STATEMENT OF FINDINGS
AND
FINDING OF NO SIGNIFICANT IMPACT
FOR
GULF INTRACOASTAL WATERWAY,
VICINTITY OF PORT O'CONNOR, TEXAS
CHANNEL EVALUATION

1. Purpose. This document addresses the proposed widening of the Gulf Intracoastal Waterway (GIWW) to address safety concerns and accommodate the installation of a barge mooring buoys along the south shoreline of the Port O'Connor to Corpus Christi reach of the GIWW near Port O'Connor in Calhoun County, Texas. The mooring buoys would replace buoys at the facility that previously was located across the GIWW from the Port O'Connor business district, but was removed due to congestion and safety concerns at that location. The project would provide a transitory mooring point for barge traffic during periods when inclement conditions exist due to excessive winds or currents on Matagorda Bay. This Environmental Assessment (EA) was prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) and Council on Environmental Quality (CEQ) regulations to document findings concerning the environmental impacts of the proposed action.

2. Proposed Action. The proposed channel widening and installation of mooring buoys would involve dredging and then installing twelve mooring buoys south of the GIWW channel and immediately north of Blackberry Island. The dredging would increase the bottom width of the channel by 102 feet on its southern side (adjacent to existing USACE Placement Area (PA) 118) for 6,350 feet between GIWW Station 649+550 and Station 655+900. The depth of the dredging would be 14 feet Mean Low Tide (MLT) (the GIWW authorized depth of 12 feet MLT plus an allowed overage of 2 feet MLT). The side slopes of the widened channel would be 3:1 (3 feet horizontal to each foot vertical). A 24-inch cutter-suction dredge will be used to perform dredging. The total amount of material to be dredged is 160,000 cubic yards (CY). Dredged material would be placed in PA 118 located on Blackberry Island, which is adjacent to the proposed mooring site. After construction, the widened channel would be maintained as part of the normal dredging cycle for the GIWW reach. It is expected that future maintenance material would be placed at PA 118. Based on capacity analysis for PA 118 conducted in 2011, there is sufficient PA capacity for the period of performance (50 years) for dredged material associated with the proposed widening, as well as routine maintenance material from the GIWW.

3. Alternatives. The USACE considered three alternatives to address safety issues in the project area. Alternative 1 was a no action plan; Alternative 2 was to replace the

moorings at the previous location across from the Port O'Connor business district; and Alternative 3 was to widen the GIWW channel immediately north of Blackberry Island and install twelve mooring buoys. Alternative 3 was selected as the preferred alternative.

4. Coordination. A Public Notice and Notice of Availability was issued to interested parties, including Federal and state agencies and other parties on September 18, 2013, which described the proposed action and announced the availability of the Draft EA. Comments on the public notice and Draft EA and the District's responses are included in Appendix A of the Final EA.

5. Environmental Effects. The USACE has taken every reasonable measure to evaluate the environmental, social and economic impacts of the proposed project. Based on information provided in the EA and coordination with Federal, state, and local agencies, temporary and permanent effects resulting from the proposed project have been identified and can be found in Section 4.0 of the Final EA. The following resources and the effects of the proposed project have been identified: approximately 2 acres of seagrasses will be permanently impacted, however, this impact will be adequately mitigated as described in Section 5.0 of the Final EA; wildlife may be temporarily affected by minor impacts during construction; there will be no likely adverse effects to federally-listed threatened or endangered species nor any adverse modifications to critical habitat; the implementation of the project would have no potential to affect Historic Properties; implementation of the proposed action would result in temporary noise impacts in the area from construction equipment, however, the impacts would not be significant; emissions from the proposed project would not be locally or regionally significant; there would be no long-term impact to water quality from the construction activities; there would be no hazardous, toxic, or radioactive waste impacts from the proposed project; the project would not impact socioeconomic resources either locally or regionally; there are no prime or unique farmlands in the project area; recreational resources would not be impacted; and no significant or adverse impacts to environmental resources are expected to occur as a result of implementation of the proposed project. Other than the previously described impacts to seagrasses within the proposed channel widening footprint described previously, all impacts to resources are expected to recover to pre-project conditions after the work is completed. The proposed project is expected to contribute beneficially to public health and safety and is not expected to contribute negative cumulative impacts to the area. It is the conclusion of the USACE that the proposed project will not have a significant impact on the environment or to the surrounding human population.

6. Determinations. The proposed project was determined to be compliant with the following Federal legislation: the NEPA; Fish and Wildlife Coordination Act of 1958, as amended; National Historic Preservation Act of 1966, as amended; Coastal Zone Management Act of 1972; Endangered Species Act of 1973, as amended; Clean Air Act of 1972, as amended; Clean Water Act of 1977, as amended; Executive Order 11990 – Protection of Wetlands; Executive Order 12898 – Environmental Justice; CEQ Memorandum Dated August 11, 1980 – Prime or Unique Farmlands; and Executive order 11988 – Floodplain Management.

7. Findings. Based on my analysis of the Final EA and information included herein pertaining to the proposed project, I find that the proposed channel widening and installation of mooring buoys along the GIWW will not have a significant effect on the quality of the human environment. The USACE reviewed the project for consistency with the goals and policies of the Texas Coastal Management Plan (TCMP). Based on this analysis, I find that the proposed plan is consistent with the goals and policies of the TCMP. I have determined that an environmental impact statement is not required under the provisions of NEPA, Section 102, and other applicable regulations of the USACE, and that the proposed project may be implemented.

_____ _____

(date) Richard P. Pannell
Colonel, U.S. Army Corps of Engineers,
District Engineer

DRAFT ENVIRONMENTAL ASSESSMENT

GULF INTRACOASTAL WATERWAY
VICINITY OF PORT O'CONNOR, TEXAS
CHANNEL EVALUATION

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1.0 PROPOSED PLAN

1.1 PROJECT SUMMARY

The proposed project is the widening of the Gulf Intracoastal Waterway (GIWW) to address safety concerns and accommodate the installation of barge mooring buoys along the south shoreline of the Port O'Connor to Corpus Christi reach of the GIWW near Port O'Connor in Calhoun County, Texas. The mooring buoys would replace buoys at the facility that previously was located across the GIWW from the Port O'Connor business district, but was removed due to congestion and safety concerns at that location. The project would provide a transitory mooring point for barge traffic during periods when inclement conditions exist due to excessive winds or currents on Matagorda Bay. The channel widening would provide tows with a place to wait for safer conditions while allowing for the free movement of vessels through the area. Figure 1 shows the location of the proposed channel widening and mooring buoys and the location of the mooring facility that previously existed near Port O'Connor. This project was identified during a previous study authorized by Section 216 of the Rivers and Harbors and Flood Control Act of 1970. This Act authorizes the U. S. Army Corps of Engineers (USACE) to review the operation of completed Federal projects and recommend modifications when advisable due to changed conditions. The proposed work would be authorized by 33 U.S.C., 562, as amended.

1.2 NEED FOR PROJECT

Barges being navigated on the GIWW are typically pushed from behind by a "tow boat". Barge tows are particularly susceptible to winds and currents because most of the steering power is typically at the back of the tow and is limited in the front. During times when winds and/or currents are in excess of that in which tows can safely maneuver, tow operators must temporarily stop and secure their barges until conditions improve. Mooring facilities provide safe places for tow operators to stop and secure their barges during such conditions. Without mooring facilities, tow operators typically will push their barges against the bank of the navigation channel to secure them. This can cause damage to the channel bank and barges may become grounded as tide levels drop.

Figure 1 - Locations of Proposed Project and Previous Mooring Facility

Until the early 2000s, a mooring facility was located on the south shoreline of the GIWW opposite Port O'Connor (Figure 1). The facility provided moorings for tows transiting the GIWW across Matagorda Bay, which is located immediately to the east of Port O'Connor. However, with increasing development on Port O'Connor's waterfront along the north side of the GIWW which resulted in increased use of the area, this area became congested and became an unsafe location for the mooring facility. The mooring buoys at the facility were therefore removed. An alternate facility at a more appropriate location is now needed to provide for safe mooring.

1.3 PROPOSED WORK

The proposed channel widening and installation of mooring buoys would involve dredging and then installing twelve mooring buoys south of the GIWW channel and immediately north of Blackberry Island. The dredging would increase the bottom width of the channel by 102 feet on its southern side (adjacent to existing USACE Placement Area (PA) 118) for 6,350 feet

between GIWW Station 649+550 and Station 655+900. The depth of the dredging would be 14 feet Mean Low Tide (MLT) (the GIWW authorized depth of 12 feet MLT plus an allowed overage of 2 feet MLT). The side slopes of the widened channel would be 3:1 (3 feet horizontal to each foot vertical). A 24-inch cutter-suction dredge will be used to perform dredging. The total amount of material to be dredged is 160,000 cubic yards (CY). Dredged material would be placed in PA 118 located on Blackberry Island, which is adjacent to the proposed mooring site. After construction, the widened channel would be maintained as part of the normal dredging cycle for the GIWW reach. It is expected that future maintenance material would be placed at PA 118. Based on capacity analysis for PA 118 conducted in 2011, there is sufficient PA capacity for the period of performance (50 years) for dredged material associated with the proposed widening. Figure 2 shows a plan view for the proposed project.

Widening the channel would permanently impact approximately 2 acres of patchy seagrass that exist within the project footprint. These impacts would be adequately mitigated through construction of 1,845 feet of breakwater along the bank of the Mad Island Marsh (MIM) Wildlife Management Area (WMA), which is owned and managed by Texas Parks and Wildlife Department (TPWD) in Matagorda County, Texas. The breakwater would be located immediately southwest of the intersection of Culver's Cut and the GIWW and would serve to protect the shoreline along the MIM from future erosion and would also establish 2 acres of emergent tidal marsh behind the breakwater. A detailed discussion of the proposed work and alternatives considered for the mitigation plan can be found in Section 5.0 of this EA.

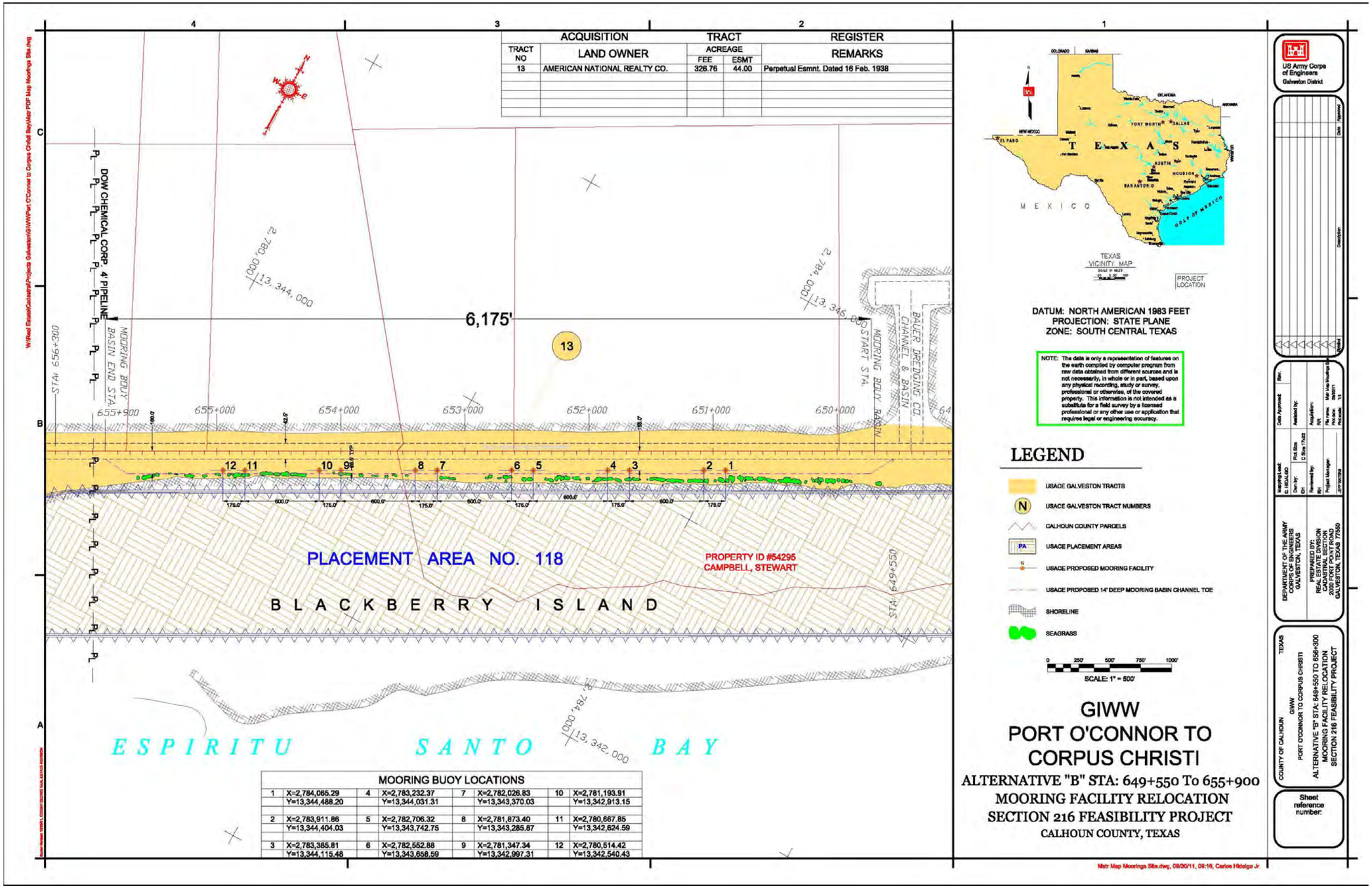

Figure 2 – Plan View of Proposed Channel Widening and Mooring Buoys.

2.0 ALTERNATIVES CONSIDERED

Measures considered as possible solutions to the identified navigation problems on the GIWW main channel in the vicinity of Port O'Connor are as follows. Table 1 summarizes the preliminary alternatives developed from these measures.

Table 1
Alternatives Matrix

Alternatives \ Objectives	Expected to Improve Navigational Safety	Expected to Increase Economic Efficiency	Environmentally Acceptable	Acceptable to Commercial Users
No Action Alternative Alternative 1: Future Without Project			✓	
Structural Alternatives				
Alternative 2: Replace Moorings at Previous Location			✓	
Alternative 3: Dredge Channel and Install Mooring Buoys West of Port O'Connor	✓	✓	✓	✓

2.1 ALTERNATIVE 1: NO ACTION MEASURE (WITHOUT-PROJECT CONDITION)

Under this alternative, the channel would not be widened and mooring buoys would not be installed. Without a widened channel and mooring buoys, tow operators would continue to push their barges against the bank of the navigation channel to secure them. This would continue to result in damage to the channel bank and barges may become grounded as tide levels drop. No other non-structural measures were identified that would adequately address the congestion problems in the Port O'Connor area.

The Port O'Connor study area reach includes the GIWW entrance from the jetties at Port O'Connor, west for approximately three miles. The without-project condition is characterized by tows waiting west of the Port O'Connor jetties to transit eastbound through Matagorda Bay. Tows wait while other vessels clear the jetties and the area immediately west of the landlocked reach. Under present and future without-project conditions, tows push into the bank due to the absence of mooring facilities. Port O'Connor congestion results from a back-up of traffic as tows delay their transit because the intersection of the GIWW through the open waters of Matagorda Bay with the Matagorda Ship Channel, a deep-draft channel, is subject to strong

currents and excessive winds and tides. As a result of these conditions, the risk of tow groundings is high.

Moorings were available in the past; however, they compounded problems as they were located too close to the entrance of the bay. The moorings were removed in the early 2000s due their damaged state and the risk to navigation that they imposed. Under the without-project condition, a continuation of existing traffic patterns is likely as and tows will continue to push into the banks of the GIWW west of the Port O'Connor jetties. The circumstances of tows pushing into the bank generate a number of problems. The lack of a set-back makes it difficult for passing traffic to traverse the GIWW due to moored vessels. It was also found that tows pushed onto the bank do not shut down their main engines. In contrast, tows at secured moorings are able to shut down their engines and save fuel. Other concerns under the without-project condition are that tows pushed into the bank contribute to property damage and erosion on private and public property.

Waterway users have requested that mooring buoys be installed further west from the previous mooring facility near the Port O'Connor jetties and set back from the GIWW in order to improve safety and reduce delays. In addition to commercial tows, the jetties area is subject to a high volume of recreational and commercial fishing vessel traffic. A collision between tows, or an allision between a tow and a shore-side structure, would involve possible loss of life, as well as extensive property and environmental damage.

2.2 ALTERNATIVE 2: REPLACE MOORINGS AT PREVIOUS LOCATION

This alternative would replace the moorings at the mooring facility that previously existed along the GIWW across from Port O'Connor (Figure 1). This area is congested and buoys are prone to being taken out by collisions from barges. Preliminary screening of alternatives resulted in elimination of this structural measure from further consideration because it would reintroduce congestion problems and safety hazard and is opposed by industry users.

2.3 ALTERNATIVE 3 (PREFERRED ALTERNATIVE): WIDEN CHANNEL AND INSTALL MOORING BUOYS WEST OF PORT O'CONNOR

This alternative, which is the preferred alternative, would widen the channel and place mooring buoys (12 mooring buoys) at the proposed new location further west on the south side of the GIWW at Blackberry Island (Figures 1 and 2). The depth of the basin would be 14 feet MLT (the GIWW authorized depth of 12 feet MLT plus an allowed overage of 2 feet MLT). The side slopes of the basin would be 3:1 (3 feet horizontal to each foot vertical).

3.0 AFFECTED ENVIRONMENT

3.1 PHYSICAL FEATURES

The proposed project is located in the Texas coastal zone of the northwest Gulf of Mexico. The Texas Gulf coast is characterized by low-lying, dynamic coastal landforms that include interconnected natural waterways, restricted bays, lagoons, estuaries, narrow barrier islands and peninsulas. These landforms are subject to the activities of waves, winds, storms, tides, climate, rising sea levels, and human activities. Man-made alterations include dredged canals and channels and dredged material disposal islands.

The GIWW is a man-made, shallow draft navigation channel, originally cut through salt marsh and uplands and passing through natural open water areas. The open water portions typically are protected by barrier islands and peninsulas. The channel has a project depth of 12 feet and bottom width of 125 feet. It was constructed in segments during the late 1800's and first half of the 1900's (Alperin, 1983). The reach from Port O'Connor to Corpus Christi was completed in the early 1940's. During the construction of the GIWW, dredged material was placed in levied disposal areas along the land portions of the channel and was placed along the channel in open water areas, creating man-made islands and shoals.

Broad areas of coastal plain occur inland from the bays. The surface topography of the inland area is mainly flat to gently rolling and slopes generally to the southeast. The coastal zone within the study area is underlain by sedimentary deposits that originated in ancient, but similar, physiographic environments. These ancient sediments were deposited by the same natural processes that are currently active in shaping the present coastline, such as long shore drift, beach wash, wind deflation and deposition, tidal currents, wind-generated waves and currents, delta outbuilding, and river point-bar and flood deposition (Brown et al., 1976).

The Gulf coastal climate is humid subtropical, with warm to hot summers and mild winters. The dominant air mass in summer is marine tropical, in which sea breezes moderate afternoon heat. Occasional showers or thunderstorms are common during this season. Winters are mild, with considerable day-to-day variation between the marine tropical air mass and modified continental polar and marine polar air masses. Periods of freezing temperatures are infrequent and usually last no longer than two or three days. Two principal wind regimes dominate the area and include persistent, southeasterly winds occurring from March through November and strong, short-lived northerly winds from December through February. Severe weather occurs periodically in the area in the form of thunderstorms, tornadoes, and tropical storms or hurricanes.

The segment of the GIWW on which the proposed project site is located was constructed just inland of Espiritu Santo Bay, between the major bays, San Antonio Bay and Matagorda Bay. San Antonio Bay is approximately 13.5 miles to the west of the project site and Matagorda Bay

is approximately 4 miles to the east. The GIWW at the proposed project site is separated from Espiritu Santo Bay to the south by Blackberry Island, which is a long, narrow island created by the construction of the GIWW and manmade channels at either end of the island. The island, which has a roughly southwest/northeast orientation, is approximately 14.5 miles long and an average of about one-quarter mile wide, ranging in width from approximately 900 to 1900 feet. At the southwest end of the island, a ferry channel passes from the GIWW, south across Espiritu Santo Bay to Matagorda Island. Matagorda Island is a coastal barrier island that separates the bay from the Gulf of Mexico.

3.2 SEA LEVEL RISE

The recent historic rate of local relative sea level rise (RSLR) was obtained from two National Oceanic and Atmospheric Administration (NOAA) tide stations. Two representative gages were selected with sufficient data recorded for the study area. These are at Freeport, TX, and Rockport, TX with mean sea level trends based on 52 years and 62 years, respectively. RSLR observed at Freeport is equal to 4.35 millimeters per year (mm/yr) (0.014 feet per year (ft/yr)) with a 95 percent confidence interval of ±1.12 mm/yr (±0.004 ft/yr). RSLR observed at Rockport is equal to 5.46 mm/yr (0.018 ft/yr) with a 95 percent confidence interval of ±0.60 mm/yr (±0.002 ft/yr). The average of these 2 observed rates is applied to estimate RSLR near Matagorda Bay; 4.91 mm /yr (0.016 ft /yr). If we assume a historic eustatic rate equal to the globally averaged rate given for the modified National Resource Council (NRC) curves (1.7 mm /yr (0.0056 ft/yr)), then the observed subsidence rate is 3.21 mm/yr (0.011 ft/yr). Texas Department of Water Resources (Ratzlaff, 1982) supports this observed rate, with an estimate of the land surface subsidence in this area of 0.15 m (0.5 feet) from 1918 to 1973, or approximately 2.72 mm/yr (0.009 ft/yr).

There is no scientific consensus on what the local subsidence rate should be for future projections. The relative influence of historic anthropogenic activities, such as oil extraction and groundwater withdrawal, are difficult to quantify. If these activities have contributed significantly to recent observations of subsidence, then the cessation of these activities may result in a rapid deceleration of subsidence rates, returning them to the long-term average rates. Several studies of basal peat layers have been conducted in the Texas and Louisiana coastal region to determine estimates of the long term average rates of subsidence. These rates are generally on the order to 0.05 mm/yr (0.00016 ft/yr) (Tornqvist *et al*, 2006), significantly lower than the observed rates. Therefore, if historic anthropogenic activities are largely responsible for the accelerated rates observed in the tide records, then rates may decelerate rapidly over the next several decades, adding potential conservatism to this analysis.

Figure 3 gives the computed sea level rise based on USACE (2011) for the low (historic) rate, the intermediate (Modified NRC Curve I) rate, and the high (Modified NRC Curve III) rate.

Also shown are curves using Basal Peat rates of subsidence for comparison. Tables 2 and 3 summarize the 50-year and 25-year projections.

Table 2
Estimates of Future Relative Sea Level Rise (2011-2061) – 50-year period

	Low	Intermediate	High
Modified NRC Curves RSLR (feet)	0.8	1.2	2.45
Basal Peat Curves RSLR (feet)	0.3	0.7	1.95

Table 3
Estimates of Future Relative Sea Level Rise (2011-2036) – 25-year period

	Low	Intermediate	High
Modified NRC Curves RSLR (feet)	0.4	0.55	1.0
Basal Peat Curves RSLR (feet)	0.15	0.3	0.8

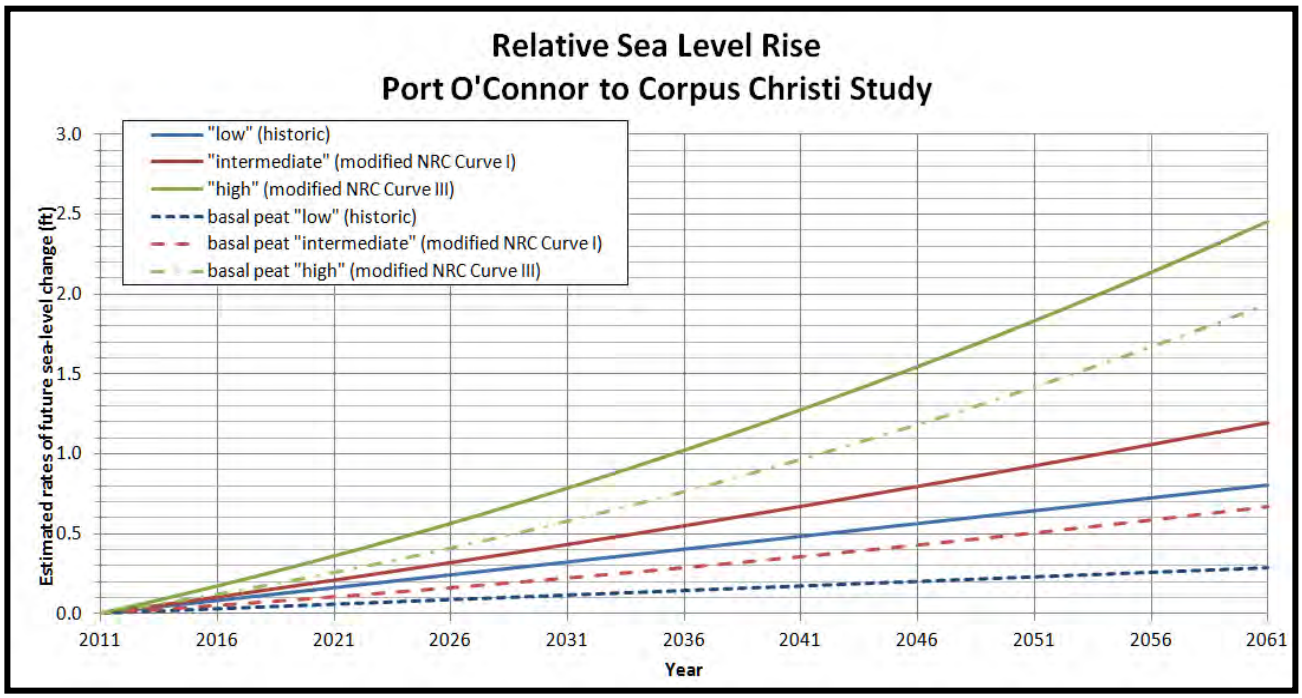

Figure 3 – Estimated Relative Sea Level Rise for 2011-2061

3.3 WETLANDS AND SEAGRASSES

The shoreline along the GIWW in the project area has a fringe of inter-tidal wetlands dominated by smooth cordgrass (*Spartina alternifora*). There is also a fringe of seagrass patches in the shallow water along the upper banks of the channel. In the area where dredging would occur for construction of the proposed channel widening, the total area of seagrasses is about 2 acres, dominated by shoal grass (*Halodule wrightii*). Figure 4 illustrates the seagrass patches, in green, that exist within the footprint of the proposed project. The fringing *Spartina* wetlands would not be impacted by construction.

3.4 WILDLIFE

The Matagorda Bay area, to the east of the proposed project site, and the Espiritu Santo Bay area, to the south and west of the site**,** provides feeding and nesting habitat for numerous species of waterfowl and shore birds. The Texas coast is a terminus or stopover for many migratory waterfowl and other birds traversing the Mississippi or Central Flyways. As a result, migratory game and non-game birds are found in large numbers along the Texas coast during the winter months. Many of these birds stay through winter or rest during migration in the Matagorda Bay system, particularly on Matagorda Peninsula in the Colorado River delta area. Primary species of migratory waterfowl in the area include Canada goose (*Branta canadensis*), white-fronted goose (*Anser albifrons*), snow goose (*Chen hyperborea*), blue goose (*C. caerulescens),* pintail (*Anas acuta*), gadwall (*A. strepera*), blue and green-winged teal (*A. discors, A. carolinensis*), mallard (*A. platyrhynchos*), mottled ducks (*A. fulvigula)*, shoveler (*A. clypeata*), lesser scaup (*Aythya offinis*), redhead (*A. americana*), and American wigeon (*Mareca americana*) (USACE, 2003). The bays and marshes contain shore and wading birds including pelicans (*Pelecanus* spp.), black skimmer (*Rynchops niger*), white-faced ibis (*Plegadis chihi*), roseate spoonbill (*Ajaia ajaja*), plovers (*Charadrius* spp.), gulls and terns (*Laridae* family), sandpipers (*Scolopacidae* family), herons and egrets (*Ardeidae* family), and whooping cranes (*Grus Americana*) as visiting migrants.

3.5 FISHERIES AND ESSENTIAL FISH HABITAT

Shallow bay areas provide important nursery and feeding areas for such commercial and sport species as red drum (*Sciaenops ocellata*), black drum (*Pogonias cromis*), spotted seatrout (*Cynoscion nebulosus*), southern flounder (*Paralichthys lethostigma*), sheepshead (*Archosargus probatocephalus*), and croaker (*Micropogonias undulatus*). Other common fishes include sea catfish (*Arius felis*), mullet (*Mugil cephalus*), bay anchovy (*Anchoa mitchilli*), and squid (*Loligo sp*.). Brown shrimp (*Farfantepenaeus aztecus*), white shrimp (*Litopenaeus setiferus*), and blue crab (*Callinectes sapidus*) are important commercial crustaceans.

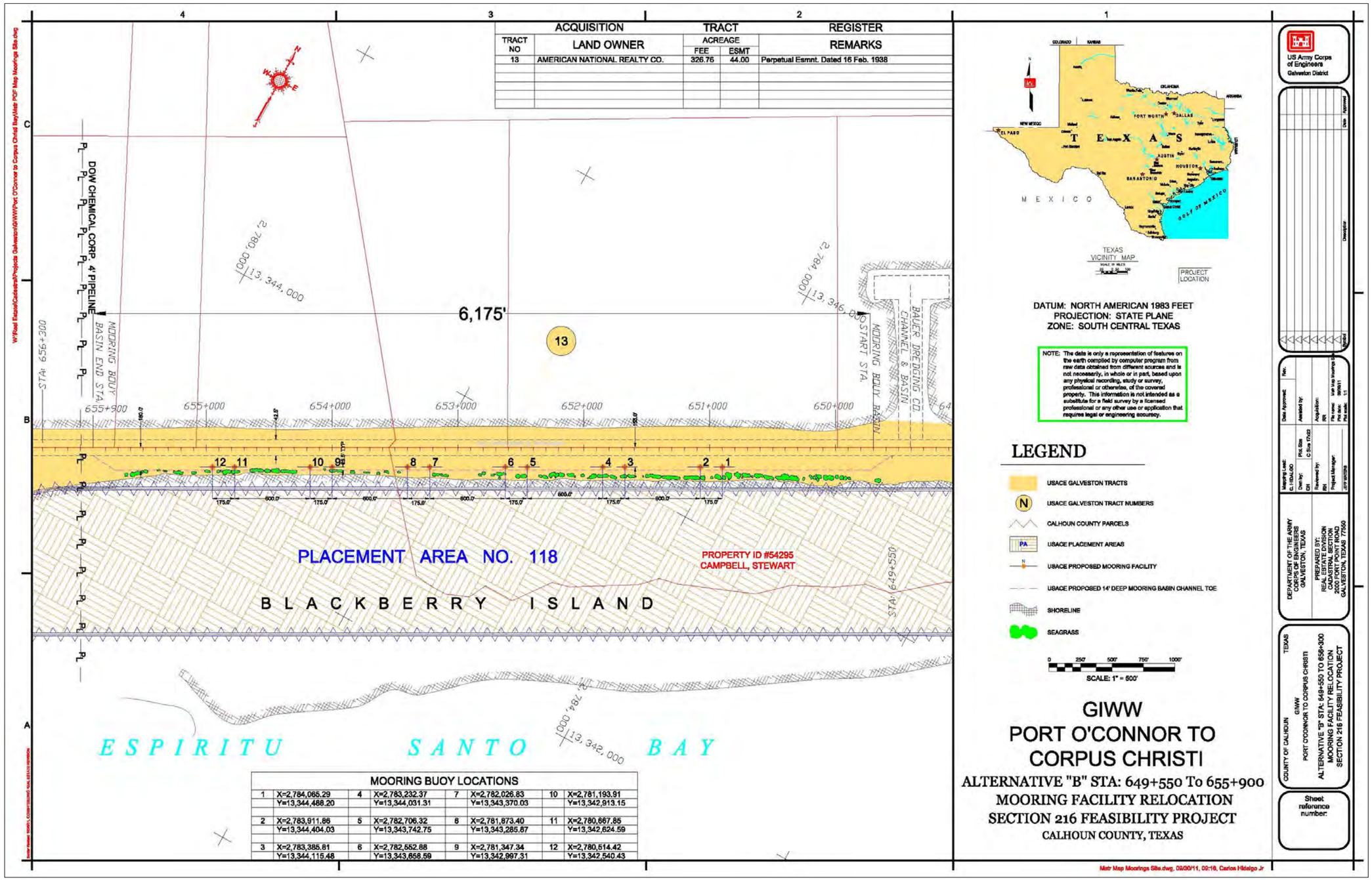

Figure 4 – Seagrass Patches within Proposed Channel Widening Footprint (identified in green)

The Magnuson-Stevens Fishery Conservation and Management Act Reauthorization (16 United States Code [U.S.C.] 1801-1882) provided added measures to describe, identify, and minimize adverse effects on essential fish habitat (EFH) (50 CFR Part 600). In the Gulf of Mexico, EFH consists of those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity of species that are federally managed by the Gulf of Mexico Fishery Management Council (GMFMC) and by the National Marine Fisheries Service (NMFS). By definition, EFH includes those waters and substrate necessary for fish and shellfish spawning, breeding, feeding, and growth through maturity. "Waters" include aquatic areas and associated physical, chemical, and biological properties currently or historically utilized by the fisheries. "Substrate" includes any sediment, hard bottom, structures underlying the waters, and associated biological communities. Those activities potentially impacting EFH may result in either direct (e.g., physical disruption) or indirect (e.g., loss of prey species) effects, and can be site-specific, habitat-wide, cumulative, and/or synergistic effects.

