee. This translates to about 43 cy per linear foot of perimeter levee that will be available for future embankment raising, which should be more than adequate. The amount of suitable clay required for the levee raising will be ascertained when the plans and specifications for this channel reach are prepared.

3.4.2.7 IH-PA 8 (Suntide Placement Area)

New work material from Sta. 1460+00 to Sta. 1561+00 will be deposited into IH-PA 8. Approximately 1.2 mcy of material will be excavated and disposed of from this channel reach. Soil borings taken in the channel indicate that approximately 75 percent of the material that will be encountered in the deepened portion of this channel reach will consist of stiff, lean clays. The predominant material that will be encountered will be dense sand. In addition, the borings indicate that the material in the channel reach beginning at Sta. 1490+00 and ending at Sta. 1560+00 consists mostly of clay that will be suitable to ring the perimeter levee of the placement area, the length of which is 17,459 LF. The amount of clay available for placement along the inside levee slope should approximate 900,000 cy. Assuming a loss of about 30 percent, it is expected that about 70 percent of the material volume, or about 630,000 cy, can be placed along the perimeter levee. This translates to about 36 cy per linear foot of perimeter levee that will be available for future embankment raising.

3.4.2.8 PA 13 (La Quinta Channel)

Approximately 2.7 mcy of clay will be excavated to construct the La Quinta Channel Extension. This material will be stockpiled in the placement area for future use as a borrow source to raise the placement area levees. Approximately 1.0 mcy of the clay will be placed along the inside slope of the existing perimeter levee. Placement of the material along the perimeter levee is absolutely required in order to displace the soft foundation material along the existing levee. Replacing the soft foundation material will create a firmer foundation for future levee raising to contain maintenance material. Approximately 1.7 mcy of clay can be placed into the northwest corner of the placement area to serve as a stockpile for future levee raising at that end.

3.4.2.9 PA 4

PA 4 is a confined site located north of the CCSC on Harbor Island. It has not been used since the 45-foot deepening project for the placement of new work dredged material. It is owned by the PCCA and may be available for use by the proposed project.

3.4.2.10 PA 5

PA 5 is an upland unconfined site located on the south side of the CCSC west of Port Aransas. It has not been used since before the CCSC was deepened to 45 feet and may be available for use by the proposed project through navigation servitude.

3.4.2.11 PA 9

PA 9 is a 120-acre unconfined emergent placement area located south of the CCSC and east of the GIWW crossing. It has not been used in the past 23 years. It was last used for placement of new work material during the 45-foot deepening project.

3.4.2.12 PA 18

PA 18 is an unconfined open-water placement area that is configured as two narrow, parallel placement corridors oriented perpendicular to the CCSC. PA 18 is available for use, but has not been used recently because of concerns that it could accelerate filling of the small-boat channels near the Corpus Christi City Marina.

3.4.3 New Beneficial Use Sites

The design of the beneficial use placement areas considered the bearing capacity of the existing foundation soils and stability of the channel side slopes for areas fronting the channel. Regarding the channel side slope stability, the embankments and fill areas have been located a sufficient distance from the channel to prevent any impacts from hydraulic fill and erosion protection loads. However, soil borings taken in the vicinity of beneficial use sites contain layers of soft plastic clays that will not withstand the loads imposed by both the hydraulic-fill embankments and the new work material to be deposited inside the areas. It is expected that much of the soft material along the alignment of the perimeter (containment) levees will be displaced by the hydraulic-fill levees during the dredging and placement operations. Depending upon the stratigraphy, it is possible that some of the soft clay will be trapped beneath the hydraulic-fill embankment, setting up the potential for some settlement of the embankment over time. This cannot be avoided however, because of the immediate need for placing the geotubes and armor protection necessary to preserve the sand embankment. The settlement effects should be minimal, and can be corrected by effective and timely maintenance of the embankments. The inside fill areas will also be subject to displacement of foundation soils to varying degrees. It is expected that mud waves will be trapped inside the fill areas and these were incorporated into the design. This does not present a problem however, since the fill area to the elevations specified can be increased without any negative impacts to the one-, two-, and three-sided design configurations, other than a somewhat larger surface area than is depicted.

3.4.3.1 BU Site MN

This area was "positioned" to lie offshore beyond the 30-foot contour and is subject to change based on a determination of the underwater bathymetry. The size of the placement area was determined by comparison with a similar structure designed for the Houston-Galveston Navigation Channels, Texas 45-Foot Project. The intent of the design is to construct underwater mounds of dredged material about 5 to 6 feet high, placed in rows. The final size of and location for the beneficial use site will be finalized during the preparation of plans and specifications for the work. A typical section of what is proposed site is shown on Plate F-36 in the Feasibility Report.

3.4.3.2 BU Site I (Dagger Island)

This area was designed to contain approximately 2.7 mcy of new work channel material within a shallow water habitat configuration open on two sides. The design envisioned an emergent outside containment embankment, protected from ship wakes, that would offer protection to the site, thereby encouraging environmental productivity. It also envisioned the building up of small islands within the area. Typical sections of the proposed containment levee are shown on Plates F-36 and F-37 in the Feasibility Report.

3.4.3.3 BU Site R

This area was designed to contain approximately 2.4 mcy of new work material. It will partially enclose approximately 201 acres of newly created shallow-water habitat, which would have an approximate mudline of –1 to –2 feet MLT, raised from the existing depth of –6 to –10 feet MLT. It will be bordered on the south and west sides by an embankment, protected by riprap and geotubes on the exterior slopes to an elevation of +5 feet MLT. Typical sections for the site are shown on Plate F-37 in the Feasibility Report.

3.4.3.4 BU Site S

This area was designed to contain approximately 1.5 mcy of new work material within a 121-acre, newly created, shallow water habitat configuration open on two sides. The shallow water would have an approximate mudline of –1 to –2 feet MLT, raised from the existing depth of –6 to –10 feet MLT. It will be located south of the ship channel, south of PA 10, and west of the GIWW. It will be bordered on the east side by an embankment, protected by riprap and geotubes to an elevation of +5 feet MLT. Typical sections for the site are shown on Plate F-37 in the Feasibility Report.

3.4.3.5 BU Site CQ – (Upper Bay at La Quinta Channel Junction)

This area was designed to contain approximately 2.9 mcy of new work material within a shallow water habitat configuration open on one side. It is located in open water, adjacent to the south side of the La Quinta Channel extension and west of PA 13 at the terminus of the existing La Quinta Channel. After construction, the site will contain approximately 200 acres of shallow water high and low marsh aquatic and estuarine habitat and will be bordered on the south and west by embankments protected by geotubes and riprap to elevation +6 feet MLT to protect the shoreline and enhance vegetation colonization. A single row of Spartina would be planted along the inside (north side) of the wave-protection levee creating 6 acres of marsh. Small islands will be "mounded" within the area. Typical sections for the site are shown on Plate F-38 in the Feasibility Report.

3.4.3.6 BU Site GH – (La Quinta Extension)

This area was designed to contain approximately 2.3 mcy of new work material within a 250-acre, shallow-water and emergent island habitat configuration, open on two sides. The new work material would be allowed to flow freely in the deeper eastern half of the site to fill to depths shallow enough to support seagrass. There may be some deeper holes that would not support seagrass, but these areas would provide a mosaic of habitats for marine life. The perimeter of the emergent mounds would be fringed with Spartina to hasten vegetation growth and erosion protection. An armored levee for wave protection and to help contain dredged material would be created around the site on the west, south, and east boundaries with geotubes or rock breakwaters to elevation +6 feet MLT. Typical sections for the site are shown on Plate F-40 in the Feasibility Report.

3.4.3.7 BU Site Pelican (Pelican Island, PAs 7 and 8)

This area will be protected on the northeast corner by riprap, connected to a hydraulic-fill embankment, designed to prevent the migration of material from Pelican Island to Mustang Island, and guard against the possible formation of a land bridge between the two islands. Typical sections for the site are shown on Plates F-37 and F-41 in the Feasibility Report.

3.4.3.8 BU Site L – (Mustang Island Shore Protection)

The shoreline along this reach of channel has been experiencing continual bank erosion, mostly from ship wakes, and this unabated erosion threats the sensitive ecology along the shoreline. Consequently, erosion protection is warranted along this reach of channel, which is shown on Plate F-35. A typical section of the stone erosion protection proposed is shown on Plate F-41 in the Feasibility Report.

3.4.3.9 BU Site P

This breakwater at Ingleside was designed for the express purpose of lessening the impact of shoreline erosion and wave action on the underwater sea grasses located between the ship channel and the landmass. No soil borings were taken at this location. The nearest borings however indicate that soft, underlying clay may be present. If this is true, then the soft foundation conditions will have to be addressed in the final design of the breakwater. One possible way of remedying the problem of a soft foundation would be to displace the soft clay with a hydraulic-fill sand embankment. This could be accomplished by arranging the dredging contracts in such an order that the hydraulic-fill embankment is constructed first so that settlement, consolidation, and stabilization of the foundation could take place along the alignment of the breakwater prior to its construction. Another solution may be to use geotextile material to bridge over the soft clay, and thereby provide support to the breakwater by employing the geotextile's tensile strength. Typical sections for the site are shown on Plate F-39 in the Feasibility Report.

4.0 DREDGED MATERIAL MANAGEMENT

4.1 DISPOSAL OF NEW WORK AND MAINTENANCE MATERIAL

4.1.1 Existing Placement Areas

The project will utilize eight (8) existing upland confined placement areas and one partially confined upland placement area that have been used in conjunction with construction and maintenance of the present authorized 45-foot channel. It will also utilize an existing offshore placement site and eight (8) bay placement areas to confine both new work and maintenance material as described below. Other PAs, as noted in Section 3.5.2, are not scheduled for use by the CCSCCIP but are still viable and available, if needed.

4.1.1.1 Inner Harbor – IH-PA 8 (Suntide Placement Area)

IH-PA 8 is a 306-acre upland confined placement area located just west of the end of the project channel, as shown on Plate F-42 in the Feasibility Report. IH-PA 8 will be used to contain approximately 1.2 mcy of new work dredged material and 1.0 mcy of future maintenance dredged material. This placement area has been used in the past for material disposal, but is not specifically provided or used under the present authorized 45-foot project. Consequently, IH-PA 8 will have to be acquired for the improved channel to satisfy storage capacity needs.

4.1.1.2 Inner Harbor – IH-PA 6 (Tule Lake Placement Area)

IH-PA 6 is a 360-acre upland confined placement area which is south of the ship channel, as shown on Plate F-42 in the Feasibility Report. IH-PA 6 will be used to contain approximately 1.6 mcy of new work material and 1.1 mcy of future maintenance dredged material. Although this placement area is an existing placement area that has been used for material disposal in the past, it is not specifically provided or used under the present authorized 45-foot project. Consequently, IH-PA 6 will have to be acquired for the improved channel to satisfy storage capacity needs.

4.1.1.3 IH-PA 3 (South Shore Placement Area)

IH-PA 3 is an upland confined placement area on the south shore of Nueces Bay, just west of IH-PA 1 and north of the ship channel. It is divided into 3 cells – "A", "B", and "C". Cell "A" is 200 acres in size and Cell "B" is 183 acres (see Plate F-43 in the Feasibility Report). Although no direct use is planned for Cell "C" (shown on Plate C-2 in the Feasibility Report) under this project, the PCCA requested that it be included, in the event future project needs make its use necessary. Furthermore, the PCCA requested that the use of IH-PA 3 be clarified to the extent that, based on projected future alternate land use, Inner Harbor placement area capacities have been determined with limitations placed on Cells "A", "B", and "C". This resulted in material being allocated to these sites in different proportions than would otherwise have been allocated without the requested limitations. It is, therefore, the contention of the PCCA, which is supported by the District, that if the limitations imposed should be relaxed during project construction or maintenance, the existing cells within IH-PA 3 could be more fully utilized for material storage. For the purpose of this report, however, the placement plan that has been developed is sufficient to satisfy all the disposal requirements for the associated reach of channel at this time. To this end, Cell "A" of IH-PA 3 will be used to contain approximately 1.0 mcy of new work material only. It is not planned for use to contain any future maintenance material. Cell "B" will be used to contain approximately 1.0 mcy of new work material and 1.0 mcy of future maintenance material.

4.1.1.4 IH-PA 2 (Rincon Placement Area)

IH-PA 2 is a 230-acre upland confined placement site north of and contiguous with IH-PA 1 as shown on Plate F-44 in the Feasibility Report. It will be used to contain approximately 900,000 cy of new work material and 5.2 mcy of future maintenance material.

4.1.1.5 IH-PA 1 (Inner Harbor)

IH-PA 1 is a 350-acre upland confined placement site located just north of the Inner Harbor as shown on Plate F-44 in the Feasibility Report. IH-PA 1 is subdivided into two cells (West Cell and East Cell) and will be used to contain approximately 800,000 cy of material obtained from new work dredging and 10.6 mcy from maintenance dredging over a 50-year period.

4.1.1.6 Upper Bay Open-Water Placement Areas 14-A, 14-B, 15-A, 15-B, 16-A, 16-B, 17-A and 17-B)

These openwater placement areas are considered to have unlimited capacity for placement of dredged material. They are located on either side of the ship channel across Corpus Christi Bay as shown on Plates C-6 through C-9 in the Feasibility Report. The areas will be used for the disposal of approximately 11.8 mcy of new work material and 87.4 mcy of future maintenance material.

4.1.1.7 PA 10 (La Quinta Junction)

PA 10 is a 196-acre site upland confined placement area on the south side of the ship channel across from Port Ingleside as shown on Plate F-31 in the Feasibility Report. PA 10 will not be used to contain any new work dredged material. It will only be used to contain maintenance material, which is projected to amount to 2.8 mcy over the life of the project.

4.1.1.8 PA 6 (Mustang Island)

PA 6 is a 304-acre upland confined placement area on the northern point of Mustang Island, south of and adjacent to the CCSC between Port Aransas and the La Quinta junction as shown on Plate C-13 in the Feasibility Report. It has been used only once in the past as a placement area, and has since fallen into disrepair. Before this area can be used, major rehabilitation of the perimeter levees will be required and a new drop structure installed. PA 6 will be used to contain approximately 2.7 mcy of new work material. This placement area is not anticipated to be used for future maintenance dredging of the channel.

4.1.1.9 PA 2 (San Jose Island)

PA 2 is an existing partially confined upland placement area that is approximately 35 acres in size. It is situated on San Jose Island, which is about 1,000 feet north of the North Jetty (see Plate C-15 in the Feasibility Report). While this report assumes minimal quantitative use of this placement area, it is included nevertheless as a viable project placement area, because it may be used on an "as needed" basis to contain small quantities of shoal material collecting within the limits of the Port Aransas Inner Turning Basin between routine maintenance dredging of the Entrance Channel by hopper dredge. The small volume of material will be removed by pipeline dredge and placed in PA 2, with the effluent being allowed to drain off. Because of the nature of the placement area's scattered use, and the comparative small volumes of material that will be placed in it, this placement area was not factored into the storage capacity analysis for the 50-year maintenance of the project.

4.1.1.10 PA 1 (EPA-designated Offshore Maintenance Material Placement Area)

PA 1 is a 510-acre rectangular open-water placement area located approximately 2 miles offshore and 1,000 feet south of the channel centerline as shown on Plate F-29 in the Feasibility Report. The placement area will be used to dispose of approximately 62.0 mcy of maintenance material dredged from the Entrance Channel over a 50-year period.

4.1.1.11 PA 13 (La Quinta Channel)

PA 13 is a 750-acre upland confined placement area at the northeast corner of Corpus Christi Bay flanking the west side of La Quinta Channel as shown on Plate F-45 in the Feasibility Report. PA 13 will be used to contain approximately 3.7 mcy of new work material obtained from excavating the proposed channel extension, and 25.2 mcy of future maintenance material.

4.1.2 Proposed New (Beneficial Use) Placement Areas

The project will utilize the beneficial use of dredged materials to create two offshore sites, one upland site, and 5 open water sites. These beneficial use sites will be used mainly to create protected shallow water and emergent island habitats. Other uses include underwater topographic relief for potential offshore fishery enhancement or as a source of offshore sand for "feeding" the existing sand beach shoreline, for protection of existing habitats, and providing material for the future creation of a buffer zone that will be eventually landscaped as a tree-lined greenbelt between public and industrial properties.

4.1.2.1 Upper Bay – BU Site CQ

BU Site CQ is a proposed rectangular open-water site encompassing approximately 250 acres of shallow water and emergent island habitat. It is located north of the CCSC and west of the La Quinta Channel as shown on Plate F-32 in the Feasibility Report. The placement area will be bordered on three sides by a hydraulic-fill embankment protected by dredge material-filled geotubes and riprap. An emergent "fringe levee" will be constructed along the interior of the embankment for the planting of marine vegetation. The project provides for the deposition of approximately 2.9 mcy of new work material only to create viable seagrass beds and marsh habitat with small emergent mounds distributed within the area. No future maintenance material will be placed into this area.

4.1.2.2 BU Site S

BU Site S is a proposed triangular-shaped open-water site encompassing approximately 121 acres of shallow water marine habitat. The placement area will be bordered on its east side by a hydraulic-fill embankment protected by riprap and dredge material filled geotubes. BU Site S is on the south side of the ship channel west of the GIWW as shown on Plate F-31 in the Feasibility Report. The project provides for the deposition of approximately 1.5 mcy of new work material only to create a shallow water environment. No future maintenance material is planned to be placed into this area.

4.1.2.3 BU Site R

BU Site R is a proposed triangular-shaped open-water site encompassing approximately 201 acres of shallow water marine habitat. The placement area will be bordered on the south and west sides by a hydraulic-fill embankment protected by riprap and geotubes on the exterior slopes. BU Site R is located on the south side of the ship channel east of the GIWW as shown on Plate F-31 in the Feasibility Report. The project provides for the deposition of approximately 2.4 mcy of new work material only to create a shallow water environment. No future maintenance material is planned to be placed into this area.

4.1.2.4 BU Site I

BU Site I is a proposed triangular-shaped open-water site, encompassing approximately 163 acres of shallow water marine habitat. The placement area will be bordered on the south and east sides by a hydraulic-fill embankment protected on the exterior slopes by riprap and dredge material-filled geotubes. BU Site I is situated on the north side of the ship channel east of the Gulf Intracoastal Waterway (GIWW) as shown on Plate F-30 in the Feasibility Report. The project provides for the deposition of approximately 2.1 mcy of new work material only to create a shallow water habitat, with islands in the interior and a high mound in the protected corner. No future maintenance material is planned to be placed into this area.

4.1.2.5 BU Site Pelican

BU Site Pelican, shown on Plate F-34 in the Feasibility Report, is an existing site adjacent to and south of the channel between BU Site R and PA 6. This area will not be used for the placement of new work material, but will continue to be used for placement of maintenance material that is part of the ongoing rookery island enhancement. The existing open water channel between Pelican and Mustang Islands will be maintained to prevent land bridge access by predators to Pelican Island from Mustang Island. The project will provide for 1,500 linear feet of shore protection on the northeast corner of the island. It will also provide for approximately 2,200 LF of dredge-filled geotube extending south on the east end of the island. Although no new work material will be disposed in the placement area per se, approximately 300,000 cy of suitable quality new work material will be used to fill the geotubes.

4.1.2.6 BU Site MN

BU Site MN is a proposed 440-acre offshore site located 10,000 feet south of the centerline of the project channel centerline, just outside the 30-foot contour as shown on Plate F-29 in the Feasibility Report. Approximately 1.7 mcy of new work material will be placed into this area, providing topographic relief to the offshore gulf bottom, and thereby enhancing the marine ecosystem in the area. The project does not allow for the deposition of any future maintenance dredged material into this area.

4.1.2.7 BU Site ZZ

BU Site ZZ (EPA-designated Navy Homeport ODMDS) is a proposed 1,150-acre offshore deep-water site, located south of the project channel centerline as shown on Plate F-29 in the Feasibility Report. Approximately 2.6 mcy of new work material will be placed into this area to provide topographic relief to the ocean bottom, thereby enhancing the marine ecosystem in the area. The project does not allow for the deposition of any future maintenance materials into this area.

4.1.2.8 BU Site E

BU Site E, or Buffer Zone, is a proposed 100-acre upland site located on Port of Corpus Christi Authority property just north of the new turning basin proposed for the La Quinta Channel Extension, as shown on Plate F-33 in the Feasibility Report. Approximately 1.0 mcy of new work material (primarily clay) will be placed in this area to serve as a future source of borrow for landscaping an environmentally aesthetic greenbelt that will separate public-use lands from industrial sites.

4.1.2.9 BU Site GH

BU Site GH is a proposed rectangular open water site encompassing approximately 200 acres of shallow water marine habitat. The placement area will be bordered on the south and west by hydraulic-fill embankments protected by dredge material-filled geotubes and riprap. An emergent fringe levee will be constructed along the interior of the embankment for the planting of marine vegetation. BU Site GH is located at the end of the existing La Quinta Channel just west of PA 13 as shown on Plate F-33 in the Feasibility Report. The project provides for the deposition of 2.5 mcy of new work material only to create a shallow water habitat. No maintenance material will be placed into this area. Fifteen (15) acres of seagrass will be planted on the eastern portion of the area to mitigate for five (5) acres of seagrass affected by the creation of the La Quinta extension.

4.1.3 Additional Beneficial Use Project Features

Other project features beneficial to the existing coastal environment will be constructed. Although these features will not employ the beneficial use of dredged material, as the beneficial use sites discussed above do, they nevertheless will benefit the environment by providing needed erosion protection along select areas of shoreline. Shore protection is proposed along the north shoreline of Mustang Island, which is on the south side of the ship channel near Port Aransas, and a rock breakwater is proposed off Port Ingleside at the La Quinta Channel junction.

4.1.3.1 BU Site L

BU Site L was selected as a plan feature to protect the existing sensitive coastal "sand flats" habitat that is eroding due to ship wakes along the channel. The area is located on the south bank of the channel between Piper Channel and the public fishing pier just west of Port Aransas, as shown on Plate F-35 in the Feasibility Report. Stone protection will be added to the existing bank to preserve the shoreline and offer protection to the east flats area.

4.1.3.2 BU Site P

BU Site P was selected as a plan feature to serve as a breakwater along the east bank of the La Quinta Channel and Port Ingleside, as shown on Plate F-32 in the Feasibility Report. BU Site P will function as a breakwater to minimize bank erosion and offer protection to the shallow water seagrass habitat, currently in place.

4.1.4 New Work Material

The quantities of new work material to be disposed of, by reach, are shown in Table F-1 above. The placement plan was developed using the beneficial use plan developed cooperatively by the Corps of Engineers, the PCCA, and participating resource and regulatory agencies. In addition to the seven (7) new beneficial use sites, sixteen (16) existing sites are proposed for use, which include nine (9) open water areas and seven (7) upland confined areas. The beneficial use sites were sized using bathymetry information furnished by Pacific International Engineering (PIE), the project's shoreline erosion study engineering consultant, that was generated from surveys taken by the Corps of Engineers, in conjunction with the alignments for the hydraulically-placed levees obtained from the beneficial use plan. PIE designed and calculated the quantities of the beneficial use site's containment and erosion protection. The Corps of Engineers determined the quantities by channel reach to be deposited into each beneficial use site to ensure the beneficial use plan for environmental enhancement could be realized. Use of the existing open water sites is unrestricted because their capacity to contain maintenance material is considered to be unlimited. The design considerations for the existing upland confined placement areas are discussed below. The placement plan that was developed for new work dredging is presented in Table F-3 below.

4.1.5 50-Year Maintenance Material

The quantities of maintenance material to be disposed of, by reach, are shown in Table F-2 above. The placement areas to be used for this work consist of the designated offshore site, Pelican Island beneficial use site, the eight (8) bay (open water) sites, one open water beneficial use site, and seven (7) existing upland confined sites. Again, the open water sites are considered to have unlimited capacity to contain the maintenance material, and are therefore not a concern. However, in an effort to improve management practices at these open-water sites and possibly reduce dredging frequency, in accordance with the non-Federal sponsors request, the dredge pipes will be placed at the back limits of the designated placement sites to release dredged material as far from the channel as possible. Material for nourishing Pelican Island will be placed in a semi-confined upland portion of the island and allowed to flow to the beach/open water. The upland confined placement areas will be

TABLE F-3

PLACEMENT PLAN FOR NEW WORK MATERIAL

Station	Station	Dredging Quantity (mcy)	Designated Placement Area Number	Designated Placement Area Size (acres)
Entrance Channel				
310+00	150+00	2.6	BU Site ZZ	1,150
150+00	-37+82	1.7	BU Site MN	440
Lower Bay				
12+55	180+00	2.7	PA 6	304
180+00	330+00	2.1	BU Site I	163
330+00	350+00	0.3	BU (Pelican)	NA
350+00	475+00	2.4	BU Site R	201
475+00	549+00	1.5	BU Site S	121
Upper Bay				
549+00	649+00	2.9	BU Site CQ	250
649+00	670+00	0.9	PA 14-A	NA
670+00	725+00	1.6	PA 14-B	NA
725+00	780+00	1.6	PA 15-A	NA
780+00	840+00	1.7	PA 15-B	NA
840+00	900+00	1.5	PA 16-A	NA
900+00	960+00	1.6	PA 16-B	NA
960+00	1020+00	1.6	PA 17-A	NA
1020+00	1080+00	1.4	PA 17-B	NA
Inner Harbor				
1080+00	1125+00	0.8	IH-PA 1	350
1125+00	1172+00	0.8	IH-PA 2	230
1172+00	1246+00	1.0	IH-PA 3A	200
1246+00	1320+00	1.0	IH-PA 3B	183
1320+00	1460+00	1.6	IH-PA 6/Tule Lake	360
1460+00	1561+00	1.2	IH-PA 8/Suntide	306
La Quinta				
309+51	362+00	2.7	PA 13	750
362+00	370+00	1.0	PA 14 (E)	100
370+00	382+00	2.5	BU Site GH	200
TOTAL		40.7		

designed to contain the maintenance material removed from the channel over a 50-year period. This can be accomplished only if the design incorporates the infusion of new work material in a manner that will allow for future raising of the perimeter levee embankments to the elevations necessary to contain the anticipated volume of dredged material. The placement plan developed for disposal of the project life maintenance material is presented in Table F-4 below. The table includes the dredging frequency for each channel reach.

4.2 DESIGN CONSIDERATIONS

4.2.1 Existing Upland Placement Areas

The existing upland placement areas designated for use under this project will require embankment designs necessary to contain both new work material from project deepening and widening, as well as maintenance material over a 50-year period. The existing upland confined PAs generally have very limited capacities, mainly due to poor foundation conditions that restrict the height to which the levees can be built. This is because, as the embankment crown is continually raised to the inside of the existing confined placement area perimeter alignment, the foundation soils upon which the raised portion of the embankment is constructed, gradually become the confined maintenance materials from past maintenance dredging operations. Maintenance materials include all materials that collect in the channel bottom over time, and are generally very soft, highly plastic clays and clayey silts, very unsuitable as foundation material. A section typical of the existing upland placement areas is shown on Plate F-41 in the Feasibility Report. Existing levees must be raised regularly to elevations sufficient to contain the maintenance material. However, the levees can only be raised as high as the available satisfactory material allows.

For placement area locations, the only place to obtain satisfactory material for embankment raising, short of costly hauling in the material, is to use side-cast material from inside the placement area. Normally, the soft, silty / clayey dredged material cannot be used for this purpose because it is too wet to be used for fill. However, the material does dry out over time and forms a crust that can be excavated and used in the raising the levee embankments. Unfortunately, the material that can be recovered by side casting is limited, and therefore the height to which the levee can be raised is limited. Without the introduction of stiff clay material into the area, the remaining volumetric storage capacities of the areas will not be sufficient to accommodate 50 years of maintenance material deposition. Therefore, the project proposes to use new work material excavated in conjunction with the channel deepening and widening to "ring" the inside of existing levees. This will require positioning the dredge discharge pipe along the inside slope of the existing levee and continuously moving it such that the satisfactory material will stack and displace the soft material. By doing this, a good foundation can be established, upon which the levees can be raised to the heights necessary to contain the future maintenance material.

4.2.2 Proposed Beneficial Use Placement Areas

Eight (8) of the nine (9) beneficial use sites will be used to contain new work material removed from the channel (BU Site Pelican will only be used to store maintenance material). These "new

TABLE F-4

PLACEMENT PLAN FOR 50-YEAR MAINTENANCE MATERIAL

From Station	To Station	Dredging Frequency (mcy)	Dredging Quantity (mcy)	Designated Placement Area
Entrance Channel				
310+00	-37+82	3	62.0	PA 1
Lower Bay				
12+55	540+00	6	11.7	BU Pelican
Upper Bay				
540+00	629+00	6	11.0	PA 14-A
629+00	706+00	6	10.9	PA 14-B
706+00	783+00	6	10.9	PA 15-A
783+00	854+00	6	10.9	PA 15-B
854+00	916+00	3	11.0	PA 16-A
916+00	972+00	3	10.9	PA 16-B
972+00	1028+00	3	10.9	PA 17-A
1028+00	1080+00	3	10.9	PA 17-B
Inner Harbor				
1080+00	1142+00	3	10.6	IH-PA 1
1142+00	1172+00	3	5.2	IH-PA 2
1172+00	1320+00	3	1.0	IH-PA 3B
1320+00	1460+00	3	1.1	IH-PA 6 or Mustang Isl.
1460+00	1561+00	3	1.0	IH-PA 6 or Tule Lake
La Quinta				
12+74	57+00	4	2.8	PA 10
57+00	382+00	4	25.2	PA 13
TOTAL			208.0	

work" sites must first be partially enclosed with hydraulically-placed levees along alignments having water depths of up to 12 feet. Satisfactory material, as determined from the information summarized in Table F-1 above, will be used to construct these emergent levees. The constructed levees will in turn provide a firm foundation for the dredge material-filled geotubes and other erosion protection of sufficient height to provide a sheltered environment conducive to establishing a shallow water habitat. Once the containment levees are in place, the remaining new work material to be dredged from a particular reach of channel can be placed to the lines and grades necessary to create shallow water environments, high mounds, and scattered small islands for estuarine habitat. The remaining beneficial use site, BU Site Pelican, will only require a similar hydraulically-placed containment levee.

4.2.3 Remaining Beneficial Use Sites

The two remaining beneficial use sites, BU L and BU P, are strictly erosion protection features that will be used to protect environmentally important habitat. BU Site L will serve to protect the shoreline from further erosion and encroachment to the existing barrier islands flats. BU P will serve as a breakwater to protect existing seagrass habitat between the ship channel and existing shoreline.

4.2.4 Entrance Channel Inlet at Jetties

Plate C-15 in the Feasibility Report shows the possible remnants of an old submerged rock groin immediately adjacent to the Entrance Channel's north bank from approximate Sta. 0+00 to Sta. –28+00. Recent hydrographic surveys, some probings, and interviews with Southern Area Office personnel (who administer maintenance dredging contracts) have failed to verify either the location or even the existence of such a rock groin. Therefore, additional probings will be required before plans and specifications for the new work dredging contract are prepared to ascertain whether submerged rock associated with the existence of this feature is actually present, as that may impact dredging operations in the area. If such probing work does indicate the possibility of submerged rock, then the plans and specifications will be composed to ensure that the rock that could be expected to be encountered in the deepening (and incidental widening of the side slopes) will be required to be removed before any new work dredging in this reach. For this reason, this report assumes the removal of about 1,000 LF of this rock groin, or approximately 16,000 tons, as part of the new work dredging for this reach of channel.

4.3 CONSTRUCTION TECHNIQUES

4.3.1 Project Channels

Pipeline and hopper dredges of sufficient size and power will be needed to pump the new work material to the areas shown on the plates in the Feasibility Report. The dredges used to place the material in the offshore sites will have to have the capability of precisely depositing the material in a prescribed manner within defined discharge corridors. The dredging industry has sufficient plant and equipment available in this area and nationwide that are capable of accomplishing the work.

4.3.2 Existing Upland Placement Area Sites

Pipeline dredges of sufficient size and power will be needed to excavate and pump new work material to, and completely along the existing perimeter levees. This will require constant monitoring and moving of the pipeline discharge to ensure that the new work clay balls discharged are properly stacked and placed along the existing levee side slopes. The stacking of material within discharge corridors other than along the inside slopes of existing levees may be allowed, depending upon the type of material that is expected to be excavated from the channel reach and upon the future borrow needs of the placement area for levee raising. This determination will not be made until plans and specifications are prepared for each specific channel reach.

4.3.3 New Beneficial Use Sites

Where hydraulic-fill embankments are required, the new work dredging contracts will be structured to direct the dredging contractor to use the dredge pipeline to initially pump the dredged material along the embankment alignment. The discharge pipes will have to be continually moved both laterally and along the alignment, in order to achieve the design embankment template. The material may be mounded to a height sufficient to allow for the mechanical movement and shaping of material to the lines and grades specified. Once the hydraulic-fill embankments are completed to a satisfactory length, a second, smaller dredge may begin to install the dredge-material-filled geotubes on the embankment crown. Other land-based equipment may complete the placement of required excavation and placement of geotextile fabric and stone protection. Where stone protection is required only to be placed underwater, barges with backhoes may be used in excavating to the lines and grades required and placing the blanket stone. Larger backhoes or cranes on barges may be required to place the larger stones of the breakwater. Smaller barges and backhoes, possibly in combination with land-based equipment, may be used to excavate to grade, and place geotextile fabric and stone protection for the shore protection required by the project.

4.4 SELECTION OF DESIGN PARAMETERS

4.4.1 Project Channels

Design parameters for the slope stability analyses performed were derived from individual or groups of soil borings in the proximity of the channel reach analyzed. Computer software used to analyzed cut slopes included the UTEXAS4 program distributed by the ERDC.

4.4.2 Placement Areas

Design parameters to evaluate the stability of the upland confined placement area levee embankments will be determined after new work material has been placed to the inside of the existing, in-place embankments. Because of the nature of the foundation material on which the new work material will be placed, there will be both initial- and near-term settlement involved. After a period of stabilization, soil borings will have to be taken to finalize the design for future crown raisings of the perimeter levees along all sites. Design parameters for beneficial use placement areas were used to the extent necessary to satisfy the designer that the proposed hydraulic-fill embankments were practical and feasible. Selected soil borings in the vicinity of each area were used to evaluate the general bearing capacities of foundation soil, but only to the extent necessary to verify that placement of the dredged material could be accomplished in the manner prescribed. Because of the nature of the finished product (shallow water habitat, open on one side), the design of the embankments, protected with stone protection and geotubes, will be of primary importance, with the inside fill areas receiving the remainder of the new work material for a given reach of channel. Practically speaking, this means that the inside "footprint" or acreage of the shallow water habitat cannot be predicted with absolute accuracy at this time. Therefore, the technical specifications for placing the material will be of utmost importance to the design of the embankments, and will dictate the design parameters for the final design when the plans and specifications are prepared.

4.4.3 Shoreline Erosion and Breakwater Protection

Pacific International Engineering (PIE), a consulting firm initially contracted by the PCCA to conduct an erosion study of the shoreline along the CCSC and La Quinta Channel, designed the beneficial use shoreline protection and breakwater features depicted. The design criteria included crest elevation, depth of scour, and rock size. Two basic assumptions were used in developing the design criteria. The first was that the breakwater structures would be designed to protect the placed dredged material from direct vessel-generated wakes and surges, and from wind-generated waves. The second was that they would not be designed so conservatively that they would withstand impacts from severe hydrological events, such as tropical storms and hurricanes. The crest elevation design criterion was premised on analysis of the water surface elevation fluctuations in the project area (refer to PIE reports entitled "Corpus Christi Ship Channel Improvement, Shoreline Erosion Study, Task 2, PCCA," dated January 2001, and "Corpus Christi Ship Channel, Mustang and Harbor Islands Shoreline Stabilization Projects, Texas General Land Office," dated November 2000). A 10-year return period of extreme surge estimated at approximately 5.0 feet mean lower low water (MLLW) was selected as a design criterion. This period, which is conservative because it assumes a relatively high frequency of occurrence of this event (usually the frequency of extreme surge events are 25, 50, or 100 years) was selected assuming that no significant damage to the placement area site would occur during overtopping of the crest. The potential depth of scour was estimated using two different engineering methods and then comparing the results calculated between the two. The methods used in the depth of scour analysis were:

a. Method 1 - CRESSWIN Model (Delft Hydraulics Lab). This method is based on a formula that calculates the scouring in front of a vertical wall in a fine, sandy bottom under wave impact. Input parameters and values for this method of calculation were: a wave height of 1.4 feet, a wave period of 3.0 seconds, and a water depth of 4.2 feet.

b. Method 2 - Combined formulae from studies by De Graauw and Pilarczyk (1980) and Mirtskhulava (1967). This method, from combined formulae, uses horizontal steady flow as a function of water depth, flow velocity, bed material, and the duration of the scour to derive the potential depth of scour.

It should be noted that soil conditions along the proposed shoreline protection are not uniform. For a conceptual level of study, non-cohesive soil conditions were assumed for all sites. The critical velocity assumed for the non-cohesive soil was 1.5 ft per second. A depth of scour equal to 3.0 feet was estimated to be a design criterion. The size of rock used for the breakwater and toe protection structures is derived from the analysis of two hydrodynamic effects – drawdown (pressure fields) and wind waves. Pressure-field effects analysis (PIE, January 2001) has identified the maximum rock size that will be stable on slopes of 1V on 2H as 2,200 lbs. This size rock is stable for design conditions that would be created by a single deep-draft vessel, 920 feet long by 174 feet wide, drafting 47 feet of water, and moving at a speed of 10 knots. For areas affected by wind waves, the maximum rock size requirement was estimated to be 1,000 lbs. This size rock is stable for a design wave height up to 2.5 to 3.0 feet for a 3- to 4-second period (PIE, January 2001).

4.5 CONSTRUCTION CONTRACTS

Seven construction contracts are planned. The first contract will be for the excavation of the La Quinta Channel Extension, constructing the barge lanes across Upper Upper Bay, and constructing the breakwater at Ingleside (BU Site P). The subsequent contract reaches in order will be:

- Entrance Channel (Sta. –30+00 to Sta. 310+00)
- Inner Basin/Port Aransas (Sta. 12+55 to Sta. 180+00)
- Lower Bay (Sta. 180+00 to Sta. 670+00)
- Upper Bay (Sta. 670+00 to Sta. 1080+00)
- Inner Harbor/Main Turning Basin and Industrial Canal (Sta. 1080+00 to 1320+00)
- Inner Harbor/Tule Lake and Viola Channels (Sta. 1320+00 to 1561+00)

As stated earlier, this appendix makes liberal assumptions regarding the design of the geotechnical features. Considering this, additional detailed engineering investigations and design analyses will have to be done when preparing the plans and specifications for each construction contract. The purposes of these investigations and analyses will be to affirm the assumptions made in this appendix and to document the design analysis for each engineering feature associated with the project in accordance with Corps of Engineers quality assurance policy. The following are brief descriptions of the additional work that will likely be necessary for each contract:

4.5.1 Contract No. 1: Dredging La Quinta Channel Extension (Sta. 309+51 to Sta. 382+00), Ingleside Breakwater (BU Site P), and Barge Lanes (Sta. 540+00 to 1050+00)

This work involves dredging to construct the La Quinta Channel Extension and the construction of three beneficial use sites (BU Site GH, BU Site P and BU Site E), as well as the "strategic placement" of new work material along the interior of PA 13, along the La Quinta Channel. The work also involves dredging of the proposed barge shelves across Upper Corpus Christ Bay, and the construction of a rock breakwater just off the shore of Ingleside-on-the-Bay adjacent to the existing La Quinta Channel. Material dredged from the barge shelves is to be placed into Open Water Placement Areas 14-A, 14-B, 15-A and 15B. At the time the plans and specifications for this contract are prepared, land surveys will have to be acquired for the two upland sites to be used for disposal and for BU Site E and PA 13. Additional hydrographic surveys will also have to be acquired for BU Site GH and along the alignment of the channel extension. Geotechnical investigations will include soil borings (on land) at the proposed beneficial use sites – BU Site E and PA 13. Additional hydrographic soil borings (in water) will have to be obtained for BU Site GH (shallow water habitat) and BU Site P (breakwater), and possibly some grab samples within the prescribed barge shelves will have to be taken. Geotechnical design will be required for the embankments and outlet works at BU Site E and PA 13, for the (submerged) embankments at BU Site GH, and the breakwater at BU Site P. At a minimum, the design work will include design of geotubes, jetties and erosion (stone) protection, and settlement investigations, depending upon the foundation conditions along the alignment for the embankment.

4.5.2 Contract No. 2: Dredging Entrance Channel (Sta. –37+82 to Sta. 310+00)

This work involves dredging the offshore reach of the project from Port Aransas into the Gulf of Mexico and placing the material into two separate offshore beneficial use placement areas – BU Site MN and BU Site ZZ. In the reach of channel from Sta. –37+82 to Sta. 150+00, the soil borings indicate that the material consists mostly of silty sand. This material will be deposited into BU Site MN, which will have a minimum prescribed water depth of 30 feet, utilizing a dumping pattern that will provide for underwater topographic relief. The material placed in this area will lend itself to providing a source of offshore material that may be transported by wave action to the surf zone and beach. From Sta. 150+00 to Sta. 310+00, the material is shown to have a more clayey consistency. This material will be placed in BU Site ZZ, utilizing a more solid mounding pattern further offshore, in an effort to enhance marine productivity by providing underwater topographic relief. The design of these beneficial use sites may require the use of a computer program, such as the ERDC program STFATE (Short Term FATE). The STFATE program calculates the location and geometry of a single "dump" from a hopper dredge. From the short-term characteristics of a single dump, the overall design (size) of the placement area can then be verified for sufficiency.

4.5.3 Contract No. 3: Dredging Lower Bay / Inner Basin at Port Aransas (Sta. 12+55 to Sta. 180+00)

This work involves dredging the channel westward from Port Aransas, construction of one beneficial use site (BU Site Pelican), and rehabilitation of PA 6, which is an existing placement area on Mustang Island adjacent to and south of the channel near Port Aransas. At the time the plans and specifications are prepared, land surveys will have to be acquired at both sites. PA 6 will require cross sections around its entire alignment. BU Site Pelican will require cross sections of the shoreline for the length of riprap to be placed along the channel. Soil borings may be necessary to validate information already on hand. The outlet works at PA 6 will require complete rehabilitation or a new structure, depending upon the condition of the present structure at the time the plans and specifications for this contract are being prepared.

4.5.4 Contract No. 4: Dredging Lower Bay Reach (Sta. 180+00 to Sta. 670+00)

This work involves dredging of the Lower Bay reach of channel and the construction of five beneficial use sites (BU Site I, BU Site R, BU Site S, BU Site CQ and BU Site Pelican). At the time the plans and specifications are prepared, hydrographic surveys, and perhaps some limited land surveys will have to be acquired at all sites. Geotechnical investigations will include soil borings and grab samples taken on the water from a spud barge at all sites. Geotechnical design will be required for the hydraulic-fill embankments and associated erosion protection, including armor plating with riprap or cellular-concrete mattress and geotubes.

4.5.5 Contract No. 5: Dredging Upper Bay Channel Reach (Sta. 670+00 to Sta. 1080+00)

This work involves dredging of the channel reach through Upper Bay. No construction work other than dredging will be required under this contract. The dredged material is to be placed into existing open water placement areas adjacent to the channel. The geotechnical effort involved in the preparation of this contract is expected to be minimal. Hydrographic surveys for the open water placement areas will have to be obtained.

4.5.6 Contract No. 6: Dredging Inner Harbor - Industrial Canal (Sta. 1080+00 to Sta. 1320+00)

This work involves the dredging of the channel reach from Upper Bay landward, into the land-locked portion of the channel, through the Main Turning Basin, Avery Point Turning Basin and Chemical Turning Basin. New work material removed from the channel will be "strategically placed" along the interior of existing upland confined placement areas IH-PA 1, IH-PA 2, IH-PA 3A, and IH-PA 3B. At the time the plans and specifications are prepared, land surveys will have to be acquired along the perimeter of the placement areas. Geotechnical investigations will include some additional soil borings and hand auger samples taken to supplement and verify known information, and to furnish new information on the characteristics of the soil at the time the work is planned. Soils design, including, but not limited to slope stability and settlement analyses, will be required at all upland sites. Structural analyses, including either rehabilitation or redesign of the outlet works at all sites will also be required.

4.5.7 Contract No. 7: Inner Harbor – Tule Lake and Viola Channels (Sta. 1320+00 to Sta. 1561+50)

This work involves the dredging of the land-locked industrial canal from the Tule Lake lift bridge near the Main Turning Basin through the end of the channel at the Viola Turning Basin. New work dredged material removed from the channel will be "strategically placed" along the interior of two existing upland confined placement areas – IH-PA 6 (Tule Lake) and IH-PA 8 (Suntide). At the time the plans and specifications are prepared, land surveys will have to be acquired along the perimeter of the placement areas. Geotechnical investigations will include some additional soil borings and hand auger samples taken to supplement and verify known information, and to furnish new information on the characteristics of the soil at the time the work is planned. Soils design, including, but not limited to slope stability and settlement analyses, will be required at the confined sites. Structural analyses, including either rehabilitation or redesign of the outlet works at all sites will also be required.

APPENDIX G

CORPUS CHRISTI SHIP CHANNEL –CHANNEL IMPROVEMENT PROJECT ECONOMIC APPENDIX

CORPUS CHRIST SHIP CHANNEL ECONOMIC BENEFIT ANALYSIS
ECONOMIC APPENDIX
4 APRIL 2003

Introduction

This appendix presents the economic evaluation of project modifications to the Corpus Christi and La Quinta channels. The project benefits were calculated based on reductions in transportation costs. Benefits were evaluated for the following alternatives: Corpus Christi depths of 48, 50 and 52 feet; deepening the existing Federal portion of the La Quinta Channel; extension of the La Quinta Channel Federal project; and widening Corpus Christi Bay Channel 400- and 500-foot reaches to 530 feet. In addition to widening of the bay channel, benefits were evaluated for a barge shelf in the 400-foot reach. The barge shelf would extend from 200 feet on each side from the toe of the proposed 530-foot channel.

An initial screening analysis of the plan alternatives was completed in January 2000. The screening results were presented at the 4 April 2000 Feasibility Scoping Meeting (FSM). The analysis showed that a Corpus Christi channel depth of 52 feet produced the highest net excess benefits for the deepening plans evaluated for the main channel. The results also suggested that additional studies were necessary to conclude if widening of the bay reach and extension of the La Quinta channel was in the Federal interest. An additional recommendation of the FSM was to further investigate deepening the La Quinta Channel beyond the existing project depth of 45 feet. In regard to channel widening, the non-Federal sponsor and pilots association expressed a strong interest in widening of the bay reach due to safety concerns along with associated vessel delays and self-imposed vessel meeting restrictions. The recommendation for widening the entire bay reach to 530 feet was based on the Engineering Research and Development Center (ERDC) findings and the safety interest of Port Aransas Pilots Association. The pilots presently limit vessel meetings to combined beam width up to 251 feet in the 400-foot reach and to combined loaded draft limit of 80 feet.

The project benefits were calculated for a 2006-2056 economic evaluation period and are based on the Fiscal Year (FY) 2003 Federal Discount rate of 5.875 percent and FY 2002 vessel operating costs (EGM 02-06). The EGM 02-06 was released in the Fall of 2002 and the next release will likely be in 2004. A 1998-2000 base period is displayed in the cost savings Tables. Some early release data for calendar years 2001-02 is also displayed in the presentation Tables; however, because its availability is not complete, evaluation is generally limited to review of its effects on the forecasted trendlines. This appendix consists of five sections. The first section presents the commodity forecasts and the next three sections contain the Corpus Christi Inner Harbor deepening and the widening benefits and the La Quinta Channel deepening and channel extension analysis. The last section contains a sensitivity of the channel deepening benefits.

Commodity and Fleet Forecast.

Due to the magnitude of the ocean-going tonnage transported through the Corpus Christi navigation system, historic trends were initially assessed for the purpose of determining the commodity groups currently or anticipated to be limited by the constraints of the existing and the without-project future channel dimensions. Within the context of this framework, channel constraints were defined to exist when some percentage of the tonnage associated with a commodity group is currently or anticipated to be transported in vessels that cannot be fully loaded. The historic transit data analysis revealed that at least some of the vessels used in the transport of crude petroleum, petroleum products, and grain are transported in draft-constrained vessels. Review of the historical transit data and vessel fleet trends resulted in detailed analyses for crude petroleum; petroleum products; and bulk grain. The detailed analysis included examination of port depths and associated trade route constraints. Tonnage associated with the remaining ocean-going commodity groups, which were found either not to be transported in draft constrained vessels at the current time or were of limited volumes, was analyzed in the aggregate. Barge traffic forecasts generated by the USCE for the Institute for Water Resources' "Inland Waterway Reports" were utilized to estimate the study area's 2006-56 shallow-draft barge movements.

