3.0 AFFECTED ENVIRONMENT

The CCSC is a navigation channel that was initially constructed in the early 20th century as a 100-foot shallow channel from the Gulf of Mexico across Corpus Christi Bay. The channel went through various improvements in 1920's, 30's, 40's, 60's and the in the early 21st century to reach its present dimension. The CCSC consists of:

- The entrance channel seaward of the jetties extending to meet the required depth contour in the Gulf of Mexico;
- The channel through the jetties and pass between San Jose and Mustang Islands; and
- The bay reach of the channel in Corpus Christi Bay.

The following subsections describe the conditions and resources of the affected environment in the project area

3.1 PHYSICAL ENVIRONMENT

This section provides general information on the non-living resources of the physical environment of the project area. General information is provided for the project setting, climate, geology, topography, soils, physical oceanography, and water and sediment quality.

3.1.1 Project Area and Climate

The CCSC is located in Corpus Christi Bay on the south-central portion of the Texas coast, 200 miles southwest of Galveston and 150 miles north of the mouth of the Rio Grande River. The CCSC provides deep water access from the Gulf of Mexico to the Port of Corpus Christi (Port), via the Port Aransas channel, through Redfish Bay and Corpus Christi Bay. The project area is located in Corpus Christi Bay and extends out for 11 miles into the Gulf of Mexico. The proposed project is located mainly in Nueces County with a small portion of the channel entrance running through Aransas County near the pass between San Jose and Mustang Islands, and is adjacent to existing terminals located in Ingleside in San Patricio County.

Access points to the CCSC include the La Quinta Channel, the Gulf Intracoastal Waterway (GIWW), and the Rincon Canal. The waterway extends from deep water in the Gulf through the Port of Aransas jettied entrance, then westerly 20.75 miles to the landlocked portion of the CCSC is referred to as the Inner Harbor. The La Quinta Channel extends off of the CCSC near Ingleside, Texas, and runs parallel to the eastern shoreline of Corpus Christi Bay for 5.9 miles to the La Quinta Turning Basin. The surface area of Corpus Christi Bay is approximately 150 square miles (TPWD 2013). Corpus Christi Bay is characterized by generally shallow water depths, generally ranging from 7 feet to 15 feet. Dredged navigation channels depths are 45 feet in Corpus Christi Bay and the Inner Harbor.

The Corpus Christi metropolitan area has a humid subtropical climate. Average monthly temperature ranges from 47°F in January to 94°F in August. Prevailing winds are from the southeast, and the region often experiences high wind conditions with gusts often reaching more than 40 miles per hour. Total yearly rainfall in the Central Texas coast including Corpus Christi varies from year to year from 5.38" in 1917 to 48.16 inches in 1888 with an average of 31.76 inches. In 2011 the area had the lowest total annual precipitation of 12 inches during one of Texas' worst drought year. The total rainfall for 2017 was 30.90 inches. In June 2018, between June 18th and the 21st, some storms produced rainfall rates as high as 5-6 inches per hour. Storm total rainfall amounts were as high as 15 to 18 inches across some locations in Nueces county and central San Patricio county. Most areas in the

Coastal Bend area received generally between 5 and 15 inches of rainfall during this period. These data are published by NOAA through electronic access of its climatological data website (NOAA NWS 2018).

Other notable severe weather event include on August 25, 2017, Hurricane Harvey made landfall near Rockport, Texas approximately 30 miles northeast of Corpus Christi, as a category 4 hurricane with maximum sustained winds of 130 mph. Harvey became the first category 4 hurricane to make landfall in Texas since Carla in 1961. Port Aransas reported sustained winds of 110 mph with a gust to 132 mph. (NOAA RCC, 2017)

3.1.2 Topography and Soils

The project area is characterized by interconnected natural waterways, restricted bays, lagoons, estuaries, narrow barrier islands, and dredged intracoastal canals and channels. The surface topography of the project area is mainly flat to gently rolling and slopes to the southeast. The Nueces River drains areas to the west of the project area and discharges into Nueces Bay. A few short, low-gradient streams drain directly into Nueces and Corpus Christi bays. Broad areas of coastal prairies, chaparral pastureland and farmland occur inland from the bays. On the Gulf side of Mustang Island, and for a short distance inland, sand dunes break the flat terrain.

The only soils within the project area are located at existing and new dredged material placement areas. The majority of the project area is located below the average high tide line, which the USDA Natural Resources Conservation Service (NRCS) does not include in Web Soil Survey (WSS) inquiry results; all sediment beneath open water is delineated as 'water' for the purposes of this evaluation. Four soils are located within the project area: Mustang fine sand, 0 to 1 percent slopes, occasionally flooded, frequently ponded (Mu); Twinpalms occasionally flooded-Yarborough frequently flooded complex, 0 to 3 percent slopes (Sb); Tidal flats, occasionally ponded (Ta); and Beaches (By).

Table 3.1.2-1 Soil Types and Characteristics

Soil Type	Soil Characteristics
By	Beaches
Mu	Mustang fine sand, 0 to 1 percent slopes, occasionally flooded, frequently ponded
Sb	Twinpalms occasionally flooded-Yarborough frequently flooded complex, 0 to 3 percent slopes
Ta	Tidal flats, occasionally ponded
W	Water

3.1.3 Geology

The project area is surrounded by Pleistocene age fluvial and deltaic sediments of the Beaumont Formation. These sediments were deposited in both marine and nonmarine environments. Recent alluvium present in the western portion of the project area is associated with the Nueces River and deposits in the eastern portion are related to Mustang Island.

The geologic units consist primarily of mixtures of sand, silt, clay, mud, and shell deposited within the last one million years. Exposed sediments are composed primarily of interdistributary mud and lesser amounts of distributary and fluvial sands and silts. The majority of the outcropping Beaumont Formation within the project area consists predominantly of stream channel, point bar, natural levee, and back swamp deposits and, to a lesser extent, coastal marsh, mud flat, lagoonal and sand dune deposits. The Beaumont Formation consists of mainly

beach and relict barrier island deposits along a north-south trending belt parallel to the Laguna Madre-Redfish Bay system. These deposits are mostly fine-grained sand and shell.

Sediment distributions within the bay system consist primarily of terrigenous elastics. Muddy sands occur adjacent to dredged material placement mounds, in the shallow bay margin areas next to the mainland shore, and at the edge of the wind-tidal flats. Muddy sand distribution is not depth controlled, rather it is related to hurricane washovers, dredging activities, and reworking of relict sediment (McGowen and Morton, 1979).

3.1.4 Physical Oceanography

The project area is comprised of a variety of marine environments consisting of the open waters of the Gulf of Mexico and a barrier island pass for the entrance channel reach, and Corpus Christi Bay for the channel from Harbor Island to La Quinta Junction. Corpus Christi Bay is characterized as a relatively large shallow bay with an interconnected system of deeper navigational ship channels.

3.1.4.1. Tides, Currents, and Water Level

The Nueces and Corpus Christi bay systems are relatively low-energy environments protected on the seaward side by barrier islands. The average water depth of Corpus Christi Bay is 11 feet (TPWD 2018). Tidal channels, passes, and dredged channels are greater than the average depth. Water exchange between the bay and the Gulf is normally limited to natural and artificial tidal passes through the barrier island. Fresh water is supplied to the bays by the Nueces River and by small streams that drain local areas adjacent to coastal uplands.

The Corpus Christi Ship Channel (CCSC) extends from the Gulf of Mexico (GOM) through Aransas Pass, then westward across Corpus Christi Bay ending at the western end of the Bay at the Port of Corpus Christi. Corpus Christi Bay is connected to four other embayments: Oso Bay to the southwest, Nueces Bay to the northwest, Upper Laguna Madre to the south, and Redfish Bay to the northeast. Redfish Bay then connects to Aransas Bay further to the northeast. The CCSC connects to other bays via additional channels. Just inside of the Aransas Pass, the CCSC channel splits into the Aransas Channel which extends through Redfish Bay and the Lydia Ann Channel which extends into Aransas Bay. Further along the CSCC, near Ingleside, the La Quinta Channel splits to the north. These features are shown in Figure 1.1.1-1 Vicinity MapFigure 1.1.1-1.

The hydrodynamic and water quality characteristics of Corpus Christie Bay have been documented in numerous studies (Ward and Armstrong 1997a, TWDB, 2010; Huang et. al, 2011; Islam et. al. 2014). The bay is shallow, on the order of 9 to 12 feet, except for the CCSC which is currently maintained at 45 feet (MLLW). There are six fresh water inflows into the bay system. They are from the Cavasso Creek, Copano Creek, Mission River, Aransas River, Nueces River and Oso Creek. Based on data prepared by the TWDB, the annual average flows from these rivers for the 10-year period 2006-2015 are approximately 73, 25, 105, 130, 311 and 63 cfs. The total average inflows for the interconnected bay systems is approximately 708 cfs.

The tides in the GOM are primarily diurnal or mixed diurnal–semidiurnal, and in the vicinity of Aransas Pass exhibit a strong spring-neap cycle. The amplitudes of the spring tides at Aransas Pass (NOAA Gage 8775241) are on the order of 2 feet. The relatively small entrance channel compared to the size of the interconnected bay system yields significant attenuation of the tidal amplitudes in the bay. For instance, the spring tide range in Corpus Christi Bay near the Port of Corpus Christi (NOAA Gage 8775296) is on the order of 0.95 feet, less than 50% of the amplitude of the tides in the GOM. Despite the tidal amplitudes being relatively small, they regularly produce peak current velocities at Aransas Pass of approximately 4 to 5 fps (Williams et al., 1991; Brown et al., 2000).

Wind data from the International Airport at Corpus Christi indicate a prevailing wind direction from the southeast (Smith, 1979). During the winter months, the prevailing wind patterns are interrupted by strong north winds associated with the passage of cold fronts.

Corpus Christi Bay receives an average of 58 inches of rainfall per year and the average evaporation rate is 118 inches per year (Orlando et al., 1991). The high evaporation during periods of low rainfall yield high salinity levels, occasionally exceeding the average seawater concentrations. Summer surface salinities typically range from 25 to 40 ppt except during freshwater inflow events associated with rainstorms. (Typical seawater salinity is 35 ppt). Vertical salinity stratification of bay waters is slight by estuarine standards, generally averaging less than 0.6 ppt/m. There is no apparent correlation between mean salinities and ship channels, suggesting that density currents as a mechanism of salinity intrusion are rarely important in Corpus Christi Bay (Ward and Armstrong, 1997a)

The principal variation in water temperature in Corpus Christi Bay is the seasonal signal, ranging about 14 to 30 C from winter to summer, which means that temperature is primarily controlled by surface fluxes, especially the seasonal heat budget, and much less by peripheral boundary fluxes and internal transport (Ward and Armstrong, 1997a).

3.1.4.2. Salinity

Based on the historical data, the Corpus Christi Bay system is a hypersaline system with a wide range of salinity observed throughout the year, depending on proximity to the Nueces River and season, ranging between 1 to 30 parts per thousand (ppt). Periods of high inflow following major rainfalls and storms result in the lower salinity, while periods of drought cause the extremely saline conditions. With the relatively low freshwater inflow, the bulk of the bay system (e.g. Corpus Christi Bay) has higher average salinities. These salinities control where oyster reefs grow in the fresher upper part and Nueces Bay); oyster reef prefer mesohaline and polyhaline conditions (5 to 25 ppt).Sea grasses prefer polyhaline conditions (18-30 ppt), and grow in the lower Bay and Redfish Bay.

3.1.4.3. Relative Sea Level Change (RSLC)

USACE guidance requires an incorporating projected relative sea level change (RSLC) in Civil Works studies and projects following policy in ER 1100-2-8162, *Incorporating Sea Level Change in Civil Works Programs*, dated December 2013 and evaluation procedures in Engineering Technical Letter (ETL) 1100-2-1, *Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaptation*, dated June 2014. USACE guidance specifies evaluating alternatives using "low", "intermediate", and "high" rates of future sea level change, which are synopsized as the following:

- Low - The historic rate of local mean sea level change best determined by local tide records (preferably with at least a 40 year data record).
- Intermediate – The rate of local mean sea level change using the modified National Research Council (NRC) Curve I. It is corrected for the local rate of vertical land movement.
- High – The local mean sea level change using the modified NRC Curve III. It is corrected for the local rate of vertical land movement.

ETL 1100-2-1 recommends an expansive approach by considering changes over periods longer than the typical 50-year assumed lifespan of a Civil Works project, because many projects can remain in service much longer. Therefore, changes over a minimum 20-, 50-, and 100-year planning horizons should be considered. An RSCL

analysis was done as recently as 2015 for the Limited Reevaluation Report (LRR) for the 54-Feet CCSIP project, and the data is summarized in this section.

Historical rates were taken from National Oceanic and Atmospheric Administration (NOAA) Center for Operational Oceanographic Products and Services (CO-OPS). These rates were averaged by month to eliminate the effect of higher frequency phenomena such as storm surge, in order to compute an accurate linear sea level trend. The tide gage nearest to the Corpus Christi Bay system with over 40 years of record is located at Rockport, TX (NOAA gage 8774770). The MSL trend at this site (from 1937 to 2014) is equal to 5.27 mm/yr with a 95 percent confidence interval of +/- ± 0.48 mm/yr. Using the estimated historic eustatic (global) rate equals that given for the Modified NRC curves (1.7 mm/yr), the observed subsidence rate was estimated at 5.27 - 1.7 = 3.57 mm/yr. The NRC curves were then used to compute future rates of RSLC over a 20-, 50-, and 100- year period of analysis. The predicted change between the years 2020 and 2070 for the Corpus Christi Bay system is summarized in the table below.

Table 3.1.4-1 Estimated Relative Sea Level Change (RSLC) over 100 years (2020 – 2120)

			NRC Curve		
Tidal Gage	**Period (Years)**	**Measured Relative SLR Rate (NOAA)**	**Low (ft)**	**Intermediate (ft)**	**High (ft)**
Rockport, TX	20	5.27 mm/yr	0.35	0.48	0.91
Rockport, TX	50	5.27 mm/yr	0.86	1.34	2.83
Rockport, TX	100	5.27 mm/yr	1.73	3.12	7.51

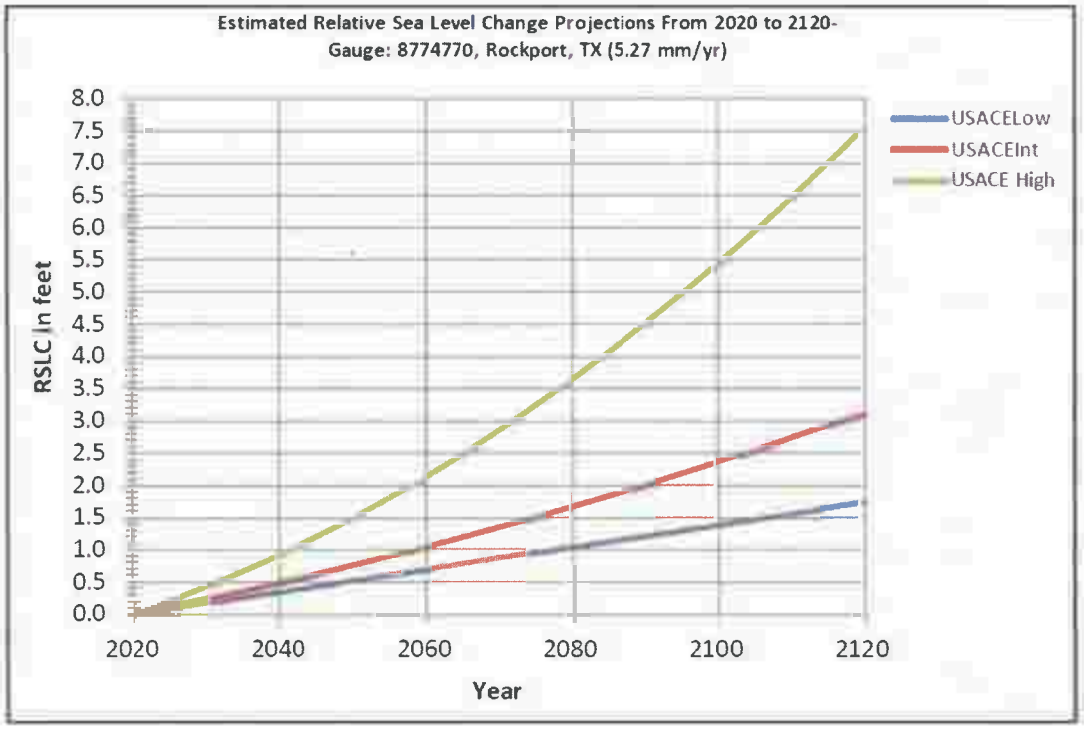

Figure 3.1.4-1 Anticipated RSLC at Rockport, TX over 100-year period

In summary, the amount of change will be an increase in relative sea level ranging from 0.35 to 7.5 feet depending on the period and NRC growth assumption use. Assuming the intermediate case, the change over 100 years would be an increase of about 3.2 feet of sea level. Based on a project horizon between 2025 and 2075, the change would be an increase of approximately 1.25 feet (1.5 ft-0.25 ft).

3.1.5 Water and Sediment Quality

The Clean Water Act (CWA), Section 303(c), requires states to review, establish, and revise water quality standards for all surface waters within the state. The major surface waters of the State are classified by the Texas Commission on Environmental Quality (TCEQ) into segments for purposes of water quality management and for the designation of site-specific uses and criteria. Additionally, managing and regulating the disposal of dredged sediment is a shared responsibility of the EPA and the USACE, under the CWA and the Marine Protection, Research, and Sanctuaries Act (MPRSA). Applicable guidelines to assess the quality of dredged sediment have been developed. The following sections describe the existing water and sediment quality in the project area.

3.1.5.1. Water Quality

The TCEQ establishes, reviews and revises water quality standards for all surface waters within the state to comply with the CWA. TCEQ designates the uses (such as aquatic habitat, recreation, and fish consumption) of a waterbody or stream segment, and adopts the water quality criteria and policy necessary to protect those designated uses. Biennially, the State submits a report required by CWA Section 305(b) to the EPA, describing the status of surface waters in the state. A use is "impaired" when it is only partially or not supported at all. A list of impaired waters required by Section 303(d) included in the 305(b) reports must be prioritized to identify waters

targeted for Total Maximum Daily Load (TMDL) standard development. The TMDL defines an environmental target by determining how much a certain pollutant must be reduced to attain and maintain the affected use. The State then develops an imple mentation plan to mitigate pollution sources in the watershed and restore full use of the water body (

The Corpus Christi area encompasses four separate classified water quality segments within Basin 24 of the Bays and Bays and Estuaries including Corpus Christi Bay (Oyster Waters – Segment 2481OW), Laguna Madre (Segment 2491), Redfish Bay (Segment 2483), Aransas Bay (Oyster Waters – Segment 2471OW), and also includes the Gulf of Mexico (Segment 2501). These segments have multiple designated uses including High Aquatic Life Use (ALU), Recreation Use (RU), General Use (GU), Fish Consumption Use (FCU) and Oyster Waters Use (OWU). Their classifications and impairments are identified in **Table 3-1** below. The proposed project channel reach traverses or is directly adjacent to, the Gulf of Mexico, Corpus Christi Bay, and Redfish Bay segments.