The project area includes EFH designated by the GMFMC for red drum (*Sciaenops ocellatus*), white shrimp (*Litopenaeus setiferus*), brown shrimp (*Farfantepenaeus aztecus*), and Spanish mackerel (*Scomberomorus maculatus*). Details regarding specific habitat requirements for each of these species are found in Table 4. The project area also includes EFH for highly migratory species managed by NMFS including: scalloped hammerhead sharks (*Sphyrna lewini*), blacktip sharks (*Carcharhinus limbatus*), bull sharks (*Carcharhinus leucas*), lemon sharks (*Negaprion brevirostris*), spinner sharks (*Carcharhinus brevipinna*), bonnethead sharks (*Sphyrna tiburo*), Atlantic sharpnose sharks (*Rizoprionodon terraenovae*), and finetooth sharks (*Carcharhinus isodon*).

Table 4
Habitat Requirements of Species with EFH in the Project Area

Species	Location/Distribution
Red Drum	Red drum commonly occur in all of the Gulf's estuaries, but also occur in a variety of habitats, ranging from depths of about 130 feet offshore to very shallow estuarine waters; the GMRMC considers all estuaries to be EFH for the red drum. Estuaries are important for both habitat requirements and for dependence on prey species which include shrimp, blue crab, striped mullet, and pinfish. Schools are common in the deep Gulf waters, with spawning occurring in deeper water near the mouths of bays and inlets and on the Gulf side of the barrier islands. Red drum are associated with a variety of substrate types including sand, mud, and oyster reefs.
Brown Shrimp	Brown shrimp are most abundant in central and western Gulf of Mexico and found in estuaries and offshore waters to 360 feet with the post-larval individuals typically occurring within estuaries. Post-larval individuals and juveniles are associated with shallow vegetated habitats, but are also found over silty-sand; non-vegetated mud bottoms are preferred. Adults typically occur outside of bay areas in marine waters extending from mean low tide to the edge of the continental shelf and areas associated with silt, sand, and sandy substrates.

Species	Location/Distribution
Spanish Mackerel	Pelagic species are found in neritic waters and along coastal areas, inhabiting the estuarine areas; especially higher salinity areas, during seasonal migrations. Spanish mackerel are rare and infrequent inhabitants of Gulf estuaries, where spawning occurs offshore from May to October. Nursery areas are in estuaries and coastal waters year-round. Larvae are found offshore over the inner continental shelf, most commonly in water depths less than 150 feet. Juveniles are found offshore, in beach surf, and occasionally in estuarine habitat; juveniles prefer marine salinity and clean sand substrate.
White Shrimp	White shrimp are offshore and estuarine dwellers; pelagic or demersal depending on their life stage. Eggs are demersal and larval stages are planktonic, and both occur in nearshore marine waters. Post-larvae become benthic upon reaching the nursery areas of estuaries, seeking shallow water with muddy sand bottoms that are high in organic detritus. Juveniles move from the estuarine areas to coastal waters as they mature. The adults are demersal and generally inhabit nearshore Gulf of Mexico waters in depths less than 100 feet on soft mud or silty bottoms.
Scalloped Hammerhead Sharks	Common, large, schooling sharks of warmer waters, migrating seasonally north-south along the eastern coastal and offshore waters of the United States, including the Gulf of Mexico. Neonates may occur in nearshore coastal waters, bays and estuaries of the Gulf of Mexico from Texas to the southern west coast of Florida; Juveniles can be found in coastal areas in the Gulf of Mexico from southern mid-coast of Texas, eastern Louisiana to the southern west coast of Florida and the Florida Keys, and in offshore waters from the mid-coast of Texas to eastern Louisiana. Adults may occur in Coastal areas in the Gulf of Mexico along the southern Texas coast, and eastern Louisiana through the Florida Keys, as well as offshore from southern Texas to eastern Louisiana.
Blacktip Sharks	Blacktips are fast-moving sharks, occurring in shallow waters and offshore surface waters of the continental shelf. Blacktips are viviparous, and young are born in bay systems in late May and early June after a year-long gestation period. The reproductive cycle occurs every 2 years. Juveniles are found in all Texas bay systems in a variety of habitats and shallow coastal waters from the shore to the 82 foot isobath. They feed mainly on pelagic and benthic fishes, cephalopods and crustaceans, and small rays and sharks (Froese and Pauly, 2012). Juvenile blacktip sharks occur in the Gulf and estuarine portions of the study area and adults in the Gulf portions of the study area.
Bull Sharks	Bull sharks are coastal and freshwater sharks that inhabit shallow waters, especially in bays, estuaries, rivers, and lakes. They frequently move between fresh and brackish water and are capable of covering great distances. Adults are often found near estuaries and freshwater inflows to the sea (Froese and Pauly, 2012). Bull sharks are viviparous, have a gestation period of a little less than 1 year, and it is assumed the reproductive cycle occurs every 2 years. Juveniles are found in waters less than 82 feet deep in shallow coastal waters, inlets, and estuaries. They feed on bony fishes, sharks, rays, shrimp, crabs, squid, sea urchins, and sea turtles (Froese and Pauly, 2012). Juvenile bull sharks occur in the Gulf and estuarine portions of the study area.
Lemon Sharks	Feeds mainly on fish but also takes crustaceans and mollusks. (Froese and Pauly, 2012). Occurs on continental and insular shelves, frequenting mangrove fringes, coral keys, docks, sand or coral mud bottoms, saline creeks, enclosed bays or sounds, and river mouths. May enter fresh water. Occasionally moves into the open ocean, near or at the surface, apparently for purposes of migration.
Spinner Sharks	Found on the continental and insular shelves from close inshore to offshore. Makes vertical spinning leaps out of the water as a feeding technique in which the sharks spins through a school of small fish with an open mouth and then breaks the surface. Feeds mainly on pelagic bony fishes, also small sharks, cuttlefish, squids, and octopi. Viviparous. Forms schools. Highly migratory off Florida and Louisiana and in the Gulf of Mexico.

Species	Location/Distribution
Bonnethead Sharks	Bonnethead sharks can be found on sand or mud bottoms in shallow coastal waters. The bonnethead shark is viviparous, reaching sexual maturity at about 30 inches. The pups are born in late summer and early fall, measuring 12 to 13 inches (Froese and Pauly, 2012). Both juveniles and adults inhabit shallow coastal waters up to 82 feet deep, inlets, and estuaries over sand and mud bottoms (Froese and Pauly, 2012). They feed mainly on small fish, bivalves, crustaceans, and octopi (Froese and Pauly, 2012). Juveniles and adults occur year-round in the Gulf and estuarine portion of the study area.
Atlantic Sharpnose Sharks	Atlantic sharpnose shark inhabits intertidal to deeper waters, often in the surf zone off sandy beaches, bays, estuaries, and river mouths (Froese and Pauly, 2012). They are viviparous, and mating occurs in June, with a gestation period of about a year. They feed on fish, shrimp, crab, mollusks, and segmented worms (Froese and Pauly, 2012). Juvenile Atlantic sharpnose shark occur in the Gulf and estuarine portions of the study area.

3.6 THREATENED AND ENDANGERED SPECIES

Federally-listed Species

Table 5 summarizes the U.S. Fish and Wildlife Service's (USFWS) list of federally-listed threatened and endangered (T&E) species for Calhoun County. In addition to the species in this table, the NMFS has identified the marine species in Table 5 as T&E species, Candidate Species, and Species of Concern that occur in the Gulf of Mexico.

The USACE Galveston District prepared a Biological Assessment (BA) that addresses the proposed project's potential impacts to these federally-listed T&E species and Species of Concern. This document, which is included in Appendix E, includes information on distribution and habitat requirements of these species.

State-listed Species

The State of Texas also has regulations to protect endangered species (Chapters 67, 68, and 88 of the TPWD Code and Sections 65.171 to 65.184 and 69.01 to 69.14 of Title 31 of the Texas Administrative Code). These regulations, administered by TPWD, prohibit commerce of threatened and endangered plants and wildlife and the collection of listed plant species from public land without a permit. Table 5 includes a list of state-listed rare species that occur in Calhoun County and may potentially occur at or near the project location as a resident or migrant. These species are among species in Calhoun County designated as threatened or endangered by TPWD (TPWD, 2012a). State-listed T&E species, while identified in this assessment, are not protected under the Endangered Species Act.

Table 5
List of Federal and State Threatened and Endangered Species, Species of Concern, and Candidate Species for Calhoun County, TX

Common Name	Scientific Name	Listing Status		
		USFWS	NMFS	TPWD
BIRDS				
American Peregrine Falcon	*Falco peregrinus anatum*			Threatened
Bald Eagle	*Haliaeetus leucocephalus*	Delisted & being monitored		Threatened
Brown Pelican	*Pelecanus occidentalis*	Delisted & being monitored		Endangered
Northern Aplomado Falcon	*Falco femoralis septentrionalis*	Endangered		Endangered
Piping Plover	*Charadrius melodus*	Threatened		Threatened
Reddish Egret	*Egretta rufescens*			Threatened
Sooty Tern	*Sterna fuscata*			Threatened
White-faced Ibis	*Plegadis chihi*			Threatened
White-tailed hawk	*Buteo albicaudatus*			Threatened
Whooping Crane	*Grus Americana*	Endangered		Endangered
Wood stork	*Mycteria americana*			Threatened
MAMMALS				
Gulf Coast jaguarundi	*Herpailurus yagouaroundi*	Endangered		Endangered
West Indian manatee	*Trichechus manatus*	Endangered		Endangered
REPTILES				
Green sea turtle	*Chelonia mydas*	Threatened	Threatened	Threatened
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	Endangered	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	Endangered	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Endangered	Endangered
Loggerhead sea turtle	*Caretta caretta*	Threatened	Threatened	Threatened
MARINE MAMMALS				
Blue whale	*Balaenoptera musculus*	Endangered	Endangered	
Finback whale	*Balaenoptera physalus*	Endangered	Endangered	
Humpback whale	*Megaptera novaengliae*	Endangered	Endangered	
Sei whale	*Balaenoptera borealis*	Endangered	Endangered	
Sperm whale	*Physeter macrocephalus*	Endangered	Endangered	

Common Name	Scientific Name	Listing Status		
		USFWS	NMFS	TPWD
FISHES				
Dusky shark	*Carcharhinus obscurus*		Species of Concern	
Opossum pipefish	*Microphis brachyurus lineatus*		Species of Concern	Threatened
Sand tiger shark	*Carcharias taurus*		Species of Concern	
Scalloped hammerhead shark	*Sphyrna lewini*		Candidate species	
Speckled hind	*Epinephelus drummondhayi*		Species of Concern	
Warsaw grouper	*Epinephelus nigritus*		Species of Concern	
INVERTEBRATES				
Boulder star coral	*Montastraea annularis*		Candidate species	
Boulder star coral	*Montastraea franksi*		Candidate species	
Elliptical star coral	*Dichocoenia stokessii*		Candidate species	
Lamarck's sheet coral	*Agaricia lamarcki*		Candidate species	
Mountainous star coral	*Montastraea faveolata*		Candidate species	
Pillar coral	*Dendrogyra cylindrus*		Candidate species	
Rough cactus coral	*Mycetophyllia ferox*		Candidate species	

3.7 CULTURAL RESOURCES

Terrestrial and marine cultural resources investigations have been conducted in the study area. In 2001, the USACE Galveston District contracted Prewitt and Associates, Inc. to conduct historic archival research and terrestrial cultural resources survey of the project area along the GIWW (Gadus and Freeman, 2005). The project entailed field examinations of the channel banks and existing dredged material placement areas. The survey identified one new prehistoric site and relocated one previously recorded prehistoric site. Of these, only the newly identified site is recommended as potentially eligible for the National Register of Historic Places (NRHP). However, neither site would be affected by the proposed project near Port O'Connor.

The proposed work was coordinated with the Texas State Historic Preservation Office (SHPO), which has concurred with the USACE Galveston District's determination that the proposed project would have no effect on any historic properties. The letter of concurrence provided by the SHPO is included in Appendix D.

3.8 AIR QUALITY AND NOISE

Air Quality

The U. S. Environmental Protection Agency (EPA) has established national air quality standards to regulate air quality. These standards are for "criteria pollutants", which include sulfur dioxide, carbon monoxide, nitrogen dioxide, ground-level ozone and suspended particulates. The Texas Commission on Environmental Quality (TCEQ) reports that Calhoun County, which includes the Port O'Connor area, has met these national air quality standards. Existing ambient air quality is good in the Port O'Connor area because of the lack of extensive development in the area, lack of heavy industry, and relatively sparse populations.

Noise

Because of the relatively remote locations where the components of the project would be located, noise levels are low. Human-generated ambient noise is primarily produced by vessels using the waterways. Periodic noise is also generated at the Port O'Connor site by dredging operations during maintenance dredging cycles, which occurs roughly every 10 years. This noise is comparable to noise produced by vessels using the channel.

3.9 WATER AND SEDIMENT QUALITY

Water Quality

This segment of the GIWW is situated between West Matagorda Bay and Espiritu Santo Bay, which are classified as water bodies designated, respectively, as Segment 2451 and Segment 2461of the Bays and Estuaries category. There are no direct industrial or municipal discharges in the vicinity that could degrade water quality. Designated water body uses of these segments are: Aquatic Life Use; Recreation Use; General Use; and Oyster Waters Use. Based on the most recent data, the TCEQ determined that all uses are fully supported near the project location. Oyster Waters Use in the northern end of Matagorda Bay is not supported because of bacteria (TCEQ, 2010a). In addition, the GIWW, within West Matagorda Bay, including the project area of the GIWW, is restricted by the Texas Department of State Health Services and closed to shellfish harvesting (DSHS, 2012). There is also concern in Segment 2451 due to increased levels of chlorophyll-a (TCEQ, 2010a).

The most recent water quality data were obtained on samples collected from the GIWW (direct area) on January 21, 1999. Chemical analyses were conducted for several metals, pesticides, polycyclic aromatic hydrocarbons, and other organic compounds. These data are located in Appendix B, and indicate that the water quality is good. The data presented are from samples collected from the GIWW from Station 645+000 to Station 650+000 and are labeled GIC-MBSA-99-05 to GIC-MBSA-99-06. Along with data on detected analytes, Appendix B also includes the complete list of contaminants analyzed, and data sheets containing field-

collected data and sample locations. The data show that detected contaminant levels in all water samples were below applicable EPA Water Quality Criteria, and Texas Surface Water Quality Standards.

Elutriate data are also included in Appendix B. The elutriate test was designed to simulate the process of hydraulic dredging and is used to predict any potential for resuspension of contaminants into the water column during dredging. The elutriate is prepared by creating a slurry which is then agitated to determine if contaminants associated with the sediment particles are re-suspended into the water column. These data show that detected contaminant levels in elutriate samples were below all applicable Texas Surface Water Quality Standards and EPA Water Quality Criteria.

Sediment Quality

Sediment quality data on channel sediments are also located at Appendix B. The sediment quality data are based on analyses of composite samples comprised of subsamples collected perpendicular to the centerline of the channel and immediately adjacent to the proposed project. There are no EPA quality criteria for sediments, so comparisons with sediment quality screening guidelines (Buchman, 1999) were made. Based on these comparisons, the channel sediments proposed to be dredged are considered to be non-hazardous.

Sediments that collect in the GIWW between dredging cycles have been regularly sampled for size characteristics since the 1980s. For the most recent sampling that occurred, the average sediment grain size distribution for the reach of the GIWW proposed for chanel widening and installation of mooring buoys is given in Table 6. The sediments in this reach are primarily sand, with relatively small fractions of silt and clay. The D_{50}, which represents the median particle size, indicates an overall size characteristic of sand. The sand composition ranges from 91.8 percent to 96.8 percent.

Table 6
Sediment and Grain Size Analysis

	Average Composition (%)*			**D_{50} (mm)**
	Sand	**Silt**	**Clay**	
GIWW – Project vicinity	94.3	1.9	3.9	0.175

3.10 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE (HTRW)

The proposed project area and vicinity were evaluated for potential HTRW sites. An Environmental Data Search, Historic Aerial Photo Search, Oil and Gas Review, 2010 Topographic Map, and Water Well Search, were ordered from the TelAll Corporation in March 2012. A review of aerial photographs shows that there have been no noticeable morphological changes to landforms or significant changes in general land use within the project area and nearby vicinity from 1958 to 2010. Access to the project area is limited to marine vessels, and possibly to the north shoreline by a primitive road. General land use through the project area is primarily remote, undeveloped land. Blackberry Island is used for disposal of dredged material (Placement Area No.118). The Bauer Dredging Company channel and turning basin are located at the northeast side of the proposed mooring area.

Submerged and emergent areas surrounding the project site have undergone extensive petroleum exploration. Records indicate there are no petroleum wells in the delineated project site. However, two pipelines cross the GIWW at the southwest end of the project area. Both pipelines are 4 ½-inch diameter lines that transport natural gas. The westernmost pipeline, Corp Permit No.05715, is part of the ME-3885 system and operated by AROC (Texas) Inc. The second pipeline, I.D. No.07025, is part of the Powderhorn System and is operated by Sterling Exploration and Production Company.

As reported in the Environmental Data Search, the Emergency Response Notification System database reports that four spills have been reported near the project area. Two involved natural gas spills, one involved a spill of 12 volt battery material, and another involved the spill of condensate. These spills should have no effect on the project site. Information acquired during the investigations indicated there are no known hazardous waste sites in the project area. The potential risk for discovering unknown waste sites in the project site is considered low. Based on information compiled by this evaluation, additional investigations related to HTRW issues are not warranted at this time.

3.11 SOCIOECONOMICS

The proposed project site is located in Calhoun County, which had a 2010 population of 21,381 persons living in 7,766 households (USCB, 2010a). The economy of Calhoun County is broadly based in manufacturing, agriculture, oil and gas production and fishing (Texas State Historical Association, 2012). According to 2010 Census data, the largest communities in Calhoun County are Port Lavaca and Seadrift with populations of 12,248 and 1,364, respectively (USCB, 2010a).

The unincorporated town of Port O'Connor is located nearest to this project component and had a population of 1,253 persons at the 2010 U.S. Census (USCB, 2010a). The racial

makeup of the city was 86.75 percent white, 0.88 percent African American, 0.64 percent Native American, 1.28 percent Asian, 0.0 percent Pacific Islander, 7.90 percent belonging to some other race, and 2.55 percent belonging to two or more races (USCB, 2010a). Of the total population, 22.35 percent were Hispanic or Latino. The median family income in 2010 was $35,500 with about 10.5 percent of family incomes below poverty level (USCB, 2010b).

3.12 ENVIRONMENTAL JUSTICE

In compliance with Executive Order 12898, Federal Action to Address Environmental Justice in Minority and Low-Income Populations, an analysis was performed to determine whether the proposed project will have a disproportionate adverse impact on minority or low-income population groups in the vicinity of the project areas. This analysis included an examination of characteristics of residential populations in the project areas, based on U. S. Census Bureau data.

The breakdown of the population of Port O'Connor by ethnic group from the 2010 U.S. Census is provided in Table 7. For comparison, the breakdown for Calhoun County and the state of Texas are also shown. The table also shows median family income and the percent of families living below poverty level. Based on the census figures, the population of Port O'Connor consists of a lower percentage of minority and low income populations than Calhoun County or the state. The reported median family income in 1999 for Port O'Connor is slightly lower than Calhoun County and somewhat lower than the state. However, the percent of families living below poverty level is lower than both the county and state.

Table 7
Demographic Information

	Port O'Connor	Calhoun County	State of Texas
Ethnicity			
White	86.8 %	81.5 %	70.4 %
African American	0.9 %	2.6 %	11.8 %
Native American	0.6 %	0.5 %	0.7 %
Asian	1.3 %	4.4 %	3.8 %
Pacific Islander	0.0 %	0.03 %	0.09 %
Other	7.9 %	8.8 %	10.5 %
Two or more races	2.6 %	2.1 %	2.7 %
Hispanic or Latino Origin	22.4 %	46.4 %	37.6 %
Income & Poverty			
Median Family Income	$35,500	$42,818	$48,615
Families Below Poverty	10.5 %	17.0 %	13.2 %

Source: (USCB, 2010a)

3.13 RECREATIONAL RESOURCES

There are numerous recreational opportunities in the vicinity Port O'Connor. Outdoor recreation in the area includes fishing, bird-watching, game and waterfowl hunting, sailing, boating, kayaking, jet skiing, shelling, and beachcombing (Port O'Connor Chamber of Commerce, 2012).

There are several fishing charter services offered in the Port O'Connor area. There are also many boat ramps in the area which provide access to boating and fishing in the bays, channels, and offshore. There is also access to wade fishing in the bays and surf as well as in undeveloped estuaries such as Powderhorn Lake, Coloma Creek, and Pringle Lake.

For the past several years, the area surrounding Port O' Connor holds the record for the highest number of bird species sighted in the nation. Boggy Bird Walk located along Boggy Bayou in the town of Port O'Connor is a popular bird-watching destination. Also, Sundown Island, located in Matagorda Bay approximately 4 miles east of Port O'Connor, is a popular spot for bird-watching by boat. TPWD's Matagorda Island Wildlife Management Area (WMA) is also a popular bird-watching destination near Port O'Connor.

The Port O'Connor area also provides many opportunities for hunting waterfowl, geese, deer, alligator, and exotics on public and private lands. TPWD's Matagorda Island WMA provides opportunities for hunting waterfowl and deer (TPWD, 2012b). Shelling and beachcombing opportunities are widely available along the many shorelines that exist throughout the area.

3.14 PRIME AND UNIQUE FARMLANDS

The project site is located in marine waters within the GIWW and is, therefore, not a suitable location for farmlands of farming activities.

3.15 INVASIVE SPECIES

The introduction of non-native, or invasive, species into a natural system can have dramatic impacts on the overall ecology of that system. According to the Texasinvasives.org website, invasive species found in Calhoun County and which can potentially occur in the project area include giant cane (*Arundo donax*), Chinese tallow (*Sapium sebiferum),* salt cedar (*Tamarix* spp.), and Macartney rose (*Rosa bracteata)*. These species are known to disrupt the stability of native plant communities, degrading native wildlife habitat by outcompeting native plant species.

Other invasive species of concern in the project area are fire ants (*Solenopsis wagneri*), Brazilian pepper (*Schinus terebenthifolius*), and deep-rooted sedge (*Cyperus entrerianus*) (personal communication with TPWD staff).The encroachment of fire ants poses a threat to colonial

nesting bird populations. Brazilian pepper is a terrestrial plant that can out-compete native terrestrial plants within uplands or wetlands and alter the viability of a habitat. Deep-rooted sedge outcompetes native grasses and sedges once it is established, threatening local plant biodiversity. Nutria (*Myocast coypus*) can also be found in the project area. Nutria can contribute to erosion through burrowing and also contribute to the loss of habitat for other species through eating and killing off aquatic vegetation.

4.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

4.1 IMPACTS ON PHYSICAL FEATURES

No Action Alternative: Under this alternative, the channel would not be widened and mooring buoys would not be installed. There would be no new direct or indirect impacts to physical features; however, tow operators would continue to push their barges against the bank of the GIWW to secure them, which will continue to cause physical damage to the bank.

Preferred Alternative: Under this alternative, widening the channel would result in direct and permanent impacts to the bathymetry within the project footprint. Construction of the widened channel would involve dredging a basin on the south side of the GIWW just north of Blackberry Island. The total amount of material to be dredged for widening the GIWW main channel is 184,000 CY. Dredging would permanently impact existing submerged channel bottom by increasing the bottom depth to as much as 14 feet MLT. Dredged material would be placed in existing USACE PA 118 located on Blackberry Island, thus introducing new material. No modifications to the existing PA are proposed. Impacts to the physical features of the existing PA are expected to be minimal.

4.2 IMPACTS ON WETLANDS AND SEAGRASSES

No Action Alternative: There would be no direct or indirect impacts to wetlands or seagrasses at the proposed construction site. Barges would continue to impact the bank of the GIWW and potentially damage wetlands and seagrasses through this action.

Preferred Alternative: Approximately 2 acres of seagrasses that exist within the project footprint would be directly and permanently impacted by dredging associated with the channel widening. However, mitigation to offset these impacts would occur as described in Section 5.0.

4.3 IMPACTS ON WILDLIFE

No Action Alternative: There would be no direct or indirect impacts to wildlife.

Preferred Alternative: The proposed project would result in temporary, minor disturbance during construction which would indirectly impact wildlife species. Species that do not tolerate disturbance would avoid the construction areas during this time. The project area does not

contain any scarce or unique feeding or reproductive areas. The habitat in the project area is similar to the habitat found extensively in the region and does not represent a significant portion of this type of habit. Therefore, the temporary disturbance would be negligible.

4.4 IMPACTS ON FISHERIES AND ESSENTIAL FISH HABITAT

No Action Alternative: There would be no direct or indirect impacts to fisheries or EFH.

Preferred Alternative: Direct impacts include the dredging of approximately 14.5 acres of shallow water bottom habitat within the proposed channel widening footprint.

Short-term adverse impacts to fisheries would be experienced during construction activities. Equipment noise and activity would result in disturbance in the immediate construction areas to some fish species. However, these effects would be temporary and would cease when construction activities are completed. Temporary increases in turbidity would be expected during construction.

The proposed action would not likely have direct impacts on managed species and would affect EFH only minimally and temporarily. There would be no impacts to marsh areas. However, approximately 2 acres of patchy seagrass would be eliminated by the dredging for the channel widening, which would be adequately mitigated as described in Section 5.0.

4.5 IMPACTS ON THREATENED AND ENDANGERED SPECIES

No Action Alternative: There would be no direct or indirect impacts to federally-listed T&E species, Candidate Species, or Species of Concern.

Preferred Alternative: The USACE Galveston District assessed the proposed project's potential to affect federally-listed T&E species, Candidate Species, and Species of Concern and determined that the proposed project would have no effect on any federally-listed T&E species, nor would it adversely modify critical habitat. Also, the project will have no effect any Candidate Species or Species of Concern.

While sea turtles may potentially occur in the project area, the proposed project will have no effect to any of these species. Dredging would be conducted using a cutter-suction dredge, which moves at a slow enough speed that turtles would be able to move out of the way of the cutterhead dredge. Since there are no potential nesting areas in the project area, there would be no direct or indirect impact on nesting activities.

Although several other T&E species may occur in the project vicinity, no regularly used habitat is known to exist at the project site, primarily due to the lack of suitable habitat or the project site's location in relation to these species' known current or historical distribution. Should any of these species wander into the project vicinity, the size and mobility of these

animals would allow them to avoid the immediate projects site during construction and maintenance operations.

4.6 IMPACTS ON CULTURAL RESOURCES

No Action Alternative: There would be no direct or indirect impacts to cultural resources.

Preferred Alternative: The proposed project would not impact any cultural resources. The proposed work was coordinated with the SHPO. The SHPO concurred that the proposed project would have no effect on any historic properties. Should any cultural resources be discovered during construction, the construction contractor would immediately stop all work in that area and notify the USACE Galveston District. The USACE Galveston District would initiate coordination with the SHPO, as necessary.

4.7 IMPACTS ON AIR QUALITY AND NOISE

Air Quality

No Action Alternative: There would be no direct or indirect impacts to air quality.

Preferred Alternative: Temporary increases in exhaust emissions would occur during construction activities due to the operation of construction equipment. These increases are minor in nature and would be temporary, occurring only during the construction period. These emissions are not expected to significantly directly or indirectly impact the area's ambient air quality nor impact the area's designation as being in attainment with the EPA's national air quality standards.

Noise

No Action Alternative: There would be no direct or indirect impacts occurring from increased noise.

Preferred Alternative: Dredging equipment and equipment required to transport and place mooring buoys at the mooring facility and to construct the mitigation breakwater would be the primary sources of noise from the proposed activities. These impacts are expected to be minor in nature and would be temporary, occurring only during the construction period and typically only during daylight hours. There are no sensitive receptors located near the proposed project area.

4.8 IMPACTS ON WATER AND SEDIMENT QUALITY

No Action Alternative: There would be no direct or indirect impacts to water or sediment quality.

Preferred Alternative: Except for increased turbidity, construction work associated with the project would have no significant adverse impacts on water and sediment quality. This increase in turbidity would be temporary as it would only occur during the period of construction.

4.9 IMPACTS FROM HAZARDOUS, TOXIC AND RADIOACTIVE WASTE (HTRW)

No Action Alternative: There would be no new HTRW-related direct or indirect impacts; however, without a place for barge tows carrying hazardous materials to safely moor, there is increased potential for a collision to occur between barge tows or an allision between a barge tow and shore-side structure. Such an event could potentially result in a spill of hazardous materials that could result in extensive environmental damage.

Preferred Alternative: The proposed work would not directly or indirectly impact any listed HTRW sites, as there are no known sites located in the project area. As discussed in Section 3.10, two natural gas pipelines cross the GIWW at the southwest end of the project area. It is not anticipated that the project would directly or indirectly impact these pipelines, as all prudent measures would be taken to avoid the pipelines.

4.10 IMPACTS ON SOCIOECONOMICS

No Action Alternative: There would be no direct or indirect impacts to the local economy.

Preferred Alternative: It is not anticipated that the proposed project would directly or indirectly have any appreciable impact on the local economy.

4.11 IMPACTS RELATING TO ENVIRONMENTAL JUSTICE

No Action Alternative: There would be no direct or indirect impacts to human populations.