The tonnage forecasts were developed using multiple-regression equations that incorporated data for the most recent 20 to 40 year period. The vessel fleet projections are based on analysis of existing fleet utilization and anticipated trends and the premise that vessel utilization will gravitate to the most efficient vessel sizes for a specific channel depth given port depth and trade route constraints. The project benefits reflect the inclusion of risk-based evaluation parameters. Probability distributions were calculated for the traffic forecasts. Risk based distributions were also used to calculate the estimated percentage of tonnage expected to utilize project depths over 45 feet.

The commodity and fleet projections prepared for the major commodity groups were primarily based on forecasts published in the U. S. Department of Energy's 2003 Annual Energy Outlook, January 2003; the U. S. Department of Commerce's 1996 Bureau of Economic Analysis projections[1]; and the February 2002 U. S. Department of Agriculture projections; and indices developed from historical trend data. The forecast data were assessed in relationship to the study area's historical commodity specific tonnage flows for the purpose of evaluating the relationship between historical U.S. tonnage volumes and study area tonnage. Assessment of the statistical variables associated with U. S. and study area tonnage provided the analytical support needed to determine which forecast would furnish the best long-term estimation of future study area tonnage flows. Total ocean-going tonnage for the 50-year period of analysis was established using the premise that the commodity groups that have historically represented the majority of foreign and coastwise tonnage, specifically, crude petroleum, petrochemical, and bulk grain would continue to dominate total tonnage in the future. A separate forecast of La Quinta container traffic was conducted.

Crude Petroleum

Corpus Christi crude petroleum imports exhibited a general upward trend during the nineteen nineties after the downturn experienced in the early eighties. Imports for the period 1991-00 averaged 29,908,000 short tons compared to 12,520,000 for the period 1981-90. In 2000, Corpus Christi imported 35,830,000 short tons. Table 1 displays 1965-2000 Corpus Christi and U. S. imports and production statistics. Analysis of the national and regional crude petroleum import volumes revealed a significant degree of correlation between study area and U. S. tonnage levels. The regional and national growth rates generally follow the same general trends, however, regional growth is characteristically higher than national growth. Average U. S. import levels increased by 72 percent from the nineteen-eighties to the nineties, and Corpus Christi imports increased by 139 percent. Corpus Christi and U. S. crude oil import trends are also correlated with U.S. production.[2] Increasing import levels for the study area and the nation parallels declines in domestic oil production. Average 1991-00 production for both the "lower 48 states" and Alaska was down 22 percent from 1981-90 levels.

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[1] For use in this document, the 1996 base associated with the Bureau of Economic Analysis projections was expanded to include records for 1997-2000. The BEA projections were used as input into regression equations, and the effect of the regression equation forecasts reflect the inclusion of the 1997-2000 expanded base. The BEA projections were used for Corpus Christi's grain export forecast.

[2] Regression analysis using Corpus Christi 1960-2000 crude oil imports as a function of U.S. Production generated an R Square of .64. The t-value and F statistics significant at the .001 level. The R Square estimated from the equation using Corpus imports as a function of U. S. imports for the same period is .92.

Table 1
United States and Corpus Christi 1960-2000
Crude Petroleum Imports and Production (1000's of short tons)

	Imports		**Production**	
Year	Corpus Christi	United States	Lower 48 States	Alaska
1960	92	55,703	385,827	84
1965	0	67,806	425,245	1,668
1970	222	72,494	514,636	12,532
1975	9,183	224,727	447,659	10,466
1980	11,060	288,924	382,881	88,671
1981	12,864	240,705	380,868	88,025
1982	8,769	190,982	380,346	92,757
1983	7,445	182,284	381,495	93,749
1984	8,894	188,092	392,559	94,479
1985	9,001	175,245	390,914	99,850
1986	13,092	228,747	372,723	102,109
1987	15,060	255,888	349,415	107,302
1988	15,563	280,351	335,860	110,627
1989	18,240	319,914	313,951	102,509
1990	16,269	322,708	305,346	97,014
1991	16,261	316,580	307,341	98,368
1992	17,365	333,951	299,341	94,018
1993	18,395	371,585	287,985	86,550
1994	29,756	386,711	279,141	85,269
1995	27,183	395,822	277,655	81,179
1996	36,737	412,176	278,165	76,435
1997	41,627	450,345	282,041	70,882
1998	39,886	476,638	277,723	64,273
1999	36,029	477,999	264,304	57,431
2000	35,840	484,584	266,099	53,234
2001	32,226	483,249	267,174	52,979
1981-90 Average Tonnage	12,520	238,492	360,348	98,842
1991-00 Average Tonnage	29,908	411,220	281,980	76,764
% Change	139%	72%	-22%	-22%
		Average Annual Growth Rates		
1981-90	2.6%	3.3%	-2.4%	1.1%
1990-91	9.2%	4.8%	-1.6%	-6.6%

Source: U.S. Army Corps of Engineers, Waterborne Commerce of the United States 1965-00 and U. S. Dept. of Energy, Energy Information Administration website, January 2003.

Corpus Christi's crude petroleum tonnage forecast was calculated using the EIA 2003 Annual Energy Outlook reference case 2000-25 projections. The EIA is projecting world oil demand to increase from 76 million barrels per day in 2001 to 123 million barrels per day in 2025, representing an average annual growth rate of 2 percent. The projected increase is due to growing petroleum demand in the U. S. as well as the Middle East, the former Soviet Union, the Pacific Rim developing countries, and China. OPEC oil production is expected to reach 60.2 million barrels per day (mbd) in 2020, representing a 123 percent increase over the 2001 and 2002 respective averages of 28 and 26 mbd. Foreign imports of crude oil have replaced domestic production for both the U. S. and Corpus Christi. The EIA notes that U. S. crude oil production is projected to decline at an average annual rate of 0.4 percent from 2001 to 2025. Advances in domestic exploration and production are not expected to offset declining oil resources. The share of demand met by net imports is projected to increase from 51 percent in 1999 to 68 percent in 2020. The EIA's current forecast shows U. S. imports increasing from 9 mbd in 2000 to 12.7 mbd in 2020 and to 13.1 mbd in 2025.

During the eighties, significant volumes of Alaskan crude petroleum was shipped to U. S. Gulf Coast ports in Post-Panama tankers from Chiriqui Grande, Panama. The Alaskan crude was shipped from Alaska to the western side of the Panama Canal where it was pipelined to Chiriqui Grande for distribution to the U. S. Gulf and East coasts. Alaskan crude is presently not shipped into Corpus Christi, nor other U. S. Gulf or East Coast ports, and shipments are not forecasted to resume in the future. Receipt of coastwise crude oil tanker vessels into Corpus Christi was low during the nineties and is expected to remain so for the foreseeable future. The EIA (January 2003) forecast shows a steady decline in Alaskan crude petroleum production from .99 million barrels per day in 2000 to .68 million barrels in 2011, followed by an increase to 1.23 million barrels per day in 2020 and decline to 1.17 million in 2025.

Corpus Christi's 2006-56 import volumes were estimated using a regression equation derivation with 1960-2000 Corpus Christi imports as a function of U. S. imports. The t value and F statistic for the equation are significant at the 99.9 percent level and the R square is .93. Figure 1 shows the trendlines for U. S. and Corpus Christi crude oil imports.

Figure 1
U. S. and Corpus Christi Crude Petroleum Imports 1960-2000 (short tons)

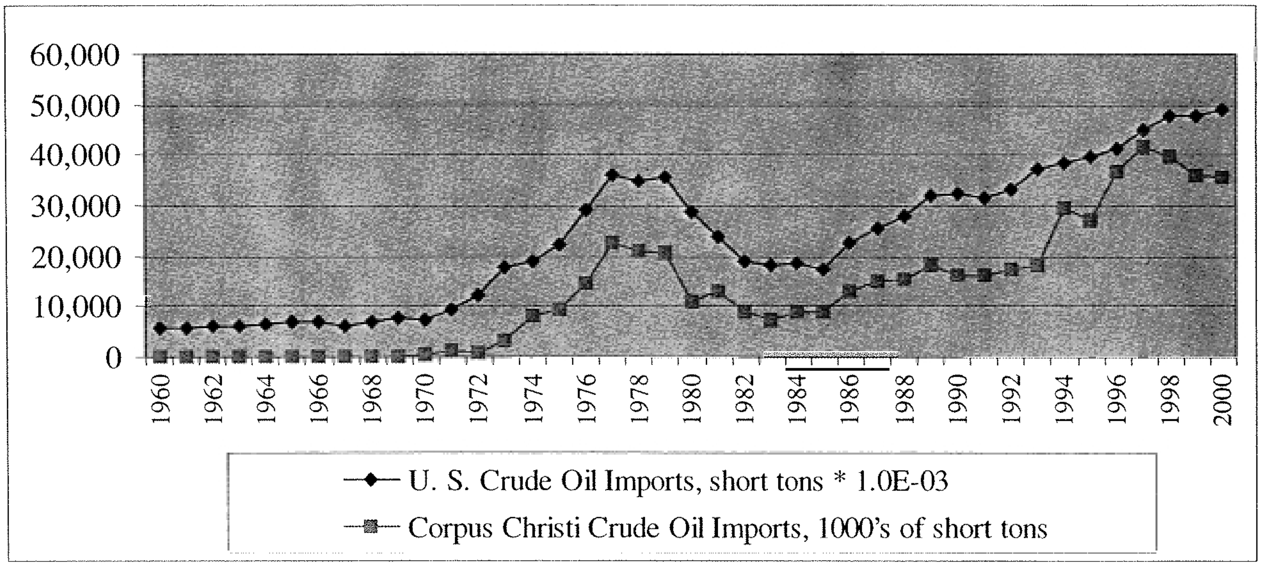


Table 2 displays the U. S. Corpus Christi tonnage forecasts. The 99 percent confidence interval associated with the estimated equation shown in Table 2 represents a relatively narrow upper and lower band of import levels. The standard error of the y estimate showed that Corpus Christi estimated tonnage is well within one standard error of the y estimate.

Petroleum Product Import Forecast

Table 3 presents Corpus Christi and U. S. petroleum import and export tonnage data. Corpus Christi refined products imports increased from an average of 4,863,000 short tons for the period 1981-90 to 8,335,000 for the period from 1991-00. In 2000, Corpus Christi imports were up by 27 percent from 1999 and U. S. levels were up 13 percent. Distribution of Corpus Christi and U. S. 1990-2000 product imports by major group is displayed in Table 4. Analysis of the historical national and regional product import volumes showed that, on average, study area imports increased at a higher rate than the national average. Regional growth was significantly higher for the 1981-90 period than between 1991-00. In recent years, regional growth has slowed and is

Table 2
Corpus Christi Crude Petroleum Import Tonnage Forecast (1998-2056)
1000's of Short Tons

Year	U. S. Imports EIA Reference Forecast	Corpus Christi Crude Petroleum Imports Base Case Imports a/	95% Confidence Interval Lower Range	Upper Range
1998	476,638	33,931	33,931	33,931
1999	477,999	34,049	34,049	34,049
2000	484,584	35,121	35,121	35,121
2006	570,286	42,037	32,601	51,474
2016	674,092	51,023	40,414	61,631
2025	709,060	54,050	45,835	62,264
2026	719,939	53,093	42,216	63,970
2036	838,342	55,247	44,098	66,398
2046	976,218	57,488	46,063	68,917
2056	1,136,769	59,821	48,117	71,532
		Average Annual Growth Rates		
2000-2025	1.5%	1.7%	1.1%	2.3%
2000-2056	1.5%	1.0%	0.6%	1.3%

Corpus Christi Crude Petroleum Imports = f(U. S. Imports) 1960-2000

Regression Equation Output

Multiple R	0.959
R Square	0.919
Adjusted R Square	0.917
Standard Error	3,512
Observations	40

Analysis of Variance Table

	df	SS	MS	F Statistic	Significance F
Regression	1	5.3E+09	5.3E+09	4.3E+02	2.4E-22
Residual	38	4.7E+08	1.2E+07		
Total	39	5.8E+09			
	Coefficients	Standard Error	t Stat	Lower 95%	Upper 95%
Intercept	-7327	1105	-6.6	-9564	-5090
U. S. Imports	0.087	0.004	20.8	0.078	0.095

a/ Corpus 2006 imports = -7327 + (U. S. 2006 Imports in BTUs * .087). The EIA 1998-2000, 2005, 2010, 2020 and 2025 respective import volumes are 18.9, 19.0, 19.7, 20.3, 22.3, 25.1, 26.9, 27.6, and 28.5 quadrillion Btu per year. The corresponding short tons equivalents are 476, 478, 490, 556, 570, 626, 688, and 709 thousand, respectively.

b/ The 2020-2025 growth rate of 2.9% was used to estimate gross domestic product for 2025-56.

Source: Application of the U. S. Department of Energy (DOE/EIA), 2003 Annual Energy Outlook, reference case forecast, January 2003.

Table 3

U. S. and Corpus Christi 1965-2000 Petroleum Products Imports and Exports (1000's of short tons)

	United States a/		Corpus Christi b/	
Year	Imports	Exports	Imports	Exports
1960	43,843	10,614	444	141
1965	67,252	10,070	148	2
1970	114,617	13,409	29	1
1975	106,732	11,133	55	67
1980	90,304	14,136	287	73
1981	87,483	20,062	666	290
1982	88,896	31,658	1,717	1,097
1983	94,197	31,459	3,705	1,293
1984	110,304	29,651	4,655	1,444
1985	102,095	31,556	4,776	1,143
1986	111,895	34,496	6,187	1,675
1987	109,622	33,536	5,287	1,952
1988	125,913	36,232	6,135	1,844
1989	121,297	39,233	7,389	1,631
1990	116,152	40,918	8,112	1,901
1991	100,899	48,402	7,913	2,813
1992	98,999	47,226	8,441	2,393
1993	100,298	49,479	7,316	2,774
1994	105,742	46,142	10,527	2,451
1995	87,816	46,755	7,818	2,042
1996	108,170	47,762	8,350	3,092
1997	106,470	49,001	8,388	3,241
1998	109,760	45,659	7,495	2,815
1999	116,340	44,960	7,627	2,699
2000	131,160	54,307	9,702	3,112
2001	139,390	52,441	8,304	3,483
1981-90 Average	106,785	32,880	4,863	1,427
1991-00 Average	106,565	47,754	8,335	2,667
% Change	-0.2%	45%	71%	87%
	Average Annual Growth Rate			
1981-90	3.2%	8.2%	32.0%	23.2%
1991-00	3.0%	1.3%	2.3%	1.1%

a/ U. S. Department of Energy, Energy Information Administration, January 2003.

b/ USACE, Waterborne Commerce of the United States, 1965-2000, Part 2.

Table 4
Corpus Christi and United States
Major Petroleum Product Imports (1000's of short tons)

Corpus Christi Petroleum Product Foreign Imports, Major Groups

	1990	1995	1996	1997	1998	1999	2000
Gasoline	0	0	0	0	0	0	96
Kerosene	0	0	0	60	141	142	0
Naphtha & solvents	1,940	1,964	5,410	5,719	4,610	2,846	1,129
Distillate fuel oil	0	228	196	195	711	2,487	1,608
Residual fuel oil	4,824	4,846	1,973	1,415	1,017	1,315	5,024
Lube oil	1,228	780	728	999	957	835	1,794
Sub-group total	7,992	7,818	8,307	8,388	7,436	7,625	9,651
Total Product Imports	8,112	7,818	8,350	8,388	7,495	7,627	9,652
Sub-group %	99%	100%	99%	100%	99%	100%	100%

United States Petroleum Product Foreign Imports, Major Groups a/

	1990	1995	1996	1997	1998	1999	2000
Gasoline	19,156	12,121	21,522	19,802	16,077	17,260	24,367
Kerosene	4,134	4,102	4,304	5,087	5,674	6,317	7,383
Naphtha & solvents	14,034	11,140	15,497	14,131	12,572	14,329	17,999
Distillate fuel oil	14,477	14,509	17,774	16,986	21,543	24,179	21,294
Residual fuel oil	44,035	29,113	30,940	29,844	32,676	33,040	40,711
Lube oil	13,298	10,738	9,758	11,390	11,780	10,224	9,118
Sub-group total	109,134	81,724	99,794	97,240	100,321	105,348	120,873
Total Product Imports a/	116,152	87,816	108,170	106,470	109,760	116,340	131,160
Sub-group %	94%	93%	92%	91%	91%	91%	92%

Source: U. S. Army Corps of Engineers, Waterborne Commerce of the U. S., 1990-2000, and U. S. Department of Energy, Energy Information Administration.

generally comparable to national growth patterns. In spite of the recent plateau in national growth, with a .2 percent decline between the 1981-90 and 1991-00 averages (Table 2), the EIA is projecting future growth in refined product import volumes. Projected demand is expected to outpace anticipated refinery capacity expansions. The EIA notes that in spite of seeming stability in product imports, significant structural shifts occurred over the last few decades in the mix of products that the U. S. imports. Residual fuel oil imports are projected to decline and be replaced by unfinished gasoline and gasoline blending components. The EIA is forecasting increases in petrochemical feedstock imports, such as naphtha and gas oils. It is noted that the Gulf Coast imports significant amount of feedstock to support its role as the main U. S. refining and petrochemical center. The EIA reference forecast shows imports of gross refined products, which includes blending components, increasing from 1.32 million barrels per day in 2000 to 5.32 million barrels per day in 2025. The forecast shows unfinished product imports, other than crude oil, increasing from 1.05 million barrels per day in 2000 to 2.51 million barrels per day in 2025.

The EIA forecasted growth is expected to effect imports of naphtha, distillate fuel oil, and kerosene. Corpus Christi oil company transportation analysts verified that an increase in refined product imports would be necessary to meet processing needs and associated demand. Refined products are expected to comprise a low of 29 percent to a high of 39 percent of net petroleum imports in 2025, as compared to 19 percent in 2000. The EIA noted that falling demand for petroleum and the deregulation of the domestic refining industry in the 1980s led to 13 years of decline in U. S. refinery capacity. During the late 1990s, domestic distillation capacity increased. It was noted in the 2002 Annual Energy Outlook (AEO) that financial and legal constraints would make it unlikely that anticipated refinery expansion can met future demand; however, it is noted in the 2003 AEO, released January 2003, that additions at existing refineries are expected to increase total U.S. refining capacity. The EIA notes that distillation capacity is projected to grow from the 2001 year-end level of 16.8 million barrels per day to 19.8 million barrels per day in 2025 in the reference case, 19.6 million barrels per day in the low economic growth case, and 20.4 million barrels per day in the high growth case, compared with the 1981 peak of 18.6 million barrels per day. Almost all the capacity additions are projected to occur on the Gulf Coast. Existing refineries are expected to continue to be utilized intensively (91 to 95 percent of operable capacity) throughout the forecast. The 2001 utilization rate was 93 percent, well above the lows of 69 percent during the 1980s and 88 percent during the early 1990s but consistent with capacity utilization rates since the mid-1990s. Additional "downstream" processing units are expected to allow domestic refineries to produce less residual fuel, which has a shrinking market, and more of the higher value "light products," such as gasoline, distillate, jet fuel, and liquefied petroleum gas.

Table 5 summaries U. S. crude petroleum refinery data for the period 1965-2000. The data presented in Table 5 shows that refinery utilization increased in the nineteen nineties after several years of decline. The U. S. Gulf Coast leads the nation in refinery capacity, with more than twice the crude oil distillation capacity. The Gulf Coast is the nation's leading supplier in refined products. Products, such as gasoline, heating oil, diesel, and jet fuel, are transported from the Gulf Coast to the East Coast and the Midwest. As of January 2001, Texas petroleum refineries were operating at 99.3 percent of capacity. In calendar year 2000, Texas Gulf Coast capacity was 93.4. Data presented in the Petroleum Supply Annual shows that in 1999 Texas refinery atmospheric crude oil distillation capacity was 4,282,430 barrels per day and operating capacity 4,265,430. Fifteen percent of Texas crude oil refinery capacity is presently located in Corpus Christi.

Table 5
United States 1965-1999
Refinery Capacity and Utilization

Year	Number of Operating Refineries	Refinery Capacity Barrels/Day	Gross Input to Distillation Barrels/Day	Operable Refineries Utilization Rate
1965	293	10,419,851	9,535,395	91.5%
1970	276	12,021,273	11,491,018	95.6%
1975	279	14,960,710	12,873,296	86.0%
1980	319	17,988,121	13,802,736	76.7%
1985	223	15,658,769	12,137,936	77.5%
1990	205	15,571,966	13,579,314	87.2%
1991	202	15,675,627	13,477,804	86.0%
1992	199	15,696,155	13,607,175	86.7%
1993	187	15,120,630	13,820,256	91.4%
1994	179	15,034,160	14,000,343	93.1%
1995	175	15,434,280	14,087,230	91.3%
1996	170	15,333,450	14,344,353	93.5%
1997	164	15,451,785	14,804,822	95.8%
1998	163	15,711,000	15,079,207	96.0%
1999	159	16,261,290	15,052,213	92.6%
2000	158	16,510,000	15,310,000	92.6%
1980-90 Average	249	16,406,285	13,173,329	80.5%
1990-00 Average	178	15,618,213	14,287,520	91.5%
% Change	-28%	-5%	9%	14%

Source: U. S. Department of Energy, Energy Information Administration, Annual Energy Outlook, 2003, website data.

Table 6 presents Corpus Christi's 2006-56 petroleum product import forecast. The forecast was estimated using a regression equation with 1960-2000 Corpus Christi petroleum product imports as a function of U. S. petroleum product imports and U. S. gross domestic product. Other variables, such as petroleum production, and energy consumption were tested; however, the

Table 6

U. S. and Corpus Christi Petroleum Product Import Forecast (1998-2056)

Thousand of Short Tons

Year	U. S. Gross Domestic Product Billions of $96	US/EIA Product Imports: Reference Case	US/EIA Product Imports: High Growth	Corpus Christi Petroleum Product Imports: Base Case Forecast Application a/	99% Confidence Interval: Lower Range	99% Confidence Interval: Upper Range
1998	8,509	109,760	109,760	7,495	7,495	7,495
1999	8,859	116,340	116,340	7,627	7,627	7,627
2000	9,191	131,160	131,160	9,702	9,702	9,702
2006	10,713	141,651	169,986	12,975	5,693	20,258
2016	14,702	189,573	301,585	19,472	10,240	28,703
2025	18,917	229,405	404,253	26,614	15,528	37,699
2026	19,447 b/	231,111	410,762	27,596	16,340	38,852
2036	25,632 b/	248,883	481,897	39,124	25,921	52,328
2046	33,784 b/	268,021	565,352	54,429	38,740	70,118
2056	44,529 b/	288,632	663,260	74,720	55,842	93,597
			Average Annual Growth Rates			
2000-2025	2.9%	2.3%	4.6%	3.9%	1.7%	5.3%
2000-2056	2.9% b/	1.4%	2.9%	3.6%	3.1%	4.0%

Corpus Christi Petroleum Product Imports = f (U. S. Petroleum Product Imports and U. S. Gross Domestic Product)

Multiple R	0.93
R Square	0.87
Adjusted R Square	0.86
Standard Error	1,373
Observations	41

Analysis of Variance Table

	df	SS	MS	F Statistic	Significance F
Regression	2	4.7E+08	2.4E+08	1.3E+02	1.9E-17
Residual	38	7.2E+07	1.9E+06		
Total	40	5.4E+08			

	Coefficients	Standard Error	t Stat	Lower 99%	Upper 99%
Intercept	-4138.5	890.1	-4.65	-5940.39	-2336.58
U.S. Product Imports	-0.026	0.009	-2.742	-0.045	-0.007
Gross Domestic Prod.	1.938	0.129	15.071	1.678	2.198

a/ Corpus 2006 imports = -5871.0 + (U. S. 2006 GDP * .1.7732).). The EIA 2000, 2001, 2005, 2010, 2020 and 2025 respective export volumes are 2.04, 2.08, 1.79, 2.59, 3.82, 5.02 and 6.76 million barrels per day. The respective short tons equivalents are shown in the Table above. . The 2001-25 gross domestic product average annual growth rate presented in the EIA forecast ranges from is 3.0% in 2001/05 to 2.8% in 2020/25. The EIA shows GDP peaking at 3.4% in 2005/10. Gross Domestic Product (1996 dollars) for the years 1998-2000 was $8,509, $8,859, and $9,191.

b/ The 2020-2025 growth rate of 2.9% was used to estimate gross domestic product for 2025-56.

Source: Application of the U. S. Department of Energy (DOE/EIA), 2003 Annual Energy Outlook, January 2003.

equation using U. S. product imports and gross domestic product generated the most significant t values and F statistic. These statistics are significant at the 99.9 percent level. The average annual growth rate for the period 2000-56 is estimated at 3.8 percent (Table 6) and the growth rate for 2000-25 is 4.6 percent. The study area's estimated average annual 2000-25 growth rate of 4.6 percent is higher than the EIA's 2000-25 average annual growth rate of 2.3 percent for U. S. petroleum product imports. Examination of the study area's historical trendline and the concentration of petroleum processing and distribution on the U. S. Gulf Coast suggests that a higher growth rate for the study area should not be surprising.

Petroleum Product Export Forecast

Corpus Christi refined products exports increased from an average volume of 1,244,000 short tons during the period 1980-89 to 2,622,000 tons between 1990-99. As shown in Table 3, Corpus Christi export volumes ranged from a low of 1,901,000 in 1990 to a high of 3,241,000 in 1997. In 2000, both Corpus Christi exports were up by 153 percent from 1999 and U. S. export levels were up by 21 percent. Corpus Christi experienced higher growth than the nation; however, both regional and national growth rates during the nineteen-nineties were generally low particularly in comparison to petroleum product import rates. The EIA is forecasting relatively modest growth for product exports over the period 2000-25. Exports of refined products are forecasted to increase at an average annual rate of .6 percent with an overall increase from .99 million barrels in 2000 to 1.10 million barrels in 2025.

Distribution of Corpus Christi and U. S. product exports by major group is presented in Table 7. During the period 1990-99, Corpus Christi product exports primarily consisted of petroleum coke, distillate fuel oil, and residual fuel oil. For the period 1990-99, petroleum coke comprised 38 percent of the total petroleum product exports; distillate fuel oil represented 26 percent, and gasoline 15 percent. Due to logistical, regulatory, and quality considerations, the Gulf Coast exports some lower quality gasoline to Latin America while the U. S. East Coast imports higher quality gasoline from Europe. Examination of 1996-98 petroleum export vessel routings showed that 26 percent of petroleum product were transported in vessels with design drafts over 43 feet and 18 percent in vessels with drafts over 46 feet. The larger vessels are used for the shipment of coke, fuel oil and gasoline. Eighty percent of 1996-98 petroleum coke exports were shipped to Northern Europe, 6 percent to North Africa and Mediterranean ports, and the remaining 14 percent were exported to South and Central America.

Table 7
Corpus Christi and United States
Major Petroleum Product Exports (1000's of short tons)

Corpus Christi Petroleum Product Foreign Exports, Major Groups

	1990	1995	1996	1997	1998	1999	2000
Petroleum coke	770	828	1,015	926	1,401	1,008	1,012
Naphtha & solvents	86	0	0	0	0	0	74
Distillate fuel oil	511	411	926	1,046	635	613	903
Residual fuel oil	52	395	386	220	294	276	38
Lube oil & greases	0	144	76	0	0	0	0
Kerosene	7	94	118	223	53	2	341
Asphalt	100	0	84	163	77	71	0
Gasoline	298	137	413	539	335	729	744
Sub-group total	1,824	2,009	3,018	3,117	2,795	2,700	3,112
Total Product Exports	1,901	2,042	3,092	3,241	2,815	2,699	3,112
Sub-group %	96%	98%	98%	96%	99%	100%	100%

United States Petroleum Product Foreign Exports, Major Groups

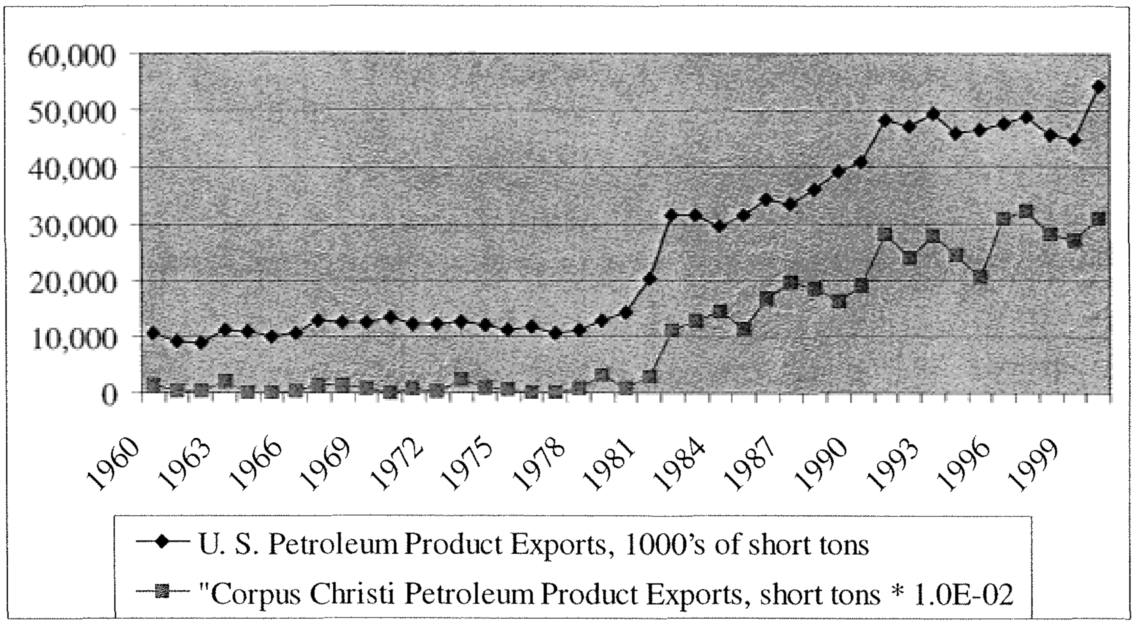
	1990	1995	1996	1997	1998	1999	2000
Petroleum coke	13,883	17,508	18,206	19,115	17,715	16,773	22,948
Naphtha & solvents	1,827	3,712	3,216	3,126	3,559	3,989	1,851
Distillate fuel oil	4,701	5,742	5,508	5,291	4,214	3,881	4,835
Residual fuel oil	11,592	8,790	8,016	7,667	8,520	9,385	12,390
Lube oil & greases	2,245	1,563	1,794	1,496	1,294	1,481	1,557
Kerosene	2,109	1,133	2,068	1,478	820	930	1,461
Asphalt	1,083	2,916	3,154	3,564	3,066	2,520	57
Gasoline	2,113	3,336	3,773	5,207	4,432	3,874	6,281
Sub-group total	39,552	44,701	45,735	46,944	43,620	42,831	51,379
Total Product Exports	40,918	46,755	47,762	49,001	45,659	44,960	54,307
Sub-group %	97%	96%	96%	96%	96%	95%	95%

Source: U. S. Army Corps of Engineers, Waterborne Commerce of the U. S., 1990-2000, and U. S. Department of Energy, Energy Information Administration.

The study area's petroleum product export forecast was estimated based on evaluation of historical trends and the EIA tonnage forecasts. Determination of the specific forecast was made based on analysis of the statistical parameters associated with trendlines and the EIA petroleum product export forecast. Analysis of 1960-2000 Corpus Christi and U. S. product exports showed a strong statistical relationship between the study area and the nation. Figure 2 displays the trendlines for U. S. and Corpus Christi product exports. The t value and the F statistic associated with the equation using Corpus exports as a function of U. S. exports is significant at the 99.9 percent level. The R square is .96. The standard error of the y estimate shows that Corpus Christi's estimated tonnage is well with one standard error of the y estimate. Table 8 displays the export forecast and regression equation outputs.

Figure 2

U. S. and Corpus Christi Petroleum Product Exports 1960-2000 (short tons)



As noted in Table 8, the Corpus Christi average annual growth rate for the period 2000-56 is .9 percent and the growth rate for 2000-25 is 1.1 percent. The study area's estimated average annual 2000-25 growth rate of 1.1 percent is comparable to the EIA's 2000-25 average annual growth rate of 1.2 percent for U. S. petroleum product imports. Review of the study area's historical trendline and the EIA national forecasts support the expectation that Corpus Christi future export volumes are likely to continue to reflect the Department of Energy forecasted national trend toward modest growth in refined product exports.

Table 8

Corpus Christi Petroleum Product Export Tonnage (1998-2056)

1000's of Short Tons

Year	U. S. Exports EIA Reference Forecast	Corpus Christi Petroleum Product Exports: Base Case Imports a/	95% Confidence Interval: Lower Range	95% Confidence Interval: Upper Range
1998	45,659	2,815	2,815	2,815
1999	44,960	2,699	2,699	2,699
2000	54,307	3,112	3,112	3,112
2006	50,869	2,860	2,366	3,354
2016	56,827	3,286	2,755	3,816
2025	60,341	3,537	2,985	4,089
2026	60,790 b/	3,569	3,014	4,123
2036	65,465 b/	3,876	3,298	4,455
2046	70,499 b/	4,210	3,607	4,814
2056	75,920 b/	4,573	3,946	5,201
		Average Annual Growth Rates		
2000-2025	1.2%	1.1%	0.4%	1.7%
2000-2056	0.9% b/	0.9%	0.7%	1.2%

Regression Equation Output

1960-00 Corpus Christi Petroleum Product Imports = f(U. S. Product Exports)

Multiple R	0.981
R Square	0.963
Adjusted R Square	0.962
Standard Error	226.2
Observations	41

Analysis of Variance Table

	df	SS	MS	F Statistic	Significance F
Regression	1	5.13E+07	5.13E+07	1002	1.99E-29
Residual	39	2.00E+06	5.12E+04		
Total	40	5.33E+07			

	Coefficients	Standard Error	t Stat	Lower 95%	Upper 95%
Intercept	-769.1	67.8	-11.4	-952.5	-585.6
x Variable	0.0714	0.0023	31.6505	0.0653	0.0775

a/ Corpus 2006 imports = -769.1 + (U. S. 2006 Imports * .0714). The EIA 2000, 2001, 2005, 2010, 2020 and 2025 respective export volumes are .99, .95, .91, 1.00, 1.03, 1.06, and 1.10 million barrels per day. The corresponding short tons equivalents are 45.0, 54.3, 49.9, 54.9, 56.5, 58.1, and 60.3 thousand, respectively. b/ Based on EIA's 2020-25 average annual growth rate for product exports.

Source: Application of the U. S. Department of Energy (DOE/EIA), 2003 Annual Energy Outlook, reference case forecast, January 2003.

Bulk Grain Exports

During the nineteen nineties, Corpus Christi bulk grain exports ranged from a low of 668,000 tons in 1992 to a high of in 1,654,000 in 1993, averaging 1,098,300 tons during over the 10-year period. Corpus Christi's 2000 bulk grain export total of 1,484,000 short tons consists of wheat (63.7%), sorghum (35.6%) and corn (.6%). The 2000 export level represents 1.7 percent of the U. S. total. For the 1991-00 period, wheat comprised 55 percent of Corpus Christi's grain exports, sorghum comprised 35 percent, and corn the remaining 10 percent. Wheat and corn exported from Corpus Christi is railed in from the Midwest. The majority of sorghum is grown within 150 miles of Corpus Christi. During the nineteen nineties, 40 percent of grain exports were shipped to Mexico and Central America, 34 percent to Africa, and the remaining 26% to Europe. Grain exports for the most recent decade are markedly low in comparison to the peak volumes of the nineteen seventies. Corpus Christi's highest export volumes were reported in 1973 when exports peaked at 4.9 million short tons. Table 9 displays Corpus Christi's historical bulk grain exports, growth rates, and the major variables evaluated in the formulation of the study area's grain export forecast. The growth rates show that Corpus Christi exports, particularly 1991-00 levels, were characteristically high in comparison to national levels.

The export forecast was formulated based on evaluation of a series of regression equations incorporating 1970-2000 U. S. grain production, gross domestic product, and U. S. and regional employment and income variables. Additional variables, including U. S. grain exports and world population were initially evaluated but dropped from consideration as they proved to be weak indicators of historic growth. Evaluation of Corpus Christi and U. S. grain exports revealed low correlation between regional and national trends. Comparison of the U. S. and Corpus Christi bulk 1991-00 grain export growth rates showed an annual growth rate of 7.4 percent and a U. S. rate of –1.5 percent. Comparison of 1991-00 annual changes for all years showed an average yearly increase of 15 percent for Corpus Christi and 2 percent for the nation. The study region's 1991-00 relatively higher growth shows Corpus Christi exports, at least historically, to follow a more accelerated trend line than national levels.

A strong correlation was, however, found for U. S. grain production of wheat and sorghum; and production was, subsequently, included in the final equation. Table 10 presents the USDA's 1999-2010 grain production and export forecast. The U. S. Department of Agriculture (USDA) is currently forecasting modest growth in grain production and exports. Wheat and sorghum exports are projected to increase at an average annual rate of 1.7 percent between 2000 and 2012 and corn exports are expected grow at an annual rate of 2 percent.

Table 9
Corpus Christi Grain Exports and Forecast Evaluation Variables

Year	Corpus Bulk Grain Exports 1000's short tons	U.S. Grain Production Millions bushels		U. S. Grain Exports Millions Bushels		Earnings millions $87		Gross Domestic Product Million $96
		Wheat	Sorghum	Wheat	Sorghum	Corpus MSA Transportation And Utilities	U. S. Farm Earnings	
1970	1.879	1.352	683	741	885	$207	$48.628	$3.578
1975	4,404	2,127	754	1,173	1,405	$313	$58,705	$4,084
1976	3,692	2,149	711	950	1,204	$420	$48,094	$4,312
1977	3,356	2,046	781	1,124	1,347	$367	$43,711	$4,512
1978	4,622	1,776	731	1,194	1,384	$395	$47,185	$4,761
1979	4,059	2,134	807	1,375	1,705	$436	$46,220	$4,912
1980	3,048	2,381	579	1,514	1,807	$444	$28,521	$4,901
1981	1,910	2,785	876	1,771	2,031	$383	$34,572	$5,021
1982	1,094	2,765	835	1,509	1,719	$345	$28,307	$4,919
1983	1,000	2,420	488	1,429	1,674	$303	$17,826	$5,132
1984	1,547	2,595	866	1,424	1,721	$306	$33,132	$5,505
1985	2,064	2,425	1,120	915	1,093	$304	$31,876	$5,717
1986	1,110	2,091	942	1,003	1,228	$250	$32,034	$5,912
1987	958	2,108	938	1,598	1,829	$226	$38,424	$6,113
1988	1,588	1,812	731	1,419	1,729	$214	$35,755	$6,368
1989	1,070	2,037	577	1,233	1,537	$204	$43,444	$6,592
1990	728	2,730	573	1,069	1,301	$202	$41,850	$6,708
1991	725	1,980	585	1,282	1,574	$197	$37,138	$6,676
1992	668	2,467	875	1,354	1,631	$204	$40,058	$6,880
1993	1,654	2,396	534	1,228	1,430	$207	$36,499	$7,063
1994	1,027	2,321	646	1,188	1,411	$215	$35,700	$7,348
1995	773	2,183	459	1,241	1,439	$228	$27,353	$7,544
1996	954	2,277	795	1,002	1,207	$279	$35,832	$7,813
1997	1,417	2,481	634	1,040	1,252	$216	$32,345	$8,160
1998	1,404	2,547	520	1,090	1,287	$223	$29,979	$8,509
1999	1,633	2,299	595	1,125	1,381	$222	$29,644	$8,859
2000	1,484	2,232	471	1,098	1,485	$226	$30,130	$9,191
				Average Annual Growth Rates				
1971-80	7.8%	3.9%	-4.0%	9.5%	9.4%	7.4%	-5.1%	2.9%
1981-90	-9.2%	-0.2%	-4.2%	-4.9%	-4.4%	-6.2%	1.9%	2.9%
1991-00	7.4%	1.2%	-2.1%	-1.5%	-0.6%	1.4%	-2.1%	3.2%

Source: USACE, Waterborne Commerce of the U. S.; USDA, Agricultural Statistics; U. S. Department of Commerce, Bureau of Economic Analysis. Note: Calendar Year 2000 exports for Corpus Christ were 950,000.

Table 10
United States Export and Production Forecast (millions of bushels)

	U. S. Grain Production by Major Bulk Grain Type a/				U. S. Grain Exports by Major Bulk Grain Type			
Year	Wheat	Sorghum	Corn	Total	Wheat	Sorghum	Corn	Total
1980/81	2,381	579	6,639	9,599	1,514	293	2,408	4,215
1990/91	2,730	573	7,934	11,237	728	232	1,725	2,685
1999/00	2,299	595	9,437	12,331	1,090	250	1,935	3,275
2000/01	2,232	471	9,968	12,671	1,061	240	1,940	3,241
2001/02	1,958	536	9,430	11,924	1,025	240	2,050	3,315
2002/03	2,190	595	9,735	12,520	950	250	1,925	3,125
2003/04	2,210	580	9,855	12,645	975	250	1,950	3,175
2004/05	2,235	590	10,115	12,940	1,025	255	2,000	3,280
2005/06	2,275	595	10,310	13,180	1,075	255	2,050	3,380
2006/07	2,315	600	10,505	13,420	1,100	260	2,100	3,460
2007/08	2,335	605	10,555	13,495	1,150	265	2,175	3,590
2008/09	2,395	620	10,750	13,765	1,200	270	2,275	3,745
2009/10	2,435	625	10,875	13,935	1,225	275	2,325	3,825
2010/11	2,475	635	11,075	14,185	1,250	285	2,375	3,910
2011/12	2,500	640	11,200	14,340	1,275	290	2,425	3,990
2000-2011/12 Average Annual Growth Rate								
	1.0%	2.8%	1.1%	1.1%	1.7%	1.7%	2.0%	1.9%

Source: U. S. Department of Agriculture, Economic Research Service (ERS), USDA Agricultural Baseline Projections to 2010, February 2002.
a/ Grain production statistics for 1999/00 through 2002/03 were obtained from data ERS, January 2003 report. The January 2003 report contains a short term forecast through 2003. The 1980/81 and 1990/91 statistics were obtained from earlier USDA reports. The 2002/03 to 2011/12 grain exports figures were obtained from the February 2002 forecast (Agricultural Baseline Projections to 2011/12).

The basis for final selection of the variables included in the regression equation was made based on the relative magnitude of the R squared values, the significance of the t-values, and the smallest standard error of the y coefficient. Analysis of the historic indicators demonstrated that Corpus Christi metropolitan statistical area transportation and utility earnings, U. S. farm earnings, U. S. wheat and sorghum production, and gross domestic product were good statistical predicators of the study area's 1970-2000 grain exports. Historically, Corpus Christi grain exports were very strongly tied to both U. S. farm income and Corpus Christi MSA transportation and utility earnings. The output of the regression analysis showed that the income variables produced higher t values than grain production and gross domestic product; however, all variables were significant at the 99 percent confidence level. The relationship between income and Corpus Christi grain exports is illustrated in Figure 3.

Figure 3
Corpus Christi Bulk Grain Exports and Income Variables

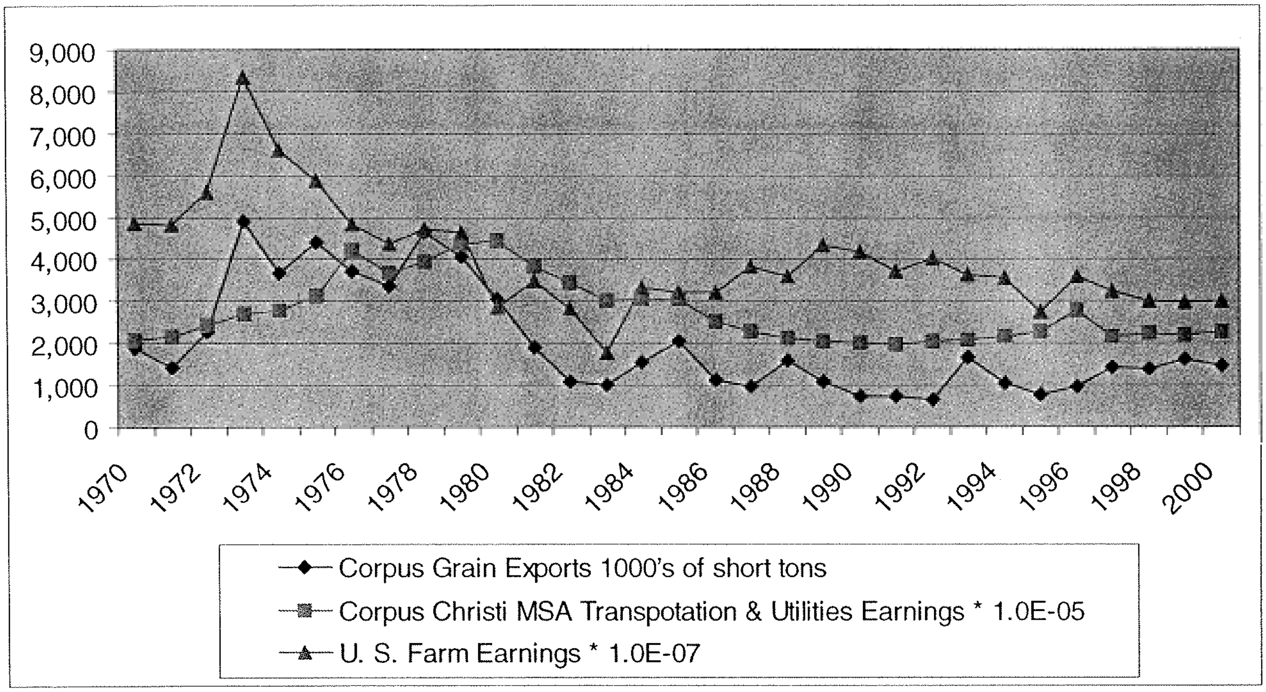


Table 11 displays the 2006-2056 baseline tonnage projections. The 2006-56 average annual growth rate generated from the regression equation is 2.3 percent. The growth rate generated from the regression equation is lower than the 1991-00 average annual rate of 7.4 percent; however, as noted, Corpus Christi grain exports were very strongly tied to U. S. farm income and Corpus Christi MSA transportation and utility income. Income was a strong variable in the regression equation. The USDA forecast shows an average annual decline of 1.3 percent between 2000-2012 in U. S. farm income. The USDA production and export forecast extends through 2012. The USDA forecast documentation notes that farm income supports that were available during the nineteen nineties are not expected for 2000-2006. The effect of the phasing-out of income supports contributed to the expected low rate of growth for Corpus Christi 2006-2056 grain exports. The other major driver in the equation was Corpus Christi MSA transportation and utility income. Income in this sector is projected to grow at an average annual rate of 1.0 percent between 2000-2012.

Table 11
Corpus Christi Bulk Grain Export Forecast (1998-2056)
1000's of Short Tons

Year	Base Forecast	95% Confidence Interval Lower	95% Confidence Interval Upper	Standard Error of the y Estimate Minus 1	Standard Error of the y Estimate Plus 1	USDA Growth Rate Application a/
1998	1,404	1,404	1,404	1,404	1,404	1,404
1999	1,633	1,633	1,633	1,633	1,633	1,633
2000	1,484	1,484	1,484	1,484	1,484	1,484
2006	1,190	0	8,981	713	1,666	1,698
2012	1,678	0	10,121	1,202	2,154	1,881
2016	1,748	0	10,409	1,271	2,224	2,013
2026	2,023	0	10,966	1,546	2,499	2,388
2036	2,500	0	11,784	2,023	2,976	2,832
2046	3,514	0	13,280	3,038	3,991	3,359
2056	3,653	0	13,705	3,176	4,129	3,984
		Average Annual Growth Rate				
2006-2056	2.3%	n/a	0.8%	3.0%	1.8%	1.7%

Corpus Christi Grain Exports, 1970-2000 Based Regression Equation Output

Multiple R	0.947
R Square	0.896
Adjusted R Square	0.876
Standard Error	451
Observations	31

Analysis of Variance Table

	df	SS	MS	F	Significance F
Regression	5	44,023,009	8,804,602	43.3	1.61E-11
Residual	25	5,084,799	203,392		
Total	30	49,107,809			

	Coefficients	Standard Error	t Stat	Lower 95%	Upper 95%
Intercept	-210,232	67,054	-3.135	-348,332	-72,132
Year	101.548	32.467	3.128	34.681	168.4
Corpus MSA Trans/Utilities Earnings	10.681	1.752	6.095	7.072	14.290
U.S. Farm Earnings	0.076	0.009	8.144	0.057	0.095
U.S. Farm Employment	1.939	0.867	2.236	0.153	3.724
U.S. Wheat and Sorghum Production.	-0.707	0.273	-2.588	-1.270	-0.144

Source: USACE, Waterborne Commerce of the U. S.; USDA, Agricultural Statistics; U. S. Department of Commerce, Bureau of Economic Analysis, Corpus Christi MSA and U. S. earnings, 1996; U. S. Department of Agriculture, Economic Research Service, Agricultural Baseline Projections to 2011/12, February 2002.

a/ The USDA/ERS 2000-2011/12 growth rates were applied to Corpus Christi's 1998-2000 average tonnage.