Table 3-3.1.5-1 – Summary of Water Quality in the Study Segments

TCEQ Water Quality Segments	Location	Uses	Status
2481OW, AU 2481OW_01	Corpus Christi Bay	OWU	OWU fully supported
2483 AU 2483_01	Redfish Bay	ALU, RU, GU	ALU fully supported. RU fully supported. GU fully supported.
2501 AU 2501_06 (Port Aransas Area)	Gulf of Mexico	ALU, RU, GU, FCU	ALU fully supported. RU fully supported. GU fully supported. FCU not supported due to mercury in edible fish tissue.
2491, AU 2491_01 AU 2491_02 AU 2491_03	Laguna Madre	ALU, RU, GU	ALU fully supported except for depressed dissolved oxygen in 2491_01, 2491_02, and 2491_03. RU fully supported except for bacteria (Enterococcus) in 2491_02. GU fully supported except for chlorophyll-a screening level concern in 2491_01 and 2491_02 and nitrate and ammonia in 2491_02.
2471OW 2471OW_01	Aransas Bay	OWU	OWU fully supported.

AU = Assessment Unit

In summary, all water quality segments with an Aquatic Life Use Designation, meet the use based on meeting minimum DO levels with no concerns except for Laguna Madre (Segment 2491). Laguna Madre has a nutrient concern with nitrate and ammonia, which exceed State screening levels but do not meet the definition of "impaired" since the nutrient screening levels are not actual water quality standards, but are just listed as "concerns". Segment 2491 lists Chlorophyll a as a concern and does not meet this use due to bacteria levels. Segment 2501 (Port Aransas Area – AU 2501_06) does not meet FCU and the Texas Department of State Health Services (DSHS) has imposed fish consumption advisories due to high levels of mercury in edible fish tissue.

Elutriate Chemistry

Elutriate testing is a procedure done with sediment samples to observe potential effects to water quality that may result from contaminants in dredged sediments. The procedure is meant to simulate agitation, suspension, and

dissolution of contaminants in the water column during dredging and disposal. During collection of samples for elutriate testing, ambient water quality samples are also collected to provide a reference for the existing water quality without the influence of dredged sediment effects. Following is a summary of past elutriate testing performed for channel sediments.

Entrance Channel

In the 2003 FEIS, historical water and elutriate data from the Entrance Channel for detected compounds from 1984, 1990, and 1999 were provided. The study indicated that even though no constituents were found in 1990, the detection limits were high. Also, in 1984, a few constituents were detected with higher detection limits. For some of the parameters, the detection limits in 1984 and 1990 were higher than the 1999 limits. In 1984 arsenic and copper were detected above the detection limits. For water and elutriate samples collected in 1999, arsenic, barium, cadmium, and zinc were above detection limits. In 1999 the water samples had detections for nickel and the elutriate samples had detections for chromium and copper. In 1999 barium and cadmium levels in the elutriate samples were higher than ambient water including reference samples, however zinc levels in the elutriate samples were lower than the ambient water samples. The samples were below the Texas Surface Water Quality Standards (TSWQS) with the exception of copper in one of the elutriate samples. The 2003 FEIS indicated that there are no trends in the data. Copper was the only compound detected in more than 1 year so trends for the other parameters could not be determined in the 2003 study. Oil and grease were detected in 1984 for water and elutriate samples. No organics were detected in the 1990 or 1999 data for any medium, except for total organic carbons (TOC) and total petroleum hydrocarbons (TPH).

Two elutriate bioassay sets had been conducted in 1980 and 1985 on samples collected from the Entrance Channel. In all tests, survival of organisms exposed to the liquid phase elutriate and suspended particulate phase of the unfiltered elutriate of sediments was greater than 50 percent. As a result, no concentration of a substance which is lethal to 50 percent of test organisms after a continuous exposure time of 96 hours could be calculated. These results indicated that no acute toxicity to water column organisms would result from dredging the Entrance Channel or placement of such sediments. There was no indication of water or elutriate problems in the Entrance Channel according to the 2003 FEIS.

In January 2017, elutriate, site water and sediment samples were collected in the Entrance Channel and Extension to support placement of new work material from the authorized 54-foot Federal project into the Corpus Christi New Work Ocean Dredged Material Disposal Site (New Work ODMDS). (USACE 2018b). The following summarizes those results. Elutriate samples were analyzed for site-specific analytes and were compared to water quality criteria. One SVOC, pentachlorophenol, was analyzed for in each Dredge Material Management Unit (DMMU). For all of the samples, pentachlorophenol was below the detection limit. No further evaluation of pentachlorophenol was required. One PAH, phenanthrene, was analyzed for in each DMMU. This analyte was below the detection limit for all samples. Two pesticides alpha-BHC and beta-BHC) were detected in elutriate samples. In one of the five samples beta-BHC exceeded the TSWQS but was below target detection limit. Of the 9 metals analyzed for in each DMMU, all 9 analytes arsenic, cadmium, copper, lead, mercury, nickel, selenium, silver, zinc) were detected above the method detection limit in at least one elutriate sample. All metals concentrations except lead were detected above the target detection limits. However, only silver exceeded the Texas and EPA screening criteria. As discussed in the next paragraph, these metals were detected at the same levels observed in the ambient water samples. This indicates that local sediment would not be expected to be the source of contaminants detected, and results are more attributable to ambient water quality concerns.

The following is a summary of these results:

- Ammonia concentrations ranged from 1520 ug/L to 5610 ug/L in the DMMU samples, which exceeded the target detection limit of 30 ug/L;
- Dissolved organic carbon mean concentrations for the elutriate samples were 0.00044% to 0.00106% and sample results were below the target detection limit of 0.1%;
- Total organic carbon in the elutriate samples was 0.0048% to 0.0703% and sample results were below the target detection limit;
- The total suspended solids results ranged from 1,760,000 ug/L to 60,000,000 ug/L with sample results above the target detection limit of 1,000 ug/L; and
- Salinity concentrations ranged from 32 pss to 71 pss (practical salinity scale).

Site water samples were analyzed for site-specific analytes to accompany and compare to the elutriate results to water quality criteria. For all of the samples, pentachlorophenol was below the detection limit. PAH was below the method detection limit, target detection limit and screening criteria for all samples. None of the pesticides were above the method detection limit. Toxaphene was non-detect in all samples and below the Target Detection Limit. Of the 9 metals analyzed for in each DMMU, 7 analytes (arsenic, copper, lead, mercury, nickel, selenium, zinc) were detected above the method detection limit in at least one site water sample. Results for 6 of the 9 metals (arsenic, cadmium, copper, nickel, silver, zinc) were above the target detection limits. However, only silver exceeded the Texas and EPA screening criteria. These ambient water sample results represented the same outcome as the elutriate samples. Therefore any detections and any results above screening limits were attributable to ambient water quality and not sediment as described below.

- Ammonia concentrations ranged from 98.2 ug/L to 110 ug/L in the DMMU samples, which exceeded the target detection limit of 30 ug/L;
- Dissolved organic carbon mean concentrations for the site water samples were 0.0002% to 0.00029% and sample results were below the target detection limit of 0.1%;
- Total organic carbon in the site water samples was 0.00019% to 0.00029% and sample results were below the target detection limit;
- The total suspended solids results ranged from 1,930 ug/L to 5,250 ug/L with sample results above the target detection limit of 1,000 ug/L;
- And salinity concentrations ranged from 29.53 pss to 31.09 pss (practical salinity scale).

Lower Bay

The 2003 FEIS noted that the material in the Lower Bay is mostly sand (72 to 97 percent) and no metals were detected in the 1988 and 1991 water and elutriate samples. No organics were detected in 1988 or 1991 water or elutriate samples. Water and construction (i.e. new work dredging) sediment samples were collected in 1986 for the proposed U.S. Navy Homeport project. No TSWQS were exceeded in the water or elutriate samples. The study noted the increase in oil and grease and TOC in the elutriate samples compared to the corresponding water sample. The oil and grease concentrations in the elutriate were not high compared to other areas (no other oil and grease data for the Lower Bay Reach exist). The elutriate concentrations in the water samples are much lower than in other areas. For TOC, the values for the water samples are comparable to the other areas but the elutriate values are much higher. The U.S. Navy indicated no water or elutriate quality problems. In 1981 toxicity testing has been conducted on elutriate samples made with maintenance material from the lower bay. The study indicated that no acute toxicity to water column organisms would be expected from dredge material of the Lower Bay

Channel or placement of Lower Bay Channel sediments. The 2003 FEIS indicated there is no indication of water or elutriate problems in the Inner Basin to La Quinta Junction Reach.

3.1.5.2. Sediment Quality

Sediment testing has been conducted on maintenance and new work dredged material over many years. Maintenance material is comprised of more recent deposition of sediment carried by rivers, streams and marine currents, that are deposited on the surface of channel bottoms (i.e. shoaled material) for which dredging to maintain the channel depth must be performed. New work material is comprised of previously undredged sediments that is typically made up of native, in situ geological material. Maintenance material tends to be more subject to contaminant impacts and spills than new work material. Testing has also been conducted on surficial sediments, which in most cases signify areas not previously dredged or routinely maintained. These surficial sediments can be comprised of a combination of more recently deposited material in the bays or Gulf, overlying native, and new work material. Since 1981, the USACE collected data on maintenance material and other material to determine the sediment quality of Corpus Christi Bay. The data varies greatly by as much as a factor of 5. The data are compared to Effects Range Low (ERL) limits provided in the National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQRT). ERL is the value that toxicity may start to be noticed in sensitive species and it is the lower 10^{th} percentile concentration of the sediment toxicity data available that includes samples originally labelled as toxic (NRC 2018). Water and elutriate samples in the 2003 FEIS were compared to TSWQS, which are TCEQ regulatory standards, and were discussed in the previous section. ERLs have no regulatory authority, but are used to establish a cause of concern.

As indicated in the 2003 FEIS, Areas found to contain elevated metals in surficial sediments were Corpus Christi Bay for chromium and lead, and the Gulf of Mexico near the Entrance Channel for copper and lead. The elevated levels were relative to other levels in the study area and not specific guidelines. Sediment samples from the Lower Bay were collected by the U.S. Navy in 1986 (Channel Station 12+55 to Channel Station 521+70) and results exceeded ERLs for arsenic, cadmium, and mercury. The results may have exceeded the ERLs but the elutriate concentrations were below the TSWQS. In 2000, the Lower Bay samples collected by Fugro did not exceed the ERLs.

From the Entrance Channel, maintenance material sediment samples were collected in 1984, 1990, and 1999 as documented in the 2003 FEIS. The sediment concentrations were below the ERLs. In 1984 arsenic was the only metal that was detected above the detection limits. All locations had zinc detections, three locations had chromium and nickel detections, and one location had a copper detection in 1990. All concentrations were below the ERLs. Mercury, silver, and selenium were not detected at some locations in 1999. One sample in 1999 exceeded an ERL for mercury. Except for the mercury exceedance, the study indicated there is no cause for concern of the maintenance material quality in the Entrance Channel. Routine sampling will be conducted of future maintenance material before actual dredging occurs. Placement material must meet environmental criteria and regulatory requirements applicable to MPRSA (40 CFR 220-228) and based on toxicological and bioaccumulative effects on marine organisms. Sediment bioassays were conducted in 1980, 1985, and 1995 with Entrance Channel sediments. Since test survival at the 95 percent confidence level was not significantly less than Reference Control survival, no major adverse impacts would occur from placing maintenance material dredged from the Entrance Channel into open water.

Sediment samples for new work dredged material were collected in the Entrance Channel and Extension in January 2017 [redacted] The following summarizes these results. Sediment samples were analyzed for site-specific analytes and were compared to sediment screening criteria from NOAA SQuiRT Cards. Eight VOCs, Total TPH, and one SVOC (PCP) for all sediment samples were non-detect and below the method detection limit and target detection limit. No applicable screening criteria is available for these analytes. PAHs

in all samples were below the target detection limit and published screening criteria but required further evaluation, since they were detected in some locations. PCB congeners were not detected above the method detection limit and were below the target detection limit. Pesticides were below the target detection limits. For all the samples, dieldren was non-detect and below the target detection limit. In each DMMU and the Reference Area 12 metals were analyzed and detected above the method detection limit except for cadmium. Concentrations for 7 metals (arsenic, cadmium, total chromium, copper, lead, nickel, zinc) in one or more samples were detected above the target detection limits although none exceeded the available screening criteria. Since there were detections for metals, further evaluation of all 12 metals (antimony, arsenic, beryllium, cadmium, total chromium, copper, lead, mercury, nickel, selenium, silver, zinc) was necessary. No significant bioaccumulation resulted from the toxicity testing of the DMMUs. Ammonia ranged from 1.7 mg/kg to 7.63 mg/kg and all samples exceeded the target detection limit. Total organic carbon in the DMMU samples ranged from 0.0167% to 0.103% and in the Reference Area ranged from 0.142% to 0.161%. The samples were all below the target detection limit. The pH results were 8 to 9.01 in the DMMU samples and the Reference Area sample had a pH of 8.48.

From the Lower Bay, maintenance material sediment samples were collected in 1988 and 1991 according to the 2003 FEIS. Chromium, copper, lead, and nickel exceeded detection limits for one location and zinc was detected at all locations in 1988. Cadmium, chromium, copper, nickel, and zinc were found at most sampling locations in 1991. Chromium, copper, nickel, and zinc had similar concentrations for the 1988 and 1991 samples. No ERLs were exceeded and no organics were detected. The maintenance material in this area is coarse (72 to 97 % sand) which tends to bind less contaminant mass than other sediment or soil types and size fractions.

Since test survival at the 95 percent confidence level was not significantly less than Reference Control survival, no major adverse impacts would occur from placing maintenance material dredged from the Lower Bay into open water according to the 2003 FEIS.

In summary, earlier surficial sampling indicated few, sporadic results above screening levels for a few metal constituents. However, more recent testing results, including new work testing for the Entrance Channel reach in 2017, have not indicated such contaminant issues.

3.2 BIOLOGICAL RESOURCES

The following sections describe the biological resources found within the study area. This includes descriptions of habitat, flora, and fauna typically found in the aquatic and terrestrial portions of the study area.

3.2.1 Vegetation and Habitats

Information from the National Estuary Program and other agency publications, and available geospatial datasets from the State and Federal resource agencies were used describe and identify existing habitats in the study area, and in the proposed project, respectively. The following sections describe the existing habitats in the study area, and specifically in the project area.

3.2.1.1. Terrestrial

The study area is located within the Gulf Coast Prairies and Marshes Natural Region as mapped by the TPWD (TPWD, 2011). The Upper Coastal Prairie of Texas (approximately 21,000 square-miles) is a narrow strip of land, approximately 50 miles wide, that spans the length of the Texas Gulf Coast. Average annual rainfall increases from west to east and ranges from 30 to 50 inches per year. Common regional habitat types are: coastline barrier islands, estuarine marshes, remnant tall grass prairies (most converted to agricultural and/or

developed lands), oak parklands, and oak mottes. Forested wetlands and riparian woodlands occur in the river bottomlands. According to the 1984 TPWD's Vegetation Types of Texas, landside portions of the study area are mapped as salt marsh and marsh/barrier island vegetation types. Typical salt marsh vegetation includes species such as saltmarsh bulrush (*Scirpus maritimus*), saltwort (*Batis maritima*), gulf dune paspalum (*Paspalum monostachyum*), and cattails (*Typhus* spp.). Marsh and barrier island habitat occurs within most of the proposed above-water dredged material placement areas. Typical vegetation found in these habitats includes: Gulf cordgrasses (*Spartina* spp), black rush (*Juncus roemerianus*), glassworts (*Salicornia* spp), and sedges (*Cyperus* spp). The channel improvement portion of the proposed project is in the open water marine environment where no terrestrial habitat is present.

3.2.1.2. Wetlands

The mainland in the study area features two common types of wetlands: depressional wetlands, and estuarine wetlands. Depressional wetlands, also regionally known as prairie potholes, are freshwater wetlands set in a prairie mosaic landscape. Rainfall and/or groundwater sources fuel these poorly drained wetlands, and they are typically dominated by herbaceous vegetation. Common herbaceous wetland plants that grow in depressional wetlands include: spike rush (*Eleocharis* spp.), smartweed (*Polygonum hydropiperoides*), various sedges (*Carex* spp.), soft rush (*Juncus effusus*), and cattail (*Typha latifolia*). Some woody species can also be found in depressional wetlands, such as: Chinese tallow tree (*Triadica sebifera*), black willow (*Salix nigra*), rattlebush (*Sesbania drummondii*), and eastern baccharis (*Baccharis halimifolia*).

Estuarine wetlands are located in a transitional area between freshwater and saltwater marshes. Common species that occur in estuarine wetlands include glasswort, salt marsh bulrush (*Scirpus maritimus*), smooth cordgrass, saltgrass (*Distichlis spicata*), and sea-oxeye (*Borrichia frutescens*). Coastal estuarine wetlands of Corpus Christi Bay, Nueces Bay and Redfish Bay/Harbor Island play an important part in sustaining the health and abundance of life within the ecosystem. They are extremely important natural resources that provide essential habitat for fish, shellfish, and other wildlife (McHugh, 1967; Turner, 1977; Sather and Smith, 1984). Coastal wetlands also serve to filter and process agricultural and urban runoff and buffer coastal areas against storm and wave damage. Geospatial data from the National Wetland Inventory (NWI) was used to map existing estuarine and coastal wetland features in the vicinity of the proposed project and placement areas. Coastal wetlands mapped in the study area are shown on Figure 3.2.1-1 and close-ups of this mapping in proposed placement sites are shown in Figure 3.2.1-2.

The channel improvement portion of the proposed project is in the open water marine environment of the Gulf of Mexico and Corpus Christi Bay where no wetlands are present. However, these area constitute waters of the United States (WOUS).

3.2.1.3. Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) includes the true seagrasses such as shoalgrass (*Halodule wrightii*), turtlegrass (*Thalassia testudinum*), manateegrass (*Syringodium filiforme*), and clovergrass (*Halophila engelmannii*), but also includes widgeongrass (*Ruppia maritima*) which is not considered a true seagrass because it grows in freshwater environments as well. Seagrass/SAV meadows typically occur in water shallower than 4 feet MLT. In the study area, they occur primarily in Redfish Bay in large, contiguous tracts, and along the bay side of Mustang Island in inlets and shallow, relatively low energy areas (TPWD, 2018a). These seagrass communities generate high primary productivity and provide refuge for numerous species including shrimp, fish, crabs and their prey. Animal abundances in seagrass beds can be 2-25 times greater than in adjacent unvegetated areas ( ). All five taxa are found within Corpus Christi Bay and Redfish Bay/Harbor Island, with shoalgrass being the most abundant. Shoalgrass and widgeongrass both occur in Nueces Bay (Pulich et al., 1997).

There are approximately 19,900 acres of seagrass beds in the greater study area. The net acreage of seagrass in Corpus Christi Bay and Redfish Bay/Harbor Island has remained relatively stable since 1958, although there has been fragmentation of this habitat and some local losses in Redfish Bay/Harbor Island. The acreage of seagrass beds in Nueces Bay fluctuates with inflows, but there has been a net increase since 1958. There have also been increases in seagrass coverage in the Harbor Island and Mustang Island areas.

