7.0 CUMULATIVE EFFECTS

The Council on Environmental Quality (CEQ) defines cumulative effects as the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions regardless of the agency (federal or non-federal) or person that undertakes such an action. These types of impacts "can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR §1508.7). The Federal Highway Administration (FHWA) states that the "cumulative effects of an action may be undetectable when viewed in the individual context of direct and even [indirect] impacts, but nonetheless can add to other disturbances and eventually lead to a measurable environmental change" (FHWA 1992).

This analysis is consistent with guidance documents provided by the Texas Department of Transportation (TxDOT) (2010d), National Cooperative Highway Research Program (NCHRP) (2007), and CEQ (1997). According to TxDOT guidance, the cumulative effects analysis consists of an eight-step process:

1. Identify the resources to consider in the analysis;
2. Define the study area for each affected resource;
3. Describe the current health and historical context for each resource;
4. Identify direct and/or the indirect impacts that may contribute to a cumulative impact;
5. Identify other reasonably foreseeable actions that may affect resources;
6. Assess potential cumulative impacts to each resource;
7. Report the results; and
8. Assess and discuss mitigation issues for all adverse impacts (TxDOT 2010d).

In accordance with the National Environmental Policy Act (NEPA) guidance, this analysis identifies quantifiable cumulative effects wherever appropriate and practicable. Potential cumulative impacts are further explored on a qualitative level within specifically defined Resource Study Areas (RSAs) for those resources determined in Step 2 to require consideration in the cumulative effects analysis. This qualitative analysis is supplemented by the input of the Collaborative Judgment Land Use Panel (discussed in **Section 6.1.4**), which aided in identification of other anticipated transportation and development projects and definition of the role the proposed project would play in potential cumulative effects to project area resources.

7.1 IDENTIFY RESOURCES TO CONSIDER IN THE ANALYSIS

Assessment of cumulative impacts focuses on resources substantially impacted by the proposed project (either directly or indirectly), as well as resources considered at risk or in poor or declining health. Even if anticipated direct or indirect impacts to a particular resource would be considered relatively minor, they are considered along with the potential effects of other past, present, or reasonably foreseeable future actions to determine if such actions, when taken together, would pose a risk to the sustainability or health of one or more resources. The scoping process for this cumulative effects analysis identifies and evaluates such at-risk resources, whether currently stable or declining, within a resource-based study area. The resources considered in this analysis, along with the rationale for either inclusion or exclusion from a more detailed evaluation of potential cumulative effects, are listed in **Table 7.1-1**. The determinations regarding whether to include or exclude a particular resource in the cumulative effects analysis are based on descriptions of the affected environment in **Section 3.0** and the results of the direct and indirect impacts assessments in **Sections 4.0** and **6.0**, respectively.