As shown in the Table 11, the forecast associated with the 95 percent confidence interval has extremely wide upper and lower limits. The range associated with the standard error of the y estimate is also presented. The application of this statistic, which measures the average deviation of the predicted values from the 1970-2000 observed values, generated a much narrower range of values. Table 11 also displays a sensitivity estimated by applying the USDA/ERS 2000-2011/12 average annual wheat, corn and sorghum export growth rates to Corpus Christi's 1998-2000 average tonnage. The lower and upper end standard error of the y estimate application was used for the sensitivity analysis.

REDUCTION IN TRANSPORTATION COST BENEFITS

Channel deepening benefits were calculated for Corpus Christi crude petroleum, petroleum products, and grain cargoes. The transportation savings benefits were calculated using a Federal discount rate of 5.875 percent and using Fiscal Year 2002 hourly operating costs. Transportation costs were calculated for 45- to 52-foot channel depth alternatives.

The transportation costs and the savings associated with the proposed project depth increases were calculated using commodity specific vessel class and trade route distributions. Transportation costs were calculated based on the channel depth alternatives and variables associated with vessel design drafts, maximum feet of light-loading, underkeel clearance, mileage traveled, and the number of hours to load and unload. Maximum vessel cargo capacities for crude oil, petroleum products, and grain were estimated using a range of load factors obtained from IWR Report 91-R-13, National Economic Development Procedures Manual Deep Draft Navigation, November 1991. The cargo capacity factors published in the deep draft manual for dry bulk carriers and tankers are shown in Table 12.

Table 12
Adjustments for Estimating Actual Vessel Capacity

Vessel DWT	Dry Bulk	Tanker
<20000	.90	.90
20-70000	.92	.92
70-120000	.95	.95
>120000	.97	.97

Source: IWR Report 91-R-13, National Economic Development Procedures Manual, Deep Draft Navigation, November 1991, p.77.

The basic procedure used to calculate transportation costs using a 120,000-dwt foreign flag tanker as an example is illustrated in Table 13. Similar computations were made for appropriate distances and vessel sizes for each of the channel depth alternatives. The resulting costs per ton computations were calculated over the relevant range of vessels projected for each channel depth improvement, and the associated savings per ton were measured using the net differences in costs between the existing 45-foot channel and the alternative channel depths. The computation presented is for a direct shipment. The in-port cost was based on an unloading rate of 30,000 barrels per hour. Unloading rates vary and it was found that offshore unloading rates are faster than in-port rates. The offshore rates average 40,000 barrels per hour. Unloading rates for refined products are significantly less than for crude oil. Industry noted that the same unloading rate and added that 5,000 to 10,000 barrels per hour is the standard unloading rate for product carriers.

Table 13
Transportation Cost Calculation
Mexico to Houston (Direct Shipment)

DWT: 120,000
Design Draft: 52 feet
Cargo Capacity: 114,000 dwt (120,000*.95)
Immersion Factor (tons per inch): 247
Maximum Load on 45-ft Channel given 4-feet underkeel clearance:
((120,000*.95)-(247 x 11 feet light x 12 in/ft = 81,396 tons
Hourly Cost at Sea: $1,160
Hourly Cost in Port: $ 908
Hours to Load and Unload for 45-ft load: 36 a/
Round Trip Mileage: 1400 miles
Speed: 15 knots
Cost for Voyage: (1400 miles/15 knots)*($1,160) = $108,267
Voyage Cost/Ton for 45-ft Channel: ($108,920/81,396 tons) $1.33/Ton
Loading & Unloading Cost/Ton for 45-ft Channel:
(36 hrs x $908) / (81,396 tons) = $.42/ short ton
Voyage Cost/Ton for 52-ft Channel:($108,920/(102,144 tons) $1.07/Ton
Loading & Unloading Cost/Ton for 52ft Channel a/:
(45 hrs x $908) / (102,144) = $.40/short ton

a/ Based on a loading and unloading rate of 4,500 tons per hour.

Table 14 presents representative round trip mileage for the trade routes or junction points used for the transportation savings computations. Tables 15 and 16 presents the Fiscal Year 2002 operating cost data. Foreign flag tankers were used to calculate the transportation costs for foreign imports of crude petroleum and petroleum product imports and exports. Foreign flag bulk carriers are used for grain export tonnage. The vessel fleet projections are based on analysis of existing fleet utilization and anticipated trends and the premise that vessel utilization will gravitate to the most efficient vessel sizes for a specific channel depth given port depth and trade route constraints.

Table 14
Representative Round Trip Mileage to Corpus Christi

Coatzacoalcos, Mexico	1,360
U. S. Gulf Coast Lightering/Lightening Zone	160
Venezuela	3,934
Panama Canal	3,132
Salvador, Brazil	9,606
Rotterdam, Netherlands	10,318
Sture, Norway	11,172
North Africa, Algiers	10,556
West Africa (Nigeria and Angola)	13,030
Persian Gulf and Indian Subcontinent via Suez Canal	19,824
Persian Gulf and Indian Subcontinent via Cape of Good Hope	25,066
Singapore via Panama Canal	24,248
Singapore via Cape of Good Hope	26,304

Trade Route Forecast

The foreign trade route forecasts used in this analysis are summarized in Table 17. The crude oil and petroleum product import trade route forecasts are based on EIA (2003) projections; the petroleum product export forecast is based on the World Fleet Forecast (1998-2050) projections. The grain export forecast was based on USDA forecasts presented in the commodity forecast section of this appendix. Reduction in transportation cost benefits from proposed Corpus Christi channel deepening were calculated for a portion of crude petroleum, petroleum product and grain tonnage. The percentage of tonnage expected to accrue benefits from deeper channel depths was identified based examination of vessel sizes, vessel loads, foreign port depths and constraints such as the Panama Canal. Port depth, trade route, and historical vessel utilization data were

Table 15
Foreign Flag Tankers
Fiscal Year 2002 Vessel Operating Costs

Design Draft(ft)	DWT	Maximum Cargo	Immersion Factor	Hourly Operating Cost at Sea	Hourly Operating Cost in Port	Hrs in Port to Load or Unload a/
30	20,000	18,000	79	$673	$542	7
32	25,000	22,500	91	$698	$561	9
35	35,000	31,500	113	$753	$601	12
40	50,000	45,000	141	$833	$664	18
42	60,000	54,000	159	$888	$704	22
44	70,000	63,000	175	$938	$743	25
46	80,000	76,000	191	$988	$783	29
47	90,000	85,500	206	$1,033	$818	33
52	120,000	114,000	247	$1,160	$908	43
55	150,000	145,500	285	$1,294	$1,005	55
58	175,000	169,750	315	$1,412	$1,096	65
60	200,000	194,000	343	$1,525	$1,183	74
66	265,000	257,050	411	$1,816	$1,401	100
70	325,000	315,250	468	$2,015	$1,537	120

Source: Economic Guidance Memorandum 02-06, Deep-Draft Vessel Operating Costs.
a/ Presentation is based on a loading and unloading rate of 5,250 tons per hour or 35,000 barrels per hour. As discussed in the text, the rate used for the cost calculations depends on the cargo and the location.

Table 16
Foreign Flag Bulk Carriers
Fiscal Year 2002 Vessel Operating Costs

Design Draft(ft)	DWT	Maximum Cargo	Immersion Factor	Hourly Operating Cost at Sea	Hourly Operating Cost In Port	Hrs in Port to Load or Unload a/ a/
27	15,000	13,500	65	$520	$379	6
32	25,000	23,000	89	$567	$410	11
35	35,000	32,200	110	$605	$437	15
37	40,000	36,800	119	$624	$450	17
40	50,000	46,000	137	$655	$481	21
42	60,000	55,200	154	$708	$508	26
44	70,000	64,400	169	$757	$544	30
46	80,000	76,000	184	$805	$579	34
48	90,000	85,500	198	$861	$624	38
50	100,000	95,000	211	$916	$669	45
52	120,000	114,000	236	$1,028	$755	50
54	135,000	128,250	254	$1,060	$769	54
56	150,000	142,500	272	$1,092	$782	62

Source: Economic Guidance Memorandum 02-06, Deep-Draft Vessel Operating Costs.
a/ Based on a unloading rate provided by the Corpus Christi grain elevator.

Table 17
Corpus Christi Ship Channel
Trade Route Forecast 2000 through 2056
Percentage of Tonnage by Trade Route for the Major Commodity Groups

	2000	2006	2016	2026	2036	2046	2056
Crude Petroleum Imports a/ c/							
Latin America & Caribbean	34%	41%	39%	41%	44%	46%	49%
Europe & Africa	39%	25%	21%	19%	18%	17%	16%
Persian Gulf	22%	31%	37%	37%	36%	35%	34%
Far East	6%	3%	3%	2%	2%	2%	1%
Total	100%	100%	100%	100%	100%	100%	100%
Petroleum Product Imports a/ b/ c/							
Latin America & Caribbean	28%	63%	67%	66%	63%	64%	61%
Europe & Africa	53%	22%	15%	15%	17%	18%	19%
Persian Gulf	16%	8%	13%	13%	13%	14%	14%
Far East	3%	7%	6%	5%	6%	6%	6%
Total	100%	100%	100%	100%	100%	100%	100%
Petroleum Product Exports b/ c/							
Latin America & Caribbean	58%	46%	49%	51%	51%	51%	49%
Europe & Africa	38%	43%	39%	36%	34%	35%	36%
Persian Gulf	2%	3%	4%	4%	4%	5%	5%
Far East	2%	8%	8%	10%	10%	11%	11%
Total	100%	100%	100%	100%	100%	100%	100%
Bulk Grain Exports c/							
Latin America & Caribbean	33%	29%	32%	32%	32%	32%	32%
Europe & Africa	57%	41%	39%	39%	39%	39%	39%
Persian Gulf	9%	7%	7%	7%	7%	7%	7%
Far East	1%	23%	22%	22%	22%	22%	22%
Total	100%	100%	100%	100%	100%	100%	100%

a/ Application of USEIA 1999-2010 trade route crude oil and product forecasts to Corpus Christi.
b/ Application of World Fleet/McGraw-Hill 1999-2050 petroleum product export trade route forecast.
c/ Port depth, trade route, and historical vessel utilization data were used to identify the percentage of tonnage anticipated to benefit from the Corpus Christi proposed depth increases.

used to identify the percentage of tonnage anticipated to benefit from the Corpus Christi proposed depth increases. Corpus Christi will not accrue deepening benefits for movements associated with Western South America trade route nor for most movements from the Far East due to the vessel beam width constraint of 106 feet and the depth constraint of 39.6 feet. Some crude oil shipped from the Far East is shipped in post-Panamax vessels and these vessels arrive in the Gulf of Mexico from by way of the Suez Canal or the Cape of Good Hope. Post-Panamax, Suez, and small VLCC vessels used for crude oil could realize cost savings from increased channel depths in Corpus Christi and the benefit calculations reflect this inclusion.

Crude Petroleum Imports

Reductions in the vessel operating costs for Corpus Christi's foreign crude petroleum imports were calculated based on the difference in transportation costs between the without-project and with-project conditions. Transportation costs and savings were calculated for crude petroleum import tonnages using the fleet distributions that were presented in Table 17. Transportation savings benefits were calculated for approximately 50 percent of Corpus Christi's 1998/2000-tonnage base. Application of the trade route forecast to Corpus Christi showed that 79 percent of 2006-56 crude petroleum import tonnage could benefit from a project depth in excess of 45 feet. For the 50-foot channel, this percentage would decrease to 77 percent and to 66 percent for the 52-foot project. The expected increase is tied to the trade route forecasts. The distribution of 1996-98 Corpus Christi crude oil import tonnage by origin port is presented in Table 18. The 1996-98 records show that an estimated 54 percent of crude oil imports are shipped from ports with depths over 45 feet. Approximately 35 percent of 1996-2000 tonnage was transported in vessels with loaded draft of 40 feet or greater. Review of Corpus Christi's 2000 records indicated continued trade with the ports listed in Table 19.

Methods of shipping crude oil are direct, lightered, lightened, and transshipped. Distribution of 1996/99 tonnage by method of shipment (direct, lightered, transshipped) is presented in Table 19. Direct shipment, as the name implies is the transfer of tonnage by vessel between two coastal ports. Lightering involves the transfer of tonnage at an offshore location from a larger vessel, called a VLCC (Very Large Crude Carrier), onto one or more shuttle vessels. With lightering, the VLCC does not enter the coastal receiving port. Transshipping occurs at one of several Caribbean port locations, and like lightering, it involves the full discharge of a VLCC. The advantage of transshipping is that vessel turnaround is faster than with lightering; however, the frequency of transshipping has decreased in recent years due to its relative high cost in comparison to lightering. The current percentage of Corpus Christi transshipped tonnage is very small in comparison to lightering. A frequent alternative to either direct shipment or lightering is lightening. The term lightening describes the process where enough cargo is offloaded from a tanker to permit the light-loaded vessel to enter a confined channel system. The format of the USCE's WCSC's shipping records, which are obtained by the USCE through the Bureau of Census, do not provide sufficient information to distinguish lightened tonnage from direct or

Table 18
1996-98 Total Crude Oil Import Total Tonnage by Channel Depth
Likely to Utilize Deeper Depths at Corpus Christi

Port Name	1996-98 Total Tonnage	Country	Depth Information (ft)
ARZEW	199,808	Algeria	76
SKIKDA	1,597,314	Algeria	45.9
ALL OTHER ALGERIA PORTS	85,661	Algeria	76 at Arzew; 46 at Skikda
FREEPORT, GRAND BAHAMA I	130,188	Bahamas	76
ALL OTHER BRAZIL PORTS N OF RECIFE	59,288	Brazil	75 at Itaqui.
ALL OTHER COLOMBIAN CARIBBEAN PORTS	4,287,316	Colombia	56 at several Atlantic Coast Colombian Ports
SHELLHAVEN	6,117,431	England	47.9
TALLINN	91,570	Estonia	54
WILHELMSHAVEN	107,856	Germany	66
HIGH SEAS,GULF OF MEXICO	4,213,112	Gulf of Mexico	76
CAYO ARCAS	5,927,615	Mexico	72.2
DOS BOCAS	8,368,171	Mexico	89.9
ORANGESTAD	75,496	Netherland Antilles	76
SAN NICOLAS BAY	1,889,282	Netherland Antilles	76
ROTTERDAM	21,786	Netherlands	74.3
BONNY	2,938,120	Nigeria	74.8
KWA IBO TERMINAL	11,220,474	Nigeria	85.3
STURE	3,644,545	Norway	75.4
RAS TANURA	4,614,099	Saudi Arabia	61-65
ALL OTHER SAUDI ARABIA PORTS	79,852	Saudi Arabia	61-65 at Ras Tanura
LOME	3,654,977	Togo	45.9
POINT A PIERRE	47,126	Trinidad	52
RIO HAINA	1,338,047	Trinidad	58
PUERTO LA CRUZ	17,903,154	Venezuela	46 to 50
EL PALITO	138,507	Venezuela	46 to 50
ALL OTHER VENEZUELA PORTS	2,215,552	Venezuela	55 at Puerto La Cruz
Total for Port Depths Over 45 feet	49,624,998		
Total Tonnage for 1996-98	79,324,154		
% of 1996-98 Total	54%		

Less likely to Utilize Deeper Depths at Corpus Christi

VANCOUVER	93,851	Canada	Panama Canal Restriction
ALL OTHER CHILE PORTS	57	Chile	Panama Canal Restriction
ALL OTHER REPUBLIC OF CHINA PORTS	116,042	China	Panama Canal Restriction
DALIAN	1,656,009	China	57.4, Panama Canal Restriction
LA LIBERTAD	221,396	Ecuador	Panama Canal Restriction

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Table 18 (continued)

Port Name	1996-98 Total Tonnage	Country	Depth Information (ft)
ALEXANDRIA	461,214	Egypt	35.0
MADRAS	204,283	India	36 to 40
MURMANSK	383,191	Former USSA	37.4
GEORGETOWN	1,178,169	Guyana	33.0
PULAU SAMBU	304,993	Indonesia	41-45
ASHDOD	3,220,275	Israel	42.6
ALL OTHER MALAYSIA PORTS	453,933	Malaysia	Panama Canal Restriction
ALL OTHER SINGAPORE PORTS	47,937	Malaysia	Panama Canal Restriction
ALTAMIRA	331,102	Mexico	42.0
COATZACOALCOS a/	116,254	Mexico	42.0
PAJARITOS a/	783,695	Mexico	42.0
TUXPAN	88,905	Mexico	42.0
VERACRUZ	782,782	Mexico	30.8
CALABAR	570,512	Nigeria	26 to 30, planned improvements at Calabar
LAGOS	188,888	Nigeria	21 to 25
LEIXOES	105,844	Portugal	44.6
SINGAPORE	43,578	Singapore	66-70
ALL OTHER TURKEY MED.REGION PORTS	39,587	Turkey	Generally less than 40
ISTANBUL	1,428,975	Turkey	39.4
FUJAIRAH	91,806	United Arab Emirates	36 to 40
AMUAY BAY	396,819	Venezuela	41 to 45
LA GUAIRA	11,055,751	Venezuela	19.7
PUERTO MIRANDA	12,333,308	Venezuela	39.5
Total for Depths Under 45 feet	36,699,156		
Total Tonnage for 1996-98	79,324,154		
% of 1996-98 Total	46%		

a/ Located in the same region as the offshore Cayo Arcas, Mexico's offshore oil terminal. Cayo Arcas can load vessel drafts of up to 76 feet.

Source: National Imagery and Mapping Agency, 2000 World Port Index, Pub. 150; Lloyds, Ports of the World, 1995; USACE, Waterborne Commerce 1996-98 detailed records.

Table 19
Corpus Christi Channel Crude Petroleum Imports
Distribution of Tonnage by Method of Shipment and Trade Route

Trade Route	2000 Distribution 45-ft	2006-56 Distribution 45-ft	47-ft	48-ft	49-ft	50-ft	52-ft
Mexico and Eastern S America							
Direct	97%	100%	100%	100%	100%	100%	100%
Lightered or Lightened	3%	0%	0%	0%	0%	0%	0%
Europe/Africa/Mediterranean							
Direct Shipments	44%	50%	50%	50%	50%	50%	50%
Lightened and	56%	50%	50%	50%	50%	50%	50%
Middle East							
Direct	0%	0%	0%	0%	0%	0%	0%
Lightered or Lightened	100%	100%	100%	100%	100%	100%	100%
Far East							
Direct	2%	0%	0%	0%	0%	0%	0%
Lightered or Lightened	98%	100%	100%	100%	100%	100%	100%

Source: USACE, Waterborne Commerce of the U. S.; Application of USEIA 1999-2010 trade route crude oil and product forecasts to Corpus Christi.

lightered tonnage. Industry personnel and additional Bureau of Census and pilots records showed indicated that lightening is common for shipments from Africa and Europe. The tanker sizes associated with lightening on the Texas Coast generally range from 120,000 to 175,000 dwt. Tankers larger than 175,000 dwt are normally lightered. Shipments from Europe/North Sea/Africa trade route are usually transported in tankers between 80,000 and 175,000 dwt, with direct shipments generally using tankers between 80,000 and 120,000 dwt. Tankers larger than 175,000 dwt are normally lightered. Shipments from Europe/North Sea/Africa trade route are usually transported in tankers between 80,000 and 175,000 dwt, with direct shipments generally using tankers between 80,000 and 120,000 dwt. The primary size vessel used on the Mexico/Eastern South America route for shipments into Corpus Christi and other U. S. Gulf Coast ports is 80,000 to 100,000 dwt; however, vessels up to 120,000 dwt are not uncommon. Review of the 1999 Fairplay Tanker Register showed that the design drafts associated with tankers of 80,000 to 100,000 dwt generally range from 40 to 51 feet, with the average being 44 feet. The limited volumes of direct shipments from the Middle East are usually shipped in vessels between 80,000 and 120,000 dwt.

Regardless of trade route, the vessel sizes utilized are also related to the way crude petroleum is sold. Currently, crude petroleum is sold in parcels of 500,000 barrels. A 500,000-barrel parcel converts to approximately 75,000 short tons. The most economical size vessel for a 75,000-ton parcel is between 75,000 and 100,000 dwt. For 150,000-ton parcels, the most efficient size is between 150,000 and 175,000 dwt. Ninety-four percent of the 100,000 to 140,000 dwt vessels in the world fleet have design drafts in excess of 45 feet, and 32 percent of the vessels between 75,000 and 100,000 dwt have design drafts over 45 feet. The with project condition was formulated assuming that the maximum ship size for both direct shipments and lightered vessels would be 175,000 dwt. Vessels over 100,000 dwt would continue to be light-loaded under the with project condition; however, there would be a reduction in the number of feet light-loaded. Gulf Coast industry personnel indicated that parcel size and associated ship size is primarily a function of the existing channel dimensions and that an increase in channel dimensions would likely result in a shift to larger parcel sizes and larger vessels.

The trade route specific costs for the Mexico/Eastern South America, Europe/North Sea/Africa, and Middle East/Indian Subcontinent trade routes were analyzed in order to determine why lightering or lightening is not used as the exclusive shipping method. Table 20 displays a comparative summary of transportation cost by method of shipment and channel depth alternative for the major trade routes. The sensitivity of the transportation cost benefits relates vessel size employed and to logistical factors associated with offshore transfer arrangements. Due to the lack of published documentation, industry inquiries were made and risk and uncertainty software was utilized. The @Risk software was used to evaluate the output of multiple spreadsheets containing probability distributions. The critical variable affecting the probability distributions is the number of hours it takes to set-up and complete offshore transfers. The costs generated from the trade route specific offshore transfer probability functions were compared to the cost for direct shipment for the purpose of determining which shipment method was most efficient. The probability functions were also used to determine if methods of shipment might change if the Inner Harbor Channel was deepened. The probability functions served to verify the rationale for a shipper's decision to choice direct shipment or offshore transfer.

Table 20
Corpus Christi Crude Petroleum Imports
Transportation Cost by Method of Shipment for Representative Trade Routes

Channel	Mexico			Venezuela			Africa and Mediterranean			Middle East		
Depth	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
						Direct Shipment						
45	$1.78	$1.71	$1.84	$4.18	$4.00	$4.35	$10.91	$10.46	$11.40	$18.77	$17.94	$19.64
47	$1.69	$1.62	$1.75	$3.93	$3.76	$4.09	$10.22	$9.80	$10.68	$17.56	$16.80	$18.39
48	$1.65	$1.58	$1.70	$3.81	$3.66	$3.97	$9.90	$9.50	$10.35	$17.01	$16.28	$17.82
50	$1.58	$1.52	$1.62	$3.61	$3.47	$3.76	$9.33	$8.95	$9.75	$16.02	$15.33	$16.78
52	$1.50	$1.46	$1.53	$3.40	$3.30	$3.45	$8.72	$8.46	$8.85	$14.95	$14.50	$15.17
						Lightened						
45	$3.99	$2.78	$4.48	$5.54	$4.21	$6.14	$10.45	$8.74	$11.49	$14.98	$12.92	$16.46
47	$3.93	$2.75	$4.42	$5.48	$4.18	$6.11	$10.38	$8.71	$11.45	$14.92	$12.90	$16.46
48	$3.93	$2.75	$4.42	$5.48	$4.18	$6.11	$10.38	$8.71	$11.45	$14.92	$12.90	$16.34
50	$3.92	$2.74	$4.39	$5.47	$4.17	$6.11	$10.37	$8.70	$11.43	$14.91	$12.89	$16.34
52	$3.92	$2.74	$4.39	$5.47	$4.17	$6.11	$10.37	$8.70	$11.43	$14.91	$12.89	$16.34
						Lightered						
45	$5.71	$2.40	$8.50	$6.81	$3.49	$9.59	$10.29	$6.97	$13.07	$15.92	$12.50	$18.60
47	$5.71	$2.36	$8.50	$6.81	$3.46	$9.59	$10.29	$6.94	$13.07	$15.92	$12.46	$18.60
48	$5.10	$2.35	$7.57	$6.19	$3.44	$9.59	$9.98	$6.92	$12.15	$15.20	$12.45	$17.67
50	$5.10	$2.31	$7.57	$6.19	$3.41	$9.59	$9.98	$6.89	$12.15	$15.20	$12.41	$17.67
52	$5.10	$2.31	$7.57	$6.19	$3.41	$9.59	$9.98	$6.89	$12.15	$15.20	$12.41	$17.67

It was found through industry inquiries and additional review of vessel documentation that lightening is often a preferable alternative to lightering for North Sea/Africa/Mediterranean movements. For purposes of analysis, the geographic region that includes North Sea, Africa, and Mediterranean, is referred to as "Region 2" in this analysis. Review of the vessel traffic records showed that for the period 1997-98, approximately 44 percent of North Sea/Africa/Mediterranean movements to Corpus Christi were shipped direct and the remaining 56 percent was lightered or lightened. The results of the risk analysis verified that the 1997-98 shipment methods were reasonable. The analysis also verified the economic rationale for the method of shipment choices for Mexico, Venezuela, Middle East, and Far East. For the years 1996-97, less than ten percent of movements from Mexico and Venezuela were lightered/lightening and over 90 percent of movements from the Middle East and Far East were lightered. There is large variability associated with the time it takes to lighter and the lower the cost difference between direct versus offshore transfer costs, the higher the probability of direct shipment becomes. Industry personnel indicated that the number of days to completely lighter a VLCC normally ranges from 4 to 10 and that the average number of days to completely lighter 200,000 to 300,000 dwt vessels is 5.5; however, it was noted that 2 weeks is not uncommon.

Five and a-half days equate to 1.5 times the in-port unloading rate. Utilization of the upper limit of 2 weeks appears to relate to a less than optimal number of shuttles and shuttle turnaround rate. The range of costs shown in Table 20 was calculated using a probability distribution of number of hours to lightered. The minimum costs are associated with optimal sized mother and shuttle vessels given the channel depth constraint. Both the minimum and maximum cost functions were defined using the same range of vessels. The vessels used in the analysis were defined on a channel specific basis. The mother vessel sizes of 120,000 to 150,000 dwt were used for the 45-foot channel lightening costs and vessels up to 175,000 dwt were used for the 48- to 52-foot channel depths. The associated shuttle sizes were defined based on cost efficiencies.

Due to its relatively small volume and decreasing use, transshipping costs and, the uncertainty associated with average transshipping conditions were not assessed, nor were a comparative assessment made for Western South American tonnage. Nearly all Western South America tonnage is shipped direct. Western South America tonnage and direct shipments from the Far East are normally transported via the draft-restricted Panama Canal. The maximum loaded draft that can be accommodated through the Canal is 39 feet and the maximum beam width is 106 feet. As shown in Table 20, only 13 percent of 1998-99 Far East tonnage shipped direct. The mother vessels originating in the Far East and associated with Far East-to-U. S. Gulf Coast lightering normally arrive in the Gulf via the Suez Canal or the Cape of Good Hope.

The cost data summarized in Table 20 shows that for tonnage from Mexico and Eastern South America, direct shipment is clearly the least cost alternative and that for tonnage from the Middle East and Indian Subcontinent, lightering is clearly the least cost alternative. Lightering would also be the least cost alternative for Far East tonnage. Comparison of direct shipment cost with those for lightering or lightening for the Europe/North Sea/Africa route presented in Table 20 indicated that while the average cost for both lightering or lightening is less than the average cost for shipping direct, the percentage difference between direct shipment costs and the offshore alternatives are considerably less than for the Mexico and Mideast routes. The relative closeness in the costs between shipping methods for Europe/North Sea/Africa tonnage, and the variance associated with the number of days necessary to complete the offshore transfer process, contribute to this relatively high percentage of direct shipment for this route. A high historical delay frequency, in association with the relative closeness in costs between shipping methods, contributes to a proportion of direct shipments that is higher than what might occur if the variance associated with the cost of lightering did not overlap with the cost of shipping direct. Examination of the cost data indicated that an increase in channel dimensions would probably result in an increase in direct shipment movements for Europe, North Sea, and Africa shipments. The maximum size vessels used for Nigerian crude oil are in the 80,000 to 130,000 dwt range. Vessels over 200,000 dwt are used for some North Sea movements and would continue to be associated lightering operations under the with project condition.

Comparison of the method of shipment costs for the Eastern South America and Persian Gulf routes did not indicate that the proposed project design would provide an incentive to switch from one method of shipment to another. Lightening is not cost effective for tonnage on the Persian Gulf trade route because the economies of scale associated with existing practices result in a lower cost for lightering than what would be attained through lightening. The reason lightering is cheaper than lightening for Persian Gulf/Indian Subcontinent shipments is because the magnitude of the mileage component of the per ton cost is large enough to offset the relatively large fixed cost attribuTable to having the mother vessel remain offshore for 5.5 days. For similar reasons, the relative short distance and high fixed costs associated with either lightening or lightering, eliminates any incentive for Mexico/Eastern South America shipments to shift to lightening. Despite the clear lack of economic rationale for lightering Mexico/Eastern South America tonnage or shipping Persian Gulf/Indian Subcontinent tonnage direct, relatively inefficient shipping methods are used for some shipments on these trade routes. The decision to lighter Mexico/Eastern South America tonnage or ship Persian Gulf/Indian Subcontinent tonnage direct results from less than perfect world market conditions. The crude petroleum transportation savings benefits are displayed in Tables 21-23. Table 24 presents the distribution of crude petroleum imports by trade route and the proportion expected to benefit from channel depths over 45 feet.

Foreign Petroleum Product Tonnage

Transportation savings benefits were calculated for Corpus Christi petroleum product import and export tonnage. Benefits were calculated for 30 percent of 2005-56 petroleum product imports and 10 percent of export tonnage. The percentage of future petroleum product movements expected to benefit from channel depths over 45 feet was identified based on examination of vessel sizes, vessel loads, foreign port depths associated with Corpus Christi's 1996-99 petroleum product imports and exports and the Department of Energy's U. S. and the World Fleet Forecast's U. S. Gulf Coast product trade forecasts.

Table 21

Corpus Christi Crude Petroleum Imports Transportation Cost and Savings by Channel Depth

Depth	45 ft.	47 ft.	48 ft.	49 ft.	50 ft.	52 ft.
Transportation Cost for Direct Shipments by Year						
2000	$37,669,998	$35,412,835	$34,398,911	$33,481,425	$32,563,938	$30,629,126
2006	$33,923,002	$31,904,022	$30,997,833	$30,178,160	$29,358,486	$27,634,220
2016	$41,082,022	$38,637,299	$37,540,041	$36,547,547	$35,555,054	$33,467,349
2026	$45,973,638	$43,246,121	$42,022,390	$40,915,699	$39,809,008	$37,483,707
2036	$49,766,759	$46,830,957	$45,514,696	$44,324,727	$43,134,758	$40,639,785
2046	$54,607,020	$51,401,906	$49,965,794	$48,667,866	$47,369,939	$44,653,781
2056	$60,614,500	$57,072,347	$55,486,081	$54,052,827	$52,619,573	$49,625,210
Transportation Savings by Channel Depth						
2000		$2,257,163	$3,271,087	$4,188,573	$5,106,059	$7,040,872
2006		$2,018,980	$2,925,169	$3,744,842	$4,564,515	$6,288,782
2016		$2,444,723	$3,541,981	$4,534,475	$5,526,968	$7,614,673
2026		$2,727,517	$3,951,248	$5,057,939	$6,164,630	$8,489,931
2036		$2,935,802	$4,252,063	$5,442,032	$6,632,000	$9,126,974
2046		$3,205,114	$4,641,226	$5,939,154	$7,237,081	$9,953,239
2056		$3,542,153	$5,128,419	$6,561,673	$7,994,927	$10,989,290
2006-56 @ 5.875%		$2,575,791	$3,731,409	$4,776,485	$5,821,561	$8,017,177

Table 22

Corpus Christi Crude Petroleum Imports Transportation Cost and Savings by Channel Depth

Depth	45 ft.	47 ft.	48 ft.	49 ft.	50 ft.	52 ft.
Transportation Cost for Lightered and Lightened Shipments by Year						
2000	$47,852,856	$47,820,739	$47,740,031	$47,688,638	$47,637,245	$47,637,245
2006	$57,383,717	$57,355,915	$57,257,006	$57,195,362	$57,133,718	$57,133,718
2016	$95,432,200	$95,398,348	$95,231,498	$95,129,021	$95,026,545	$95,026,545
2026	$109,681,371	$109,645,053	$109,452,744	$109,334,943	$109,217,143	$109,217,143
2036	$114,203,604	$114,167,546	$113,966,862	$113,844,146	$113,721,429	$113,721,429
2046	$119,303,530	$119,267,135	$119,057,133	$118,928,873	$118,800,614	$118,800,614
2056	$124,954,079	$124,916,738	$124,696,522	$124,562,120	$124,427,718	$124,427,718
Transportation Savings by Channel Depth						
2000		$32,117	$112,825	$164,218	$215,611	$215,611
2006		$27,802	$126,711	$188,356	$250,000	$250,000
2016		$33,852	$200,702	$303,179	$405,655	$405,655
2026		$36,318	$228,628	$346,428	$464,228	$464,228
2036		$36,057	$236,741	$359,458	$482,175	$482,175
2046		$36,395	$246,397	$374,657	$502,916	$502,916
2056		$37,341	$257,557	$391,959	$526,361	$526,361
2006-56 @ 5.875%		$34,084	$199,142	$300,587	$402,032	$402,032

Table 23
Corpus Christi Crude Petroleum Imports
Transportation Cost and Savings Summary

Depth	45 ft.	47 ft.	48 ft.	49 ft.	50 ft.	52 ft.
	Transportation Cost for Total Movements by Year					
2000	$85,522,854	$83,233,574	$82,138,942	$81,170,063	$80,201,183	$78,266,371
2006	$91,306,719	$89,259,937	$88,254,839	$87,373,522	$86,492,204	$84,767,938
2016	$136,514,222	$134,035,647	$132,771,539	$131,676,568	$130,581,598	$128,493,894
2026	$155,655,009	$152,891,174	$151,475,134	$150,250,643	$149,026,151	$146,700,850
2036	$163,970,362	$160,998,503	$159,481,558	$158,168,873	$156,856,187	$154,361,214
2046	$173,910,550	$170,669,041	$169,022,927	$167,596,740	$166,170,552	$163,454,395
2056	$185,568,579	$181,989,085	$180,182,603	$178,614,947	$177,047,291	$174,052,928
	Transportation Savings by Channel Depth					
2000		$2,289,280	$3,383,912	$4,352,791	$5,321,671	$7,256,483
2006		$2,046,782	$3,051,880	$3,933,197	$4,814,515	$6,538,781
2016		$2,478,575	$3,742,684	$4,837,654	$5,932,624	$8,020,328
2026		$2,763,835	$4,179,875	$5,404,367	$6,628,858	$8,954,159
2036		$2,971,859	$4,488,804	$5,801,490	$7,114,175	$9,609,149
2046		$3,241,509	$4,887,623	$6,313,811	$7,739,998	$10,456,155
2056		$3,579,494	$5,385,976	$6,953,632	$8,521,288	$11,515,651
	Equivalent Annual Savings 5.857%					
2006-56 @ 5.875%		$2,609,875	$3,930,551	$5,077,072	$6,223,593	$8,419,209

The vessels sizes and port depths associated with Corpus Christi's 1996-99 product imports showed that 20 percent of imports were shipped in vessels with design drafts over 50 feet and were 33 percent of imports were shipped from ports with depths in excess of 50 feet. The vessel sizes associated with these import movements range from 80,000 to 150,000. Table 25 presents the 1996-98 distribution of petroleum product import and export tonnage by origin port. Examination of the vessel size data showed that 6 percent of existing product exports tonnage was shipped in vessels with design drafts in excess of 45 feet and 4 percent of tonnage was shipped to foreign ports with depths in excess of 50 feet. The vessel sizes associated with these export movements presently range from 80,000 to 100,000. Application of the trade route forecasts to Corpus Christi showed that 10 percent of 2006-56 product export tonnage could benefit from a project depth in excess of 45 feet.

Table 24
Corpus Christi Crude Petroleum Tonnage (1000's of short tons)

	2000	2006	2016	2026	2036	2046	2056
Direct Shipment Tonnage Used for Channel Deepening Benefits							
South America & Mexico	7,605	7,377	8,952	10,464	12,227	14,287	16,694
Mexico a/	3,123	3,820	4,635	5,418	6,331	7,398	8,644
Latin America a/	4,483	3,557	4,317	5,046	5,896	6,889	8,050
Africa & North Sea	2,044	1,493	1,893	1,995	1,988	2,060	2,206
N Sea	1,224	328	310	302	266	234	207
Africa	820	1,165	1,583	1,694	1,722	1,825	1,999
Middle East	0	0	0	0	0	0	0
Far East	0	0	0	0	0	0	0
Sub-Total	9,649	8,871	10,846	12,459	14,214	16,346	18,900
Lightered Tonnage Used for Channel Deepening Benefits							
South America & Mexico a/	0	0	0	0	0	0	0
Europe/Africa/Med	0	228	277	324	378	442	516
Middle East	204	1,493	1,893	1,995	1,988	2,060	2,206
Far East	977	3,768	6,627	7,721	8,151	8,614	9,110
Sub-Total	1,298	419	539	517	452	397	351
Total Tonnage for Deepening Calculation							
Applicable Tonnage	12,129	14,779	20,182	23,015	25,182	27,859	31,084
Total Tonnage	35,121	42,037	51,023	54,050	53,093	57,488	59,821
% of Total Tonnage	35%	35%	40%	43%	47%	48%	52%

Source: USACE, Waterborne Commerce of the U. S., and USDOE/EIA 2003 Annual Review application.
a/ Excludes movement to Western Mexico and South America.

After identifying the percentage range of tonnage constrained by the 45-foot Corpus depth, the trade routes associated with these movements were evaluated in relationship to the USEIA and WFF trade route forecasts. Examination of Corpus Christi's 1996-99 routings showed that tonnage associated with larger vessels moving to deepwater ports is primarily associated with Northern Europe and the Persian Gulf. Total project tonnage and the volumes and associated trade route shares used to calculate project benefits for Corpus project depths over 45 feet are displayed in Tables 26 and 27. The USEIA and WFF forecasts show that refined product import and export trade between the U. S. regions and Northern Europe and Persian Gulf locations will continue for the period 2006 to 2025/50.

Table 25
Corpus Christi Petroleum Product Import and Export Tonnage (1996-98)

Petroleum Product Exports

Port and Country	Total	Depth Information (ft)
AMSTERDAM, HOLLAND	12,375	46 to 50
ANTWERP, BELGIUM	210,240	55
BILBAO, SPAIN	75,147	Over 50
ROTTERDAM, NETHERLANDS	101,801	Over 50
Grand Total Restricted Tonnage	399,564	
3-year total tonnage, 1996-98	9,153,116	
Percent of Total	4.4%	

Petroleum Product Imports

Port and Country	Total	
ABIDJAN, COTE D'IVORIE	109,568	66 to 70
ALL OTHER SAUDI ARABIA PORTS	434,631	Over 50
AMSTERDAM, HOLLAND	72,999	46 to 50
ARZEW, ALGERIA	758,727	76
FREEPORT, GRAND BAHAMA ISLAND	56,484	76
MINA ABD FAHL, KUWAIT	410,502	51 to 55
ORANGESTAD, NETH. ANT.	100,124	76
RAS TANURA, SAUDIA ARABIA	3,434,828	76
ROTTERDAM, NETHERLANDS	70,505	Over 50
SAN NICOLAS BAY, NETH. ANT.	78,325	76
TALLINN, ESTONIA	140,283	54
TARRAGONA, SPAIN	75,902	55
Grand Total Restricted Tonnage	5,794,792	
3-year total tonnage, 1996-98	17,569,540	
Percent of Total	33.0%	

Source: National Imagery and Mapping Agency, 2000 World Port Index, Pub. 150; Lloyds, Ports of the World, 1995; USACE, Waterborne Commerce 1996-98 detailed records.

The Corpus Christi share was estimated based on the assumption that percentage of these draft-constrained movements would be continue to move through U. S. Gulf Coast ports. The U. S. Gulf Coast 1998/99 to 2050 projections shows increasing volumes of tonnage moving in large vessels. Table 28 presents the U. S. Gulf Coast distribution of petroleum product tonnage by vessel class and the Corpus Christi application. Tables 29 and 30 display the transportation cost savings benefits for petroleum product import and export tonnage.

Table 26
Corpus Christi Petroleum Product Imports by Trade Route

	2000	2006	2016	2026	2036	2046	2056
Corpus Christi Petroleum Product Import Tonnage Total by Trade Route a/							
Latin America & Caribbean	2,425,500	5,415,093	11,263,655	15,305,290	18,759,353	21,852,447	28,181,910
Western S. America	291,060	601,677	1,052,547	1,700,588	2,084,373	2,428,050	3,131,323
Europe & Africa	5,142,060	3,447,108	2,728,426	2,932,048	3,593,746	4,186,292	5,398,833
Persian Gulf	1,552,320	1,754,891	5,041,657	7,297,542	8,944,434	10,419,217	13,437,096
Far East	291,060	1,190,819	1,423,527	1,628,916	1,996,525	2,325,718	2,999,352
Total Tonnage	9,702,000	12,409,588	21,509,813	28,864,383	35,378,431	41,211,724	53,148,515
Corpus Christi Petroleum Product Import Total by Trade Route (%) a/							
Latin America & Caribbean	25%	44%	52%	53%	53%	53%	53%
Western S. America	3%	5%	5%	6%	6%	6%	6%
Europe & Africa	53%	28%	13%	10%	10%	10%	10%
Persian Gulf	16%	14%	23%	25%	25%	25%	25%
Far East	3%	10%	7%	6%	6%	6%	6%
Total (%)	100%	100%	100%	100%	100%	100%	100%
Draft Restricted Tonnage a/							
Europe	1,501,972	2,031,318	3,458,943	4,808,033	5,893,099	6,864,769	8,853,119
Persian Gulf	438,428	1,691,558	3,053,692	3,851,282	4,720,430	5,498,748	7,091,435
Total Tonnage	1,940,400	3,722,876	6,512,635	8,659,315	10,613,529	12,363,517	15,944,555
% of Total Imports	20%	30%	30%	30%	30%	30%	30%

Source: USACE, Waterborne Commerce of the U. S. and U. S. Department of Energy, December 2000 application.
a/ Port depth, trade route, and historical vessel utilization data were used to identify the percentage of tonnage anticipated to benefit from the Corpus Christi proposed depth increases. The benefit calculations were limited to Europe, Mediterranean, and Middle East trade routes.

Table 27
Corpus Christi Petroleum Product Exports by Trade Route a/

	2000	2006	2016	2026	2036	2046	2056
Corpus Christi Petroleum Product Export Tonnage Total by Trade Route							
Latin America & Caribbean	1,786,288	1,070,833	1,288,521	1,360,703	1,369,947	1,353,071	1,354,793
Western S. America	34,232	106,878	165,906	211,494	228,181	228,609	228,854
Europe & Africa	1,173,224	1,107,088	1,170,646	1,124,896	1,081,033	1,111,405	1,156,205
Persian Gulf	62,240	89,832	111,995	120,608	134,232	146,989	153,852
Far East	56,016	199,293	251,581	303,181	327,823	335,326	339,498
Total Tonnage	3,112,000	2,573,924	2,988,649	3,120,882	3,141,216	3,175,400	3,233,201
Corpus Christi Petroleum Product Export Total by Trade Route (%)							
Latin America & Caribbean	57%	42%	43%	44%	44%	43%	42%
Western S. America	1%	4%	6%	7%	7%	7%	7%
Europe & Africa	38%	43%	39%	36%	34%	35%	36%
Persian Gulf	2%	3%	4%	4%	4%	5%	5%
Far East	2%	8%	8%	10%	10%	11%	11%
Total (%)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Draft Restricted Tonnage							
Europe	114,880	257,392	298,865	312,088	314,122	317,540	323,320
Persian Gulf	0	0	0	0	0	0	0
Total Tonnage	114,880	257,392	298,865	312,088	314,122	317,540	323,320
% of Total Exports	3.7%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%

Source: USACE, Waterborne Commerce of the U. S., and World Fleet Forecast, U. S. Gulf Coast application.
a/ Port depth, trade route, and historical vessel utilization data were used to identify the percentage of tonnage anticipated to benefit from the Corpus Christi proposed depth increases.

Table 28
Petroleum Product Tonnage Distribution by Vessel Class, Imports and Exports
U. S. Gulf Coast Petroleum Product Tanker Imports
Tonnage from Europe and the Persian Gulf

DWT Class 1000's	1998	2006	2016	2026	2036	2046	2056
<16.5	6.0%	6.4%	7.2%	7.6%	7.5%	7.3%	7.3%
16.5 to 25	4.6%	5.9%	9.7%	12.4%	14.0%	14.9%	15.2%
25 to 45	45.8%	42.8%	40.6%	39.2%	38.0%	37.1%	36.8%
45 to 80	19.6%	17.8%	19.0%	20.1%	20.9%	21.4%	21.6%
80 to 160	13.7%	12.9%	14.1%	15.3%	16.3%	16.9%	17.1%
>160	10.2%	14.2%	9.5%	5.5%	3.4%	2.4%	2.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

U. S. Gulf Coast Petroleum Product Tanker Export Tonnage to Europe

DWT Class 1000's	1998	2006	2016	2026	2036	2046	2056
<16.5	12.6%	12.2%	11.9%	11.7%	11.3%	10.8%	10.7%
16.5 to 25	12.9%	13.0%	12.2%	10.9%	9.6%	8.5%	8.2%
25 to 45	30.5%	29.6%	29.0%	28.0%	26.3%	24.7%	24.1%
45 to 80	25.1%	24.8%	23.9%	22.3%	20.3%	18.4%	17.7%
80 to 160	16.9%	15.9%	18.5%	23.7%	30.0%	35.5%	37.5%
>160	1.9%	4.5%	4.5%	3.5%	2.6%	2.1%	1.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Corpus Christi 1996/98 and average 2006-56 Refined Petroleum Products by Vessel Class

	Imports				Exports			
DWT Class 1000's	1996	1997	1998	2006/56	1996	1997	1998	2006/56
< 80	58.3%	66.7%	63.7%	50.0%	97.5%	94.3%	95.1%	86.0%
80 to 100	19.0%	11.0%	15.3%	23.0%	2.5%	5.7%	4.9%	10.0%
100 to 150	22.8%	22.4%	21.0%	25.0%	0.0%	0.0%	0.0%	4.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: World Fleet Forecast, U. S. Gulf Coast application.

Port depth, trade route, and historical vessel utilization data were used to identify the percentage of tonnage anticipated to benefit from the Corpus Christi proposed depth increases.

Table 29
Corpus Christi Petroleum Product Imports Transportation Cost and Savings

Depth	45 ft.	47 ft.	48 ft.	49 ft.	50 ft.	52 ft.
			Transportation Cost by Year			
2000	$54,325,255	$51,179,659	$49,626,015	$48,458,986	$46,789,815	$44,838,113
2006	$57,851,741	$54,497,789	$52,842,047	$51,594,599	$49,815,604	$47,721,737
2016	$95,420,050	$89,631,910	$87,700,961	$85,308,756	$82,636,659	$77,866,152
2026	$135,811,555	$127,558,102	$124,196,941	$120,821,779	$117,046,809	$110,116,338
2036	$190,297,019	$178,732,713	$173,992,654	$169,267,272	$163,975,171	$154,283,810
2046	$262,445,467	$246,496,388	$239,927,647	$233,414,389	$226,112,823	$212,766,627
2056	$359,223,605	$337,391,862	$328,385,923	$319,472,061	$309,476,061	$291,216,306
			Transportation Savings			
2000		$3,145,596	$4,699,240	$5,866,269	$7,535,441	$9,487,142
2006		$3,353,952	$5,009,693	$6,257,142	$8,036,137	$10,130,004
2016		$5,788,140	$7,719,089	$10,111,294	$12,783,391	$17,553,898
2026		$8,253,453	$11,614,614	$14,989,776	$18,764,746	$25,695,217
2036		$11,564,306	$16,304,365	$21,029,747	$26,321,849	$36,013,210
2046		$15,949,079	$22,517,821	$29,031,079	$36,332,645	$49,678,841
2056		$21,831,743	$30,837,682	$39,751,544	$49,747,544	$68,007,299
			Equivalent Annual Savings			
2006-56 @ 5.875%		$7,361,546	$10,302,120	$13,284,971	$16,731,076	$22,669,722

Table 30
Corpus Christi Petroleum Product Exports Transportation Cost and Savings

Depth	45 ft.	47 ft.	48 ft.	49 ft.	50 ft.	52 ft.
			Transportation Cost by Year			
2000	$1,402,589	$1,337,206	$1,299,261	$1,292,114	$1,285,359	$1,272,903
2006	$3,436,339	$3,273,563	$3,179,096	$3,161,304	$3,144,488	$3,113,478
2016	$3,960,981	$3,756,864	$3,633,595	$3,600,847	$3,569,879	$3,512,731
2026	$4,297,017	$4,075,321	$3,941,435	$3,905,868	$3,872,232	$3,810,162
2036	$4,661,551	$4,420,785	$4,275,383	$4,236,755	$4,200,227	$4,132,817
2046	$5,058,144	$4,796,632	$4,638,700	$4,596,744	$4,557,068	$4,483,850
2056	$5,489,173	$5,205,112	$5,033,562	$4,987,989	$4,944,892	$4,865,361
			Transportation Savings			
2000		$65,383	$103,328	$110,475	$117,230	$129,686
2006		$162,776	$257,242	$275,035	$291,851	$322,861
2016		$204,117	$327,386	$360,133	$391,102	$448,250
2026		$221,696	$355,581	$391,149	$424,784	$486,855
2036		$240,766	$386,168	$424,795	$461,324	$528,733
2046		$261,513	$419,445	$461,400	$501,077	$574,295
2056		$284,061	$455,611	$501,184	$544,281	$623,812
			Equivalent Annual Savings			
2006-56 @ 5.875%		$211,116	$337,525	$369,036	$398,833	$453,813

Bulk Grain Exports

Corpus Christi bulk grain transportation costs were estimated using the grain export tonnage and fleet data presented in the commodity and fleet forecast sections. The percentage of future grain export tonnage expected to benefit from channel depths over 45 feet was identified based on examination of vessel sizes, vessel loads, foreign port depths. Examination of 1996-99 Corpus Christi grain showed that 7.5 percent of 1996-99 tonnage was shipped in vessels that could be loaded to depths over 45 feet. The port depths for Corpus Christi's 1996-98 grain exports were examined in relationship to channel depth published in the National Imagery and Mapping Agency's 2000 World Port Index and Lloyds' 1995 Ports of the World. These publications provide well defined depth data for crude petroleum and product carriers; however, the accommodating depths for grain carriers are less definitive. However, examination of the origin-destination pairings indicated that approximately 8.5 percent of 1996-98 of Corpus Christi's grain exports were shipped to world ports which could accommodate grain carriers with loaded depths over 45 feet.