The most currently available geospatial data for seagrass mapping was downloaded from the National Oceanic and Atmospheric Administration (NOAA) and Texas Parks and Wildlife Department (TPWD) Geographic Information System (GIS) data sites and combined to provide mapping of seagrass. **Error! Reference source not found.** and Figure 3.2.1-2 show the seagrass mapped in the project area surrounding the proposed project channel reach, and a close-up of mapped resources within proposed placement sites. Within the proposed project footprint where the project will be located, the depth of the existing channel, side slopes and regular maintenance are not conducive to supporting seagrasses. Therefore the proposed project location is currently devoid of seagrass. There are only three to four small areas mapped directly adjacent to the channel in the shallow margins of dredge spoil islands near the Ingleside area.

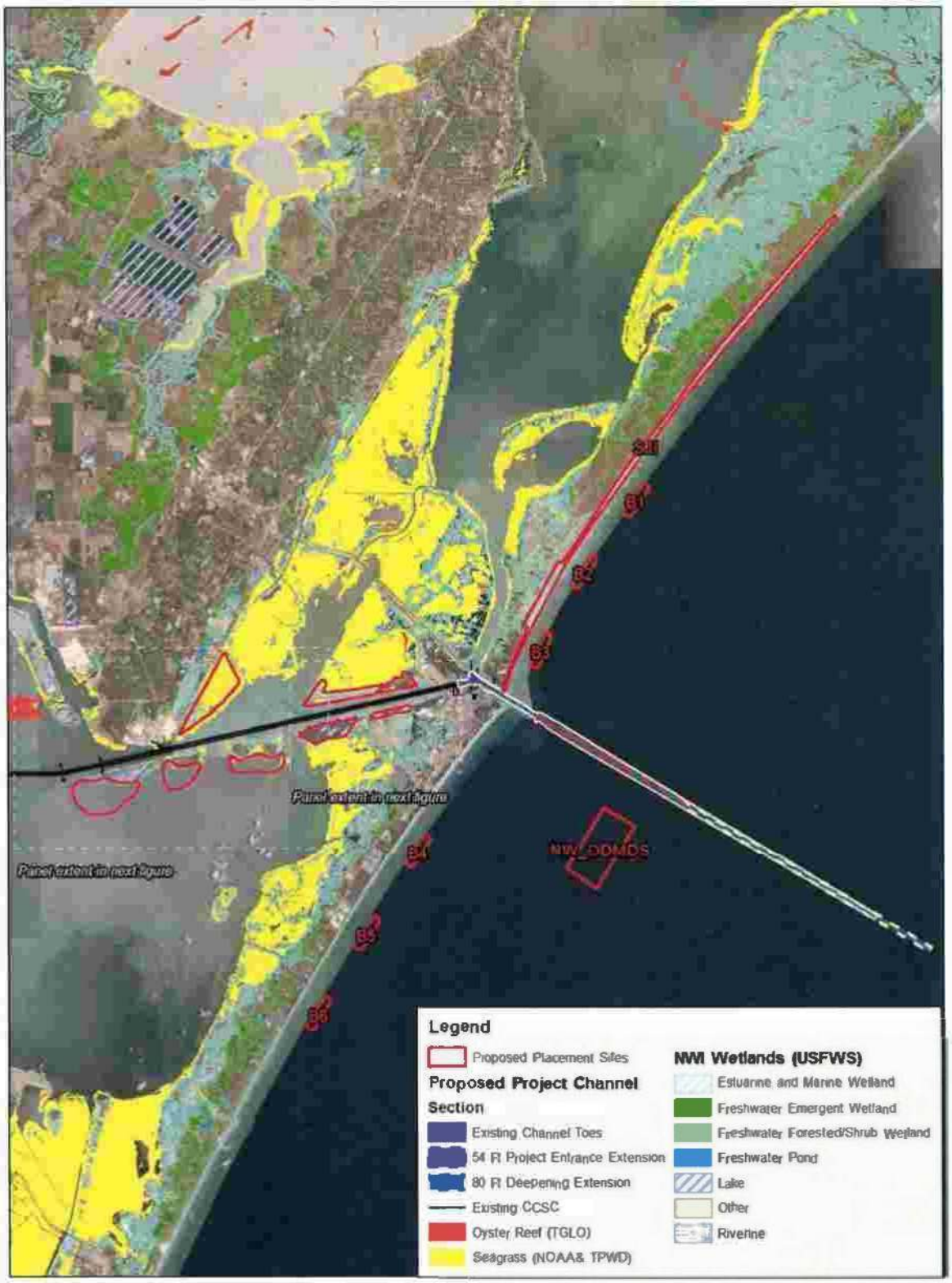

Figure 3.2.1-1 Aquatic Resources in Project Vicinity

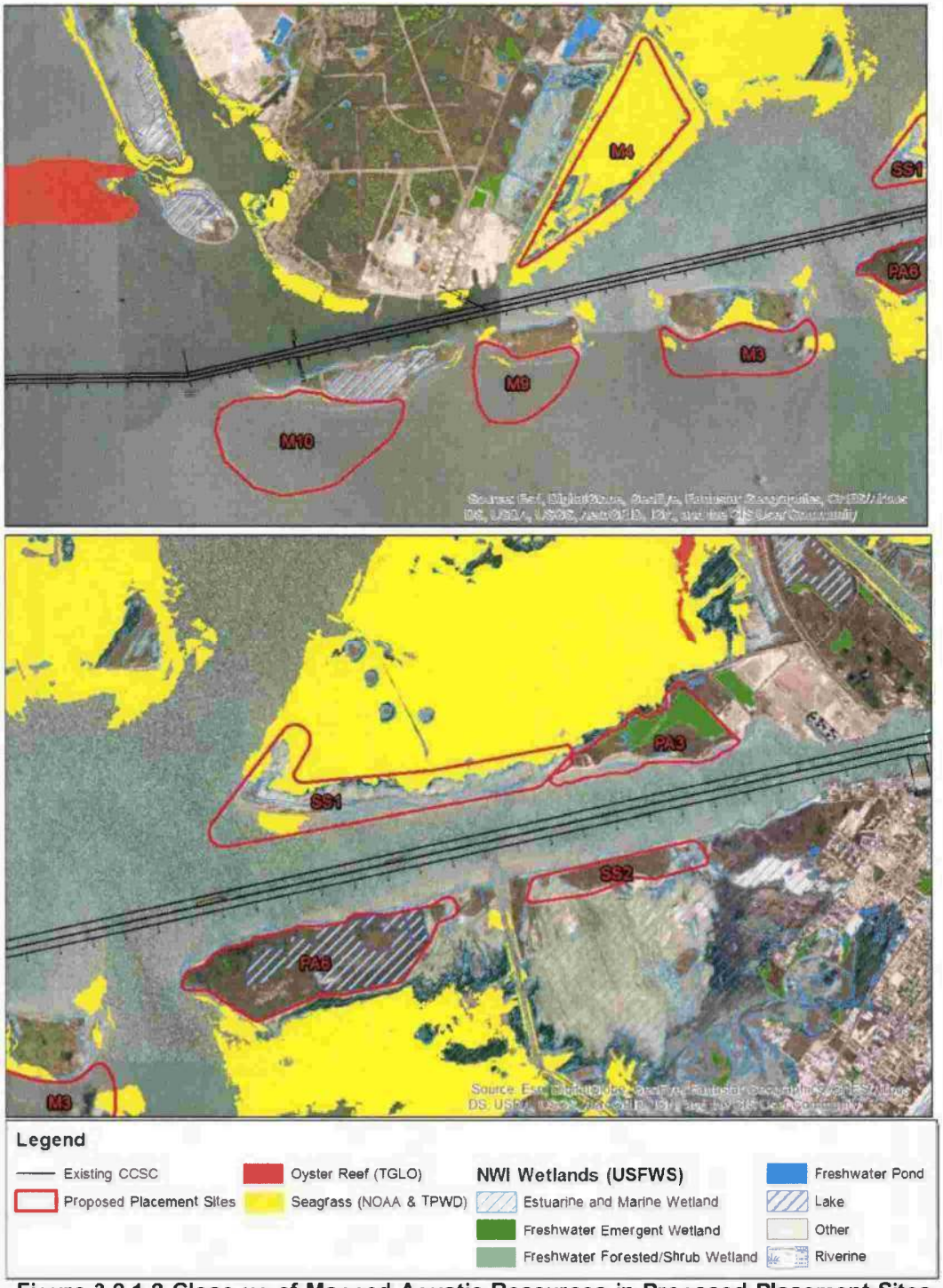

Figure 3.2.1-2 Close-up of Mapped Aquatic Resources in Proposed Placement Sites

3.2.1.4. Tidal Flats and Beaches

The study area also contains wind tidal flats, categorized as such because they are exposed primarily by wind and storm tides as opposed to astronomical tides. These areas are important feeding grounds for coastal shorebirds, including the threatened piping plover, fish, and invertebrates. There are approximately 5,100 acres of this category within the study area. These areas are generally hypersaline, which prevents or restricts macrophytic vegetation. Blue-green algal mats also tend to form in these areas. There are approximately 807 acres of algal mats in Corpus Christi Bay (including Oso Bay) and 87 acres in Redfish Bay/Harbor Island (Pulich et al., 1997). Closer to the project area and the proposed placement sites, tidal flats have been identified by the national estuary program at the shoreline margins of the western end of Harbor Island (near SS1), Pelican Island (near M3), PA 9 and PA 10, and sand flats in the Port Aransas Nature Preserve near SS2 (Withers and Tunnell Jr. 1998). The flats on Pelican Island, PA 9, and PA 10 have also been identified in National Wetland Inventory (NWI) mapping as estuarine marine habitat types consisting of unconsolidated shoreline with "spoil" substrate qualifiers, meaning the habitat was formed by spoil disposal.

Beaches along the south Texas and Coastal Bend coastline are dynamic habitats subject to a variety of environmental influences, such as wind and wave action, salt spray, high temperature, and moisture stress. These coastal shore areas function as buffers protecting upland habitats from erosion and storm damage, and adjacent marshes and waterways from water-quality problems. A variety of birds occur on these coastal shores, and few are restricted to one particular habitat (Britton and Morton, 1989). Cranes, rails, coots, gallinules, and other groups can be found on the shorelines and in fringing marshes of the study area. Closer to the project area and the proposed placement sites, the Gulf side of Mustang Island and San Jose Island contain the extensive barrier island beaches that provide this type of habitat. Hurricane Harvey in August of 2017 made landfall on San Jose Island and caused extensive erosion to the beachline and dune system at the south end of the island, and resulted in significant erosion along the entire foreshore (the seaward sloping part of the beach within normal tidal range) of the island (FEMA 2018).

3.2.1.5. Open Water

Open water areas include the open water column and unvegetated, bottom portion (excludes hard substrates such as oyster reefs) of the subtidal estuarine and Gulf environments. This type of habitat is the main habitat comprising Corpus Christi Bay, and the Gulf of Mexico in the vicinity of the project area. Open water habitats support communities of benthic organisms and corresponding fisheries populations. Approximately 154,000 acres of open water habitat are in the project area.

3.2.1.6. Hard Bottom Oyster Reef Habitat

Hard bottom habitat are areas of bay or ocean bottom where the bottom substrate is firm enough to recruit sessile (fixed) invertebrates (oysters, coral etc.), which in the project area's case means oysters. There are a few scattered Eastern oyster (*Crassostrea virginica*) reefs present in some areas of Corpus Christi Bay (1.14 acres), Redfish Bay/Harbor Island (112.6 acres) and Nueces Bay (24.99 acres) (Pulich et al., 1997). According to the Corpus Christi National Estuary report (CCBNEP 1996b), Gatsoff found most oyster reefs in Corpus Christi Bay to be dead; but some living oyster reefs exist in Nueces Bay and the intertidal zone. Periodic TPWD surveys completed since also support these findings. The most recent area reef mapping geospatial data was obtained from TNRIS, and is illustrated in Figure 3.2.1-2. The data was sourced from surveys conducted from 2004 to 2012. As shown, there are no mapped reefs within or directly adjacent to the subject segment of the CCSC from the Gulf to Harbor Island.

3.2.2 Wildlife

Wildlife in the study area reflects the diversity of habitat present in the terrestrial and marine environments described the study area. The following sections summarize the wildlife found in these habitats.

3.2.2.1. Terrestrial and Shoreline

The mainland surrounding the project area lies within Blair's (1950) Tamaulipan Biotic Province. The area is semiarid and hot, with marked deficiency of moisture for plant growth. The vertebrate fauna of this province includes considerable elements of neotropical as well as grassland species. Wildlife habitats found within the project area include upland prairies, salt marsh and seagrass beds, and tidally influenced lowlands and shoreline. The Upper Laguna Madre supports documented migratory and waterbird nesting sites, two Audubon sanctuaries, Padre Island National Seashore, Mollie Beattie Habitat Community, and Mustang Island State Park.

The Tamaulipan Biotic Province supports diverse fauna composed of a mixture of species that are common in neighboring biotic provinces. The fauna include a substantial number of neotropical species from the south, a large number of grassland species from the north and northwest, a few Austroriparian species from the northeast, and some Chihuahuan species from the west and southwest (Blair, 1950).

At least 19 species of lizards and 36 species of snakes occur in the Tamaulipan Biotic Province (Blair, 1950).

- Amphibian species of potential occurrence in the project area include Blanchard's cricket frog *(Acnis creptians b/anchardi),* Texas toad *(Bufo speciosus),* Great Plains narrowmouth toad *(Gastnophryne o/ivacea),* and bull frog *(Rana catesbiana).*
- Terrestrial reptiles of potential occurrence in the project area include the western glass lizard *(Ophisaurus attenuatus attenuatus),* six-lined racerunner *(Cnemidophorus sex/ineatus sox/ineatus),* keeled earless lizard *(Ho/bnookia propinqua propinqua),* Texas spotted whiptail *(Cnemidophonus gulanis),* western coachwhip *(Masticophis lagellum tesaceus),* ground snake *(Sonora semiannu/ata),* and western diamondback rattlesnake *(Crotalus atrox).*

The project area and vicinity support abundant and diverse avifauna. Tidal flats and beaches create excellent habitat for numerous species of gulls, terns, herons, shorebirds, and wading birds. Some common species which occur within the project area include the Laughing gull *(Larus atnici/la),* Ring-billed gull *(Larus delawarensis),* Royal tern *(Sterna maxima),* Sandwich tern *(Sterna sandvicensis),* Great blue heron *(Andea herodias),* Little blue heron *(Egretta caerulea),* Sanderlings *(Ca/idnis a/ba),* Least sandpiper *(Ca/idnis minutil/a),* Roseate spoonbill *(Ajaia ajaja),* and White ibis *(Eudocimus a/bus).* Thousands of Sandhill cranes *(Gnus canadensis)* utilize tall grass coastal prairies and fallow agricultural fields throughout the south Texas coast. Many other species of raptors, songbirds, and migratory waterfowl are also associated with south Texas prairies and marshes. Texas is one of the most significant waterfowl wintering regions in North America with three to five million waterfowl annually (recent years) wintering in the state (Texas Coastal Management Program (TCMP), 1996).

At least 61 mammalian species occur or have occurred within recent times in the Tamaulipan Biotic Province ( ). Terrestrial mammals likely to occur in the project area include the black-tailed jack rabbit *(Lepus californicus),* Gulf Coast kangaroo rat *(Dipodomys compactus),* marsh rice rat *(Onyzomys palustnis),* fulvous harvest mouse *(Reithrodontomys fu/vescens),* common raccoon *(Procyon lotor),* striped skunk *(Mephitis mephitis),* and coyote *(Canis /atrans).*

3.2.2.2. Aquatic

The following sections discuss the flora and fauna of Corpus Christi Bay in the water column as well as on and in the benthic substrate.

3.2.2.2.1. Benthic

Benthicfauna are the various organisms found on (epifauna) and in (infauna) the seabed and include invertebrates such as mussels, snails, crustaceans, worms and others. In a comprehensive assessment of the substrate at stations throughout Corpus Christi and Aransas Bays, a total of 331 benthic species were found and identified including annelids (oligochaetes and polychaetes), molluscs, arthropods (crustaceans and pycnogonids), sipunculids, echinoderms and various other phyla (Holland et al. 1973). The authors found the benthic assemblages to be more diverse than either phytoplankton or zooplankton. They also determined that abundance is higher in December and March/April at many stations. They state that five of the most common species were *Mediomastus californiensis*, *Glycinde solitaria*, *Prionospio pinnata*, *Neanthes succinea* and *Gyptis vittata*, which are all polychaetes. Silty clay (or muddy) sediments tend to support a community dominated by polychaetes, while more sandy (coarse grained) sediments are primarily dominated by crustaceans ( ).

Flint and Younk ( ) studied benthic communities in Corpus Christi Bay from 1974 to 1979 to identify variations (natural and human-induced) in community dynamics of the benthos over a long term of monthly sampling. The authors state their results were comparable to previous shorter-term studies in respect to dominant species, total densities and species diversity measures. Their stations were from two different habitats; channel stations 15 m deep and shoal stations <3.5 m deep. They found that channel stations had lower species numbers, densities, and species diversity than the shoal stations but showed more even distributions of population numbers between species than the shoal sites. The authors attributed major disturbances to the channel maintenance dredging activities as well as minor and more frequent disturbances from large ship traffic and shrimp trawling activities as reasons for the differences in community structure patterns. The authors also conclude that their study illustrates the resilience of the benthic communities to disturbance.

Flint and Kalke ( ) found that polychaetes comprised the majority of benthic macrofauna which represented more than 85% of total abundance. The 13 most abundant species (10 polychates, 2 molluscs and an enteropneust) represented 72% of the total of all macroinfaunal species collected while the molluscs represented 4.3% and the enteropneust was 3.0% of total abundance.

Hypoxia reoccurs in Corpus Christi Bay every summer in the bottom waters, but is more prevalent in the southeastern portion of the Bay than any other region including the Project area (Morehead and Montagna 2004). Hypoxia can reduce abundance, biomass, diversity, species richness and species evenness (Montagna and Ritter) and the stress from hypoxia affects taxa intolerant of low oxygen conditions (Montagna and Froeschke).

3.2.2.2.2. Phytoplankton and Macroalgae

Phytoplankton, or the free-floating plant-like microscopic marine algae in the water column is comprised of dinoflagellates or diatoms that form part of the base of the marine food web. Macroalgae are larger forms of algae that are comprised of the fixed algal mats or floating seaweeds. In a three-year study in the Corpus Christi Bay ecosystem Flint ( ) found phytoplankton production increased with distance from riverine influence and was most closely associated with deeper, less turbid water at the end of the estuary close to the GOM which provided a greater euphotic zone. Measured primary productivity rates varied due to water column nutrients in January and

July and to salinity changes in April and October. Flint estimated annual phytoplankton production at 174.1 g $C/m^2/yr$ representing 52% of total new organic production in the estuary. Flint found macrophytes and tidal flat algae comprised the remainder of new organic carbon production. Freshwater input (river flow or rainfall) was found to most significantly affect annual production, though the high turbidity of the estuary is thought to limit production when compared to other North American estuaries (Flint 1984).