Preferred Alternative: Any direct adverse impacts on human populations caused by the project would be minimal and would be distributed among all population groups within the project area. As presented in Table 7, other than a significantly lower percentage of African Americans and a slightly lower percentage of persons of Hispanic/Latino origin, the ethnic breakdown in this area is not significantly different from that of the county as a whole or of the state. Accordingly, the project would not have a disproportionate adverse impact on minority or

low-income population groups. The project is expected to have a positive impact on all population groups by providing safer navigation along the GIWW.

4.12 IMPACTS ON RECREATIONAL RESOURCES

No Action Alternative: There would be no direct or indirect impacts to recreational resources.

Preferred Alternative: There would be minimal adverse effects from the planned project on vessel traffic within the GIWW. The present use of the channel by commercial and recreational vessels is light and only brief delays may be expected during set-up of dredging equipment during construction and maintenance operations. The proposed project would not restrict access for commercial or recreational boating. The project would have a beneficial effect on local navigation and would enhance the free movement of boats through the project area.

4.13 IMPACTS ON PRIME AND UNIQUE FARMLANDS

No Action Alternative: There would be no direct or indirect impacts on prime and unique farmlands.

Preferred Alternative: Due to the locations of the project components and the lack of suitable land for farming activities, the project would not have any direct or indirect impacts on prime or unique farmlands.

4.14 IMPACTS RELATED TO INVASIVE SPECIES

No Action Alternative: There would be no direct or indirect impacts related to invasive species.

Preferred Alternative: This action would not be expected to increase colonization by invasive species.

5.0 MITIGATION

A mitigation plan is required for all forms of compensatory mitigation as outlined in 33 CFR 332.4(c) and 40 CFR 230.92.4(c). Application of compensatory mitigation is to formulate an alternative that avoids, minimizes, and compensates for unavoidable adverse impacts. This EA evaluates the potential impacts associated with constructing a widened channel and installing mooring buoys, which, as described previously, would impact approximately 2 acres of patchy seagrass. The twelve components of a compensatory mitigation plan as outlined in 33 CFR

332.4(c) and 40 CFR 230.92.4(c) are located within various sections of this document. These twelve components and information regarding each are as follows:

1) Objectives: this information is located in Section 5.1
2) Site Selection: this information is located in Sections 5.1 and 5.3.
3) Site Protection: The land adjacent to the proposed mitigation breakwater, as described below, is owned and managed by TPWD.
4) Baseline Information: this information is located in Section 5.2 and within the Habitat Evaluation Procedures (HEP) Analysis report located in Appendix F.
5) Determination of Credits: this information is located in Section 5.2 and within the Habitat Evaluation Procedures Analysis report located in Appendix F.
6) Mitigation Work Plan: this information is located in Section 5.1
7) Maintenance Plan: this information is located in Section 5.5 and Table 9.
8) Performance Standards: this information is located in Section 5.5 and Table 9.
9) Monitoring Requirements: this information is located in Section 5.5 and Table 9.
10) Long-Term Management Plan: this information is located in Section 5.5 and Table 9.
11) Adaptive Management: this information is located in Section 5.5 and Table 9.
12) Financial Assurances: will be provided by the Federal Government.

5.1 MITIGATION PLAN AND ENVIRONMENTAL SETTING

The proposed project would permanently impact approximately 2 acres of seagrasses; therefore, a mitigation plan would be implemented in order to compensate for this habitat loss. A number of potential seagrass mitigation sites were considered, but all were found to be prohibitively expensive to construct, or unlikely to succeed without excessive maintenance. Because of this, resource agency coordination was initiated and out-of-kind mitigation was formally agreed to. In lieu of construction of seagrass habitat, mitigation for this impact would be accomplished by constructing approximately 1,845 feet of breakwater along the north bank of the GIWW adjacent to TPWD's MIM WMA in Matagorda County, Texas.

The proposed mitigation breakwater would be located immediately west of Culver's Cut in Matagorda County, Texas (from GIWW Station 467+300 to GIWW Station 469+170) which is approximately 3 miles west of the town of Matagorda (Figure 5). This area is located within the Colorado River to Matagorda Bay reach of the GIWW (completed in the 1940's) and is adjacent to an expansive coastal wetland system, comprised of palustrine emergent wetlands (freshwater wetlands), farmed wetlands (rice fields), coastal prairie and cordgrass meadows, and

estuarine intertidal emergent and aquatic bed wetlands (intertidal marshes). The area is scarcely populated as TPWD's MIM WMA and The Nature Conservancy's MIM Preserve comprise a majority of the area. Much of the shoreline has a fringe of inter-tidal wetlands dominated by smooth cordgrass.

Figure 5 – Location of Proposed Mitigation Breakwater (indicated in red)

The area surrounding the proposed mitigation breakwater provides feeding and nesting habitat for numerous species of waterfowl and shore birds as well as food and cover for numerous wildlife species. EFH in the area is the same as described above in Section 3.5 of this EA. Federally-listed T&E species and Species of Concern are discussed in the BA prepared for this project (Appendix E). TCEQ reports that Matagorda County has met existing national air quality standards and ambient air quality in the area is good due to the lack of extensive development in the area, lack of heavy industry, and relatively sparse populations. There are a small number of cultural resource sites potentially eligible for listing on the National Register of Historic Places (NHRP), located along the GIWW within TPWD's MIM WMA, but none are located adjacent to the proposed breakwater.

Wave action and prevailing winds have resulted in erosion rates averaging from 1 to 4 feet annually along this stretch of shoreline. The breakwater would serve to reduce shoreline erosion along the GIWW and would establish approximately 2 acres of emergent tidal marsh. Construction of the breakwater would contribute to a larger effort to protect the 7-mile length of shoreline from Mad Island Cut to Culver's Cut (see Figure 5). This length of shoreline is adjacent to TPWD's 7,281 acre MIM WMA and The Nature Conservancy's 7,063 acre MIM Preserve.

Construction of breakwaters along this length shoreline is being sought to: 1) reduce erosion and therefore potentially stop the loss of estuarine and palustrine marsh immediately adjacent to the GIWW, 2) potentially stop the loss of interior estuarine and palustrine marsh habitat and marsh productivity due to increased salt water intrusion, and 3) establish emergent marsh in the area between the breakwaters and the shoreline. Limited work has been done by the Texas General Land Office (GLO) to prevent erosion along this stretch of shoreline. In 2011, approximately 2 miles of rock breakwater was constructed and was funded through a GLO Coastal Impact Assistance Program grant. The GLO breakwater is located immediately east of the proposed breakwater.

The proposed mitigation breakwater is similar to the GLO breakwater in construction design and would provide added erosion protection along this stretch of shoreline. Emergent marsh is expected to be established naturally in the sheltered area between the proposed breakwater and the south shoreline TPWD's MIM WMA. The breakwater would promote accretion of sediments in the sheltered area to a suitable elevation that would support growth of emergent tidal marsh. The proposed breakwater would incorporate a 50-foot opening that would facilitate tidal circulation and ingress/egress of estuarine organisms such as fish and shrimp. Approximately 0.74 acres of shallow water habitat would be converted to rock breakwater and it is expected that approximately 2 acres of emergent tidal marsh would be established in the area between the breakwater and the shoreline. A plan view of the proposed breakwater is shown in Figure 6.

Just south of this area, similar projects have been implemented along the Texas GIWW with successful results. As an example, approximately ten miles of breakwater have been constructed along the GIWW in Texas adjacent to the McFaddin National Wildlife Refuge. Emergent tidal marsh has naturally colonized within the sheltered area between the breakwater and shoreline within approximately 2 years.

The length of the proposed breakwater was determined by calculation of the area of mitigation that would directly offset the impacts of the proposed channel widening. Required mitigation was determined by HEP analysis, as described below in Section 5.2. Monitoring will take place as described below in Section 5.5 to ensure that the mitigation plan achieves the desired outcome.

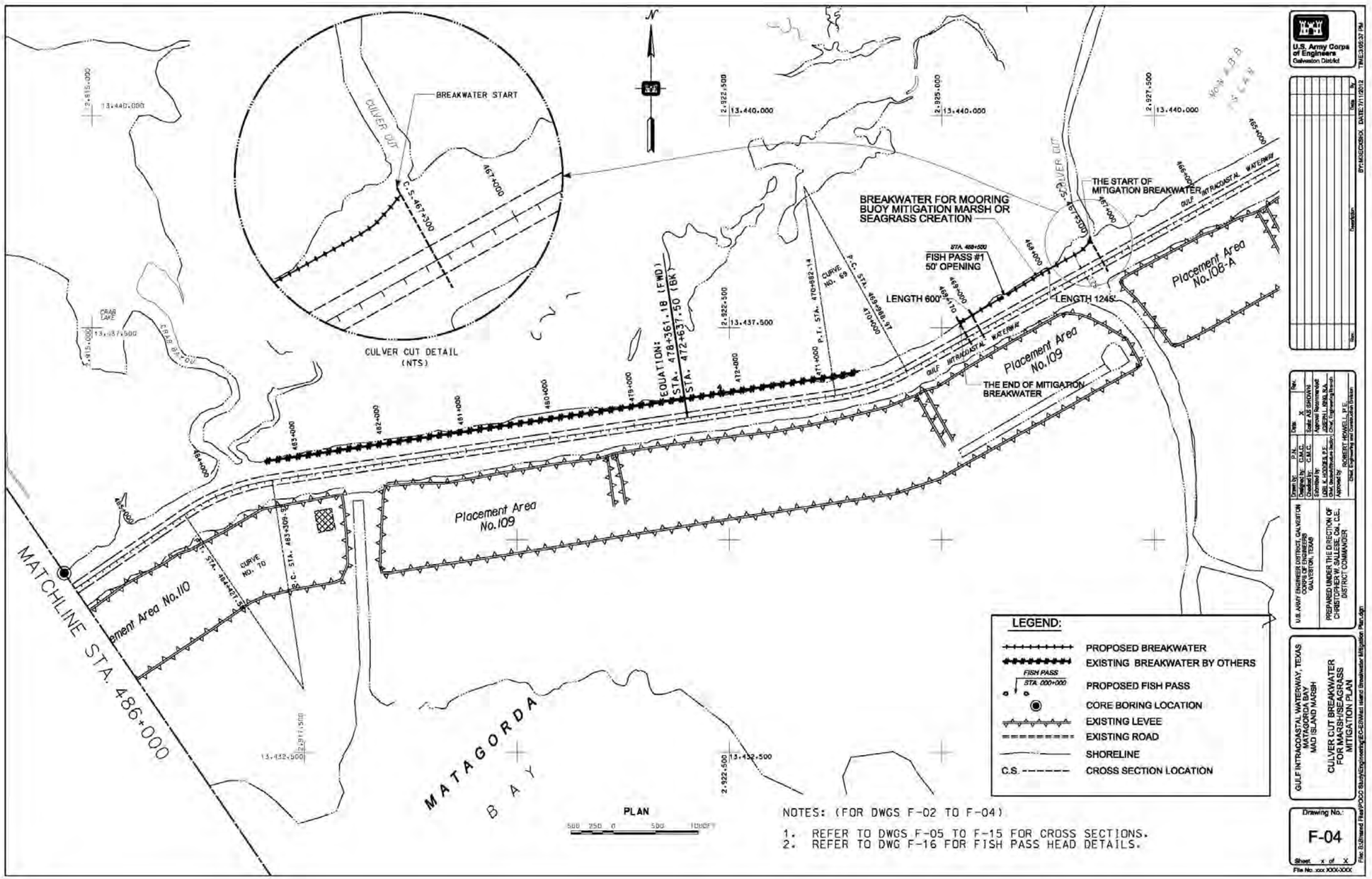

Figure 6 – Plan View of Proposed Mitigation Breakwater

5.2 HABITAT EVALUATION PROCEDURE ANALYSIS

HEP analysis, developed by USFWS, was performed on the impact area for the proposed project to determine the appropriate amount of mitigation that would be required to replace the values and functions of the aquatic habitat lost due to construction of the project. HEP is a species-habitat approach to impact assessment that quantifies habitat quality for selected evaluation species through the use of habitat suitability index (HSI). The HSI value is derived from an evaluation of the ability of key habitat components to provide the life requisites of selected species of wildlife. HEP is based on the assumption that habitat for selected species can be described as a specified point in time by an HSI. The species HSI is multiplied by the area of available habitat at that time to determine the total habitat units (HU) for the species for particular cover types in the study area. HSI model selection was based on species utilization of the seagrass and open-bay cover types. Two certified HSI models were selected to evaluate habitat quality: red drum (*Sciaenops ocellatus*) and white shrimp (*Penaeus setiferus*). These species were selected based on their ecological dependence upon the habitat that would be impacted by construction of the proposed project. The HEP analysis report can be found as Appendix F. Based upon conclusions of HEP analysis, establishment of 2 acres of tidal marsh dominated by smooth cordgrass would be required to fully offset impacts resulting from the construction of the proposed project.

5.3 MITIGATION ALTERNATIVES CONSIDERED

Other than a No Action alternative, four mitigation alternatives were considered and are as follows:

1. Alternative A: Construct 3,200 linear feet of breakwater that would result in the natural establishment of 4 acres of emergent tidal marsh dominated by smooth cordgrass between the breakwater and north shoreline of the GIWW. This alternative assumes smooth cordgrass from adjacent marsh areas would naturally recruit from adjacent marsh areas, and would not include planting in the sheltered area behind the breakwater. Mitigation Alternative A would provide an output of 4.75 Average Annual Habitat Units (AAHUs) to offset project impacts.
2. Alternative B: Construct 3,200 linear feet of breakwater and plant vegetation that would result in the establishment of 4 acres of emergent tidal marsh dominated by smooth cordgrass between the breakwater and north shoreline of the GIWW. This alternative would include planting of smooth cordgrass in the sheltered area behind the breakwater. Mitigation Alternative B would provide an output of 4.88 AAHUs.
3. Alternative C: Construct 1,845 linear feet of breakwater that would result in the natural establishment of 2 acres of emergent tidal marsh dominated by smooth cordgrass between the breakwater and north shoreline of the GIWW. This alternative assumes smooth

cordgrass from adjacent marsh areas would naturally recruit from adjacent marsh areas, and would not include planting in the sheltered area behind the breakwater. Mitigation Alternative C would provide an output of 3.31 AAHUs.

4. Alternative D: Construct 1,845 linear feet of breakwater and plan vegetation that would result in the establishment of 2 acres of emergent tidal marsh dominated by smooth cordgrass between the breakwater and north shoreline of the GIWW. This alternative would include planting of smooth cordgrass in the sheltered area behind the breakwater. Mitigation Alternative D would provide an output of 3.46 AAHUs.

Direct and indirect impacts resulting from implementation of any of these four alternatives would be similar in nature. There would be temporary displacement of benthic and mud substrate, but this would be replaced by a hard substrate of higher quality that would encourage colonization by oysters, invertebrates, and small fish. Void space in the breakwater would provide shelter and feeding areas for small fish and invertebrates. The vegetated marsh that would be established between the breakwater and shoreline would increase fishery utilization in the area and would attract usage of the site by birds. Short-term adverse impacts to fisheries would be experienced during construction activities. Equipment noise and activity would result in disturbance in the immediate construction areas to some fish species. However, these effects would be temporary and would cease when construction activities are completed. Temporary increases in turbidity would be expected during construction.

Temporary, minor disturbances to wildlife are expected to occur during construction, but species that do not tolerate disturbance would avoid construction during this time. Potential impacts to federally-listed T&E species and Species of Concern are addressed in the BA prepared for this project (Appendix E). Temporary increases in exhaust emissions would occur during construction activities due to the operation of construction equipment. These increases are minor in nature and would be temporary, occurring only during the construction period. These emissions are not expected to significantly impact the area's ambient air quality nor impact the area's designation as being in attainment with the EPA's national air quality standards. Noise impacts are expected to be minor in nature and would be temporary, occurring only during the construction period and typically only during daylight hours. No cultural resources sites would be impacted by breakwater construction as none are located in the immediate area and known sites would be avoided. It is expected that the breakwater would provide a benefit in protecting yet undiscovered archeological sites from further erosion associated with GIWW.

5.4 COST EFFECTIVENESS AND INCREMENTAL COST ANALYSIS

Cost Effectiveness and Incremental Cost Analysis (CE/ICA) was used to evaluate the best mitigation alternative based on habitat benefits determined through HEP and cost. Using

CE/ICA, mitigation alternatives providing the greatest increase in benefits for the least increase in costs are identified as the "Best Buy" alternatives.

The No Action alternative, Alternative B, and Alternative C were determined to be Best Buy alternatives, while Alternative A and Alternative C were determined to be cost effective, as shown in Table 8. The mitigation alternative and their associated costs and Average Annual Habitat Unit (AAHU) outputs are also shown in Table 8.

Table 8
Results of CE/ICA Analysis

Mitigation Alternative	AAHUs	Annualized Cost	Cost Effectiveness
No Action	0	$0	Best Buy
Alternative A	4.75	$42,695	Yes (Cost Effective)
Alternative B	4.88	$43,195	Best Buy
Alternative C	3.31	$29,886	Yes (Cost Effective)
Alternative D	3.46	$30,386	Best Buy

Alternative C was ultimately selected as the mitigation plan as it is considered to be the most cost effective alternative that accomplishes the mitigation requirements outlined in the HEP analysis report. The establishment of 2 acres of emergent tidal marsh would fully compensate for the impacts that would occur by construction of the proposed project. Additionally, per the HEP analysis report, an average net impact of -3.23 AAHUs would occur by construction of the proposed project. Alternative C would provide for 3.31 AAHUs, thus fully compensating for impacts to habitat incurred through construction of the proposed project.

5.5 MONITORING

The USACE Galveston District would be responsible for the implementation and costs of monitoring activities at the mitigation site. Parameters to be monitored include the presence of invasive/noxious/exotic plant species and establishment of native/typical emergent marsh. Smooth cordgrass dominates fringe marsh along the shoreline and it is expected that this species will expand and colonize the area between the breakwater and shoreline. Table 9 summarizes the objectives, performance standards, monitoring methods, and remedial actions associated with monitoring these parameters.

Table 9
Summary of Objectives, Performance Standards, Monitoring Methods, Remedial Action, and Schedule for Monitoring the Proposed Mitigation Site

MONITORING PARAMETERS		
Objective	Ensure that emergent tidal marsh habitat has been established between the proposed mitigation breakwater and shoreline.	
Performance Standards	Invasive, noxious, and/or exotic plant species should comprise less than 4 percent of vegetative cover.	The marsh site should contain 60 to 80 percent native, typical emergent marsh vegetation five years post breakwater construction.
Monitoring Methods	Visual observation along transects with photo documentation.	Visual observation along transects with photo documentation.
Remedial Action	Implement any necessary actions to remove and manage undesirable species such as manual removal or use of herbicide.	Planting of smooth cordgrass and consider use of fill material to establish appropriate elevation for smooth cordgrass growth.
Schedule	Monitor at three years and five years post breakwater construction, and then annually until performance standards are met.	Monitor at three years and five years post breakwater construction, and then annually until performance standards are met.

The mitigation site would be determined to be successful if all the performance standards are met. Remedial actions as described in Table 9 would be implemented if performance standards are not met after monitoring results are analyzed at 3 years post breakwater construction in order to correct any observed problems.

6.0 CUMULATIVE IMPACTS

A cumulative effect is defined as the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a long period of time (40 CFR Part 1508.7). The following analysis abides by the National Environmental Quality Act (NEPA) Council on Environmental Quality's

(CEQ) Considering Cumulative Effects under NEPA (CEQ, 1997), and Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (CEQ, 2005).

Channel Widening Site

Past projects in the area mainly consist of residential developments and marinas. The entrance to a residential development known as "The Sanctuary" is located approximately one-half mile west of the eastern limit of the proposed project site. Construction of this development began in 2007. It is located north of the GIWW and is a subdivision of approximately 680 acres in size, contains approximately 125 acres of lakes and channels, and includes 776 waterfront lots. To date, approximately twelve homes have been constructed within the subdivision.

Other past projects in the area consist of other residential developments and marinas at and near Port O'Connor. The Caracol condominium and marina development at Port O'Connor is an example of one such development. Located approximately 4 miles northeast of the proposed project site, construction began in 2010. This development proposes to develop a condominium complex and provide recreational vessel mooring and other ancillary facilities. The development consists of constructing 2,224 linear feet of reconfigured bulkhead, new walkways, and finger piers. It also consists of 44 boat slips of varying widths; two multi-family buildings (120 units), pool, and other ancillary facilities. The pilings proposed for construction totaled 478, of which 329 would be constructed in existing open water, and 149 in created open water. The development is set back 13.5 feet from the GIWW (300-foot right-of-way).

Current and reasonably foreseeable projects near the project area include continued residential development, construction of bulkheads, and sediment removal from existing marinas. Depending on the rate of increased residential development in the area, there is potential for future congestion problems similar to those that occurred at the mooring facility previously located near Port O'Connor. However, at this time it is not expected that the proposed project would significantly contribute to the cumulative effects of past, present, and future projects in the area and the anticipated adverse impacts to the surrounding environment are minimal.

Mitigation Site

There have been relatively few past projects in the area as the area is scarcely populated due to TPWD's MIM WMA and The Nature Conservancy's MIM Preserve comprising much of the area. As mentioned previously, approximately 2 miles of rock breakwater was constructed by the GLO immediately to the east of the proposed mitigation breakwater in order to reduce erosion occurring along the shoreline. The proposed mitigation breakwater is intended to serve a similar function.

The town of Matagorda is located approximately 3 miles east of the proposed mitigation breakwater where past projects have consisted mainly of residential development and

construction of marinas. Current and reasonably foreseeable projects near the town of Matagorda include continued residential development, construction of bulkheads, and silt removal from existing marinas. At this time it is not expected that the proposed mitigation breakwater would significantly contribute to the cumulative effects of past, present, and future projects in the area and the anticipated adverse impacts to the surrounding environment are minimal or non-existent.

7.0 RELATIONSHIP TO OTHER FEDERAL PROJECTS

This plan is part of the Gulf Intracoastal Waterway, Texas Project which is a Federally-maintained navigation channel. The purpose is to increase the efficiency and safety of operation and maintenance of this project. There are no other Federal projects directly affected by this plan.

8.0 COMPLIANCE WITH PLANNING AND ENVIRONMENTAL REQUIREMENTS

8.1 PLANNING REQUIREMENTS

The planning of the proposed project is in accordance with the "USACE Campaign Plan" goals. Plan formulation has been based on collaboration with partners and stakeholders. Potential direct and indirect affects inside and outside the project areas have been considered. Risk and uncertainty have been considered in evaluating alternatives, which are discussed in this document. The proposed plan has been selected based on inter-disciplinary coordination that utilizes the best professional and technical expertise available during the planning process.

8.2 ENVIRONMENTAL REQUIREMENTS

This assessment has been prepared to satisfy the requirements of all applicable environmental laws and regulations, and has been prepared in accordance with the Council on Environmental Quality's implementing regulations for NEPA, 40 CFR Parts 1500 – 1508, and USACE Regulation ER 200-2-2, *Environmental Quality: Procedures for Implementing NEPA*. The planning and implementation of the proposed project is consistent with the USACE's Environmental Operating Principles.

The following is a list of applicable environmental laws and regulations that were considered in the planning of this project and the status of compliance with each:

National Environmental Policy Act – This EA has been prepared in accordance with Council on Environmental Quality regulations for implementing NEPA. The environmental and social consequences of the recommended plan have been analyzed in accordance with NEPA and presented in the assessment.

Fish And Wildlife Coordination Act Of 1958, as amended – The proposed plan has been coordinated with the USFWS and TPWD. Information provided by USFWS and TPWD on fish and wildlife resources has been considered in the development of the project. The USFWS prepared a Planning Aid Letter dated June 5, 2012 (Appendix D), which the USACE Galveston District considered in formulating plans for avoiding and minimizing impacts to fish and wildlife.

Endangered Species Act of 1973, as amended – The USACE Galveston District is coordinating this project with the USFWS and NMFS regarding threatened, endangered or proposed species and their critical habitats in the project area. The USACE Galveston District has preliminarily concluded that the proposed project would not result in any significant adverse impacts to federally listed threatened or endangered species (Sections 3.6 and 4.5). This Draft EA will serve to initiate informal consultation under the Endangered Species Act.

Magnuson-Stevens Fishery Conservation and Management Act – Congress enacted amendments to the Magnuson-Stevens Fishery Conservation and Management Act in 1996 that established procedures for identifying essential fish habitat and required interagency coordination to further the conservation of federally managed fisheries. Rules published by the National Marine Fisheries Service (50 CFR 600.805 through 600.930) specify that any federal agency that authorizes, funds or undertakes, or proposes to authorize, fund or undertake an activity that could adversely affect EFH be subject to the consultation provisions of the act. No significant impacts to living marine resources or EFH would occur as a result of the project (Sections 3.5 and 4.4). The Draft EA was coordinated with NMFS and comments from NMFS regarding fisheries and EFH are included in Appendix A.

Clean Water Act of 1977 – The USACE Galveston District evaluated the proposed action pursuant to Section 404 of the Clean Water Act and project impacts are summarized in a Section 404(b)(1) analysis, which is included in Appendix B. A Joint Public Notice will be issued with the TCEQ (Appendix A) and state water quality certification pursuant to Section 401 of the Clean Water Act (Appendix B) will be sought.

Marine Mammal Protection Act of 1972 – Under the Marine Mammal Protection Act, all species of marine mammals are protected. The Act prohibits the "take" of marine mammals, which is defined as harassing, hunting, capturing, killing or collecting, or attempting to harass, hunt, capture, kill or collect. The proposed project will not result in a take of any marine mammal species.

National Historic Preservation Act of 1966, as amended – Compliance with the National Historic Preservation Act of 1966, as amended, requires identification of all properties in the project area listed on, or eligible for listing on, the National Register of Historic Places. For any adversely affected properties, mitigation measures must be developed in coordination with the SHPO and the Advisory Council on Historic Preservation. The USACE Galveston District

coordinated the proposed project with the SHPO. The SHPO concurred that the project would have no effect on historic properties and that the project may proceed. (Sections 3.7, 4.6 and Appendix D).

Coastal Barrier Resources Act of 1982 – This Act established the John H. Chaffee Coastal Barrier Resources System to minimize the loss of human life, wasteful federal expenditures, and damage to fish, wildlife, and other natural resources associated with coastal barriers. Coastal barriers are bay barriers, barrier islands, and other geological features composed of sediment that protect landward aquatic habitats from direct wind and waves. As part of the program, the federal government discourages development on designated undeveloped coastal barriers by restricting certain federal financial assistance and expenditures, including USACE development projects. The proposed project will not affect any coastal barrier areas.

Coastal Zone Management Act of 1972 – This Act requires that all land-use changes in the project area be conducted in accordance with approved state coastal zone management programs. Any project that is located in, or which may affect land and water resources in the Texas coastal zone and that requires a federal license or permit, or is a direct activity of a federal agency, or is federally funded must be reviewed for consistency with the Texas Coastal Management Program (TCMP). The proposed action is within the coastal boundary defined by the TCMP.

The USACE Galveston District reviewed the project for consistency with the goals and policies of the TCMP. Coastal Natural Resource Areas in the project area were identified and evaluated for potential impacts from project activities. The USACE Galveston District has determined that the proposed project would not adversely impact these resource areas and that the proposed activities are consistent with the goals and policies of the TCMP to the maximum extent practicable. The Galveston District's consistency review is included in Appendix C.

Clean Air Act of 1977 – The EPA established nationwide air quality standards to protect public health and welfare. The State of Texas has adopted the National Ambient Air Quality Standards as the state's air quality criteria. The project is located in Calhoun County, which has attainment status. Emissions from construction activities are not considered regionally significant (Sections 3.8 and 4.7).

Executive Order 11990, Protection of Wetlands – Executive Order 11990 requires federal agencies to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in executing federal projects. The proposed action has been analyzed for compliance with Executive Order 11990. The project footprint area occurs in shallow water habitat. The project area will not adversely impact any wetlands. Therefore, the proposed project is in compliance with this Order (Sections 3.3 and 4.2).

Executive Order 11988, Floodplain Management – This Order directs Federal agencies to evaluate the potential effects of proposed actions in floodplains. The recommended plan would not induce increased flooding in developed areas and would not contribute to increased future flood damages.

Council on Environmental Quality Memorandum dated August 11, 1980, Prime or Unique Farmlands – Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses. There is no farmland in the project or mitigation areas.

Executive Order 12898, Environmental Justice – This Order directs Federal agencies to achieve environmental justice to the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review. Agencies are required to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. The proposed project would not have a disproportionate adverse impact on minority or low-income population groups (Sections 3.12 and 4.11).

Memorandum of Agreement (MOA) with the Federal Aviation Administration (FAA) to Address Aircraft Wildlife Strikes – This MOA was executed between the FAA, the U.S. Air Force, the U.S. Army, the EPA, the USFWS, and the U.S. Department of Agriculture. Through this MOA, the agencies establish procedures necessary to coordinate their missions to more effectively address existing and future environmental conditions contributing to aircraft-wildlife strikes throughout the United States. There are no airports located within five statute miles of the proposed project. Therefore, the risk of aircraft-wildlife strikes is considered to be negligible, and no further coordination is required.

9.0 CONCLUSIONS

The following conclusions summarize the findings of the EA, as detailed in the environmental analyses in Section 4.0:

- Aquatic habitat would be temporarily affected during channel widening activities, but these impacts do not represent significant impacts to the environment.
- No wetlands would be impacted by the proposed project.
- Impacts to seagrasses would be adequately mitigated.
- No terrestrial habitats would be affected by this proposed action.
- Fish and invertebrates may be affected locally in the project area, but this does not represent significant or adverse impacts to the environment.

- Threatened or endangered species would not be affected by the proposed project.
- Historic properties or recorded archeological sites would not be affected by the proposed action.
- Emissions from construction activities would not be locally or regionally significant.
- Implementation of the proposed action would not result in any significant or permanent noise impacts.
- There would be no long-term impacts to water quality from the proposed activities.
- There are no hazardous and/or toxic waste issues in the project area.
- There would be minor, temporary impacts to localized aesthetics during the construction period, but no long-term impacts. Navigation would benefit from there being an area to moor barges during adverse weather conditions while allowing the for the free movement of vessels.
- No significant or adverse impacts to environmental resources are expected to occur as a result of implementation of the proposed project. No adverse cumulative impacts to environmental resources are expected as a result of project implementation.
- The USACE finds that the proposed action is in compliance with the TCMP.
- The proposed project would not result in significant impacts to the human environment. Therefore, the preparation of an Environmental Impact Statement is not required.

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APPENDIX A

Public Notice, Comments on the Draft Environmental Assessment, and Responses to Comments

[A copy of the public notice, comments on the draft Environmental Assessment. and responses to the comments will be included in the final Environmental Assessment]

APPENDIX B

Clean Water Act Section 404(b)(1) Evaluation, Water & Sediment Quality Data, and Water Quality Certification

EVALUATION OF SECTION 404(b)(1) GUIDELINES (SHORT FORM)

PROPOSED PROJECT: Gulf Intracoastal Waterway, Port O'Connor to Corpus Christi, Texas, Section 216 Study.