The annual transportation savings associated with the proposed channel deepening alternatives are presented in Table 31. An estimated 12 percent of 2006-56 tonnage is projected to use vessels with loaded drafts in excess of 45 feet. For the 50-foot channel, this percentage would decrease to 7 percent and to 3 percent for the 52-foot project. The bottom part of Table 31 displays Corpus Christi's grain export forecast. The tonnage projected to benefit from increased channel depths in Corpus Christi is restricted to movements to Europe and the Middle East. Transportation savings benefits were calculated for vessels in the 70,000 to 150,000 dwt range. Eighty-eight percent of the benefits are associated with vessels in the 70,000 to 90,000 dwt range and the remaining 12 percent with vessels over 100,000 dwt.

Table 31
Grain Exports Annual Transportation Cost and Savings

	45	47	48	49	50	52
	Transportation Cost for Grain Exports					
2000	$1,131,354	$1,065,319	$1,048,781	$1,033,203	$1,025,881	$1,020,312
2006	$1,534,297	$1,444,743	$1,422,314	$1,401,189	$1,391,259	$1,383,707
2016	$2,253,740	$2,122,193	$2,089,248	$2,058,217	$2,043,631	$2,032,537
2026	$2,608,304	$2,456,062	$2,417,934	$2,382,021	$2,365,140	$2,352,302
2036	$3,223,312	$3,035,173	$2,988,055	$2,943,674	$2,922,813	$2,906,947
2046	$4,530,688	$4,266,240	$4,200,011	$4,137,629	$4,108,306	$4,086,005
2056	$4,709,904	$4,434,995	$4,366,147	$4,301,297	$4,270,814	$4,247,631
				Transportation Savings		
		47	48	49	50	52
2000		$66,035	$82,573	$98,150	$105,473	$111,041
2006		$89,554	$111,982	$133,108	$143,038	$150,590
2016		$131,547	$164,492	$195,523	$210,109	$221,203
2026		$152,242	$190,370	$226,283	$243,164	$256,003
2036		$188,139	$235,257	$279,638	$300,499	$316,365
2046		$264,448	$330,677	$393,059	$422,382	$444,683
2056		$274,909	$343,757	$408,607	$439,090	$462,273
2006-56 Annual Savings, 5.875%		$145,145	$181,495	$215,734	$231,828	$244,068

Corpus Grain Exports	**2000**	**2006**	**2016**	**2026**	**2036**	**2046**	**2056**
Depths Over 45 Feet	105,297	142,800	211,776	244,786	302,036	423,726	440,416
% of Total tonnage	7.5%	12.0%	12.1%	12.1%	12.1%	12.1%	12.1%
Total Tonnage	1,404,000	1,190,000	1,748,000	2,023,000	2,500,000	3,514,000	3,653,000

Channel Deepening Benefit Summary

Table 32 displays a summary of the project deepening benefits.

Table 32
Corpus Christi Main Channel Deepening Benefits 2006-56
by Commodity and Channel Depth

Commodity	47	48	49	50	52
Crude Oil Imports	$2,609,875	$3,930,551	$5,077,072	$6,223,593	$8,419,209
Product Imports	$7,361,546	$10,302,120	$13,284,971	$16,731,076	$22,669,722
Product Exports	$211,116	$337,525	$369,036	$398,833	$453,813
Bulk Grain Exports	$145,145	$181,495	$215,734	$231,828	$244,068
2006-56 Equivalent Annual Savings 5.875 %	$10,327,682	$14,751,691	$18,946,813	$23,585,330	$31,786,812

Channel Widening Benefits

Benefits were calculated for widening the Corpus Christi Bay Channel 400- and 500-foot reaches to 530 feet. In addition to widening of the bay channel, benefits are being evaluated for a barge shelf in the 400-foot reach. The barge shelf would extend from 200 feet from the toe of the proposed 530-foot channel.

The benefits associated with widening the bay reach to 530 feet were calculated based on the probability of vessel meetings and potential delays. The Port Aransas Pilots Association vessel meeting criteria is that vessels with combined beam widths of 251 feet or more cannot meet in the 400-foot reach. An additional criterion is that meetings are not permitted between vessels with combined loaded drafts in excess of 80 feet. The pilots noted that the 80-foot combined draft limit was invoked in the early nineteen nineties. The 45-foot channel deepening project became operational in the late eighties and at that time, crude oil tankers with loaded drafts up to 45 feet mean low water (MLW) were not uncommon. Presently, few crude oil vessels are loaded to more than 41 feet. Examination of the vessel records showed that some petroleum coke vessels are presently loaded to depths up to 45 feet MLW. The Pilots said that they would allow dry cargo, such as petroleum coke, to be loaded to deeper depths than liquid cargo. The general policy is that vessels should have 3 feet or underkeel clearance. Examination of 1996-99 transit records showed that loaded drafts over 41 feet are infrequent, particularly for liquid cargo. Comparison of 1990 traffic data compiled for the 1994-reconnaissance report with recent traffic data showed that 1 foot of underkeel or less was not uncommon for liquid cargoes during the early nineties.

Benefits for widening the bay reach was calculated based on reductions in delays due to the combined beam width restriction. Benefits were not calculated for easement of the underkeel clearance policy as the pilots indicated that there would not be a change in the policy to maintain an average minimum of 3 feet of underkeel clearance.

Table 33 presents the distribution of 1997-2000 Corpus Christi deep-draft vessel transits by beam width. Table 33 also presents summary data associated with the probability of vessel meetings for combined beam widths of 251 feet or more and combined loaded drafts over 80 feet in the 400-foot wide 12-mile reach of Corpus Bay. Based on a random arrival pattern and a distance of 25 miles across Corpus Bay, it was determined that there was a 48 percent chance of vessels meeting in the 12-mile reach. The value of .48 was applied to the probability of combined beam width meetings. Analysis of the 1997-2000 indicated that the probability of meetings between beam widths of 251 feet ranged from 6 percent in 1994 to 21 percent in 2000. The future probability of meetings in the 12-mile reach was estimated to range from 3 percent for 1994 to 10 percent in 2000. Port Aransas Pilot log records for the period January 1, 2000 through September 30, 2001 generated similar, however slightly more conservative, findings; however, the pilot records showed that for a 9-month sample period 75 vessels were delayed. The pilots said they may not of recorded every vessel delay. Application of the sample data indicates that 94 vessels would be delayed annually with an expected annual cost due to beam width delays of $227,000. Use of the statistically generated random arrival data generates an annual delay cost of $243,856. The average annual cost base of $243,856 was calculated based on 94 to 106 vessels delayed annually, EGM 02-06 foreign-flag tanker vessel operating costs corresponding to the delayed vessels, and an average delay duration of 1.77 hours. The number of hours delayed was calculated from the January through September pilot data. The pilots said that vessels that presently incur delays in the 400-foot reach are not restricted in the 500-foot reach and they said that the channel widening improvement would essentially reduce all of the present delay cost.

Table 33
Corpus Christi Ship Channel
1994-2000 Distribution of Vessel Trips by Vessel Beam Width (feet)

Beam Range (feet)	Average Beam	1994	1995	1996	1997	1998	1999	2000
<99	72	34.0%	32.3%	34.6%	38.0%	35.7%	37.9%	30.5%
100-104	102	32.5%	29.0%	28.6%	7.3%	6.9%	2.7%	3.3%
105	105	7.6%	10.0%	5.8%	7.8%	5.2%	2.8%	5.0%
105-107	106	5.6%	6.4%	9.0%	14.8%	15.8%	17.1%	21.0%
108-112	108	0.1%	0.1%	0.1%	0.2%	0.0%	0.6%	0.3%
113-114	113	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
115-122	118	0.5%	1.4%	0.8%	1.3%	1.3%	1.3%	1.1%
123-127	125	0.3%	0.3%	0.5%	0.7%	0.9%	2.0%	1.6%
128-140	136	13.8%	14.0%	15.0%	20.4%	23.7%	26.9%	26.6%
141-153	146	5.7%	6.1%	5.8%	9.3%	10.3%	7.8%	9.9%
>153	161	0.1%	0.3%	0.0%	0.2%	0.2%	0.8%	0.8%
Total		100%	100%	100%	100%	100%	100%	100%
Total One-Way Trips								
		984	1007	826	1091	1121	1056	1065
Probability of Combined Beams Greater than 251 feet Meeting in Corpus Bay								
		6.3%	7.0%	6.5%	15.6%	18.3%	17.7%	20.8%
Probability of Combined Beams Greater than 251feet Meeting in 400-foot Wide 12-mile Reach								
		3.0%	3.3%	3.1%	7.5%	8.8%	8.5%	10.0%
Estimated Number of Vessels Delayed in the 400-ft Reach								
		30	34	26	81	98	90	106

The interview and log data were used to formulate probability distributions that incorporated the range of delay times obtained from the data the interviews. The project benefits were based on reductions in delays presently incurred due to the channel dimensions. The annual reduction in delay costs is summarized in Table 34. Total vessel trips were projected to increase at an average annual rate of 1 percent for the period 2000 through 2056 and the rate of growth for draft restricted vessels was projected to increase at an annual rate of 2 percent between 2000-26 and by 1 percent for the remainder of the economic evaluation period. Determination of the vessel trip growth rate was based on examination of historical growth. It was found that vessel sizes have increased and the average tons per trip have risen. Vessel trip growth has been slower than tonnage growth due to utilization of larger vessels. The results of the analysis showed that an annual growth rate of – should be expected.

In addition to beam width delays, the pilots said that channel widening and deepening would likely result bay transit time savings of 6 to 20 minutes for all vessels with beam widths over 80 feet. The pilots noted that these timesavings would occur for the entire 25-mile bay reach. A 6 to 8 minute timesavings noted from examination of ERDC vessel simulation data. The pilots contended that the timesavings would likely be between 15 and 20 minutes. An average savings of 13 minutes (the midpoint between 6 and 20) was used to calculate project induced hydraulic time savings for vessels with beams over 80 feet. The transit timesavings for 1994-2000 traffic are displayed in Table 35 and the equivalent annual 2006-56 benefits are displayed in Table 36.

Table 34
Corpus Christi Ship Channel, Annual Deep-Draft Vessel Widening Benefits
Delays Due to Combined Beam and Draft Restrictions, and Tug Availability

Year	Annual One-Way Trips	Hourly Cost	Annual Trips Delayed	Annual Delay Cost
2000	1,084	$1,205	100	$243,856
2006	1,197	$1,205	122	$258,287
2016	1,323	$1,205	149	$395,293
2026	1,461	$1,205	181	$481,859
2036	1,614	$1,205	200	$532,273
2046	1,783	$1,205	221	$587,960
2056	1,969	$1,205	244	$649,474
2000-56 Average Annual Growth Rate	1.7%	2006-56 Equivalent Annual Benefits 5.875 %		$417,660

Table 35
Corpus Christi Transit Time Savings Due to Deepening and Widening a/

Average Beam (ft)	At Sea Hourly Cost	1994	1995	1996	1997	1998	1999	2000
72	$672	$0	$0	$0	$0	$0	$0	$0
102	$751	$52,068	$47,505	$38,460	$13,037	$12,548	$4,726	$5,704
105	$829	$13,492	$18,169	$8,635	$15,291	$10,434	$5,397	$9,534
106	$835	$10,056	$11,687	$13,408	$29,172	$32,072	$32,796	$40,588
108	$884	$96	$288	$96	$384	$0	$1,151	$575
113	$909	$0	$0	$0	$0	$0	$197	$0
118	$934	$912	$2,837	$1,317	$2,837	$3,040	$2,837	$2,432
125	$1,031	$559	$783	$895	$1,790	$2,237	$4,698	$3,803
136	$1,099	$32,314	$33,507	$29,453	$53,182	$63,436	$67,729	$67,491
146	$1,238	$14,977	$16,522	$12,895	$27,133	$31,163	$22,029	$28,208
161	$1,434	$311	$934	$0	$622	$622	$2,489	$2,489
Total Delay Annual Cost		$124,786	$132,232	$105,159	$143,449	$155,553	$144,051	$160,825

a/ Calculated using EGM 00-06 Deep-Draft Vessel Operating Costs. Application of the EGM 02-06 costs would reduce these delays by 1 to 2 percent. The saving presented in Table 36 reflect EGM 02-06 costs.

Table 36
Corpus Christi Transit Time Savings Due to Deepening and Widening 2000-56
Energy Savings Benefits a/

Year	Vessel Trips	Annual Savings
2000	740	$158,497
2006	786	$168,248
2016	868	$185,850
2026	958	$205,294
2036	1,059	$226,772
2046	1,170	$250,498
2056	1,292	$276,705
Equivalent Annual Benefits 5.875%		$200,572

a/ The Port Aransas Harbor Pilots said these benefits could not be exclusively allocated as widening or deepening specific. The combination of widening and deepening was projected by the pilots to facilitate reduction in energy force as the vessel moves through the channel.

Corpus Christi Barge Shelf Analysis

The Corpus Christi Ship Channel's inner bays segment (mile 12 to mile 22) is characterized by intersection of deep draft ship traffic coming from the Gulf of Mexico and inland waterway tug and barge traffic traveling on the Gulf Inter-Coastal Waterway (GIWW). Congestion in the waterway has brought about traffic management rules governing maximum beam and draft avoid collisions. The cost of this operating regime is manifested in vessel delays affecting deep-draft ocean-going vessels and shallow-draft tow barges. Barge shelves are proposed to separate the traffic and reduce the congestion induced delay cost. This section of the report examines the economic feasibility of the barge shelves.

The existing Inner Bay section of the Corpus Christi Ship Channel is 45 x 400 feet. Traffic delays have four sources. The largest is the beam restriction. Vessels are not allowed to pass if their combined beam is greater than 251 feet. One vessel must delay in a safe area until the other vessel has passed. Tugs are required to assist vessels operating the inner harbor, when tugs are not available, vessels must wait. The restricted draft results in large vessels waiting for adequate traffic conditions. The final source of delay, and the one that would be affected by a barge shelf, is the delay caused when towboats and ships are expected to meet at specific points in the inner bay segment of the ship channel. An example is the turn in the channel at light #44. Pilots avoid meeting tow operators at this point by delaying. The Port Aransas Pilots have provided an approximation of these delays based on a group consensus. The pilots estimate the incident of delays to be one out every three ship movements. The average delay time was noted as approximately 15 minutes. For the year 2000, 1254 incidents where estimated for a total of 313.5 hours delay time[5].

Existing Condition Delay Cost for Deep-Draft Vessels. To estimate the annual delay cost of barge congestion delays a weighted vessel operating cost per hour was developed. In the year 2000, 3762 vessels traversed the Corpus Christi Ship Channel inner bay segment. The predominate vessel type was foreign flag tankers followed by bulk and general cargo vessels. Based on the movements in 2000, the weighted average vessel operating cost was estimated at $800 per hour. Multiplying this time the 313.5 hours delay estimated by the pilots yields an annual delay cost of about $250,000. There has been no cost associated with allisions, collisions and groundings that would be alleviated by the barge shelf. However, pilots report "near misses" occur on nearly every movement. While these near misses have no monetary cost, they produce great anxiety and suggest a future with either collisions, or more likely, more operating rules and procedures designed to prevent accidents.

The reductions in transportation cost associated with the barge shelf feature were calculated using the annual delay reduction of $250,000. Under this scenario the incident of delay remains at one per three movements. Vessel traffic is forecasted to increase by one to two percent per year. The equivalent annual benefits for the 50-year economic evaluation period were estimated at $311,787 ($207,650 for deep-draft vessels and $104,137 for shallow-draft vessels). The

[5] Letter dated October 9, 2001 from the Port Aransas Pilots association to the Galveston District.

consensus of the deep-draft pilots was that two-thirds of the delay cost that they incur due to barge traffic would be alleviated by widening the deep-draft channel to 530 feet and one-third of the delays that the deep-draft vessels would be used by the barge shelf alone.

Existing Condition Delay Cost for Tow Barges. Representatives of three major tow operating companies that regularly use the Corpus Christi Ship Channel were interviewed concerning the interaction between towboats and deep-draft vessels in the bay reach of the Corpus Channel. Of the three operators, two said that tow vessels delay of "hold up" due to deep-draft vessel traffic between 30 and 33 percent of the time. The third company representative said that their operators indicated that they delay movements about 5 percent of the time. The estimated delay times for the 3 companies interviewed ranged between 10 and 15 minutes. This information suggests that annual towboat delays are approximately $23,597. The annual delay cost was calculated use a 2-barge tow consisting of tow 195- by 35-foot barges and a 1,200 horsepower towboat and the annual tow trip forecast presented in Table 37. Examination of the barge fleet associated with study region transits showed that this tow size is representative of average tow dimensions. The hourly operating cost for this tow is approximately $175 per hour (EGM 00-05 FY2000 shallow-draft vessel operating cost).

Table 37
Corpus Christi Cut B
Annual Towboat Trips and Barge Shelf Savings

Year	1996	1997	1998	2006	2016	2026	2036	2046	2056	2006-56 Equivalent Annual Savings
Towboat Trips	2570	2610	2814	3048	3366	3719	4108	4537	5012	5.875%
Annual Benefits			$23,597	$25,552	$28,225	$31,179	$34,440	$38,044	$42,024	$30,461

Source: USACE, dock-to-dock records. Growth for 1998-2056 was estimated at 1% per annum.

Channel Widening and Barge Shelf Summary

Table 38 presents a summary of the total benefits from the barge shelf and from channel widening. The benefits were calculated using probability distributions, which were defined from delay records and interview data. The range associated with the equivalent annual widening benefit of $819,837 is $615,170 to $1,377,835. The range associated with the barge shelf benefits of $134,598 is $101,710 to $354,942. Incorporation of these ranges into an @risk triangular distribution shows that there is a 75 percent probability that widening benefits are higher than $819,837, a 1 percent probability that they are lower than $672,129. The risk evaluation shows that there is an 87 percent probability that the barge shelf benefits are higher than $134,157 and a 1 percent probability that the benefits are lower than $110,829.

Table 38
Summary of Channel Widening Benefits and Barge Shelf Benefits

	Widening	**Channel Widening & Deepening**			**Barge Shelf**		
Year	Delays to Deep-Draft Vessels Due to Beam & Draft Restrictions, And Tug Availability a/	Transportation Cost to Deep-Draft Vessels From Resistance Reductions b/	Deep-Draft Vessel Delays from Ship-Barge Delays c/	**Widening Total**	Deep-Draft Vessel Delays from Barge Induced Delays	Shallow-Draft Vessel Delays From Deep-Ship Induced Delays	**Barge Shelf Total**
2000	$240,326	$158,497	$164,090	$562,913	$82,291	$23,597	$105,888
2006	$254,548	$168,248	$174,185	$596,981	$87,354	$25,552	$112,906
2016	$389,571	$185,850	$192,409	$767,830	$96,493	$28,225	$124,718
2026	$474,884	$205,294	$212,538	$892,716	$106,588	$31,179	$137,767
2036	$524,568	$226,772	$234,775	$986,115	$117,740	$34,440	$152,180
2046	$579,449	$250,498	$259,338	$1,089,285	$130,058	$38,044	$168,102
2056	$640,073	$276,705	$286,469	$1,203,247	$143,665	$42,024	$185,689
			Equivalent Annual Savings 2006-56				
5.875%	$411,615	$200,572	$207,650	$819,837	$104,137	$30,461	$134,598

a/ Reductions in year 2000 transportation cost associated with tug availability delays were estimated at $33,775 or 6 percent of the $562,913 total.

b/ The pilots noted that the benefits could not be exclusively allocated as widening or deepening specific. The combination of widening and deepening was projected by the pilots to facilitate reduction in energy force as the vessel moves through the channel.

c/ The pilots noted that channel widening would facilitate a reduction in deep-draft delay frequencies associated with time lost to avoid the possibility of meeting tows at critical points.

La Quinta Channel

This section presents the La Quinta Channel analyses. The project alternatives investigated were deepening the existing Federal portion of the La Quinta Channel and extension of Federal project.

Deepening of the Existing Federal Project

Examination of the vessel sizes and trade routes associated with tonnage transported through the existing 45-foot channel showed that only a small number of vessels were loaded to drafts in excess of 40 feet. Additional analyses indicated that the port depths at shipping and receiving ports were and would continue to remain a constraint. Comparison of the project construction costs to deepening the existing channel to depths over 45 feet with potential reductions in transportation costs associated with more deeply loaded vessels did not produce a benefit-to-cost ratio above unity.

Extension of the Federal Project

Determination of the Federal interest in the extension of the existing limits of the La Quinta was evaluated based on the results of a multiport analysis. The purpose of the analysis was to determine if La Quinta offered a competitive advantage over existing and anticipated container facilities such as the Port of Houston's Barbours Cut and Bayport projects and the Texas City Shoal Point project.

Currently, a dedicated containerized cargo handling facility does not exist at any locale or landside terminal supported by the existing Corpus Christi Channel System (CCCS). The governing non-Federal port authority for the harbor has decided to undertake studies to determine the economic viability of establishing a new terminal northward of the terminus of the existing La Quinta Channel and vessel turning basin. A critical consideration for the establishment of such facilities is whether incremental or marginal extension of the existing waterway can be justified to support the movement of vessel services to dockside facilities proposed for construction at the identified location of the new terminal.

Initially, three sites were considered for establishment of containerized cargo facilities. These locales included the site presently identified for terminal development that is situated on the northern shore estuarine area northwestward of the terminus of the channel. The other locations are further southeastward, also along the northern or eastern shoreline and within reach of the existing channel system. It was found that the other two sites were excluded from further consideration due to costs of acquisition, development, and limitations imposed by proximity to landside rail linkages and arable land readily suiTable for related development.

Studies for the placement of new facilities in the vicinity of La Quinta Channel emphasize the application of multi-port analyses. While multi-port studies are a mandated consideration under USACE planning guidance for all deep-draft or coastal harbor navigation studies, the requirement and extent to which such efforts are undertaken is dependent upon the influence of conditions unique to proposed waterway improvements on alternative ports and terminals (and modes of transportation) and the potential of such influences to structure plan formulation. While many studies do include some components of multi-port analysis, most do not emphasize multi-port efforts as existing waterway systems already have a baseline or captive market and marginal realignment of tonnage from a alternative is either not considered viable or sufficiently significant to marginally alter plan formulation or development at alternative locales or facilities of (potential) concern.

As stated previously, analyses for extension of La Quinta Channel emphasized the application of multi-port analyses. This requirement is based on the determination from preliminary inquiries (and subsequent studies) that presently, subject facilities do not exist (nor would they foreseeably exist without some level or scope of waterway improvements) and that little or a relatively insignificant portion of the cargo throughput that would be handled by new facilities would be comprised of induced cargo movements unique to the new terminal. Consequently, studies required the assessment of tonnage movements currently handled or processed via some alternative port or terminal location in the absence of facilities proposed for La Quinta Channel.

The general approach of the multi-port analysis was to determine if facilities and supporting waterway improvements proposed for extension of La Quinta Channel would afford sufficient logistical or transportation cost efficiencies to allow attraction or cultivation of cargo throughput and business to economically justify the life-cycle costs of terminal development and waterway improvements over time.

Comparative or Alternative Port Facilities and Markets. With terminal facility location being the coast of Texas bordering the Gulf of Mexico, several ports represent potential or competitive alternatives to containerized cargo facilities located in Corpus Christi. With respect to imports and exports to\from the United States, the most noTable of these is Houston followed secondarily by other ports along the Gulf coast extending from Texas to perhaps as far eastward as Alabama. While ports eastward of Texas may offer significantly less competition to tonnage destined to/from Texas, they are nonetheless included in studies because the tonnage that these ports handle collectively influences the nature of vessel services and logistics which serve Gulf coast domestic ports.

In addition to competitive consideration of domestic Gulf coast ports, investigations also reveal that facilities in Corpus Christi would also be favorably located to compete with port facilities in Mexico, notably Altamira which presently handles a variety of non-perishable containerized cargo destined for U.S. ports outside the Gulf and other foreign nations.

Comparative or Alternative Modes of Transport. Integral to multi-port facility studies is the requirement for multi-mode transport analysis. The requirements for such studies as they related to proposed development for LaQuinta involves consideration of both landside and waterborne forms of transport with the former largely comprised of the alternatives of rail or truck (with little or no emphasis on air transport given the nature of cargo probably involved). Multi-mode transport analysis is also often part of economic study efforts to determine transportation cost efficiencies from origin to destination of a unit of cargo with consideration of ultimate origin and destination as practical study requirements and associated budgetary and time constraints allow.

Data from the Journal of Commerce Port Import/Export Research System/Service (JoC-PIERS) was combined with data compiled by the Waterborne Commerce Statistics Center of the U.S. Army Corps of Engineers (WCSC-USACE) and supplemented with data for respective vessel physical characteristics (length, breadth, draft, capacity, etc.) to assess the geographic flow or distribution patterns of cargo moving by deep-draft waterborne trade via the Gulf coast region. The combined data product rendered a comprehensive database for origin and destination (reasonably determined as available data permitted), general inferences on trade routings and ports of process or handling, magnitude of movement, probable mode and scale of landside and waterborne transport, and similar or additional information which could be applied for transportation cost analysis concerning proposed and alternative port facilities. With data analyzed from a geographical perspective, procedures to analyze total transportation costs both landside and waterborne could be undertaken and the economically rational range(s) of market(s) for port hinterlands could be reasonably determined to ascertain the potential market and market share for La Quinta facilities. Particular to landside transport costs, efforts involved the research of rail and trucking rates according to scale and frequency of movement, and hinterland or port origin/destination with an emphasis of geographic market thresholds where the Port of Corpus Christi would be competitively positioned based on such costs.

Potential or Viable Markets. Studies to-date indicate that the most favorable geographic markets for containerized cargo terminal facilities situated in Corpus Christi are some market hinterlands which are presently served regionally by the port of Houston (domestically) and containerized cargo handling facilities in Altamira (Mexico). Further, analysis of available information also indicates that containerized facilities in Corpus Christi may also render a competitive transportation cost efficiency to land bridging of selected movements to\from the west coast (via such ports as Los Angeles\Long Beach) which are currently moving through the Panama Canal. The primary trade partners or markets which existing Gulf coast ports serve (with noTable reference to Houston and Altamira) and which Corpus Christi would also likely serve include South America, the Caribbean basin, Europe and potentially some limited coastwise movements to and from the eastern seaboard of the United States. Corpus Christi offers an advantage of existing facilities in Houston because terminal capacity in Houston is near capacity. Container throughput in the Port of Houston has been reported at levels between 900,000 and 1,000,000 TEUs including empties. The Executive Summary of Phase 2, Conceptual Development Study for Shoal Point described the Port of Houston's maximum practical capacity at 1.2 million TEUs and its sustainable capacity at approximately 900,000 TEUs. In response to the need for future terminal capacity several terminal projects are being pursued including projects at Bayport, Galveston and Texas City. However, it is not clear at this time that these projects will succeed or that those that do succeed will provide sufficient capacity for long-term market growth. In addition, the Houston area is facing significant challenges in the areas of traffic congestion and pollution. The terminal development in Corpus Christi may provide a portion of the incremental capacity needed to serve Texas markets without potential pollution and congestion problems. In addition, Corpus offers a mileage advantage over Houston for landbridge movements from the U. S. West Coast and Texas. Corpus Christi offers a 50-mile over Houston for movements from West Texas and the U. S. West Coast and a 193-mile advantage for movements from Brownsville. Furthermore, Corpus Christi has a relatively better position for serving the growing Northeast Mexico market. Corpus Christi offers a mileage and time savings advantages over Altamira, Mexico for several locations in Northern Mexico. In some cases mileage differentials were less than 5 miles; however, there was a timesavings of over 2 hours due to relatively more advantageous roads. Specific to waterborne transport, review and analysis of vessel classes or sizes currently employed for container trade along the U.S. Gulf coast indicates that vessels ranging in size from approximately 1,800 to 2,200 twenty-foot equivalent unit (TEU) capacity would form the lower bound of fleet service with the upper bound typically supported by vessels of 2,400-3,700 TEUs augmented by vessels of Panamax class with capacities of approximately 3,900 to 4,850 TEUs. Presently available information indicates vessels of Post-Panamax design would not routinely or significantly service proposed facilities, at least in the immediate and interim term of the port assuming a base period of analysis beginning in 2005 to 2006. Respective to vessel utilization, it is largely anticipated that containerized cargo carriers which serve Corpus Christi will be employed with similar utilization and loading patterns and resulting transit drafts, though it is also anticipated the progression of vessel services will exhibit some time lag behind those comprehensively employed to serve the port of Houston. In addition, as with other Gulf coast containerized services, the utilization (both loading and service frequency) of upper class carriers will be influenced prior and post ports of call and considerations of transit time to transit the Gulf.

With review of such considerations and data for transit draft(s) as exhibited for vessel services serving the port of Houston, prevailing and foreseeable transit patterns indicate that containerized vessel service in the region to/from foreign destinations can be viably supported with transit drafts (and commensurate vessel loadings) of 30 to 35 feet which may serve as a threshold level of service sufficient to justify initial placement and ongoing operation of proposed terminal facilities. Due to the significant value of NED benefits associated with threshold development of facilities it is conceivable that typical NED economic optimization of channel depth could result in authorized reference depths of less than 37.0-39.0 feet. However, the typical process is often applied to existing waterways and harbor reaches for which proposed improvements and development constitute a marginal or incremental measure (and which often do not derive a predominant share of NED benefits from realignment of landside transportation) as opposed to the establishment of new facilities design to garner applicable market share and economic viability through realignment of landside transportation as much as (or more than) improvements to waterborne vessel operation(s). In addition, it is anticipated that transit draft will increase over time as vessel classes are more intensively utilized commensurate with expected growth in trade. Accordingly it appears economically and technically rational to analyze the potential for Federal interest in proposed waterway improvements from a two-stage process; optimization based on initial placement of facilities and supporting transport services (threshold level of activity for placement and economic return) and secondary or final optimization for waterway improvements based on foreseeable changes or efficiencies in vessel service commensurate with marginal improvements beyond threshold or initial placement requirements. This would allow optimization of Federal interest to be based primarily on efficiencies for vessel services (as typically encountered with other studies) and avoid the probable need of the sponsor to immediately request another study to justify depths practically needed to service evolving vessel services supporting the Gulf of Mexico. To require pursuit of an additional study effort or authority to justify marginal depth that may be reasonably justified at the time of initial project placement would likely impose marginal costs detrimental to the Federal interest of economic efficiency and impose a developmental lag on development of non-Federally sponsored facilities.

Assuming a process based on incremental optimization of vessel operations, the primary foreign trade partners and level of TEU throughput (including allowances for repositioning or prepositioning of empty containers) is illustrated in Table 39 for container movements for which NED benefits are derived, notably Europe, Latin America, and the Caribbean Basin while Table 40 summarizes the approximate NED benefits for betterments to landside transportation (on an average annual equivalent for trade partners listed in Table 39 and respective flows or origins/destinations of movement. Table 40 summarizes the NED markets and benefits and calculates the total NED benefits for the POCC the base year. Table 41 presents the 2006-2056 annual landside transportation savings benefits anticipated as a result of La Quinta site transportation efficiencies. The benefits are derived from the net landside transportation cost savings that La Quinta could provide over alternative existing and anticipated container port sites. Table 42 summarizes total NED benefits and project construction cost according to depth.

Table 39
TEUs Per Call Including Empties by Market

Europe	2 Weekly Services	714	74,297
Latin America (Based on 75% of Latin America)	2 Weekly Services	366	38,082
Central America/Caribbean (Based on 25% of Latin America)	2 Weekly Service	122	12,694
		Total Annual TEUs	125,073

Table 40
Summary of NED Annual Benefits for Annual NED Throughput of 25,978 TEUs

	POCC NED TEUs	Savings/ Benefit	Total Savings/Benefits	Percent of Total
Southwest Texas	6,990	$ 107.54	$ 751,705	38.5%
Landbridge	14,423	$ 47.22	$681,017	34.9%
NE Mexico	3,136	$ 50.00	$156,793	8.0%
Asia-Latin America	1,430	$252.94	$ 361,577	18.5%
Total Annual TEUs	25,978		$1,951,092	

Table 41
La Quinta Channel Extension Landside Transportation Cost NED Benefits

Base Year	$1,951,092
2006	$2,350,004
2016	$4,696,234
2026	$7,346,718
2036	$10,392,186
2046	$14,143,507
2056	$15,999,160
2006-56 Equivalent Annual Benefits 5.785%	$6,152,960

Table 42
Ocean-Going Transportation Equivalent Annual Cost Savings Thousands of dollars

Channel Depth	First Cost	Average Cost	O&M Cost	Total Cost	Average Benefits	B/C Ratio	Net Benefits
37	$23.578	$1.470	$532	$2.002	$2.817	1.4	$814
38	$23,920	$1,491	$533	$2,025	$3,077	1.5	$1,053
39	$23,968	$1,494	$535	$2,029	$3,112	1.5	$1,083
40	$24,016	$1,497	$536	$2,033	$3,085	1.5	$1,052
41	$24,418	$1,522	$541	$2,063	$2,993	1.5	$930
Total Transportation Cost Savings Benefits							
Ocean-Going Costs and Landside Transportation Cost Savings							
37	$23,578	$1,470	$532	$2,002	$9,059	4.5	$7,056
'38	$23,920	$1,491	$533	$2,025	$9,319	4.6	$7,295
39	$23,968	$1,494	$535	$2,029	$9,354	4.6	$7,325
40	$24,016	$1,497	$536	$2,033	$9,327	4.6	$7,294
41	$24,418	$1,522	$541	$2,063	$9,235	4.5	$7,172

La Quinta Channel Associated Costs

This section presents analysis of the costs associated with the development of the La Quinta container facility and provides a comparison of the project's associated costs with the expected transportation savings benefits and revenue. According to the port's preliminary master plan, the terminal will be built in three phases. Table 43 displays a summary of the project's site development and equipment costs. As noted in Table 43, the estimated average annual equivalent cost, which includes engineering supervision, administration and contingencies, is $21,773,932. Phase 1 will be built in conjunction with the channel extension and will cost approximately $211 million. The first cost of $211 is in addition to the channel deepening cost $24 million. Phases 2 and 3 will proceed as need arises and will each cost approximately $68 million. Phase I cost includes wharf construction, container rails, site grading and paving, a 94-acre container terminal, 3 container cranes, 10 gantry cranes, 30-yard hostlers, reefer connections, and other yard equipment. The site development costs were annualized over the 50-year economic evaluation period for evaluation in relationship the equivalent annual benefit stream anticipated from the proposed facility.

Table 43
Summary of Average Annual Equivalent (AAEQ) Costs Associated With Placement of La Quinta Container Terminal Under With Project Conditions
5.875% unless otherwise noted

Cost Components	First Cost	AAEQ Cost
Off-Site Infrastructure	$ 1,070,880	$66,759
Site Preparation / Infrastructure	15,899,862	$991,198
Wharf and Marine Terminal	72,437,253	$4,515,739
Intermodal Yard	20,178,320	$1,257,917
Public Access Improvements	1,354,991	$84,470
Land Acquisition Cost	3,027,910	$188,760
Cargo-Handling Equipment Costs	96,924,628	$6,042,282
Phase I Subtotal(s)	$210,893,844	$13,147,125
Engineering Supervision & Administration (15%)	$31,634,077	$1,974,035
Engineering Contingency (15%)	$31,634,077	$1,974,035
Phase 1 Total Costs	$274,161,997	**$17,095,194**
Phase 2 and 3 Costs (assume to occur by year 10)	$136,000,000	**$4,678,738**
Total Average Annual Equivalent Cost	**n/a**	**$21,773,932**

Along with site development costs, the associated costs needed to realize the project benefits include daily facility operation expenses. Anticipated operation and maintenance costs for the facility were estimated using budget data for comparable ship terminals presently servicing dry cargo goods at other U. S. Gulf Coast ports. Additionally, the port's 1999 and 2000 annual reports were reviewed and pertinent data were pro-rated based on the expected throughput volume for the La Quinta facility. Operating expenses include direct and indirect costs for employee services, utilities, telephone, insurance, security, office equipment and administrative services. Table 44 summaries the annual operating expenses for the proposed facility. The combined estimated average annual equivalent associated costs for both site development and operation and maintenance totals $22,915,066 ($21,773,932 + 1,141,134).

Table 44
La Quinta Container Facility Expected Operating Cost

	Total Annual TEUs	Estimated Operating Expenses
2006	150,645 [a/]	$513,613
2016	238,632	$813,601
2026	386,001	$1,316,045
2036	568,568	$1,938,495
2046	786,419	$2,681,243
2056	906,657	$3,091,185
2006-56 Average Annual Equivalent Expenses 5.875%		$1,141,134

[a/] Opening the facility in the year 2000 was expected to generate an annual volume of 125,073 TEUs. Growth was expected to increase to 176,217 by the year 2006. The present construction schedule suggests that the year 2006 volume should be 150,645 TEUs.

La Quinta Channel Container Revenue

The revenue stream expected from the proposed container cargo facility was evaluated in relationship to total project cost. Expected revenue was used as a proxy for evaluating the port's ability to generate returns sufficient to cover the La Quinta channel extension costs and the associated site facility and operational costs. The port expects to find a private terminal operator to undertake these investments and operate the facility at a profit. There is expected to be little public investment in the entire La Quinta Terminal. Normal shipping costs, which include such things as terminal charges, berth charges, crane costs, yard storage costs, rail and truck costs can all be expected, whether containers move through La Quinta or any other facility. The independent market analysis conducted by the Corps shows that expected TEU throughput during the first year of service would increase from 150,645 TEUs in year 1 to 966,135 by year 50. The NED throughput for year one is expected to be 31,290 TEUs or 20.8 percent of annual throughput. Income revenue for the La Quinta facility was estimated based on tariffs paid to container companies presently operating at existing ports and from data published in the "Journal of Commerce". Current tariffs range from $181 for a 20-foot equivalent unit to $226 per 40-foot equivalent unit. Using 150,645 TEUs and a tariff of $200 per container, annual revenue is $30,129,000. Average annual equivalent revenue for the 50-year economic evaluation period is $78,653,863. The revenue associated with NED movements is $16,336,612. Table 45 presents the annual revenues that could the port could expect over the 50-year economic evaluation period.

Table 45
Corpus Christi Container Facility
Annual TEU Throughput and Estimated Annual Revenue

Year	Total Annual TEUs	NED TEUs [a/]	Revenue Based On Annual TEUs	Total Annual TEUs based on present schedule [b/]	Revenue based on present schedule
2000	125,073	25,978	$ 25,014,600		
2006	176,217	36,601	$ 35,243,345	150,645	$ 30,128,973
2016	301,048	62,528	$ 60,209,572	301,048	$ 60,209,572
2026	470,955	97,819	$ 94,190,952	470,955	$ 94,190,952
2036	666,182	138,368	$133,236,350	666,182	$ 133,236,350
2046	906,657	188,315	$181,331,362	906,657	$ 181,331,362
2056	1,025,612	213,022	$205,122,450	966,135	$ 193,226,948
2006-56 Average Annual Equivalent Revenue 5.875 %			**$ 80,335,686**		**$ 78,653,863**

La Quinta Project Construction and Associated Cost and Benefit Evaluation

As displayed in Table 42, the 39-foot depth generates the highest net excess benefits for the La Quinta Extension. The first cost for construction of the La Quinta 39-foot channel extension is $23,968,000 and average annual equivalent project costs, which include channel operation and maintenance, is $2,029,000. The expected annual transportation cost savings benefits for the 39-foot channel depth are $9,354,000. The benefit-to-cost ratio based on the equivalent annual benefits of $9,354,000 and annualized project cost of $2,029,000 is 4.6. Inclusion of the average annual associated costs increases the equivalent annual cost from $2,029,000 to $24,944,066. Revenue generated from container traffic will be used to payback the sponsor's site investment costs. Comparison of the combined channel construction and landside facility cost of $24,944,066 with the revenue of $78,653,863 produces a return of 3.2. Calculation of the rate of return for the NED throughput and the full facility cost is 0.7. Comparison of the Phase I construction cost and the NED throughput represents a relatively "worst case" test condition as it is based on the low cargo throughput and maximum project cost. The cost needed to realize the NED benefits would be less than the full facility cost. The cost difference would be reflected in the cargo handling equipment cost. The cargo handling equipment cost represents 36 percent of facility cost. It should be noted that the port would be less inclined to construct the facility if they did not anticipate capturing the higher volumes identified in the market analyses; however, the associated cost analysis suggests that the transportation cost benefits and associated tariff generated revenues are sufficient to cover the water and landside construction and maintenance cost based on the Port's expected tonnage throughput.

Corpus Christi and La Quinta Channels Benefit Summary

Table 46 displays a summary of the NED benefits for deepening the Corpus Christi Channel, widening the bay reach, and extending the La Quinta Channel. The project benefits were calculated at 5.875 percent interest and are for the period 2006-56. The NED plan for the Corpus Christi Main Channel is the 52- by 530-foot alternative. The NED plan for the La Quinta extension is 39 feet. The barge shelf feature has a benefit-to-cost ratio of 1.3 and justified as a stand-alone feature.

Table 46

Construction Cost and Benefit Summary 2006-2056 and AAEB 5.875%

	First Cost	Average Annual Cost	O&M Cost	Total Cost a/	Annual Benefits	B/C Ratio	Net Excess Benefits
Corpus Christi Channel Beneficial Use Plans Deepening, Widening							
48x530	$109,687,247	$6,837,904	$947,809	$7,785,713	$15,571,529	2.0	$7,785,816
50x530	$143,475,000	$8,944,233	$1,303,607	$10,247,840	$24,405,167	2.4	$14,157,327
52x530	$156,984,000	$9,786,384	$1,669,900	$11,456,284	$32,606,650	2.8	$21,150,365
Corpus Christi Barge Shelf							
	$1,257,000	$78,361	$26,982	$105,343	$134,598	1.3	$29,255
La Quinta Channel Deepening of Existing 45-foot Project							
48	$12,683,000	$790,658	n/a	$790,658	$482,169	0.6	($308,489)
50	$13,279,000	$827,813	n/a	$827,813	$702,502	0.8	($125,311)
52	$13,297,700	$828,979	n/a	$828,979	$702,502	0.8	($126,477)
La Quinta Channel Extension of Existing Project							
36 a/	23,195,000	$1,445,692	$546,850	$1,992,542			
37 d/	23,557,500	$1,468,575	$547,824	$2,016,398	$8,913,620	4.4	$6,897,222
38 a/	23,920,000	$1,491,173	$548,797	$2,039,970	$9,230,160	4.5	$7,190,190
39 d/	23,968,000	$1,494,165	$550,306	$2,044,471	$9,264,460	4.5	$7,219,989
40 a/	24,016,000	$1,497,158	$551,815	$2,048,973	$9,238,000	4.5	$7,189,027
41 d/	24,418,000	$1,522,218	$556,424	$2,078,642	$9,145,880	4.4	$7,067,238
42 a/	24,820,000	$1,547,279	$561,032	$2,108,311	$9,145,880	4.3	$7,037,569

a/ Provided by Cost Estimating Branch, December 2001 unless otherwise noted.
b/ The 48-foot project cost was estimating by applying the December 1999 to 2001 price change factor to the December 1999 costs provided by the Cost Estimating Branch.
c/ The cost for deepening of the existing La Quinta Channel were done by Cost Estimating in December 1999 and reflect 1999 prices.
d/ The costs for La Quinta 37-, 39-, and 41-foot depths were interpolated.

DEEP-DRAFT TRANSPORTATION SAVINGS SENSITIVITY ANALYSIS

Introduction

Sensitivities were evaluated for crude petroleum and petroleum product imports. The sensitivity effects were assessed in relationship to the benefit-to-cost ratios, net excess benefits, and NED plan. The tonnage ranges used for the sensitivities were based on the upper and lower range of the projection levels displayed in Tables 2 and 6. The percentage of tonnage expected to utilize Corpus Christi channel depths beyond the existing 45-foot depth was also evaluated for the crude petroleum and petroleum product import sensitivities. An additional criteria used for crude petroleum was evaluation of the alternative distributions of direct shipment versus offshore transfer for North Sea and Africa tonnage. As discussed previously and outlined in the following section, there is a relatively large degree of variance in transportation cost for this route.

Crude Petroleum Imports

Two crude petroleum sensitivity scenarios were developed using the lower and higher range crude petroleum import forecasts and alternative percentage distributions of direct versus lightering or lightening. Lightering and lightening are referred to as offshore transfer. As discussed in detail in the main portion of the appendix, lightering involves the transfer of tonnage at an offshore location from a larger vessel, called a VLCC (Very Large Crude Carrier), onto one or more shuttle vessels. With lightering, the VLCC does not enter the coastal receiving port.

Total tonnage used for the low and high range scenarios was displayed in Table 2 and is summarized in Table 47. Besides the percentage of tonnage expected to utilize increased Corpus Christi channel depth, the most sensitive variable affecting the crude petroleum import benefits is the distribution of direct shipments versus offshore transfer. As discussed on pages 30-32 and presented in Table 20, direct shipment is the least cost method for shipments from Mexico and South America and offshore transfer is the least cost shipping method for the North Sea, Africa, and the Middle East. The cost analyses showed that a long duration offshore transfer process due to demurrage, the less cost effective offshore transfer is. The range of demurrage used for offshore transfer sensitivity was defined to range from a minimum of 1.0; average 1.8; and maximum of 2.5. The range was identified based on industry input. As noted in the main portion of the appendix, industry personnel indicated that the number of days to completely lighter a VLCC is normally from 4 to 10 and the average number of days to completely lighter 200,000 to 300,000 dwt vessels is 5.5; however, it was noted that 2 weeks is not uncommon.

Five and a-half days equate to 1.5 times the in-port unloading rate. Utilization of the upper limit of 2 weeks relates to a less than optimal shuttle turnaround.

Table 47

Corpus Christi Crude Petroleum Import Tonnage Forecast (1998-2056)
1000's of Short Tons

		Corpus Christi Crude Petroleum Imports		
	U. S. Imports		95% Confidence Interval	
Year	EIA Reference Forecast	Base Case Imports	Lower Range	Upper Range
1998	476,638	33,931	33,931	33,931
1999	477,999	34,049	34,049	34,049
2000	484,584	35,121	35,121	35,121
2006	570,286	42,037	32,601	51,474
2016	674,092	51,023	40,414	61,631
2025	709,060	54,050	45,835	62,264
2026	719,939	53,093	42,216	63,970
2036	838,342	55,247	44,098	66,398
2046	976,218	57,488	46,063	68,917
2056	1,136,769	59,821	48,117	71,532
		Average Annual Growth Rates		
2000-2025	1.5%	1.7%	1.1%	2.3%
2000-2056	1.5%	1.0%	0.6%	1.3%

Source: Application of the DOE/EIA 2003 Annual Review Forecast.

The minimum cost per ton for offshore transfer is based on a factor difference between on-shore and offshore demurrage of 1.0. The mean and maximum costs are based on a triangular distribution of 1 as a minimum, 1.8 as the mean, and 2.5 as the maximum. The factor of 1.8 is slightly higher than the factor difference between the on-shore and offshore average and 2.5 is less than the maximum factor difference between two weeks and on-shore loading rates. The latter factor difference is 3.5. It is recognized that offshore transfer rates are characteristically faster than on-shore rates. Recent discussions with industry indicated that offshore transfer rates average 40,000 barrels per hours, whereas on-shore rates average 25,000 to 35,000. These transfer rates were used for the main report analysis and for this sensitivity.