Macroalgae present in the Corpus Christi Bay system and adjacent Gulf of Mexico were catalogued in 1999 and included various taxanomic divisions such rodophytes (red algaes), phaeophytes (brown algaes), and chlorophytes (green algaes) (Lehman 1999). These macroalgae represent a variety of species that attach to other plants such as seagrass (epiphytic). They grow subtidally preferentially on soft (such as protected flats) or hard bottoms (such as rock or reef), or are pelagic where they dwell and drift in bay or Gulf water columns. Common rodophytes included *Erythrotrichia carnea, acrochaetium hoytii*, and *bryocladia cuspidata.* Common phaeophytes include *Ectocarpus rallsiae Vickers, Dictyota menstrualis*, and *Sargassum fluitans.* Common chlorophytes include *Ulothrix flacca, Enteromorpha flexuosa*, and *Bryopsis pennata.* As macroalgae depend on light for growth, water clarity and depth limit where they grow in the area. Also, most fixed macroalgae need some sort of firm substrate to grow. In the proposed project channel itself, these factors would tend to largely limit macroalgae to those that drift or dwell in the water column. These microalgae include *Chondria cnicophylla* and *Sargassum* species, which constitute the minority of species catalogued.

3.2.2.2.3. Zooplankton

Zooplankton are an important part of the ecosystem because they transfer energy from the primary producers to the larger consumers including the larval young of almost all species of fish, shrimp and adult fish that remain plankton feeders throughout their lives. Zooplankton include;

- Holoplankton (organisms that are planktonic throughout their life histories – i.e. copepods, larvaceans, chaetognaths, cladocerans and ctenophores); and
- Meroplankton (organisms which spend only a part of their lives as plankton – i.e. larval forms of many benthic organisms and the pelagic larvae of fish).

More than 200 species of zooplankton were identified during a survey of Corpus Christi Bay in 1972/1973 (Holland et al., 1973). The authors noted a spring bloom apparent in Corpus Christi Bay beginning in February reaching a maximum peak abundance in March associated with large catches of the dinoflagellate *Noctiluca scintillans.*

3.2.2.2.4. Finfish and Shellfish

The variety of aquatic and marine habitats present in the study area support the various life stages for many finfish and shellfish species, several of which form the basis of recreational and commercial fisheries. Common game finfish include sand seatrout (*Cynoscion arenarius*), black drum (*Pogonias cromis*), Atlantic croaker (*Micropogonias undulatus*), southern flounder (*Paralichthys lethostigma*), mullet species, Atlantic cutlassfish (*Trichiurus lepturus*), and sheepshead (*Archosargus probatocephalus*). Common shellfish include brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*Farfantepenaeus duorarum*), and white shrimp (*Litopenaeus setiferus*). Typically, tidal marshes and seagrass serve as nursery habitat for the juvenile life stages of various of these finfish and shellfish, while the open water column and soft bay or seafloor serve as habitat for adult stages. The most common oyster species is *Crassostrea virginica.* Oyster reefs have been mapped in Corpus Christi Bay as discussed in Section 3.2.1.6, but are not found in the immediate project area. Historically, reefs were found

further west along the channel (Martinez 1961). These commercial and recreational species are discussed in more detail later in this section.

The 2003 FEIS listed other common finfish expected in the area. Those expected mainly in shallow areas include the longnose killifish (*Fundulus similis*), Gulf killifish (*F. grandis)*, and tidewater silverside (*Menidia peninsulae*), while those found in seagrass include pinfish (*Lagodon rhomboides*), silver perch (*Bairdiella chrysura*), sheepshead, and pigfish (*Orthopristis chrysoptera*). Other species found in deeper water include Gulf menhaden (*Brevoortia patronus*), and sea catfish (*Anus felis*), while a number of fish occur in abundance in both seagrass and deeper water, including bay anchovy (*Anchoa mitchilli*), spot (*Leiostomus xanthurus*), and striped mullet (*Mugil cephalus*). The majority (90%) of surf-zone fish in a study referenced in the FEIS were larvae and small juveniles including sardine (*Harengula jaguana*), anchovy, Atlantic croaker, mullet, Gulf menhaden, Atlantic thread herring (*Opisthonema oglinum*), and Florida pompano (*Trachinotus carolinus*).

State Managed Recreational and Commercial Fisheries

Texas recreational and commercial fishermen fishing less than 9 nautical miles off the coast of Texas are considered to be in State regulated waters, and must comply with the rules and regulations for each type of fishing that have been published by the TPWD. The TPWD provides electronic access to the rules and regulations for coastal fishing on its website at http://tpwd.texas.gov/regulations/outdoor-annual/fishing/general-rules-regulations/, as accessed on July 16, 2018. The former Texas Parks and Wildlife Commission adopted management plans for only the shrimp, oyster and crab fisheries. The remaining species which are regulated by the State of Texas are regulated only through written rules and regulations, not through FMPs.

A comparison of total finfish landed in the Texas major bay systems for the five year period from 1997-2001 shows that Corpus Christi Bay contributed nine percent, the fourth largest contribution in the state with black drum being the dominant species landed (Culbertson et al., 2004). The annual commercial finfish catch within Corpus Christi Bay between 1981 and 2001 averaged approximately 326,981 lbs (Table 3.2.2-1), and the annual ex-value of finfish averaged $331,328 (Table 3.2.2-2) (Culbertson, et al., 2004). Finfish species caught in Corpus Christi Bay in 2001 included black drum, Atlantic croaker, flounder species, mullet species, Atlantic cutlassfish, sheepshead, killifish, snake eel and other unclassified scrap (Culbertson et al. 2004). While the majority of recreational revenue is generated through the collection of finfish, the commercial catch is predominantly comprised of shellfish. The 2001 shellfish landings in Corpus Christi Bay were worth approximately $1.02 million while finfish accounted for only $384 thousand (all values given are in U.S. dollars (USD)) (Culbertson et [redacted]). Landings of brown, pink and white shrimp account for the majority of the commercial value, followed by blue crab (*Callinectes sapidus*) with oysters a very minor (if at all) contributor (Culbertson et. al., 2004).

Table 3.2.2-1 Weight (lbs) of species landed commercially from Corpus Christi Bay system

	Finfish						Shellfish								
							Shrimp								
Year	Black Drum	Flounder	Sheepshead	Mullet	Other	Total	Brown and Pink	White	Other	Total	Blue Crab	Eastern Oyster	Other	Total	Grand Total
1981	58074	5880	51927	23592	188663	328136	510541	153353	0	663894	7723	0	0	671617	999753
1982	58262	36632	43574	8568	1685	148721	257888	202810	0	460698	141558	0	0	602256	750977
1983	105884	74422	87195	0	9186	276687	257711	428097	0	685808	231757	0	35	917600	1194287
1984	64620	32236	31185	1515	1075	130631	1209190	882215	0	2091405	76135	0	1014	2168554	2299185
1985	29309	86770	39254	4422	18723	178478	870957	178381	0	1049338	132786	0	22284	1204408	1382886
1986	58969	120588	20443	358	23920	224278	596192	396758	0	992950	877180	0	13618	1883748	2108026
1987	105461	65419	21379	0	24710	216969	822283	496547	0	1318830	267622	403	9445	1596300	1813269
1988	136953	33082	59716	0	2289	232040	609771	301025	0	910796	202774	175	9717	1123462	1355502
1989	63773	7757	2535	0	11705	85770	541797	56476	0	598273	948543	0	7568	1554384	1640154
1990	151628	9634	540	354	8629	170785	1217343	873631	0	2090974	665532	35	6039	2762580	2933365
1991	112772	44831	4485	3412	17165	182665	1494548	640730	198	2135476	112180	280	3006	2250942	2433607
1992	300710	93777	11518	123	32960	439088	1537287	810940	0	2348227	508370	0	8033	2864630	3303718
1993	282113	52161	13044	121	11843	359282	946624	439367	0	1385991	973641	0	1028	2360660	27199.42
1994	375588	66664	9369	3051	37322	491994	1229258	261614	0	1490872	153625	0	6131	1650628	2142622
1995	598421	48323	17549	1693	48201	714187	1202579	92768	0	1295347	50459	0	7269	1353075	2067262
1996	946497	64183	33079	1130	24275	1069164	626211	60411	0	686622	20271	0	5722	712615	1781779
1997	519188	30772	20449	737	22705	593851	1051068	8225	0	1059293	18855	0	9943	1088091	1681942
1998	316272	28416	10495	2768	9470	367421	1216078	52795	31	1268904	56780	0	7538	1333222	1700643
1999	134920	1841	2900	1488	18706	159855	318551	30225	82	348858	8039	0	3994	360891	520746
2000	193954	13440	2902	3202	24294	237792	282914	24270	0	307184	3017	0	5113	315314	553106
2001	206994	14188	2815	6422	28397	258816	421204	31349	0	452553	5879	0	8101	466533	725349

Source: Culbertson et al 2004

Table 3.2.2-2 Ex-vessel value ($) of each species landed commercially from Corpus Christi Bay system

	Finfish						Shellfish								
							Shrimp								
Year	Black Drum	Flounder	Sheepshead	Mullet	Other	Total	Brown and Pink	White	Other	Total	Blue Crab	Eastern Oyster	Other	Total	Grand Total
1981	34387	5938	7860	2118	199312	249616	573037	299668	0	872705	3850	0	0	876555	1126171
1982	39150	35720	10638	728	849	87086	367070	584649	0	951719	43920	0	0	995639	1082725
1983	68644	72870	22966	0	1552	166032	374992	1372413	0	1747405	93369	0	18	1840791	2006823
1984	39855	30909	5985	169	246	77165	1542711	1832256	0	3374967	27079	0	507	3402553	3479718
1985	23813	82569	7756	444	3263	117845	1003843	366485	0	1370328	44889	0	59735	1474951	1592797
1986	36612	108600	4764	45	5808	155830	1122620	904385	0	2027005	273693	0	29259	2329957	2485786
1987	61085	62060	5479	0	8284	136908	1729886	1193485	0	2923371	102021	1449	8309	3035150	3172058
1988	119231	40652	17647	0	1374	178904	1023308	630631	0	1653939	80745	500	22318	1757503	1936407
1989	70311	11863	1007	0	18488	101670	868183	131012	0	999195	384931	0	19314	1403440	1505110
1990	214047	16226	254	237	7093	237858	1777207	2480713	0	4257920	310237	40	14294	4582491	4820348
1991	129487	62426	1733	853	15336	209834	2693838	1789107	215	4483160	46555	1152	3935	4534802	4744636
1992	291765	118554	5757	281	26169	442525	3137433	2200493	0	5337926	252450	0	17163	5607538	6050064
1993	250286	94345	5715	291	12046	362682	1517564	981804	0	2499368	566315	0	1857	3067541	3430223
1994	339091	128959	4310	5601	48228	526190	2971299	978946	0	3950245	125230	0	11940	4087415	4613605
1995	573274	92773	9412	4800	75523	755783	2271821	297478	0	2569299	45567	0	18278	2633145	3388927
1996	910277	131020	14828	3245	30177	1089547	1579485	230475	0	1809960	14438	0	8033	1832432	2921979
1997	520985	57298	10093	2573	50667	641615	2588655	38334	0	2626989	11119	0	18579	2656622	3298303
1998	353827	63524	5358	5377	38484	466571	2049533	168626	38	2218197	42111	0	13730	2274038	2740609
1999	136549	4039	1549	3112	88556	233805	568355	155314	137	723806	3707	0	5190	732704	966509
2000	174465	28499	1215	7163	124969	336312	594684	102023	0	696707	1163	0	9647	707517	1043829
2001	151805	34197	1285	16022	180809	384118	888337	117163	0	1005500	3069	0	12852	1021421	1405539

Source: Culbertson et al 2004

The Texas recreational fishery is an economically important segment of the total coastal fishery industry with resultant direct expenditures translating to over $2 billion annually to the State's economy (Texas Water Development Board, 1987). Recreational fishing in the Corpus Christi Bay system accounts for 611 jobs, $21.7 million in labor income, $33.8 million in value-added (contribution to Texas GDP), and $59.4 million in output (sales value of goods and services) (Ropicki et al 2016). Shore-based fishing accounted for approximately 71% of all angler trips (more than any other Texas bay system) and the majority of economic impacts (~61%) (Ropicki et [redacted]). When compared to all other Texas bay systems, non-resident fishermen accounted for a greater percentage of trips taken and economic impacts in Corpus Christi Bay (Ropicki et al 2016). The primary species targeted and landed by recreational fisherman include spotted seatrout, flounder, sheepshead and black and red drum (Ropicki et al 2016). From 2006 to 2017 the TPWD stocked an average of 1.16 million red drum fingerlings in Corpus Christi Bay (TPWD 2018b)

State records for Corpus Christi Channel only include four species: gafftopsail catfish, hardhead catfish, striped mullet and pinfish. Records for Corpus Christi Bay using all types of tackle list 24 different species including drums, flounder, jacks, seatrout, snapper and others. Another list includes records separated by tackle type; rod and reel (22 species), fly fishing (6 species), and bow fishing (1 species).

The entire length of the channel where the deepening is proposed is documented as restricted for shellfishing, meaning the entire area is closed to the harvesting of molluscan shellfish (TDSHS 2018).

3.2.2.2.5. Reptiles and Mammals

Five species of sea turtles are known to occur within the Gulf of Mexico and associated bays. These sea turtles include the loggerhead sea turtle *(Caretta caretta),* green sea turtle *(Chelonia mydas),* leatherback sea turtle *(Denmochelys coniacea),* Atlantic hawksbill sea turtle *(Eretmocheys imbricata),* and Kemp's Ridley sea turtle *(Lepidochelys kempil).* They use the various types of marine, aquatic, and nearshore habitats found in the study area, include the estuarine and oceanic open water, seagrass, and beach habitats. All five species of turtles are listed as threatened or endangered, and are discussed in detail in Section 3.2.4, Threatened and Endangered Species. Marine mammals are also likely to occur within the project area, primarily consisting of bottlenose dolphins (*Tursiops truncatus*). The West Indian manatee (*Trichechus manatus*) rarely occurs in the area and is discussed further in Section 3.2.4.

3.2.3 Essential Fish Habitat

3.2.3.1. Introduction to Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) set forth a new mandate for the National Marine Fisheries Service (NMFS), regional Fishery Management Councils (FMC), and other Federal agencies to identify and protect important marine and anadromous fisheries habitat, referred to as Essential Fish Habitat (EFH). To achieve this goal, it was recognized by NMFS that suitable marine fishery habitat needed to be maintained. The NMFS and the regional FMCs were required to delineate EFH in Fishery Management Plans (FMP) for all federally managed fisheries. The 1996 amendments to the MSFCMA also required that EFH consultation be conducted for any activity that may affect important habitats of federally managed marine and anadromous fish species.

EFH has been defined in MSFCMA § 3(10) as those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity. The EFH final rule summarizing EFH regulations (50 CFR Part 600, 2002) further specified the EFH definition as waters and their associated physical, chemical, and biological properties that are used by fish. EFH may include aquatic areas historically used by fish where appropriate. Substrate includes sediment, hard-bottom, structures underlying the waters, and associated biological communities. 'Necessary' means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. 'Spawning, breeding, feeding, or growth to maturity' covers a species' full life cycle.

NOAA Fisheries Gulf of Mexico Fishery Management Council (GMFMC) is responsible for the creation of FMPs in Federal waters off Texas, Louisiana, Mississippi, Alabama, and Florida. GMFMC defines six FMPs for the Gulf of Mexico (GOM] for:

- Shrimp (4 species);
- Red drum (1 species);
- Reef fish (43 species);
- Coastal migratory pelagics (3 species managed, 4 not in the management group);
- Corals (managed species are not listed under this FMP); and
- Spiny lobster (1 species).

Based on the NOAA Atlas (NOAA, 1985) and functional relationships analysis, EFH consists of areas of higher species density for the Red Drum, Reef Fish, Coastal Migratory Pelagics, Shrimp, and Spiny Lobster FMPs, and known distributions for the Coral FMP.

The MSFCMA established procedures for identifying EFH and required interagency coordination to further the conservation of federally managed fisheries. Any Federal agency that authorizes funds or undertakes, or proposes to authorize, fund, or undertake an activity that could adversely affect EFH is subject to the consultation provisions of the above-mentioned Act. This EA serves to initiate EFH consultation under the MSFCMA. The following paragraphs briefly describe EFH and the managed species within the Project area.

3.2.3.2. Project Area EFH Determination by FMPs

EFH for Corpus Christi Bay is identified by the GMFMC as Ecoregion 5 and determined as the composite of EFH for various species and life stages in the fishery management units (FMU) of the Gulf of Mexico. General EFH

information presented was derived from the EFH mapping tool provided by NOAA. Details on EFH for specific species and life stages in each FMU are provided in Section 3 of the EFH FEIS (GMFMC, 2004). EFH information is summarized in this section to provide a description of what EFH and managed species is defined for the project area.

Information from the habitat descriptions from the GNFMC FMPs and the EFH FEIS were used to provide the following summary of what EFH and managed species (and associated life stages) are thought to be present in the project area (GMFMC 2004 and 2005).

Red Drum FMP EFH: All estuaries in the GOM, which would include Corpus Christi Bay, are defined as EFH for the Red drum (*Sciaenops ocellatus*). The area of Corpus Christi Bay where the proposed project is planned is considered to be EFH for all life stages of the red drum.

Reef Fish and Coastal Migratory Pelagics FMPs EFH: All estuaries in the GOM, which would include Corpus Christi Bay, are defined as EFH for all species and life stages of Reef Fish and Coastal Migratory Pelagics. EFH for reef fish and coastal migratory pelagics is defined as GOM waters and substrates extending from:

- The US/Mexico border to the boundary between the areas covered by the GMFMC; and
- The SAFMC from estuarine waters out to depths of 100 fathoms.

Shrimp FMP EFH: All estuaries in the GOM, which would include Corpus Christi Bay, are defined as EFH for shrimp. Of the species listed in the Shrimp FMP, only brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*F. duorarum*), and white shrimp (*Litopenaeus setiferus*) have habitat descriptions associated with Corpus Christi Bay (GMFMC, 2004).

Corpus Christi Bay does not have habitat defined as EFH for the other GMFMC FMPs, which are the Spiny Lobster FMP and Coral FMP. The absence of EFH for the species not found in Corpus Christi Bay is generally attributable to life stage requirements for oceanic salinity, continental shelf or reef structure, and seagrass, but also may be due to natural range, offshore spawning habits, and other causes.

The above EFH descriptions are broad and cover much of the GOM. Consultation with NMFS for a previous EA further defined EFH for Corpus Christi Bay limited to five species of reef fish: dog snapper (*Lutjanus jocu*), gray snapper (*Lutjanus griseus*), lane snapper (*Lutjanus synagris*), goliath grouper (*Epinephelus itajara*) and yellowmouth grouper (*Mycteroperca interstitialis*) along with the eight highly migratory species described below (HDR 2012).