Table 7.1-1: Determination of Resources Included in Cumulative Effects Analysis					
Resource	**Direct Impacts**	**Indirect Impacts**	**Is the Resource in Poor or Declining Health?**	**Included in the Cumulative Effects Analysis?**	**Reason for Including/Excluding Resource From Cumulative Effects Analysis**
Air Quality	**All Build Alternatives:** potential construction phase emissions; long-term reduction of MSAT emissions as a result of pollution control strategies.	**All Build Alternatives:** minimal indirect impacts.	No The Corpus Christi area is in attainment for all NAAQS, and modeled and measured ambient levels of MSATs are below comparison levels for health protection.	Yes	While substantial adverse direct and indirect impacts to air quality would not occur as a result of any of the build alternatives, potential air quality effects on health have been identified as a community concern. Therefore, potential cumulative effects to air quality are considered.
Water Resources (including surface water and ground water)	**All Build Alternatives:** construction-phase alteration of vegetation, soils, and surface water hydrology; minor water temperature effects in shaded areas; no substantial encroachment on floodplains or direct effects on ground water. **Green:** permanent impacts to 0.13 acres of WOTUS. **Red:** permanent impacts to 0.25 acres of WOTUS. **Orange:** permanent impacts to 0.14 acres of WOTUS. **West:** permanent impacts to 0.46 acres of WOTUS.	**All Build Alternatives:** potential increases in impervious cover could lead to increased stormwater runoff, controlled through SW3P and BMPs; operation and maintenance runoff would enter City's MS4; potential for increased localized erosion could lead to increased sediment loads within watershed, controlled through implementation of BMPs and final stabilization measures. Potential direct effects on surface water would not result in encroachment-alteration or induced effects on ground water.	No For the near-term (within the 2035 timeframe of the cumulative effects analysis), surface water quality appears to be stable. The availability of fresh water is declining.	Yes	Direct and indirect impacts to water resources would not be substantial under any of the proposed build alternatives; however, minor, incremental effects of the proposed project could contribute to a cumulative impact on water resources.
Coastal Resources (including protected species)	See direct impacts listed in this table under Water Resources and Vegetation and Wildlife Resources.	See indirect impacts listed in this table under Water Resources and Vegetation and Wildlife Resources.	Yes Overall, coastal resources are not considered to be in decline; however, these include habitats for threatened and endangered species, which are, by definition, at risk.	Yes	Coastal resources include habitat for threatened and endangered species, which are considered to be at risk. Discussion in the cumulative effects analysis considers how changes in water quality, declining freshwater inflows to bays and estuaries, and impacts to sensitive environmental features such as mangroves could potentially impact coastal resources and their dependent species.
Vegetation and Wildlife Resources (not including protected species)	**Green:** minor impacts to vegetation during construction-related activities; no impacts to Essential Fish Habitat (EFH). **Red:** minor impacts to vegetation during construction-related activities; potential impacts to approximately 0.42 of EFH. **Orange:** minor impacts to vegetation during construction-related activities; potential impacts to 0.10 acres of EFH. **West:** highest amount of direct impacts during construction-phase activities, most notably to marsh habitats containing black mangrove; potential impacts to 0.59 acres of EFH.	**All Build Alternatives:** potential habitat removal due to vegetation clearing during the construction phase; potential indirect impacts to Texas windmill-grass habitat during right of way clearing and road placement; would be minimized through use of BMPs, vegetation clearing techniques, and replanting. **West**: indirect impacts to mangrove vegetation, covered under a Section 404 IP.	No Vegetation and (non-protected) wildlife resources in general are not considered to be at risk; potential impacts to rare black mangroves under the West Alternative.	Yes (considered together with Coastal Resources)	Effects to vegetation, particularly with respect to sensitive environmental features such as black mangroves, are considered under Coastal Resources. Wildlife resources are not considered to be at risk and are discussed as necessary under Coastal Resources.

Table 7.1-1: Determination of Resources Included in Cumulative Effects Analysis

Resource	Direct Impacts	Indirect Impacts	Is the Resource in Poor or Declining Health?	Included in the Cumulative Effects Analysis?	Reason for Including/Excluding Resource From Cumulative Effects Analysis
Threatened & Endangered Species	**All Build Alternatives:** project may impact habitat for five state-listed species (the opossum pipefish, Wood Stork, Reddish Egret, White-faced Ibis, and Southern yellow bat); project may affect but is not likely to adversely affect six federally listed species (the Loggerhead sea turtle, Green sea turtle, Atlantic hawksbill sea turtle, Kemp's Ridley sea turtle, Leatherback sea turtle, and West Indian manatee). Potential direct impacts would be limited to the construction and demolition phase of the proposed project and would be minimized through use of BMPs and preventative measures implemented during construction and demolition activities.	**All Build Alternatives:** minor potential impacts to vegetation which could serve as potential habitat for listed species; minor potential impacts to Texas windmill grass (and rare/ecologically sensitive mangrove vegetation under West Alternative only); potential impacts limited to construction phase, minimized through implementation of regulatory control measures.	Yes Threatened and endangered species are by definition at risk.	Yes (considered together with Coastal Resources)	Potential cumulative effects to habitat for threatened and endangered species are discussed under Coastal Resources. Potential effects to the state-threatened Southern yellow bat would be temporary and are not discussed further in this analysis. This species potentially utilizes palm trees within the area, some of which would be removed during construction of this and other proposed projects; however, these trees are common ornamental vegetation used throughout the area for landscaping.
Community Resources	**Green:** existing US 181 barrier would remain downtown. **Red:** existing barrier removed from downtown; potential for increased separation and decline in Northside community cohesion; placement of US 181 would change neighborhood aesthetic of the Northside community. **Orange:** existing barrier removed from downtown; displacement of 15% of households in Washington-Coles neighborhood; increased separation in Northside; adverse impact to community cohesion in Washington-Coles neighborhood; placement of US 181 would substantially change neighborhood aesthetic in Washington-Coles neighborhood; loss of important community business. **West:** existing barrier removed from downtown; adverse impacts to accessibility in Northside; potential visual screen from refineries and changed aesthetic in part of Hillcrest; introduction of major interchange to viewshed for some areas of Oak Park in Westside.	**Green:** perpetuation of US 181 barrier. **Red:** improved connectivity in the downtown area through removal of existing US 181 barrier; long-term barrier and separation effects in Northside. **Orange:** improved connectivity in the downtown area through removal of existing US 181 barrier; long-term barrier and separation effects in Northside. **West:** improved connectivity in the downtown area through removal of existing US 181 barrier; potential for increased feelings of isolation in North Beach due to increased circuity; adverse impacts to access in Northside.	Community cohesion in North Beach is considered stable. Community cohesion in South Central is considered stable. Community cohesion in Northside is considered to be in decline. Community cohesion in Westside is considered to be relatively low in some areas but stable. Community cohesion in Refinery Row is considered stable. Community cohesion in Portland is considered stable.	Yes	The long-term effects to cohesion within these communities are considered in the cumulative effects analysis. The health of these communities as it relates to air quality is also considered.