	Yes	No*
1. Review of Compliance (230.10(a)-(d))		
A review of the proposed project indicates that:		
a. The placement represents the least environmentally damaging practicable alternative and, if in a special aquatic site, the activity associated with the placement must have direct access or proximity to, or be located in the aquatic ecosystem, to fulfill its basic purpose (if no, see section 2 and information gathered for EA alternative).	X	
b. The activity does not appear to:		
1) Violate applicable state water quality standards or effluent standards prohibited under Section 307 of the Clean Water Act;	X	
2) Jeopardize the existence of Federally-listed endangered or threatened species or their habitat; and	X	
3) Violate requirements of any Federally-designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies).	X	
c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, an economic values (if no, see values, Section 2)	X	
d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see Section 5)	X	

	Not Applicable	Not Significant	Significant*
2. Technical Evaluation Factors (Subparts C-F) (where a 'Significant' category is checked, add explanation below.)			
a. Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)			
1) Substrate impacts		X	
2) Suspended particulates/turbidity impacts		X	
3) Water column impacts		X	
4) Alteration of current patterns and water circulation	X		
5) Alteration of normal water fluctuation/hydroperiod	X		
6) Alteration of salinity gradients	X		
b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)			
1) Effect on threatened/endangered species and their habitat	X		
2) Effect on the aquatic food web		X	
3) Effect on other wildlife (mammals, birds, reptiles and amphibians)		X	

	Not Applicable	Not Significant	Significant*
2. Technical Evaluation Factors (Subparts C-F) (where a 'Significant' category is checked, add explanation below.)			
c. Special Aquatic Sites (Subpart E)			
1) Sanctuaries and refuges		X	
2) Wetlands		X	
3) Mud flats	X		
4) Vegetated shallows		X	
5) Coral reefs	X		
6) Riffle and pool complexes	X		
d. Human Use Characteristics (Subpart F)			
1) Effects on municipal and private water supplies	X		
2) Recreational and Commercial fisheries impacts		X	
3) Effects on water-related recreation		X	
4) Aesthetic impacts		X	
5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves		X	

	Yes
3. Evaluation of Dredged or Fill Material (Subpart G)	
a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material (check only those appropriate)	
1) Physical characteristics	X
2) Hydrography in relation to known or anticipated sources of contaminants	X
3) Results from previous testing of the material or similar material in the vicinity of the project	X
4) Known, significant sources of persistent pesticides from land runoff or percolation	
5) Spill records for petroleum products or designated (Section 311 of Clean Water Act) hazardous substances	X
6) Other public records of significant introduction of contaminants from industries, municipalities or other sources	X
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities	

List appropriate references:

1) Unpublished Corps of Engineer data, Gulf Intracoastal Waterway, Port O'Connor to Corpus Christi, 1999.

2) Environmental Data Search, Historic Aerial Photo Search, Oil and Gas Review, 2010 Topographic Map, and Water Well Search, ordered from TelAll Corporation, March 2012.

	Yes	No
b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredged or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and placement sites and not likely to degrade the placement sites, or the material meets the testing exclusion criteria.	X	

	Yes
4. Placement Site Delineation (230.11(f))	
a. The following factors as appropriate, have been considered in evaluating the placement site:	N/A
1) Depth of water at placement site	
2) Current velocity, direction, and variability at placement site	
3) Degree of turbulence	
4) Water column stratification	
5) Discharge vessel speed and direction	
6) Rate of discharge	
7) Fill material characteristics (constituents, amount, and type of material, settling velocities)	
8) Number of discharges per unit of time	
9) Other factors affecting rates and patterns of mixing (specify)	

List appropriate references:

	Yes	No
b. An evaluation of the appropriate factors in 4a above indicates that the placement site and/or size of mixing zone are acceptable.	N/A	

	Yes	No
5. Actions to Minimize Adverse Effects (Subpart H)		
All appropriate and practicable steps have been taken, through application of recommendations of 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.	X	

List actions taken:

1) The placement area (PA) to be used is an existing upland confined PA disposal site that has been used previously for dredged material discharge for the Gulf Intracoastal Waterway.

	Yes	No*
6. Factual Determination (230.11)		
A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short- or long-term environmental effects of the proposed discharge as related to:		
a. Physical substrate at the placement site (review Sections 2a. 3, 4, and 5 above)	X	
b. Water circulation, fluctuation and salinity (review Sections 2a. 3, 4, and 5)	X	
c. Suspended particulates/turbidity (review Sections 2a. 3, 4, and 5)	X	
d. Contaminant availability (review Sections 2a. 3, and 4)	X	
e. Aquatic ecosystem structure and function (review Sections 2b and c, 3, and 5)	X	
f. Placement site (review Sections 2, 4, and 5)	X	
g. Cumulative impacts on the aquatic ecosystem	X	
h. Secondary impacts on the aquatic ecosystem	X	

7. Evaluation Responsibility

a. This evaluation was prepared by: **Mark I. Garza**
Position: **Environmental Lead/Biologist**

8. Findings	Yes
a. The proposed placement site for discharge of or fill material complies with the Section 404(b)(1) Guidelines.	X
b. The proposed placement site for discharge of dredged or fill material complies with the Section 404(b)(1) Guidelines with the inclusion of the following conditions:	

List of conditions:

c. The proposed placement site for discharge of dredged or fill material does not comply with the Section 404(b)(1) Guidelines for the following reason(s):	
1) There is a less damaging practicable alternative	
2) The proposed discharge will result in significant degradation of the aquatic ecosystem	
3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem	

7 Aug 13
Date

Carolyn Murphy
CAROLYN MURPHY
Chief, Environmental Section

NOTES:

* A negative, significant, or unknown response indicates that the permit application may not be in compliance with the Section 404(b)(1) Guidelines.

Negative responses to three or more of the compliance criteria at the preliminary stage indicate that the proposed projects may not be evaluated using this “short form” procedure. Care should be used in assessing pertinent portions of the technical information of items 2a-e before completing the final review of compliance.

Negative response to one of the compliance criteria at the final stage indicates that the proposed project does not comply with the Guidelines. If the economics of navigation and anchorage of Section 404(b)(2) are to be evaluated in the decision-making process, the “short form” evaluation process is inappropriate.

GULF INTRACOASTAL WATERWAY
Matagorda Bay to San Antonio Bay

Sediment results are calculated on a dry weight basis.

Sample Number	Date Sampled	Station/ Distance from ℄	Arsenic		Barium		Cadmium		Chromium		Copper		Lead		Mercury	
			µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg
Criteria:			69.0				43.0		1100		2.9		140.0		2.1	
Sediment				0.55		36.8		<0.10		3.43		1.38		3.65		<0.02
Water **GIC-MBSA-99-01**	21 Jan 1999	630+000 20'	<1.00		73.6		0.17		<1.00		2.00		<1.00		<0.20	
Elutriate			<1.00		52.6		<0.10		1.36		<1.00		<1.00		<0.20	
Sediment				1.18		123.0		<0.10		3.89		1.70		4.58		<0.02
Water **GIC-MBSA-99-02**	21 Jan 1999	635+000 15'	<1.00		38.6		0.28		<1.00		<1.00		<1.00		<0.20	
Elutriate			2.74		47.8		<0.10		<1.00		<1.00		<1.00		<0.20	
Sediment				0.79		122.0		<0.10		2.52		1.43		3.98		<0.02
Water **GIC-MBSA-99-03**	21 Jan 1999	640+000 20'	<1.00		40.1		0.19		<1.00		<1.00		<1.00		<0.20	
Elutriate			1.56		63.9		<0.10		<1.00		<1.00		<1.00		<0.20	
Sediment				1.47		218.0		<0.10		6.37		4.31		10.30		<0.02
Water **GIC-MBSA-99-04**	21 Jan 1999	645+000 20'	<1.00		40.6		0.22		<1.00		<1.00		<1.00		<0.20	
Elutriate			11.0		64.1		<0.10		<1.00		<1.00		<1.00		<0.20	
Sediment				1.15		203.0		<0.10		7.14		3.90		10.10		<0.02
Water **GIC-MBSA-99-05**	21 Jan 1999	650+000 0	3.20		53.1		<0.10		<1.00		<1.00		<1.00		<0.20	
Elutriate			4.30		93.1		<0.10		<1.00		<1.00		<1.00		<0.20	
Sediment				0.32		55.3		<0.10		2.27		1.03		2.08		<0.02
Water **GIC-MBSA-99-06**	21 Jan 1999	655+000 0	<1.00		58.8		<0.10		<1.00		<1.00		<1.00		<0.20	
Elutriate			<1.00		58.3		<0.10		<1.00		1.53		<1.00		<0.20	
Sediment				0.95		39.9		<0.10		2.49		1.60		2.89		<0.02
Water **GIC-MBSA-99-07**	21 Jan 1999	660+000 0	<1.00		47.3		<0.10		<1.00		<1.00		<1.00		<0.20	
Elutriate			3.52		54.7		<0.10		<1.00		<1.00		<1.00		<0.20	
Sediment				0.54		45.7		<0.10		3.28		1.32		3.41		0.04
Water **GIC-MBSA-99-08**	21 Jan 1999	665+000 0	<1.00		50.3		0.25		<1.00		<1.00		<1.00		<0.20	
Elutriate			<1.00		56.1		<0.10		<1.00		<1.00		<1.00		<0.20	
Sediment				0.84		20.3		0.14		1.89		1.48		2.22		<0.02
Water **GIC-MBSA-99-09**	21 Jan 1999	670+000 0	<1.00		56.9		0.11		<1.00		<1.00		<1.00		<0.20	
Elutriate			<1.00		104.0		<0.10		<1.00		1.06		<1.00		<0.20	
Sediment				0.55		55.7		<0.10		4.06		1.86		5.26		0.04
Water **GIC-MBSA-99-10**	21 Jan 1999	675+000 0	<1.00		59.6		<0.10		<1.00		<1.00		<1.00		<0.20	
Elutriate			3.52		159.0		<0.10		<1.00		<1.00		<1.00		<0.20	
Sediment				0.35		14.3		<0.10		2.40		0.81		2.85		<0.02
Water **GIC-MBSA-99-11**	21 Jan 1999	680+000 0	<1.00		62.2		0.13		<1.00		<1.00		<1.00		<0.20	
Elutriate			<1.00		114.0		<0.10		<1.00		<1.00		<1.00		<0.20	

GULF INTRACOASTAL WATERWAY
Matagorda Bay to San Antonio Bay

Sediment results are calculated on a dry weight basis.

Sample Number	Date Sampled	Station/ Distance from ℄	Arsenic		Barium		Cadmium		Chromium		Copper		Lead		Mercury	
			µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg
Criteria:			69.0				43.0		1100		2.9		140.0		2.1	
Sediment				0.35		12.7		<0.10		0.94		0.73		1.65		<0.02
Water **GIC-MBSA-99-12**	21 Jan 1999	685+000	<1.00		63.5		<0.10		<1.00		1.66		<1.00		<0.20	
Elutriate		0	<1.00		105.0		<0.10		<1.00		<1.00		<1.00		<0.20	
Sediment				0.91		31.7		<0.10		4.08		1.72		4.65		<0.02
Water **GIC-MBSA-99-13**	21 Jan 1999	690+000	<1.00		67.0		<0.10		<1.00		<1.00		<1.00		<0.20	
Elutriate		0	1.17		155.0		<0.10		<1.00		1.39		<1.00		<0.20	

GULF INTRACOASTAL WATERWAY
Matagorda Bay to San Antonio Bay

Sediment results are calculated on a dry weight basis.
Sampled: 21-Jan-99

Sample Number		Nickel		Silver		Selenium		Zinc		TOC		Total PCB		4,4'-DDT		Chlordane		Toxaphene	
		µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	mg/l	mg/kg	µg/l	µg/kg	µg/l	µg/kg	µg/l	µg/kg	µg/l	µg/kg
Criteria:		75.0		2.3		300		95.0				10.0		0.13		0.09		0.21	
Sediment			2.42		<0.10		<0.20		7.15		3390		<1.00		<10.0		<10.0		<50.0
Water	**GIC-MBSA-99-01**	<1.00		<1.00		<1.00		34.50		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate		1.34		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Sediment			3.19		0.14		<0.20		10.90		3460		<1.00		<10.0		<10.0		<50.0
Water	**GIC-MBSA-99-02**	<1.00		<1.00		<1.00		3.70		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate		<1.00		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Sediment			2.86		<0.10		<0.20		8.78		14300		<1.00		<10.0		<10.0		<50.0
Water	**GIC-MBSA-99-03**	<1.00		<1.00		<1.00		6.10		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate		1.10		1.37		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Sediment			5.84		<0.10		<0.20		24.00		5980		<1.00		<10.0		<10.0		<50.0
Water	**GIC-MBSA-99-04**	<1.00		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate		<1.00		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Sediment			8.14		<0.10		<0.20		20.70		6940		<1.00		<10.0		<10.0		<50.0
Water	**GIC-MBSA-99-05**	<1.00		<1.00		<1.00		6.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate		<1.00		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Sediment			3.04		<0.10		<0.20		6.62		3080		<1.00		<10.0		<10.0		<50.0
Water	**GIC-MBSA-99-06**	<1.00		<1.00		<1.00		1.90		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate		<1.00		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Sediment			4.64		<0.10		0.44		7.31		7730		<1.00		<10.0		<10.0		<50.0
Water	**GIC-MBSA-99-07**	<1.00		<1.00		<1.00		6.30		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate		<1.00		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Sediment			5.18		<0.10		<0.20		6.76		8670		<1.00		<10.0		<10.0		<50.0
Water	**GIC-MBSA-99-08**	<1.00		<1.00		2.46		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate		<1.00		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Sediment			3.75		<0.10		0.54		5.17		3480		<1.00		<10.0		<10.0		<50.0
Water	**GIC-MBSA-99-09**	<1.00		<1.00		2.87		5.10		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate		<1.00		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Sediment			2.97		<0.10		<0.20		10.70		4600		<1.00		<10.0		<10.0		<50.0
Water	**GIC-MBSA-99-10**	<1.00		<1.00		<1.00		7.50		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate		<1.00		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Sediment			2.76		0.10		<0.20		4.97		1920		<1.00		<10.0		<10.0		<50.0
Water	**GIC-MBSA-99-11**	<1.00		<1.00		1.23		1.70		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate		<1.00		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	

GULF INTRACOASTAL WATERWAY
Matagorda Bay to San Antonio Bay

Sediment results are calculated on a dry weight basis.
Sampled: 21-Jan-99

Sample Number	Nickel		Silver		Selenium		Zinc		TOC		Total PCB		4,4'-DDT		Chlordane		Toxaphene	
	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	mg/l	mg/kg	µg/l	µg/kg	µg/l	µg/kg	µg/l	µg/kg	µg/l	µg/kg
Criteria:	75.0		2.3		300		95.0				10.0		0.13		0.09		0.21	
Sediment		1.21		<0.10		<0.20		3.75		5460		<1.00		<10.0		<10.0		<50.0
Water **GIC-MBSA-99-12**	<1.00		<1.00		<1.00		3.60		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate	1.40		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Sediment		3.59		<0.10		<0.20		10.90		3380		<1.00		<10.0		<10.0		<50.0
Water **GIC-MBSA-99-13**	2.93		1.23		<1.00		10.00		<1.00		<0.01		<0.10		<0.14		<0.50	
Elutriate	1.46		<1.00		<1.00		<1.00		<1.00		<0.01		<0.10		<0.14		<0.50	

GULF INTRACOASTAL WATERWAY
Matagorda Bay to San Antonio Bay

Sediment results are calculated on a dry weight basis.
Sampled: 21-Jan-99

Sample Number	Total PAH		Naphthalene		Acenaphthene		Fluoranthene		Benzo(a)pyrene	
	µg/l	mg/kg	µg/l	µg/kg	µg/l	µg/kg	µg/l	µg/kg	µg/l	µg/kg
Criteria:	300		2350		970		40.0		43.0	
Sediment		<0.50		<20.0		<20.0		<20.0		<20.0
Water **GIC-MBSA-99-01**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate	<5.00		<2.00		<2.00		<0.50		<0.50	
Sediment		<0.50		<20.0		<20.0		<20.0		<20.0
Water **GIC-MBSA-99-02**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate	<5.00		<2.00		<2.00		<0.50		<0.50	
Sediment		<0.50		<20.0		<20.0		<20.0		<20.0
Water **GIC-MBSA-99-03**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate	<5.00		<2.00		<2.00		<0.50		<0.50	
Sediment		<0.50		<20.0		<20.0		<20.0		<20.0
Water **GIC-MBSA-99-04**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate	<5.00		<2.00		<2.00		<0.50		<0.50	
Sediment		<0.50		<20.0		<20.0		<20.0		<20.0
Water **GIC-MBSA-99-05**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate	<5.00		<2.00		<2.00		<0.50		<0.50	
Sediment		<0.50		<20.0		<20.0		<20.0		<20.0
Water **GIC-MBSA-99-06**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate	<5.00		<2.00		<2.00		<0.50		<0.50	
Sediment		<0.50		<20.0		<20.0		<20.0		<20.0
Water **GIC-MBSA-99-07**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate	<5.00		<2.00		<2.00		<0.50		<0.50	
Sediment		<0.50		<20.0		<20.0		<20.0		<20.0
Water **GIC-MBSA-99-08**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate	<5.00		<2.00		<2.00		<0.50		<0.50	
Sediment		<0.50		<20.0		<20.0		<20.0		<20.0
Water **GIC-MBSA-99-09**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate	<5.00		<2.00		<2.00		<0.50		<0.50	
Sediment		<0.50		<20.0		<20.0		<20.0		<20.0
Water **GIC-MBSA-99-10**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate	<5.00		<2.00		<2.00		<0.50		<0.50	
Sediment		<0.50		<20.0		<20.0		<20.0		<20.0
Water **GIC-MBSA-99-11**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate	<5.00		<2.00		<2.00		<0.50		<0.50	

GULF INTRACOASTAL WATERWAY
Matagorda Bay to San Antonio Bay

Sediment results are calculated on a dry weight basis.
Sampled: 21-Jan-99

Sample Number		Total PAH		Naphthalene		Acenaphthene		Fluoranthene		Benzo(a)pyrene	
		µg/l	mg/kg	µg/l	µg/kg	µg/l	µg/kg	µg/l	µg/kg	µg/l	µg/kg
Criteria:		300		2350		970		40.0		43.0	
Sediment			<0.50		<20.0		<20.0		<20.0		<20.0
Water	**GIC-MBSA-99-12**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate		<5.00		<2.00		<2.00		<0.50		<0.50	
Sediment			<0.50		<20.0		<20.0		<20.0		<20.0
Water	**GIC-MBSA-99-13**	<5.00		<2.00		<2.00		<0.50		<0.50	
Elutriate		<5.00		<2.00		<2.00		<0.50		<0.50	

NOTES:

1. Criteria shown are EPA Quality Criteria for Water, 1986; March 1987 and January 1988. These water quality criteria are shown only for comparative purposes since there is no regulatory requirement for the discharge of dredged material to meet these criteria. Presently, no EPA criteria exist for marine sediment.

2. No EPA criteria presently exist for the following parameters: total PAH; acenapthene; fluoranthene and naphthalene. The value shown is that concentration at which acute toxicity to saltwater aquatic life has been observed.

3. The criterion for toxaphene lies below the detection limit which is routinely attainable by commercial laboratories. Consequently, this minimum detection limit is used as a reference value.

4. Chromium is expressed as total chromium.

5. Total PAH is expressed as fluoranthene equivalents.

Target Detection Levels[a] (TDLs)
for Analysis of Sediment, Water, and Elutriate

Analyte	Sediment (Dry Wt.)	Water/Elutriate
Metals [e]		
	mg/kg	**µg/l**
Antimony	2.5	3 (0.02)[c]
Arsenic	0.3[b]	1 (0.005)[c]
Beryllium	1[b]	0.2
Cadmium	0.1	1 (0.01)[c]
Chromium (total)	1[b]	1
Chromium (3+)	1	1
Chromium (6+)	1	1
Copper	1[b]	1 (0.1)[c]
Lead	0.3[b]	1 (0.02)[c]
Mercury	0.2	0.2 (0.0002)[c]
Nickel	0.5[b]	1 (0.1)[c]
Selenium	0.5[b]	2
Silver	0.2	1 (0.1)[c]
Thallium	0.2	1 (0.02)[c]
Zinc	2[b]	1 (0.5)[c]
Conventional/Ancillary Parameters		
	mg/kg	**mg/l**
Ammonia	0.1	0.03
Cyanides	2	0.1[d]
Total Organic Carbon	0.1%	0.1%
Total Petroleum Hydrocarbons	5	0.1
Grain Size	1%	-
Total Solids/Dry Weight	0.1%	-
LPAH Compounds		
	µg/kg	**µg/l**
Naphthalene	20	0.8[b]
Acenaphthylene	20	1.0[b]
Acenaphthene	20	0.75[b]
Fluorene	20	0.6[b]
Phenanthrene	20	0.5[b]
Anthracene	20	0.6[b]

Target Detection Levels[a] (TDLs)
for Analysis of Sediment, Water, and Elutriate

Analyte	Sediment (Dry Wt.)	Water/Elutriate
HPAH Compounds		
	µg/kg	**µg/l**
Fluoranthene	20	0.9[b]
Pyrene	20	1.5[b]
Benzo(a)anthracene	20	0.4[b]
Chrysene	20	0.3[b]
Benzo(b&k)fluoranthene	20	0.6[b]
Benzo(a)pyrene	20	0.3[b]
Indeno[1,2,3-c,d]pyrene	20	1.2[b]
Dibenzo[a,h]anthracene	20	1.3[b]
Benzo[g,h,i]perylene	20	1.2[b]
Organonitrogen Compounds		
	µg/kg	**µg/l**
Benzidine	5	1
3,3-Dichlorobenzidine	300[b]	3[b]
2,4-Dinitrotoluene	200[b]	2[b]
2,6-Dinitrotoluene	200[b]	2[b]
1,2-Diphenylhydrazine	10	1
Nitrobenzene	160[b]	0.9[b]
N-Nitrosodimethylamine	-	3.1[b]
N-Nitroso-di-n-propylamine	150[b]	0.9[b]
N-Nitrosodiphenylamine	20	2.1[b]
Phthalate Esters		
	µg/kg	**µg/l**
Dimethyl Phthalate	50	1[b]
Diethyl Phthalate	50	1[b]
Di-n-butyl Phthalate	50	1[b]
Butyl Benzyl Phthalate	50	4[b]
Bis[2-ethylhexyl] Phthalate	50	2[b]
Di-n-octyl Phthalate	50	3[b]
Phenols/Substituted Phenols		
	µg/kg	**µg/l**
Phenol	100	10
2,4-Dimethylphenol	20	10
Pentachlorophenol	100	50
2,4,6-Trichlorophenol	140[b]	0.9[b]
4-Chloro-3-methylphenol	140[b]	0.7[b]

Target Detection Levels[a] (TDLs)
for Analysis of Sediment, Water, and Elutriate

Analyte	Sediment (Dry Wt.)	Water/Elutriate
2-Nitrophenol	200[b]	2[b]
4-Nitrophenol	500[b]	5[b]
2,4-Dinitrophenol	500[b]	5[b]
2-Chlorophenol	110[b]	0.9[b]
2,4-Dichlorophenol	120[b]	0.8[b]
4,6-Dinitro-o-cresol	600	10
Polychlorinated Biphenyls		
	µg/kg	**µg/l**
Total PCB	1	0.01
Pesticides		
	µg/kg	**µg/l**
Aldrin	3[b]	0.03[b]
Chlordane and Derivatives	3[b]	0.03[b]
Dieldrin	5[b]	0.02
4,4'-DDD	5[b]	0.1
4,4'-DDE	5[b]	0.1
4,4'-DDT	5[b]	0.1
Endosulfan and Derivatives	5[b]	0.1
Endrin and Derivatives	5[b]	0.1
Heptachlor and Derivatives	3[b]	0.1
Alpha-BHC	3[b]	0.03
Beta-BHC	3[b]	0.03
Delta-BHC	3[b]	0.03
Gamma-BHC (Lindane)	3[b]	0.1
Toxaphene	50	0.5
Chlorinated Hydrocarbons		
	µg/kg	**µg/l**
1,3-Dichlorobenzene	20	0.9[b]
1,4-Dichlorobenzene	20	1[b]
1,2-Dichlorobenzene	20	0.8[b]
1,2,4-Trichlorobenzene	10	0.9[b]
Hexachlorobenzene	10	0.4[b]
2-Chloronapthalene	160[b]	0.8[b]
Hexachlorocyclopentadiene	300[b]	3.0[b]
Hexachloroethane	100	0.9[b]
Hexachlorobutadiene	20	0.9[b]

Target Detection Levels[a] (TDLs)
for Analysis of Sediment, Water, and Elutriate

Analyte	Sediment (Dry Wt.)	Water/Elutriate
Halogenated Ethers		
	***µ*g/kg**	***µ*g/l**
Bis(2-chloroethyl)ether	130[b]	0.9[b]
4-Chlorophenyl phenyl ether	170[b]	0.6[b]
4-Bromophenyl phenyl ether	160[b]	0.4[b]
Bis(2-chloroisopropyl)ether	140[b]	0.7[b]
Bis(2-chloroethoxy)methane	130[b]	1[b]
Miscellaneous		
	***µ*g/kg**	***µ*g/l**
Isophorone	10	1

[a]The primary source of these TDLs was EPA 823-B-95-001, *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations*.

[b]These values are based on recommendations from the EPA Region 6 Laboratory in Houston; these values were based on data or other technical basis.

[c]The values in parentheses are based on EPA "clean techniques", (EPA 1600 series methods) which are applicable in instances where other TDLs are inadequate to assess EPA water quality criteria.

[d]This value recommended by Houston Lab using colorimetric method.

[e]Metals shall be expressed as Dissolved values in water samples, except for mercury and selenium, which shall be reported as Total Recoverable Concentrations.

WATER QUALITY DATA

PBSJ 15650-78

Project: Gulf Intracoastal Waterway - Matagorda Bay to San Antonio Bay **EHA Job#:** DO 0062

Date samples collected: 1-21-99 **Tide, MLT:** Incoming, 1.6 MLT

Wind direction: SW **Wind speed:** 10-15 mph

Weather and water conditions: Overcast, Sl. choppy

SAMPLE NUMBER	GIC-MBSA-99-01	GIC-MBSA-99-02	GIC-MBSA-99-03	GIC-MBSA-99-04	GIC-MBSA-99-05	GIC-MBSA-99-06	GIC-MBSA-99-07	GIC-MBSA-99-08
STATION	630+000	635+000	640+000	645+000	650+000	655+000	660+000	665+000
DISTANCE FROM CL	20'	15'	20'	20'	0'	0'	0'	0'
WATER DEPTH MLT (ft)	12.3'	13'	12'	13'	13.4'	12.2'	14'	13.5'
DO (mg/l)	4.81	4.83	5.10	5.02	5.11	7.52	7.85	7.42
pH	8.4	8.4	8.4	8.5	8.4	8.4	8.4	8.4
SALINITY (ppt)	22	23	24	22	20	17	22	18
WATER TEMP. (°C)	18	18	18	19	19	19	19	19
AIR TEMP. (°C)	23	23	22	22	22	22	22	22

Remarks:

WATER QUALITY DATA

PBSJ 15650-78

Project: Gulf Intracoastal Waterway - Matagorda Bay to San Antonio Bay **EH&A Job#:** DO 0062

Date samples collected: 1-21-99 **Tide, MLT:** INCOMING 1.6 MLT

Wind direction: SW **Wind speed:** 10-15 MPH

Weather and water conditions: OVERCAST, CHOPPY

SAMPLE NUMBER	GIC-MBSA-99-01	GIC-MBSA-99-02	GIC-MBSA-99-03	GIC-MBSA-99-04	GIC-MBSA-99-05	GIC-MBSA-99-06	GIC-MBSA-99-07	GIC-MBSA-99-08
STATION	630+000	635+000	640+000	645+000	650+000	655+000	660+000	665+000
DENSITY (g/l)	28.0	30.5	30.0	29.5	24.0	45.0	24.0	42.0
TURBIDITY (NTU)	12.0	10.0	12.0	13.0	14.0	21.0	14.0	13.0
TSS (mg/l)	43.0	35.0	34.0	37.0	42.0	21.0	25.0	23.0

Remarks:

WATER QUALITY DATA

PBS&J 15650-78

Project: Gulf Intracoastal Waterway - Matagorda Bay to San Antonio Bay **~~EHA~~ Job#:** DO 0062

Date samples collected: 1-21-99 **Tide, MLT:** Incoming, 1.6 MLT

Wind direction: SW **Wind speed:** 10-15 mph.

Weather and water conditions: Overcast, SI. choppy pup.