The highly migratory species are managed by the NOAA Fisheries Highly Migratory Species Management Unit, Office of Sustainable Fisheries and an FMP was developed for the Atlantic species of sharks, tunas, and swordfish, and Atlantic billfishes (NMFS, 2006). EFH has been mapped for 53 of the species managed by this FMP, and are listed in and discussed in more detail in the Draft EFH Amendment 10 (NOAA Fisheries, 2016). Of the 53 highly migratory species for which EFH has been mapped, only the following have EFH within the area in Corpus Christi Bay. This area is located at approximately the junction with the La Quinta Channel and points east and the species are: Atlantic sharpnose shark neonates, juveniles and adults (*Rhizoprionodon terraenovae*), Blacktip shark neonates only (*Carcharinus limbatus*), Bonnethead shark neonates, juveniles and adults (*Sphyrna tiburo*), Bull shark neonates, juveniles and adults (*Carcharhinus leucas*), finetooth shark neonates, juveniles and adults (*Carcharinus isodon*), Spinner shark neonates only (*Carcharhinus brevipinna*), lemon shark neonates only (*Negaprion brevirostris*), and the Scalloped hammerhead shark neonates only (*Sphyrna lewini*).

The proposed project area is located within Ecoregion 5 estuarine and nearshore zones as identified by the GMFMC. The categories of EFH in the project area include estuarine emergent marsh, sand/shell substrate, estuarine soft substrate, submerged aquatic vegetation (SAV) and estuarine and nearshore water column. In addition to being designated as EFH, these habitats provide nursery, foraging, and refuge habitats that support various economically important marine fishery species. These species include: spotted seatrout (*Cynoscion nebulosus*), flounder (*Paralichthys* spp.), Atlantic croaker (*Micropogonias undulatus*), black drum (*Pogonias cromis*), gulf menhaden (*Brevoortia patronus*), striped mullet (*Mugil cephalus*), and blue crab (*Callinectes sapidus*). Such estuarine-dependent organisms serve as prey for other fisheries managed under the Magnuson-Stevens Act by the GMFMC (e.g., red drum, mackerels, snappers, and groupers) and highly migratory species managed by NMFS (e.g., billfishes and sharks). These habitats also provide other essential estuarine support functions, including: (1) providing a physically recognizable structure and substrate for refuge and attachment above and below the sediment surface; (2) binding sediments; (3) preventing erosion; (4) collecting organic and inorganic material by slowing currents; and (5) providing nutrients and detrital matter to the Corpus Christi Bay estuary.

3.2.3.3. Description of Project Area EFH Identified by the GMFMC

Open Water Column: Zooplankton and phytoplankton are the dominant organisms in this habitat and serve as the foundation of the estuarine and marine food webs. Phytoplanktons are major contributors to primary production, which is directly linked to production of biomass of species managed under the MSFCMA. In addition to supplying food for animals, phytoplankton plays a central role in nutrient cycling in Corpus Christi Bay.

Open-Bay Bottom: The open-bay bottoms in the project area include flat areas consisting of mixtures of mud and mud/shell hash. Benthic epifauna and infauna are the primary organisms that utilize this habitat by adhering to the surface or burrowing into the sediment. These organisms feed by filtering particles from the water column or by ingesting sediments and extracting nutrients. Many of the epifauna and infauna feed on plankton, and are then directly fed upon by some of the species managed under the MSFCMA, such as shrimp and demersal fish species.

Submerged Aquatic Vegetation (SAV): Seagrass areas provide nursery grounds for many fish species, support a tremendously complex ecosystem and are extremely productive. Seagrass areas are considered EFH for many species of fish. As previously shown in **Error! Reference source not found.**, there are no areas of seagrass directly adjacent to the proposed project footprint of the channel (TPWD 2018a). Project site conditions are not conducive to seagrass growth due to depth and maintenance dredging. There is seagrass mapped in some of the proposed placement sites where dredged new work material would be beneficially used to convert open water areas to tidal marsh or more seagrass habitat, or where shoreline and land mass would be restored to protect large areas of seagrass behind these shorelines. These areas are discussed in Sections 3.2.1.3 and 4.2.1.3.

Oyster Reefs: Oyster reefs provide structural complexity in soft sediment environments by increasing available surface area for use by other organisms. Oyster reefs serve as fish habitat by providing structure, protection and trophic support to juveniles and adults (SAFMC 1998). Oyster reefs of various sizes are present in all Texas estuaries, but are best developed between Galveston Bay and Corpus Christi Bay( ). However, oyster reef habitat is not found in the area of the proposed project.

Estuarine Emergent Marsh: Estuarine wetlands exist in the Corpus Christi Bay system across a salinity gradient and are classified into salt marshes and brackish marshes. This type of habitat is discussed further in Section 3.2.1.2. Specifically within the proposed project footprint, no marsh is found within the area of the channel improvements.

Coral Areas: There are no coral areas within Corpus Christi Bay or the Gulf of Mexico area around the Entrance Channel.

3.2.3.4. Habitat Areas of Particular Concern (HAPC)

Habitat Areas of Particular Concern (HAPC) are a subset of the EFH information. They are areas that provide extremely important ecological functions or are especially vulnerable to degradation. The EFH regulations require that designation of specific HAPC's be based on one or more of the following considerations:

- The importance of the ecological function provided by the habitat;
- The extent to which the habitat is sensitive to human-induced environmental degradation;
- Whether and to what extent development activities are or will be stressing the habitat; and
- The rarity of the habitat type.

The GMFMC designated HAPC's in the Gulf of Mexico Generic EFH Amendment (GMFMC 1998). In the Final Generic Amendment Number 3 for Addressing HAPC (GMFMC 2005), the Council identified several HAPC's to benefit all FMP-managed species under Council jurisdiction. The proposed project is not in or near any of these areas identified as HAPC. These areas are all offshore and not close to Corpus Christi Bay. The nearest HAPCs are the Stetson Bank and West and East Flower Garden Banks, approximately 160 to 190 miles from the Texas coast near Corpus Christi. The Final EFH Assessment and the five year review of EFH and HAPC (GMFMC), discuss the details and lists the locations of the areas designated as HAPC.

3.2.4 Threatened and Endangered Species

The following describes the Threatened and Endangered (T&E) species listed for the project area, and any designated critical habitat in the project area.

3.2.4.1. Species

The USFWS has legislative authority to list and monitor the status of species whose populations are considered to be imperiled. This federal legislative authority for the protection of threatened and endangered species issues from the Endangered Species Act (ESA) of 1973 and its subsequent amendments. Regulations supporting this act are codified and regularly updated in Sections 17.11 and 17.12 of Title 50 of the Code of Federal Regulations (CFR). The federal process stratifies potential candidates based upon the species' biological vulnerability. Species listed as endangered or threatened by the Federal government are provided full protection. This protection not only prohibits the direct take of a protected species, but also includes a prohibition of indirect take, such as destruction of designated critical habitat.

The USFWS Environmental Conservation Online System (ECOS) Information, Planning, and Conservation System (IPaC) website (USFWS 2018b) was utilized to obtain a species list of federally threatened, endangered, and candidate species along with designated critical habitat that may occur within Nueces and San Patricio Counties. The TPWD annotated county list of rare, threatened, or endangered species that are known to potentially occur in Texas was reviewed for Nueces and San Patricio Counties (TPWD, 2018c). The NOAA National Marine Fisheries Service (NMFS) list of threatened and endangered marine species was reviewed for Texas, within the Southeast Region (NMFS, 2018).

The USFWS IPaC report identified 16 federally listed or proposed to be listed species that have the potential to occur within Nueces and San Patricio Counties. According to TPWD, there are 36 state listed species that have the potential to occur within Nueces and San Patricio Counties. The NMFS lists 15 marine species with the potential to occur along the Texas Gulf Coast. Table 3.2.4-1 summarizes species that are listed as endangered, threatened, or candidate by USFWS, TPWD, or NMFS.

Table 3.2.4-1 Federally-Listed Threatened and Endangered Species in Nueces & San Patricio Counties

Common Name	Scientific Name	Listing Status		
		USFWS IPaC List	TPWD	NMFS
Amphibians				
Black-spotted newt	*Notophthalmus meridionalis*	NL	T	NL
Sheep frog	*Hypopachus variolosus*	NL	T	NL
South Texas siren (large form)	*Siren sp 1*	NL	T	NL
Birds				
American Peregrine Falcon	*Falco peregrinus anatum*	NL	T	NL
Eskimo Curlew	*Numenius borealis*	NL	E	NL
Least Tern*	*Sterna antillarum*	E		NL
Northern Aplomando Falcon	*Falco femoralis septentrionalis*	E	E	NL
Peregrine Falcon	*Falco peregrinus*	NL	T	NL
Piping Plover	*Charadrius melodus*	T	T	NL
Red Knot	*Calidris canutus rufa*	T	NL	NL
Reddish Egret	*Egretta rufescens*	NL	T	NL
Sooty Tern	*Onychoprion fuscatus*	NL	T	NL
Texas Botteri's Sparrow	*Peucaea botterii texana*	NL	T	NL
White-faced Ibis	*Plegadis chihi*	NL	T	NL
White-tailed hawk	*Buteo albicaudatus*	NL	T	NL
Whooping Crane	*Grus americana*	E	E	NL
Wood stork	*Mycteria americana*	NL	T	NL
Fishes				
Opossum pipefish	*Microphis brachyurus*	NL	T	NL
Smalltooth sawfish	*Pristis pectinata*	NL	E	NL
Oceanic whitetip shark	*Carcharhinus longimanus*	NL	NL	T
Giant manta ray	*Manta birostris*	NL	NL	T
Mammals				
Gulf Coast Jaguarundi	*Herpailurus yagouaroundi cacomitli*	E	E	NL
Ocelot	*Leopardus pardalis*	E	E	NL
Red wolf	*Canis rufus*	NL	E	NL
Southern yellow bat	*Dasypterus ega*	NL	T	NL
West Indian Manatee	*Trichechus manatus*	T	E	NL
White-nosed coati	*Nasua narica*	NL	T	NL
Fin whale	*Balaenoptera physalus*	NL	NL	E
Sei whale	*Balaenoptera borealis*	NL	NL	E
Sperm whale	*Physeter macrocephalus*	NL	NL	E
Gulf of Mexico Bryde's whale	*Balaenoptera edeni – subspecies*	NL	NL	C
Corals				
Lobed star coral	*Orbicella annularis*	NL	NL	T
Mountainous star coral	*Orbicella faveolata*	NL	NL	T
Boulder star coral	*Orbicella franksi*	NL	NL	T
Elkhorn coral	*Acropora palmata*	NL	NL	T

Common Name	Scientific Name	Listing Status		
		USFWS IPaC List	TPWD	NMFS
Clams/Mollusks				
Golden Orb	*Quadrula aurea*	C	T	NL
Reptiles				
Green sea turtle	*Chelonia mydas*	T	T	T
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E	E
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	E	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E	E
Loggerhead sea turtle	*Caretta caretta*	T	T	T
Texas horned lizard	*Phrynosoma cornutum*	NL	T	NL
Texas indigo snake	*Drymarchon melanurus erebennus*	NL	T	NL
Texas scarlet snake	*Cemophora coccinea lineri*	NL	T	NL
Texas tortoise	*Gopherus berlandieri*	NL	T	NL
Timber rattlesnake	*Crotalus horridus*	NL	T	NL
Plants				
Slender Rush-pea	*Hoffmannseggia tenella*	E	E	NL
South Texas Ambrosia	*Ambrosia cheiranthifolia*	E	E	NL

E = Endangered, T = Threatened, C = Candidate, DL - Delisted, NL = Not Listed
* Only needs to be considered for wind related projects within migratory route

The two endangered plant species listed for Nueces and San Patricio Counties are unlikely to occur in the selected terrestrial placement areas as a function of constant disturbance and lack of habitat. Amphibians, reptiles, and shorebirds are most likely to occur in placement areas within and around the bay; all of the threatened and endangered mammal species listed in Table 3.2.4-1 are extremely unlikely to occur within the project area due to a lack of habitat, extirpation, and human activity. All four species of whale listed in Table 3.2.4-1 are considered unlikely to enter the existing channel or the adjacent nearshore waters. Hard-bottomed marine habitat that would support the listed species of coral is not present within the project area. The oceanic whitetip shark is a deepwater species that would not be expected to inhabit the CCSC or nearby waters, as they generally remain offshore in the open ocean, on the outer continental shelf, or around oceanic islands in water depths greater than 600 feet (NOAA 2018). The giant manta ray is also not anticipated to occur within the project area, as it typically inhabits areas near feeding grounds such as coral reefs. Of the federally-listed species, the following species are expected to have the relevant type of habitat present in the waters and aquatic habitat of Corpus Christi Bay, coastal waters of the Gulf of Mexico, and along the barrier islands of Mustang Island and San Jose Island, in the vicinity of the proposed project: Piping Plover (*Charadrius melodus*), Red Knot (Calidris canutus rufa), West Indian Manatee (*Trichechus manatus*), Green sea turtle (*Chelonia mydas*), Hawksbill sea turtle (*Eretmochelys imbricate*), Kemp's Ridley sea turtle (*Lepidochelys kempii*), Leatherback sea turtle (*Dermochelys coriacea*), and Loggerhead sea turtle (*Caretta caretta*). Of these, the West Indian Manatee and Leatherback sea turtle are most unlikely to occur in the project area (USACE 2003 Appendix C).

3.2.4.2. Critical Habitat

For species managed by the USFWS, the USFWS designates critical habitat in areas that "contain the physical or biological features that are essential to the conservation of endangered and threatened species and that may need special management or protection" (USFWS, 2017). Two species—the piping plover and the loggerhead sea turtle—have final critical habitat located within the project area. Final critical habitat for the piping plover overlaps with proposed placement areas SJI and SS2 on San Jose Island and Salt Island, respectively. For species managed by NOAA Fisheries, critical habitat is designated for "specific areas within the geographical area occupied by the species at the time of listing that contain physical or biological features essential to conservation

of the species and that may require special management considerations or protection; and specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation." (NOAA Fisheries 2018) Final critical habitat for the loggerhead sea turtle is designated as LOGG-S-2 Gulf of Mexico Sargassum critical habitat, located beyond the outer reaches of Mustang Island. Loggerhead critical habitat overlaps with approximately 10.57 nautical miles of project deepening segments, as well as the New Work Offshore Dredged Material Disposal Site (NW ODMDS). These final critical habitats and affected environment are discussed in a separate biological assessment, presented in Appendix B.

3.2.5 Invasive Species

An invasive species is defined as a species that is non-native or "alien" to the ecosystem or habitat whose introduction does or is likely to cause economic or environmental harm or harm to human health. There are several marine non-native species that have infiltrated estuaries in the GOM. According to the TPWD, these include the brown mussel, the Australian spotted jellyfish, tiger shrimp, the lionfish, and a cup coral. The 2003 FEIS included a comprehensive list of non-indigenous marine species found in the Gulf of Mexico. These species include shrimp viruses, sea squirts, bryozoans, algae, jellyfish, worms, mollusks, crustaceans, and fish. Most are species that are not native to the Gulf of Mexico, but several are species that are native but of concern for introduction elsewhere. Such marine species travel in ballast water of ships that sail from one ocean to another. More robust recent international maritime regulations for ballast water management have been enacted, and are discussed in Chapter 4.

3.2.6 Coastal Zone Management Resources

The Texas General Land Office (TxGLO) is responsible for administering the Texas Coastal Management Program (TCMP) within the State to manage the Coastal Natural Resource Areas (CNRA) under the Coastal Zone Management Act (CZMA). The project area is located within the TCMP Coastal Zone Boundary. Of the sixteen types of CNRAs listed in the governing rules in Texas Natural Resources Code (TNRC) Chapter 33, Paragraph §33.203, the following CNRAs are found in the vicinity of the project:

- Coastal barriers – Five U.S. Fish and Wildlife Service (USFWS) designated coastal barrier areas are in the vicinity of the project (USFWS 2018c). Two areas extend north along San Jose Island (T08 and T08P) adjacent to the proposed project channel through Aransas Pass. Two others are located on Shamrock Island approximately 2.5 miles south of the proposed project channel reach in lower Corpus Christi Bay (TX-17 and TX-17P). The last one is located on the southern part of Mustang Island approximately 6 miles south of the proposed project channel (TX-15P).
- Coastal historic areas – Onshore historical markers are located in Nueces County at Aransas Pass. There are two eligible state archaeological landmarks (SAL) and 10 other SALs identified in the 2003 FEIS. These landmarks are located between 2.5 to 15 miles from the CCSC and are not near the proposed project's area of impact.
- Coastal preserves – There are no designated Texas Coastal Preserves located in the vicinity of the proposed project reach of the CCSP. The closest State-owned land managed as a park, recreation area, scientific area, wildlife refuge, or historic site is Mustang Island State Park, located approximately 8 miles south of the CCSC.
- Coastal shore areas – Areas 100 feet landward of the highwater mark on submerged lands are present all along the shorelines of the natural and manmade features such as: natural barrier islands, dredge material placement areas, beneficial use sites, and mainland adjacent to the CCSC within the proposed project

reach. These include Mustang, San Jose and Harbor Islands, PAs 6, 9, and 10, Pelican Island/BU sites 7 and 8, and the mainland at Ingleside.

- Critical Dune Areas – Active dune areas within 1,000 feet of the mean high tide can be found on either side of Aransas Pass on the Gulf beaches of Mustang Island and San Jose Island.
- Coastal wetlands – Estuarine wetlands (salt water marsh etc.) found in the project area are discussed in Section 3.2.1.2. No wetlands are located within the proposed project channel itself or in the open water directly adjacent.
- Critical erosion areas – Parts of the Mustang Island and San Jose Island shorelines north and south of the project area are listed as historically eroding per the latest Texas Bureau of Economic Geology (BEG) data (Paine *et al.* 2014). For Mustang Island, the first 4.5 miles south of the CCSC is mapped as slightly accreting (0.5 to 1.5 feet per year) or slightly eroding (-0.5 to 0.5 ft/year), while the next 3.5 miles further south is mapped as eroding (-0.5 to -1.5 ft/year). For San Jose Island, the first 4.5 miles north of the CCSC is predominantly mapped as slightly eroding (-0.5 to 0.5 ft/year), while the next 13 miles further north are mapped as eroding (-0.5 to -1.5 ft/year). However, Hurricane Harvey in August 2017 caused more severe erosion to San Jose Island just north of Aransas Pass that is not reflected in BEG data.
- Gulf Beaches – Gulf beaches that border the Gulf of Mexico and extend inland from the line of mean low tide to the natural line of vegetation are the undeveloped San Jose Island to the north, and the more developed part of Mustang Island, to the south of Aransas Pass. The Entrance Channel passes through Aransas Pass. Gulf beaches are part of a contiguous beach area to which the public has a right of use or easement. These beaches are continuously held by the public or acquired by the public by prescription, dedication, or estoppel. The only other beach accretions near the proposed project channel reach are small fringes lining PAs and BU sites that do not involve this sort of real property situation.
- Hard substrate reefs and oyster reefs – Hard-bottom habitat and oyster reef is discussed in Section 3.2.1.6. The Corpus Christi Bay system is dominated by soft bottom. The closest rock outcrop documented in the 2003 FEIS was just north of the City Aransas Pass along the GIWW. There are no serpulid worm reefs in the vicinity of the proposed project channel with the closest being in Baffin Bay, some 40 miles downcoast. Oyster reef is present in the upper part of Corpus Christi Bay and Nueces Bay, but not near the proposed project channel reach.
- Submerged land – The areas immediately adjacent to the proposed project channel, and existing and proposed placement sites located in water, are characterized as submerged land.
- Special hazard areas – Floodplain areas are mapped by the Federal Emergency Management Agency (FEMA) as Zones AE and VE in and adjacent to the CCSC within the project reach. This is discussed in detail in Chapter 6.
- Tidal sand or mud flats – Tidal sand and mud flats are discussed in Section 3.2.1.4. This type of habitat tends to be located in accreted areas along the shoreline, islands, and placement sites. However, this type of habitat is not found within the proposed project channel itself or in the open water directly adjacent.
- Waters of the Open Gulf of Mexico – The Entrance Channel portion of the proposed project and the existing ODMDS site are located in the Gulf of Mexico.
- Water under tidal influence – The entire proposed project is located in waters under tidal influence within Corpus Christi Bay.