Table 7.1-1: Determination of Resources Included in Cumulative Effects Analysis					
Resource	**Direct Impacts**	**Indirect Impacts**	**Is the Resource in Poor or Declining Health?**	**Included in the Cumulative Effects Analysis?**	**Reason for Including/Excluding Resource From Cumulative Effects Analysis**
Economic Resources	**All Build Alternatives:** increased business exposure due to increased accessibility. **Green:** 57 business displacements; construction cost of $558M; earnings of $208M; 4,303 new jobs; estimated loss of $101,087 in tax revenue. **Red:** 3 business displacements; construction cost of $637M; earnings of $238M; 4,913 new jobs; estimated loss of $72,478 in tax revenue. **Orange:** 10 business displacements; construction cost of $630M; earnings of $235M; 4,861 new jobs; estimated loss of $153,398 in tax revenue. **West:** 2 business displacements; construction cost of $679M; earnings of $254M; 5,242 new jobs; estimated loss of $119,477 in tax revenue.	**All Build Alternatives:** potential contribution to economic opportunity from transportation infrastructure development. **Green:** indirect + induced output of $462M; indirect + induced earnings of $132M; 3,371 indirect + induced jobs. **Red:** indirect + induced output of $524M; indirect + induced earnings of $151M; 3,849 indirect + induced jobs. **Orange:** indirect + induced output of $522M; indirect + induced earnings of $149M; 3,809 indirect + induced jobs. **West:** indirect + induced output of $563M; indirect + induced earnings of $161M: 4,107 indirect + induced jobs.	No	Yes	The cumulative effects of the potential economic opportunity created by all of the build alternatives are explored further in this analysis.
Cultural Resources	**All Alternatives:** Adverse effects to the Harbor Bridge System (comprised of the Harbor Bridge and six concrete bridges carrying US 181 in the project area) coordinated and mitigated through the Section 106 process; no adverse effects to archeological resources.	None	No	No	Section 106 coordination process determined the project would not result in cumulative effects to historic properties or archeological resources.

Source: US 181 Harbor Bridge EIS Team 2013

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7.2 DEFINITION OF STUDY AREA AND TIMEFRAME FOR EACH AFFECTED RESOURCE

Resource Study Areas (RSAs) serve as spatial (geographic) and temporal boundaries within which the potential cumulative effects on project area resources are analyzed. These boundaries were developed based on resource-specific data (TxDOT 2010d). The geographic RSA boundaries and corresponding timeframes for this cumulative effects analysis are listed in **Table 7.2-1** and discussed further below.