The maximum cost calculations used both for the sensitivity and the main portion of the appendix reflect utilization of some less than optimal vessels; however, the same range of vessels were used for the mean and maximum cost calculations. The direct shipment costs, like the costs for offshore transfer, reflects utilization of the most efficient range of vessel sizes given the Corpus Christi channel depths and trade route constraints.

Analysis of the Middle East transportation costs showed that, even with long duration offshore transfer periods, direct shipment is more costly than lightering. Review of shipping records for 2000 indicates no direct shipments for Middle East crude oil. The cost difference between lightening and direct shipment for the North Sea and Africa route is relatively small and there is an overlap in the costs between the two methods of shipment. The overlap appears to contribute to a significant portion of North Sea and Africa crude oil imports being shipped direct. Table 48 displays the mean, minimum and maximum cost by method of shipment cost for direct, lightening, and lightening for Africa and North Sea movements. Crude petroleum shipped from Africa and the North Sea is normally transported in Suezmax vessels, which characteristically range between 126,000 and 158,000 dwt. The median design drafts for Suezmax vessels exceed 50 feet. Crude shipped from the Persian Gulf is usually shipped in VLCCs and ULCCs (ultra large crude carriers). The VLCCs and ULCCs remain offshore and transfer oil to shuttle vessels. VLCCs are characteristically between 200,000 and 350,000 dwt.

The benefit calculations for the *low range* crude petroleum import sensitivity are based on 100 percent of Africa and North Sea crude oil imports using offshore transfer. The historical data shows that approximately 50 percent of Africa and North Sea is presently shipped direct and the remainder is lightered or lightened. The *higher range* crude petroleum import scenario assumes the same distribution of direct versus offshore transfer as the base case scenario but has 75 to 85 percent of tonnage utilizing the increased channel depth instead of the 50 percent used for the base case. Table 49 displays the base case tonnage distribution. The tonnage for the low and high range sensitivities were calculated from these base tonnages.

Table 50 presents the low and high range for the crude petroleum import benefits. For comparative purposes, the benefits for the base case as presented in Tables 21-23 are also summarized in Table 50.

Table 48
Corpus Christi Crude Petroleum Imports
Transportation Cost by Method of Shipment for Representative Trade Routes

Channel	North Sea & Africa			Africa		
Depth	Mean	Min	Max	Mean	Min	Max
			Direct Shipment			
45	$9.80	$9.44	$10.38	$10.91	$10.46	$11.40
47	$9.17	$8.79	$9.66	$10.22	$9.80	$10.68
48	$8.89	$8.50	$9.36	$9.90	$9.49	$10.35
50	$8.38	$8.01	$8.79	$9.33	$8.95	$9.76
52	$7.83	$7.57	$7.98	$8.72	$8.46	$8.85
			Lightened			
45	$9.80	$9.44	$10.38	$10.91	$10.46	$11.40
47	$9.17	$8.79	$9.66	$10.22	$9.80	$10.68
48	$8.89	$8.50	$9.36	$9.90	$9.49	$10.35
50	$8.38	$8.01	$8.79	$9.33	$8.95	$9.76
52	$7.83	$7.57	$7.98	$8.72	$8.46	$8.85
			Lightered			
45	$9.89	$7.87	$12.68	$10.68	$8.66	$13.47
47	$9.89	$7.85	$12.68	$10.68	$8.64	$13.47
48	$9.28	$7.64	$11.75	$10.68	$8.43	$12.54
50	$9.28	$7.64	$11.75	$10.68	$8.43	$12.54
52	$9.28	$7.64	$11.75	$10.68	$8.43	$12.54

Petroleum Product Imports

The sensitivity evaluation for petroleum product imports was based on the lower and upper ends of the tonnage projections presented in Table 6. Total tonnage used for the low and high range scenarios as displayed in Table 6 and is summarized in Table 50. The transportation savings for the base case assume 30 percent utilization of the channel depths over 45-feet. The low range sensitivity assumes 15 percent, and the high range assumes 50 percent. Table 51 summarizes the base case transportation savings benefits and the low and high range sensitivities.

Summary of Sensitivity Findings

Table 52 summarizes the effects of the sensitivities on the benefit-to-cost ratios, net excess benefits, and subsequent determination of the NED plan. The indication from the sensitivities evaluated is that the is no change in the NED plan.

Table 49
Recommended Plan
Deep-Draft Tonnage Used for Channel Deepening Benefits
Method of Shipment & Trade Route

Direct Shipments	2000	2006	2016	2026	2036	2046	2056
South America & Mexico	7,377	7,377	8,952	10,464	12,227	14,287	16,694
Mexico	3,820	3,820	4,635	5,418	6,331	7,398	8,644
Latin America	3,557	3,557	4,317	5,046	5,896	6,889	8,050
Europe/Africa/Med	1,347	1,493	1,893	1,995	1,988	2,060	2,206
N Sea	406	328	310	302	266	234	207
Africa	941	1,165	1,583	1,694	1,722	1,825	1,999
Middle East	0	0	0	0	0	0	0
Far East	0	0	0	0	0	0	0
Total Direct	8,724	8,871	10,846	12,459	14,214	16,346	18,900
Lightered / Lightened							
South America & Mexico	0	228	277	324	378	442	516
Europe/Africa/Med	1,347	1,493	1,893	1,995	1,988	2,060	2,206
Middle East	2,052	3,768	6,627	7,721	8,151	8,614	9,110
Far East	208	419	539	517	452	397	351
Total Lightered	3,607	5,909	9,336	10,557	10,968	11,512	12,183
Total Used For Benefits	12,331	14,779	20,182	23,015	25,182	27,859	31,084
Total Tonnage	35,121	42,037	51,023	54,050	53,093	57,488	59,821
% of Total Tonnage	35%	35%	40%	43%	47%	48%	52%

Table 50

Corpus Christi Crude Petroleum Imports
Transportation Savings Sensitivity Comparison

	47-ft	48-ft	49-ft	50-ft	52-ft
		Base Case (Table 23)			
2006	$2,046,782	$3,051,880	$3,933,197	$4,814,515	$6,538,781
2016	$2,478,575	$3,742,684	$4,837,654	$5,932,624	$8,020,328
2026	$2,763,835	$4,179,875	$5,404,367	$6,628,858	$8,954,159
2036	$2,971,859	$4,488,804	$5,801,490	$7,114,175	$9,609,149
2046	$3,241,509	$4,887,623	$6,313,811	$7,739,998	$10,456,155
2056	$3,579,494	$5,385,976	$6,953,632	$8,521,288	$11,515,651
2006-56 @ 5.875%	$3,579,494	$5,385,976	$6,953,632	$8,521,288	$11,515,651
		Low Range Scenario			
2006	$656,194	$2,790,606	$3,305,923	$3,767,302	$4,527,226
2016	$1,007,594	$3,300,435	$4,015,331	$4,673,580	$5,762,280
2026	$1,147,215	$3,562,471	$4,352,969	$5,085,200	$6,303,779
2036	$1,289,651	$3,898,699	$4,767,786	$5,575,457	$6,933,798
2046	$1,456,247	$4,315,463	$5,277,337	$6,173,325	$7,695,173
2056	$1,650,272	$4,823,076	$5,893,497	$6,892,132	$8,604,269
2006-56 @ 5.875%	$1,037,565	$3,464,803	$4,198,761	$4,873,460	$5,996,204
		High Range Scenario			
2006	$5,628,616	$6,694,142	$8,904,925	$11,167,258	$15,724,407
2016	$8,359,568	$8,437,373	$11,472,623	$14,635,950	$21,015,107
2026	$8,743,580	$8,868,917	$12,045,902	$15,356,132	$22,010,144
2036	$8,652,477	$9,313,938	$12,546,186	$15,893,659	$22,579,614
2046	$8,584,550	$9,900,293	$13,212,794	$16,619,159	$23,376,740
2056	$8,536,264	$10,636,770	$14,052,332	$17,536,708	$24,399,917
2006-56 @ 5.875%	$7,954,421	$8,507,407	$11,472,128	$14,543,200	$20,713,112

Table 51

U. S. and Corpus Christi Petroleum Product Import Forecast (1998-2056)

Thousand of Short Tons

Corpus Christi Petroleum Product Imports

Year	Base Case Forecast Application	Lower Range	Upper Range
1998	7,495	7,495	7,495
1999	7,627	7,627	7,627
2000	9,702	9,702	9,702
2006	12,975	5,693	20,258
2016	19,472	10,240	28,703
2025	26,614	15,528	37,699
2026	27,596	16,340	38,852
2036	39,124	25,921	52,328
2046	54,429	38,740	70,118
2056	74,720	55,842	93,597
	Average Annual Growth Rates		
2000-2025	3.9%	1.7%	5.3%
2000-2056	3.6%	3.1%	4.0%

Source: Application of the DOE/EIA 2003 Annual Review Forecast.

Table 52

Corpus Christi Petroleum Product Imports
Transportation Savings Sensitivity Comparison

	47-ft	48-ft	49-ft	50-ft	52-ft
	Petroleum Product Base Case (Table 29)				
2006	$3,353,952	$5,009,693	$6,257,142	$8,036,137	$10,130,004
2016	$5,788,140	$7,719,089	$10,111,294	$12,783,391	$17,553,898
2026	$8,253,453	$11,614,614	$14,989,776	$18,764,746	$25,695,217
2036	$11,564,306	$16,304,365	$21,029,747	$26,321,849	$36,013,210
2046	$15,949,079	$22,517,821	$29,031,079	$36,332,645	$49,678,841
2056	$21,831,743	$30,837,682	$39,751,544	$49,747,544	$68,007,299
2006-56 @ 5.875%	$7,361,546	$10,302,120	$13,284,971	$16,731,076	$22,669,722
	Petroleum Product Low Range Scenario				
2006	$735,801	$1,099,044	$1,372,713	$1,762,995	$2,222,355
2016	$1,521,943	$2,029,670	$2,658,681	$3,361,286	$4,615,651
2026	$2,443,496	$3,438,592	$4,437,834	$5,555,442	$7,607,259
2036	$3,830,876	$5,401,102	$6,966,467	$8,719,566	$11,929,997
2046	$5,675,902	$8,013,562	$10,331,478	$12,929,933	$17,679,530
2056	$8,157,978	$11,523,273	$14,854,160	$18,589,416	$25,412,631
2006-56 @ 5.875%	$2,178,438	$3,047,847	$3,932,866	$4,947,094	$6,720,818
	Petroleum Product High Range Scenario				
2006	$8,727,599	$13,036,143	$16,282,233	$20,911,504	$26,360,131
2016	$14,220,161	$18,964,068	$24,841,180	$31,405,922	$43,125,988
2026	$19,366,523	$27,253,405	$35,173,139	$44,031,013	$60,293,193
2036	$25,778,593	$36,344,905	$46,878,498	$58,675,395	$80,278,909
2046	$34,243,924	$48,347,527	$62,332,003	$78,009,039	$106,664,368
2056	$45,578,730	$64,380,678	$82,990,391	$103,859,316	$141,980,709
2006-56 @ 5.875%	$17,277,019	$24,180,927	$31,173,689	$39,279,953	$53,162,995

Table 53

Construction Cost and Benefit Summary 2006-2056 and AAEB 5.875%

Plan	First Cost	Average Annual Cost	O&M Cost	Total Cost a/	Annual Benefits	B/C Ratio	Net Excess Benefits
Base Case (Table 46) Corpus Christi Channel Beneficial Use Plans Deepening, Widening							
48x530	$109,687,247	$6,837,904	$947,809	$7,785,713	$15,571,529	2.0	$7,785,816
50x530	$143,475,000	$8,944,233	$1,303,607	$10,247,840	$24,405,167	2.4	$14,157,327
52x530	~~$156,984,000~~	~~$9,786,384~~	~~$1,669,900~~	~~$11,456,284~~	~~$32,606,650~~	~~2.8~~	$21,150,365
Low Range Scenario Corpus Christi Channel Beneficial Use Plans Deepening, Widening							
48x530	$109,687,247	$6,837,904	$947,809	$7,785,713	$7,851,507	1.0	$65,794
50x530	$143,475,000	$8,944,233	$1,303,607	$10,247,840	$11,271,052	1.1	$1,023,212
52x530	$156,984,000	$9,786,384	$1,669,900	$11,456,284	$14,234,742	1.2	$2,778,457
High Range Scenario Corpus Christi Channel Beneficial Use Plans Deepening, Widening							
48x530	$109,687,247	$6,837,904	$947,809	$7,785,713	$34,027,191	4.4	$26,241,478
50x530	$143,475,000	$8,944,233	$1,303,607	$10,247,840	$55,273,651	5.4	$45,025,811
52x530	$156,984,000	$9,786,384	$1,669,900	$11,456,284	$75,393,826	6.6	$63,937,542

APPENDIX H

CORPUS CHRISTI SHIP CHANNEL –CHANNEL IMPROVEMENT PROJECT
REAL ESTATE PLAN

CORPUS CHRISTI SHIP CHANNEL, TEXAS
FIFTY-FOOT PROJECT
FEASIBILITY STUDY PHASE
REAL ESTATE PLAN

CESWG-RE-E

April 2003

TABLE OF CONTENTS

GENERAL: This Real Estate Plan (REP) is the real estate work product of the U.S. Army Corps of Engineers, Galveston District, Real Estate Division (the "District") that supports project plan formulation for the Corpus Christi Ship Channel, Texas, Channel Improvement Project (the "Project"). It identifies and describes the lands, easements, and rights-of-way (LER) required for the construction, operation, and maintenance of the proposed Project, including those required for relocations, borrow material, and dredged or excavated material disposal. The REP also identifies and describes the facility/utility relocations that are necessary to implement the Project.

PROJECT DESCRIPTION: The Corpus Christi Ship Channel is a deep-draft navigation project, which connects harbor facilities in the Corpus Christi area with the Gulf of Mexico. The work required for this Feasibility Study consists of office, field, and laboratory work necessary for evaluating deep-draft navigation improvements for the Corpus Christi Ship Channel from the Gulf of Mexico to the Corpus Christi Inner Harbor and the La Quinta Channel. The Corpus Christi Ship Channel is located in Corpus Christi Bay on the southern portion of the Texas coast, 200 miles southwest of Galveston and 150 miles north of the mouth of the Rio Grande. The Project study area is situated in Nueces and San Patricio Counties.

PROJECT TYPE & APPLICABILITY: The Feasibility Study is prepared in response to a Congressional study resolution adopted August 1, 1990, by the Committee on Public Works and Transportation, U.S. House of Representatives. The resolution reads:

> Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, That the Board of Engineers for Rivers and Harbors, is requested to review the reports on the Port Aranasas-Corpus Christi Ship Channel, Texas (45-Foot Project) published as House Document 99, 90th Congress, Second Session, and other pertinent reports to determine the feasibility of modifying the Corpus Christi Ship Channel, with particular emphasis on the La Quinta Channel and Harbor Island, in the interest of commercial navigation and related purposes.

SCOPE & CONTENT: Three deepening alternatives for the entire length of the Corpus Christi Ship Channel from the Gulf of Mexico to Viola Turning Basin, and four widening alternatives across Corpus Christi Bay from La Quinta Junction to Beacon 82 for a total of twelve alternatives, were evaluated. In addition to the above twelve alternatives, one widening alternative across Corpus Christi Bay was evaluated. Three deepening alternatives were evaluated for the La Quinta Channel, as well as an extension at five depths and turning basin at the west end of the La Quinta Channel for eight more alternatives considered. One alternative of barge shelves was also evaluated on both sides of a portion of the Corpus Christi Ship Channel. The without project, or no-action alternative, is one more for a grand total of twenty-three alternatives. Each alternative is be analyzed at the level of detail sufficient to determine the recommended plan. Each alternative is divided into the following increments for quantity computations, dredged material placement plans, and cost and benefit estimating purposes:

1. Entrance Channel to Inner Basin
2. Inner Basin to La Quinta Junction
3. La Quinta Junction to Beacon 82
4. Beacon 82 to Viola Turning Basin
5. La Quinta Channel Extension

PURPOSE: The purpose of the REP is to identify the real estate requirements for the Project and to estimate the costs of acquisition. The plan will also identify the estate to be acquired in the various tracts. The Non-Federal Sponsor already owns all lands needed for the Project. The sponsor will receive credit for the fair market value of these lands at the time they are made available to the Government for construction. The sponsor will also receive credit for the administrative costs of acquisition for all lands acquired within the five (5) years preceding the signing of the Project Cooperation Agreement.

DESCRIPTION OF LER: Approximately 41 million cubic yards (mcy) of new work material and 208 mcy of maintenance material will be generated over the 50-year life of the Project. A Dredging Material Placement Plan was developed to determine where and how the dredged material would be used.

The Project will utilize eight (8) existing confined upland sites, all subject to navigation servitude, that have been used in conjunction with construction and maintenance of the present authorized 45-foot channel:

IH-PA 1, East and West Cells (2 sites), 350 acres Plate F-44;
Rincon Placement Area (IH-PA 2), 230 acres Plate F-44:
South Shore Placement Area (IH-PA 3), Cell A 200 acres, Cell B 183 acres, Cell C (3 sites) Plate F-43;
Mustang Island (IH-PA 6), 304 acres Plate C-13; and
La Quinta Channel (IH-PA 13), 750 acres Plate F-45.

All of these sites except will be utilized for placement of new work and maintenance material throughout the economic life of the project. Mustang Island will be utilized for new work material only.

An additional three (3) sites will be utilized for the Project. These are owned by the Non-Federal Sponsor.

Suntide Placement Area (IH-PA 8), 306 acres Plate F-42;
Tule Lake Placement Area (IH-PA 6), 360 acres Plate F-42; and

La Quinta Buffer Zone (BU E), 100 acres Plate F-33, 5-year temporary work easement.

Suntide and Tule Lake will be utilized for new work and maintenance throughout the economic life of the project. BU E will be used only once for new work material.

When the 45-Foot Project was authorized in 1968, the Non-Federal Sponsor, as an element of local cooperation, was responsible for 100 percent of the disposal areas, including the construction and maintenance of all appurtenant facilities (i.e. berms, levees, spill-boxes, etc.). In 1976, Section 124, PL 94-587 modified local cooperation requirements for the 1968 Act, shifting responsibility for cost of disposal areas and confinement works from sponsor to joint 75 percent Federal and 25 percent non-Federal responsibility. Therefore, all existing confined upland sites are "Dredged Material Disposal Facilities," as described in Section 217 of WRDA 96 and PGL 47, and cost sharing will remain the same.

The Project will also use two existing upland unconfined placement sites that have been used in the past:

Placement Area No. 2 on San Jose Island, Plate C-15; and
Pelican Island (PA's 7 and 8), Plate F-34.

Both sites will be utilized for new work and maintenance throughout the economic life of the project.

The Project will also utilize an existing offshore placement site (PA 1, 510 acres) and eight (8) bay sites (14-A, 14-B, 15-A, 15-B, 16-A, 16-B, 17-A, & 17-B) to confine both new work and maintenance dredging material. Seven (7) new open-water beneficial-use sites will be established:

1) Offshore Underwater Topography Relief – BU MN, Plate F-29;
2) Dagger Island – BU I, Plate F-30;
3) La Quinta Junction, East – BU R, Plate F-31;
4) La Quinta Junction, West – BU S, Plate F-31;
5) Corpus Christi Bay – BU CQ, Plate F-32;
6) La Quinta Extension – BU GH, Plate F-33; and
7) Offshore Underwater Topography Relief – BU ZZ, Plate F-29.

All of these sites will be used only once to contain new work material.

A perpetual pipeline easement and right-of-way for the location, construction, operation, maintenance, and repair and patrol of the dredged material placement pipeline will be needed for the Suntide Disposal Area. The non-Federal Sponsor has previously provided a term pipeline easement that will be converted to perpetual. Because the same easement has been previously provided, the non-Federal Sponsor will receive no additional credit. The entirety of the La Quinta Channel Extension is subject to navigation servitude and no real property interest is required. **Where dredge material is used to produce environmental benefits, the increased costs associated is shared with a non-Federal partner at 65% Federal and 35% non-Federal for implementation and 100% non-Federal for operation and maintenance.**

NON-FEDERAL LER: The Non-Federal Sponsor for the Project is the Port of Corpus Christi Authority (the "Non-Federal Sponsor"). Acquisition needed for the Project will be the responsibility of the Non-Federal Sponsor. The Sponsor owns fee title to all of the Placement areas, however investigation has shown that additional easement acreage of 340 for Suntide placement area, 378 for the Tule Lake placement area, and 130 acres for the La Quinta Channel Extension are required to be conveyed to the United States. Suntide Placement Area (IH-PA 8) is an upland confined placement area located just west of the end of the Project channel, as shown on Plate F-42. This placement area was used in the past for material disposal and was secured by a 50-year easement. Acreage in this site not secured by the easement has now been added for this Project and has been valued accordingly. The appraised market value, subject to a surface area drainage easement, is $246,000. Tule Lake Placement Area (IH-PA 7) is an upland confined placement area, which is south of the ship channel, as shown on Plate F-42. Although this placement area is an existing placement area that has been used for material disposal in the past, it was not then owned in fee by the PCCA. The PCCA purchased this site in early 1990. The appraised market value of this parcel is $3,475,000. La Quinta Buffer Zone (BU E) is an upland site located on Port of Corpus Christi Authority property just north of the new turning basin proposed for the La Quinta Channel Extension, as shown on Plate F-33. The appraised market value of this parcel is $1,950,000. New work material (primarily clay) will be placed in this area to be used for the future development of a buffer zone that will separate public-use lands from industrial sites. All these tracts are owned in fee by the Non-Federal Sponsor and the fee estate will remain with the Sponsor. Perpetual disposal easements for all upland sites will be conveyed to the Government. ER 405-1-12, paragraph 12-9 declares that "it is the policy of USACE to acquire, or to require a non-Federal sponsor to provide" fee title for disposal and borrow areas required for future maintenance work. The Non-Federal Sponsor is providing fee title. The added benefit of requiring the conveyance of perpetual easements to the Government is that it gives the Corps better control for future maintenance dredge cycles. A recorded easement puts the Public on notice that the Government has an interest in the property and must be consulted before placing any structures on the property. **The amount of credit received for these tracts will be controlled by the procedures set out in a future PCA.**

As described in Section 101(a) of WRDA 86, as amended, for harbor or inland harbor commercial navigation projects, the Non-Federal Sponsor is entitled to credit against its share of project costs for the value of LER it provides and the value of relocations that are required for the Project. The amount of credit afforded will directly affect the amount of the Non-Federal Sponsor's cash contribution otherwise required for construction of the Project. For the purpose of determining the amount of credit to be afforded, the value of LER is the fair market value of the real property interests, plus certain incidental costs of acquiring those interests, that the Non-Federal Sponsor provided for the Project as required by the Government. The fair market value is determined by, or is based upon, an appraisal prepared by a qualified appraiser. Although State rules will typically control the appraisal process for acquisition and crediting purposes by a Non-Federal Sponsor, application of Federal rules of just compensation may be required as a matter of policy for crediting purposes.

For LER acquired by a Non-Federal Sponsor within a five-year period preceding the effective date of the PCA for the Project, or at any time after the effective date of that PCA, the value of the real property interests also will include the documented incidental costs of acquiring such interests, as determined by the Government, subject to an audit to determine the reasonableness, allocability, and allowability of costs. These incidental costs include, but are not necessarily limited to, closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps and mapping costs, as well as the actual amounts expended for payment of P.L. 91-646 relocation assistance benefits as required for compliance with law and implementing regulations. In no event shall contingency or planning type allowances be included in land contribution appraisal values approved for credit against the sponsor's share of construction costs.

The Non-Federal Sponsor shall not receive credit for the value of any LER, including incidental costs that have been provided previously as an item of cooperation for another Federal project. Further, for projects that include LER value as a part of shared total project costs, the value amount that is non-creditable must be excluded from total project costs. Requests for exceptions to this policy together with persuasive rationale must be forwarded through Division to HQUSACE (ATTN: CERE-AP) for coordination and final determination.

ACQUISITION SCHEDULE: Acquisition of LER necessary for the Project is the responsibility of the Non-Federal Sponsor, however, for the current Project, the Sponsor owns all lands needed including the La Quinta extension, therefore there is no need for an acquisition schedule.

ESTATES/NON-STANDARD ESTATES: **Generally, it is the policy of USACE to acquire, or to require a non-Federal sponsor to provide, fee title for disposal areas located on fast land that are required for commercial navigation projects for a harbor or inland harbor. (405-1-12, Chap. 12-3)** A permanent disposal area easement and a perpetual dredge material pipeline and effluent easement will be required for future maintenance work. A permanent nonstandard disposal area easement will be required by the Government as follows:

> A perpetual and assignable right and easement and right-of-way in, on, and over and across lands as specified will grant to the United States, its representatives, agents, and contractors as a disposal area including the right to construct, operate and maintain levees, ditches and pipelines and

further including the right to borrow and/or deposit fill, dredged material and waste material thereon and to perform any other work necessary and incidental to the construction of the Project; reserving, however to the landowner, their heirs and assigns, all such rights and privileges as may be used without interfering with abridging the rights and easement hereby acquired; subject, however to existing easements for public roads and highways, public utilities, railroads and pipelines.

This non-standard estate was approved and used in the Houston-Galveston Navigation Channels, Texas, Project.

INTERNAL FEDERAL PROJECTS: There are several Federal water-related projects in the Corpus Christi Bay area:

The Rincon Canal is located just west of the Nueces Bay Causeway on the Corpus Christi side of the Causeway. This Canal was not constructed as a Federal Project, but was recently assumed for Federal maintenance.

The Port Aransas Channel and Basin is located just behind the jetties in the community of Port Aransas in the area formerly referred to as Turtle Cove. This project consists of an entrance channel, a harbor, and two overlapping rubble stone breakwaters at the entrance to the harbor. The original Federal improvements were authorized in 1913;

The Jewel Fulton Canal is a shallow-draft tributary channel to the Corpus Christi Ship Channel project. It is located off of the La Quinta Channel, approximately 1.9 miles north of the intersection of the La Quinta Channel and Corpus Christi Ship Channel. Federal improvements to this channel were authorized in 1958;

The Channel to Aransas Pass is a channel which extends from Port Aransas to the Aransas Pass Turning Basin and Conn Brown Harbor which are located in the city of Aransas Pass on the mainland. This project was last improved in 1979;

The Channel to Encinal Peninsula extends a distance of about 8 miles from the Corpus Christi Ship Channel near Ingleside, southward toward the U.S. Naval Air Station on Encinal Peninsula, and terminates with a turning basin. This Project was completed in December 1941 and is currently inactive;

The Gulf Intracoastal Waterway (GIWW) is an inland shallow-draft navigation channel that parallels the Gulf of Mexico shoreline and provides over 1,300 miles of sheltered waterway between Brownsville, Texas, and St. Marks, Florida. The GIWW traverses the study area from north to south and intersects the Corpus Christi Ship Channel near Ingleside, approximately 9.5 miles inland from the Gulf;

The Lydia Ann Channel is an alternate route for the GIWW between Rockport and the Corpus Christi Ship Channel. The existing channel was authorized to be a Federally maintained channel in October 1962; and

Naval Station Ingleside is located just north of the Corpus Christi Ship Channel at Ingleside. This facility connects with the ship channel and consists of a harbor, turning basin, and dock facilities constructed by the Department of the Navy. The Navy's Mine Countermeasure Fleet is currently stationed at this facility.

FEDERALLY OWNED LAND WITHIN LER: The majority of Federally owned or controlled lands within the LER are subject to Navigation Servitude.

LER BELOW MEAN HIGH WATER MARK: All lands and affected facilities located below the mean high water are subject to Navigation Servitude.

PROJECT INDUCED FLOODING: No project induced flooding is anticipated.

RELOCATION ASSISTANCE BENEFITS: There will be no relocation assistance benefits payable under Public Law 91-646 as amended by Public Law 100-17. No residences, business, or farming operations will be displaced.

MINERAL ACTIVITY: The procedure of the Corps of Engineers in acquiring the necessary land or interests therein to accommodate projects authorized by the Congress is to permit the reservation of the minerals in the land, unless the reservation is inimical to the operation of the Project. In most cases wherein a reservation is permitted, the mineral interests are subordinated to the primary project purposes, including public access and preservation of environmental quality. Generally fee title to all subsurface interests will be acquired in areas required for all structures, areas required for project operations and public use including access, and in areas where the value of the subsurface interests is nominal. Reservation of coal, oil, gas and other minerals will be permitted whenever any aspect of mineral development will not interfere with project purposes. The reservation of mineral rights will be predicated upon the Government's right to so regulate their development as to eliminate any interference with project purposes and to minimize any adverse impact on the environment including aesthetic values. Oil and gas mining is active in the Project area. A review of oil and gas activity indicates that there are a total of one thousand five hundred sixty eight (1,568) permitted well sites in the Project area. There are no wells in the current disposal areas or channels to be used for this Project. In Texas, while mineral estate can be severed from the surface and is considered by law to be the dominant estate, the Texas Railroad Commission has spacing and other rules which protect developed areas from having oil wells drilled in dangerous proximity. There is also a court developed doctrine often called the accommodation doctrine whereby the oil interest is required to act reasonably in not overburdening the surface estate. No mineral, oil, or gas rights will be acquired since dredging operations will be limited to existing ship channels and no impact to oil and gas wells is expected. Based on the foregoing, subordination of the mineral interest to the surface estate is deemed to be unnecessary.

TABLE 1
BASELINE COST ESTIMATE
CORPUS CHRISTI SHIP CHANNEL-CHANNEL IMPROVEMENT PROJECT
FEASIBILITY STUDY PHASE
REAL ESTATE PLAN

The values contained in the table below are solely for cost estimating purposes. The amount of credit for all LER provided by the non-Federal sponsor will be controlled by the procedures set out in a future PCA.

ACCOUNT	DESCRIPTION	ESTIMATE Total	ESTIMATE Mitigation	CONTINGENCIES Total	CONTINGENCIES Mitigation
01	**Lands & Damages**				
01-23	**Construction Contract Documents**				
01-23-03	**Real Estate Analysis Documents**				
01-23-03-01	**Real Estate Planning Documents**				
	Planning by non Federal Sponsor				
	Review of Sponsor Plan				
01-23-03-02	**Real Estate Acquisition Documents**				
	Acquisitions by Sponsor	0	0	0	0
	Review of Sponsor	$7,000	0	$1,750	0
01-23-03-03	**Real Estate Condemnation Documents**				
	Condemnations by Sponsor	0	0	0	0
	Review of Sponsor	0	0	0	0
01-23-03-05	**Real Estate Appraisal Documents**				
	Appraisals by Sponsor	$15,000	0	$1,000	0
	Review of Sponsor	0	0	0	0
01-23-03-06	**Real Estate PL 91-646 Asst. Documents**				
	PL 91-646 Asst. By Sponsor	0	0	0	0
	Review of Sponsor	0	0	0	0
01-23-03-15	**Real Estate Payment Documents**				
	Payments by Sponsor (Land)	$5,734,000	0	$15,750	0
	Payments by Sponsor (Damages)	0	0	0	0
	Payments by Sponsor (Deep Draft Utility Relocations)	$13,015,647	0	0	0
	Payments by Sponsor (PL 91-646)	0	0	0	0
	Review of Sponsor				
01-23-03-17	**Real Estate LERRD Credit Documents**	0	0	0	0
	Total Admin & Payments	$18,771,647	0		
	Total Contingencies			$18,500	0
	GRAND TOTAL	$18,790,147			

NON-FEDERAL SPONSOR'S CAPABILITY TO PROVIDE LER: The Non-Federal Sponsor is highly capable of performing the real estate acquisition required by this Project. The Non-Federal Sponsor has performed real estate acquisition satisfactorily for similar navigation projects and is well acquainted with Federal real estate acquisition regulations including the provisions of PL 91-646. The Non-Federal Sponsor already owns all lands needed for this Project, therefore we anticipate no issue here. (SEE Capability Assessment of Potential Non-Federal Sponsors of Cost-Shared Civil Works Projects, Appendix 8.)

ANTICIPATED ZONING CHANGES: No zoning changes are anticipated for this Project.

LAND ACQUISITION: All LER necessary for the Project are the responsibility of the Non-Federal Sponsor, however the Sponsor owns all needed lands.

FACILITY/UTILITY RELOCATIONS: There are 48 pipeline and conduit facilities below the channel that will be affected by the Project. A determination of which of the facilities will probably be impacted was made during the feasibility study.

These include forty (40) deep draft utility relocations, eight (8) removals. The cost of the removals will be borne 100 per cent by the non-Federal interests. For all deep draft utility relocations, one-half of the costs shall be borne by the owner of the facility being relocated and one-half of the cost shall be borne by the non-Federal sponsor. A line-by-line categorization of these facilities is attached as Appendix 6. All removals and deep draft utility relocations are located in the open water. There are no bank removal areas affecting removals or relocations.

Based on current law and Administration policy, cost-sharing for the recommended plan will be based on Section 101(a)(4) of the Water Resources Development Act of 1986 and the U.S. Army Corps of Engineers policy contained in Policy Guidance Letter 44 (PGL 44) that sets forth the policy regarding the categorization and assignment of costs for actions involving facilities interfering with Federal navigation improvements. Cost sharing has been determined as to whether the affected facilities have been categorized as "removals" or "deep draft utility relocations," as defined in PGL 44 and presented in Appendix 6 for each of the pipelines and conduits affected by the Project.

Any conclusion or categorization contained in this report that an item is a deep draft utility relocation or a removal, to be performed by the Non-Federal Sponsor as part of its LERRD responsibilities is preliminary only. The Government will make a final determination of the relocations necessary for the construction, operation, or maintenance of the Project after further analysis and completion and approval of final attorney's opinions of compensability for each of the impacted utilities and facilities. In the event the future status of a pipeline or facility is converted from a relocation to a removal, such as a pipeline that becomes abandoned, the Non-Federal Sponsor will work with the owner to ensure the removal and none of the costs of removal will be creditable against the Sponsor's cost share.

HTRW IMPACTS: Review of a regulatory agency database information search, an aerial photographic review, interviews with regulatory officials, and a site reconnaissance were conducted to determine the location and status of sites regulated by the State of Texas and the EPA and any unreported hazardous material sites. The support data for the assessment can be found in PBS&J Document No. 010095 entitled "Hazardous, Toxic, and Radioactive Waste Assessment, Corpus Christi Ship Channel – Channel Improvements Project, Corpus Christi and Nueces Bays, Nueces and San Patricio Counties, Texas" dated April 2001. (SEE Environmental & Regulatory Division, Planning Branch, Galveston District Corps of Engineers, Galveston, Texas, for copy of PBS&J Document No. 010095.) The review of the regulatory agency database search indicated a total of 1,611 sites or listings associated with 257 facilities or properties located within the study area. On the basis of the results of the regulatory database searches, the following sites are located within the subject area:

16 CERCLIS/NFRAP/CORRACT sites;
27 RCRA generators sites;
5 RCRA treatment, storage, and disposal sites;
296 petroleum storage tanks;
55 leaking underground storage tank sites;
2 State voluntary cleanup sites;
528 reported emergency response actions at 60 facilities/properties;
323 reported spills at 58 facilities/properties;
7 NPDES sites;
152 TRI listings associated with one facility; and
200 FINDS listings associated with 69 facilities/properties. (SEE Appendix B, sheets 1-3.)

None of these facilities appear to pose an environmental concern to the Project.

A review of oil and gas wells and pipelines located within the study area was also conducted. The results of the oil/gas well review indicate a total of 1,568 permitted well sites located within the study area. These well sites include 1,368 vertical wells and 200 directional wells. The database indicates that the vertical well sites include the following types/status:

378 are listed as active producing oil/gas wells;
573 as plugged;
291 as dry holes;
75 as permitted locations;
41 as abandoned locations;
5 as injection wells; and

5 well sites as unknown.

The database indicates that the directional well sites include the following types/status:

67 active producing oil/gas wells;
56 plugged wells;
40 dry holes;
20 permitted well sites;
10 abandoned locations;
3 shut-in wells;
1 injection well; and
3 well sites were listed as the type/status of unknown. (SEE Appendix D, sheets 1-5.)

Since dredging operations will be limited to existing ship channels, no impact to oil and gas wells are expected.

No National Priority List, State Superfund or City/County solid waste landfill sites were located within the study area. According to the Texas Commission on Environmental Quality (TCEQ) regional officials, the industrial activity adjacent to the Inner Harbor of the CCSC and La Quinta Channel has caused measurable impacts to the ground water adjacent to the waterways. The seepage of contaminated ground water to the waterway has been nearly contained through the efforts of the TCEQ and the responsible parties. Based on the information compiled by the HTRW assessment, it is recommended that sediment and elutriate samples in the vicinity of the turning basin of La Quinta Channel be analyzed for carbon tetrachloride and perchloroethane prior to dredging operations. There is moderate potential of encountering contaminated material during construction of the Project. With the laws and regulations, which govern the handling of hazardous material, there is a decreased risk of future releases of hazardous material causing long-term detrimental impacts to the sediments of the study area. Future use of the deeper channel is not expected to result in greater impacts to the environment. Ecosystem restoration features are cost shared 65/35% between the Federal and non-Federal interests, respectively.

LANDOWNER ATTITUDE: Overall, the modest public interest shown for this study has been positive.

NOTIFICATION TO NON-FEDERAL SPONSOR: The Non-Federal Sponsor, PCCA, is aware of the study and participates in meetings and decisions.

OTHER REAL ESTATE ISSUES:

<u>Impact on Aids To Navigation</u> – The navigation benefit categories that are evaluated are

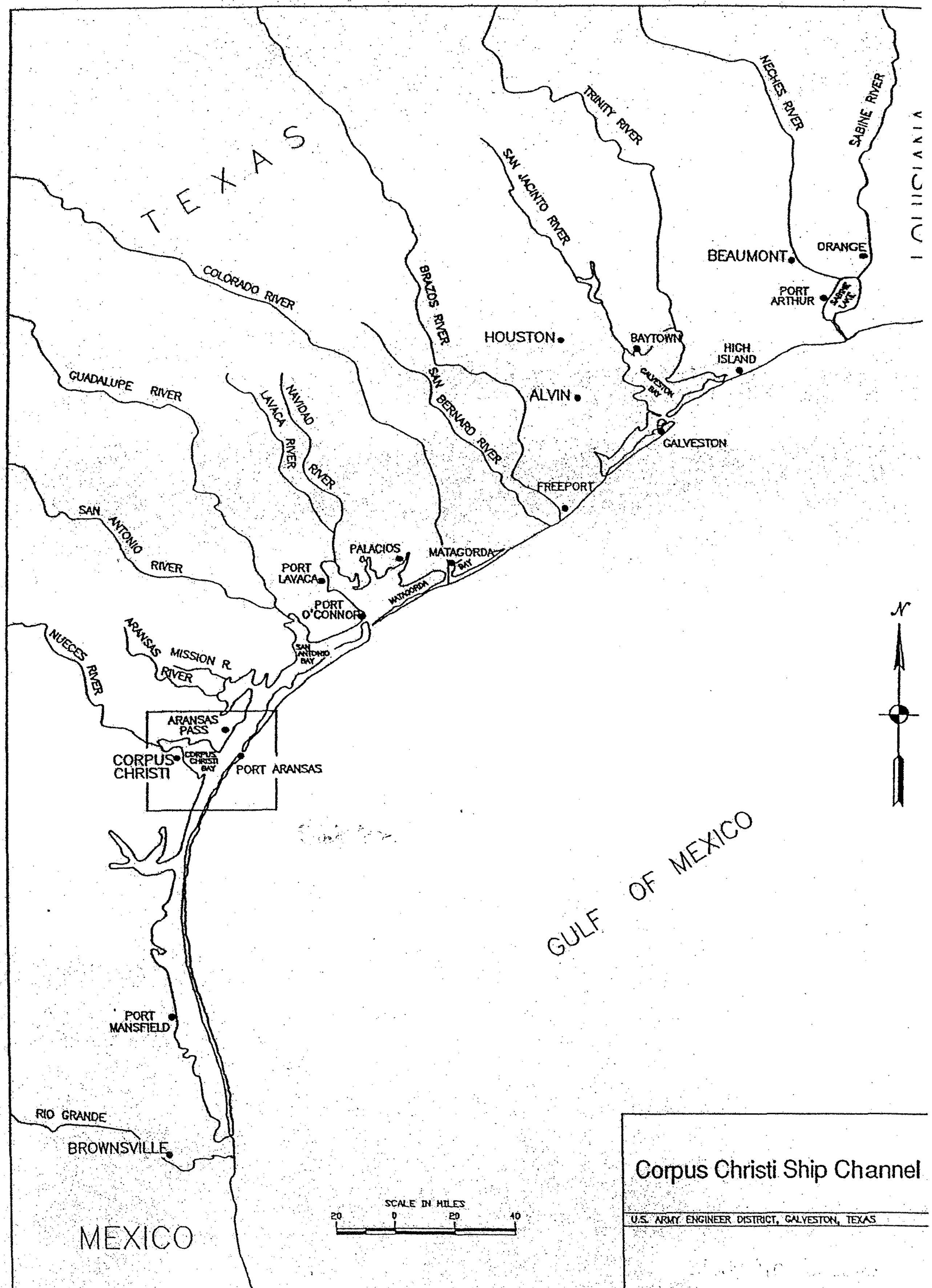
reductions in vessel operating costs, reductions in vessel delays, and reductions in vessel casualties. Widening the upper bay reach would increase the safety factor for this area and would reduce the shipping delays for the Project, especially since shipping trends indicate a movement toward use of larger vessels. Plans were formulated and evaluated with improvement to the efficiency and safety of the deep-draft navigation system.

Mitigation: After avoiding and minimizing environmental impacts to the maximum extent possible, the remaining unavoidable habitat losses are compensated to the extent justified according to ER-1105-2-100. To initiate this process, a Mitigation Workgroup is formed consisting of the members of the Study Management Team, project sponsor, and Federal and State resource agencies. An incremental analysis is conducted for each habitat type using the available alternatives and their associated costs to choose the most cost efficient plan for mitigation. Mitigation features are designed with input from Environmental Section. If restoration/mitigation activities take place in waters adjacent to the Project, acquisition of additional lands will be unnecessary, because the Government will exercise its rights under the Navigation Servitude to secure any sub aqueous placement sites that are required. If, on the other hand, mitigation/restoration were to take place on upland sites, the Non-Federal Sponsor would be required to acquire additional tracts in fee. Based on Mitigation Workgroup findings to date, fifteen acres of mitigation will be created in BU Site GH. No acquisition will be necessary on this tract.

Federal & State Rule Concepts for Cost Shared Projects: The Non-Federal Sponsor is responsible for all LER. State rules of acquisition apply; however, no additional acquisition is envisioned for this project.