These resources are subject to the requirements of the CZMA and TCMP discussed in Section 6.

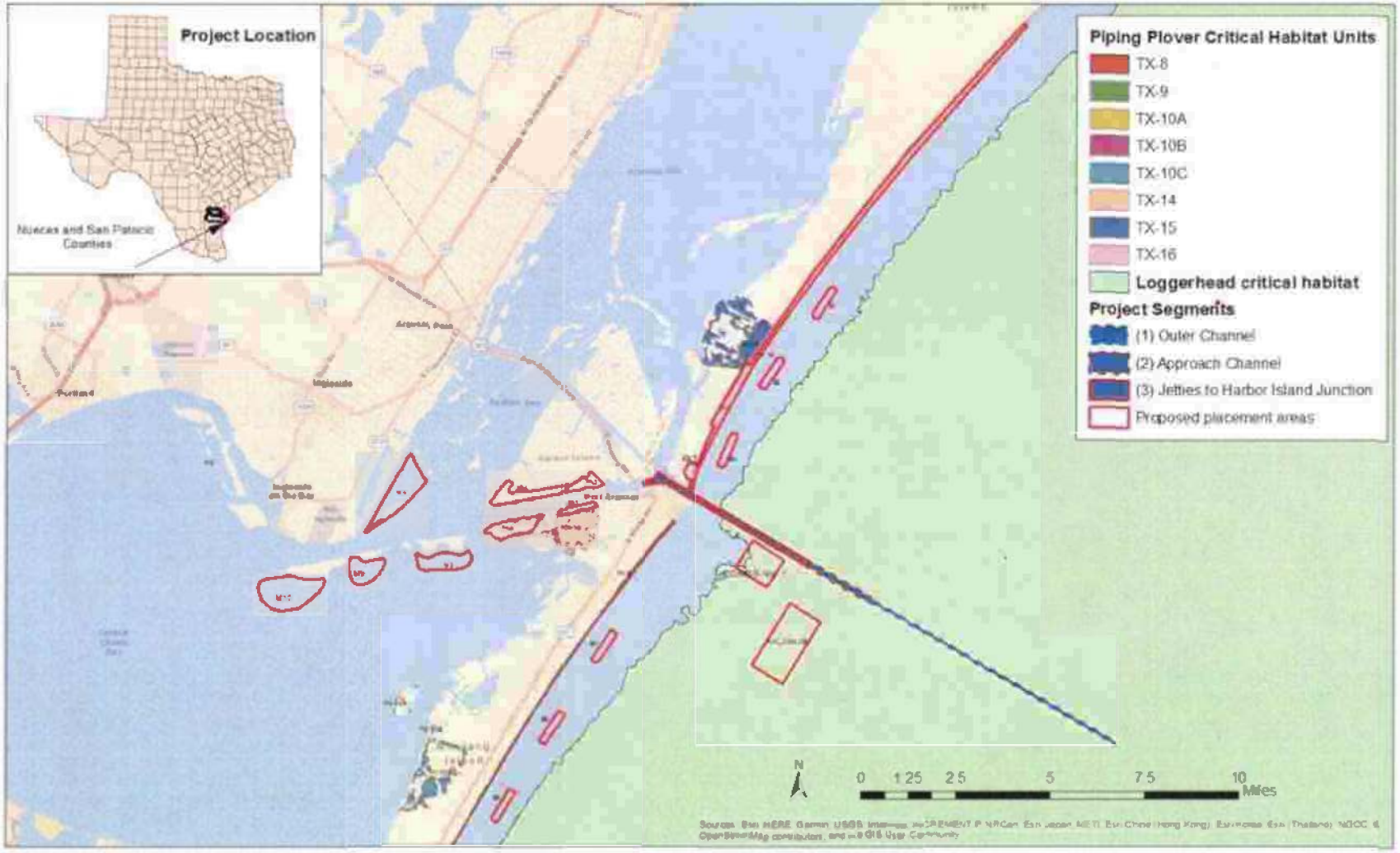

Figure 3.2.6-1 Critical Habitat in the Project Area

3.3 HUMAN ENVIRONMENT

3.3.1 Socioeconomics

This section presents existing population, demographic, and employment data within Nueces, Aransas, and San Patricio counties, and the cities located within or directly adjacent to the proposed project. San Patricio County, Ingleside and Ingleside at the Bay are not directly within the proposed channel or proposed placement areas but are less than 0.5 mile from the proposed channel improvements. The review includes both county level, and city, and Census tract data where available. For the existing environment section, the Community Study Area encompasses 4 Census tracts including Census tracts 9501, 51.02, 62, and 9900, and population, employment and community facilities and recreational areas were examined within this geographic area (Figure 3.3.3-1).

3.3.1.1. Population and Employment

This proposed project is located primarily within Nueces County but includes a small portion of Aransas County near San Jose Island and one Placement Option M4 is directly adjacent to San Patricio County. City limits for the cities of Aransas Pass, Corpus Christi, and Port Aransas cross the proposed project. Past and current population statistics were examined for population and employment. The trends show that populations has increased in Aransas and Nueces counties but San Patricio has lost or experienced minimal population growth. City level population estimates by the Census bureau were not available for the 2017 American Community Survey (ACS) 5-year estimates.

There is a civilian labor force of 2,010,696 and 156,875 in Aransas, Nueces, and San Patricio counties, respectively, with respective unemployment rates of 8.8, and 11.0 percent as of January 2011, according to the Bureau of Labor Statistics. As shown in Table 3.3.2-1, the average median household income for the Community Study Area was $62,103.

Table3.3.1-1shows the population and employment trends for the counties and cities within or directly adjacent the proposed project channel and placement areas.

Table 3.3.1-1 Population Statistics for Counties and Cities in the Community Study Area

Geographic Area	Population			Employment (Labor Force)	
	2000	2010	2017*	First Quarter 2011	Fourth Quarter 2017
Aransas County	22,497	23,158	25,572	5,250	4,912
Nueces County	313,645	340,223	361,221	150,369	162,830
San Patricio County	67,138	64,804	67,215	18,861	19,284
Aransas Pass	8,138	8,204	NA	NA	NA
Port Aransas	3,370	3,480	NA	NA	NA
City of Corpus Christi	277,454	305,215	NA	NA	NA

U.S. Census 2000, 2010, and ACS 2017 population estimates
* Texas Workforce Commission (TWC) Texas Quarterly Census Employment and Wages First Quarter 2011 and Fourth Quarter 2017

3.3.1.2. Social Characteristics

3.3.1.2.1. Population by Race and Ethnicity

As shown in Table 3.3.2-1, the Community Study Area (4-tract area) has a 17.3 percent minority population. The demographic breakdown is 82.7 percent White (Caucasian), 12.9 percent Hispanic, 0.6 percent Black or African American, 1.9 percent Asian, and 1.8 Other. As compared to Aransas, Nueces, and San Patricio counties, with 29.4, 67.1 and 57.8 percent minority populations, respectively; the Community Study Area has a lower minority population, respectively. Most of cities in the project have higher minority populations than the Community Study area. Port Aransas is predominantly White race/ethnicity.

3.3.2 Environmental Justice

Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, mandates that Federal agencies identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of programs on minority and low income populations (Federal Register 7629 7633, February [illegible]). A minority population is defined as a group of people and/or a community experiencing common conditions of exposure or impact, consisting of persons classified by the U.S. Census Bureau as Black, Asian, American Indian or Alaska Native, Hispanic, or other non-white persons including those persons of two or more races. A low income population is defined as a group of people and/or a community that, as a whole, live below the national poverty level. The poverty guideline for a family of four people in 2010, as defined by the U.S. Department of Health and Human Services, is $25,100 in 2018, the year the latest city and census tract-level statistics are available through the American Community Survey (ACS). Disproportionate environmental impact occurs when the risk or rate for a minority population or low income population from exposure to an environmental hazard exceeds the risk or rate of the general population and, where available, to another appropriate comparison group(s) (U.S. Department of Defense [DOD], 1995; USEPA,). As shown in Table 3.3.2-1, the percent minority of the specific census tracts surrounding the proposed project do not constitute a majority of the population; the median household income is significantly above the national poverty level.

Table 3.3.2-1 Percent Race/Ethnicity and Median Household Income for Counties, Cities, and the Community Study Area

Geographic Area	2010 Population	Race/Ethnicity (Percent)					Percent Minority	Median* Household Income
		White	Hispanic/ Latino	Black/ African American	Asian	Other		
Aransas County	23,158	70.6	24.6	1.1	1.9	1.8	29.4	$44,851
Nueces	340,223	32.9	60.6	1.4	1.6	3.5	67.1	$51,882
San Patricio	64,804	42.2	54.4	0.6	0.8	2.1	57.8	$52,659
Cities in the Community Study Area								
Aransas Pass	8,204	54.5	39.9	3.9	0.9	0.7	45.5	$43,832
City of Corpus Christi	305,215	33.2	59.7	1.7	1.8	3.5	66.7	$52,154

Geographic Area	2010 Population	Race/Ethnicity (Percent)					Percent Minority	Median* Household Income
		White	Hispanic/ Latino	Black/ African American	Asian	Other		
Ingleside on the Bay	615	80.3	17.2	0.3	0.3	1.8	19.7	$69,191
Ingleside	9,387	53.5	39.9	3.9	0.9	0.7	45.5	$60,414
Port Aransas	3,480	88.6	7.7	0.3	1.2	2.2	11.4	$50,471
Census Tracts in the Community Study Area								
9501	5,495	80.8	14.4	0.3	2.8	1.8	19.2	$43,401
51.02	3,389	88.5	7.7	0.7	1.3	1.7	11.5	$46,974
62	9,235	81.7	14.0	0.7	1.7	1.8	18.3	$95,934
9900	0	0	0	0	0	0	0	$0
Community Study Area (Totals)	**18,119**	**82.7**	**12.9**	**0.6**	**1.9**	**1.8**	**17.3**	**$62,103**

Source: U.S. Census Bureau, 2010 Summary File 1 and 2012-2016 ACS 5-year estimates

3.3.3 Community and Recreational Resources

Corpus Christi and its surrounding areas contribute billions of dollars to the region's economy. The Corpus Christi Metropolitan Area has a population of approximately 442,600 in 2018 (http://worldpopulationreview.com/us-cities/corpus-christi-population/) and is the ninth largest city in the state. Some of the most visited sites in the Corpus Christi area include North Beach, where the USS Lexington Museum and the Texas State Aquarium are located. (Forbes: The Best Places for Business and Careers). The Corpus Christi Museum District consists of the Museum of Asian Cultures, Corpus Christi Museum of Science and History, and the South Texas Institute for the Arts. The City is also near Padre Island and Mustang Island, as well as King Ranch which is one of the world's largest ranches.

One of the major economic factors is this area is tourism. Based on the following report, "The Economic Significance of Tourism and Nature Tourists in Corpus Christi – 2014 Update" Corpus Christi was the sixth most popular tourist destination in Texas. Between 2012 and 2013, tourists spent approximately 55 percent more compared to 2003. Visitors are becoming more affluent who visit the areas as well as being older.

3.3.3.1. Community Facilities

The following is a summary of community facilities within the general study area including fire departments, law enforcement agencies, hospitals, schools, churches, and cemeteries. The facilities that are primarily in the Port Aransas area are shown on Figure 3.3.3-1.

Fire Departments: In this general area there are voluntary fire departments and well as municipal fire departments. Cities/communities that provide this service are the City of Corpus Christi, Port Aransas, Aransas Pass, Ingleside, and Ingleside on the Bay.

Law Enforcement Agencies: Law enforcement in the general area is served by state and local services. The Texas Highway Patrol maintains a district office in Corpus Christi. The Nueces County Sherriff's office and the Texas Highway Patrol monitor the roadways in the unincorporated areas of Nueces County. Likewise, the San Patricio County Sheriff's Office and the Texas Highway Patrol monitor the roadways in unincorporated areas in San Patricio County. In the incorporated areas the cities/communities (Corpus Christi, Port Aransas, Aransas Pass, and Ingleside) provide police protection.

Hospitals: Hospitals in the general areas are served by the Care Regional Medical Center in Aransas Pass, and numerous hospital facilities in Corpus Christi. Major hospitals in Corpus Christi include: Christus Spohn Hospital, Driscoll Children's Hospital, and the Corpus Christi Medical Center – Bay Area. Some smaller medical facilities are located in Port Aransas, Aransas Pass, and Ingleside.

Schools: Schools surrounding the communities in and near the project area include numerous schools located in Corpus Christi, Port Aransas, Aransas Pass, and Ingleside.

Churches and Cemeteries: In the communities surrounding the project area there are numerous places of worship and cemeteries.

3.3.3.2. Recreational Facilities

A significant amount of tourism is due to the many opportunities for outdoor recreation in the Corpus Christi area as well as having the Corpus Christi Bay, Mustang Island, North Padre Island, and the Gulf of Mexico. Popular outdoor recreational activities include boating, fishing, camping, horseback riding, skiing, among many other types of activities that are offered. There are several marinas are in the Corpus Christi Bay area and Port Aransas that offer recreational as well as commercial fishing.

3.3.3.2.1. Public Parks and Beaches

There are numerous public parks and beaches in the area. There are over 190 City Parks in Corpus Christi which provide various amenities to the public. The Bayfront beaches (North Beach and McGee Beach) are recognized nationally as some of the best restored beaches in 2010 and 2012 by the American Shore and Beach Preservation Association (ASBPA). North Beach is located near the Harbor Bridge which also contains the historical aircraft carrier and the Texas State Aquarium. McGee Beach is located along the seawall and has numerous venues for various activities.

Beaches on Padre Island and Mustang Island in the Gulf of Mexico offer numerous recreational activities to visitors and local residents. Padre Island is the longest undeveloped barrier island in the world. It is 70 miles in length and one of most critical conservation areas in Texas. It has more than 130,000 acres of beach, dunes, and grassland habitats and is home to rare sea turtles and numerous migratory birds.

Within less than a mile of the proposed project, the closest public parks are Roberts Point Park, located on the northwest tip of Mustang Island near the ferry landing and IB Magee Beach Park on the northeast tip of Mustang Island. Both are located in Port Aransas and directly adjacent to the CCSC in or near Aransas Pass (https://www.cityofportaransas.org/Parks.cfm).

- Roberts Point Park is a 50-acre city waterfront park featuring pavilions, jetty fishing, an observation tower and amphitheater. It forms a shelter around the municipal small craft harbor that hosts recreational motor and sail boats.

- IB Magee is a 167-acre Nueces County Coastal Park with recreational vehicle pads and campsites, picnic facilities, and a fishing pier (https://www.nuecesbeachparks.com/ibmageebeachpark.html). It was damaged by Hurricane Harvey in 2017 and remains closed in 2018.

Another recreational facility close to the channel is the Port Aransas Nature Preserve, which is approximately a mile from the proposed terminus near Harbor Island. This city-owned nature preserve has hike-and-bike trails, pavilions and an observation deck with sand flat, salt marsh and other habitats, and is home to the Leonabelle Turnbull Birding Center. It was damaged in Hurricane Harvey but remains open on a limited basis.

3.3.3.2.2. Boating

There are numerous business along the Corpus Christi Bay that cater to boating and recreational fishing, as well as some smaller business near the Portland/Ingleside communities in the northern part of the Corpus Christi Bay, and near Port Aransas on the eastern side of the Bay.

3.3.3.2.3. Bird Watching

There are a number of places for bird watching in this general area. Of particular note, Padre Island is a very popular place for bird watching. It has approximately 350 different species visit this island on the Central Flyway migratory route. Other primary locations for bird watching activities include:

- Leonabelle Turnbull Birding Center – this is located on the northern part of Mustang Island in Port Aransas. In 2006 the Texas Parks and Wildlife Magazine named the Birding Center #1 of the Top Ten Boardwalks in Texas. Portions of the area were damaged by Hurricane Harvey and are currently being restored.
- Blucher Park – this is a four-acre park located in downtown Corpus Christi and has flycatchers, thrushes, vireos, warbles, and many other types birds.
- Hans & Pat Suter Wildlife Refuge – this refuge is located along Oso Bay in south Corpus Christi and is ideal to observe birds, wildlife, etc.in this area.
- Hazel Bazemore County Park – This Park has the largest number of hawks and species in the United States. Over 30 species have been seen and during the peak in September an average of 575,000 hawks are typically counted. It is located west of Corpus Christi near the intersection of I-37 and I-69.
- South Texas Botanical Garden & Nature Center – this area consists of over 180 acres of nature trails, platforms, and birding and photography blinds. It has a variety of birds and reptiles and is located just south of Corpus Christi near Oso Creek and FM 2444.
- Pelican Island – this island has a bird sanctuary that is operated by The Audubon Society.