SAMPLE NUMBER	GIC-MBSA-99-09	GIC-MBSA-99-10	GIC-MBSA-99-11	GIC-MBSA-99-12	GIC-MBSA-99-13			
STATION	670+000	675+000	680+000	685+000	690+000			
DISTANCE FROM CL	0'	0'	0'	0'	0'			
WATER DEPTH MLT (ft)	14.2'	15.5'	16.1'	13.3'	12.5'			
DO (mg/l)	7.65	8.30	7.75	6.30	5.21			
pH	8.4	8.4	8.5	8.5	8.4			
SALINITY (ppt)	16	15	14	13	12			
WATER TEMP. (°C)	19	19	19	19	19			
AIR TEMP. (°C)	21.5	21.5	21.5	21.5	21.5			

Remarks:

WATER QUALITY DATA

PBSJ 15650-78
Project: Gulf Intracoastal Waterway - Matagorda Bay to San Antonio Bay ~~EHA~~ **Job#:** DO 0062

Date samples collected: 1-21-99 **Tide, MLT:** INCOMING, 1.6 MLT

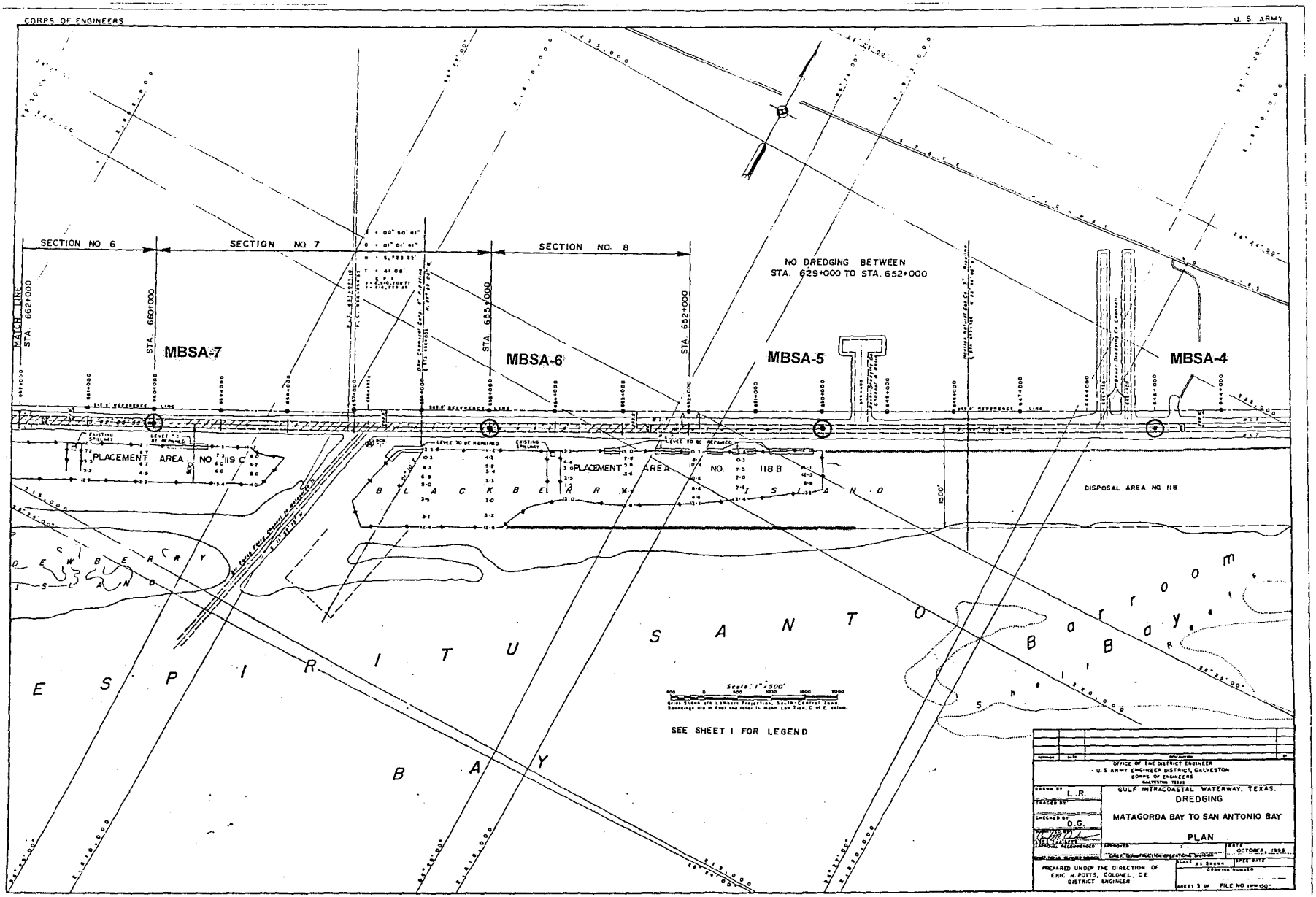
Wind direction: SW **Wind speed:** 10-15 MPH

Weather and water conditions: OVERCAST, CHOPPY

SAMPLE NUMBER	GIC-MBSA-99-09	GIC-MBSA-99-10	GIC-MBSA-99-11	GIC-MBSA-99-12	GIC-MBSA-99-13			
STATION	670+000	675+000	680+000	685+000	690+000			
DENSITY (g/l)	19.5	17.5	16.0	15.0	13.5			
TURBIDITY (NTU)	15.0	18.0	19.0	22.0	33.0			
TSS (mg/l)	25.0	37.0	36.0	34.0	52.0			

Remarks:

Sampling Map



Grain Size Summary Report

24-Mar-99

Delivery Order Number: 96-051

GULF INTRACOASTAL WATERWAY
Matagorda Bay to San Antonio Bay

Sample Number	Date	Location	Percent by Weight			D50
			Sand	Silt	Clay	
GIC-MBSA-99-01	21-Jan-99	630+000	79.7	9.3	11.0	0.130
GIC-MBSA-99-02	21-Jan-99	635+000	90.6	1.4	8.0	0.200
GIC-MBSA-99-03	21-Jan-99	640+000	90.1	2.4	7.5	0.130
GIC-MBSA-99-04	21-Jan-99	645+000	78.2	4.4	17.4	0.130
GIC-MBSA-99-05	21-Jan-99	650+000	96.8	3.2	0.0	0.190
GIC-MBSA-99-06	21-Jan-99	655+000	91.8	0.5	7.7	0.210
GIC-MBSA-99-07	21-Jan-99	660+000	87.0	2.5	10.5	0.140
GIC-MBSA-99-08	21-Jan-99	665+000	87.9	0.3	11.8	0.200
GIC-MBSA-99-09	21-Jan-99	670+000	88.0	4.3	7.7	0.150
GIC-MBSA-99-10	21-Jan-99	675+000	87.4	-1.2	13.8	0.220
GIC-MBSA-99-11	21-Jan-99	680+000	92.9	2.0	5.1	0.140
GIC-MBSA-99-12	21-Jan-99	685+000	97.8	2.2	0.0	0.210
GIC-MBSA-99-13	21-Jan-99	690+000	76.6	16.1	7.3	0.150

[A copy of the TCEQ water quality certification letter will be included in the final Environmental Assessment]

APPENDIX C

Compliance with Goals and Policies of Section 501.25(a)-(f), Texas Coastal Management Program

COMPLIANCE WITH GOALS AND POLICIES – SECTION 501.25(a)-(f)
DREDGING AND DREDGED MATERIAL DISPOSAL AND PLACEMENT
TEXAS COASTAL MANAGEMENT PROGRAM
GULF INTRACOASTAL WATERWAY,
PORT O'CONNOR TO CORPUS CHRISTI BAY, TEXAS, SECTION 216 STUDY

Section 501.25 Dredging and Dredged Material Disposal and Placement

(a) 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 proposed project is to deposit dredged material in existing dredged material placement area (PA) 118. The placement of this material has avoided and minimized adverse effects to coastal waters, submerged lands, critical areas, coastal shore areas and Gulf beaches by placing material in an area that historically been used for dredged material placement.

(1) 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 §501.21 of this title.

Compliance: No water quality standards would be violated by this project. Temporary elevations of turbidity may be caused as a result of construction; however, the increase in turbidity would only be temporary as it would only occur during the period of construction.

(2) Except as otherwise provided in paragraph (4) of this subsection, 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 §501.23 of this title.

Compliance: "Critical area", per Texas Natural Resources Code, §33.203(8), means a coastal wetland, an oyster reef, a hard substrate reef, submerged aquatic vegetation, or a tidal sand or mud flat. Approximately 2 acres of submerged aquatic vegetation would be impacted by the proposed project. Mitigation for project specific impacts would also be provided off-site. Approximately 12 acres of emergent tidal marsh and shallow water habitat would be restored adjacent to Texas Parks and Wildlife's Mad Island Marsh Wildlife Management Area to mitigate for project related impacts.

(3) Except as provided in paragraph (4) of this subsection, dredging and the disposal and placement of dredged material shall not be authorized if:

(A) 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;

Compliance: No practicable alternative exists that would have fewer adverse effects on coastal waters, submerged lands, critical areas, coastal shore areas, and Gulf Beaches. The PA to be used is an existing upland confined PA disposal site that has been used previously fro dredged material discharge for the Gulf Intracoastal Waterway (GIWW).

(B) 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

Compliance: All practicable steps have been taken to minimize adverse affects on these resources. The project impact area is situated adjacent to an existing PA, thereby avoiding impact to locations within the GIWW with no prior environmental impacts. The PA to be used is an existing upland confined PA disposal site that has been used previously for dredged material discharge for the GIWW.

(C) significant degradation of critical areas under §501.23(a)(7)(E) of this title would result.

Compliance: No significant degradation of critical areas would result from this project. Approximately 2 acres of submerged aquatic vegetation would be impacted. Resource impacts are offset by the proposed mitigation, which would restore approximately 12 acres of emergent tidal marsh and shallow water habitat adjacent to Texas Parks and Wildlife's Mad Island Marsh Wildlife Management Area.

(4) A dredging or dredged material disposal or placement project that would be prohibited solely by application of paragraph (3) of this subsection 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.

Compliance: The project has overriding importance to the public and national interest because it would allow for safer commercial navigation conditions within the GIWW.

(b) Adverse effects from dredging and dredged material disposal and placement shall be minimized as required in subsection (a) of this section. Adverse effects can be minimized by employing the techniques in this paragraph where appropriate and practicable.

Compliance: Adverse effects of dredging as described in this EA have been minimized as described under "Compliance" for paragraph (a2) of this section. The project has been cited and sized to optimize plan performance while minimizing environmental impacts and cost.

(1) 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:

(A) locating and confining discharges to minimize smothering of organisms;

Compliance: Discharge has been confined to PA 118, an existing upland confined PA.

(B) locating and designing projects to avoid adverse disruption of water inundation patterns, water circulation, erosion and accretion processes, and other hydrodynamic processes;

Compliance: The project is not anticipated to have adverse effects to water inundation patterns, water circulation, erosion and accretion processes, or other hydrodynamic processes.

(C) 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;

Compliance: Materials are proposed to be discharged in an area that has been previously disturbed by placement of dredged materials. Materials are proposed to be discharged in PA 118.

(D) 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;

Compliance: The proposed project has been sized to maximize PA capacity, while minimizing environmental impacts. The placement of this material has avoided and minimized adverse effects to coastal waters, submerged lands, critical areas, coastal shore areas and Gulf beaches by placing material in an area that has historically been used for dredged material placement.

(E) discharging materials at sites where the substrate is composed of material similar to that being discharged;

Compliance: Material would be discharged at sites of comparable substrate. Material for project construction would be dredged from the GIWW and placed at PA 118 which is directly adjacent to the PA and has been historically used to place GIWW dredged material.

(F) locating and designing discharges to minimize the extent of any plume and otherwise control dispersion of material; and

Compliance: Placement has been designed to minimize environmental impacts. Discharge has been confined to PAs 118, an existing upland confined PA. Best Management Practices would be utilized during construction of the levees to minimize dispersion of sediments.

(G) avoiding the impoundment or drainage of critical areas.

Compliance: There would be no impoundment or drainage of critical areas.

(2) 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:

(A) 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;

(B) limiting the solid, liquid, and gaseous components of material discharged;

(C) adding treatment substances to the discharged material; and (iv) adding chemical flocculants to enhance the deposition of suspended particulates in confined disposal areas,

Compliance: Material to be dredged complies with applicable standards for sediment toxicity.

(3) 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:

(A) use of containment levees and sediment basins designed, constructed, and maintained to resist breaches, erosion, slumping, or leaching;

(B) use of lined containment areas to reduce leaching where leaching of chemical constituents from the material is expected to be a problem;

(C) capping in-place contaminated material or, selectively discharging the most contaminated material first and then capping it with the remaining material;

(D) properly containing discharged material and maintaining discharge sites to prevent point and nonpoint pollution; and

(E) timing the discharge to minimize adverse effects from unusually high water flows, wind, wave, and tidal actions.

Compliance: Dredged material will be placed in PA 118, an upland confined placement area, with properly maintained levees.

(4) 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:

(A) where environmentally desirable, distributing the material in a thin layer;

(B) orienting material to minimize undesirable obstruction of the water current or circulation patterns;

(C) using silt screens or other appropriate methods to confine suspended particulates or turbidity to a small area where settling or removal can occur;

(D) using currents and circulation patterns to mix, disperse, dilute, or otherwise control the discharge;

(E) minimizing turbidity by using a diffuser system or releasing material near the bottom;

(F) selecting sites or managing discharges to confine and minimize the release of suspended particulates and turbidity and maintain light penetration for organisms; and

(G) setting limits on the amount of material to be discharged per unit of time or volume of receiving waters.

Compliance: Dredged material will be placed in a confined placement area with properly maintained levees. Training levees will be used to ensure the material is dispersed evenly within the site.

(5) 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:

(A) using appropriate equipment, machinery, and operating techniques for access to sites and transport of material, including those designed to reduce damage to critical areas;

(B) having personnel on site adequately trained in avoidance and minimization techniques and requirements; and

(C) 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.

Compliance: Materials would be pumped by pipeline and hydraulic pipeline dredge to PA 18. Personnel familiar with the equipment that would be to ensure avoidance and minimization is adhered to.

(6) Adverse effects on plant and animal populations from dredging and dredged material disposal or placement can be minimized by:

(A) avoiding changes in water current and circulation patterns that would interfere with the movement of animals;

Compliance: Changes to water current and circulation patterns would be localized, minimal, and would not adversely interfere with the movement of animals.

(B) 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;

Compliance: The project would create areas of disturbance that may be conducive to the establishment of undesirable species, however, it is not expected to increase colonization of invasive species as PA 118 has regularly been used to for placement of dredged material.

(C) avoiding sites having unique habitat or other values including habitat of endangered species;

Compliance: No Federal endangered or threatened species are expected to be found within the project area.

(D) 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;

Compliance: Impacts resulting from construction of the proposed project would be fully mitigated

by the restoration of emergent tidal marsh and shallow water habitat adjacent to Texas Parks and Wildlife's Mad Island Marsh Wildlife Management Area. Habitat Evaluation Procedure (HEP) Analysis has been conducted to assess environmental impacts associated with construction of the proposed project and to plan for appropriate mitigation.

(E) 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;

Compliance: Discharge has been confined to PA 118, an existing upland confined PA, and Impacts resulting from construction of the proposed project would be fully mitigated by the restoration of emergent tidal marsh and shallow water habitat adjacent to Texas Parks and Wildlife's Mad Island Marsh Wildlife Management Area.

(F) timing dredging and dredged material disposal or placement activities to avoid spawning or migration seasons and other biologically critical time periods; and

Compliance: If construction occurs during a biologically critical time period, additional resource agency coordination of construction would be undertaken, especially to ensure compliance with the Endangered Species Act.

(G) avoiding the destruction of remnant natural sites within areas already affected by development.

Compliance: The project is in an area already disturbed by an existing PA.

(7) Adverse effects on human use potential from dredging and dredged material disposal or placement can be minimized by:

(A) 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;

Compliance: Discharge has been confined to PA 118, an existing upland confined PA which has been historically used for GIWW maintenance dredging.

(B) selecting sites which are not valuable as natural aquatic areas;

Compliance: The restoration of 12 acres emergent tidal marsh and shallow water habitat adjacent to Texas Parks and Wildlife's Mad Island Marsh Wildlife Management Area would more than compensate for the loss of aquatic natural areas resulting from project impacts.

(C) 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

Compliance: Recreational activities associated with the site are not unique to the surrounding area.

Ample opportunity would exist to recreate in similar areas within the GIWW during dredging and dredged material placement activities.

(D) selecting sites that will not increase incompatible human activity or require frequent dredge or fill maintenance activity in remote fish and wildlife areas.

Compliance: The project would not increase incompatible human activity or require frequent dredge or fill maintenance activities in remote fish and wildlife areas.

(8) Adverse effects from new channels and basins can be minimized by locating them at sites:

(A) that ensure adequate flushing and avoid stagnant pockets; or

(B) 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

(C) 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;

(D) 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).

Compliance: No new channels or basins would be constructed as part of the proposed project.

(c) 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.

Compliance: Discharge has been confined to PA 118, an existing upland confined PA which has been historically used for GIWW maintenance dredging and would comply with requirements of paragraph (1) of this section.

(d) Dredged material from dredging projects in commercially navigable waterways is a potentially reusable resource and must be used beneficially in accordance with this policy.

Compliance: There are no cost effective opportunities for beneficial use of dredged material.

(1) 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.

(2) 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:

(A) environmental benefits, recreational benefits, flood or storm protection benefits, erosion prevention benefits, and economic development benefits;

(B) the proximity of the beneficial use site to the dredge site; and

(C) the quantity and quality of the dredged material and its suitability for beneficial use.

Compliance: There are no cost effective opportunities for beneficial use of dredged material.

(3) Examples of the beneficial use of dredged material include, but are not limited to:

(A) projects designed to reduce or minimize erosion or provide shoreline protection;

(B) projects designed to create or enhance public beaches or recreational areas;

(C) projects designed to benefit the sediment budget or littoral system;

(D) projects designed to improve or maintain terrestrial or aquatic wildlife habitat;

(E) projects designed to create new terrestrial or aquatic wildlife habitat, including the construction of marshlands, coastal wetlands, or other critical areas;

(F) projects designed and demonstrated to benefit benthic communities or aquatic vegetation;

(G) projects designed to create wildlife management areas, parks, airports, or other public facilities;

(H) projects designed to cap landfills or other waste disposal areas;

(I) projects designed to fill private property or upgrade agricultural land, if cost-effective public beneficial uses are not available; and

(J) projects designed to remediate past adverse impacts on the coastal zone.

Compliance: There are no cost effective opportunities for beneficial use of dredged material.

(e) If dredged material cannot be used beneficially as provided in subsection (d) (2) of this section, to avoid and otherwise minimize adverse effects as required in paragraph (a) of this subsection, preference will be given to the greatest extent practicable to disposal in:

(1) contained upland sites;

(2) other contained sites; and

(3) open water areas of relatively low productivity or low biological value.

Compliance: Discharge has been confined to PA 118, an existing upland confined PA.

(f) 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.

Compliance: This project would be constructed under Federal navigation servitude.

APPENDIX D

Other Agency Coordination

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

December 20, 2012

Environmental Section

Mr. Rusty Swafford
National Marine Fisheries Service
Habitat Conservation Division
4700 Avenue U
Galveston, Texas 77551-5997

Dear Mr. Swafford:

This letter is in regard to the proposed installation of a barge mooring facility along the south shoreline of the Gulf Intracoastal Waterway (GIWW) near Port O'Connor in Calhoun County, Texas. The proposed mooring facility would provide a transitory mooring point for barge traffic to wait during periods when inclement conditions exist due to excessive winds or currents on Matagorda Bay. The proposed mooring facility would be installed approximately three miles west of the former mooring basin site that was located on the GIWW in Port O'Connor but which was removed due to congestion and safety concerns at that location. The proposed mooring basin site and the location of the former mooring basin are shown in the enclosed figure (Enclosure 1).

Construction dredging activities would impact approximately two acres of seagrass dominated by shoal grass (*Halodule wrightii*) within the proposed mooring basin footprint. To mitigate for these impacts, a breakwater would be constructed between Mad Island Cut and Culver's Cut along the north shore of the GIWW adjacent to the Texas Parks and Wildlife Department's 7,281-acre Mad Island Marsh Wildlife Management Area (Enclosure 2). The breakwater would serve to: 1) reduce erosion and therefore potentially stop the loss of estuarine and palustrine marsh immediately adjacent to the GIWW, 2) potentially stop the loss of interior estuarine and palustrine marsh habitat and marsh productivity due to increased salt water intrusion, and 3) establish two acres of emergent marsh in the area between the breakwater and the natural shoreline. The breakwater would contribute to a larger effort to protect the 7-mile length of shoreline from Mad Island Cut to Culver's Cut.

We are working to finalize a Draft Environmental Assessment (EA) for the proposed project that includes a description of EFH resources in the project area and an evaluation of the project's potential impact to these resources. Pursuant to regulations published by the National Marine Fisheries Service (NMFS) (50 CFR 600.805 through 600.930) under the Magnuson Stevens Fishery Conservation and Management Act, we request that the NMFS review the enclosed sections of the Draft EA (Enclosure 3) and provide written comments regarding the EFH resources in the project area and the potential project impacts that have been described.

We would appreciate your timely review of these documents and comments by January 18, 2013. If you have any questions or need additional information, please contact Mr. Mark Garza at the letterhead address, by telephone at 409-766-6348, or by email at mark.garza@usace.army.mil.

Sincerely,

Andrea Catazaro

for Carolyn Murphy
Chief, Environmental Section

Enclosures
1. Proposed Mooring Facility Location
2. Proposed Mitigation Location
3. EFH Section of the Draft EA

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

June 5, 2012

Colonel Christopher W. Sallese
District Engineer U.S. Army Corps of Engineers
(Attn: Mark Garza)
P.O. Box 1229
Galveston, Texas 77553-1229

Re: Fish and Wildlife Coordination Act Planning Aid Letter for the Port O'Connor Mooring Basin Proposed Mitigation Project

Dear Colonel Sallese:

This letter constitutes the U.S. Fish and Wildlife Service's (Service) Planning Aid Letter (PAL) on the Galveston District, U.S. Army Corps of Engineers' (USACE) Port O'Connor Mooring Basin and Proposed Mitigation Project in accordance with Section 2(b) of the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). The purpose of this letter is to identify and evaluate the suitability of proposed mitigation for the impacts of the construction of a mooring basin on the Gulf Intracoastal Waterway (GIWW) near Port O'Connor, Calhoun Co., Texas.

The Service is mandated to provide expertise during the planning and development of major federal projects, to ensure fish and wildlife resources are conserved, and that impacts to these resources are avoided or minimized.

Project Background:

The Service has been coordinating informally on the proposed mooring basin and options for mitigation for the impacts of the project since summer, 2010. On November 10, 2010, the USACE hosted an interagency meeting to review the proposed Port O'Connor Mooring Basin Project and potential mitigation options for the project. The proposed mooring basin is a relocation of an existing facility. The existing barge mooring basin had been located since 2005 on the south shoreline of the GIWW approximately 5000 feet west of the intersection of the GIWW with Matagorda Bay. The facility provided moorings for tows transiting the GIWW across Matagorda Bay when winds and/or currents were too high to allow a safe crossing of the bay. An increase in boat traffic associated with development in the Port O'Connor area has increased congestion around the existing basin making the facility unsafe for mooring tows. The USACE proposes to relocate the mooring basin approximately 3 miles west along the same

shoreline. The new facility would require dredging an area adjacent to the GIWW to a depth of 14 feet. The new facility would impact approximately 2 acres of seagrasses dominated by shoal grass (*Halodule wrightii*). The USACE has proposed 3 options for mitigating the seagrass impacts of the new mooring basin. The options include 2 seagrass mitigation sites and a mitigation project for the construction of a marsh protection breakwater at the Mad Island Wildlife Management Area.

Project Area Description:

The proposed mooring basin extends approximately 6,200 feet along the south shoreline of the GIWW. The western-most terminus of the basin begins near The Sanctuary housing development and extends to the east. Currently, the property immediately opposite the proposed basin on the north shoreline is undeveloped. The new facility is adjacent to Blackberry Island north of the Matagorda Island Ferry Channel.

There are three proposed mitigation sites, two of the sites are proposed as seagrass mitigation projects, and the third is a marsh protection and enhancement project. Potential Mitigation Site #1 (Site #1) is located adjacent to and west of an existing USACE beneficial use site at the Turnstake Island intersection. Site #1 is a seagrass planting, habitat creation project in submerged, unvegetated bay bottom. Potential Mitigation Site #2 (Site #2) is located along the north shoreline of Matagorda Bay southeast of Mad Island Lake. Site #2 is also a seagrass planting, habitat creation project in submerged, unvegetated bay bottom. Potential Mitigation Site #3 (Site #3) is an extension of the Mad Island Marsh Ecosystem Restoration Project designed by the USACE with the Texas Nature Conservancy (TNC) as the non-Federal sponsor. Site #3 would involve the construction of approximately 3,000 feet of breakwater to protect existing marsh habitat to the north and to facilitate the creation of additional emergent marsh between the breakwater and the existing marsh shoreline.

Fish and Wildlife Resources:

The southern shorelines of the areas along the GIWW from the Turnstake Island intersection to Matagorda Bay are typically steep as a result of the construction of levees for dredge material placement and the effects of commercial and recreational boat traffic in the less than 500 foot-wide waterway that lies between the mainland and the fringing islands along Espiritu Santo Bay. Seagrass beds are located in scattered patches along both shorelines of this part of the GIWW where they have not been eliminated by boat wakes or the construction of hard structures such as bulkheads. Some narrow bands of emergent marsh remain between submerged areas of the channel and upland slopes. The USACE proposes to avoid emergent marsh at the site to the extent possible in the construction of the mooring basin.

Proposed mitigation areas Site #1 and Site #2 are currently unvegetated bay bottom. Although the Service generally supports in-kind mitigation for project impacts, the Service expressed concerns about these two alternatives in email and telephone communications to the USACE. Site #1 is located in an area that would be exposed to strong winds and currents. With regard to both Site #1 and Site #2, the Service questions the ability to transform unvegetated bay bottom to seagrass beds, without additional structures. Where seagrasses can establish and grow,

generally, they establish naturally. No sizes were proposed for Site #1 and Site #2, and no wave-protection structures were proposed to be installed to protect the new plantings. At the November 2010, upon further investigation by the USACE, Site #2 was determined to be unacceptable because the shoreline proposed for the project is within the boundary of a designate USACE dredge material placement site. Additionally, the USACE agreed with the concerns of the Service and other resource agencies regarding the vulnerability of Site #1.

Therefore, Site #3 and the construction of a breakwater that would protect existing emergent marsh and facilitate the creation of additional marsh habitat is the USACE's preferred mitigation project for the mooring basin project impacts. Although Site #3 would be out-of-kind mitigation for the seagrass impacts, the USACE indicated they will conduct habitat modeling to determine the appropriate equivalent amount of habitat units that need to be created by the project at Site #3 to offset the approximate 2 acres of seagrass impacts at the mooring basin site. The Service supports this approach and recommends that the USACE provide the results of their modeling efforts to the Service and other resource agencies as documentation for the final mitigation project design. The mitigation project proposed at Site #3 is part of a larger shoreline protection and enhancement effort along this shoreline. Grant applications by TNC for additional breakwater construction outline in greater detail the diversity of Gulf coast habitats that would benefit by shoreline protection structures along this shoreline. The grant application emphasizes that:

> The protected areas will include diverse habitats ranging from saline to freshwater marsh, native tall grass coastal prairie, freshwater lakes, oak/hackberry mottes, and Tamaulipan Scrub. Saline and brackish and freshwater marsh habitats are important to coastal fisheries, providing nursery and spawning habitat. Native coastal prairie, lakes, oak/hackberry mottes and Tamaulipan scrub provide habitat to over 200 species of native and migratory songbirds, shorebirds, colonial nesting birds, wading birds and waterfowl.

The protection and enhancement of avian species is of special importance to the Service as birds are trust resources of the Service. Through the Migratory Bird Treaty Act of 1918, as amended (MBTA), the Service was given authority to enforce provisions of the MBTA. Additionally, the Service's migratory bird program goals are to protect, restore, and manage migratory bird populations. The Service is responsible for maintaining healthy migratory bird populations for the benefit of the American people.

Federally Regulated Species:

The proposed mooring basin project and preferred mitigation project are located in Calhoun County and Matagorda County respectively. The species, federally-listed as threatened or endangered, for these counties, as well as any candidates, are listed in the enclosure to this letter. Federally-regulated species that should be considered in the decision-making process for the construction of the mooring basin and the proposed mitigation project at Site #3 include the West Indian manatee (*Trichechus manatus*), piping plover (*Charadrius melodus*), whooping crane (*Grus americana*), northern aplomado falcon (*Falco femoralis septentrionalis*), Gulf coast

jaguarundi (*Herpailurus yagouaroundi cacomitli*), brown pelican (*Pelecanus occidentalis*), and the five species of sea turtles that occur on the Texas coast, as well as migratory birds.

Section 7 of the Endangered Species Act of 1973, as amended (ESA) requires that all Federal agencies consult with the Service to ensure that actions authorized, funded or carried out by such agencies do not jeopardize the continued existence of any listed threatened or endangered species or adversely modify or destroy critical habitat of such species. *It is the responsibility of the Federal action agency to determine if the proposed project may affect threatened or endangered species.* If a "may affect" determination is made, the Federal agency shall initiate the formal section 7 consultation process by writing to: Field Supervisor; U.S. Fish and Wildlife Service; c/o TAMU-CC, Unit 5837; 6300 Ocean Drive; Corpus Christi, Texas 78412-5837. If no effect is evident, no further consultation is needed; however, we would appreciate the opportunity to review the criteria used to arrive at that determination.

The Service appreciates the opportunity to coordinate with the USACE on the proposed project and to provide our comments and recommendations through this PAL. If you have any questions regarding the contents of this PAL, please contact Pat Clements at 361-994-9005, or by email at pat_clements@fws.gov.

Sincerely,

for Allan M. Strand
Field Supervisor

Encl: Federally listed threatened and endangered species of Calhoun and Matagorda counties, Texas.

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

October 17, 2012

CESWG-PE-PR

Mr. Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
P.O. Box 12276
Austin, TX 78711-2276

CONCUR
by [signature]
for Mark Wolfe
State Historic Preservation Officer
Date 11/19/2012
Track# 201301640

Dear Mr. Wolfe:

The U.S. Army Corps of Engineers, Galveston District, in cooperation with the Texas Department of Transportation (TXDOT) has developed plans to install a new mooring basin along the southern shoreline of the Gulf Intracoastal Waterway (GIWW). The proposed project is located along the Port O'Connor to Corpus Christi reach of the GIWW in Texas.

The proposed project is to install a barge mooring basin along the south shoreline of the GIWW near Port O'Connor in Calhoun County, Texas (Figure 1). The mooring facility would replace the facility that previously was located in Port O'Connor but was removed due to congestion and safety concerns at that location. It would provide a transitory mooring point for barge traffic during periods when inclement conditions exist due to excessive winds or currents on Matagorda Bay. The facility would provide tows with a place to wait for safer conditions.

Until 2005, a mooring facility was located on the south shoreline of the GIWW opposite Port O'Connor. The facility provided moorings for tows transiting the GIWW across Matagorda Bay, which is located immediately to the east of Port O'Connor. However, with increasing development on Port O'Connor's waterfront along the north side of the GIWW which resulted in increased use of the area, this area became congested and became an unsafe location for the mooring facility. The mooring buoys at the facility were therefore removed. An alternate facility at a more appropriate location is now needed to provide for safe mooring.

The proposed mooring basin would involve dredging a basin and installing of twelve mooring buoys south of the GIWW channel and immediately north of Blackberry Island. The depth of the basin would be 14 feet (the GIWW authorized depth of 12 feet plus an allowed overage of 2 feet). The side slopes of the basin would be 3:1 (3 feet horizontal to each foot vertical). The north side of the GIWW channel, opposite the mooring basin, would be widened by about 15 feet. Dredged material would be placed in existing USACE Placement Area 118, which is adjacent to the proposed mooring site. Figure 2 shows a plan view for the proposed mooring basin.

Installation of the proposed mooring basin would impact approximately 2 acres of seagrasses. In order to mitigate for these impacts, a breakwater of approximately 1,930 linear

feet will be constructed along the northern shoreline of the GIWW, approximately 5 miles southwest of the town of Matagorda in Matagorda County, Texas (Figure 3). This breakwater would serve to reduce shoreline erosion and restore approximately 12 acres of emergent tidal marsh and shallow water habitat. A plan view of the breakwater is shown in Figure 4. The proposed mooring basin is located entirely within a portion of the GIWW that is not considered high probability for containing historic properties as of the most recent update to state tracts provided by the Texas Historical Commission.

The proposed mitigation area has been inventoried three times for cultural resources: Hubbard et al. 1996, *Archeological Investigations at Mad Island Wildlife Management Area, Matagorda County, Texas*; Moore et al. 1992, *An Archeological Survey of a Wavefront, Inc., Seismic Line, Mad Island Wildlife Area, Matagorda County, Texas*; and Gadus and Freeman 2005, *Cultural Resources Survey of the Gulf Intracoastal Waterway from the Brazos River Floodgates to Port O'Connor, Brazoria, Calhoun, and Matagorda Counties, Texas*. The most recent survey was conducted by Prewitt and Associates, Inc. (PAI) under contract with the Galveston District (Gadus and Freeman 2005). No archeological resources or Historic Properties were identified within or adjacent to the proposed mitigation area.

Therefore, the USACE requests your concurrence with our determination that no historic properties investigations are needed and that construction of the proposed mooring basin may proceed and with our determination of "no Historic Properties present" for the proposed mitigation area. Thank you for your cooperation. If you have any questions or require additional information, please call staff archeologist Jerry Androy at (409) 766-3821.

Sincerely,

Carolyn Murphy
Chief, Environmental Section

Enclosure

APPENDIX E

Endangered Species Coordination and Biological Assessment

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

February 28, 2012

CESWG-PE-PR

Mr. David M. Bernhart
Assistant RA for Protected Resources
Southeast Regional Office
National Marine Fisheries Service
263 13th Avenue South
St. Petersburg, FL 33701

Dear Mr. Bernhart:

This letter is in regard to the proposed installation of a barge mooring facility along the south shoreline of the Gulf Intracoastal Waterway (GIWW) near Port O'Connor in Calhoun County, Texas. The mooring facility would serve to replace the facility that was previously located in Port O'Connor which was removed due to congestion and safety concerns at that location. The mooring facility would be installed approximately three miles west of the former facility and would eliminate the congestion and safety concerns of the former site. The mooring facility would provide a transitory mooring point for barge traffic during periods when inclement conditions exist due to excessive winds or currents on Matagorda Bay. The facility would provide tows with a place to wait for safer conditions. The proposed project site is shown in the enclosed figure (Enclosure 1). The figure also shows the location of the former site.

To mitigate for the impacts associated with the proposed installation of this mooring facility, we are considering construction of a breakwater that would be constructed along the north shore of the GIWW adjacent to the Texas Parks and Wildlife Department's and The Nature Conservancy's Mad Island Marsh Preserve in Matagorda County. Emergent tidal marsh habitat would be restored in the sheltered area between the breakwater and the shoreline. The length of breakwater required to create an appropriate amount of marsh habitat has yet to be determined, but construction would occur somewhere along the area highlighted in red and labeled as "Project Location" in the enclosed figure (Enclosure 2).