Table 7.2-1 Resource Study Area for Each Resource Considered in the Analysis

Resource	Geographic RSA Boundary	Temporal Timeframe
Air Quality	Nueces and San Patricio Counties	1930–2035
Water (quality and availability)	North Corpus Christi Bay and South Corpus Christi Bay Watersheds	1930–2035
Coastal Resources	Corpus Christi, Nueces, and Oso Bay Systems and associated wetlands	1930-2035
Community Resources (including health)	Community Impact Assessment study area	1950–2035
Economic Resources	Corpus Christi MSA	1930–2035

Source: US 181 Harbor Bridge EIS Team 2013

7.2.1 Air Quality RSA

The Air Quality RSA (see **Figure 7.2-1** in **Appendix A**) includes the Corpus Christi air quality planning area (Nueces and San Patricio Counties) as identified in the Texas Commission on Environmental Quality (TCEQ) State Implementation Plan (SIP). The six National Ambient Air Quality Standard (NAAQS) criteria pollutants (described in **Section 3.6.1**) are measured within these two counties in order to determine the attainment status of the Corpus Christi area. Potential cumulative effects on air quality related to emissions of Mobile Source Air Toxics (MSATs) are also considered in this analysis.

The temporal boundary for the Air Quality RSA begins in 1930, the decade in which the Port began to develop into the primary driver of the economy. During this decade, growth at the newly established Port of Corpus Christi (1926) was enabled by the dredging of a canal and construction of a new turning basin. The temporal boundary for the RSA extends to 2035, the planning horizon year for the Corpus Christi Metropolitan Planning Organization's (MPO) current Metropolitan Transportation Plan (MTP), *MTP 2010-2035*.

7.2.2 Water RSA

The Water RSA incorporates the North Corpus Christi Bay and South Corpus Christi Bay Watersheds (see **Figure 7.2-2** in **Appendix A**) (Environmental Protection Agency [EPA] 2013b). The North Corpus Christi Bay Watershed includes Corpus Christi and Nueces Bays, while the South Corpus Christi Bay Watershed includes the Corpus Christi Inner Harbor, Nueces Bay, Oso Bay, and Oso Creek.

This cumulative effects assessment largely relies on data from the Region N Planning Group as determined by the Texas Water Development Board (TWDB), which includes portions of the Nueces

River Basin and adjoining coastal basins, including the Nueces Estuary (TWDB 2013). This region, also known as the Coastal Bend Regional Water Planning Area (Coastal Bend Region), is comprised of the following: Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, and San Patricio Counties. This 11-county region serves as a data-collection and study area for the TWDB's 2010 *Coastal Bend Regional Water Plan*, a comprehensive, long-term plan for development, conservation, and management of the surface and groundwater resources within the region. The major surface water sources in the Coastal Bend Region include the Choke Canyon Reservoir/Lake Corpus Christi System, the Nueces River Basin, and Lake Texana on the Navidad River (HDR, Inc. 2010). Two major aquifers underlie the region: the Carrizo-Wilcox and Gulf Coast Aquifers, the latter of which is located beneath the project area.

The temporal boundaries for the Water RSA extend from 1930, the decade in which the Port began to develop into the primary driver of the economy, to 2035, the planning horizon for the *MTP 2010-2035*.

7.2.3 Coastal RSA

The Coastal RSA includes the following area waterways: the Corpus Christi, Nueces, and Oso Bay systems, including the Inner Harbor, Rincon Channel, and associated wetlands (see **Figure 7.2-3** in **Appendix A**). This RSA provides an appropriate boundary for assessing cumulative effects to threatened and endangered species that would potentially result during construction of the proposed project or during actions by others. It was determined in **Section 4.16.1** that the proposed project may affect/impact nine aquatic species, identified in this analysis as "species of concern." These include five species of federally listed sea turtle, the federally listed West Indian manatee, and one state-listed fish. All of these species were determined to have potential habitat within the Corpus Christi and Nueces Bay systems. Potential wetland habitat for the three state-listed birds that the proposed project may impact is also included in the Coastal RSA. Finally, due to its unique ecological function within the South Texas coastal area and identification as a rare vegetation species (see **Section 4.15.1.1**), black mangrove vegetation is also included in this cumulative effects analysis of coastal resources.

The temporal boundary for the Coastal RSA begins in 1930, the decade in which the Port began to develop into the primary driver of the economy, and extends to 2035, the planning horizon for the Corpus Christi MPO's *MTP 2010-2035*.