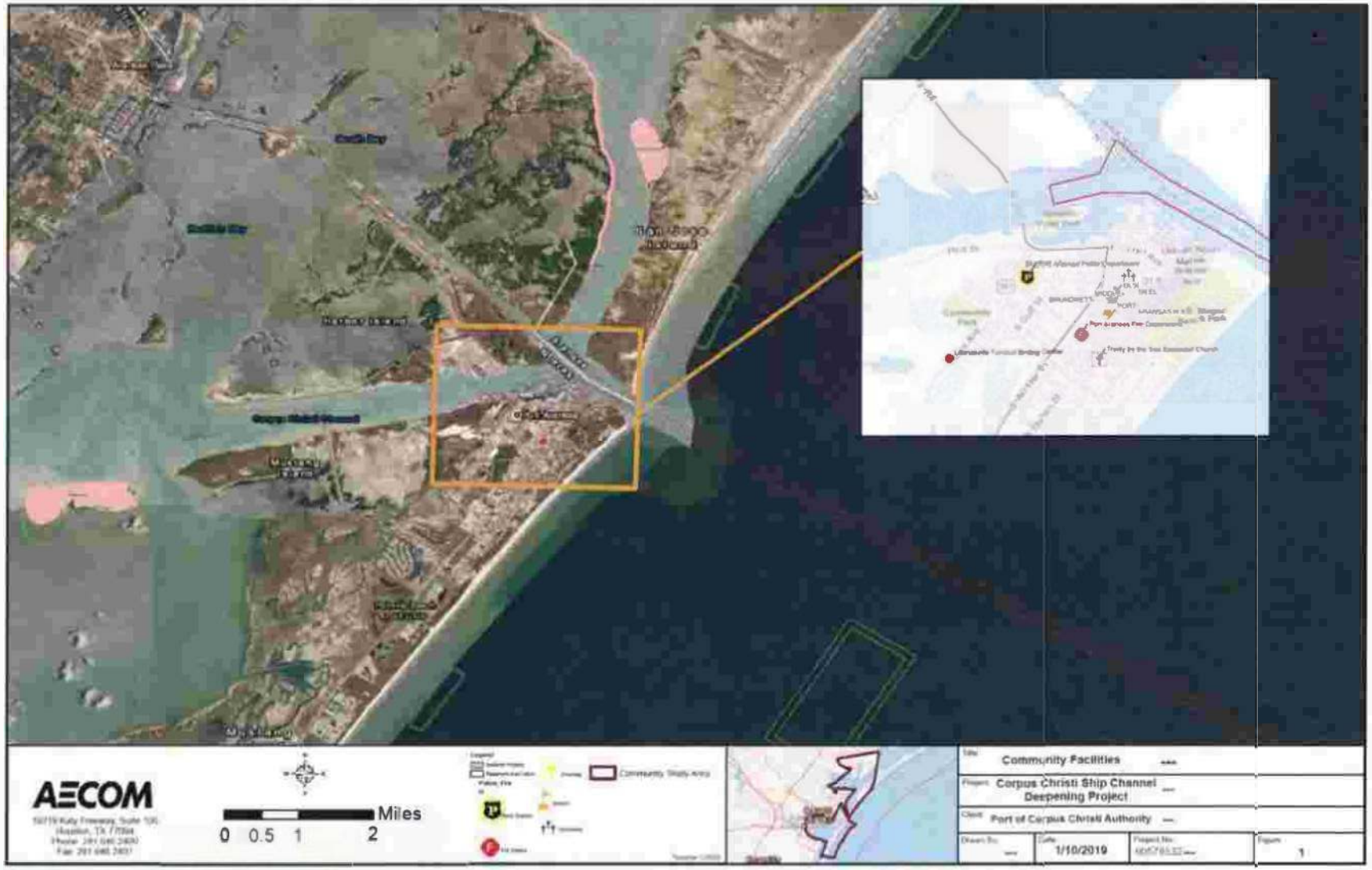

Figure 3.3.3-1 Community Facilities and Community Study Area

3.3.4 Visual and Aesthetic Resources

Existing characteristics of the viewsheds for the proposed project area are discussed in this section. A viewshed is defined as the entire area an individual can see from a given point. The study area for visual and aesthetic resources consists of viewsheds of the project area looking out from the existing shoreline in residential areas or public parks towards the area of the proposed project.

The viewshed area boundary starts at the area bordering the entrance of the Ship Channel and encompasses the northern boundary of the City of Port Aransas. The first viewshed viewpoints are located at Magee Beach Park and are bordered by the Port A Jetty on the south side of the channel entrance. The University of Texas Austin Marine Science Institute (UTMSI) facility is located directly north of Magee Beach Park. Continuing northwest along the channel, several residences and condominiums borders the channel past a yacht basin that house the Aransas-Corpus Christi Pilot. Other than the UTMSI facility, this entire area bordering the entrance channel is directly accessible to the public by road and offers an unobstructed view of the channel.

Moving northwest toward Harbor Inland, the only area accessible to the public is on the North side of Port Aransas, east and west of the Ferry Landing. Roberts Point Park is located east of the TXDOT Port Aransas Ferry Landing. This area is accessible via public road (W. Cotter Ave.) which leads to Roberts Point Park. To the area west of the Ferry Landing are the facilities of the UTMSI Fisheries and Mariculture Lab and more private residences bordering the channel. The next public access area is located along Port Street which borders the channel. All these area offers an unobstructed view of the Channel and of harbor Island which across the channel.

The next viewshed is in the area of Ingleside by the Bay bordering the north side of the entrance of the La Quinta Channel. This are is nestled between heavy industrial (Oxy and Flint Hill to the East and Kiewit to the north). In the Ingleside by the Bay community area, unobstructed view of the channel is provided from Bayshore Drive and several private residences bordering the channel.

Source: Geo-Search 2018

Figure 3.3.4-1 Hazardous Material Sites, Pipelines and Well Sites

3.3.5 Existing Infrastructure

Resources produced in the proposed project area and vicinity include oil and natural gas, steel, and other commodities produced by industrial facilities located along and in the vicinity of the Port of Corpus Christi Inner Harbor and the La Quinta Channels.

Pipelines and other existing infrastructure within the proposed project area can be seen in Exhibit___. At least one oil/gas pipelines cross the proposed project area.

3.3.6 Traffic and Transportation

According to the Port of Corpus Christi Strategic Plan 2014-2020 (Port of Corpus Christi 2013), the Port of Corpus Christi is located geographically at the eastern edge of South Texas. According to this plan, the region served by the seaport is a geographic triangle bounded on the north by San Antonio and on the west by Laredo. Corpus Christi is the region's connection to world markets via the seaport. The area is served by three interstate highways, three of North America's Class I rail carriers and the marine transportation assets at Corpus Christi. The Port delivers multiple means of access to overland transportation, with on-site and direct connections to three Class I railroads, BNSF, KCS, and UP, and direct, vessel-to-rail discharge capabilities.

3.3.6.1. Surface Transportation

The information below was based on review of the Final Environmental Impact Statement of the Corpus Christi Harbor Bridge project (Harbor Bridge FEIS 2014).

Road Transportation

Roadways that directly provide access to the ship channel, adjacent industrial employers, and intermodal terminals are key infrastructure to Coastal Bend shippers that must get freight to and from the port area or workers to and from industrial facilities adjacent to the ship channel. Equally important are the inter-regional highways that provide connectivity to points in the port's hinterland. There is direct access to the Port of Corpus Ship Channel Inner Harbor via Interstate Highway 37 (I-37), and US 181. The Joe Fulton Corridor is directly connected to I-37 and runs along properties that border the north side of the Ship Channel. As a result, the Northside docks have uncongested, direct access to Interstate Highway 37 and U.S. Highway 181. The Southside docks also have uncongested, direct access to Interstate Highway 37 and U.S. Highway 181.

US 181 and the Harbor Bridge cross the Ship Channel at the entrance of the Inner Harbor. The Harbor Bridge is slated for replacement and the new harbor Bridge is currently under construction with a scheduled completion around mid-2020. The bridge is expected to have a vertical clearance of 205 feet compared to 138 feet at the existing bridge. The new clearance would match the 205 feet under the Bridge of the Americas on the Panama Canal and will allow larger ships to clear the bridge and enter the Inner harbor of the Corpus Christi Ship Channel. Properties bordering the La Quinta Channel are accessible via SH 181 and State Highway 361. SH 361 provide access to Cities of Ingleside, Aransas Pass and vicinities located on the north side of the Ship Channel.

The entrance of the Ship Channel is located directly north of Port Aransas and cuts through SH 361 (Mustang Island Drive) between Port Aransas on the north side of Mustang Island and Harbor Island. TxDOT operates a ferry that crosses the CCSC at that location and connects Port Aransas to Aransas Pass via SH 361. Other than SH 361, which is a ferry crossing at the channel, the proposed project channel reach does not cross any other road, bridge or other surface transportation facility.

Rail Transportation

Information on the existing rail infrastructure also from the 2014 Harbor Bridge FEIS was reviewed and are summarized below:

> The city of Corpus Christi and the Port are served by three Class 1 (large freight) railroads: Union Pacific (UP), Kansa City Southern (KCS) and Burlington Northern Santa Fe (BNSF). These railroads share the UP tracks between Odem and the Inner harbor, which allows all three of the railroads to access the PCCA La Quinta Channel. The Nueces River Rail Yard provides eight tracks for storage of unit trains up to 8,500 feet long. Switching services are operated by the Corpus Christi Terminal Railroad (CCPN), which operates 42 miles of track and is owned by PCCA. There are five currently existing rail yards within Corpus Christi; the only yard within the vicinity of the proposed project, though, is the Missouri Pacific (MoPac) Rail Yard on the north side of I-37 west of the Crosstown Expressway, which is currently inactive but planned for rehabilitation.
>
> Freight from the Port travels along the UP Corpus Christi Subdivision. On the east side of Corpus Christi Bay and at the proposed La Quinta Gateway terminal, rail access is provided by the UP Kosmos Subdivision. The Port is also connected to Laredo through the KCS Laredo Subdivision. Currently, approximately 1.5 million tons of rail traffic travel through the Port each year, and PCCA anticipates that rail activity will continue to rise. Rail cargo includes coal, North Texas and Midwest grain, alumina, petroleum coke, limestone, carbon black, other chemicals and petroleum products, as well as heavy cargo such as petroleum refining equipment.
>
> The PCCA Rail Master Plan includes a list of proposed rail improvements to help support the expected increase in freight rail activity in the near future. These improvements include: the Joe Fulton International Trade Corridor, a $56 million road and rail project to improve access to over 2,000 acres of land for existing and future development, and the La Quinta Gateway property development, expected to result in increased rail traffic over the next decade (Harbor Bridge FEIS 2014).

3.3.6.2. Marine Transportation

Port Corpus Christi is the fourth largest port in the United States in total tonnage. The Port provides a relatively straight, 45' deep channel (approved and authorized for 54 ft. deepening) and quick access to the Gulf of Mexico and the entire United States inland waterway system.

The CCSC and La Quinta Channel are the main components for commercial marine transport in the PCCA channel system. Heavy industries, petrochemical plants, and other terminals are accessed through the CCSC and La Quinta channels. These comprise the major deep draft navigation channels for the Port. Areas adjacent to the CCSC are important to commercial transportation destinations inland. The CCSC has two principal segments that contain deep draft berths adjacent to the channel: the segment at Ingleside that connects with the La Quinta Channel, and the Inner Harbor segment above the Harbor Bridge. Barges (or tows) and other shallow draft shipping traffic, carry cargo through the Gulf Intracoastal Waterway (GIWW) and the PCCA system to cargo terminals and industrial facilities. Vessels using the channel system transport a wide variety of cargo including crude oil and petrochemical products such as gasoline, liquefied natural gas, solvents and ethylene. There are vessels that also transport containerized cargo such as finished good, bulk cargo including agricultural products, grains, and coal, and heavy project cargo such as offshore oil exploration platforms and wind turbine parts.

Further detail regarding commercial marine transportation in the CCSC can be found in the Economic Analysis Report of the Section 204(f) Report.

There are various other smaller shallow draft channels that intersect the CCSC and the deeper parts of Corpus Christi Bay that are used by commercial fishing boat and recreational vessels.

3.3.7 Hazardous, Toxic and Radioactive Waste

A Hazardous, Toxic, and Radioactive Waste (HTRW) investigation was conducted to identify indicators of potential hazardous materials or waste issues in the vicinity of the proposed project that have the potential for impacts as result of the proposed project. A regulatory database search was performed in accordance with American Society for Testing and Materials (ASTM) standard: E 1527-05 Standard Practice for Environmental Site Assessment. A commercial database vendor, Geo-Search prepared a regulatory database report originally on July 13, 2018 for the geographic area that includes the Corpus Christi Ship Channel proposed deepening segment extending out into the Gulf (study area) and the recommended record search distances (Geo-Search 2018). The The search radius also covered the existing. Several addresses listed in Table 3.3.7-1 represent old instances of ownership superseded by another entity on the list. For example, as discussed, in Section 3.3.5, one gas transmission pipeline was examined in the CCSC areas.

The regulatory listings are limited and include only those sites located within a 1-mile radius of the study area that are known to the regulatory agencies to be permitted, contaminated, or in the process of evaluation for potential contamination at the time of publication.

Large industrial complexes are located north and west of the CCSC. The sites listed below are known to handle hazardous materials, experience releases of pollutants, and are listed in regulatory databases. The regulatory database reports included a review of the ASTM and All Appropriate Inquiry (AAI) required databases. The project regulatory database search radius was based on the dredged area footprint of the proposed action, which starts at station -600+00 in the Gulf, continues through the entrance of the ship channel and continues up to station 565+00 at La Quinta Junction (Exhibit). An abbreviated list of ASTM and AAI recommended Federal and State databases and other records that were searched for relevant information is included below. Additional databases were searched but no information was found.

- Emergency Response Notification System (ERNSTX). This National Response Center database contains data on reported releases of oil, chemical, radiological, biological, and/or etiological discharges into the environment anywhere in the United States and its territories. The data comes from spill reports made to the U.S. Environmental Protection Agency, U.S. Coast Guard, the National Response Center and/or the U.S. Department of Transportation.
- Superfund Enterprise Management System (SEMS). The U.S. Environmental Protections Agency's (EPA) Office of Solid Waste and Emergency Response, Office of Superfund Remediation and Technology Innovation (OSRTI), has implemented The Superfund Enterprise Management System (SEMS), formerly known as CERCLIS (Comprehensive Environmental Response, Compensation and Liability Information System) to track and report on clean-up and enforcement activities taking place at Superfund sites. SEMS represents a joint development and ongoing collaboration between Superfund's Remedial, Removal, Federal Facilities, Enforcement and Emergency Response programs.
- Superfund Enterprise Management System Archived Site Inventory (SEMSARCH). The Superfund Enterprise Management System Archive listing (SEMS-ARCHIVE) has replaced the CERCLIS NFRAP reporting system in 2015. This listing reflect sites that have been assessed and no further remediation is planned and is of no further interest under the Superfund program.

- Resource Conservation & Recovery Act - Generator (RCRAGR06). The Resource Conservation and Recovery Act (RCRA) gives EPA the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous solid wastes. The 1986 amendments to RCRA enabled EPA to address environmental problems that could result from underground tanks storing petroleum and other hazardous substances. This listing refers to facilities currently generating hazardous waste. EPA region 6 includes the following states: Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.
- Department of Defense Sites (DOD). This information originates from the National Atlas of the United States Federal Lands data, which includes lands owned or administered by the Federal government. Army DOD, Army Corps of Engineers DOD, Air Force DOD, Navy DOD and Marine DOD areas of 640 acres or more are included.
- Petroleum Storage Tanks (PST). The Petroleum Storage Tank database is administered by the Texas Commission on Environmental Quality (TCEQ). Both underground storage tanks (USTs) and aboveground storage tanks (ASTs) are included in this report. Petroleum Storage Tank registration has been a requirement with the TCEQ since 1986.
- Leaking Petroleum Storage Tanks (LPST). The Leaking Petroleum Storage Tank listing is derived from the Petroleum Storage Tank (PST) database and is maintained by the Texas Commission on Environmental Quality. This listing includes aboveground and underground storage tank facilities with reported leaks.
- Closed & Abandoned Landfill Inventory (CALF). The Texas Commission on Environmental Quality, under a contract with Texas State University, and in cooperation with the 24 regional Council of Governments (COGs) in the State, has located over 4,000 closed and abandoned municipal solid waste landfills throughout Texas. This listing contains "unauthorized sites". Unauthorized sites have no permit and are considered abandoned. The information available for each site varies in detail and this historical information is not updated. Please refer to the specific regional COG for the most current information.
- Voluntary Cleanup Program Sites (VCP). The Texas Voluntary Cleanup Program (VCP) provides administrative, technical, and legal incentives to encourage the cleanup of contaminated sites in Texas. Since all non-responsible parties, including future lenders and landowners, receive protection from liability to the state of Texas for cleanup of sites under the VCP, most of the constraints for completing real estate transactions at those sites are eliminated. As a result, many unused or underused properties may be restored to economically productive or community beneficial uses. The VCP database is maintained by the Texas Commission on Environmental Quality.
- Industrial and Hazardous Waste Corrective Action Sites (IHWCA). This database is provided by the Texas Commission on Environmental Quality (TCEQ). According to the TCEQ, the mission of the industrial and hazardous waste corrective action program is to oversee the cleanup of sites contaminated from industrial and municipal hazardous and industrial nonhazardous wastes. The goals of this program are to: Ensure that sites are assessed and remediated to levels that protect human health and the environment; Verify that waste management units or facilities are taken out of service and closed properly; and to Facilitate revitalization of contaminated properties.
- Industrial and Hazardous Waste Sites (IHW). Owner and facility information is included in this database of permitted and non-permitted industrial and hazardous waste sites. Industrial waste is waste that results from or is incidental to operations of industry, manufacturing, mining, or agriculture. Hazardous waste is defined as any solid waste listed as hazardous or possesses one or more hazardous characteristics as defined in federal waste regulations. The IHW database is maintained by the Texas Commission on Environmental Quality.

- Recycling Facilities (WMRF). This listing of recycling facilities is provided by the Texas Commission on Environmental Quality's Recycle Texas Online service. The company information provided in this database is self-reported. Since recyclers post their own information, a facility or company appearing on the list does not imply that it is in compliance with TCEQ regulations or other applicable laws. This database is no longer maintained and includes the last compilation of the program participants before the Recycle Texas Online program was closed.

According to the regulatory database search, 22 listings were identified at 12 sites within the search radius. One of these listing is an ERNSTX site. The following sites listed in Table 3.3.7-1 are located within the search radius.

Table 3.3.7-1 Regulatory Database Summary

Type of Database	Number of Sites within ASTM Search Radius
CALF	1
DOD	1
IHW	1
IHWACA	2
RCRA Generator	3
ERNSTX	1
LPST	8
State/Tribal PST	2
State/Tribal VCP	1
Superfund (SEMS)	1
WMRE	1
Total number of sites identified in the search radius	22

Source: Geo-Search 2018.

Several sites are registered in multiple databases. Multiple database sites may be located at a single facility or map location. Table 3.3.7-2 lists regulatory database sites by facility/site name, address, and Map ID number (No.). The facility locations are shown on Exhibit 3.3.4-1. Several large industrial facilities are located near the La Quinta Channel Junction, however, they are not within the project limits. Two facilities located at Map ID No. 2 are conditionally exempt small quantity generators (CESGQ) hazardous waste. A CESQG is defined as a facility that generates 100 kilograms or less of hazardous waste per month, or 1 kilogram or less per month of acutely hazardous (highly toxic) waste.

Table 3.3.7-2 Summary of facilities identified in database or during field investigation in the Project Area

Map ID No.	Name (s) of Facilities/Sites	Site Address	Regulatory Database Site Listings
1	Corpus Christi Bay	Vessel Incident, Ingleside, TX 08402	ERNSTX
2	Naval Station Ingleside, Oxy Ingleside Energy Center, LLC, Information Technology Solutions	262 Coral Sea Rd, Ingleside, TX 78362, 1450 Lexington Blvd, Ingleside, TX 78362188 Coral Sea Rd Fisk Bldg	DOD, RCRAGR06, SEMSARCH,
3	Port Aransas Ferry Operation	619 W Cotter Ave, Port Aransas, TX	LPST,PST

Map ID No.	Name (s) of Facilities/Sites	Site Address	Regulatory Database Site Listings
4	McDermott - Harbor Island Facility	Highway 361, Port Aransas, TX 78336	VCP
5	Unknown	Port Aransas - Near Ship Channel. At The End Of Port Street., TX	CALF
6	Fishermans Wharf Inc	900 Tarpon St, Port Aransas, TX	LPST
7	City of Port Aransas	710 W Avenue A, Port Aransas, TX 78373	WMRF
8	Woodys Sports Center	114 W Cotter Ave, Port Aransas, TX	LPST
9	Stripes 9433	511 E Cotter Ave, Port Aransas, TX	LPST
10	Diamond Shamrock 426	715 N Alister, Port Aransas, TX	LPST
11	Clanton Texaco	429 N Alister St, Port Aransas, TX	LPST
12	FHR Ingleside Marine Terminal Facility	103 FM 1069, Ingleside, TX 78362	IHWCA

Source: Geo-Search 2018 ; TCEQ Central Registry 2018.