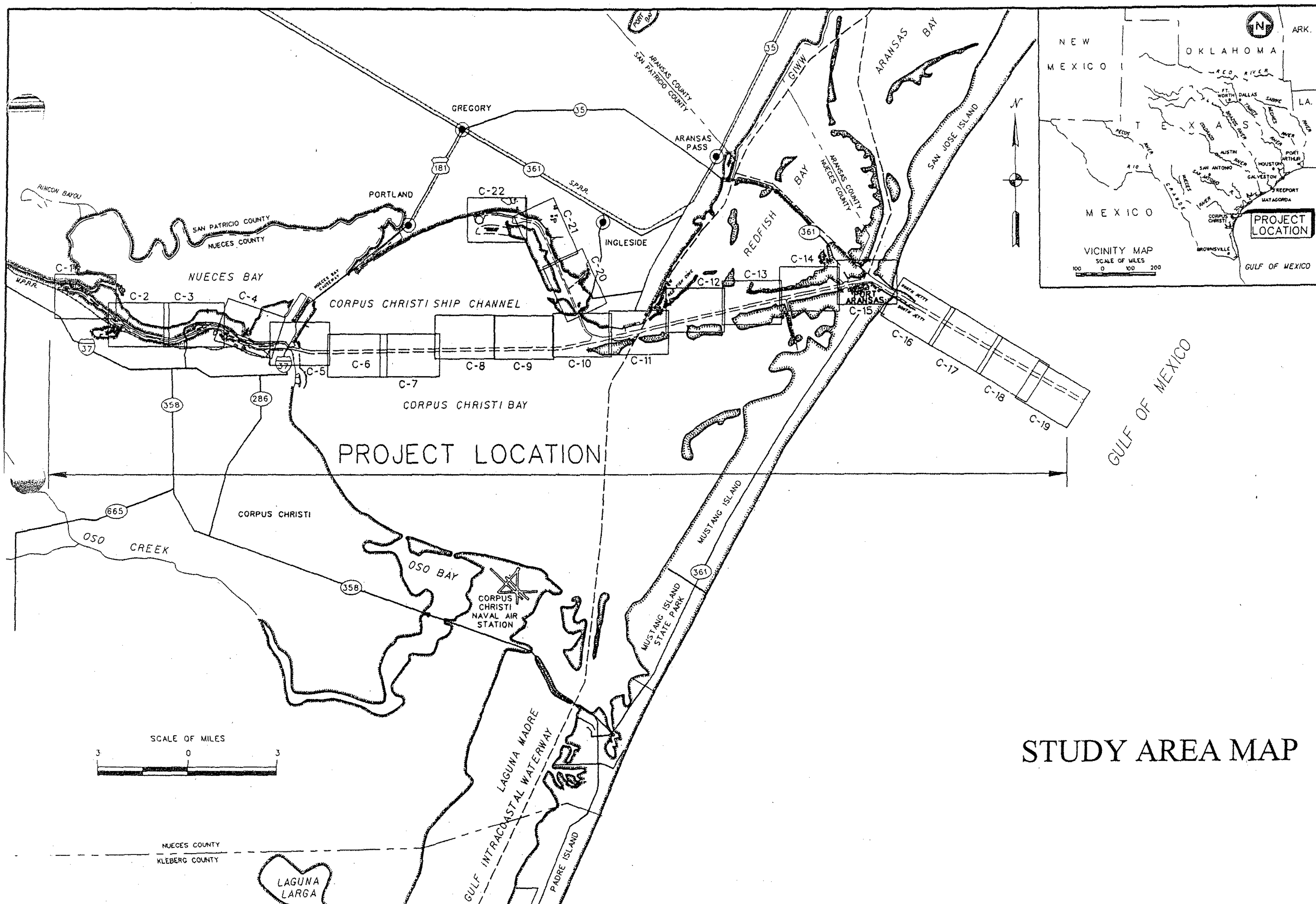
APPENDIX

1


TEXAS
LOUISIANA
COLORADO RIVER
BRAZOS RIVER
TRINITY RIVER
NECHES RIVER
SABINE RIVER
SAN JACINTO RIVER
BEAUMONT
ORANGE
PORT ARTHUR
SABINE LAKE
HOUSTON
BAYTOWN
HIGH ISLAND
GALVESTON BAY
ALVIN
GALVESTON
GUADALUPE RIVER
NAVIDAD RIVER
LAVACA RIVER
SAN BERNARD RIVER
FREEPORT
SAN ANTONIO RIVER
PALACIOS
MATAGORDA
MATAGORDA BAY
PORT LAVACA
PORT O'CONNOR
NUECES RIVER
ARANSAS RIVER
MISSION R.
SAN ANTONIO BAY
ARANSAS PASS
CORPUS CHRISTI
CORPUS CHRISTI BAY
PORT ARANSAS
GULF OF MEXICO
PORT MANSFIELD
RIO GRANDE
BROWNSVILLE
MEXICO
SCALE IN MILES
20 0 20 40
N
Corpus Christi Ship Channel
U.S. ARMY ENGINEER DISTRICT, GALVESTON, TEXAS

APPENDIX

2



STUDY AREA MAP

APPENDIX

3

SUMMARY OF ASSOCIATED COSTS
IMPACTED DOCK STRUCTURES

Port of Corpus Christi Authority Owned Docks

Oil Dock 1	COE Sta. 1127+00	$ 717,500
Oil Dock 4	COE Sta. 1236+00	$ 1,037,000
Oil Dock 7	COE Sta. 1245+00	$ 1,010,000
Oil Dock 8	COE Sta. 1556+00	$ 803,000
Oil Dock 11	COE Sta. 1255+00	$ 1,010,000
Bulk Dock 2	COE Sta. 1348+00	$ 200,000
CCPE	COE Sta. 1203+00	$ 2,020,000
Sub-Total		$ 6,797,500

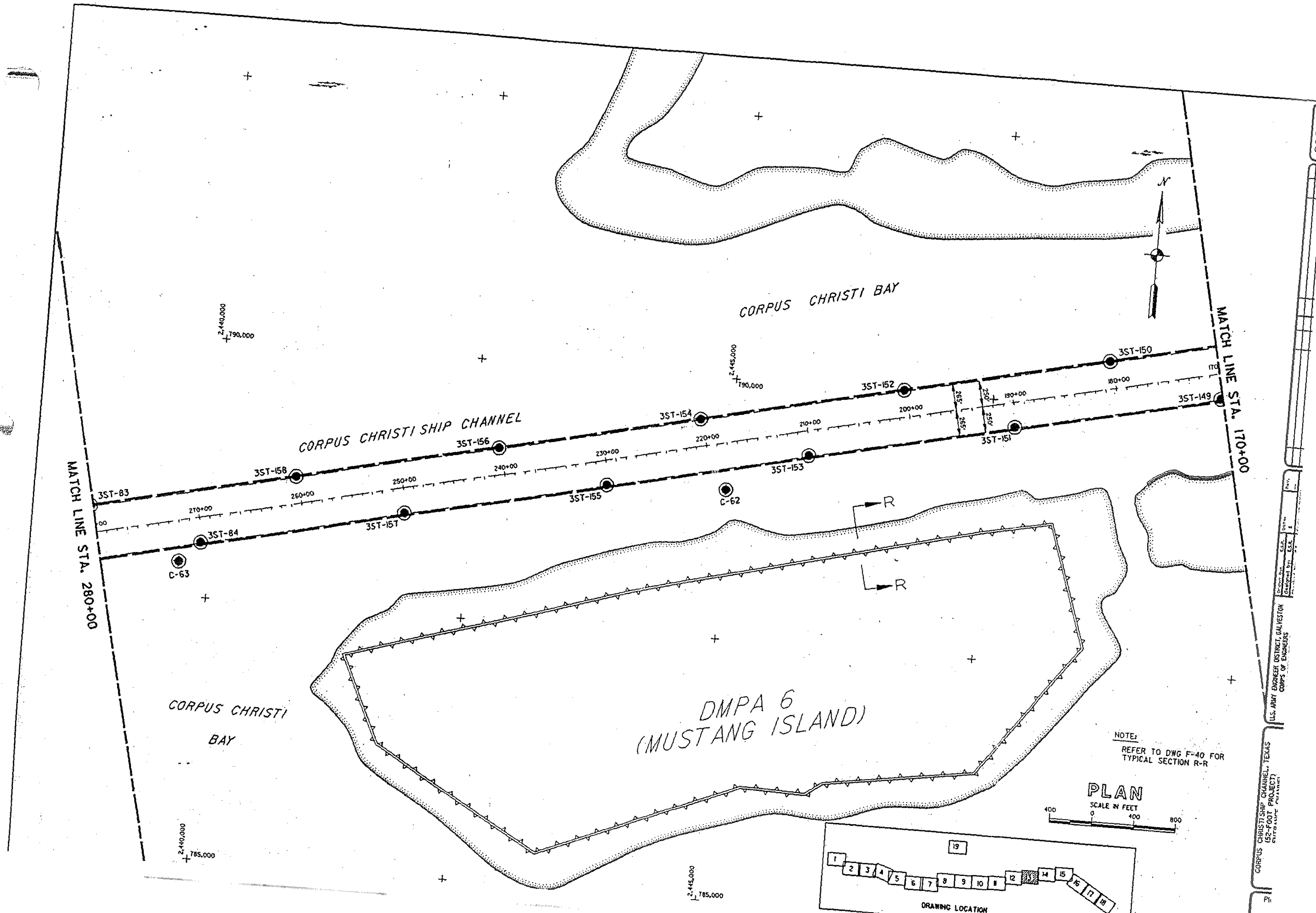
Privately Owned Docks

Citgo Dock 3	COE Sta. 1439+00	$ 605,000
Koch East 3	COE Sta. 1169+00	$ 875,000
Valero 2	COE Sta. 1396+00	$ 200,000
Valero 3	COE Sta. 1406+00	$ 200,000
Sub-Total		$ 1,880,000
TOTAL		$ 8,677,500

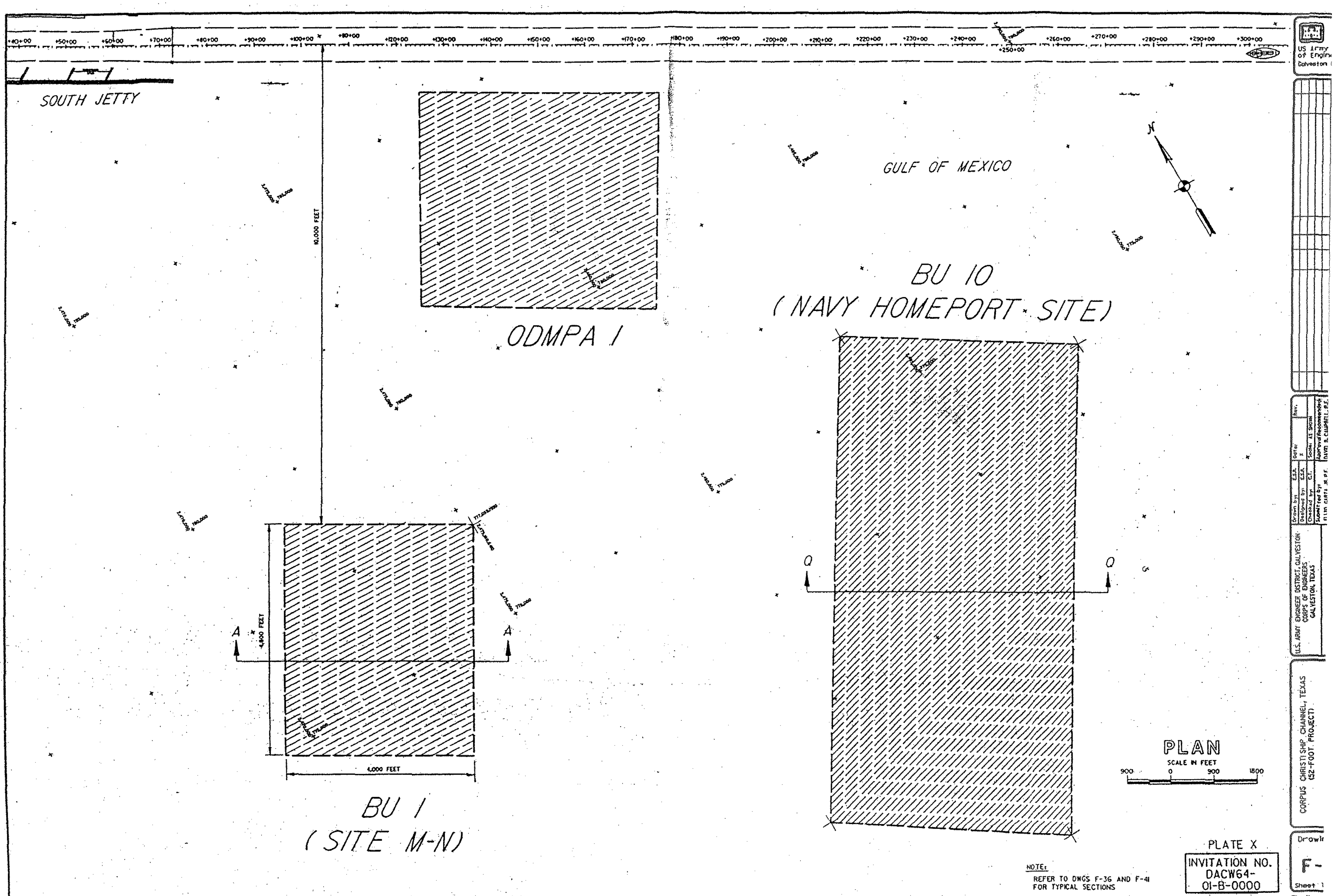
According to current data, any structures not included in this list will not be impacted.

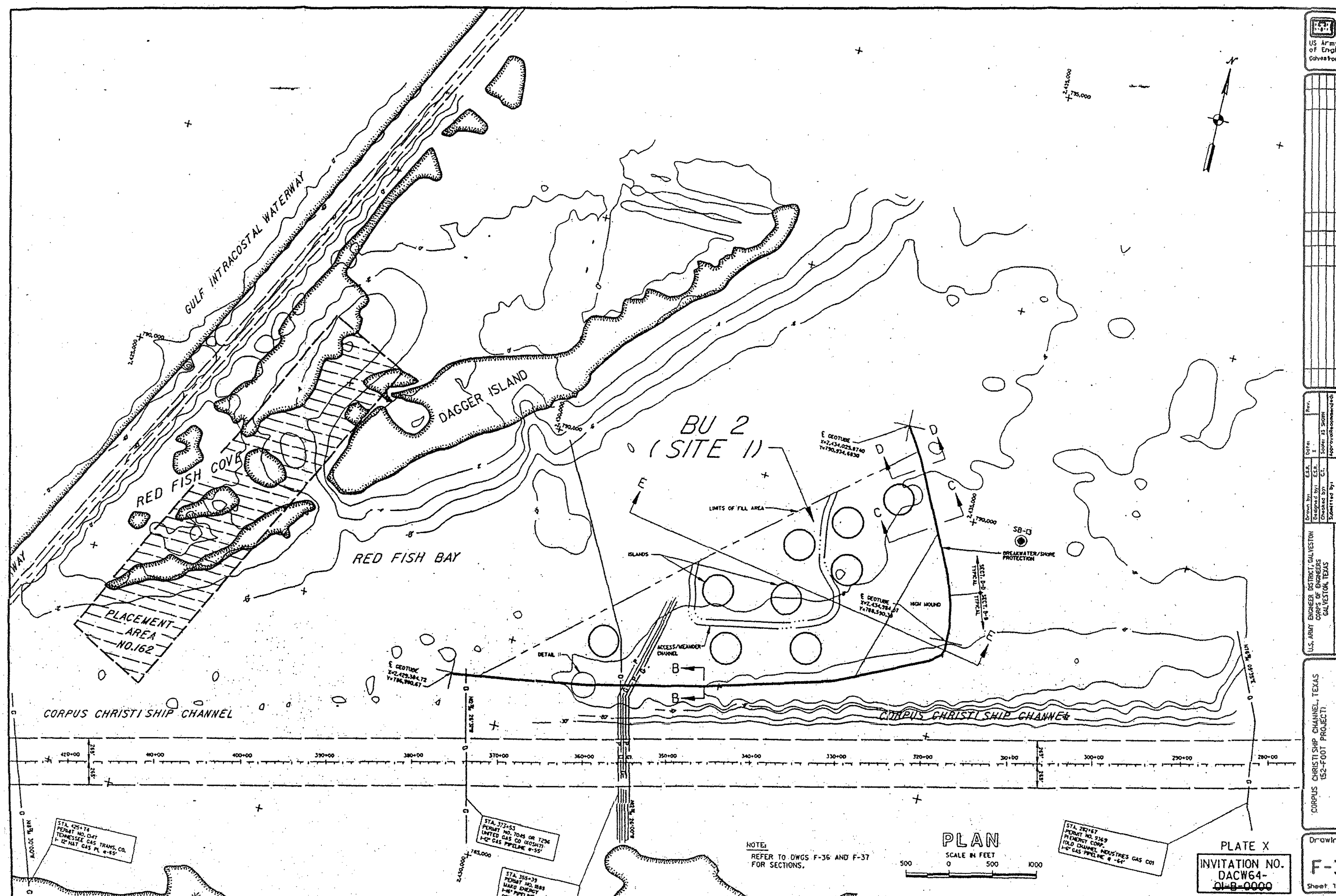
APPENDIX

4



CORPUS CHRISTI BAY
CORPUS CHRISTI SHIP CHANNEL
MATCH LINE STA. 280+00
MATCH LINE STA. 170+00
3ST-83
3ST-84
3ST-149
3ST-150
3ST-151
3ST-152
3ST-153
3ST-154
3ST-155
3ST-156
3ST-157
3ST-158
C-62
C-63
DMPA 6
(MUSTANG ISLAND)
CORPUS CHRISTI
BAY
NOTE:
REFER TO DWG F-40 FOR TYPICAL SECTION R-R
PLAN
SCALE IN FEET
DRAWING LOCATION
U.S. ARMY ENGINEER DISTRICT, GALVESTON CORPS OF ENGINEERS
CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)


SOUTH JETTY
GULF OF MEXICO
10,000 FEET
ODMPA I
BU 10
(NAVY HOMEPORT SITE)
4,800 FEET
4,000 FEET
BU 1
(SITE M-N)
PLAN
SCALE IN FEET
900 0 900 1800
NOTE:
REFER TO DWGS F-36 AND F-41
FOR TYPICAL SECTIONS
PLATE X
INVITATION NO.
DACW64-
01-B-0000
U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS
CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)



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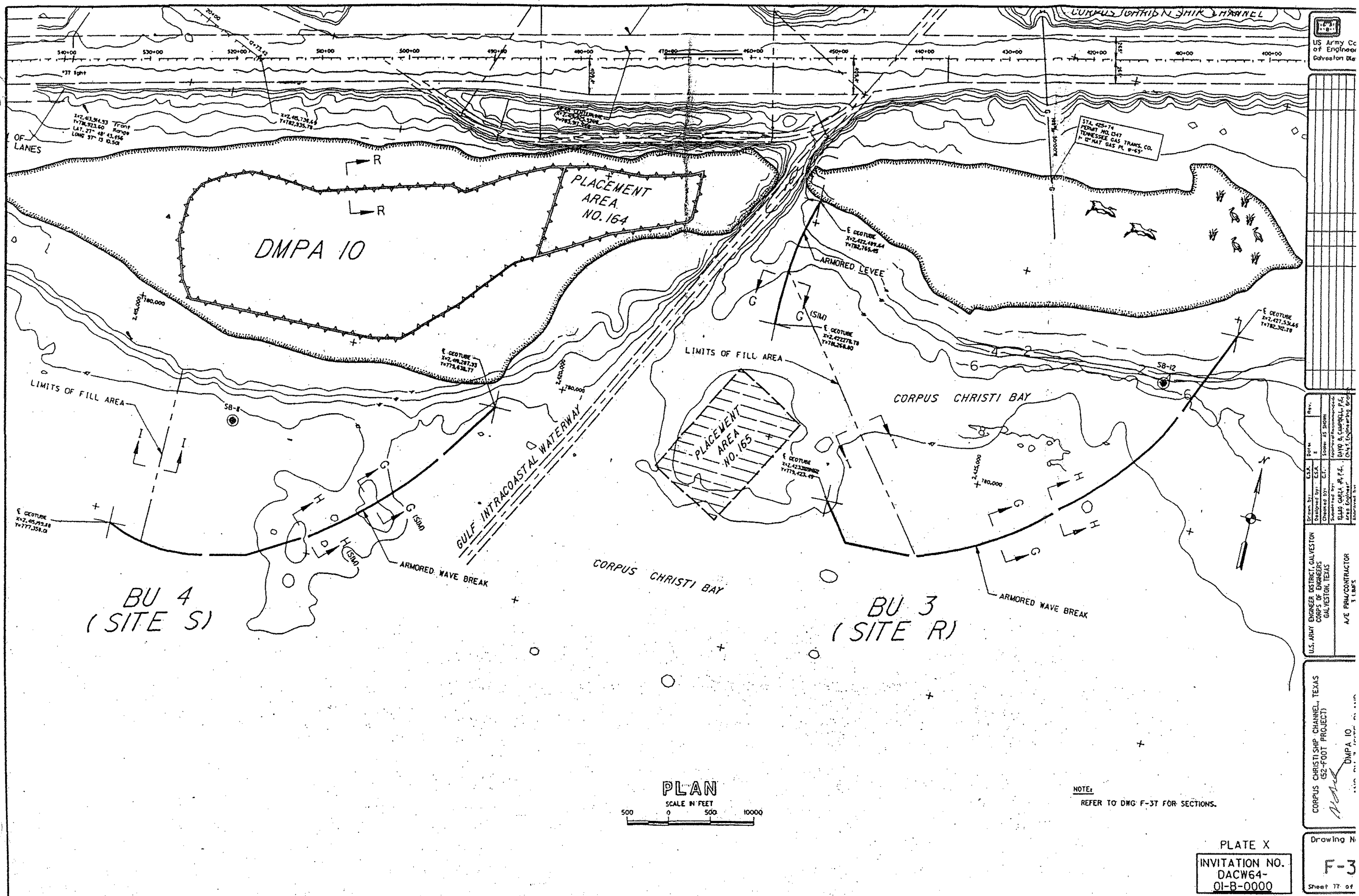
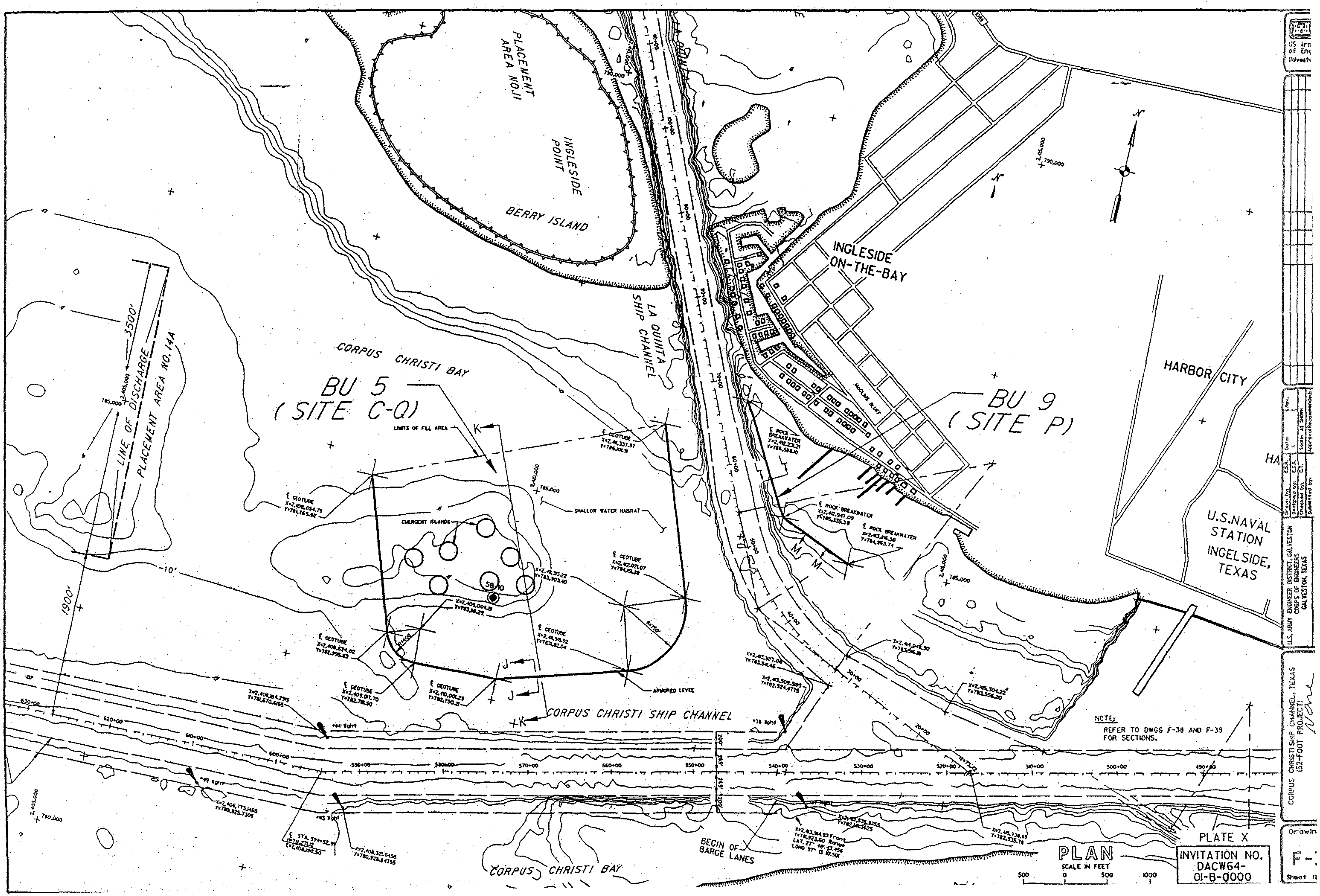
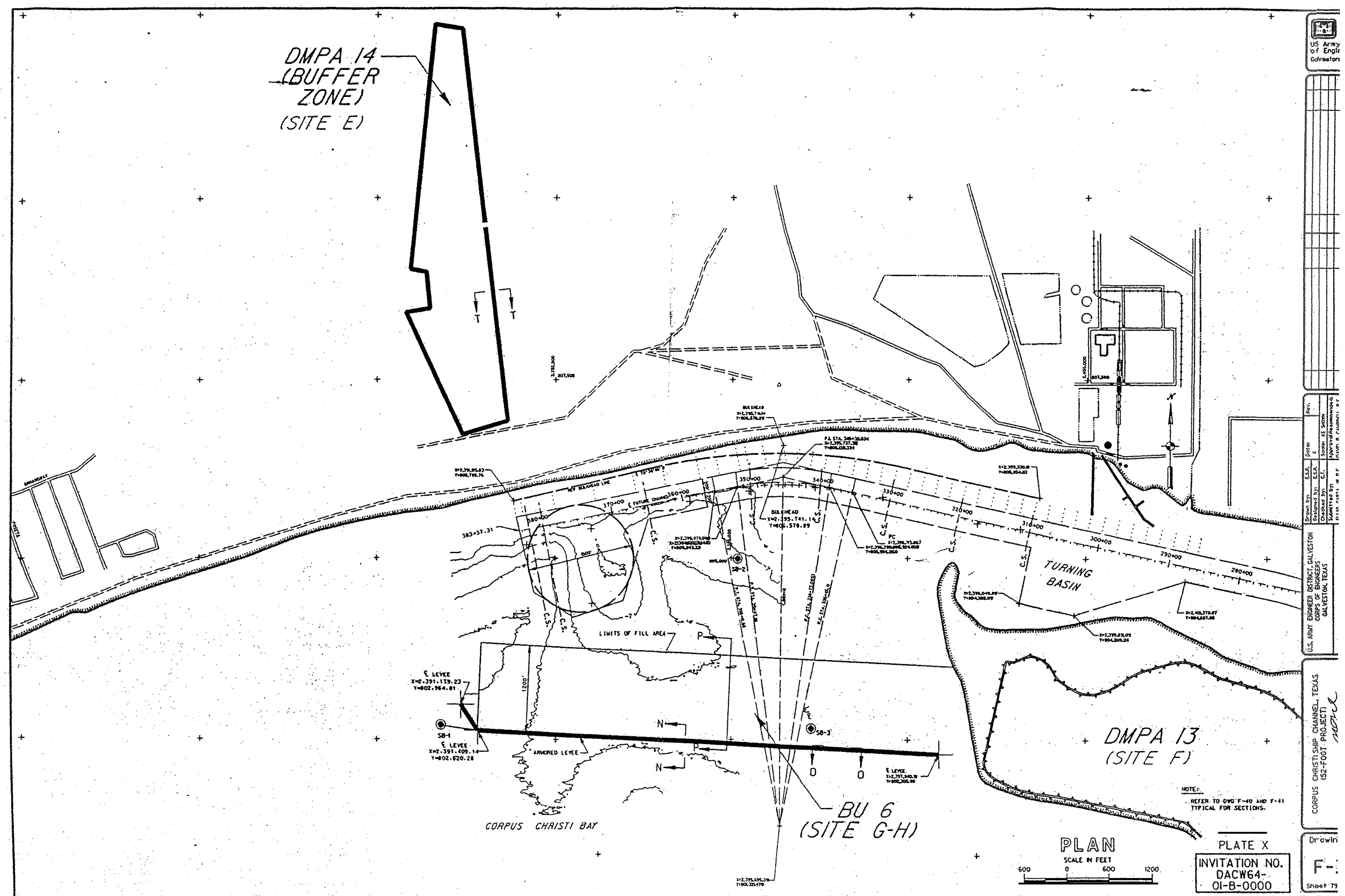


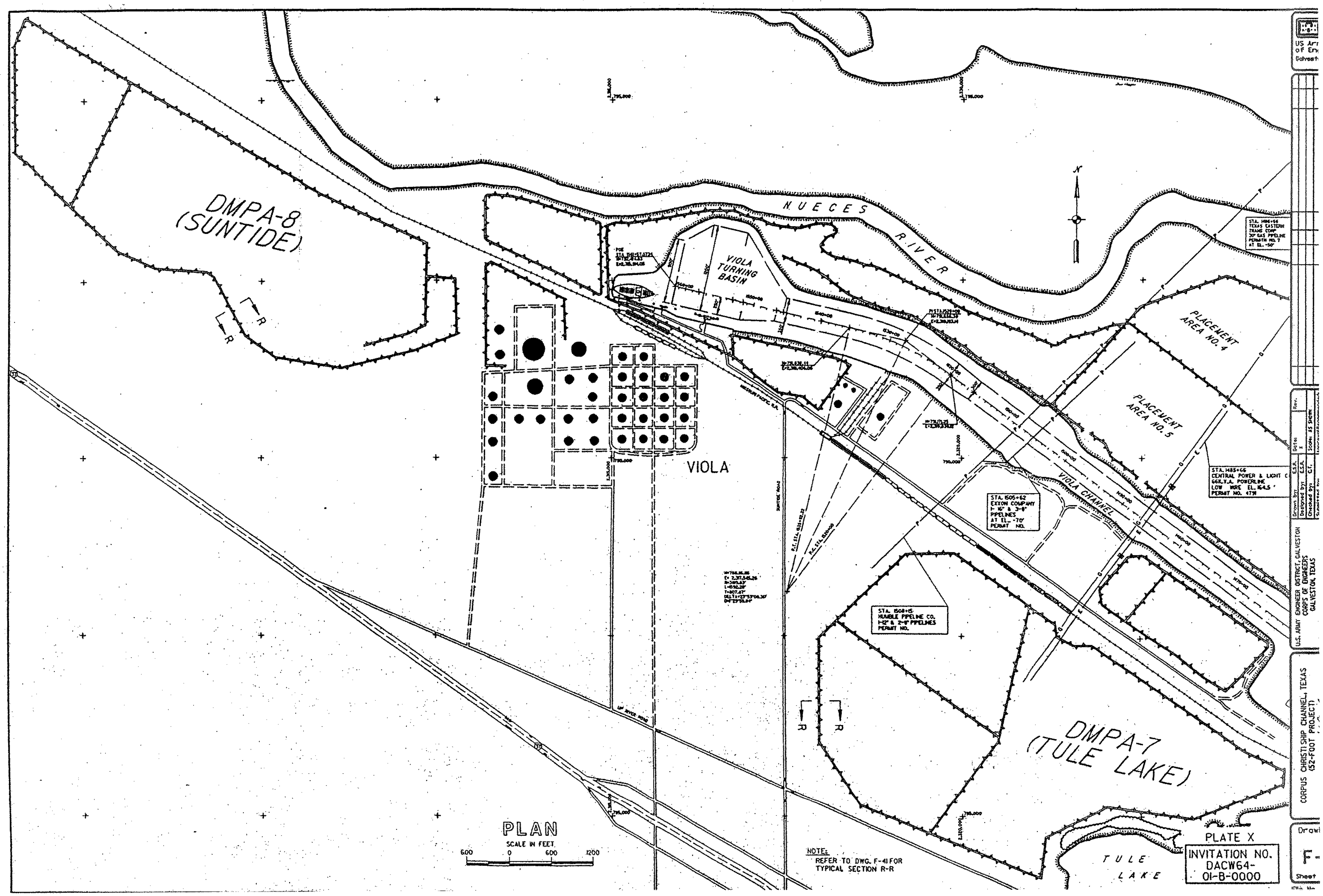
CORPUS CHRISTI SHIP CHANNEL
US Army Corps of Engineers
Galveston District
OF LANES
PLACEMENT AREA NO. 164
DMPA 10
ARMORED LEVEE
LIMITS OF FILL AREA
LIMITS OF FILL AREA
CORPUS CHRISTI BAY
GULF INTRACOASTAL WATERWAY
PLACEMENT AREA NO. 165
ARMORED WAVE BREAK
ARMORED WAVE BREAK
CORPUS CHRISTI BAY
BU 4 (SITE S)
BU 3 (SITE R)
SB-11
SB-12
PLAN
SCALE IN FEET
NOTE:
REFER TO DWG F-3T FOR SECTIONS.
PLATE X
INVITATION NO. DACW64-01-B-0000
U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS
CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)
DMPA 10
Drawing No.
F-3

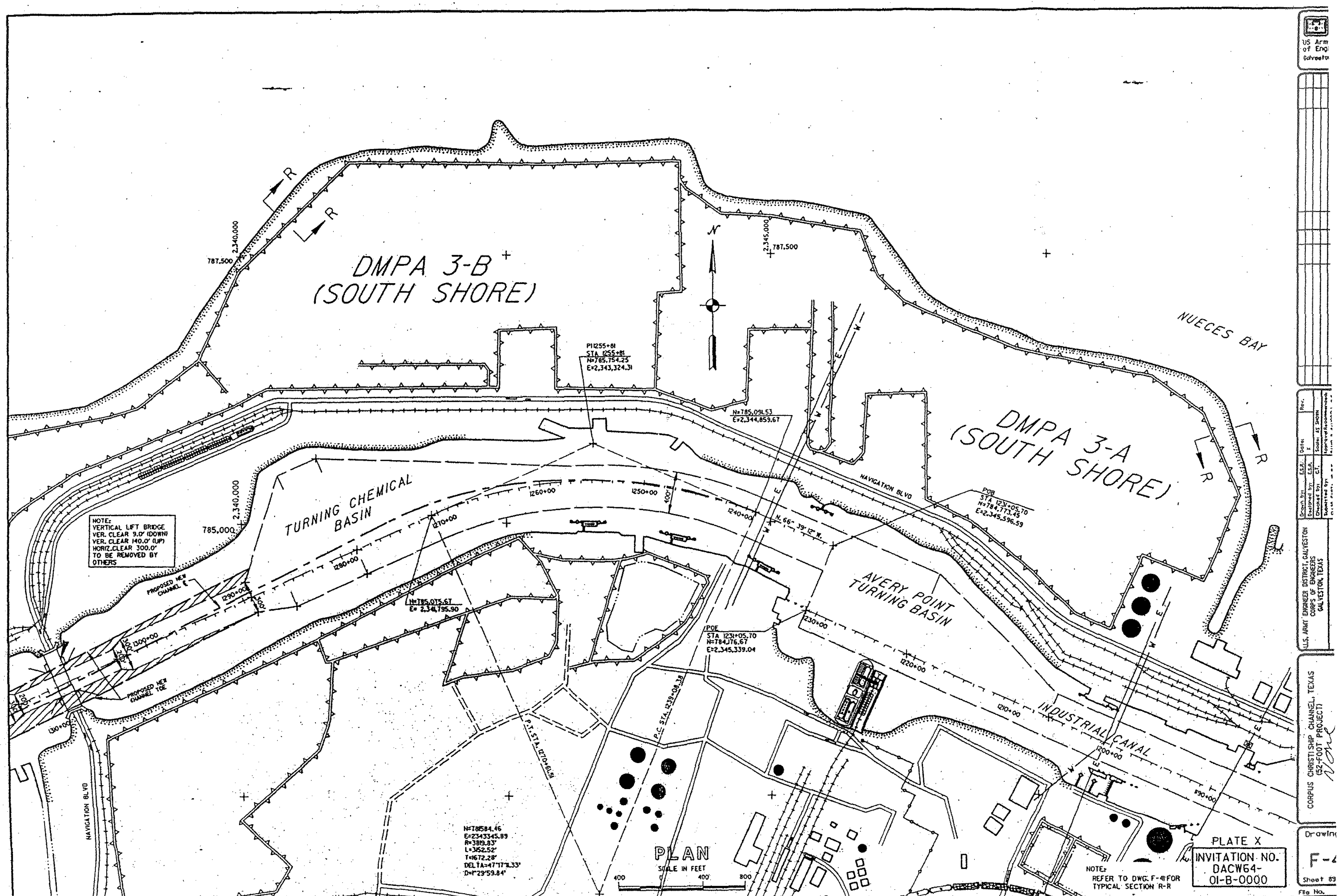


PLACEMENT AREA NO.11
INGLESIDE POINT
BERRY ISLAND
LA QUINTA SHIP CHANNEL
INGLESIDE ON-THE-BAY
CORPUS CHRISTI BAY
BU 5 (SITE C-Q)
BU 9 (SITE P)
HARBOR CITY
LINE OF DISCHARGE
PLACEMENT AREA NO. 14A
3500'
1900'
LIMITS OF FILL AREA
EMERGENT ISLANDS
SHALLOW WATER HABITAT
ARMORED LEVEE
ROCK BREAKWATER
U.S.NAVAL STATION INGELSIDE, TEXAS
CORPUS CHRISTI SHIP CHANNEL
BEGIN OF BARGE LANES
NOTE: REFER TO DWGS F-38 AND F-39 FOR SECTIONS.
PLAN
SCALE IN FEET
PLATE X
INVITATION NO. DACW64-01-B-0000
U.S. ARMY ENGINEER DISTRICT, GALVESTON CORPS OF ENGINEERS GALVESTON, TEXAS
CORPUS CHRISTI SHIP CHANNEL, TEXAS (52-FOOT PROJECT)



DMPA 14
(BUFFER
ZONE)
(SITE E)
TURNING
BASIN
LIMITS OF FILL AREA
ARMORED LEVEE
DMPA 13
(SITE F)
BU 6
(SITE G-H)
CORPUS CHRISTI BAY
PLAN
SCALE IN FEET
600 0 600 1200
NOTE:
REFER TO DWG F-40 AND F-41
TYPICAL FOR SECTIONS.
PLATE X
INVITATION NO.
DACW64-
01-B-0000
US Army
of Engi
Galveston
U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS
CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)


DMPA-8 (SUNTIDE)
NUECES RIVER
VIOLA TURNING BASIN
VIOLA
PLACEMENT AREA NO. 4
PLACEMENT AREA NO. 5
VIOLA CHANNEL
STA. 1505+62 EXXON COMPANY 1- 16" & 3-8" PIPELINES AT EL. -70' PERMIT NO.
STA. 1508+15 HUMBLE PIPELINE CO. 1-12" & 2-8" PIPELINES PERMIT NO.
DMPA-7 (TULE LAKE)
TULE LAKE
PLAN
SCALE IN FEET
600 0 600 1200
NOTE: REFER TO DWG. F-41 FOR TYPICAL SECTION R-R
PLATE X
INVITATION NO. DACW64-01-B-0000
U.S. ARMY ENGINEER DISTRICT, GALVESTON CORPS OF ENGINEERS GALVESTON, TEXAS
CORPUS CHRISTI SHIP CHANNEL, TEXAS (52-FOOT PROJECT)



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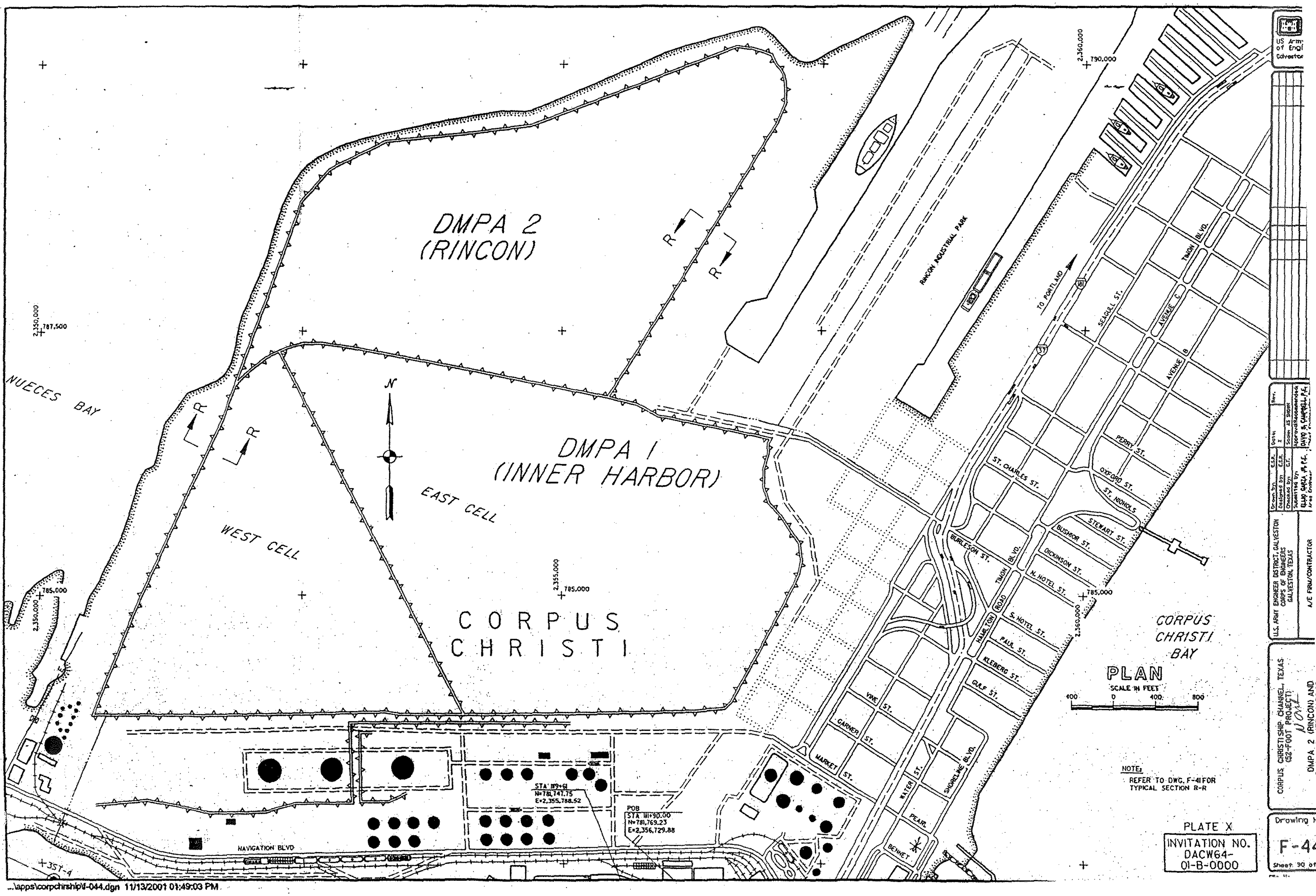

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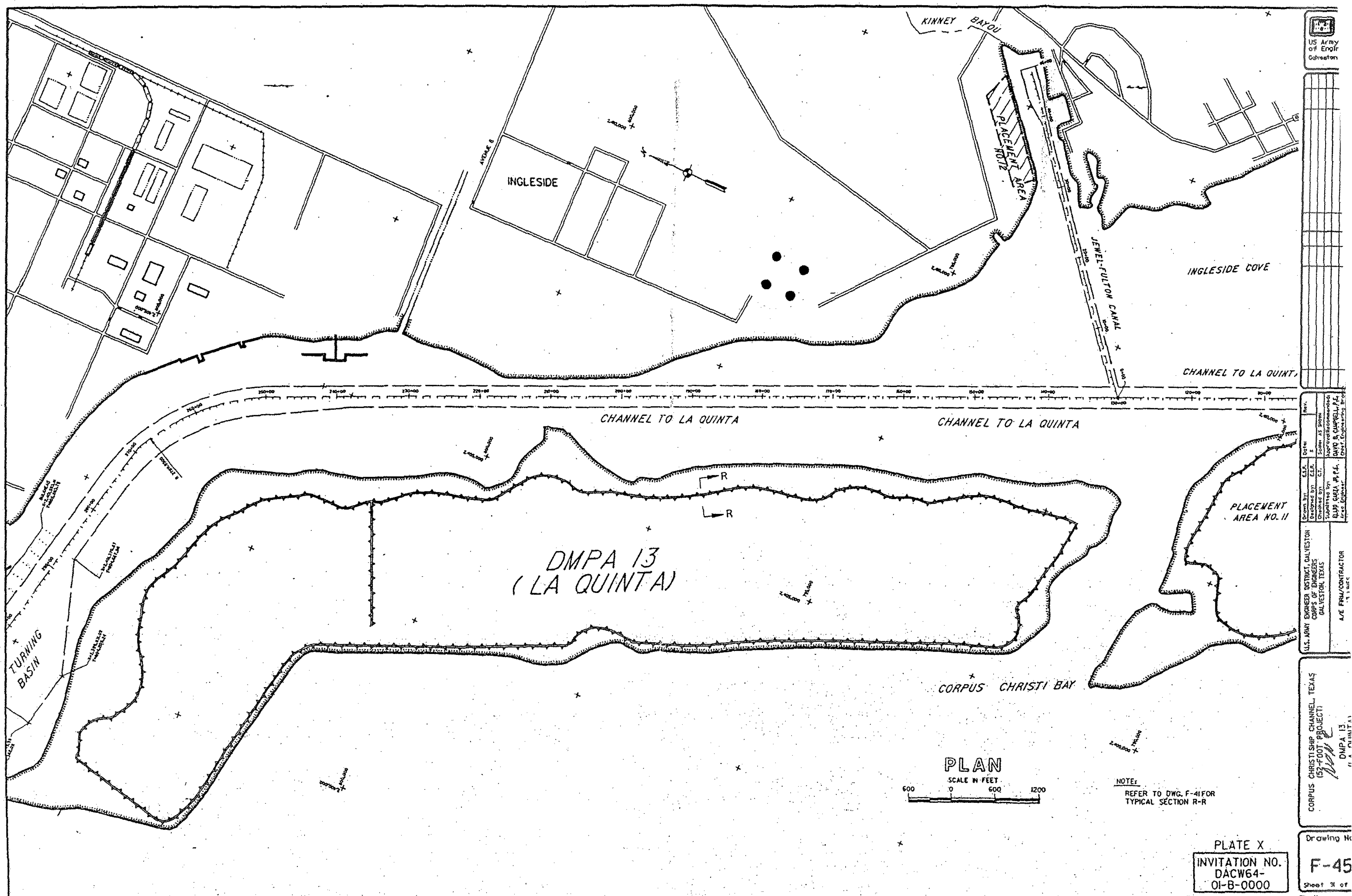

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APPENDIX

5

ASSESSMENT OF NON-FEDERAL SPONSOR'S REAL ESTATE ACQUISITION CAPABILITY

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? (yes/no)
b. Does the sponsor have the power of eminent domain for this project? (yes/no)
c. Does the sponsor have "quick-take" authority for this project? (yes/no)
d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? (yes/no)
e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? (yes/no)

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? (yes/no)
b. If the answer to II.a. is "yes", has a reasonable plan been developed to provide such training? (yes/no)
c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? (yes/no)
d. Is the sponsor's projected in-house staffing level sufficient considering its other work load, if any, and the project schedule? (yes/no)
e. Can the sponsor obtain contractor support, if required, in a timely fashion? (yes/no)
f. Will the sponsor likely request USACE assistance in acquiring real estate? (yes/no) (If "yes", provide description.)
Non-Federal Sponsor has requested the Corps to enforce removal of pipelines.

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? (yes/no)
b. Has the sponsor approved the project/real estate schedule/milestones? (yes/no)

IV. Overall Assessment:

a. Has the sponsor performed satisfactorily on other USACE projects? (yes/no/not applicable)
b. With regard to this project, the sponsor is anticipated to be: highly capable/fully capable/moderately capable/marginally

capable/insufficiently capable. (If sponsor is believed to be "insufficiently capable", provide explanation.)

V. Coordination:

a. Has this assessment been coordinated with the sponsor? (yes/no)
b. Does the sponsor concur with this assessment? (yes/no) (If "no", provide explanation.)