To facilitate compliance with the requirements of Section 7, subsection (a) (2) of the Endangered Species Act Amendments of 1978, a list of any species which is listed or proposed to be listed, that may be present in the areas of the proposed action and mitigation area is requested.

If you or your staff has any questions regarding this activity, please contact Mark Garza by phone at (409) 766-6348 or by e-mail at mark.garza@usace.army.mil.

Sincerely,

Carolyn Murphy
Chief, Environmental Section

Enclosures
1. Proposed Mooring Facility Location
2. Mitigation Location

From: Adam Brame
To: Garza, Mark SWG
Subject: mooring facility near Port O"Connor
Date: Monday, March 19, 2012 9:19:59 AM

Mr. Garza,
The Protected Resources Division of NMFS received a letter requesting a species list of any protected species which may be present in the area of your proposed project. Our website (http://sero.nmfs.noaa.gov/pr/endangered%20species/specieslist/PDF2012/Texas.pdf) lists 5 species of whales and 5 species of sea turtles that may be present in Texas waters. Since your project is located in estuarine waters, only the turtles would likely apply, unless this new mooring facility would increase barge traffic in offshore waters where whales may be struck.
If I can be of any further assistance please feel free to contact me.
Regards,
Adam

--

Adam Brame
National Marine Fisheries Service
NOAA Southeast Regional Office
Protected Resources Division
263 13th Ave. South
St. Petersburg, FL 33701
ph: (727) 209-5958
fax: (727) 824-5309

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

February 28, 2012

Mr. Allan Strand
Field Supervisor
U.S. Fish and Wildlife Service
Ecological Services Field Office
6300 Ocean Drive, TAMUCC Unit 5837
Corpus Christi, TX 78412

Dear Mr. Strand:

This letter is in regard to the proposed installation of a barge mooring facility along the south shoreline of the Gulf Intracoastal Waterway (GIWW) near Port O'Connor in Calhoun County, Texas. The mooring facility would serve to replace the facility that was previously located in Port O'Connor which was removed due to congestion and safety concerns at that location. The mooring facility would be installed approximately three miles west of the former facility and would eliminate the congestion and safety concerns of the former site. The mooring facility would provide a transitory mooring point for barge traffic during periods when inclement conditions exist due to excessive winds or currents on Matagorda Bay. The facility would provide tows with a place to wait for safer conditions. The proposed project site is shown in the enclosed figure (Enclosure 1). The figure also shows the location of the former site.

To mitigate for the impacts associated with the proposed installation of this mooring facility, we are considering construction of a breakwater that would be constructed along the north shore of the GIWW adjacent to the Texas Parks and Wildlife Department's and The Nature Conservancy's Mad Island Marsh Preserve in Matagorda County. Emergent tidal marsh habitat would be restored in the sheltered area between the breakwater and the shoreline. The length of breakwater required to create an appropriate amount of marsh habitat has yet to be determined, but construction would occur somewhere along the area highlighted in red and labeled as "Project Location" in the enclosed figure (Enclosure 2).

To facilitate compliance with the requirements of Section 7, subsection (a) (2) of the Endangered Species Act Amendments of 1978, a list of any species which is listed or proposed to be listed, that may be present in the areas of the proposed action and mitigation area is requested.

If you or your staff has any questions regarding this activity, please contact Mark Garza by phone at (409) 766-6348 or by e-mail at mark.garza@usace.army.mil.

Sincerely,

Carolyn Murphy
Chief, Environmental Section

Enclosures
1. Proposed Mooring Facility Location
2. Mitigation Location

DRAFT BIOLOGICAL ASSESSMENT
FOR FEDERALLY-LISTED
THREATENED AND ENDANGERED SPECIES

GULF INTRACOASTAL WATERWAY
PORT O'CONNOR TO CORPUS CHRISTI BAY, TEXAS
SECTION 216

1.0 INTRODUCTION

1.1 PURPOSE OF THE BIOLOGICAL ASSESSMENT

This Biological Assessment (BA) is being prepared to fulfill the U.S. Army Corps of Engineers' (USACE) obligations under Section 7(c) of the Endangered Species Act (ESA) of 1973, as amended. It is also being prepared to assist the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) in fulfilling their obligations under the ESA. The proposed Federal action to install a barge mooring basin along the south shoreline of the Gulf Intracoastal Waterway (GIWW) near Port O'Connor in Calhoun County, Texas. The mooring facility would replace the facility that previously was located in Port O'Connor but was removed due to congestion and safety concerns at that location. It would provide a transitory mooring point for barge traffic during periods when inclement conditions exist due to excessive winds or currents on Matagorda Bay. The facility would provide tows with a place to wait for safer conditions.

Installation of the mooring basin would impact approximately 2 acres of seagrass, therefore mitigation would be accomplished by constructing a breakwater along the north bank of the GIWW in Matagorda County, Texas. The breakwater would serve to reduce shoreline erosion and would create approximately 2 acres of emergent tidal marsh in the sheltered area between the breakwater and shoreline. This BA addresses the project's potential to affect federally-listed threatened and endangered species and species of concern in Calhoun County where the proposed project is to occur as well as in Matagorda County where the proposed mitigation is to occur.

1.2 DESCRIPTION OF THE PROPOSED PROJECT AND MITIGATION

The proposed mooring basin would involve dredging a basin and installing of twelve mooring buoys south of the GIWW channel and immediately north of Blackberry Island. The basin would be installed beginning approximately 4 miles west of Port O'Connor at GIWW Station 649+500, extending west and ending at GIWW Station 655+900. The depth of the basin

would be 14 feet (the GIWW authorized depth of 12 feet plus an allowed overage of 2 feet). The side slopes of the basin would be 3:1 (3 feet horizontal to each foot vertical). A 24-inch cutter-suction dredge would be used to perform dredging operations. The total amount of material to be dredged is 160,000 cubic yards. Dredged material would be placed in existing USACE Placement Area 118 located on Blackberry Island, which is adjacent to the proposed mooring site. Figure 1 shows the location of the proposed mooring basin. Figure 2 shows a plan view of the proposed mooring basin.

Figure 1 – Map of Project Location

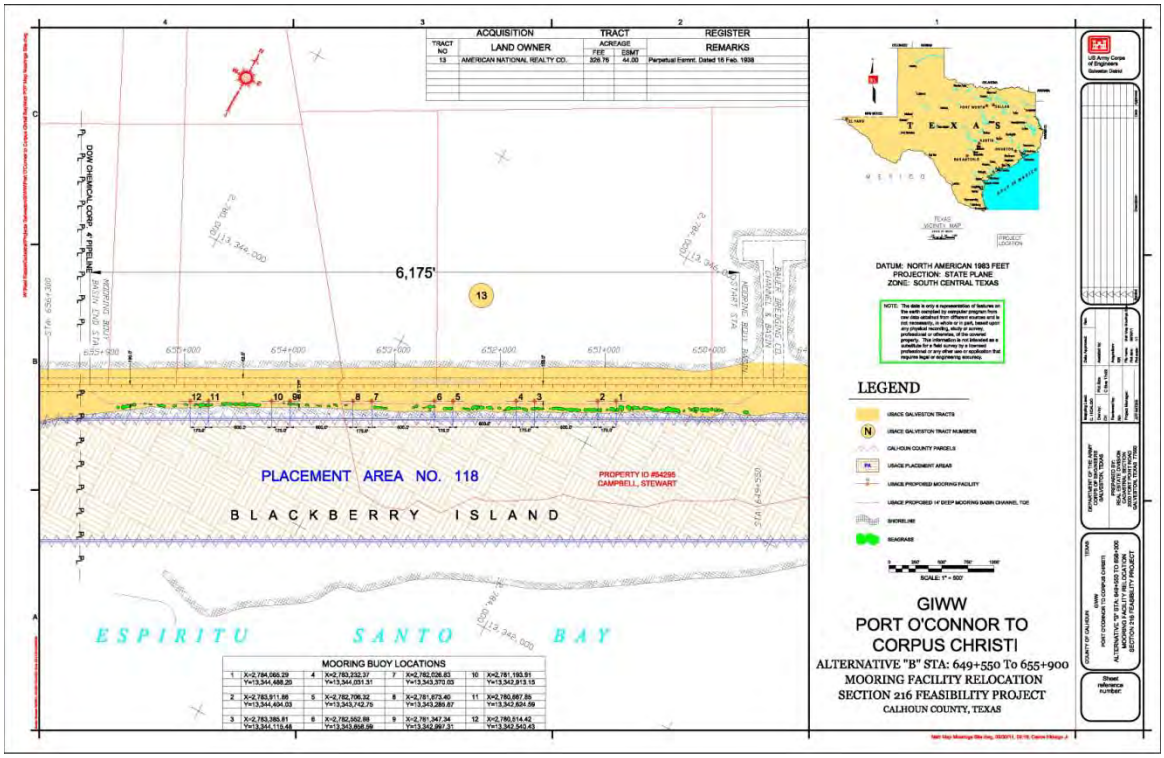


Figure 2 – Plan View of Proposed Mooring Basin

Mitigation for impacts to seagrasses would be accomplished by constructing approximately 1,845 feet of breakwater along the north bank of the GIWW from GIWW Stations 467+300 to 469+170. The breakwater would serve to reduce shoreline erosion and would restore approximately 2 acres of emergent tidal marsh in the sheltered area between the breakwater and the south shoreline the Texas Parks and Wildlife Department's Mad Island Wildlife Management Area. One 50-foot open section would be incorporated into the breakwater to provide for tidal circulation and ingress/egress of estuarine organisms such as fish and shrimp into the area behind the breakwater. The proposed breakwater would be located immediately west of Culver's Cut in Matagorda County, Texas which is approximately 3 miles west of the town of Matagorda (Figure 3). A plan view of the proposed breakwater is shown in Figure 4.

Figure 3 – Location of Proposed Mitigation Breakwater

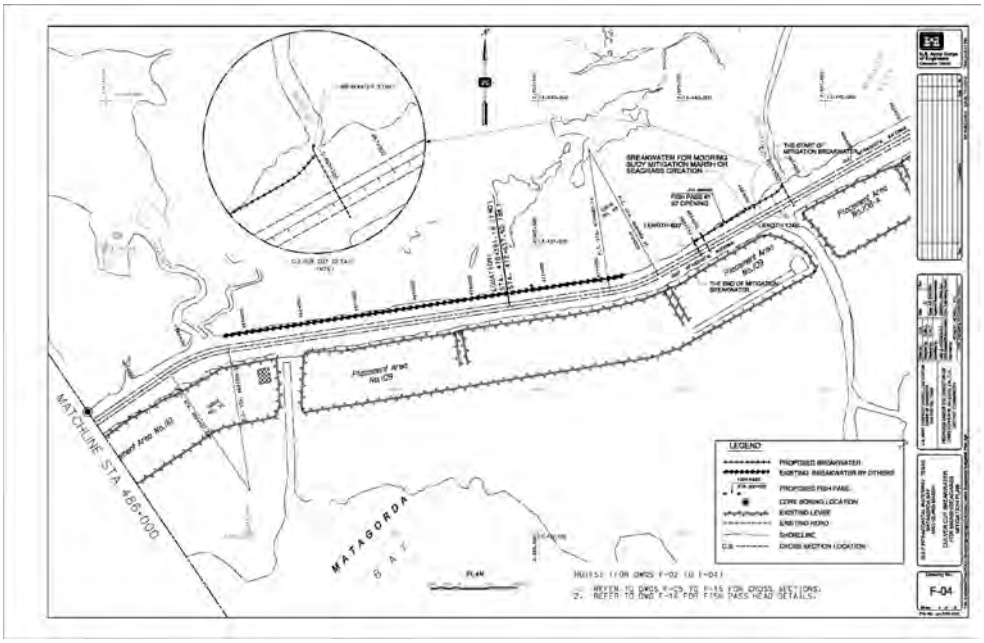


Figure 4 – Plan View of Proposed Mitigation Breakwater

2.0 FEDERALLY-LISTED THREATENED AND ENDANGERED SPECIES AND SPECIES OF CONCERN

The proposed project area is located in the GIWW in Calhoun County, Texas, approximately 4 miles west of the town of Port O'Connor. This area is on the mid-coast of the Gulf of Mexico. The proposed mitigation area is located along the north bank of the GIWW in Matagorda County, Texas, approximately 3 miles west of the town of Matagorda. This area is also on the mid-coast of the Gulf of Mexico. Table 1 includes the list of threatened and endangered species and species of concern considered by the USFWS and the NMFS to occur in Texas and/or Matagorda and Calhoun Counties. These species were identified from lists obtained from databases managed by the USFWS (USFWS, 2012a, 2012b) and NMFS (NMFS 2012).

Table 1
List of Threatened and Endangered Species and Species of Concern for Matagorda County and Calhoun County, TX

Common Name	Scientific Name	Listing Status	
		USFWS	NMFS
BIRDS			
Bald Eagle	*Haliaeetus leucocephalus*	Delisted & being monitored	N/A
Brown Pelican	*Pelecanus occidentalis*	Delisted & being monitored	N/A
Piping Plover	*Charadrius melodus*	Threatened	N/A
Northern aplomado falcon*	*Falco femoralis septentrionalis*	Endangered	N/A
Whooping Crane	*Grus Americana*	Endangered	N/A
MAMMALS			
West Indian manatee	*Trichechus manatus*	Endangered	N/A
Gulf Coast jaguarondi*	*Herpailurus yagouaroundi cacomitli*	Endangered	N/A
REPTILES			
Green sea turtle	*Chelonia mydas*	Threatened	Threatened
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Endangered
Loggerhead sea turtle	*Caretta caretta*	Threatened	Threatened
MARINE MAMMALS			
Blue whale	*Balaenoptera musculus*	N/A	Endangered
Finback whale	*Balaenoptera physalus*	N/A	Endangered

Humpback whale	*Megaptera novaengliae*	N/A	Endangered
Sei whale	*Balaenoptera borealis*	N/A	Endangered
Sperm whale	*Physeter macrocephalus*	N/A	Endangered
FISH			
Scalloped hammerhead shark	*Sphyrna lewini*	N/A	Candidate Species
Dusky shark	*Carcharhinus obscurus*	N/A	Species of Concern
Opossum pipefish	*Microphis brachyurus lineatus*	N/A	Species of Concern
Sand tiger shark	*Carcharias taurus*	N/A	Species of Concern
Speckled hind	*Epinephelus drummondhayi*	N/A	Species of Concern
Warsaw grouper	*Epinephelus nigritus*	N/A	Species of Concern
INVERTEBRATES			
Boulder star coral	*Montastraea annularis*	N/A	Candidate Species
Boulder star coral	*Montastraea franksi*	N/A	Candidate Species
Elliptical star coral	*Dichocoenia stokesii*	N/A	Candidate Species
Lamarck's sheet coral	*Agaricia lamarcki*	N/A	Candidate Species
Mountainous star coral	*Montastraea faveolata*	N/A	Candidate Species
Pillar coral	*Dendrogyra cylindrus*	N/A	Candidate Species
Rough cactus coral	*Mycetophyllia ferox*	N/A	Candidate Species

***** Listed in Calhoun County only.

2.1 SPECIES DESCRIPTIONS

Of the species listed in Table 1, only the brown pelican, all five species of sea turtles, and the piping plover are likely to occur in the vicinity of, or in areas adjacent to, the project and mitigation areas. Other species listed on Table 1 are not likely to occur in the vicinity of the project or mitigation areas due to lack of suitable habitat, known range limits, or they are presumed to be extinct. There is no designated critical habitat for any of the listed species within the project area or mitigation areas. Of the species in Table 1, only the brown pelican is known to

have regular occurrence in the project/mitigation area vicinity. Species descriptions follow below.

2.2 BROWN PELICAN

The brown pelican is a common bird of Texas coastal and near-shore areas and they occur in the project/mitigation areas. Foraging or resting area in bay waters in the vicinity of the project may become less attractive during construction because of increased noise and human activity, but the habitat would not be destroyed.

2.3 SEA TURTLES

Green sea turtle. The green sea turtle was historically the most abundant sea turtle in Texas. Over harvesting and destruction of nesting habitat brought about a rapid decline, although this species can still be found on the seagrass meadows of the lower Laguna Madre. This species is most likely to occur in the southern bays of Texas where clear water and seagrass and algal beds are more abundant. It is not likely to occur along the mid-Texas coast or in the project/mitigation areas.

Hawksbill sea turtle. This turtle is extremely rare in Texas coastal waters and is not expected to be present in the project/mitigation areas.

Kemp's ridley sea turtle. The Kemp’s ridley sea turtle migrates along the coast of Texas and is probably the most common sea turtle in Texas bays. It frequently enters bays to feed on shrimp, crab, and other invertebrates. This species is found in Matagorda Bay and may be present in waters in the vicinity of the project/mitigation areas.

Leatherback sea turtle. The leatherback turtle is rare along the Texas coast. It is a pelagic species that tends to keep to deeper offshore waters where it feeds primarily on jellyfish. There are no known aggregation sites or feeding areas in the project/mitigation areas and the species is not expected to be present.

Loggerhead sea turtle. The loggerhead sea turtle frequents the temperate waters of the continental shelf along the Atlantic coast and Gulf of Mexico, where it forages around rocks, coral reefs, and shellfish beds. Sub-adults also commonly enter Texas bays, lagoons, and estuaries. This species may be present in bay waters in the vicinity of the project/mitigation areas.

2.4 PIPING PLOVER

While designated critical habitat units for piping plover occur on the Matagorda Peninsula, these species are not likely to occur in the vicinity of the project due to lack of suitable habitat along the GIWW. The shorelines along the GIWW in the vicinity of the proposed project and mitigation areas primarily consist of small, narrow stretches of smooth cordgrass with intermittent patches of sand and shell hash. These areas are continuously disturbed by ongoing maintenance dredging activities, commercial shipping and recreational vessel traffic and other human activities making these areas unsuitable for piping plover.

3.0 EFFECTS OF THE PROPOSED ACTION ON LISTED SPECIES

The following sections provide the findings of the USACE Galveston District and species specific avoidance, minimization, and conservation measures that support the effect determinations presented. Effect determinations are presented using the language of the ESA:

- *No effect* - the proposed action will not affect a federally-listed species or critical habitat;

- *May effect, but not likely to adversely affect* - the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial; or

- *Likely to adversely affect* - adverse effects to listed species and/or critical habitat may occur as a direct result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or completely beneficial. Under this determination, an additional determination is made whether the action is likely to jeopardize the continued survival and eventual recovery of the species.

3.1 BROWN PELICAN

Foraging brown pelicans are common along the Texas coast and may be found in the project area. However, no nesting sites are located in the project/mitigation areas. Although the waters surrounding the project/mitigation areas may be used by pelicans for feeding or resting, these birds are highly mobile and are able to relocate to avoid disturbance from construction activities. Although there may be disturbance of feeding and displacement during construction, these are localized activities that would not negatively affect this species' feeding, nesting, or resting activities overall. We conclude that the project will have no affect on the brown pelican.

3.2 SEA TURTLES

It is unlikely that leatherback and hawksbill sea turtles would occur in the project/mitigation areas due to their scarcity. Green sea turtles most likely occur in the southern bays of Texas where clear water and seagrass and algal beds are more abundant Turtles that may occur in bay waters near the project area include the Kemp's ridley and loggerhead sea turtles. The proposed project involves dredging activities within the GIWW. However, these activities would be accomplished by cutterhead dredge, as opposed to hopper dredges that may impact sea turtles. Placement of dredged material would be in an existing upland confined PA where no suitable habitat exists for potential nesting turtles. Therefore, the project is not expected to affect sea turtles.

3.3 PIPING PLOVER

The project and mitigation areas are located along the GIWW, a man-made channel cut through marsh and uplands with an eroding marsh shoreline. The GIWW has a high level of barge and recreational vessel traffic. Due to the high level of disturbance and the lack of suitable habitat in the project or mitigation areas, the proposed project will have no effect on this species.

4.0 CONCLUSIONS

Construction and placement activities for the proposed project and associated mitigation are short-term and would occur along the areas of the GIWW which undergo routine maintenance dredging and placement activities. The routine maintenance activities and commercial and recreational vessel traffic produce disturbances similar to those expected from the construction dredging and placement being proposed. For these reasons, the proposed action is not expected to impact any listed species or their critical habitat as discussed in this BA. Therefore, no effect on any of the federally-listed species or their critical habitat is anticipated.

5.0 LITERATURE CITED

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APPENDIX F

Habitat Evaluation Procedures Analysis Report

Habitat Evaluation Procedure Analysis

Gulf Intracoastal Waterway,
Port O'Connor to Corpus Christi, Texas, Project
Proposed Mooring Basin
Calhoun County, Texas

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September 2011

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1.0 BACKGROUND INFORMATION

1.1 PROJECT DESCRIPTION

The U.S. Army Corps of Engineers (USACE), Galveston District, proposes to construct a mooring basin as part of the Gulf Intracoastal Waterway (GIWW), from Port O'Connor to Corpus Christi, Texas, Project (Figure 1). The proposed mooring basin would be located south of the GIWW channel and immediately north of Blackberry Island to replace a basin that was previously removed due to vessel traffic congestion. The USACE has begun preparation of an Environmental Assessment (EA). As part of the EA, a Habitat Evaluation Procedure (HEP) analysis is required for the proposed project.

The proposed mooring basin element would involve the dredging of a basin and the installation of 12 mooring buoys south of the GIWW channel and immediately north of Blackberry Island. The depth of the basin would be 14 feet (the GIWW authorized depth of 12 feet plus an allowed overage of 2 feet). Dredged material would be placed in USACE Placement Area 118, which is adjacent to the proposed mooring site. See Figure 2 for a conceptual design drawing.

1.2 HEP OVERVIEW

The HEP, developed by the U.S. Fish and Wildlife Service (USFWS), is a method used to quantify the impacts of a proposed project by evaluating the ability of the wildlife habitat within a study area to provide key components necessary for specific wildlife species (USFWS, 1980). HEP is a species-habitat approach to impact assessment that quantifies habitat quality for selected evaluation species through the use of a habitat suitability index (HSI). The HSI value is derived from an evaluation of the ability of key habitat components to provide the life requisites of selected species of wildlife (USFWS, 1980). HEP is based on the assumption that habitat for selected species can be described at a specified point in time by an HSI. The species HSI is multiplied by the area of available habitat at that time to determine the total habitat units (HU) for the species for particular cover types in the study area.

The first step of the HEP analysis, the baseline assessment, describes the existing habitat conditions in terms of HUs for the study area. The next step involves projecting future habitat conditions in the defined project area in terms of HUs and comparing the future habitat conditions with the proposed project to the future habitat conditions without the proposed project. To do so, the HUs are integrated over time for each scenario and then annualized by the life of the project to derive an Average Annual Habitat Unit (AAHU) for each scenario. The impact of the proposed project is equal to the difference between the future “without project” AAHUs and the future “with project” AAHUs. The quantitative project impact value is then used to determine the mitigation required to compensate for the habitat lost as a result of the proposed project.

2.0 HEP BASELINE ASSESSMENT

The HEP baseline assessment was conducted in January 2011. The baseline assessment determined cover types present within the proposed project area and evaluated the habitat quality of such cover types to which impact is anticipated and mitigation would be necessary. The objective of the baseline assessment is to record and quantify the habitat quality of cover types in terms of HUs prior to construction.

Delineation of the project area was based on conceptual design drawings and preliminary plans. The project area boundaries extend southeast from the existing GIWW channel southeast top of cut to the proposed mooring basin top of cut adjacent Blackberry Island. Provided a 3:1 channel side slope and given the locations of the proposed mooring basin channel toe and the existing GIWW channel toe, the top of cut was assumed to be approximately 40 feet southeast of each of these features. As defined, the project area encloses 17.62 acres.

2.1 COVER TYPE DESCRIPTIONS

The cover types identified within the project area, as described by Cowardin et al. (1979), consist of estuarine subtidal rooted vascular aquatic bed (E1AB3) and estuarine subtidal unconsolidated bottom (E1UBL).

Approximately 2.0 acres of the E1AB3 cover type, also referred to as seagrass areas, were identified within the project area. Submerged aquatic vegetation was observed within the seagrass areas and was comprised of shoal grass (*Halodule wrightii*). Shoal grass beds were observed in areas that are permanently inundated with tidal waters. Construction of the mooring basin is expected to impact the entire extent of the seagrass areas. At the time of sampling for the baseline assessment, none of the seagrass within the project footprint had been impacted. See Figure 3 for seagrass locations.

No submerged aquatic vegetation was observed within the E1UBL areas, also referred to as open-bay bottom. These areas are permanently inundated with tidal waters. Approximately 15.62 acres of the E1UBL cover type was determined to be within the project footprint. Construction of the mooring basin would impact all 15.62 acres of the E1UBL cover type.

The data collected within these areas is assumed to be representative of the conditions present within the project area prior to construction. Because the project area would impact the seagrass and estuarine subtital unconsolidated bottom cover types, these acreages were included in the analysis for a total project area of 17.62 acres.

2.2 HSI MODEL SELECTION

HSI model selection was based on species utilization of the seagrass and open-bay bottom cover types. Two HSI models were selected to evaluate habitat quality: red drum (*Sciaenops ocellatus*) (Buckley, 1984) and white shrimp (*Penaeus setiferus*) (Turner and Brody, 1983). These species were selected based on their ecological dependence upon the habitat that would be impacted by the proposed action. Each of the two species was separately evaluated, yielding individual AAHU values that were averaged for the cover type that was evaluated, which is discussed further in Section 3. Additional details regarding the selection of each species are provided below.

Red drum (*Sciaenops ocellatus*) is an estuarine-dependent species found along the Atlantic coast and in the Gulf of Mexico. The red drum HSI model was selected to be incorporated into the HEP analysis for this project because of this species' importance to commercial and recreational fisheries. The red drum HSI is designed for use throughout their range and can be used to assess habitat suitability for both their larval or juvenile life stages. No model was developed for the adult stage because adults are highly mobile and tolerate a wide range of environmental conditions. Of the two models developed for the larval and juvenile red drum, one is designed for use in estuaries with naturally vegetated substrates and the other for use in estuaries that cannot support bottom vegetation because of natural factors such as high turbidity. Each model utilizes different variables. These HSI models are applicable in the estuarine subtidal habitat classes of Cowardin et al. (1979). The naturally vegetated substrate HSI model for the red drum was utilized for the mooring basin project area because the project area contains submerged aquatic vegetation.

White shrimp (*Penaeus setiferus*) occur in both marine and estuarine habitats, depending on life stage. Adult shrimp spawn offshore in marine waters. Post-larval shrimp enter estuaries where they are highly dependent on coastal wetlands for food and habitat cover. Juvenile shrimp leave the estuary and move offshore to mature into adults. White shrimp HSI models should be used to evaluate areas with salt and brackish marshes with alternately flooding and receding waters and submerged seagrass beds, which is representative of the project area E1AB3 cover type. The white shrimp HSI model was selected to be incorporated into the HEP analysis for this project due to the importance of this species to commercial and recreational fisheries.

2.3 SAMPLING METHODOLOGY

Sixteen evenly spaced sample points along a transect line, as depicted on Figure 4, were established within the project area for habitat parameter sampling. The transect was aligned within the seagrass areas and parallel to the GIWW and Blackberry Island. The appropriate habitat data for each species was observed and recorded within an approximate 10-foot radius at each sampling location. Field data sheets are included in Attachment A, and representative photographs are included in Attachment B. Data for water quality variables were obtained from long-term water quality monitoring datasets recorded by the

Texas Water Development Board (TWDB). Water quality data from the Texas Parks and Wildlife Department (TPWD)–TWDB "Matagorda" Hydrolab Datasonde were utilized as the data source for the project area, as this was the closest available monitoring station to the project site. Aerial photographic interpretation and bathymetric data were also utilized to aid in data compilation. Species-specific HSI model variables that were sampled are described in Table 1.

Table 1
HSI Model Variables for Project Area

Habitat Variable	Species	
	Red Drum	White Shrimp
Substrate composition[1]		X
Mean temperature[2]	X	X
Mean salinity[2]	X	X
% of open water fringed with persistent emergent vegetation[3]	X	
% of open water supporting growth of submerged vegetation[3]	X	
% estuary covered by vegetation[3]		X

1 Data obtained from visual observation (January 2011).
2 Data obtained from TPWD-TWDB Hydrolab Datasonde website (TWDB, 2009).
3 Estimated from observations made during transect assessments (January 2011) and aerial photointerpretation (FSA, 2010).

2.4 BASELINE ASSESSMENT RESULTS

A HEP baseline assessment was conducted for each evaluation species. Data were applied to species-specific HSI models over one cover type to obtain HSI scores for red drum and white shrimp. Observed data was referenced to suitability index (SI) graphs, found in the species-specific HSI model reports, to obtain suitability indices based on graph-derived mathematical equations, where applicable, and on categorical values. Suitability indices were then used in model-defined HSI equations to complete the HSI analysis. Subsequent sections describe the derivation of HSIs for each species. The baseline HSI scores are included in Attachment C.

2.4.1 Red Drum HSI Model

The HSI model for the red drum in estuaries with naturally submerged vegetation is based on four habitat variables, described in Table 2, aggregated into two life requisites (water quality and food/cover) for larval and juvenile red drum. Optimal water quality conditions are assumed to occur when:

- The mean water temperature is between 25 and 30°C
- The mean salinity is between 25 and 30 ppt

Optimal feeding conditions are assumed to occur when:

- 100 percent of open water is fringed by persistent emergent vegetation

Optimal cover conditions are assumed to occur when:

- The percentage of area covered by submerged vegetation is between 50 and 75 percent

See Table 2 for results of the field survey and data collection, along with SI scores for each red drum variable. Water quality habitat variables (V_1 and V_2) included in this model were obtained from long-term monitoring data from TPWD. Vegetation data (V_3) were obtained via qualitative observations made in the field. Percentage of area covered by submerged vegetation was obtained via visual assessment during transect sampling.

Table 2
Baseline Habitat Variables, Observed Data, and Suitability Index for Red Drum

Habitat Variable Category	Habitat Variable	Habitat Variable Description	Cover Type	
			E1AB3 and E1UBL	
			Observed	SI
Temperature	V_1	Mean Temperature (°C)	24.55	0.96
Salinity	V_2	Mean salinity (ppt)	26.7	1.00
Vegetation	V_3	Percent of open water fringed with persistent emergent vegetation (%)	7%	0.26
Submerged Vegetation	V_4	Percent of open water supporting growth of submerged vegetation	11%	0.23

The mathematical equations used to determine HSI for red drum in estuaries with naturally submerged vegetation are as follows:

Water quality = $(V_1^2 \times V_2)^{1/3}$
Food/cover = $(V_3 \times V_4)^{1/2}$
HSI = water quality or food/cover, whichever is lower

The calculations for the HSI based on the above equations are as follows:

Water quality = $(0.96^2 \times 1.0)^{1/3} = 0.97$
Food/cover = $(0.26 \times 0.23)^{1/2} = 0.24$
HSI = 0.24

The baseline HSI score for the red drum is 0.24.

2.4.2 White Shrimp HSI Model

The HSI model for the white shrimp in estuarine habitats is based on four habitat variables, described in Table 3, that are aggregated into two life requisites (food/cover and water quality). Optimal food/cover conditions are assumed to occur in estuaries that:

- Are covered by 100 percent cover of vegetation (marsh and seagrass)
- Have substrate composition comprised of a soft bottom with peaty silts and/or organic mud with decaying vegetation and organic material

Optimal water quality conditions are assumed to occur when:

- The mean summer salinity is between 1 and 15 ppt
- The mean summer water temperature is between 20 and 30°C

See Table 3 for results of the field survey and data collection, along with SI scores for each white shrimp variable. Water quality habitat variables (V_{3w} and V_4) included in this model were obtained from long-term monitoring data from TPWD. Vegetation data (V_1) and substrate composition were obtained via visual assessment during transect sampling.