The ERNS site identified is related to a December 2006 incident when a caller reported an unknown sheen in Corpus Christi Bay. No additional information was found for this incident.

Site No. 2 is the location of several facilities that appears in multiple databases. They include a former Department of Defense Facility (NAVSTA Ingleside Main property). Approximately 816 acres of this property was sold along with adjacent PCCA property to Oxy Ingleside Property Holdings, LLC, a wholly owned subsidiary of Occidental Petroleum Corporation (Oxy) (CITE 2012 Caller Times).

This property was later acquired by Oxy and was the site of Oxy Ingleside Energy Center LLC until it was acquired by Moda. There are multiple addresses listed for this property with facilities located on Lexington Drive, Coral Sea Road, and Ticonderoga Road.

The Oxy Energy Facility is listed in the following regulatory databases:

- Conditionally Exempt Small Quantity Generator Industrial
- Resource Conservation & Recovery Act - Generator
- Hazardous Waste Corrective Action Sites

The Former Naval Air Station Site is listed under:

- Petroleum Storage Tanks (PST)
- Resource Conservation & Recovery Act/CESQG (Former Information Technology Solution)
- Superfund Enterprise Management System Archived Site Inventory (SEMSARCH); however, it was determined that the site did not meet the criteria for listing as an NPL site.

This former Naval Station Ingleside facility was located at 1445 Ticonderoga Road, Suite W40; the spill or discharge associate with this site did not qualify for NP listing.

Leaking Petroleum Storage Tanks (LPST) sites were identified at the following facilities. The regulatory findings for these facilities are listed below:

- Map ID# 3: TxDOT's Port Aransas Ferry Operation located at 619 Cooter Avenue; Detected soil contamination only required full site assessment response action plan (RAP)
- Map ID# 6: Fisherman's Warth Inc. located at 900 Tarpon Street: Detected soil contamination only required full site assessment response action plan (RAP; however groundwater impact was detected within 0.25 mile of public/domestic water supply well.
- Map ID # 8 Woody's Sports Center located at 114 Cotter Street: Detected soil contamination only required full site assessment response action plan (RAP); groundwater contamination was detected but off-site migration was deemed unlikely. Final regulatory concurrence was issued related to site's corrective action.
- Map ID #9 Stripes 9433 located at 511 W Cotter Street: There is a potential for impacted groundwater to discharge to surface water located within less 500 feet. Final concurrence for corrective action was issued and the site is now closed.
- Map ID #10: Diamond Shamrock located at 715 N Alister St, Port Aransas, TX. Groundwater impact was detected within 0.25 mile of public/domestic water supply well. Final concurrence for corrective action was issued and the site is now closed.
- Map ID#11 Clanton Texaco 429 N Alister St, Port Aransas, TX. Groundwater impact was detected within 0.25 mile of public/domestic water supply well. Final concurrence for corrective action was issued and the site is now closed.

Voluntary Cleanup Sites (VCP)

The VCP site identified in the regulatory database search, is associated with Map ID No. 4 and is listed under the McDermott Harbor Island Facility. The exact location of the spill is not specified. Media affected included water and soils. A certificate of competitions dated April 4, 2014 was issued as Final.

Other listings for the search area include:

- City of Port Aransas recycling facility (Map ID#7) is found under Recycling Facilities (WMRF) database. This facility is located at 710 W Avenue A. There were no specific regulatory findings other than the list of materials recycled.
- A Closed and Abandoned Landfill Inventory (CALF) data entry was also located within the search area. That site is located near the ship channel at the end of Port Street. The database findings noted the following about this site: "An open dump on private property - Nothing toxic is known to have been dumped at the site. There are no controls on the use of the site and no attendant is present. The landowners have been unable to stop the areas use as a dump site."

Only one release in 2006 was identified in the water. It would be expected to dissipate in water with dispersion and tidal exchange, and degrade over time following the spill incident, not posing a permanent water quality impact. Some non-water soluble pollutants released in water might leave more residual contaminants in bay sediments, portions of which would degrade and portions which could be more persistent. Therefore, dredged sediment quality would be the primary HTRW concern.

Some of the inland releases also have to potential of reaching the water in the CCSC due to their proximity to the coastline; however, like direct spills in the channel, they are expected to dissipate in water with dispersion and tidal exchange, and degrade over time; dredged sediment quality would also be the primary concern.

Other potential hazardous materials sites in the project area include pipelines, and oil and gas facilities. Data from the Texas Railroad Commission (TRCC) were reviewed to identify the location of oil and gas sites, and pipelines within the project area. One gas transmission line crosses Corpus Christi Bay from Ingleside to Mustang Island. Detailed description of these locations are discussed in Section 3.3.5 and shown on Exhibit 3.3.4-1.

3.3.8 Air Quality

The Clean Air Act (CAA), last amended in 1990, regulates air emissions from stationary and mobile sources. The CAA requires the USEPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The CAA established two types of standards: 1) primary standards with limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly, and 2) secondary standards with limits to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. Currently, there are air quality standards for six "criteria" pollutants designated by USEPA. These criteria pollutants are carbon monoxide, lead, nitrogen dioxide, inhalable airborne particulate matter, ozone, and sulfur oxides, ([redacted]). A list of the standards is provided in Table 3.3.8-1. In Texas, the EPA and TCEQ are responsible for enforcing air quality standards. The TCEQ implements the Texas State Implementation Plan (SIP), which is the State's comprehensive plan to improve air quality to meet or maintain compliance with federal air quality standards.

The CAA requires the EPA to designate each area of the U.S. with regards to compliance with the NAAQS. EPA classifies an area as an attainment area (designated "unclassifiable/attainment") if air quality meets or is cleaner than the standard. An area is designated as nonattainment if doesn't meet the standard, or in some cases, if EPA is not able to determine an area's status after evaluating the available information, as "unclassifiable ([redacted]). For purposes of the SIP, TCEQ manages Nueces and San Patricio Counties under the Corpus Christi area, which is currently classified as Unclassifiable/Attainment for all NAAQS ([redacted]).

Table 3.3.8-1 National Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)	primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	
Lead (Pb)	primary and secondary	Rolling 3 month average	0.15 µg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide (NO_2)	primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	primary and secondary	1 year	53 ppb (2)	Annual Mean
Ozone (O_3)	primary and secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Particle Pollution (PM)	$PM_{2.5}$	primary	1 year	12.0 $\mu g/m^3$	annual mean, averaged over 3 years
		secondary	1 year	15.0 $\mu g/m^3$	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 $\mu g/m^3$	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24 hours	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Source: USEPA 2016

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m3 as a calendar quarter average) also remain in effect.

(2) The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

(4) The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO2 standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

TCEQ operates the Continuous Air Monitoring Stations (CAMS) that provide monitoring data for purposes of CAA compliance. Not all NAAQS parameters are monitored at every station. Available monitored values for the criteria pollutants in the Corpus Christi SIP area are summarized in Table 3.3.8-2. As shown, the monitored values have been below the NAAQS limits. The Ingleside monitor is the station closest to the proposed project.

Table 3.3.8-2 Area Monitoring for NAAQS

Pollutant/*Station*	Value Type	2015	2016	2017	2018	Above Standard?
Ozone	Running 3-year Avg. of 4th Highest					
Victoria C87		64	65	65	64	No
Corpus Christi West C4		65	64	62	61	No
Corpus Christi Tuloso C21		64	63	61	60	No
Ingleside C685		54	51	-	-	
SO2	Running 3-year average of 99th percentile of 1-hour daily max					
Huisache C98		3.9	4.8	6.1	7.0	No
Corpus Christi Tuloso C21		4.3	3.4	3.5	6.0	No
Corpus Christi West C4		3.7	3.4	2.9	11.3	No
PM2.5	Annual mean, averaged over 3 years					
Dona Park C199		9.1	8.9	8.7	9.0	No
National Seashore C314		9.0	8.9	8.8	10.3	No

Source: TCEQ CAMS data sites and web pages at TCEQ 2018b, c, d and e in References section.

3.3.9 Noise

Noise is typically categorized as unwanted sound. Sound is characterized by variables including frequency, duration, and intensity. Sound intensity is measured in decibels (dB), which is a logarithmic measure for which values cannot be simply added arithmetically to calculate aggregate levels. Sound exposure is often expressed in terms of averages over standard durations such as 1-hour, 8-hour, and 24-hour periods. These averages are expressed as an equivalent continuous sound level (L_{eq}) with the same duration. Normal speech has a typical sound level of approximately 60 dB. The human ear typically cannot detect changes of 3 dB or less (U.S. Department of Transportation, 2010; Minnesota Pollution Control Agency, 2008; Nevada Department of Transportation, 2000). Human hearing is less sensitive to low frequencies and extremely high frequencies, and is most sensitive to mid-range frequencies. The most widely-accepted method of quantifying sound for human receptors is the A-weighted sound level, expressed as dB A-weighted units, or dBA. This involves measuring sound across a wide frequency spectrum and applying a specific "A-weighting" factor to the individual decibel value at each frequency to mimic the hearing response of the human ear and logarithmically summing them to provide a single dBA value. Another sound measure that compensates for increased sensitivity to noise during quieter nighttime hours is the Day-Night Average Sound Level (L_{dn}). It is a 24-hour averaged sound level with a 10 dBA penalty added to measured nighttime levels (from 10:00 P.M. to 7:00 A.M.) and has been used by several agencies such as the U.S. Department of Housing and Urban Development (HUD) and the U.S. Air Force to determine compatibility of noise with the existing land use.

Noise-sensitive receivers are locations or areas where excessive noise may disrupt normal activity, or cause annoyance or loss of business. Land uses such as residential, religious, educational, recreational, and medical facilities are more sensitive to increased noise levels than are commercial and industrial land uses. The nearest residence to the project area (proposed project footprint and immediate vicinity) is approximately 300 feet southwest of the CCSC in the Port Aransas community where the channel traverses the pass between San Jose Island and Mustang Island. There are no hospitals near the proposed project channel reach, with the closest, Coastal Bend Hospital, almost 6 miles north of the channel in the town of Aransas Pass. Small private practice clinics are in Port of Aransas a half mile or more away from the channel. The closest place of worship to the proposed project is the Port Aransas Church of Christ, located approximately one-half mile from the channel of the proposed project. Besides the University of Texas Marine Science Institute located directly adjacent to the channel in Port Aransas, the closest school is Port Aransas High School, located approximately 0.7 miles south of the proposed project channel. There are no cemeteries near the proposed project channel reach, with the closest Prairie View Cemetery, located approximately 6 miles of the channel in the town of Aransas Pass.

The existing land use within the project study area varies greatly from residential to industrial. Through the interpretation of aerial photography, it was determined that land use along the proposed project channel is predominantly either 1) undeveloped, uninhabited natural or created (through dredged material) islands, or 2) maritime industry and port-related properties and facilities. Only two miles of the project channel through the pass near Port Aransas has adjacent mixed residential, institutional, and commercial land uses. The existing sound environment of the area surrounding the proposed channel is influenced by numerous existing noise generating sources and activities associated with the land use and use of the waterway. Waterborne activities in the area include commercial ship traffic, barges and tugs, commercial fishing vessels, and sport and recreational boats and are expected to be present along the channel. Around the undeveloped islands, waterborne vessel activity would comprise the main sound sources. Around maritime industry and port facilities, besides waterborne vessel activity, dock loading operations (e.g. cranes, pumps and terminal vehicles) would be expected to be the primary sound sources. Besides waterborne traffic, the existing sound environment in Port Aransas near the

channel is expected to be influenced by residential and commercial activity such as local road traffic, recreational activities at Robert's Point Park including park and pavilion use and motorboat use.

3.3.10 Cultural Resources

The majority of the proposed channel deepening project is within the footprint of the currently authorized channel bottom and side slopes, with the exception of the necessary extension of the entrance channel to meet deeper Gulf contours. At that location an existing segment will be subject to very minor widening to afford the recommended one-way width for a VLCC between Station xxx and yyyy. The previous cultural resource investigations conducted for the 2003 FEIS covered a wider general area around the existing and then-proposed channel summarized as follows:

- For the entrance channel extension of the authorized project, the area investigated was 800 wide, which is 100 feet wider than the proposed new bottom width of 700 feet.
- For the channel through the jetties to the La Quinta Junction (the Outer Bar and Inner Harbor segments), the survey was 200 feet outward on each side the channel from a point 50 feet inside the top of cut. This segment was below the start of proposed barge lanes on each side, and proposed for widening by 130 feet, or 65 feet on each side. The proposed project terminates at the end of the Entrance Channel to Harbor Island.

Therefore, for the length covered by the currently authorized channel, much of the previous cultural investigations are useful for the proposed project. The following summary of historical resources is based on a 2018 review of Texas Archeological Sites Atlas (TASA) maintained by the Texas Historical Commission (THC). The Corpus Christi study area is located in the Southern Coastal Corridor (SCC) Archeological Region of the Central and Southern Planning Region of Texas as determined by the THC. The study area is confined to the Corpus Christi and Nueces Bays in San Patricio and Nueces counties.

3.3.10.1. Overview of Cultural Setting

The generally accepted cultural history of the area is divided into four periods, the Paleoindian, Archaic, Late Prehistoric, and Historic.

- The Paleoindian period in the SCC Archeological Region is the earliest recognized cultural period, dating from at least 10,000 B.C. to circa 6,000 B.C. No archeological site from this period is located within the Corpus Christi study area.
- The Archaic period (approximately 6000 B.C. to A.O. 1200) is identified during the early and middle Holocene by intensive human utilization of a wide variety of ecological niches including the coastal zone. Numerous cemeteries have been identified in the SCC Archeological Region dating to the Late Archaic and Late Archaic/Late Prehistoric associations.
- Late Prehistoric Period is represented by the Rockport phase in the SCC Archeological Region. With the advent of the bow and arrow and ceramic vessels, the Rockport focus replaced the Aransas focus. The later phase is characterized by the exploitation of larger game and an intensified exploitation of fish ([redacted]).
- Historic Period - The post-contact historic period for the Texas coast and south Texas effectively begins with the explorations of the Gulf of Mexico by Spanish explorers seeking to locate new land and economic resources for the Spanish royal crown in Madrid. The Texas coastal area was inhabited by two historic Indian groups at that time: the Coahuiltecan and the Karankawas.

By the early-nineteenth century the increase in Anglo and Mexican ranchers and the establishment of coastal ports and towns left the indigenous populations without access to the coastal resources needed for subsistence. As the numbers of Anglo-Americans increased due to immigration, the tension between the Mexican government and the new settlers increased, ultimately leading to war. As the war concluded with an independent Texas, settlement and economic growth of the area resumed. Corpus Christi was established as a trading post in 1839. After the Civil War, ranching developments characterized the area's economy and the use of Aransas Pass increased significantly.

History of Waterway Improvements in Corpus Christi Bay

Aransas Pass has been the main entrance into Corpus Christi Bay since early historic times. However, its harsh environment and lack of deep-water channels has been a hindrance to waterway traffic in and out of the bay throughout its development. The shoaling of Aransas Pass became a serious problem for Corpus Christi Bay commerce by the late 1870s.

While Galveston was initially chosen as the best location along the Texas coast for a deepwater port, several towns in the Corpus Christi Bay area were vying for government approval to be designated the main U.S. port in south Texas. The local inhabitants realized that without a continuous, direct deep-water route to its port facilities, in addition to a stable entrance into the bay, Corpus Christi Bay would not be able to compete.

The Turtle Cove Channel Project was adopted in 1907 with the intention of dredging a channel 10 feet deep and 100 feet wide into Corpus Christi Bay. By 1910, the cut had been expanded to a depth of 12 feet. The channel, also known as the Corpus Christi Channel, extended for 21 miles to Corpus Christi in 1926.

Improvements in the bay area included a 25 feet deep by 250 feet wide channel through Harbor Island to connect the town of Aransas to Aransas Pass in 1922. Later, in the mid-1900s, the USACE was requested to dredge the La Quinta Channel. Work began in 1954 on the 6-mile-long, 150-foot-wide La Quinta Channel. Following its completion in 1958, the channel measures 36 feet in depth and 200 feet in width.

Potential Shipwrecks in the Project Vicinity

There have been a number of shipwrecks in Corpus Christi Bay and Aransas Pass during the historic period. Vessel losses, documented in numerous historic sources, have been summarized in several archaeological reports. The majority of wrecks are known to have occurred in the vicinity of Aransas Pass (the bay entrance, not the town), owing to the concentration of vessel traffic there combined with the hazards of shifting sandbars prior to construction of the jetties.

The number of shipwrecks that have been archaeologically documented in the vicinity of impact areas is significantly smaller than the total number of wrecks listed in the historic record. Only twelve shipwrecks have been confirmed in the vicinity of CCSC Channel Improvement project impacts. Of those, only two were classified as State Archaeological Landmarks, suggesting that they may be eligible for listing in the National Register of Historic Places (NRHP). Both vessels, the Cardena and the Mary Lorena, were characterized as merchant sailing ships, and both are situated inside of the proposed beach nourishment area immediately north of Aransas Pass. The reviewed cultural resources background data indicate that the Cardena sank in 1834, while the Mary Lorena sank in 1900.

3.3.10.2. Previous Investigations

Based on a review of the TASA, a total of 68 cultural resources investigations have been previously completed within 1.6 km (1.0 mi) of the proposed project items. However, only 14 of the identified surveys overlapped portions of the proposed project items. Most of these were nautical surveys that examined portions of the Corpus Christi Channel and/or Aransas Pass. In fact, overlapping nautical archeological survey coverage extends offshore for approximately 5.8 km (3.6 mi). However, very few portions of the proposed dredge placement areas have been subjected to previous cultural resources surveys.

3.3.10.3. Previously Recorded Archeological Sites

Data collected from the TASA indicated that 42 archeological sites were located within 1.6 km (1.0 mi) of the proposed project items. Only two of those sites were identified in currently proposed project items. Site 41AS91, an early twentieth century factory, was determined to be ineligible for listing in the NRHP. Site 41NU210, the Dagger Island #1 Site, was classified as an unknown prehistoric campsite. It was assessed as not significant.

3.3.10.4. Properties Listed in the National Register of Historic Places

One property listed in the NRHP was identified 1.6 km (1.0 mile) of the proposed project items. The property, the Tarpon Inn, which is addressed at 200 E. Cotter Street in Port Aransas, was listed in the NRHP in 1979. The property was determined to be eligible under criteria A and C, for its association with the development of Port Aransas in the early twentieth century, as well as for being one of the largest buildings to depict the area's architectural landscape. The property is located approximately 350 m (1,150 feet) south of the proposed Corpus Christi Channel improvement area; therefore, it is outside of any direct impact areas.

3.3.10.5. Summary

Cultural resource background investigations identified two previously recorded archeological sites and 12 shipwrecks situated within direct impact areas. Both of the archeological sites have been assessed as not significant applying the NRHP Criteria for Evaluation (36 CFR 60.4 [a-d]). Two of the previously recorded shipwrecks were classified as State Archaeological Landmarks, suggesting that they may be eligible for listing in the NRHP. Both vessels, the Cardena and the Mary Lorena, were characterized as merchant sailing ships, and both are situated inside of the proposed beach nourishment area immediately north of Aransas Pass.

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