Prepared by:

Arlynra Edwards

Type name: Arlynra Edwards
Title: Staff Appraiser

Reviewed and approved by:

Richard Harrison

Type name: Richard Harrison
Chief, Real Estate Division

APPENDIX

6

Pipelines Crossing the Corpus Christi Ship Channel

Categorization of Pipelines for Channel Improvement Project

PIPELINE I.D.	CHANNEL	COE SHIP CHANNEL STATION	COMPANY	SIZE	TYPE	FACILITY CATEGORIZATION
A2	Port Aransas to Ingleside	45+35	AEP/Central Power & Light	8"	Electrical Conduit	Remain
A3	Port Aransas to Ingleside	45+40	Nueces County Water Control & Improvement District #4	20"	Water	Remain
A4	Port Aransas to Ingleside	287+67	IBC Enterprises, Inc.	6 5/8"	Full Stream- Crude, Brine, Gas	Remain
A5	Port Aransas to Ingleside	355+54	Mako Energy, Inc.	16"	Gas Production	Deep Draft Utility Relocation
A6	Port Aransas to Ingleside	355+15	Kerr-McGee Oil and Gas Onshore LLC	12"	Gas Production	Deep Draft Utility Relocation
A7	Port Aransas to Ingleside	355+15	Kerr-McGee Oil and Gas Onshore LLC	6"	Gas Production	Deep Draft Utility Relocation
A8	Port Aransas to Ingleside	355+15	Kerr-McGee Oil and Gas Onshore LLC	4"	Gas Production	Deep Draft Utility Relocation
A9	Port Aransas to Ingleside	355+15	IBC Enterprises, Inc.	4"	Gas Production	Deep Draft Utility Relocation
A10	Port Aransas to Ingleside	373+54	IBC Pipeline Operating, L.P.	12"	Gas Production	Deep Draft Utility Relocation
A11	Port Aransas to Ingleside	425+47	Tennessee Gas Pipeline Company	12.75	Natural Gas	Remain
A12	Port Aransas to Ingleside	35+00	Charter Communications	4"	Cable	Remain

B1	La Quinta	117+68	Koch Pipeline	10"		Remain
B2	La Quinta	118+91	George R. Brown Partnership	2 1/2"		Remain
B3	La Quinta		Tennessee Gas Pipeline Company	12"		Remain

Pipelines Crossing the Corpus Christi Ship Channel
Categorization of Pipelines for Channel Improvement Project

PIPELINE I.D.	CHANNEL	COE SHIP CHANNEL STATION	COMPANY	SIZE	TYPE	FACILITY CATEGORIZATION
C1	La Quinta Extension	311+09	Crosstex Energy Services	10"	Natural Gas	Removal
C2	La Quinta Extension	321+10	Royal Production Co., Inc.	7"	Gas Production	Removal
C3	La Quinta Extension	338+43	Crosstex Energy Services	3.5"	Natural Gas	Removal
C4	La Quinta Extension	346+11	Crosstex Energy Services	16"	Natural Gas	Removal
C5	La Quinta Extension	346+11	Sabco Operating Company	4"	Gas Production	Removal
D1	Upper Bay - across CC Bay	733+50	Crosstex Energy Services	16"	Natural Gas	Deep Draft Utility Relocation
D2	Upper Bay - across CC Bay	733+50	Sabco Operating Company	4"	Gas Production	Deep Draft Utility Relocation
D3	Upper Bay - across CC Bay	740+00	Crosstex Energy Services	10"	Natural Gas	Remain
D4	Upper Bay - across CC Bay	953+33	Copano Field Services / Copano Bay, L.P.	12"	Gas Production	Deep Draft Utility Relocation
E1	Inner Harbor	1099+95	City of Corpus Christi	12"	Sanitary Force main	Reported to be replaced by 2004
E2	Inner Harbor	1099+95	City of Corpus Christi	12"	Sanitary Force main	Reported to be replaced by 2004
E3	Inner Harbor	1099+95	City of Corpus Christi Gas Department	10"	Natural Gas (H. P.)	Reported to be removed by 2004

Pipelines Crossing the Corpus Christi Ship Channel
Categorization of Pipelines for Channel Improvement Project

PIPELINE I.D.	CHANNEL	COE SHIP CHANNEL STATION	COMPANY	SIZE	TYPE	FACILITY CATEGORIZATION
E4	Inner Harbor	1099+95	City of Corpus Christi Gas Department	10"	Natural Gas (H. P.)	Reported to be removed by 2004
E5	Inner Harbor	1099+95	City of Corpus Christi	12"	Water	Reported to be replaced by 2004
E6	Inner Harbor	1099+95	City of Corpus Christi	12"	Water	Reported to be replaced by 2004
E7	Inner Harbor	1099+95	Corpus Christi Fire Department	1"	Fire Alarm Conduit - ABANDONED	Reported to be removed by 2004
E8	Inner Harbor	1103+73	Southwestern Bell Telephone Company	12"	Cable Conduit	Remain
E9	Inner Harbor	1183+86	Koch Pipeline	8 5/8"	Petroleum or Petroleum Product	Remain
E10	Inner Harbor	1183+86	Koch Pipeline	8 5/8"	Petroleum or Petroleum Product	Remain
E11	Inner Harbor	1183+86	Copano Field Services	8 5/8"	Petroleum or Petroleum Product	Remain
E12	Inner Harbor	1200+63	AEP/CPL	8"	Electrical Conduit	Remain
E13	Inner Harbor	1200+63	AEP/CPL	8"	Electrical Conduit	Remain
E14	Inner Harbor	1200+63	AEP/CPL	8"	Electrical Conduit	Remain
E15	Inner Harbor	1200+63	AEP/CPL	1"	Control Cable	Remain
E16	Inner Harbor	1200+63	AEP/CPL	1"	Control Cable	Remain
E18	Inner Harbor-Avery Point	1236+88	Crosstex Energy Services	6"	Natural Gas	Deep Draft Utility Relocation
E19	Inner Harbor-Avery Point	1236+88	El Paso Field Services	10"	Natural Gas	Deep Draft Utility Relocation
E20	Inner Harbor-Avery Point	1236+88	El Paso Field Services, L.P.	14"	Natural Gas	Deep Draft Utility Relocation
E21	Inner Harbor-Avery Point	1236+88	El Paso Field Services	6"	LPG	Deep Draft Utility Relocation

Pipelines Crossing the Corpus Christi Ship Channel
Categorization of Pipelines for Channel Improvement Project

PIPELINE I.D.	CHANNEL	COE SHIP CHANNEL STATION	COMPANY	SIZE	TYPE	FACILITY CATEGORIZATION
E22	Inner Harbor-Avery Point	1236+88	City of Corpus Christi	16"	Water	Deep Draft Utility Relocation
E23	Inner Harbor-Avery Point	1236+88	City of Corpus Christi	16"	Water	Deep Draft Utility Relocation
E24	Inner Harbor-Avery Point	1236+88	Crosstex Energy Services	6"	Natural Gas	Deep Draft Utility Relocation
E25	Inner Harbor-Avery Point	1236+88	El Paso Field Services	6"	Petroleum Product	Deep Draft Utility Relocation
E26	Inner Harbor-Avery Point	1236+88	AEP/Houston Pipe Line Company	12"	Natural Gas	Deep Draft Utility Relocation
E27	Inner Harbor-Avery Point	1236+88	AEP/Houston Pipe Line Company	12"	Natural Gas	Deep Draft Utility Relocation
E28	Inner Harbor-Avery Point	1236+88	El Paso Field Service	12"	Petroleum or Petroleum Product	Deep Draft Utility Relocation
E29	Inner Harbor-Avery Point	1236+88	El Paso Field Service	6"	Butane	Deep Draft Utility Relocation
E30	Inner Harbor-Avery Point	1236+88	El Paso Field Service	6"	Crude Oil	Removal
E31	Inner Harbor-Avery Point	1236+88	CITGO Refining and Chemicals Company L.P.	8"	Abandoned in Place	Removal
E32	Inner Harbor-Avery Point	1236+88	Koch Pipeline	6"	Petroleum or Petroleum Product	Deep Draft Utility Relocation
E33	Inner Harbor-Avery Point	1236+88	El Paso Field Service	8"	LPG	Deep Draft Utility Relocation
E34	Inner Harbor-Avery Point	1236+88	El Paso Field Services	8"	Crude Oil	Removal
E35	Inner Harbor-Avery Point	1236+88	CITGO Products Pipeline Company	8"	Petroleum Product	Deep Draft Utility Relocation

Pipelines Crossing the Corpus Christi Ship Channel

Categorization of Pipelines for Channel Improvement Project

PIPELINE I.D.	CHANNEL	COE SHIP CHANNEL STATION	COMPANY	SIZE	TYPE	FACILITY CATEGORIZATION
E36	Inner Harbor-Avery Point	1236+88	Koch Pipeline	6"	Petroleum or Petroleum Product	Deep Draft Utility Relocation
E37	Inner Harbor-Avery Point	1236+88	El Paso Field Services	12"	Petroleum or Petroleum Product	Deep Draft Utility Relocation
E38	Inner Harbor-Avery Point	1236+88	El Paso Field Services	12"	Petroleum or Petroleum Product	Deep Draft Utility Relocation
E39	Inner Harbor-Avery Point	1236+88	El Paso Field Services	30"	Petroleum or Petroleum Product	Deep Draft Utility Relocation
E40	Inner Harbor-Avery Point	1236+88	El Paso Field Services	10"	Petroleum or Petroleum Product	Deep Draft Utility Relocation
E41	Inner Harbor-Avery Point	1236+88	El Paso Field Services	10"	Petroleum or Petroleum Product	Deep Draft Utility Relocation
E42	Inner Harbor-Avery Point	1236+88	El Paso Field Services	2 1/2" in 4"	LPG	Deep Draft Utility Relocation
E43	Inner Harbor-Avery Point	1236+88	El Paso Field Services	6"	LPG	Deep Draft Utility Relocation
E44	Inner Harbor-Avery Point	1236+38	AEP/CPL	5"	H.V. Cable	Deep Draft Utility Relocation
E45	Inner Harbor-Avery Point	1236+38	AEP/CPL	5 1/2"	H.V. Cable Conduit	Deep Draft Utility Relocation
E46	Inner Harbor-Avery Point	1236+38	AEP/CPL	5 9/16"	H.V. Cable	Deep Draft Utility Relocation
E47	Inner Harbor	1319+58	Javelina Company	6"	Ethylene	Remain
E48	Inner Harbor	1320+12	El Paso Field Services	16"	Petroleum or Petroleum Product	Deep Draft Utility Relocation
E49	Inner Harbor	1320+12	El Paso Field Services	12"	Petroleum Product	Deep Draft Utility Relocation

Pipelines Crossing the Corpus Christi Ship Channel

Categorization of Pipelines for Channel Improvement Project

PIPELINE I.D.	CHANNEL	COE SHIP CHANNEL STATION	COMPANY	SIZE	TYPE	FACILITY CATEGORIZATION
E50	Inner Harbor	1320+12	El Paso Field Services	12"	Petroleum Product	Deep Draft Utility Relocation
E51	Inner Harbor	1409+65.7	Copano Bay, L.P.	10"	Gas Production	Deep Draft Utility Relocation
E52	Inner Harbor	1486+66	Texas Eastern Transmission, L.P.	30"	Gas	Deep Draft Utility Relocation
E53	Inner Harbor	1505+62	Flint Hills	8"	off (dry) gas	Remain
E54	Inner Harbor	1505+62	Koch Pipeline	8"	Nitrogen	Remain
E55	Inner Harbor	1505+62	Exxon Mobil Pipeline Company	16"	Dilute Propylene	Remain
E70	Inner Harbor	1211+02.84	Crosstex Energy Services	16"	Natural Gas	Remain
E71	Inner Harbor	1197+13	AEP/CPL	30"	HDPE Conduit with Multiple Electrical Cables	Remain

APPENDIX

A

APPENDIX A
HAZARDOUS MATERIAL SITE INDEX

SITE ID NO.	SITE NAME AND ADDRESS	DATABASE	SUMMARY TABLE
1	Byrd's Chevron, 14005 S Padre Island Dr, Corpus Christi, Tx 78418-6025	TXUST	Appendix B-4
2	Compass Marine Services, Balero Docks, Corpus Christi, Tx	ERNS	Appendix B-6
3	Coastal Market #3093, 13947 S Padre Island Dr, Corpus Christi, Tx 78418-6023	TXLUST TXUST	Appendix B-5 Appendix B-4
4	Fire Station #15, 14202 Commodores Dr, Corpus Christi, Tx 78418-6086	TXUST	Appendix B-4
5	Billings Bait & Tackle, 13428 S Padre Island Dr, Corpus Christi, Tx 78418-5911	TXAST	Appendix B-3
6	City of Corpus Christi, Padre Isles Subd., Wwtp, Whitecap Plant, Padre Island, Corpus Christi, Tx 78469	TXSPILL	Appendix B-7
7	Marker 37, 13317 S Padre Island Dr, Corpus Christi, Tx 78418-5910	TXLUST TXUST	Appendix B-5 Appendix B-4
8	Reynolds Metals Co., Hwy 361 E of Gregory, Corpus Christi, Tx 78469	TXSPILL FINDS	Appendix B-7 Appendix B-10
9	Nueces Rural Fire Prec. Dist.# 2, 1201 Laguna Shores Rd, Corpus Christi, Tx 78418-3414	TXLUST TXUST	Appendix B-5 Appendix B-4
10	JKC Communications Inc. Dba Ki, 441 Laguna, Corpus Christi, Tx 78401	FINDS	Appendix B-10
11	Rodd Village Apts, Corpus Christi, Tx	NPDES	Appendix B-8
12	Rodd Village Apts, Mr David Hull-Owner 10701 S Padre Island Dr, Corpus Christi, Tx 78418	FINDS	Appendix B-10
13	Cosmo Inc, Rincon Channel A, Corpus Christi, Tx	ERNS	Appendix B-6
14	Braco Products, 402 Jester St, Corpus Christi, Tx 78418-3218	FINDS	Appendix B-10
15	Dixie Carriers, Red Fish Bay Terminal, Corpus Christi, Tx	ERNS	Appendix B-6
16	USN-NAS Corpus Christi, Building 2512 Pelican Drive, Corpus Christi, Tx	ERNS	Appendix B-6
17	Trifinery Petroleum SVCS, 6600 Up River Rd, Corpus Christi, Tx 78409-3034	CORRACT FINDS RCRA-G ERNS TXSPILL	Appendix B-1 Appendix B-10 Appendix B-2 Appendix B-6 Appendix B-7
18	USN Air Station, Runway 31R, Nas, Corpus Christi, Corpus Christi, Tx 78419-5021	TXSPILL	Appendix B-7
19	USN-NAS Corpus Christi, Building 8 4Th Street, Corpus Christi, Tx 78419-5021	TXSPILL ERNS	Appendix B-7 Appendix B-6
20	Central Power & Light Co., 221 Jefferson, Eagle Pass, Corpus Christi, Tx 78403	TXSPILL	Appendix B-7
21	Central Power & Light, 6401 Country Club Drive Victoria, Corpus Christi, Tx 78403	TXSPILL	Appendix B-7
22	Coastal Maverick #3011, 5702 S Alameda St, Corpus Christi, Tx 78412-3207	TXUST	Appendix B-4
23	Oso Municipal Golf Course, 5601 S Alameda St, Corpus Christi, Tx 78412-3204	TXUST	Appendix B-4
24	Central Power & Light Co., 5817 Rio Vista, Corpus Christi, Corpus Christi, Tx 78403	TXSPILL	Appendix B-7
25	Central Power & Light, 509 Idylwood, Laredo, Tx, Corpus Christi, Tx 78403	TXSPILL	Appendix B-7
26	Texas A&M University-Corpus Christi State University, 6300 Ocean Dr, Corpus Christi, Tx 78412-5599	RCRA-G TXLUST TXUST FINDS	Appendix B-2 Appendix B-5 Appendix B-4 Appendix B-10

APPENDIX A
HAZARDOUS MATERIAL SITE INDEX

SITE ID NO.	SITE NAME AND ADDRESS	DATABASE	SUMMARY TABLE
27	Circle K Store #9886, 6101 Ocean Dr, Corpus Christi, Tx 78412-2864	TXUST	Appendix B-4
28	Central Power & Light Co, 120 Center & 4Th, Columbus,Tx, Corpus Christi, Tx 78403	TXSPILL	Appendix B-7
29	Central Power & Light, 402 Clairemore Dr., Corpus Christi, Corpus Christi, Tx 78403	TXSPILL	Appendix B-7
30	Central Power & Light Company, 5502 Ocean Drive, Corpus Christi,Tx, Corpus Christi, Tx	TXSPILL	Appendix B-7
31	Seaside Memoral Park, 255 Robert Dr, Corpus Christi, Tx 78412-2598	TXLUST TXUST	Appendix B-5 Appendix B-4
32	SSP-Circle K Corporation, Circle K # 9390, 4214 Carroll Lane, Corpus Christi, Corpus Christi, Tx 78401	TXSPILL	Appendix B-7
33	Unknown, 4222 Ocean Drive, Corpus Christi, Tx 78411	ERNS	Appendix B-6
34	Elementis Chromium LP/ American Chrome & Chemicals, 3800 Buddy Lawrence Dr,Corpus Christi, Tx 78407-1900	CORRACT RCRA-G TRI TXAST TXUST FINDS ERNS TXSPILL	Appendix B-1 Appendix B-2 Appendix B-9 Appendix B-3 Appendix B-4 Appendix B-10 Appendix B-6 Appendix B-7
35	Central Power & Light Co., 432 Pasadena,Corpus Christi, Corpus Christi, Tx 78403	TXSPILL	Appendix B-7
36	Samedan Oil Corp., Platform B State Lease 818L, Corpus Christi, Tx	ERNS	Appendix B-6
37	Central Power & Light Company, 326 Meldo Park, Corpus Christi,Tx, Corpus Christi, Tx 78403	TXSPILL	Appendix B-7
38	Central Power & Light Co., 2904 Monterrey, Laredo,Tx, Corpus Christi, Tx 784032121	TXSPILL	Appendix B-7
39	Unknown, 3414 Ocean Drive Apt 3, Corpus Christi, Tx	ERNS	Appendix B-6
40	Citgo Refining & Chemical Co Lp,1801 Nueces Bay Blvd,Corpus Christi, Tx 78407-2221	AIRS CORRACT FINDS NFRAP RCRA TSD RCRA-G TRI ERNS TXSPILL	 Appendix B-1 Appendix B-10 Appendix B-1 Appendix B-1 Appendix B-2 Appendix B-9 Appendix B-6 Appendix B-7
41	Slop Oil Inc, 2933 Santa Fe St, Corpus Christi, Tx 78404-1659	RCRA-G FINDS	Appendix B-2 Appendix B-10
42	Baker Property, 800 N Water St, Corpus Christi, Tx 78401-2020	TXUST	Appendix B-4
43	Maverick Market #100, 2806 Santa Fe St, Corpus Christi, Tx 78404-1746	TXLUST TXUST	Appendix B-5 Appendix B-4
44	OBI Hughes Inc, Fm 2725, Ingleside, Tx 78362	FINDS	Appendix B-10
45	Brown & Root Inc WHMC, Hwy 361 S to Ferry, Port Aransas, Tx 78373	RCRA-G ERNS FINDS	Appendix B-2 Appendix B-6 Appendix B-10
46	Central Power & Light, 1725 Second St., Corpus Christi, Corpus Christi, Tx 78403	TXSPILL	Appendix B-7

SITE ID NO.	SITE NAME AND ADDRESS	DATABASE	SUMMARY TABLE
47	Spohn Hospital, 600 Elizabeth St, Corpus Christi, Tx 78404-2235	RCRA-G TXLUST TXUST FINDS	Appendix B-2 Appendix B-5 Appendix B-4 Appendix B-10
48	Marine inland Transport., Oil Dock No.8, Corpus Christi, Tx	ERNS	Appendix B-6
49	1403 Associates, 1403 3Rd St, Corpus Christi, Tx 78404-2101	TXUST	Appendix B-4
50	IHS Corpus Christi (Harbor View, 1314 3Rd St, Corpus Christi, Tx 78404-2208	TXUST	Appendix B-4
51	Circle K #2121, 1303 3Rd St, Corpus Christi, Tx 78404-2207	TXLUST TXUST TXSPILL	Appendix B-5 Appendix B-4
52	7-Eleven Store #25158, 701 Alister, Port Aransas, Tx 78469	TXLUST	Appendix B-5
53	Enjet Refining Inc, Fm 2725 At Sunray Rd, Ingleside, Tx 78362	FINDS	Appendix B-10
54	Central Power & Light Co., 1001 2Nd Street, Mercedes,Tx, Corpus Christi, Tx 784032121	TXSPILL	Appendix B-7
55	Unknown, Sw No. 3, Corpus Christi, Tx	ERNS	Appendix B-6
56	Dos Patios, 911 S Tancahua St, Corpus Christi, Tx 78404-2340	TXLUST TXUST	Appendix B-5 Appendix B-4
57	PMI #2, 910 S Tancahua St, Corpus Christi, Tx 78404-2341	TXLUST TXUST	Appendix B-5 Appendix B-4
58	Padre & Mustang Islands, 1621 Beach, Corpus Christi, Tx 78415	FINDS	Appendix B-10
59	Central Power & Light, 5Th Street At Las Lomas West Section, Rio Grande City, Corpus Christi, Tx 78403	TXSPILL	Appendix B-7
60	City of Corpus Christi, Shoreline & Coopers Alley, Corpus Christi, Corpus Christi, Tx 78469-9227	TXSPILL	Appendix B-7
61	Wilson Plaza Texaco, 520 S Carancahua St, Corpus Christi, Tx 78401-3438	TXUST	Appendix B-4
62	Former Fina Service Station, Agnes & Port Ave, Corpus Christi, Tx 78405	TXUST	Appendix B-5
63	Allen Samuels Bay Chevrolet, 401 S Water St, Corpus Christi, Tx 78401-2821	RCRA-G FINDS	Appendix B-2 Appendix B-10
64	Mercantile Bank, 615 S Upper Broadway St, Corpus Christi, Tx 78401-3432	TXUST	Appendix B-4
65	Cellular One, 101 N Shoreline Blvd, Corpus Christi, Tx 78401-2824	TXUST	Appendix B-4
66	Water Division - Pump Plant ""B"", 301 Kinney St, Corpus Christi, Tx 78401-2834	TXLUST TXUST	Appendix B-5 Appendix B-4
67	Bailey Cadillac Corp, 320 Chaparral, Corpus Christi, Tx 78401	FINDS	Appendix B-10
68	Unknown, Coppers Alley L-Head, Corpus Christi, Tx	ERNS	Appendix B-6
69	Unknown, 100 Coopers Alley L-Head, Corpus Christi, Tx	ERNS	Appendix B-6
70	Fire, 209 S Carancahua St, Corpus Christi, Tx 78401-3033	TXLUST TXUST	Appendix B-5 Appendix B-4
71	Police Department Headquarters, 120 N Chaparral St, Corpus Christi, Tx 78401-2802	TXUST	Appendix B-4
72	Trinity Towers, 101 N Upper Broadway St, Corpus Christi, Tx 78401-2756	TXUST	Appendix B-4
73	Firestone Store #4488 /023280, 323 Williams St, Corpus Christi, Tx 78401-2536	TXUST	Appendix B-4

SITE ID NO.	SITE NAME AND ADDRESS	DATABASE	SUMMARY TABLE
74	Unknown, 400A North Shoreline, Corpus Christi, Tx	ERNS	Appendix B-6
75	Keeper's Locker, Inc., Lawrence Street T-Head, 444 N Shoreline Blvd, Corpus Christi, Tx 78401-2556	TXUST TXLUST TXVCP	Appendix B-4 Appendix B-5 Appendix B-1
76	Parks & Recreation, Lawrence Street, Corpus Christi, Tx 78401	TXUST	Appendix B-4
77	Pennzoil Company, 210 Schatzel, Corpus Christi, Tx 78408	FINDS	Appendix B-10
78	Nationsbank, 502 N Water St, Corpus Christi, Tx 78471-0001	TXUST	Appendix B-4
79	Vessel ""Avalon"", People'S ""T"" Head Dock Corpus Christi Waterfront, Corpus Christi, Tx	ERNS	Appendix B-6
80	Koch East, Nueces Bay Blvd Dock 3, Corpus Christi, Tx 78469	ERNS	Appendix B-6
81	Unknown, La Quinta Channel Mouth of Channel, Corpus Christi, Tx	ERNS	Appendix B-6
82	T.A. Harrell, Jr., 622 N Water St, Corpus Christi, Tx 78401-2328	TXUST	Appendix B-4
83	Unknown, People Street, T-Heads Corpus Christi Marina, Corpus Christi, Tx	ERNS	Appendix B-6
84	Greyhounds Lines Inc, 702 N Chaparral St, Corpus Christi, Tx 78401-2306	TXLUST TXUST	Appendix B-5 Appendix B-4
85	Various Facilities and Properties	TXSPILL ERNS FINDS	Appendix B-7 Appendix B-6 Appendix B-10
86	Omni Bayfront, 900 N Shoreline Blvd, Corpus Christi, Tx 78401-2093	TXUST	Appendix B-4
87	US DOJ DEA Corpus Christi, 400 Mann St Ste 405, Corpus Christi, Tx 78401-2046	FINDS	Appendix B-10
88	Central Power & Light Co, Mann Street, Maverick Markets, Laredo,Tx, Corpus Christi, Tx 78403	TXSPILL	Appendix B-7
89	C C Rental Equip Repair Shop, 1201 N Chaparral St, Corpus Christi, Tx 78401-1502	RCRA-G TXUST FINDS	Appendix B-2 Appendix B-4 Appendix B-10
90	Circle K #2119, 1202 N Chaparral St, Corpus Christi, Tx 78401-1503	TXLUST TXUST	Appendix B-5 Appendix B-4
91	Central Power & Light Co., 1204 No. Chapparal; Corpus Christi, Tx, Corpus Christi, Tx 78403	TXSPILL	Appendix B-7
92	Exxon Ras 6-7219, 1201 N Water St, Corpus Christi, Tx 78401-1539	TXUST FINDS	Appendix B-4 Appendix B-10
93	Water, 1218 N Water St, Corpus Christi, Tx 78401-1540	TXLUST TXUST	Appendix B-5 Appendix B-4
94	Del Mar College E Campus, Baldwin & Ayers St, Corpus Christi, Tx 78404	FINDS	Appendix B-10
95	Rick's Detailing, 1421 N Chaparral St, Corpus Christi, Tx 78401-1506	TXLUST TXUST	Appendix B-5 Appendix B-4
96	Overnite Transportation, 1922 North Sam Rankin Rd Overnite Transportation Term, Corpus Christi, Tx 78407	ERNS	Appendix B-6
97	Former Riviera Wholesale Food, 1502 N Tancahua St, Corpus Christi, Tx 78401-1416	TXUST	Appendix B-4
98	Convention Center, 1901 N Shoreline Blvd, Corpus Christi, Tx 78401-1137	TXLUST TXUST	Appendix B-5 Appendix B-4
99	Celanese Engineering Resins Inc, 2500 W Broadway St, Corpus Christi, Tx 78407-2403	RCRA-G FINDS	Appendix B-2 Appendix B-10

APPENDIX A
HAZARDOUS MATERIAL SITE INDEX

SITE ID NO.	SITE NAME AND ADDRESS	DATABASE	SUMMARY TABLE
100	ILC-Corpus Christi, 1806 Sam Rankin St, Corpus Christi, Tx 78401-1042	TXLUST TXAST FINDS	Appendix B-5 Appendix B-3 Appendix B-10
101	Williams Distributing Co, 1717 N Tancahua St, Corpus Christi, Tx 78401-1009	TXUST	Appendix B-4
102	Texas Emulsions Inc, 2702 W Broadway, Corpus Christi, Tx 78401	FINDS	Appendix B-10
103	Yellow Freight, 1724 N Tancahua St, Corpus Christi, Tx 78401-1010	TXLUST TXUST	Appendix B-5 Appendix B-4
104	Crocker Transfer & Storage Co, 817 Brewster St, Corpus Christi, Tx 78401-1030	TXUST	Appendix B-4
105	Crockett Oil - Gasateria, 1823 N Chaparral St, Corpus Christi, Tx 78401-1111	TXLUST TXUST	Appendix B-5 Appendix B-4
106	Brown Express, Inc., 1102 E Port Ave, Corpus Christi, Tx 78401-1005	TXLUST TXUST	Appendix B-5 Appendix B-4
107	Corpus Christi Public Compress, 1002 E Port Ave, Corpus Christi, Tx 78401-1004	TXUST	Appendix B-4
108	Susser Envrnmtl Svcs, 950 E Port Ave # 5, Corpus Christi, Tx 78401-1002	RCRA-G TXLUST FINDS	Appendix B-2 Appendix B-5 Appendix B-10
109	Recyclable Hw Transfer Facility, 1925 N Sma Rankin, Corpus Christi, Tx 78401	FINDS	Appendix B-10
110	Unknown, 5400 Upriver Rd, Corpus Christi, Tx	ERNS	Appendix B-6
111	Coastal States Refining, 5450 Upriver Road, Corpus Christi, Tx	ERNS	Appendix B-6
112	Corpus Christi Area Office, 101 Sisson, Corpus Christi, Tx 78401	TXUST	Appendix B-4
113	Nueces Petrochemical Company, 5441 Up River Rd, Corpus Christi, Tx 78407-1411	RCRA-G FINDS	Appendix B-2 Appendix B-10
114	Various Facilities and Properties, Lawrence Street T-Head, Corpus, Christi, Tx	ERNS	Appendix B-6
115	Javelina Company, 5314 Ih 37, Mcbride Lane, Corpus Christi, Tx 78415-5326	TXSPILL	Appendix B-7
116	Encycle Texas Inc, 5500 Up River Rd, Corpus Christi, Tx 78407-1322	TXSPILL RCRA-G CORRACT RCRA TSD NPDES ERNS FINDS	Appendix B-7 Appendix B-2 Appendix B-1 Appendix B-1 Appendix B-8 Appendix B-6 Appendix B-10
117	Armor Cote Corp, 1616 Navigation Blvd, Corpus Christi, Tx 78408	FINDS	Appendix B-10
118	Circle K #9270, 5555 Up River Rd, Corpus Christi, Tx 78407-1335	TXLUST TXUST	Appendix B-5 Appendix B-4
119	Texas Lehigh Cement, 1800 Navigation Blvd, Corpus Christi, Tx 78402	TXUST TXUST FINDS	Appendix B-4 Appendix B-4 Appendix B-10
120	Producers Grain Port, 5700 Up River Rd, Corpus Christi, Tx 78407-1201	ERNS FINDS	Appendix B-6 Appendix B-10
121	Central Power & Light- Neuces Bay Station, 2000 Navigation Blvd. South, Corpus Christi, Tx 78407	NFRAP FINDS	Appendix B-1 Appendix B-10
122	Koch Refining, Suntide Road, Half Mile North of I-37, Chorpus Christi, Tx 787403	CORRACT RCRA-TSD NFRAP	Appendix B-1 Appendix B-1 Appendix B-1

~~SITE ID~~ NO.	SITE NAME AND ADDRESS	DATABASE	SUMMARY TABLE
147	Seven Eleven Store #52118, 4010 E Causeway Blvd, Corpus Christi, Tx 78402-1411	TXLUST	Appendix B-5
148	Central Power & Light, Rincon Oil Field North of Rio Grande City, Rio Grande, Corpus Chrisit, Tx 78403	TXSPILL	Appendix B-7
149	Gibson Recycling, Inc., 4810 Rincon, Gibson Tire Recycling, Corpus Christi, Tx 78402	TXSPILL	Appendix B-7
150	Nueces Co Wcid #4, 1500 Ross Avenue, Port Aransas, Tx	ERNS FINDS	Appendix B-6 Appendix B-10
151	Street, 2525 Hygeia, Corpus Christi, Tx 78415	TXUST	Appendix B-4
152	Padre & Mustang Islands 2, 1441 Beach, Corpus Christi, Tx 78416	FINDS	Appendix B-10
153	Allwaste, Allwaste Environmental Services, 9014 Agnes, Corpus Christi, Tx 78406	TXSPILL	Appendix B-7
154	Duran Petroleum Dist. Inc, 309 Sandbar Ave, Corpus Christi, Tx 78402-1718	TXUST TXAST FINDS	Appendix B-4 Appendix B-3 Appendix B-10
155	Hwy 181 Taft,Tx, Corpus Christi, Tx 78469	TXSPILL	Appendix B-7
156	Port Aransas Isd, 100 S Station St, Port Aransas, Tx 78373-5233	FINDS	Appendix B-10
157	Central Power & Light Co., Hwy 181, Tuletia, Corpus Christi, Tx 784032121	TXSPILL	Appendix B-7
158	Nueces Co Water Control & Id #4, 315 S 9Th St, Port Aransas, Tx 78373-5207	TXLUST TXUST	Appendix B-5 Appendix B-4
159	Citgo Ref. & Chem.- West Plant, 7350 IH 35, Corpus Christi, Tx 78469-0321	TXSPILL	Appendix B-7
160	Koch Pipeline Lp, 1Mi. E of Hobson, Downstream of Hwy 181, Fall City Bridge, Corpus Christi, Tx 78409	TXSPILL	Appendix B-7
161	Bristol Resources, Corpus Christy Bay State Tract 470, Port Aransas, Tx	TXSPILL ERNS	Appendix B-7 Appendix B-6
162	Force Energy inc, 7134 St Hwy 361, Port Aransas, Tx	ERNS	Appendix B-6
163	Shoreline Lift inc., Gulf of Mexico 22 Miles off of Port, Port Aransas, Tx	ERNS	Appendix B-6
164	City Auditorium, 710 W Avenue A, Port Aransas, Tx 78373-4128	TXUST	Appendix B-4
165	Sun Marine Terminals Inc (Ingleside), Highway 1069, Ingleside, Tx 78362	FINDS	Appendix B-10
166	Mora Marine Service, 124 W Cotter Ave, Port Aransas, Tx 78373-4030	RCRA-G FINDS	Appendix B-2 Appendix B-10
167	Unknown, Mustang island Approx. 1.5 Miles South of Port Aransas, Port Aransas, Tx	ERNS	Appendix B-6
168	Unknown, Mustang island Beach, Port Aransas, Tx	ERNS	Appendix B-6
169	Island Moorings Yacht Club, 3500 Island Moorings Pkwy, Port Aransas, Tx 78373-4901	ERNS TXUST TXSPILL	Appendix B-6 Appendix B-4 Appendix B-7
170	Island Auto Service, 115 N. Oleander, Port Aransas, Tx	ERNS	Appendix B-6
171	Diamond Shamrock Unit #00426, 715 N Allister, Port Aransas, Tx 78373	TXUST TXLUST	Appendix B-4 Appendix B-5
172	Clanton's Texaco, 429 N Alistir, Port Aransas, Tx 78373	TXUST TXLUST	Appendix B-4 Appendix B-4
173	Carl Moore (Bilmore & Son), 115 N Alister St, Port Aransas, Tx 78373-4008	TXUST	Appendix B-4

APPENDIX A
HAZARDOUS MATERIAL SITE INDEX

SITE ID NO.	SITE NAME AND ADDRESS	DATABASE	SUMMARY TABLE
174	Port Aransas Ferry Operation, 619 W Cotter Ave, Port Aransas, Tx 78373-4041	TXUST	Appendix B-4
175	Dolphin Docks, 300 W Cotter Ave, Port Aransas, Tx 78373-4032	TXUST	Appendix B-4
176	DPC Ind., Suntide Road 1 Mile North of I-37 Corpus Christi, Corpus Christi, Tx 78469	TXSPILL	Appendix B-7
177	J W Miller Estate, 11601 Leopard St, Corpus Christi, Tx 78410-3417	TXLUST TXUST	Appendix B-5 Appendix B-4
178	E & P Truck Co Inc, 11200 Up River Rd, Corpus Christi, Tx 78410-3311	FINDS RCRA-G	Appendix B-10 Appendix B-2
179	Vernons Automotive Spec, 11700 Leopard St, Corpus Christi, Tx 78410-3418	RCRA-G FINDS	Appendix B-2 Appendix B-10
180	City Stop #24, 11102 Ih 37, Corpus Christi, Tx 78415	TXUST	Appendix B-4
181	Circle K #9437, 11901 Leopard St, Corpus Christi, Tx 78410-3423	TXLUST TXUST	Appendix B-5 Appendix B-4
182	Midgulf Energy, Fm 2725 At Bishop Rd, Ingleside, Tx 78362	RCRA-G TXUST FINDS	Appendix B-2 Appendix B-4 Appendix B-10
183	Unknown, 11403 Up River Rd Near the Violet , Exit off I-37, Corpus Christi, Tx	ERNS	Appendix B-6
184	Southwest Marine Inc, 1555 Main St, Ingleside, Tx 78362-0999	RCRA-G FINDS TXLUST	Appendix B-2 Appendix B-10 Appendix B-5
185	Offshore Specialty Fab Inc, 802 Sunray Rd, Aransas Pass, Tx 78336	TXAST	Appendix B-3
186	Unknown, Harbor Road, Port Aransas, Tx	ERNS	Appendix B-6
187	Raymond Dugat Jr, 421 Market St, Portland, Tx 78374-1535	TXUST	Appendix B-4
188	Ft. Worth Oil & Gas Co., 100' From Hwy. 181/W. of Hwy. Nueces Bay, Portland, Tx	ERNS	Appendix B-6
189	Delta Plumbing Company, Inc, 313 5Th St, Portland, Tx 78374-1701	TXUST	Appendix B-4
190	Snappy Food, 617 Moore Ave, Portland, Tx 78374-1607	TXUST	Appendix B-4
191	Texas Department Of Transportation, U.S. Hwy 181 and Moore Avenue, Portland, Tx 78374	NPDES	Appendix B-8
192	One Hour Martinizing, 821 Dallas St, Portland, Tx 78374-1603	FINDS	Appendix B-10
193	Nu-Way Oil (Ffp #300), 716 Moore Ave, Portland, Tx 78374-1835	TXLUST TXUST	Appendix B-5 Appendix B-4
194	Glen Coker/Century 21, 821 Houston St, Portland, Tx 78374-1651	TXLUST TXUST	Appendix B-5 Appendix B-4
195	Allied Chemical Co., 117 San Saba, Portland, Tx 78374	NFRAP FINDS	Appendix B-1 Appendix B-10
196	City Of Portland (Police Dept), 902 Moore Ave, Portland, Tx 78374-2228	TXUST FINDS	Appendix B-4 Appendix B-10
197	Amerada Hess Corp Corpus Christi Ref,1828 Poth Lane,Corpus Christi, Tx 78407	FINDS RCRA-G NFRAP	Appendix B-10 Appendix B-2 Appendix B-1
198	Wright, J Frank, 1000 Floerke Rd, Portland, Tx	TXUST	Appendix B-4
199	Strom Property, 409 Hwy 181, Portland, Tx 78374	TXLUST	Appendix B-5

SITE ID NO.	SITE NAME AND ADDRESS	DATABASE	SUMMARY TABLE
200	Texas Dept Of Transportation, 501 W Broadway, Portland, Tx 78374	TXUST	Appendix B-4
201	Grace Baptist Church, 611 College St, Portland, Tx 78374-2060	FINDS	Appendix B-10
202	City of Portland, 1101 Moore Ave, Portland, Tx 78374	TXUST NPDES	Appendix B-4 Appendix B-8
203	Teal Lodge, 1135 S Bay St, Aransas Pass, Tx 78336-5818	ERNS TXLUST TXUST	Appendix B-6 Appendix B-5 Appendix B-4
204	Unknown, 526 Bigelow, Aransas Pass, Tx	ERNS	Appendix B-6
205	Aransas Shrimp Co-Aransas Pass, Aransas Pass, Tx	NPDES	Appendix B-8
206	Univ Of Tx Marine Science Inst, 750 Channel View Dr, Port Aransas, Tx 78373-5015	RCRA-G FINDS	Appendix B-2 Appendix B-10
207	Central Power & Light Co., Dupont Plant, Ingleside, Hwy 361, 3 Mi W. of Gregory, In OCB Unit, Corpus Christi, Tx	TXSPILL	Appendix B-7
208	Corpus Christi Gas Company,702 Power Street,Corpus Christi, Tx 78401	NFRAP FINDS	Appendix B-1 Appendix B-10
209	American Petrofina, Hwy 361, Port Aransas, Tx 78373	FINDS	Appendix B-10
210	Bailey Cadillac Corp., 401 S Shoreline Blvd, Corpus Christi, Tx 78401-2813	TXLUST TXUST FINDS	Appendix B-5 Appendix B-4 Appendix B-10
211	Corpus Christi Refined Products, 2700 Texaco Rd, Corpus Christi, Tx	TXUST	Appendix B-5
212	HBH Petroleum Corp Inc, Corpus Christi, Corpus Christi, Tx 78411	FINDS	Appendix B-10
213	Central Power & Light(Alice Service Ctr), 400 Main, Corpus Christi, Tx 78403	FINDS	Appendix B-10
214	CSI Business Systems, 1223 N Water St, Corpus Christi, Tx 78401-1539	TXLUST TXUST	Appendix B-5 Appendix B-4
215	Coastal Iron Works, Inc., 1133 E Port Ave, Corpus Christi, Tx 78401-1047	TXLUST TXUST FINDS	Appendix B-5 Appendix B-4 Appendix B-10
216	PCCA Port Transfer Fac, 1134 E Port Ave # 1136, Corpus Christi, Tx 78401-1005	FINDS	Appendix B-10
217	Jay Bludworth Inc-Coastal Iron Works, 3101 E Navigation Blvd, Corpus Christi, Tx 78402-1906	TXLUST FINDS TXUST RCRA-G	Appendix B-5 Appendix B-10 Appendix B-4 Appendix B-2
218	Corpus Christi Public Elevator, 2122 Navigation, Corpus Christi, Tx 78402	TXAST	Appendix B-3
219	Hollywood Marine Inc, 3501 E Navigation Blvd, Corpus Christi, Tx 78402-1902	TXAST	Appendix B-3
220	Navigation Yard, 2602 Navigation, Corpus Christi, Tx 78402	TXUST	Appendix B-4
221	Nueces Bay Power Station, 2002 Navigation Blvd, Corpus Christi, Tx 78402	TXUST ERNS	Appendix B-4 Appendix B-6
222	PCCA Public Elevator, 2121 Navigation Blvd, Corpus Christi, Tx 78402	FINDS	Appendix B-10
223	Southwest Env Ser Inc Mar Div, 3103 E Navigation Blvd, Corpus Christi, Tx 78402-1906	RCRA-G FINDS	Appendix B-2 Appendix B-10
224	Unknown, 1335 East Navigation Blvd, Corpus Christi, Tx	ERNS	Appendix B-6
225	Baker Marine Corporation, Rincon Industrial Park, Corpus Christi, Tx 78403	FINDS	Appendix B-10

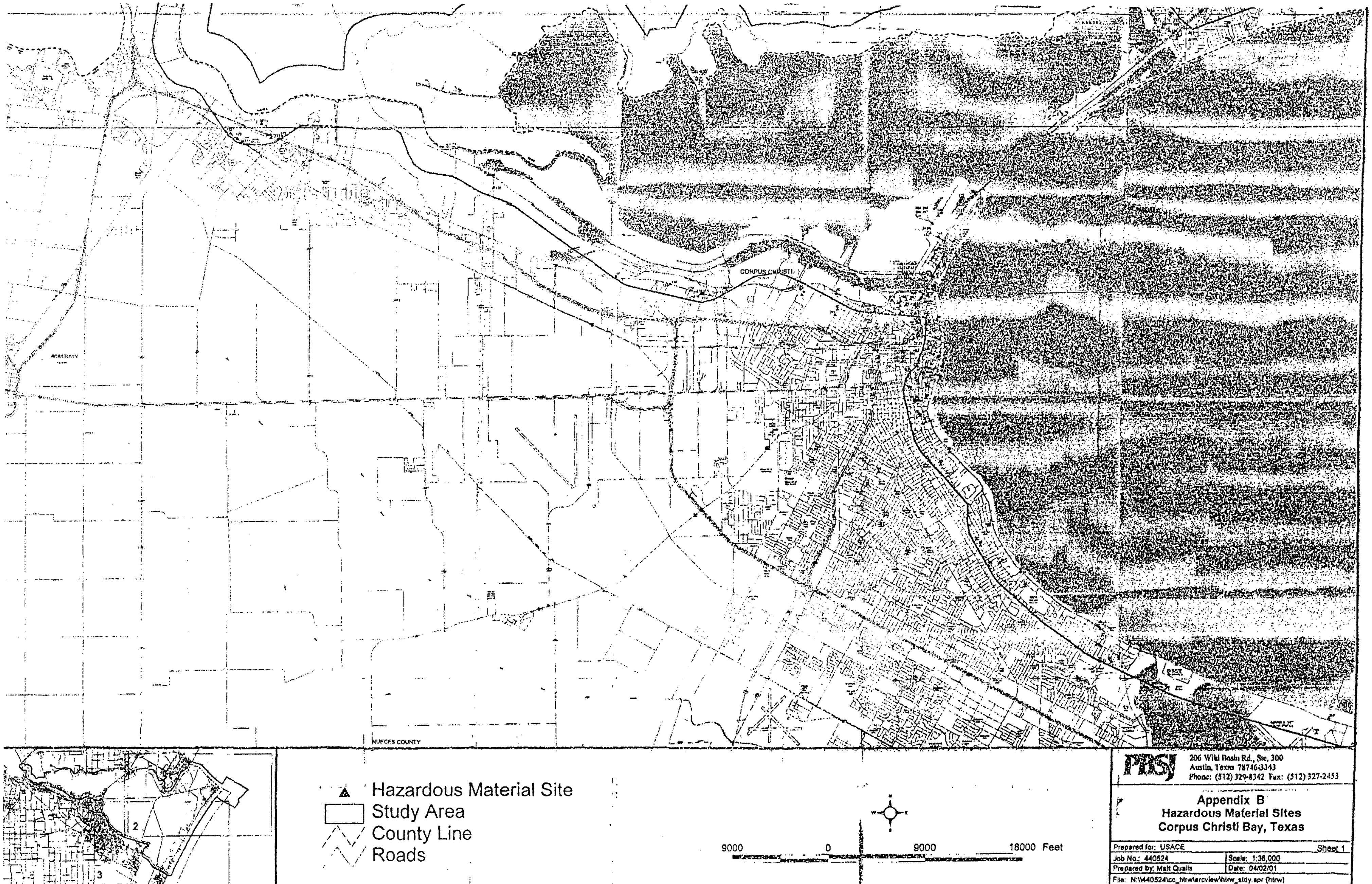
SITE ID NO.	SITE NAME AND ADDRESS	DATABASE	SUMMARY TABLE
226	Blenrite Intnl Inc, 3710 Rincon Rd, Corpus Christi, Tx 78402-1802	RCRA-G FINDS	Appendix B-2 Appendix B-10
227	Texas Dept Of Transp, Us 181 Sh 35, Corpus Christi, Tx 78401	FINDS RCRA-G	Appendix B-10 Appendix B-2
228	Diamond Shamrock Corner Store #1, 4502 Hwy 181, Corpus Christi, Tx 78402	TXUST TXUST TXLUST	Appendix B-4 Appendix B-4 Appendix B-5
229	Circle K #2118, 4010 Hwy 181, Corpus Christi, Tx 78402	TXUST	Appendix B-4
230	Woody'S Sports Center, 136 W Cotter Ave, Port Aransas, Tx 78373-4030	ERNS TXAST	Appendix B-6 Appendix B-3
231	Mid-Coast Barge Corp, 150 W Cotter Ave, Port Aransas, Tx 78373-4030	TXUST	Appendix B-4
232	Oceans of Seafood, 165 W Cotter Ave, Port Aransas, Tx 78373-4034	TXUST	Appendix B-4
233	Turtcv/Frb-Austin, 114 W Cotter Ave, Port Aransas, Tx 78373-4030	TXUST TXLUST	Appendix B-4 Appendix B-5
234	Circle K #2145, 219 N Alister, Port Aransas, Tx 78373	TXUST	Appendix B-4
235	Circle K #2161, 11201 Ih 37, Corpus Christi, Tx 78410-3302	TXUST FINDS TXLUST	Appendix B-4 Appendix B-10 Appendix B-5
236	Coastal Maverick #3095, 706 Moore Ave, Portland, Tx 78374-1835	TXLUST TXUST	Appendix B-5 Appendix B-4
237	Maverick Market #3055, 1301 Moore Ave, Portland, Tx 78374-1846	TXLUST TXUST	Appendix B-5 Appendix B-4
238	USCG Station Port Aransas, 800 N Station St, Port Aransas, Tx 78373	ERNS FINDS TXUST TXAST	Appendix B-6 Appendix B-10 Appendix B-4 Appendix B-3
239	Fisherman's Wharf, Inc, 900 Tarpon St, Port Aransas, Tx 78373-5034	TXLUST TXUST TXAST	Appendix B-5 Appendix B-4 Appendix B-3
240	Tulip Toll Bldg., 406 N Carancahua St, Corpus Christi, Tx 78401-2742	TXAST	Appendix B-3
241	Koch Refining Co., East Plant/Southwestern Refining Company,1700 Nueces Bay Blvd,Corpus Christi, Tx 78401	ERNS NFRAP FINDS TXSPILL RCRA-G TRI TXUST	Appendix B-6 Appendix B-1 Appendix B-10 Appendix B-7 Appendix B-2 Appendix B-9 Appendix B-4
242	Allwaste Environmental, Rincon Rd Rincon Ind. Park, Corpus Christi, Tx 78406	ERNS	Appendix B-6
243	Tradewinds Ford Sales, Inc., 401 N Water St, Corpus Christi, Tx 78401-2532	TXUST TXLUST	Appendix B-4 Appendix B-5
244	Patterson's Inc, 615 N Mesquite St, Corpus Christi, Tx 78401-2309	TXUST	Appendix B-4
245	Southwestern Pipelines, Citgo Refinery, 1800 Nueces, Corpus Christi, Tx 78407	TXSPILL	Appendix B-7
246	Reynolds Aluminum-Sherwin, Southwest Corner of Area 45, Corpus Christi, Tx 78469	TXSPILL	Appendix B-7
247	Swantner Richard, 402 N Water St, Corpus Christi, Tx 78401-2533	TXLUST	Appendix B-5
248	Sabine Towing & Trans Co, Southwestern Docks, Corpus Christie, Tx	ERNS	Appendix B-6

APPENDIX A
HAZARDOUS MATERIAL SITE INDEX

SITE ID NO.	SITE NAME AND ADDRESS	DATABASE	SUMMARY TABLE
249	Hollywood Marine Inc, Southwestern, Corpus Christi, Tx	ERNS	Appendix B-6
250	Maryland Marine, Southwest Terminal, Corpus Christi, Tx	ERNS	Appendix B-6
251	Marine Inland Transportation, SW Dock Environmental, Corpus Christi, Tx	ERNS	Appendix B-6
252	Us Naval Air Station Corpus Christi, Ocean Drive & Saipan St., Corpus Christi, Tx 78419	CORRACT RCRA TSD CERCLIS	Appendix B-1 Appendix B-1 Appendix B-1
253	Coast Guard Depot,1201 Navigation Blvd.,Corpus Christi, Tx 78407	NFRAP RCRA-G FINDS	Appendix B-1 Appendix B-2 Appendix B-10
254	Diamond Shamrock Cc Oil Docks, 2700 And One Half Texaco Rd, Corpus Christi, Tx 78401	RCRA TSD	Appendix B-1
255	American Petrofina Pipe Line Co, Harbor Island, Aransas Pass, Tx 78335	TXLUST	Appendix B-5
256	RTFC Training Facility, Koch Refinery, Corpus Christi, Tx 78409	TXLUST	Appendix B-5
257	Rincon Industrial Park (PCCA), Rincon Road North of Burleson Street, Corpus Christi, Tx	TXVCP ERNS	Appendix B-1 Appendix B-6