7.2.4 Community RSA

The boundaries of the Community RSA (see **Figure 7.2-4** in **Appendix A**) are the same as the Community Impact Assessment boundaries and incorporate the following areas: North Beach; South Central, including the Central Business District (CBD), Evans Elementary and Crosstown East neighborhoods; Northside, including the Hillcrest and Washington-Coles neighborhoods; Westside, including the Oak Park, Leopard Street, Ben Garza, and Crosstown West neighborhoods; Refinery Row, including the Academy Heights and Dona Park neighborhoods; and Portland. Community cohesion within and among these communities is discussed, as well as potential effects to community health.

The temporal boundary for the Community RSA begins in 1950, the decade in which existing communities began to experience changes related to new development, growth at the Port, and infrastructure improvements. The temporal boundary extends to 2035, the planning horizon for the Corpus Christi MPO's *MTP 2010-2035*.

7.2.5 Economic RSA

The Economic RSA is defined as the Corpus Christi Metropolitan Statistical Area (MSA), which includes all of Aransas, Nueces, and San Patricio Counties (see **Figure 7.2-5** in **Appendix A**). Data collected within this area come from the U.S. Bureau of Labor and Statistics, the Corpus Christi Regional Economic Development Corporation, the U.S. Census Bureau, and economic studies from Texas A&M-Corpus Christi (TAMU-CC).

The temporal boundary for the economic RSA begins in 1930, the decade in which the Port began to develop into the primary driver of the economy. The temporal boundary extends to 2035, the planning horizon for the Corpus Christi MPO's *MTP 2010-2035*.

7.3 DEFINITION OF CURRENT STATUS/VIABILITY AND HISTORICAL CONTEXT OF EACH RESOURCE

7.3.1 Air Quality

The Corpus Christi area (Nueces and San Patricio Counties) is currently in attainment for all NAAQS. According to the TCEQ, San Patricio and Nueces Counties were designated as in attainment/unclassifiable under the 2008 eight-hour NAAQS for ozone, effective July 20, 2012 (TCEQ 2013d). Given the current attainment status of the area as well as the monitoring efforts and control measures described below, air quality in the Corpus Christi area is considered to be in stable condition.

7.3.1.1 Regional Air Quality Efforts

The Corpus Christi area participated in the Ozone Flex Program, a cooperative program for reducing air pollution that can lead to generation of ground-level ozone, until the program expired in 2012. The Environmental Protection Agency (EPA) has initiated the Ozone Advance Program as a replacement for the Ozone Flex Program to allow areas attaining the 2008 8-hour ozone NAAQS to pursue voluntary measures to reduce ozone precursor emissions. On December 21, 2012, the Corpus Christi area submitted to the EPA an application for participation in the program, which included resolutions from the City of Corpus Christi, San Patricio County, the Port of Corpus Christi Authority, the MPO, and the RTA. Measures included in the Corpus Christi Ozone Flex Program are anticipated to be compatible with the new Ozone Advance Program as well and include: use of less volatile gasoline from May through September; installation of vapor recovery and control systems at marine fuel transfer and loading facilities; rescheduling of uncontrolled loading activities on ozone action days until evening or until another day; a pollution-prevention program that targets both small and large businesses; promotion of alternative fuels through the Clean Cities Program of the U.S Department of Energy; and promotion of reformulated gasoline for use in large fleets by a local refiner. Several of the air pollution control strategies and measures being implemented are also expected to reduce emissions of MSATs in the Corpus Christi area, discussed in further detail below in **Section 7.3.1.2**.

The latest (2012) annual report by the CCAQG includes an assessment of trends in ozone levels as they are tracked for comparison to the NAAQS, which require that the three-year average of the fourth-highest daily maximum 8-hour average ozone level not exceed 75 parts per billion. The 2012 annual report shows that, for annual fourth-highest values and three-year averages of fourth-highest values measured at the two compliance monitoring stations, there was an overall downward trend in ozone levels from 2000 to 2009, while both sites show a gradual increase in ozone levels from 2009 to 2011. The report notes that while recent three-year averages at both monitors are currently below the NAAQS by a small margin, the area could move into nonattainment status with any future NAAQS revision and implementation of more stringent ozone standards. The report also points out that consistently higher ozone levels have been recorded over the last several years at a research monitor for an upwind site at Aransas Pass. Modeling analysis of high ozone episode days at the Aransas Pass monitor in September 2011, including wind trajectories, indicate that these high ozone days were associated with transport of polluted air from highly urbanized and industrialized regions in North and East Texas and from Louisiana.