Table 3
Baseline Habitat Variables, Observed Data, and Suitability Index for White Shrimp

Habitat Variable Category	Habitat Variable	Habitat Variable Description	Cover Type	
			E1AB3 and E1UBL	
			Observed	SI
Vegetation	V_1	Estuary covered by vegetation (%)	11%	0.11
Substrate	V_{2w}	Substrate composition	Hard Bottom	0.20
Water Quality	V_{3w}	Mean summer salinity (ppt)	29.07	0.06
	V_4	Mean summer water temperature (°C)	28.42	1.00

The mathematical equations used to determine HSI for white shrimp in estuarine habitats are as follows:

Food/cover = $(V_1^2 \times V_{2w})^{1/3}$
Water quality = $(V_{3w} \times V_4)^{1/2}$
HSI = water quality or food/cover, whichever is lower

The calculations for the HSI based on the above equations are as follows:

Food/cover = $(0.11^2 \times 0.2)^{1/3} = 0.13$
Water quality = $(0.06 \times 1.0)^{1/2} = 0.25$
HSI = 0.13

The baseline HSI score for the white shrimp is 0.13.

2.4.3 Results

HSI scores for each species were determined and then multiplied by the acreage of the available habitat to obtain HUs. Baseline HSIs and HUs for the project area are summarized by evaluation species in Table 4.

Table 4
Habitat Units Within the Study Area at Baseline

Cover Types	Evaluation Species	Evaluation Species' HSI	Total Area of Habitat in Project Area (acres)	Evaluation Species HUs
E1AB3 & E1UBL	Red drum	0.24	17.62	4.23
	White shrimp	0.13		2.29

3.0 HEP ANALYSIS BACKGROUND INFORMATION

Federal projects are evaluated over a period of time that is referred to as the "period of analysis" and includes a "pre-start period" and the "life of the project" as defined by the HEP Manual (USFWS, 1980). The pre-start period is the construction period. The life of the project is defined as that period between the times the project becomes operational (end of construction period) and the end of the project life, as determined by the lead agency, which is a 50-year period for this project. Although called "life of the project," the project is expected to last over 50 years, and benefits will still be derived from the project after the 50-year period. For the purposes of this project, the pre-start period is defined as 2011 through 2012, and the life of the project extends from 2013 through 2062. Habitat conditions (HSI and area) described for each target year represent the expected conditions at the end of that year.

Impact analysis projects future habitat conditions over the period of analysis in terms of average annual habitat units (AAHUs) and determines the net impact of the proposed project. AAHUs were calculated for the habitat conditions within the project area with the proposed project constructed (with project) and the habitat conditions within the mooring basin area without the proposed project constructed (without project). The following equation was used to determine cumulative HUs for each target year (USFWS, 1980).

$$\text{Cumulative Habitat Units} = (\text{T2} - \text{T1})\left(\frac{\text{A2H2}-\text{A1H1}}{3}\right) + \left(\frac{\text{A2H1}-\text{A1H2}}{6}\right)$$

T1 = First target year of time interval
T2 = Last target year of time interval
A1 = Habitat area of first target year
A2 = Habitat area of last target year
H1 = HSI of first target year
H2 = HSI of last target year

The cumulative HUs were annualized by summing the cumulative HUs for all years in the period of analysis and dividing the total by the number of years in life of the project, resulting in AAHUs. The net average annual impact of the proposed project is equal to the difference between the "without project" AAHUs and the "with project" AAHUs. The required mitigation for the project is determined based on the net average annual impact of the proposed project compared to such value for mitigation activities within the proposed mitigation area from similar analysis, as discussed further below and in Section 6.

The mitigation alternatives analysis evaluates the habitat associated with the proposed mitigation site (described in Section 6) using the HSI models for the same two evaluation species. Whether the required mitigation for the proposed project is likely to be achieved through proposed mitigation activities is determined based on the predicted net average annual benefit (in AAHUs) for the mitigation area, which is equal to the difference between the "without project" AAHUs and the "with project" AAHUs.

4.0 HEP ANALYSIS METHODS

The project impact analysis involves projecting future habitat conditions in terms of AAHUs and comparing the projected habitat conditions with the proposed project to the projected habitat conditions without the proposed project. The net average annual impact of the proposed project is equal to the difference between the "without project" AAHUs and the "with project" AAHUs. To determine future AAHUs, HSI variable values were predicted for interval years over the period of analysis. In order to predict HSI variable values, assumptions for future conditions were established. The assumptions listed in Table 5 were used to predict the future HSI variable values for the "with project" and "without project" conditions.

Table 5
HSI Variable Assumptions

HSI Model	Variable	Habitat Variable	Assumption	
			With Project	Without Project
Red Drum	V_1	Mean temperature	Mean temperature would remain consistent with baseline conditions.	Mean temperature would remain consistent with baseline conditions.
	V_2	Mean salinity	Salinity would remain consistent with baseline conditions.	Salinity would remain consistent with baseline conditions.
	V_3	% of open water fringed with persistent emergent vegetation*	Emergent vegetation would not be impacted by the proposed project and would remain consistent with baseline conditions.	Emergent vegetation would remain consistent with baseline conditions.
	V_4	% of open water supporting growth of submerged vegetation	Submerged vegetation would be removed and re-colonization is not anticipated due to boat traffic and routine maintenance.	Percent of open water supporting growth of submerged vegetation would remain consistent with baseline conditions.

HSI Model	Variable	Habitat Variable	Assumption	
			With Project	Without Project
White Shrimp	V_1	% of estuary covered by vegetation*	Baseline conditions are 11% vegetation cover, of which all is seagrass. Percentage of seagrass within the project area would be reduced to 0% at TY1 due to construction of project. Submerged aquatic vegetation would not re-establish due to boat traffic and routine maintenance.	Percentage of estuary in the project area covered by vegetation would remain consistent with baseline conditions.
	V_{2w}	Substrate composition	Substrate composition would remain consistent with baseline conditions.	Substrate composition would remain consistent with baseline conditions.
	V_{3w}	Mean summer salinity	Mean summer salinity would remain consistent with baseline conditions.	Mean summer salinity would remain consistent with baseline conditions.
	V_4	Mean summer water temperature	Mean summer water temperature would remain consistent with baseline conditions.	Mean summer water temperature would remain consistent with baseline conditions.

* Cover of emergent vegetation was estimated through observation.

5.0 HEP ANALYSIS PROJECT IMPACT RESULTS

A project impact analysis using HEP was conducted for each evaluation species. The HSI scores for each evaluation species were predicted over the period of analysis under the assumptions presented in Section 4.0. The projected HSI scores are presented in Attachment C. The proposed project would impact 2.0 acres of seagrass and 15.62 acres of open-bay bottom.

The "with project" AAHUs and the "without project" AAHUs were determined by multiplying the HSI scores in Attachment C by the area of available habitat by species, integrating over the period of analysis, and annualizing the cumulative HUs. The AAHUs calculated for the "with project" conditions and the "without project" conditions are presented in Attachment D.

Predicted AAHUs and the net impacts associated with the proposed project are summarized by cover type in Table 6.

Table 6
Net Impact in Terms of AAHUs

Evaluation Species	Total Area of Habitat at Baseline Year (acres)[a]	"Without Project" AAHUs	"With Project" AAHUs	Net Impact AAHUs
Red drum	17.62	4.23	0.04	-4.19
White shrimp	17.62	2.29	0.02	-2.27
Average Net Impact AAHUs		**3.26**	**0.03**	**-3.23**

[a]Total area of habitat for species stable throughout the life of the project.

Over the period of analysis, the habitat within the project area would provide an interspecies average 3.26 AAHUs without the proposed project and 0.03 AAHU with the proposed project. The proposed project would impact 17.62 acres of red drum and white shrimp habitat. The loss of habitat over the period of analysis based on aforementioned assumptions would result in an average net impact of -3.23 AAHUs.

6.0 MITIGATION ANALYSIS

The purpose of the mitigation analysis is to determine the mitigation requirements based on the net impact of the project. Proposed mitigation includes installation of a rock breakwater structure along the GIWW in Matagorda County along the shoreline of the Mad Island Wildlife Management Area, an estuarine wetland ecosystem managed by TPWD. Project completion will result in permanent protection and restoration of critically important terrestrial and estuarine wildlife habitats by mitigating the effects of wave energy on unprotected shorelines and limiting threats of saltwater intrusion into brackish and freshwater coastal marshes. Currently, a breakwater exists to the west of the proposed mitigation area and was constructed under the Mad Island Shoreline Protection and Ecosystem Restoration project. This breakwater promotes marsh creation and stabilization of a currently eroding bank. The proposed mitigation plan will add to this existing breakwater project and has been coordinated with various resource agencies for approval.

A mitigation analysis was conducted for the same evaluation species, red drum and white shrimp, assessed for the project area. Similarly, the approach included a site visit to the proposed mitigation area, which was conducted on August 22, 2011. Locations of sampling points taken during the site visit are presented on Figure 5. Sampling methods used and variables recorded were as described for the project area (Section 4). The proposed mitigation area currently consists of estuarine subtidal unconsolidated bottom (E1UBL) with adjacent upland cover, limited estuarine inter-tidal emergent marsh (E2EM), and no estuarine subtidal rooted vascular aquatic bed (E1AB3). The proposed mitigation project in this area would mitigate for impacts to the subtidal aquatic vegetation within the project area.

The HSI scores for each evaluation species within the proposed mitigation area were predicted over the period of analysis under assumptions presented below.

- Construction of the mitigation area will be completed in 2013.

- Data for water quality variables of the mitigation site were obtained from the TPWD-TWDB "East Matagorda Bay" Hydrolab Datasonde. The East Matagorda Bay monitoring station was the closest available to the mitigation site.

- Naturally nonvegetated substrate HSI model was used for red drum because no submerged aquatic vegetation was observed in the mitigation site nor is it likely that under current conditions such vegetation could establish in this location due to high turbidity and wave action. Establishment of submerged aquatic vegetation is not anticipated in the mitigation area after breakwater construction. Use of this model includes the addition of one habitat variable: mean depth of estuarine open water area at low tide (V_6).

- Mitigation scenarios include breakwater installation with and without planting of persistent emergent marsh vegetation. It was assumed that vegetation of newly created marsh would be primarily dependent on accretion rates and both scenarios would allow vegetation of new marsh areas. However, planting would facilitate more rapid vegetation than achieved without planting.

Habitat variable assumptions are listed in Table 7.

Table 7
Mitigation Site Variable Assumptions

HSI Model	Variable	Habitat Variable	Mitigation Site Assumptions	
			With Project	Without Project
Red drum	V_1	Mean temperature	Mean temperature would remain consistent with baseline conditions throughout the period of analysis.	Mean temperature would remain consistent with baseline conditions throughout the period of analysis.
	V_2	Mean salinity	Mean salinity would remain consistent with baseline conditions throughout the period of analysis.	Mean salinity would remain consistent with baseline conditions throughout the period of analysis.
	V_3	Percentage of open water fringed with persistent emergent vegetation	Percentage of open water in the mitigation area fringed with persistent emergent vegetation would be expected to incrementally increase each year to achieve full (100%) coverage after the third year of growth with planting (TY3) or the fifth year (TY6) of the project life without planting.	Percentage of open water in the mitigation area fringed with persistent emergent vegetation would remain consistent with baseline conditions throughout the period of analysis.
	V_5	Substrate composition	Construction of breakwater would accumulate shoal material and change the substrate composition to mud beginning at TY4. Substrate would become mud by TY11 and would remain mud for the remainder of the period of analysis.	Substrate composition would remain consistent with baseline conditions throughout the period of analysis.
	V_6	Mean depth at low tide	Mean depth at low tide would remain consistent with baseline conditions throughout the period of analysis.	Mean depth at low tide would remain consistent with baseline conditions throughout the period of analysis.

HSI Model	Variable	Habitat Variable	Mitigation Site Assumptions	
			With Project	Without Project
White shrimp	V_1	Percentage of estuary covered by vegetation	Baseline conditions are ~0% cover, with limited marsh and no seagrass. Percentage of estuary in the mitigation area covered by vegetation would be expected to increase each year forward from TY1 until reaching ~17% in TY20. Thereafter, vegetation cover would remain stable through the life of the project (with and without planting).	Percentage of estuary in the mitigation area covered by vegetation would remain consistent with baseline conditions throughout the period of analysis.
	V_{2w}	Substrate composition	Construction of breakwater would accumulate shoal material and change the substrate composition to soft bottom over time.	Substrate composition would remain consistent with baseline conditions throughout the period of analysis.
	V_{3w}	Mean summer salinity	Mean summer salinity would remain consistent with baseline conditions throughout the period of analysis.	Mean summer salinity would remain consistent with baseline conditions throughout the period of analysis.
	V_4	Mean summer water temperature	Mean summer water temperature would remain consistent with baseline conditions throughout the period of analysis.	Mean summer water temperature would remain consistent with baseline conditions throughout the period of analysis.

Assumptions of habitat acreages at the mitigation site, with and without project, are included in Table 8.

Table 8
Assumption of Acreages at Mitigation Site

Target Year	Future With Project		Future Without Project	
	Open Water (E1UB)	Marsh (E2EM)	Open Water (E1UB)	Marsh (E2EM)
TY0 (2011) (Baseline)	17.62	0.03	17.62	0.03
TY1 (2013)	16.83	0.85	17.68	0.03
TY5 (2017)	15.79	1.89	18.32	0.03
TY10 (2022)	15.37	2.31	18.73	0.03
TY20 (2032)	14.74	2.94	19.54	0.03
TY30 (2042)	14.74	2.94	20.34	0.03
TY40 (2052)	14.74	2.94	21.15	0.03
TY50 (2062)	14.74	2.94	21.95	0.03
Net Change	–2.88	+2.91	+4.33	0

Baseline and projected HSI scores, HUs, AAHUs, and net impact analysis for the mitigation site with and without the proposed project are presented in Attachments E and F. Additionally, "with project" scenarios

are presented with and without planting. The proposed mitigation would result in net impact of +4.88 AAHUs with planting and +4.75 AAHUs without planting. The projected AAHUs by species and combined for the "future without project" and "future with project" (with and without planting) are presented and compared to project impacts in Table 9.

Table 9
Net AAHUs[1] for Mitigation Scenarios With and Without Planting
Compared to Project Impacts

Scenario	Red Drum	White Shrimp	Interspecies Average
Project Impacts	-4.19	-2.27	-3.23
Mitigation Scenarios			
without planting	5.67	3.83	4.75
(Δ *Net AAHU* s)	(*+1.48*)	(*+1.56*)	(*+1.52*)
with planting	5.80	3.95	4.88
(Δ *Net AAHU* s)	(*+1.61*)	(*+1.68*)	(*+1.65*)

[1] Net AAHUs = $AAHU_{WITH}$ – $AAHU_{WITHOUT}$
[2] Δ *Net AAHU* s = Mitigation Scenario Net AAHUs – Project Impact Net AAHUs

Accordingly, net impacts to evaluation species from proposed mitigation and project actions vary between species, as seen in Table 9. Overall, proposed mitigation activities would provide positive net benefits for both the red drum and white shrimp by this analysis. Based on equal replacement (equal trade-off) compensation, the net benefits provided to the evaluation species collectively would exceed the negative net impacts to these species under the proposed project by 1.65 AAHUs with planting and 1.52 AAHUs without planting.

Because evaluation of the candidate mitigation area indicates that such plans would overcompensate for project impacts, further analyses were conducted to better define the required mitigation for proposed project impacts. The following equation was used to calculate the area required to directly offset project impacts according to the HEP handbook (USFWS, 1980):

$$\text{Compensation Area} = -A\left(\frac{\sum_{i=1}^{n} I_i}{\sum_{i=1}^{m} M_i}\right)$$

Where:
A = size of candidate compensation study area
M = HUs gained through compensation for a target species
I = HUs lost for same species
i = species number
n = total number of evaluation species

The calculations for the compensation area with and without planting based on the above equation are as follows:

$$\text{Compensation Area (with planting)} = -17.67 \text{ ac} \left(\frac{(-209.33 \text{ HUs}) + (-113.39 \text{ HUs})}{290.12 \text{ HUs} + 197.59 \text{ HUs}} \right)$$
$$= -17.67 \text{ ac} \left(\frac{-322.72 \text{ HUs}}{487.71 \text{ HUs}} \right) = -17.67 \text{ ac} * -0.66170 = 11.69 \text{ acres}$$

$$\text{Compensation Area (without planting)} = -17.67 \text{ ac} \left(\frac{(-209.33 \text{ HUs}) + (-113.39 \text{ HUs})}{283.52 \text{ HUs} + 191.46 \text{ HUs}} \right)$$
$$= -17.67 \text{ ac} \left(\frac{-322.72 \text{ HUs}}{474.98 \text{ HUs}} \right) = -17.67 \text{ ac} * -0.67944 = 12.01 \text{ acres}$$

Determination of the area of mitigation that will directly offset project impacts requires several assumptions under the presented application. For one, restoration benefits from breakwater installation must be directly proportional to construction scale. Though localized differences may occur, overall it is assumed that a proportionally equivalent area of open water bay bottom (E1UBL) will receive benefits and new marsh will be created for such efforts regardless of the length of breakwater installed. Further, benefits are assumed to occur along the same timeline regardless of breakwater length. If such conditions are met, 11.69 acres of mitigation area with planting, or 12.01 acres without planting, will be required to directly offset project impacts based on HEP analysis using red drum and white shrimp as evaluation species over a 50-year project life.

7.0 REFERENCES

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Figures

Datum: NAD 1983
Projection: State Plane TX
Zone: South Central FIPS 4204
Units: Feet
Background: Bing Map

0 8 16 Miles

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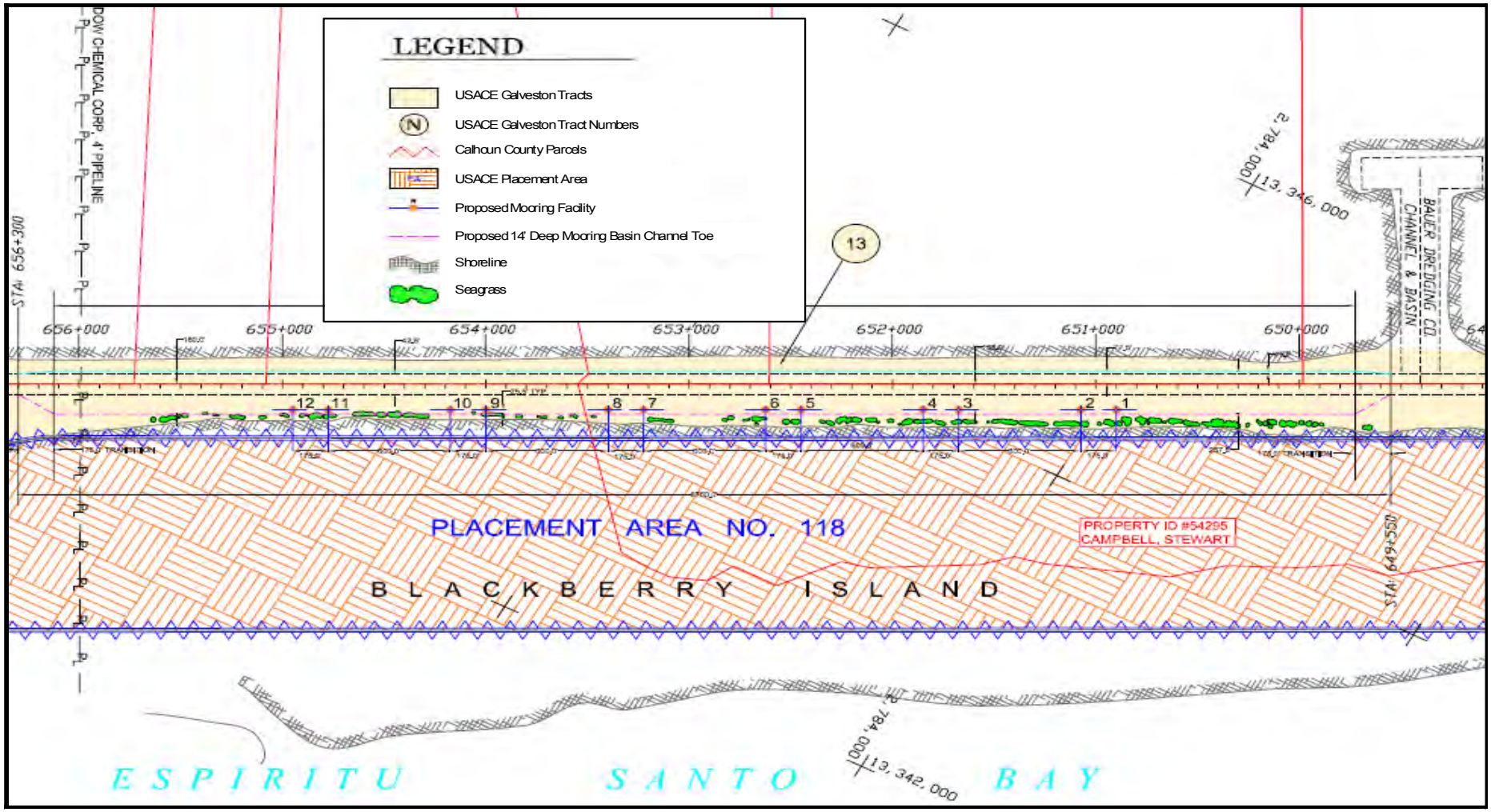
Figure 1
Project Vicinity Map
USACE Mooring Basin
HEP Analysis
Matagorda & Calhoun Counties, Texas

Prepared By: ATKINS/19955	Scale: 1 in = 15 miles
Job No.: 100015151	Date: Sep 09, 2011

File: N:\ENV\USACE\100015151\proj\A_vicinity_HEPAnlsis_aerial



Datum: NAD 83
Projection: State Plane TX
Zone: South Central
Units: Feet

* Provided by USACE

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Figure 2
Preliminary Design*
USACE Mooring Basin
HEP Analysis
Calhoun County, Texas

Prepared By: ATKINS/19955	Scale:
Job No.: 100015151	Date: Sep 09, 2011
File: N:\ENV\USACE\100015151\projects\mxd\A_CAD_Samplingpt	

Seagrass Area

Project Area

N

0 1,000 2,000 Feet

Datum: NAD 1983
Projection: State Plane TX
Zone: South Central FIPS 4204
Units: Feet
Aerial: NAIP USDA 2010, 1 Meter

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Figure 3
Project Location Map
USACE Mooring Basin
HEP Analysis
Calhoun County, Texas

Prepared By: ATKINS/19955	Scale: 1 in = 1,000 Ft.
Job No.: 100015151	Date: Sep 09, 2011

File: N:\ENV\USACE\10001515\projects\mxd\A_Location_Seagrass_Area

Seagrass Sampling Points

Project Area

Datum: NAD 1983
Projection: State Plane TX
Zone: South Central FIPS 4204
Units: Feet
Aerial: NAIP USDA 2010, 1 Meter

0 2,000 4,000 Feet

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Figure 4
Project Area
Sampling Point Map
USACE Mooring Basin
HEP Analysis
Calhoun County, Texas

Prepared By: ATKINS/19955	Scale: 1 in = 2,000 Ft.
Job No.: 100015151	Date: Sep 09, 2011
File: N:\ENV\USACE\10001515\projects\mxd\A_Location_Seagrass	

Mad Island Mitigation Area Sampling Points
Transects

Datum: NAD 1983
Projection: State Plane TX
Zone: South Central FIPS 4204
Units: Feet
Aerial: NAIP USDA 2010, 1 Meter

0 1,000 2,000 Feet

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Figure 5
Mad Island Mitigation Area
Sampling Point Map
USACE Mooring Basin
HEP Analysis
Matagorda County, Texas

Prepared By: ATKINS/19955	Scale: 1 in = 1,000 Ft.
Job No.: 100015151	Date: Sep 09, 2011

File: N:\ENV\USACE\10001515\projects\mxd\A_Location_Madisland

Attachment A

Field Data Sheets

Date: January 10, 2011

Mooring Basin HEP Field Data Sheet

Site SP1	Site SP2	Site SP3	Site SP4	Site SP5
Gulf menhaden	**Gulf menhaden**	**Gulf menhaden**	**Gulf menhaden**	**Gulf menhaden**
Water Color V_{12}	Water Color V_{12}	Water Color V_{12}	Water Color V_{12}	Water Color V_{12}
Brown or Green	Brown or Green	Brown or Green	Brown or Green	Brown or Green
Turquoise	Turquoise	Turquoise	Turquoise	Turquoise
Blue or Clear	Blue or Clear	Blue or Clear	Blue or Clear	Blue or Clear
Substrate Composition V_5	Substrate Composition V_5	Substrate Composition V_5	Substrate Composition V_5	Substrate Composition V_5
Mud	Mud	Mud	Mud	Mud
Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud
Sand and Shell	Sand and Shell	Sand and Shell	Sand and Shell	Sand and Shell
Red drum	**Red drum**	**Red drum**	**Red drum**	**Red drum**
% of open water edge fringed w/ persistent emergent vegetation V_3	% of open water edge fringed w/ persistent emergent vegetation V_3	% of open water edge fringed w/ persistent emergent vegetation V_3	% of open water edge fringed w/ persistent emergent vegetation V_3	% of open water edge fringed w/ persistent emergent vegetation V_3
0-100 5%	0-100 10	0-100 0	0-100 0	0-100 2
% of area covered by submerged vegetation V_4	% of area covered by submerged vegetation V_4	% of area covered by submerged vegetation V_4	% of area covered by submerged vegetation V_4	% of area covered by submerged vegetation V_4
0-100 15	0-100 15	0-100 15	0-100 20	0-100 30
White Shrimp	**White Shrimp**	**White Shrimp**	**White Shrimp**	**White Shrimp**
% of estuary covered by vegetation V_1	% of estuary covered by vegetation V_1	% of estuary covered by vegetation V_1	% of estuary covered by vegetation V_1	% of estuary covered by vegetation V_1
0-100 15	0-100 15	0-100 15	0-100 20	0-100 30
Substrate composition V_{2w}	Substrate composition V_{2w}	Substrate composition V_{2w}	Substrate composition V_{2w}	Substrate composition V_{2w}
Soft Bottom	Soft Bottom	Soft Bottom	Soft Bottom	Soft Bottom
Muddy Sands	Muddy Sands	Muddy Sands	Muddy Sands	Muddy Sands
Coarse or Hard Bottom	Coarse or Hard Bottom	Coarse or Hard Bottom	Coarse or Hard Bottom	Coarse or Hard Bottom

Date: January 10, 2011

Mooring Basin HEP Field Data Sheet

Site SP6	Site SP7	Site SP8	Site SP9	Site SP10
Gulf menhaden Water Color V_{12} Brown or Green Turquoise Blue or Clear	**Gulf menhaden** Water Color V_{12} Brown or Green Turquoise Blue or Clear	**Gulf menhaden** Water Color V_{12} Brown or Green Turquoise Blue or Clear	**Gulf menhaden** Water Color V_{12} Brown or Green Turquoise Blue or Clear	**Gulf menhaden** Water Color V_{12} Brown or Green Turquoise Blue or Clear
Substrate Composition V_5 Mud Sandy Mud Sand and Shell	Substrate Composition V_5 Mud Sandy Mud Sand and Shell	Substrate Composition V_5 Mud Sandy Mud Sand and Shell	Substrate Composition V_5 Mud Sandy Mud Sand and Shell	Substrate Composition V_5 Mud Sandy Mud Sand and Shell
Red drum % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 60	**Red drum** % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 25	**Red drum** % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 10	**Red drum** % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 0	**Red drum** % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 2
% of area covered by submerged vegetation V_4 0-100 30	% of area covered by submerged vegetation V_4 0-100 35	% of area covered by submerged vegetation V_4 0-100 40	% of area covered by submerged vegetation V_4 0-100 35	% of area covered by submerged vegetation V_4 0-100 50
White Shrimp % of estuary covered by vegetation V_1 0-100 30	**White Shrimp** % of estuary covered by vegetation V_1 0-100 35	**White Shrimp** % of estuary covered by vegetation V_1 0-100 40	**White Shrimp** % of estuary covered by vegetation V_1 0-100 35	**White Shrimp** % of estuary covered by vegetation V_1 0-100 50
Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom	Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom	Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom	Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom	Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom

Date: January 10, 2011

Mooring Basin HEP Field Data Sheet

Site SP11	Site SP12	Site SP13	Site SP14	Site SP15
Gulf menhaden Water Color V_{12} Brown or Green Turquoise Blue or Clear	**Gulf menhaden** Water Color V_{12} Brown or Green Turquoise Blue or Clear	**Gulf menhaden** Water Color V_{12} Brown or Green Turquoise Blue or Clear	**Gulf menhaden** Water Color V_{12} Brown or Green Turquoise Blue or Clear	**Gulf menhaden** Water Color V_{12} Brown or Green Turquoise Blue or Clear
Substrate Composition V_5 Mud Sandy Mud Sand and Shell	Substrate Composition V_5 Mud Sandy Mud Sand and Shell	Substrate Composition V_5 Mud Sandy Mud Sand and Shell	Substrate Composition V_5 Mud Sandy Mud Sand and Shell	Substrate Composition V_5 Mud Sandy Mud Sand and Shell
Red drum % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 0	**Red drum** % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 0	**Red drum** % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 0	**Red drum** % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 0	**Red drum** % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 0
% of area covered by submerged vegetation V_4 0-100 55	% of area covered by submerged vegetation V_4 0-100 40	% of area covered by submerged vegetation V_4 0-100 35	% of area covered by submerged vegetation V_4 0-100 60	% of area covered by submerged vegetation V_4 0-100 30
White Shrimp % of estuary covered by vegetation V_1 0-100 55	**White Shrimp** % of estuary covered by vegetation V_1 0-100 40	**White Shrimp** % of estuary covered by vegetation V_1 0-100 35	**White Shrimp** % of estuary covered by vegetation V_1 0-100 60	**White Shrimp** % of estuary covered by vegetation V_1 0-100 30
Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom	Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom	Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom	Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom	Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom

Date: January 10, 2011

Mooring Basin HEP Field Data Sheet

Site SP16

Gulf menhaden

Water Color V_{12}

Brown or (Green)

Turquoise

Blue or Clear

Substrate Composition V_5

Mud

(Sandy Mud)

Sand and Shell

Red drum

% of open water edge fringed w/ persistent emergent vegetation V_3

0-100 0

% of area covered by submerged vegetation V_4

0-100 60

White Shrimp

% of estuary covered by vegetation V_1

0-100 60

Substrate composition V_{2w}

Soft Bottom

Muddy Sands

(Coarse or Hard Bottom)

Date: August 22, 2011

Mooring Basin HEP Field Data Sheet

Mitigation area

Site 1	Site 2	Site 3	Site 4	Site 5
Pics 16-20	Pics 21-23	Pics 24-26	Pics 27-28	Pics 29-32
Gulf menhaden	**Gulf menhaden**	**Gulf menhaden**	**Gulf menhaden**	**Gulf menhaden**
Water Color V_{12}	Water Color V_{12}	Water Color V_{12}	Water Color V_{12}	Water Color V_{12}
Brown or Green	Brown or Green	~~Brown or Green~~	Brown or Green	Brown or Green
~~Turquoise~~	Turquoise	Turquoise	~~Turquoise~~	~~Turquoise~~
Blue or Clear	Blue or Clear	Blue or Clear	Blue or Clear	Blue or Clear
Substrate Composition V_5	Substrate Composition V_5	Substrate Composition V_5	Substrate Composition V_5	Substrate Composition V_5
Mud	Mud	Mud	Mud	Mud
Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	~~Sandy Mud~~
~~Sand and Shell~~	Sand and Shell Rock	Sand and Shell	Sand and Shell	Sand and Shell
Red drum	**Red drum**	**Red drum**	**Red drum**	**Red drum**
% of open water edge fringed w/ persistent emergent vegetation V_3	% of open water edge fringed w/ persistent emergent vegetation V_3	% of open water edge fringed w/ persistent emergent vegetation V_3	% of open water edge fringed w/ persistent emergent vegetation V_3	% of open water edge fringed w/ persistent emergent vegetation V_3
0-100	0-100	0-100	0-100	0-100
% of area covered by submerged vegetation V_4	% of area covered by submerged vegetation V_4	% of area covered by submerged vegetation V_4	% of area covered by submerged vegetation V_4	% of area covered by submerged vegetation V_4
0-100	0-100	0-100	0-100	0-100
White Shrimp	**White Shrimp**	**White Shrimp**	**White Shrimp**	**White Shrimp**
% of estuary covered by vegetation V_1	% of estuary covered by vegetation V_1	% of estuary covered by vegetation V_1	% of estuary covered by vegetation V_1	% of estuary covered by vegetation V_1
0-100	0-100	0-100	0-100	0-100
Substrate composition V_{2w}	Substrate composition V_{2w}	Substrate composition V_{2w}	Substrate composition V_{2w}	Substrate composition V_{2w}
Soft Bottom	Soft Bottom	Soft Bottom	~~Soft Bottom~~	Soft Bottom
Muddy Sands	Muddy Sands	Muddy Sands	Muddy Sands	Muddy Sands
Coarse or Hard Bottom	Coarse or Hard Bottom	~~Coarse or Hard Bottom~~	Coarse or Hard Bottom	~~Coarse or Hard Bottom~~

Get points for marsh acreage

Date: August 22, 2011

Pics 44-46
Barge + ICWW

Mooring Basin HEP Field Data Sheet

Mitigation area

Site 6 (DW 33-34)	Site 7 (DW Pics 35-37)	Site 8 (DW Pics 38-41)	Site 9 (DW Pics 42-43)	Site
Gulf menhaden Water Color V_{12} Brown or Green Turquoise Blue or Clear	**Gulf menhaden** Water Color V_{12} Brown or Green Turquoise Blue or Clear	**Gulf menhaden** Water Color V_{12} Brown or Green Turquoise Blue or Clear	**Gulf menhaden** Water Color V_{12} Brown or Green Turquoise Blue or Clear	**Gulf menhaden** Water Color V_{12} Brown or Green Turquoise Blue or Clear
Substrate Composition V_5 Mud Sandy Mud Sand and Shell	Substrate Composition V_5 Mud Sandy Mud Sand and Shell	Substrate Composition V_5 Mud Sandy Mud Sand and Shell	Substrate Composition V_5 Mud Sandy Mud Sand and Shell	Substrate Composition V_5 Mud Sandy Mud Sand and Shell
Red drum % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 0	**Red drum** % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 0	**Red drum** % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 10	**Red drum** % of open water edge fringed w/ persistent emergent vegetation V_3 0-100 10	**Red drum** % of open water edge fringed w/ persistent emergent vegetation V_3 0-100
% of area covered by submerged vegetation V_4 0-100 0	% of area covered by submerged vegetation V_4 0-100 0	% of area covered by submerged vegetation V_4 0-100 0	% of area covered by submerged vegetation V_4 0-100 0	% of area covered by submerged vegetation V_4 0-100
White Shrimp % of estuary covered by vegetation V_1 0-100 0	**White Shrimp** % of estuary covered by vegetation V_1 0-100 0	**White Shrimp** % of estuary covered by vegetation V_1 0-100 10	**White Shrimp** % of estuary covered by vegetation V_1 0-100 10	**White Shrimp** % of estuary covered by vegetation V_1 0-100
Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom	Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom	Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom	Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom	Substrate composition V_{2w} Soft Bottom Muddy Sands Coarse or Hard Bottom

Get points for marsh acreage

Attachment B

Representative Photographs

Gulf Intracoastal Waterway Port O'Connor to Corpus Christi, Texas Project
Proposed Mooring Basin and Mad Island Mitigation Area
Representative Photographs

Photo 1: Representative view of the Mooring Basin project area, facing northeast. Note the green water within the project area.