APPENDIX

B


CORPUS CHRISTI
NUECES COUNTY
Hazardous Material Site
Study Area
County Line
Roads
9000 0 9000 18000 Feet
206 Wild Basin Rd., Ste. 300
Austin, Texas 78746-3343
Phone: (512) 329-8342 Fax: (512) 327-2453
Appendix B
Hazardous Material Sites
Corpus Christi Bay, Texas
Prepared for: USACE
Sheet 1
Job No.: 440524
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Prepared by: Matt Qualls
Date: 04/02/01
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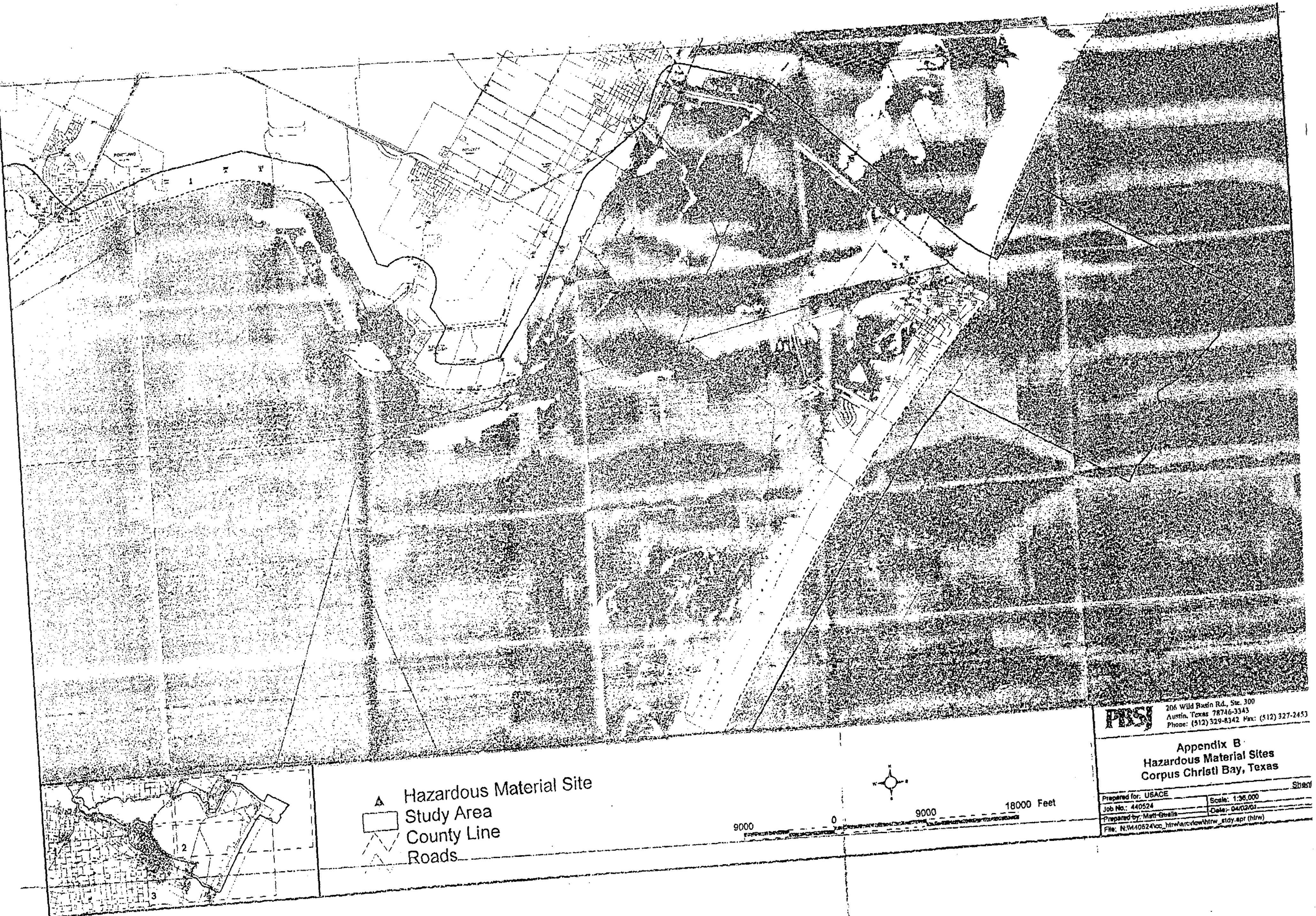
Hazardous Material Site
Study Area
County Line
Roads
9000
0
9000
18000 Feet
PBSJ
206 Wild Basin Rd., Ste. 300
Austin, Texas 78746-3343
Phone: (512) 329-8342 Fax: (512) 327-2453
Appendix B
Hazardous Material Sites
Corpus Christi Bay, Texas
Prepared for: USACE
Scale: 1:36,000
Job No.: 440524
Date: 04/02/03
Prepared by: Matt Goslin
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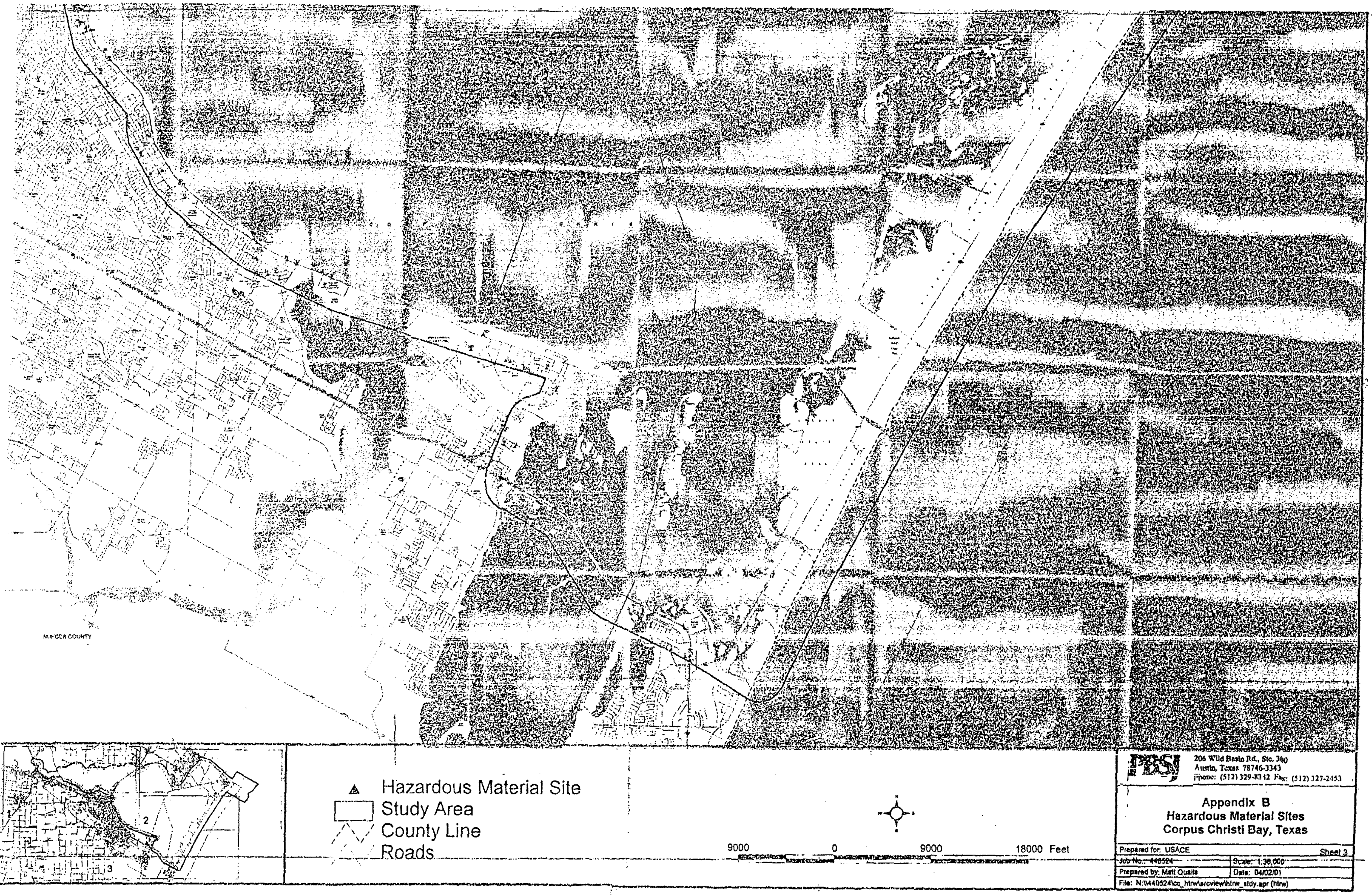


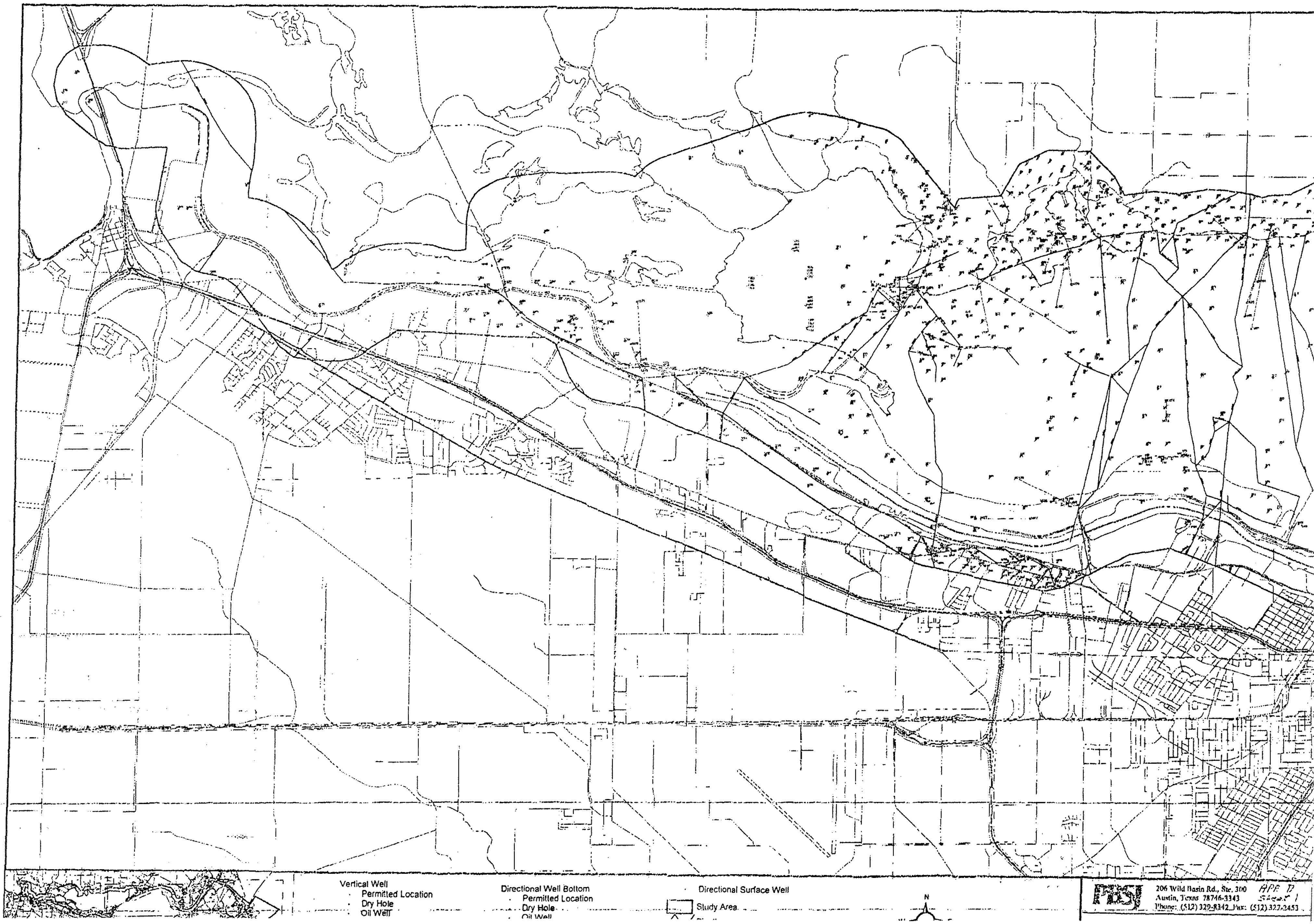
PBSJ
206 Wild Basin Rd., Ste. 300
Austin, Texas 78746-3343
Phone: (512) 329-8342 Fax: (512) 327-2453

Appendix B
Hazardous Material Sites
Corpus Christi Bay, Texas

Prepared for: USACE
Sheet 3
Job No.: 440524
Scale: 1:36,000
Prepared by: Matt Qualls
Date: 04/02/01
File: N:\440524\cc_hlrw\arcview\hlrw_stdy.apr (hlrw)

APPENDIX

D


Vertical Well
Permitted Location
Dry Hole
Oil Well
Directional Well Bottom
Permitted Location
Dry Hole
Oil Well
Directional Surface Well
Study Area
N
206 Wild Basin Rd., Ste. 300
Austin, Texas 78746-3343
Phone: (512) 329-8342 Fax: (512) 327-2453

Vertical Well
· Permitted Location
Dry Hole

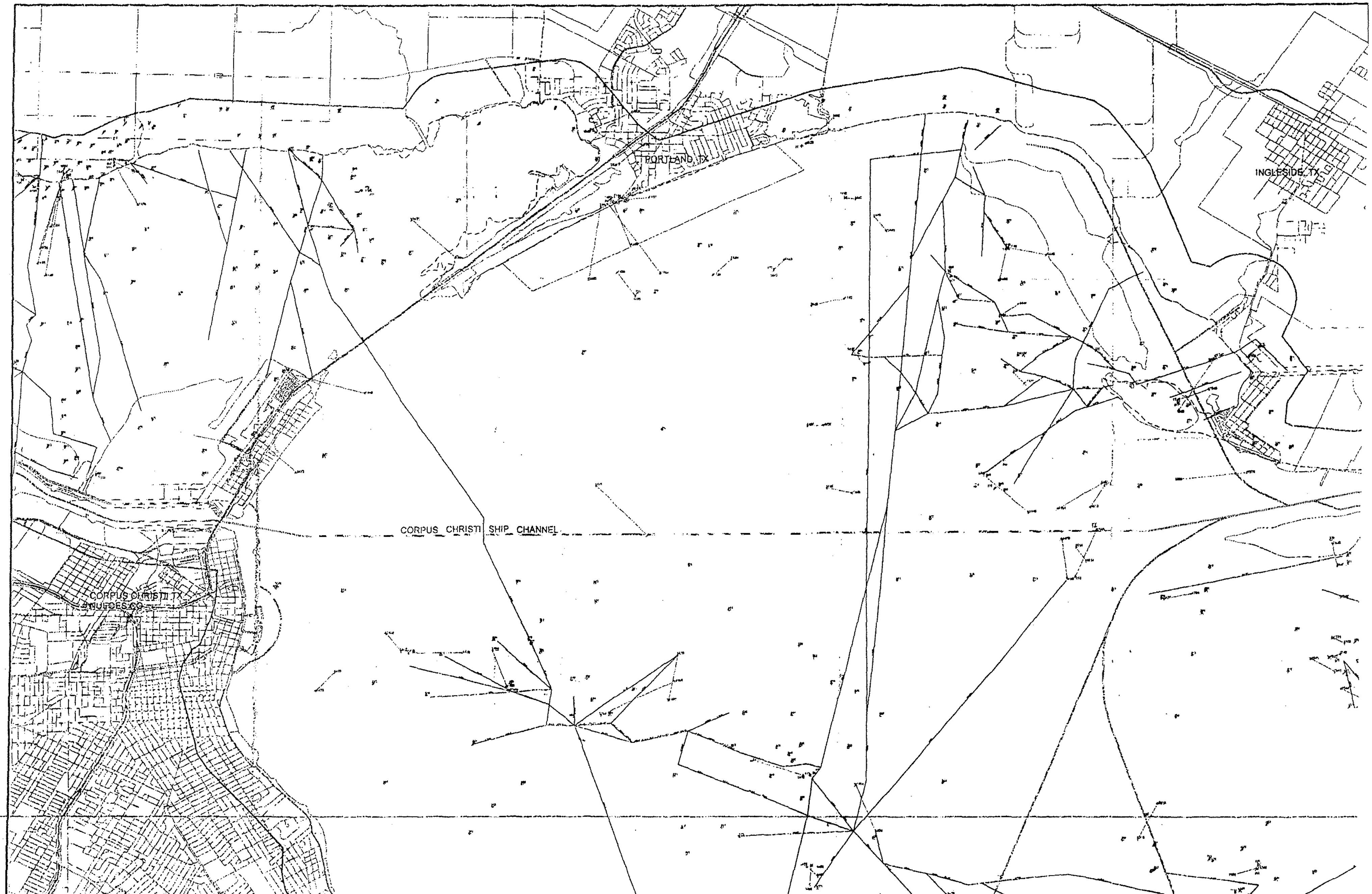
Directional Well Bottom
Permitted Location

• Directional Surface Well

N

PBSJ 206 Wild Basin Rd., Ste. 300 Austin, Texas 78746-3343

APP. D Sheet 3



Vertical Well
Permitted Location
Dry Hole

Directional Well Bottom
Permitted Location
Dry Hole

Directional Surface Well

Study Area

N

FBSY
206 Wild Basin Rd., Ste. 300
Austin, Texas 78746-3343
Phone: (512) 329-8342 Fax: (512) 327-2453

Att. D
Sheet 2

Vertical Well
Permitted Location

Directional Well-Bottom
Permitted Location

Directional Surface Well

N

206 Wild Basin Rd., Ste. 300
Austin, Texas 78746-3343

App D
Sheet 4

APPENDIX I

CORPUS CHRISTI SHIP CHANNEL –CHANNEL IMPROVEMENT PROJECT
BASELINE COST ESTIMATE

C.C.S.C. Baseline Cost Estimate

Designed By: CESWG-EC
Estimated By: CESWG-EC-E

Prepared By:
John K. Bember, Jr., P.E.

Preparation Date: 06/01/01
Effective Date of Pricing: 10/01/01

Sales Tax: 0.00%

SUMMARY REPORTS SUMMARY PAGE

No Detailed Estimate...

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

** PROJECT OWNER SUMMARY - ACTIVITY **

		QUANTITY	UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
50	Charges Prior To 1 October 2001			5,682,000	0	0	5,682,000	
60	La Quinta Exten. & Barge Lanes			21,703,171	4,350,394	1,795,040	27,848,605	
62	CCSC -- Sta. 310+00 to -38+00			10,050,930	2,013,370	826,961	12,891,260	
64	CCSC -- Sta. 12+55 to 180+00			7,911,689	1,582,774	949,247	10,443,710	
66	CCSC -- Sta. 180+00 to 670+00			37,642,135	7,562,126	6,705,517	51,909,778	
68	CCSC -- Sta. 670+00 to 1080+00			11,805,903	2,367,816	2,138,853	16,312,572	
70	CCSC -- Sta. 1080+00 to 1320+00			11,902,715	2,391,842	2,667,387	16,961,944	
72	CCSC -- Sta. 1320+00 to 1561+00			9,688,024	1,938,782	2,340,463	13,967,270	
TOTAL	C.C.S.C. Baseline Cost Estimate			116,386,566	22207103	17423468	156,017,138	

	QUANTITY UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
50 Charges Prior To 1 October 2001						
50-1 Non-Federal Costs						
50-1-01 Lands and Damages		5,682,000	0	0	5,682,000	
TOTAL Non-Federal Costs		5,682,000	0	0	5,682,000	
TOTAL Charges Prior To 1 October 2001		5,682,000	0	0	5,682,000	
60 La Quinta Exten. & Barge Lanes						
60-1 Non-Federal Costs						
60-1-01 Lands and Damages		7,000	1,750	169	8,919	
TOTAL Non-Federal Costs		7,000	1,750	169	8,919	
60-2 Federal Costs						
60-2-01 Lands and Damages		14,000	3,500	338	17,838	
60-2-12 Navigation Ports and Harbors		14,851,295	2,970,259	1,297,082	19,118,636	
60-2-16 Bank Stabilization		4,836,223	967,245	422,386	6,225,854	
60-2-30 Engineering and Design		1,059,075	197,160	24,228	1,280,463	
60-2-31 Construction Management		935,578	210,480	50,838	1,196,896	
TOTAL Federal Costs		21,696,171	4,348,644	1,794,872	27,839,686	
TOTAL La Quinta Exten. & Barge Lanes		21,703,171	4,350,394	1,795,040	27,848,605	
62 CCSC -- Sta. 310+00 to -38+00						
62-2 Federal Costs						
62-2-12 Navigation Ports and Harbors		9,003,668	1,800,734	786,362	11,590,764	
62-2-30 Engineering and Design		516,550	93,250	11,761	621,561	
62-2-31 Construction Management		530,712	119,386	28,838	678,936	
TOTAL Federal Costs		10,050,930	2,013,370	826,961	12,891,260	
TOTAL CCSC -- Sta. 310+00 to -38+00		10,050,930	2,013,370	826,961	12,891,260	
64 CCSC -- Sta. 12+55 to 180+00						
64-1 Non-Federal Costs						

	QUANTITY	UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
64-1-01 Lands and Damages			2,000	500	111	2,611	
TOTAL Non-Federal Costs			2,000	500	111	2,611	
64-2 Federal Costs							
64-2-01 Lands and Damages			3,000	750	166	3,916	
64-2-12 Navigation Ports and Harbors			4,840,120	968,024	608,031	6,416,175	
64-2-16 Bank Stabilization			2,146,861	429,372	269,695	2,845,928	
64-2-30 Engineering and Design			491,070	87,710	25,674	604,454	
64-2-31 Construction Management			428,638	96,418	45,569	570,625	
TOTAL Federal Costs			7,909,689	1,582,274	949,136	10,441,099	
TOTAL CCSC -- Sta. 12+55 to 180+00			7,911,689	1,582,774	949,247	10,443,710	
66 CCSC -- Sta. 180+00 to 670+00							
66-1 Non-Federal Costs							
66-1-01 Lands and Damages			8,000	2,000	868	10,868	
TOTAL Non-Federal Costs			8,000	2,000	868	10,868	
66-2 Federal Costs							
66-2-01 Lands and Damages			9,000	2,250	976	12,226	
66-2-12 Navigation Ports and Harbors			18,431,833	3,686,367	3,351,911	25,470,110	
66-2-16 Bank Stabilization			15,820,798	3,164,160	2,877,082	21,862,039	
66-2-30 Engineering and Design			1,330,750	247,980	137,016	1,715,746	
66-2-31 Construction Management			2,041,754	459,370	337,664	2,838,788	
TOTAL Federal Costs			37,634,135	7,560,126	6,704,649	51,898,910	
TOTAL CCSC -- Sta. 180+00 to 670+00			37,642,135	7,562,126	6,705,517	51,909,778	
68 CCSC -- Sta. 670+00 to 1080+00							
68-1 Non-Federal Costs							
68-1-01 Lands and Damages			4,000	1,000	444	5,444	
TOTAL Non-Federal Costs			4,000	1,000	444	5,444	
68-2 Federal Costs							

	QUANTITY	UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
68-2-01 Lands and Damages			5,000	1,250	554	6,804	
68-2-12 Navigation Ports and Harbors			10,678,383	2,135,677	1,980,239	14,794,298	
68-2-30 Engineering and Design			448,520	79,164	46,815	574,499	
68-2-31 Construction Management			670,000	150,725	110,802	931,527	
TOTAL Federal Costs			11,801,903	2,366,816	2,138,410	16,307,128	
TOTAL CCSC -- Sta. 670+00 to 1080+00			11,805,903	2,367,816	2,138,853	16,312,572	
70 CCSC -- Sta. 1080+00 to 1320+00							
70-1 Non-Federal Costs							
70-1-01 Lands and Damages			44,000	11,000	7,425	62,425	
TOTAL Non-Federal Costs			44,000	11,000	7,425	62,425	
70-2 Federal Costs							
70-2-01 Lands and Damages			49,000	12,250	8,269	69,519	
70-2-12 Navigation Ports and Harbors			10,140,880	2,028,176	2,341,603	14,510,659	
70-2-30 Engineering and Design			1,024,275	195,415	164,664	1,384,354	
70-2-31 Construction Management			644,560	145,001	145,425	934,986	
TOTAL Federal Costs			11,858,715	2,380,842	2,659,961	16,899,518	
TOTAL CCSC -- Sta. 1080+00 to 1320+00			11,902,715	2,391,842	2,667,387	16,961,944	
72 CCSC -- Sta. 1320+00 to 1561+00							
72-1 Non-Federal Costs							
72-1-01 Lands and Damages			16,000	4,000	3,684	23,684	
TOTAL Non-Federal Costs			16,000	4,000	3,684	23,684	
72-2 Federal Costs							
72-2-01 Lands and Damages			15,000	3,750	3,453	22,203	
72-2-12 Navigation Ports and Harbors			8,207,987	1,641,597	2,013,125	11,862,710	
72-2-30 Engineering and Design			912,560	168,752	199,162	1,280,474	
72-2-31 Construction Management			536,477	120,683	121,039	778,199	
TOTAL Federal Costs			9,672,024	1,934,782	2,336,780	13,943,586	
TOTAL CCSC -- Sta. 1320+00 to 1561+00			9,688,024	1,938,782	2,340,463	13,967,270	

** PROJECT OWNER SUMMARY - FEATURE **

	QUANTITY	UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
TOTAL C.C.S.C. Baseline Cost Estimate			116,386,566	22207103	17423468	156,017,138	

	QUANTITY	UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
50 Charges Prior To 1 October 2001							
50-1 Non-Federal Costs							
50-1-01 Lands and Damages							
50-1-0105 Appraisals			11,000	0	0	11,000	
TOTAL Appraisals			11,000	0	0	11,000	
50-1-0115 Real Estate Payments							
50-1-011501 Land Payments			5,671,000	0	0	5,671,000	
TOTAL Real Estate Payments			5,671,000	0	0	5,671,000	
TOTAL Lands and Damages			5,682,000	0	0	5,682,000	
TOTAL Non-Federal Costs			5,682,000	0	0	5,682,000	
TOTAL Charges Prior To 1 October 2001			5,682,000	0	0	5,682,000	
60 La Quinta Exten. & Barge Lanes							
60-1 Non-Federal Costs							
60-1-01 Lands and Damages							
60-1-0113 Facility/Utility Relocations			7,000	1,750	169	8,919	
TOTAL Lands and Damages			7,000	1,750	169	8,919	
TOTAL Non-Federal Costs			7,000	1,750	169	8,919	
60-2 Federal Costs							
60-2-01 Lands and Damages							
60-2-0102 Acquisitions			1,000	250	24	1,274	
60-2-0105 Appraisals			1,000	250	24	1,274	
60-2-0113 Facility/Utility Relocations			7,000	1,750	169	8,919	
60-2-0117 LERRD Crediting			5,000	1,250	121	6,371	
TOTAL Lands and Damages			14,000	3,500	338	17,838	
60-2-12 Navigation Ports and Harbors							

	QUANTITY	UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
60-2-1201 Mobilization and Demobilization			350,000	70,000	30,568	450,568	
60-2-1202 Dredging La Quinta to BU-6	2503800	CY	4,606,992	921,398	402,365	5,930,756	2.37
60-2-1203 Dredging La Quinta to DMPA-13	2739800	CY	6,739,908	1,347,982	588,650	8,676,540	3.17
60-2-1204 Dredging La Quinta to DMPA-14	1013200	CY	1,752,836	350,567	153,089	2,256,492	2.23
60-2-1210 Dredging -- Barge Lanes	270700.00	CY	641,559	128,312	56,032	825,903	3.05
60-2-1214 Raise Existing Levee - DMPA-13	155000.00	CY	310,000	62,000	27,075	399,075	2.57
60-2-1215 New Drop Structure - DMPA-13			75,000	15,000	6,550	96,550	
60-2-1218 Raise Existing Levee - DMPA-14	150000.00	CY	300,000	60,000	26,201	386,201	2.57
60-2-1219 New Drop Structure - DMPA-14			75,000	15,000	6,550	96,550	
TOTAL Navigation Ports and Harbors			14,851,295	2,970,259	1,297,082	19,118,636	
60-2-16 Bank Stabilization							
60-2-1601 Beneficial Use Site #6							
60-2-160102 Scour Apron	19500.00	SY	293,987	58,797	25,676	378,461	19.41
60-2-160103 Geotube, 30-Ft Circumference	7020.00	LF	1,129,928	225,986	98,686	1,454,599	207.21
60-2-160107 Rip Rap + Blanket Stone	38046.00	TON	1,555,503	311,101	135,855	2,002,458	52.63
60-2-160110 Hydraulic Fill	675843.00	CY	345,396	69,079	30,166	444,642	0.66
60-2-160112 Marsh Planting	10.00	ACR	35,774	7,155	3,124	46,053	4605.35
TOTAL Beneficial Use Site #6			3,360,588	672,118	293,507	4,326,213	
60-2-1602 Mitigation							
60-2-160201 Marsh Planting	15.00	ACR	53,661	10,732	4,687	69,080	4605.35
TOTAL Mitigation			53,661	10,732	4,687	69,080	
60-2-1604 Beneficial Use Site #9							
60-2-160406 Rip Rap + Blanket Stone	34780.00	TON	1,421,973	284,395	124,192	1,830,560	52.63
TOTAL Beneficial Use Site #9			1,421,973	284,395	124,192	1,830,560	
TOTAL Bank Stabilization			4,836,223	967,245	422,386	6,225,854	
60-2-30 Engineering and Design							
60-2-3001 Plans and Specifications			983,075	188,760	22,600	1,194,435	
60-2-3002 Environmental Studies Docs			7,000	1,400	162	8,562	
60-2-3005 Cost Estimates			12,000	2,400	278	14,678	
60-2-3008 Value Engineering Analysis Docs			20,000	1,000	405	21,405	
60-2-3013 Const Engrng Tech Mgmt Docs			6,000	1,000	135	7,135	
60-2-3014 Const Prog/Proj Mgmt Docs			31,000	2,600	648	34,248	

** PROJECT OWNER SUMMARY - ELEMENT **

	QUANTITY UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
TOTAL Engineering and Design		1,059,075	197,160	24,228	1,280,463	
60-2-31 Construction Management						
60-2-3102 Area Office S&A		778,815	194,704	43,184	1,016,703	
60-2-3103 District Office S&A		155,763	15,576	7,600	178,939	
60-2-3104 Programs/Project Mgmt Docs		1,000	200	53	1,253	
TOTAL Construction Management		935,578	210,480	50,838	1,196,896	
TOTAL Federal Costs		21,696,171	4,348,644	1,794,872	27,839,686	
TOTAL La Quinta Exten. & Barge Lanes		21,703,171	4,350,394	1,795,040	27,848,605	
62 CCSC -- Sta. 310+00 to -38+00						
62-2 Federal Costs						
62-2-12 Navigation Ports and Harbors						
62-2-1201 Mobilization and Demobilization		250,000	50,000	21,834	321,834	
62-2-1202 Hopper, Sta 310+00 to 150+00	2595600 CY	4,853,772	970,754	423,919	6,248,445	2.41
62-2-1203 Hopper, Sta 150+00 to -38+00	1741600 CY	3,674,776	734,955	320,948	4,730,679	2.72
62-2-1205 Remove Existing Rock Groin	16000.00 TON	225,120	45,024	19,662	289,806	18.11
TOTAL Navigation Ports and Harbors		9,003,668	1,800,734	786,362	11,590,764	
62-2-30 Engineering and Design						
62-2-3001 Plans and Specifications		298,550	56,050	6,839	361,439	
62-2-3002 Environmental Studies Docs		7,000	1,400	162	8,562	
62-2-3004 Cultural Resource Studies Docs		141,000	28,200	3,263	172,463	
62-2-3005 Cost Estimates		4,000	800	93	4,893	
62-2-3008 Value Engineering Analysis Docs		20,000	1,000	405	21,405	
62-2-3013 Const Engrng Tech Mgmt Docs		6,000	1,000	135	7,135	
62-2-3014 Const Prog/Proj Mgmt Docs		40,000	4,800	864	45,664	
TOTAL Engineering and Design		516,550	93,250	11,761	621,561	
62-2-31 Construction Management						
62-2-3102 Area Office S&A		441,427	110,357	24,476	576,260	
62-2-3103 District Office S&A		88,285	8,829	4,308	101,422	
62-2-3104 Programs/Project Mgmt Docs		1,000	200	53	1,253	
TOTAL Construction Management		530,712	119,386	28,838	678,936	

	QUANTITY UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
TOTAL Federal Costs		10,050,930	2,013,370	826,961	12,891,260	
TOTAL CCSC -- Sta. 310+00 to -38+00		10,050,930	2,013,370	826,961	12,891,260	
64 CCSC -- Sta. 12+55 to 180+00						
64-1 Non-Federal Costs						
64-1-01 Lands and Damages						
64-1-0113 Facility/Utility Relocations		2,000	500	111	2,611	
TOTAL Lands and Damages		2,000	500	111	2,611	
TOTAL Non-Federal Costs		2,000	500	111	2,611	
64-2 Federal Costs						
64-2-01 Lands and Damages						
64-2-0113 Facility/Utility Relocations		2,000	500	111	2,611	
64-2-0117 LERRD Crediting		1,000	250	55	1,305	
TOTAL Lands and Damages		3,000	750	166	3,916	
64-2-12 Navigation Ports and Harbors						
64-2-1201 Mobilization and Demobilization		350,000	70,000	43,968	463,968	
64-2-1202 Pipeline, Sta 12+55 to 180+00	2702000 CY	4,215,120	843,024	529,517	5,587,661	2.07
64-2-1203 Raise Existing Levee - DMPA-6	100000.00 CY	200,000	40,000	25,125	265,125	2.65
64-2-1204 New Drop Structure - DMPA-6		75,000	15,000	9,422	99,422	
TOTAL Navigation Ports and Harbors		4,840,120	968,024	608,031	6,416,175	
64-2-16 Bank Stabilization						
64-2-1601 Beneficial Use Site #8						
64-2-160101 Geotextile Fabric	30100.00 SY	123,063	24,613	15,460	163,135	5.42
64-2-160107 Rip Rap + Blanket Stone	49500.00 TON	2,023,798	404,760	254,236	2,682,793	54.20
TOTAL Beneficial Use Site #8		2,146,861	429,372	269,695	2,845,928	
TOTAL Bank Stabilization		2,146,861	429,372	269,695	2,845,928	
64-2-30 Engineering and Design						

	QUANTITY	UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
64-2-3001 Plans and Specifications			421,070	79,960	22,225	523,255	
64-2-3002 Environmental Studies Docs			7,000	1,400	373	8,773	
64-2-3005 Cost Estimates			10,000	2,000	532	12,532	
64-2-3008 Value Engineering Analysis Docs			15,000	750	699	16,449	
64-2-3013 Const Engrng Tech Mgmt Docs			7,000	1,000	355	8,355	
64-2-3014 Const Prog/Proj Mgmt Docs			31,000	2,600	1,490	35,090	
TOTAL Engineering and Design			491,070	87,710	25,674	604,454	
64-2-31 Construction Management							
64-2-3102 Area Office S&A			356,365	89,091	38,661	484,117	
64-2-3103 District Office S&A			71,273	7,127	6,804	85,204	
64-2-3104 Programs/Project Mgmt Docs			1,000	200	104	1,304	
TOTAL Construction Management			428,638	96,418	45,569	570,625	
TOTAL Federal Costs			7,909,689	1,582,274	949,136	10,441,099	
TOTAL CCSC -- Sta. 12+55 to 180+00			7,911,689	1,582,774	949,247	10,443,710	
66 CCSC -- Sta. 180+00 to 670+00							
66-1 Non-Federal Costs							
66-1-01 Lands and Damages							
66-1-0113 Facility/Utility Relocations			8,000	2,000	868	10,868	
TOTAL Lands and Damages			8,000	2,000	868	10,868	
TOTAL Non-Federal Costs			8,000	2,000	868	10,868	
66-2 Federal Costs							
66-2-01 Lands and Damages							
66-2-0113 Facility/Utility Relocations			8,000	2,000	868	10,868	
66-2-0117 LERRD Crediting			1,000	250	108	1,358	
TOTAL Lands and Damages			9,000	2,250	976	12,226	
66-2-12 Navigation Ports and Harbors							
66-2-1201 Mobilization and Demobilization			350,000	70,000	63,649	483,649	
66-2-1202 Pipeline, Sta 180+00 to 330+00	2083000	CY	3,457,780	691,556	628,813	4,778,149	2.29
66-2-1203 Pipeline, Sta 330+00 to 350+00	330500.00	CY	558,545	111,709	101,574	771,828	2.34

		QUANTITY	UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
66-2-1204	Pipeline, Sta 350+00 to 475+00	2393800	CY	3,997,646	799,529	726,990	5,524,165	2.31
66-2-1205	Pipeline, Sta 475+00 to 549+00	1511300	CY	2,523,871	504,774	458,977	3,487,622	2.31
66-2-1206	Pipeline, Sta 549+00 to 649+00	2918700	CY	6,917,319	1,383,464	1,257,945	9,558,728	3.27
66-2-1207	Pipeline, Sta 649+00 to 670+00	591200.00	CY	626,672	125,334	113,963	865,969	1.46
	TOTAL Navigation Ports and Harbors			18,431,833	3,686,367	3,351,911	25,470,110	
66-2-16	Bank Stabilization							
66-2-1601	Beneficial Use Site #2							
66-2-160101	Mob & Demobe			80,482	16,096	14,636	111,214	
66-2-160102	Scour Apron	24450.00	SY	368,615	73,723	67,034	509,372	20.83
66-2-160103	Geotube, 30-Ft Circumference	8800.00	LF	1,416,433	283,287	257,585	1,957,305	222.42
66-2-160104	Hydraulic Fill	381000.00	CY	194,714	38,943	35,410	269,066	0.71
66-2-160105	Geotextile Fabric	18120.00	SY	74,083	14,817	13,472	102,372	5.65
66-2-160106	Rip Rap + Blanket Stone	56632.00	TON	2,315,388	463,078	421,064	3,199,529	56.50
66-2-160108	Marsh Planting	20.00	ACR	71,548	14,310	13,011	98,869	4943.47
	TOTAL Beneficial Use Site #2			4,521,263	904,253	822,212	6,247,728	
66-2-1602	Beneficial Use Site #7							
66-2-160202	Scour Apron	15000.00	SY	226,144	45,229	41,125	312,498	20.83
66-2-160203	Geotube, 30-Ft Circumference	5400.00	LF	869,175	173,835	158,063	1,201,073	222.42
66-2-160204	Hydraulic Fill	225000.00	CY	114,989	22,998	20,911	158,897	0.71
66-2-160206	Rip Rap + Blanket Stone	24400.00	TON	997,589	199,518	181,416	1,378,523	56.50
	TOTAL Beneficial Use Site #7			2,207,897	441,579	401,516	3,050,992	
66-2-1603	Beneficial Use Sites #3 and #4							
66-2-160302	Scour Apron	34080.00	SY	513,799	102,760	93,437	709,996	20.83
66-2-160303	Geotube, 30-Ft Circumference	12268.00	LF	1,974,637	394,927	359,096	2,728,661	222.42
66-2-160304	Hydraulic Fill	1087000	CY	555,522	111,104	101,024	767,651	0.71
66-2-160306	Rip Rap + Blanket Stone	33973.00	TON	1,388,979	277,796	252,592	1,919,367	56.50
	TOTAL Beneficial Use Sites #3 and #4			4,432,938	886,588	806,149	6,125,675	
66-2-1606	Beneficial Use Site #5							
66-2-160602	Scour Apron	22870.00	SY	344,794	68,959	62,702	476,456	20.83
66-2-160603	Geotube, 30-Ft Circumference	8233.00	LF	1,325,170	265,034	240,988	1,831,192	222.42
66-2-160604	Hydraulic Fill	389390.00	CY	199,002	39,800	36,189	274,991	0.71
66-2-160605	Geotextile Fabric	25620.00	SY	104,747	20,949	19,049	144,745	5.65
66-2-160606	Rip Rap + Blanket Stone	64797.00	TON	2,649,212	529,842	481,771	3,660,826	56.50

	QUANTITY	UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
66-2-160608 Marsh Planting	10.00	ACR	35,774	7,155	6,506	49,435	4943.47
TOTAL Beneficial Use Site #5			4,658,699	931,740	847,205	6,437,645	
TOTAL Bank Stabilization			15,820,798	3,164,160	2,877,082	21,862,039	
66-2-30 Engineering and Design							
66-2-3001 Plans and Specifications			1,225,250	234,630	126,701	1,586,581	
66-2-3002 Environmental Studies Docs			7,000	1,400	729	9,129	
66-2-3004 Cultural Resource Studies Docs			3,500	700	365	4,565	
66-2-3005 Cost Estimates			20,000	4,000	2,083	26,083	
66-2-3008 Value Engineering Analysis Docs			15,000	750	1,367	17,117	
66-2-3013 Const Engrng Tech Mgmt Docs			9,000	1,500	911	11,411	
66-2-3014 Const Prog/Proj Mgmt Docs			51,000	5,000	4,860	60,860	
TOTAL Engineering and Design			1,330,750	247,980	137,016	1,715,746	
66-2-31 Construction Management							
66-2-3102 Area Office S&A			1,700,628	425,157	286,991	2,412,776	
66-2-3103 District Office S&A			340,126	34,013	50,511	424,650	
66-2-3104 Programs/Project Mgmt Docs			1,000	200	162	1,362	
TOTAL Construction Management			2,041,754	459,370	337,664	2,838,788	
TOTAL Federal Costs			37,634,135	7,560,126	6,704,649	51,898,910	
TOTAL CCSC -- Sta. 180+00 to 670+00			37,642,135	7,562,126	6,705,517	51,909,778	
68 CCSC -- Sta. 670+00 to 1080+00							
68-1 Non-Federal Costs							
68-1-01 Lands and Damages							
68-1-0113 Facility/Utility Relocations			4,000	1,000	444	5,444	
TOTAL Lands and Damages			4,000	1,000	444	5,444	
TOTAL Non-Federal Costs			4,000	1,000	444	5,444	
68-2 Federal Costs							
68-2-01 Lands and Damages							
68-2-0113 Facility/Utility Relocations			4,000	1,000	444	5,444	

	QUANTITY	UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
68-2-0117 LERRD Crediting			1,000	250	111	1,361	
TOTAL Lands and Damages			5,000	1,250	554	6,804	
68-2-12 Navigation Ports and Harbors							
68-2-1201 Mobilization and Demobilization			200,000	40,000	37,089	277,089	
68-2-1202 Pipeline, Sta 670+00 to 725+00	1548300	CY	1,362,504	272,501	252,668	1,887,673	1.22
68-2-1203 Pipeline, Sta 725+00 to 780+00	1548300	CY	1,285,089	257,018	238,312	1,780,418	1.15
68-2-1204 Pipeline, Sta 780+00 to 840+00	1714400	CY	1,628,680	325,736	302,028	2,256,444	1.32
68-2-1205 Pipeline, Sta 840+00 to 900+00	1540400	CY	1,494,188	298,838	277,088	2,070,113	1.34
68-2-1206 Pipeline, Sta 900+00 to 960+00	1567200	CY	1,551,528	310,306	287,721	2,149,555	1.37
68-2-1207 Pipeline, Sta 960+00 to 1020+00	1567200	CY	1,441,824	288,365	267,377	1,997,566	1.27
68-2-1208 Pipeline, Sta 1020+00 to 1080+00	1417000	CY	1,714,570	342,914	317,956	2,375,440	1.68
TOTAL Navigation Ports and Harbors			10,678,383	2,135,677	1,980,239	14,794,298	
68-2-30 Engineering and Design							
68-2-3001 Plans and Specifications			356,520	66,664	37,544	460,728	
68-2-3002 Environmental Studies Docs			7,000	1,400	745	9,145	
68-2-3005 Cost Estimates			12,000	2,400	1,278	15,678	
68-2-3008 Value Engineering Analysis Docs			5,000	500	488	5,988	
68-2-3013 Const Engrng Tech Mgmt Docs			7,000	1,000	710	8,710	
68-2-3014 Const Prog/Proj Mgmt Docs			61,000	7,200	6,051	74,251	
TOTAL Engineering and Design			448,520	79,164	46,815	574,499	
68-2-31 Construction Management							
68-2-3102 Area Office S&A			557,500	139,375	94,081	790,956	
68-2-3103 District Office S&A			111,500	11,150	16,558	139,208	
68-2-3104 Programs/Project Mgmt Docs			1,000	200	162	1,362	
TOTAL Construction Management			670,000	150,725	110,802	931,527	
TOTAL Federal Costs			11,801,903	2,366,816	2,138,410	16,307,128	
TOTAL CCSC -- Sta. 670+00 to 1080+00			11,805,903	2,367,816	2,138,853	16,312,572	

70 CCSC -- Sta. 1080+00 to 1320+00

70-1 Non-Federal Costs

70-1-01 Lands and Damages

		QUANTITY UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
70-1-0113	Facility/Utility Relocations		44,000	11,000	7,425	62,425	
	TOTAL Lands and Damages		44,000	11,000	7,425	62,425	
	TOTAL Non-Federal Costs		44,000	11,000	7,425	62,425	
70-2	Federal Costs						
70-2-01	Lands and Damages						
70-2-0113	Facility/Utility Relocations		44,000	11,000	7,425	62,425	
70-2-0117	LERRD Crediting		5,000	1,250	844	7,094	
	TOTAL Lands and Damages		49,000	12,250	8,269	69,519	
70-2-12	Navigation Ports and Harbors						
70-2-1201	Mobilization and Demobilization		300,000	60,000	69,272	429,272	
70-2-1202	Pipeline, Sta 1080+00 to 1125+00	796800.00 CY	1,744,992	348,998	402,931	2,496,922	3.13
70-2-1203	Pipeline, Sta 1125+00 to 1172+00	832200.00 CY	2,197,008	439,402	507,305	3,143,715	3.78
70-2-1204	Pipeline, Sta 1172+00 to 1246+00	984400.00 CY	2,618,504	523,701	604,632	3,746,836	3.81
70-2-1205	Pipeline, Sta 1246+00 to 1320+00	984400.00 CY	2,500,376	500,075	577,355	3,577,806	3.63
70-2-1206	Raise Existing Levee - DMPA-1	105000.00 CY	210,000	42,000	48,491	300,491	2.86
70-2-1207	New Drop Structure - DMPA-1		75,000	15,000	17,318	107,318	
70-2-1208	Raise Existing Levee - DMPA-2	85000.00 CY	170,000	34,000	39,254	243,254	2.86
70-2-1209	New Drop Structure - DMPA-2		75,000	15,000	17,318	107,318	
70-2-1211	New Drop Structure - DMPA-3A		75,000	15,000	17,318	107,318	
70-2-1212	Raise Existing Levee - DMPA-3B	50000.00 CY	100,000	20,000	23,091	143,091	2.86
70-2-1213	New Drop Structure - DMPA-3B		75,000	15,000	17,318	107,318	
	TOTAL Navigation Ports and Harbors		10,140,880	2,028,176	2,341,603	14,510,659	
70-2-30	Engineering and Design						
70-2-3001	Plans and Specifications		965,275	187,815	155,673	1,308,763	
70-2-3002	Environmental Studies Docs		7,000	1,400	1,134	9,534	
70-2-3005	Cost Estimates		12,000	2,400	1,944	16,344	
70-2-3008	Value Engineering Analysis Docs		1,000	200	162	1,362	
70-2-3013	Const Engrng Tech Mgmt Docs		8,000	1,000	1,215	10,215	
70-2-3014	Const Prog/Proj Mgmt Docs		31,000	2,600	4,536	38,136	
	TOTAL Engineering and Design		1,024,275	195,415	164,664	1,384,354	
70-2-31	Construction Management						
70-2-3102	Area Office S&A		536,300	134,075	123,473	793,848	
70-2-3103	District Office S&A		107,260	10,726	21,731	139,717	

	QUANTITY	UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
70-2-3104 Programs/Project Mgmt Docs			1,000	200	221	1,421	
TOTAL Construction Management			644,560	145,001	145,425	934,986	
TOTAL Federal Costs			11,858,715	2,380,842	2,659,961	16,899,518	
TOTAL CCSC -- Sta. 1080+00 to 1320+00			11,902,715	2,391,842	2,667,387	16,961,944	
72 CCSC -- Sta. 1320+00 to 1561+00							
72-1 Non-Federal Costs							
72-1-01 Lands and Damages							
72-1-0102 Acquisitions			7,000	1,750	1,612	10,362	
72-1-0105 Appraisals			4,000	1,000	921	5,921	
72-1-0113 Facility/Utility Relocations			5,000	1,250	1,151	7,401	
TOTAL Lands and Damages			16,000	4,000	3,684	23,684	
TOTAL Non-Federal Costs			16,000	4,000	3,684	23,684	
72-2 Federal Costs							
72-2-01 Lands and Damages							
72-2-0102 Acquisitions			3,000	750	691	4,441	
72-2-0105 Appraisals			2,000	500	460	2,960	
72-2-0113 Facility/Utility Relocations			5,000	1,250	1,151	7,401	
72-2-0117 LERRD Crediting			5,000	1,250	1,151	7,401	
TOTAL Lands and Damages			15,000	3,750	3,453	22,203	
72-2-12 Navigation Ports and Harbors							
72-2-1201 Mobilization and Demobilization			300,000	60,000	73,579	433,579	
72-2-1202 Pipeline, Sta 1320+00 to 1460+00	1550100	CY	4,634,799	926,960	1,136,750	6,698,509	4.32
72-2-1203 Pipeline, Sta 1460+00 to 1561+00	1237200	CY	2,833,188	566,638	694,880	4,094,705	3.31
72-2-1206 Raise Existing Levee - DMPA-7	95000.00	CY	190,000	38,000	46,600	274,600	2.89
72-2-1207 New Drop Structure - DMPA-7			75,000	15,000	18,395	108,395	
72-2-1208 Raise Existing Levee - DMPA-8	50000.00	CY	100,000	20,000	24,526	144,526	2.89
72-2-1209 New Drop Structure - DMPA-8			75,000	15,000	18,395	108,395	
TOTAL Navigation Ports and Harbors			8,207,987	1,641,597	2,013,125	11,862,710	
72-2-30 Engineering and Design							

	QUANTITY	UOM	CONTRACT CST	CONTINGN	ESCALATN	TOTAL COST	UNIT CST
72-2-3001 Plans and Specifications			791,560	152,952	173,965	1,118,477	
72-2-3002 Environmental Studies Docs			7,000	1,400	1,547	9,947	
72-2-3003 HTRW/RCRA Studies Docs			32,000	6,400	7,073	45,473	
72-2-3005 Cost Estimates			12,000	2,400	2,652	17,052	
72-2-3008 Value Engineering Analysis Docs			30,000	1,500	5,802	37,302	
72-2-3013 Const Engrng Tech Mgmt Docs			9,000	1,500	1,934	12,434	
72-2-3014 Const Prog/Proj Mgmt Docs			31,000	2,600	6,189	39,789	
TOTAL Engineering and Design			912,560	168,752	199,162	1,280,474	
72-2-31 Construction Management							
72-2-3102 Area Office S&A			446,231	111,558	102,736	660,525	
72-2-3103 District Office S&A			89,246	8,925	18,082	116,253	
72-2-3104 Programs/Project Mgmt Docs			1,000	200	221	1,421	
TOTAL Construction Management			536,477	120,683	121,039	778,199	
TOTAL Federal Costs			9,672,024	1,934,782	2,336,780	13,943,586	
TOTAL CCSC -- Sta. 1320+00 to 1561+00			9,688,024	1,938,782	2,340,463	13,967,270	
TOTAL C.C.S.C. Baseline Cost Estimate			116,386,566	22207103	17423468	156,017,138	