Photo 2: Representative view of the Mooring Basin project area, facing southwest. Note seagrass area in the lower portion of photograph and emergent vegetation along Blackberry Island.

Gulf Intracoastal Waterway Port O'Connor to Corpus Christi, Texas Project
Proposed Mooring Basin and Mad Island Mitigation Area
Representative Photographs

Photo 3: Representative view of Mad Island mitigation area.

Photo 4: Representative view of Mad Island mitigation area.

Attachment C

Baseline and Projected HSI Scores

Mooring Basin Baseline and Projected HSI Scores
Without Project

Red Drum HSI Model

		TY0		TY1		TY3		TY5		TY10		TY20		TY30		TY40		TY50	
Variable	Optimal	2011 (Baseline)	SI	2013	SI	2015	SI	2017	SI	2022	SI	2032	SI	2042	SI	2052	SI	2062	SI
V_1	25-30°C	24.55	0.96	24.55	0.96	24.55	0.96	24.55	0.96	24.55	0.96	24.55	0.96	24.55	0.96	24.55	0.96	24.55	0.96
V_2	25-30 ppt	26.7	1.00	26.7	1.00	26.7	1.00	26.7	1.00	26.7	1.00	26.7	1.00	26.7	1.00	26.7	1.00	26.7	1.00
$V_{3(\%)}$	100%	7%	0.26	7%	0.26	7%	0.26	7%	0.26	7%	0.26	7%	0.26	7%	0.26	7%	0.26	7%	0.26
$V_{4(\%)}$	50-75%	11%	0.22	11%	0.22	11%	0.22	11%	0.22	11%	0.22	11%	0.22	11%	0.22	11%	0.22	11%	0.22
Water Quality SI	$(V_1^2 \times V_2)^{1/3}$		0.97		0.97		0.97		0.97		0.97		0.97		0.97		0.97		0.97
Food/Cover SI	$(V_3 \times V_4)^{1/2}$		0.24		0.24		0.24		0.24		0.24		0.24		0.24		0.24		0.24
HSI	Lowest among WQSI or F/CSI		**0.24**		**0.24**		**0.24**		**0.24**		**0.24**		**0.24**		**0.24**		**0.24**		**0.24**

Mooring Basin Baseline and Projected HSI Scores
Without Project

White Shrimp HSI Model

		TY0		TY1		TY3		TY5		TY10		TY20		TY30		TY40		TY50	
Variable	Optimal	2011 (Baseline)	SI	2013	SI	2015	SI	2017	SI	2022	SI	2032	SI	2042	SI	2052	SI	2062	SI
$V_{1(\%)}$	100%	11%	0.11	11%	0.11	11%	0.11	11%	0.11	11%	0.11	11%	0.11	11%	0.11	11%	0.11	11%	0.11
V_{2w}	Soft Bottom	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20
V_{3w}	1-15 ppt	29.07	0.06	29.07	0.06	29.07	0.06	29.07	0.06	29.07	0.06	29.07	0.06	29.07	0.06	29.07	0.06	29.07	0.06
V_4	20-30°C	28.42	1.00	28.42	1.00	28.42	1.00	28.42	1.00	28.42	1.00	28.42	1.00	28.42	1.00	28.42	1.00	28.42	1.00
Water Quality SI	$(V_{3w} x\ V_4)^{1/2}$		0.25		0.25		0.25		0.25		0.25		0.25		0.25		0.25		0.25
Food Cover SI	$(V_1^2 x\ V_{2w})^{1/3}$		0.13		0.13		0.13		0.13		0.13		0.13		0.13		0.13		0.13
HSI	Lowest among WQSI and FCSI		**0.13**		**0.13**		**0.13**		**0.13**		**0.13**		**0.13**		**0.13**		**0.13**		**0.13**

HSI SCORES		
	Red Drum	**White Shrimp**
TY0	0.24	0.13
TY1	0.24	0.13
TY3	0.24	0.13
TY5	0.24	0.13
TY10	0.24	0.13
TY20	0.24	0.13
TY30	0.24	0.13
TY40	0.24	0.13
TY50	0.24	0.13

Mooring Basin Baseline and Projected HSI Scores
With Project

Red Drum HSI Model

		TY0		TY1		TY3		TY5		TY10		TY20		TY30		TY40		TY50	
Variable	Optimal	2011 (Baseline)	SI	2013	SI	2015	SI	2017	SI	2022	SI	2032	SI	2042	SI	2052	SI	2062	SI
V_1	25-30°C	24.55	0.96	24.55	0.96	24.55	0.96	24.55	0.96	24.55	0.96	24.55	0.96	24.55	0.96	24.55	0.96	24.55	0.96
V_2	25-30 ppt	26.7	1.00	26.7	1.00	26.7	1.00	26.7	1.00	26.7	1.00	26.7	1.00	26.7	1.00	26.7	1.00	26.7	1.00
$V_{3(\%)}$	100%	7%	0.26	7%	0.26	7%	0.26	7%	0.26	7%	0.26	7%	0.26	7%	0.26	7%	0.26	7%	0.26
$V_{4(\%)}$	50-75%	11%	0.22	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Water Quality SI	$(V_1^2 x V_2)^{1/3}$		0.97		0.97		0.97		0.97		0.97		0.97		0.97		0.97		0.97
Food/Cover SI	$(V_3 x V_4)^{1/2}$		0.24		0		0		0		0		0		0		0		0
HSI	Lowest among WQSI or F/CSI		**0.24**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**

Mooring Basin Baseline and Projected HSI Scores
With Project

White Shrimp HSI Model

		TY0		TY1		TY3		TY5		TY10		TY20		TY30		TY40		TY50	
Variable	Optimal	2011 (Baseline)	SI	2013	SI	2015	SI	2017	SI	2022	SI	2032	SI	2042	SI	2052	SI	2062	SI
$V_{1(\%)}$	100%	11%	0.11	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
V_{2w}	Soft Bottom	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20	Coarse or Hard Bottom	0.20
V_{3w}	1-15 ppt	29.07	0.06	29.07	0.06	29.07	0.06	29.07	0.06	29.07	0.06	29.07	0.06	29.07	0.06	29.07	0.06	29.07	0.06
V_4	20-30°C	28.42	1.00	28.42	1.00	28.42	1.00	28.42	1.00	28.42	1.00	28.42	1.00	28.42	1.00	28.42	1.00	28.42	1.00
Water Quality SI	$(V_{3w} x\ V_4)^{1/2}$		0.25		0.25		0.25		0.25		0.25		0.25		0.25		0.25		0.25
Food Cover SI	$(V_1^2 x\ V_{2w})^{1/3}$		0.13		0		0		0		0		0		0		0		0
HSI	Lowest among WQSI and FCSI		**0.13**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**

HSI SCORES		
	Red Drum	**White Shrimp**
TY0	0.24	0.13
TY1	0	0
TY3	0	0
TY5	0	0
TY10	0	0
TY20	0	0
TY30	0	0
TY40	0	0
TY50	0	0

Attachment D

With and Without Project AAHUs

Mooring Basin Without Project AAHUs

Average AAHUs: 3.26

Cumulative habitat units:

$$(T2-T1)\left|\frac{A2H2 + A1H1}{3.00} + \frac{A2H1 + A1H2}{6.00}\right|$$

T1: First Year of time interval
T2: Second year of time interval
A1: Habitat area of first target year
A2: Habitat area of second target year
H1: HSI of first target year
H2: HSI of second target year

Average Annual Habitat Units = Total cumulative HU's/years

Red Drum

TY	Year	E1AB3 and E1UBL				
		Acres	HSI	HUs	Cumulative HUs	AAHUs
0	2011	17.62	0.24	4.23		
1	2013	17.62	0.24	4.23	4.23	
3	2016	17.62	0.24	4.23	8.46	
5	2017	17.62	0.24	4.23	8.46	
10	2022	17.62	0.24	4.23	21.14	4.23
20	2032	17.62	0.24	4.23	42.29	
30	2042	17.62	0.24	4.23	42.29	
40	2052	17.62	0.24	4.23	42.29	
50	2062	17.62	0.24	4.23	42.29	
				Sum	211.44	

White Shrimp

TY	Year	E1AB3 and E1UBL				
		Acres	HSI	HUs	Cumulative HUs	AAHUs
0	2011	17.62	0.13	2.29		
1	2013	17.62	0.13	2.29	2.29	
3	2016	17.62	0.13	2.29	4.58	
5	2017	17.62	0.13	2.29	4.58	
10	2022	17.62	0.13	2.29	11.45	2.29
20	2032	17.62	0.13	2.29	22.91	
30	2042	17.62	0.13	2.29	22.91	
40	2052	17.62	0.13	2.29	22.91	
50	2062	17.62	0.13	2.29	22.91	
				Sum	114.53	

Average AAHUs (combining species): 3.26

Sum AAHUs 6.52

Mooring Basin With Project AAHUs

Average AAHUs: 0.033

Cumulative habitat units:

$$(T2-T1)\left|\frac{A2H2 + A1H1}{3.00} + \frac{A2H1 + A1H2}{6.00}\right|$$

T1: First Year of time interval
T2: Second year of time interval
A1: Habitat area of first target year
A2: Habitat area of second target year
H1: HSI of first target year
H2: HSI of second target year

Average Annual Habitat Units = Total cumulative HU's/years

Red Drum

TY	Year	E1AB3 and E1UBL				
		Acres	HSI	HUs	Cumulative HUs	AAHUs
0	2011	17.62	0.24	4.23		
1	2013	17.62	0	0	2.11	
3	2015	17.62	0	0	0	
5	2017	17.62	0	0	0	
10	2022	17.62	0	0	0	0.04
20	2032	17.62	0	0	0	
30	2042	17.62	0	0	0	
40	2052	17.62	0	0	0	
50	2062	17.62	0	0	0	
				Sum	2.11	

White Shrimp

TY	Year	E1AB3 and E1UBL				
		Acres	HSI	HUs	Cumulative HUs	AAHUs
0	2011	17.62	0.13	2.29		
1	2013	17.62	0	0	1.15	
3	2015	17.62	0	0	0	
5	2017	17.62	0	0	0	
10	2022	17.62	0	0	0	0.02
20	2032	17.62	0	0	0	
30	2042	17.62	0	0	0	
40	2052	17.62	0	0	0	
50	2062	17.62	0	0	0	
				Sum	1.15	

Average AAHUs (combining species): 0.03

Sum AAHUs 0.06

Attachment E

Mitigation Area Baseline and Projected HSI Scores

Mitigation Area Baseline and Projected HSI Scores
Without Project

Red Drum HSI Model

		TY0		TY1		TY5		TY10		TY20		TY30		TY40		TY50	
Variable	Optimal	2011 (Baseline)	SI	2013	SI	2017	SI	2022	SI	2032	SI	2042	SI	2052	SI	2062	SI
V_1	25-30°C	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00
V_2	25-30 ppt	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00
V_3	100%	10%	0.28	10%	0.28	10%	0.28	10%	0.28	10%	0.28	10%	0.28	10%	0.28	10%	0.28
V_5	Mud	Shell (n=1), Rock (n=1), sandy mud (n=7)	0.72	Shell (n=1), Rock (n=1), sandy mud	0.72	Shell (n=1), Rock (n=1), sandy mud	0.72	Shell (n=1), Rock (n=1), sandy mud	0.72	Shell (n=1), Rock (n=1), sandy mud	0.72	Shell (n=1), Rock (n=1), sandy mud	0.72	Shell (n=1), Rock (n=1), sandy mud	0.72	Shell (n=1), Rock (n=1), sandy mud	0.72
V_6	1.5-2.5 m	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61
Water Quality SI	$(V_1^2 x V_2)^{1/3}$		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
Food	V_3		0.28		0.28		0.28		0.28		0.28		0.28		0.28		0.28
Cover	$(V_5 x V_6)^{1/2}$		0.66		0.66		0.66		0.66		0.66		0.66		0.66		0.66
HSI	Lowest among WQSI, FSI, and CSI		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**
Acres of E1UB[1]			17.64		17.65		18.29		18.70		19.51		20.31		21.15		21.92
Habitat Units (HUs)			4.88		4.88		5.06		5.17		5.39		5.61		5.85		6.06

[1]From USACE "Marsh_Acreages.xlsx"

Mitigation Area Baseline and Projected HSI Scores
Without Project

White Shrimp HSI Model

		TY0		TY1		TY5		TY10		TY20		TY30		TY40		TY50	
Variable	Optimal	2011 (Baseline)	SI	2013	SI	2017	SI	2022	SI	2032	SI	2042	SI	2052	SI	2062	SI
V_1	100%	0.2%	0.002	0.2%	0.002	0.2%	0.002	0.2%	0.002	0.2%	0.002	0.2%	0.002	0.2%	0.002	0.2%	0.002
V_{2w}	Soft Bottom	Coarse or Hard Bottom (n=2) and Muddy Sands (n=7)	0.51	Coarse or Hard Bottom (n=2) and Muddy Sands (n=7)	0.51	Coarse or Hard Bottom (n=2) and Muddy Sands	0.51	Coarse or Hard Bottom (n=2) and Muddy Sands	0.51	Coarse or Hard Bottom (n=2) and Muddy Sands	0.51	Coarse or Hard Bottom (n=2) and Muddy Sands	0.51	Coarse or Hard Bottom (n=2) and Muddy Sands	0.51	Coarse or Hard Bottom (n=2) and Muddy Sands	0.51
V_{3w}	1-15 ppt	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27
V_4	20-30°C	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98
Water Quality SI	$(V_{3w} x\ V_4)^{1/2}$		0.52		0.52		0.52		0.52		0.52		0.52		0.52		0.52
Food Cover SI	$(V_1^2 x\ V_{2w})^{1/3}$		0.01		0.01		0.01		0.01		0.01		0.01		0.01		0.01
HSI	Lowest among WQSI and FCSI		**0.01**		**0.01**		**0.01**		**0.01**		**0.01**		**0.01**		**0.01**		**0.01**
Acres of E2EM			0.03		0.03		0.03		0.03		0.03		0.03		0.03		0.03
Acres of E1UBL			17.64		17.65		18.29		18.70		19.51		20.31		21.15		21.92
Acres Habitat (white shrimp)			17.67		17.68		18.32		18.73		19.54		20.34		21.18		21.95
Habitat Units (HUs)			0.22		0.22		0.23		0.23		0.24		0.25		0.26		0.27

HSI SCORES		
	Red Drum	**White Shrimp**
TY0	0.28	0.01
TY1	0.28	0.01
TY51	0.28	0.01
TY10	0.28	0.01
TY20	0.28	0.01
TY30	0.28	0.01
TY40	0.28	0.01
TY50	0.28	0.01

Mitigation Area Baseline and Projected HSI Scores
With Project and No Planting

Red Drum HSI Model

		TY0		TY1		TY5		TY10		TY20		TY30		TY40		TY50	
Variable	Optimal	2011 (Baseline)	SI	2013	SI	2017	SI	2022	SI	2032	SI	2042	SI	2052	SI	2062	SI
V_1	25-30°C	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00
V_2	25-30 ppt	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00
V_3	100%	10%	0.28	10%	0.28	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00
V_5	Mud	Shell (n=1), Rock (n=1), sandy mud (n=7)	0.72	Shell (n=1), Rock (n=1), sandy mud	0.72	Mud and Fine Sand	0.90	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00
V_6	1.5-2.5 m	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61
Water Quality SI	$(V_1^2 x V_2)^{1/3}$		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
Food	V_3		0.28		0.28		1.00		1.00		1.00		1.00		1.00		1.00
Cover	$(V_5 x V_6)^{1/2}$		0.66		0.66		0.74		0.78		0.78		0.78		0.78		0.78
HSI	Lowest among WQSI, FSI, and CSI		**0.28**		**0.28**		**0.74**		**0.78**		**0.78**		**0.78**		**0.78**		**0.78**
Acres of E1UB[1]			17.64		16.83		15.79		15.37		14.74		14.74		14.74		14.74
Habitat Units (HUs)			4.88		4.65		11.67		11.97		11.48		11.48		11.48		11.48

[1]From USACE "Marsh_Acreages.xlsx"

Mitigation Area Baseline and Projected HSI Scores
With Project and No Planting

White Shrimp HSI Model

		TY0		TY1		TY5		TY10		TY20		TY30		TY40		TY50	
Variable	Optimal	2011 (Baseline)	SI	2013	SI	2017	SI	2022	SI	2032	SI	2042	SI	2052	SI	2062	SI
V_1	100%	0.2%	0.002	4.8%	0.048	10.7%	0.107	13.1%	0.131	16.6%	0.166	16.6%	0.166	16.6%	0.166	16.6%	0.166
V_{2w}	Soft Bottom	Coarse or Hard Bottom (n=2) and Muddy Sands (n=7)	0.51	Coarse or Hard Bottom (n=2) and Muddy Sands (n=7)	0.51	Muddy sands	0.60	Soft bottom	1.00	Soft bottom	1.00	Soft bottom	1.00	Soft bottom	1.00	Soft bottom	1.00
V_{3w}	1-15 ppt	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27
V_4	20-30°C	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98
Water Quality SI	$(V_{3w} x\ V_4)^{1/2}$		0.52		0.52		0.52		0.52		0.52		0.52		0.52		0.52
Food Cover SI	$(V_1^2 x\ V_{2w})^{1/3}$		0.01		0.11		0.19		0.26		0.30		0.30		0.30		0.30
HSI	Lowest among WQSI and FCSI		**0.01**		**0.11**		**0.19**		**0.26**		**0.30**		**0.30**		**0.30**		**0.30**
Acres of E1UB [1]			17.64		16.83		15.79		15.37		14.74		14.74		14.74		14.74
Acres of E2EM[1]			0.03		0.85		1.89		2.31		2.94		2.94		2.94		2.94
Acres Habitat (white shrimp)			17.67		17.68		17.68		17.68		17.68		17.68		17.68		17.68
Habitat Units (HUs)			0.22		1.87		3.36		4.55		5.35		5.35		5.35		5.35

HSI SCORES		
	Red Drum	**White Shrimp**
TY0	0.28	0.01
TY1	0.28	0.11
TY51	0.74	0.19
TY10	0.78	0.26
TY20	0.78	0.30
TY30	0.78	0.30
TY40	0.78	0.30
TY50	0.78	0.30

Mitigation Area Baseline and Projected HSI Scores
With Project and Planting

Red Drum HSI Model

		TY0		TY1		TY3		TY5		TY10		TY20		TY30		TY40		TY50	
Variable	Optimal	2011 (Baseline)	SI	2013	SI	2015	SI	2017	SI	2022	SI	2032	SI	2042	SI	2052	SI	2062	SI
V_1	25-30°C	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00	29.19	1.00
V_2	25-30 ppt	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00	28.89	1.00
V_3	100%	10%	0.28	10%	0.28	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00
V_5	Mud	Shell (n=1), Rock (n=1), sandy mud (n=7)	0.72	Shell (n=1), Rock (n=1), sandy mud	0.72	Mud and Fine Sand	0.86	Mud and Fine Sand	0.90	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00
V_6	1.5-2.5 m	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61	0.91	0.61
Water Quality SI	$(V_1^2 x V_2)^{1/3}$		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
Food	V_3		0.28		0.28		1.00		1.00		1.00		1.00		1.00		1.00		1.00
Cover	$(V_5 x V_6)^{1/2}$		0.66		0.66		0.72		0.74		0.78		0.78		0.78		0.78		0.78
HSI	Lowest among WQSI, FSI, and CSI		**0.28**		**0.28**		**0.72**		**0.74**		**0.78**		**0.78**		**0.78**		**0.78**		**0.78**
Acres of E1UB[1]			17.64		16.83		16.05		15.79		15.37		14.74		14.74		14.74		14.74
Habitat Units (HUs)			4.88		4.65		11.56		11.67		11.97		11.48		11.48		11.48		11.48

[1]From USACE "Marsh_Acreages.xlsx"

Mitigation Area Baseline and Projected HSI Scores
With Project and Planting

White Shrimp HSI Model

		TY0		TY1		TY3		TY5		TY10		TY20		TY30		TY40		TY50	
Variable	Optimal	2011 (Baseline)	SI	2013	SI	2015	SI	2017	SI	2022	SI	2032	SI	2042	SI	2052	SI	2062	SI
V_1	100%	0.2%	0.002	4.8%	0.048	10.7%	0.110	13.1%	0.131	16.6%	0.166	16.6%	0.166	16.6%	0.166	16.6%	0.166	16.6%	0.166
V_{2w}	Soft Bottom	Coarse or Hard Bottom (n=2) and Muddy Sands (n=7)	0.51	Coarse or Hard Bottom (n=2) and Muddy Sands (n=7)	0.51	Coarse or Hard Bottom and Muddy Sands	0.58	Muddy sands	0.60	Soft bottom	1.00	Soft bottom	1.00	Soft bottom	1.00	Soft bottom	1.00	Soft bottom	1.00
V_{3w}	1-15 ppt	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27	25.94	0.27
V_4	20-30°C	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98	30.19	0.98
Water Quality SI	$(V_{3w} x\ V_4)^{1/2}$		0.52		0.52		0.52		0.52		0.52		0.52		0.52		0.52		0.52
Food Cover SI	$(V_1^2 x\ V_{2w})^{1/3}$		0.01		0.11		0.19		0.22		0.30		0.30		0.30		0.30		0.30
HSI	Lowest among WQSI and FCSI		**0.01**		**0.11**		**0.19**		**0.22**		**0.30**		**0.30**		**0.30**		**0.30**		**0.30**
Acres of E1UB [1]			17.64		16.83		15.79		15.37		14.74		14.74		14.74		14.74		14.74
Acres of E2EM[1]			0.03		0.85		1.89		2.31		2.94		2.94		2.94		2.94		2.94
Acres Habitat (white shrimp)			17.67		17.68		17.68		17.68		17.68		17.68		17.68		17.68		17.68
Habitat Units (HUs)			0.20		1.87		3.38		3.84		5.35		5.35		5.35		5.35		5.35

HSI SCORES		
	Red Drum	**White Shrimp**
TY0	0.28	0.01
TY1	0.28	0.11
TY51	0.72	0.19
TY10	0.74	0.22
TY20	0.78	0.30
TY30	0.78	0.30
TY40	0.78	0.30
TY50	0.78	0.30
TY50	0.78	0.30

Attachment F

Mitigation Area
With and Without Project AAHUs

Mitigation Area Without Project AAHUs

Average AAHUs: 2.87

Cumulative habitat units:

$$(T2-T1)\left|\frac{A2H2 + A1H1}{3.00} + \frac{A2H1 + A1H2}{6.00}\right|$$

T1: First Year of time interval
T2: Second year of time interval
A1: Habitat area of first target year
A2: Habitat area of second target year
H1: HSI of first target year
H2: HSI of second target year

Average Annual Habitat Units = Total cumulative HU's/years

Red Drum

TY	Year	E1UB				
		Acres	HSI	HUs	Cumulative HUs	AAHUs
0	2011	17.64	0.28	4.88		5.50
1	2013	17.65	0.28	4.88	4.88	
5	2017	18.29	0.28	5.06	19.87	
10	2022	18.70	0.28	5.17	25.56	
20	2032	19.51	0.28	5.39	52.81	
30	2042	20.31	0.28	5.61	55.04	
40	2052	21.15	0.28	5.85	57.31	
50	2062	21.92	0.28	6.06	59.53	
				Sum	275.01	

White Shrimp

TY	Year	E1UB				
		Acres	HSI	HUs	Cumulative HUs	AAHUs
0	2011	17.67	0.01	0.22		0.25
1	2013	17.68	0.01	0.22	0.22	
5	2017	18.32	0.01	0.23	0.90	
10	2022	18.73	0.01	0.23	1.16	
20	2032	19.54	0.01	0.24	2.39	
30	2042	20.34	0.01	0.25	2.49	
40	2052	21.18	0.01	0.26	2.59	
50	2062	21.95	0.01	0.27	2.69	
				Sum	12.43	

Average AAHUs (combining species): 2.87

Sum AAHUs 5.75

Mitigation Area With Project and No Planting AAHUs

Average AAHUs: 7.62

Cumulative habitat units:

$$(T2-T1)\left|\frac{A2H2 + A1H1}{3.00} + \frac{A2H1 + A1H2}{6.00}\right|$$

T1: First Year of time interval
T2: Second year of time interval
A1: Habitat area of first target year
A2: Habitat area of second target year
H1: HSI of first target year
H2: HSI of second target year

Average Annual Habitat Units = Total cumulative HU's/years

Red Drum

TY	Year	E1UB (no SAV)				
		Acres	HSI	HUs	Cumulative HUs	AAHUs
0	2011	17.64	0.28	4.88		11.17
1	2013	16.83	0.28	4.65	4.76	
5	2017	15.79	0.74	11.67	32.96	
10	2022	15.37	0.78	11.97	59.11	
20	2032	14.74	0.78	11.48	117.26	
30	2042	14.74	0.78	11.48	114.81	
40	2052	14.74	0.78	11.48	114.81	
50	2062	14.74	0.78	11.48	114.81	
				Sum	558.52	

White Shrimp

TY	Year	E1UB (no SAV)				
		Acres	HSI	HUs	Cumulative HUs	AAHUs
0	2011	17.64	0.01	0.22		4.08
1	2013	16.83	0.11	1.78	1.01	
5	2017	15.79	0.19	3.00	9.62	
10	2022	15.37	0.26	3.96	17.42	
20	2032	14.74	0.30	4.46	42.12	
30	2042	14.74	0.30	4.46	44.57	
40	2052	14.74	0.30	4.46	44.57	
50	2062	14.74	0.30	4.46	44.57	
				Sum	203.89	

Average AAHUs (combining species): 7.62

Sum AAHUs 15.25

Mitigation Area With Project and Planting AAHUs

Average AAHUs: 7.75

Cumulative habitat units:

$$(T2-T1)\left[\frac{A2H2 + A1H1}{3.00} + \frac{A2H1 + A1H2}{6.00}\right]$$

T1: First Year of time interval
T2: Second year of time interval
A1: Habitat area of first target year
A2: Habitat area of second target year
H1: HSI of first target year
H2: HSI of second target year

Average Annual Habitat Units = Total cumulative HU's/years

Red Drum

TY	Year	E1UB (no SAV)				
		Acres	HSI	HUs	Cumulative HUs	AAHUs
0	2011	17.64	0.28	4.88		
1	2013	16.83	0.28	4.65	4.76	
3	2015	16.05	0.72	11.56	16.33	
5	2017	15.79	0.74	11.67	23.23	
10	2022	15.37	0.78	11.97	59.11	11.30
20	2032	14.74	0.78	11.48	117.26	
30	2042	14.74	0.78	11.48	114.81	
40	2052	14.74	0.78	11.48	114.81	
50	2062	14.74	0.78	11.48	114.81	
				Sum	565.13	

White Shrimp

TY	Year	E1UB (no SAV)				
		Acres	HSI	HUs	Cumulative HUs	AAHUs
0	2011	17.64	0.01	0.2007		
1	2013	16.83	0.11	1.78	1.00	
3	2015	15.79	0.19	3.02	4.83	
5	2017	15.37	0.22	3.34	6.36	
10	2022	14.74	0.30	4.46	19.53	4.20
20	2032	14.74	0.30	4.46	44.57	
30	2042	14.74	0.30	4.46	44.57	
40	2052	14.74	0.30	4.46	44.57	
50	2062	14.74	0.30	4.46	44.57	
				Sum	210.02	

Average AAHUs (combining species): 7.75

Sum AAHUs 15.50