7.3.1.2 Mobile Source Air Toxics

MSATs are a subset of the 188 air toxics regulated as hazardous air pollutants (HAP) under EPA rules developed pursuant to the 1990 Clean Air Act Amendments. In this assessment, MSATs refer to the seven compounds that EPA has identified as having significant contributions from mobile sources and that are among the regional and national-scale health risk drivers from the National Air Toxics Assessment (NATA). These include: 1,3 butadiene, acrolein, benzene, diesel particulate matter (PM), formaldehyde, naphthalene, and polycyclic organic matter (POM). Information on levels of certain MSATs in ambient air of the project area is available from air quality monitoring programs operated by the TCEQ and reported in TCEQ air monitoring data and health effects reports by the TCEQ Toxicology Division. Other information on MSAT levels is available from a University of Texas study as part of the Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project (Allen 2012) as well as a NATA 2005 assessment, which used computer modeling techniques to estimate ambient air concentrations.

Modeled ambient concentrations from the 2005 NATA database are presented in **Table 7.3-1**, which shows estimated 2005 concentrations of the seven MSATs for Nueces and San Patricio Counties as well as for thirteen census tracts in the project area. The predicted ambient concentrations are based on a computer model analysis of 2005 pollutant emissions from various categories of sources, adjusted for updated analyses such as use of the MOVES (Motor Vehicle Emissions Simulator) model for mobile sources, and information on background levels (representing contributions from natural sources, emissions of persistent chemicals from previous years, and long-range transport from distant sources) (EPA 2013c). In the 2005 NATA database, modeled ambient concentrations developed at the Census block level were aggregated to Census tract level by applying the average of block level concentrations and were aggregated to county level by using a population-weighting method. The Census tract numbers listed in **Table 7.3-1** correspond to the 2000 Census tracts, which are shown in **Figure 7.3-1** in **Appendix A**. The NATA database shows ambient concentrations for these air toxics as micrograms per cubic meter (ug/m^3). Concentrations for five of the seven MSATs were converted to parts per billion for easier comparison to other ambient concentration data presented in this section. Concentrations for the aggregate compounds diesel PM and POM are presented in units of ug/m^3 since there is no standard for converting these to ppb-V.

Table 7.3-1: Ambient Concentrations of MSATs in the Project Area from 2005 NATA Modeling

Modeled Ambient Concentrations from 2005 NATA Database by County and 2000 Census Tract

MSAT	Nueces County	CT 1	CT 3	CT 4	CT 5	CT 6	CT 7	CT 10	CT 11	CT 50	San Patricio County	CT 10601	CT 10602	CT 10603	CT 10604
1, 3 butadiene (ppb-V)	0.019	0.017	0.033	0.043	0.032	0.025	0.031	0.031	0.033	0.017	0.012	0.013	0.012	0.013	0.013
acrolein (ppb-V)	0.008	0.007	0.019	0.023	0.017	0.012	0.016	0.017	0.017	0.007	0.003	0.003	0.003	0.003	0.003
benzene (ppb-V)	0.293	0.312	0.690	0.689	0.789	0.634	0.741	0.472	0.519	0.523	0.156	0.171	0.153	0.162	0.167
diesel PM (ug/m^3)	0.870	0.976	2.235	3.787	2.526	1.418	2.408	1.981	2.151	3.796	0.191	0.307	0.170	0.262	0.265
formaldehyde (ppb-V)	1.247	1.284	1.830	2.097	1.843	1.640	1.816	1.792	1.820	1.516	0.862	0.804	0.774	0.793	0.796
naphthalene (ppb-V)	0.004	0.004	0.011	0.011	0.012	0.006	0.009	0.008	0.008	0.005	0.002	0.002	0.002	0.002	0.002
POM (ug/m^3)	0.003	0.003	0.009	0.008	0.009	0.006	0.007	0.007	0.009	0.004	0.001	0.001	0.001	0.001	0.002

Source: EPA 2011d

According to the 2005 data above, Census tracts 3, 4, 5, 6, 7, 10, and 11 were above the estimated 2005 concentrations of the seven MSATs for Nueces County. These areas loosely correspond to the South Central, Northside, Westside, and Refinery Row communities. Census tract 1, which corresponds to the North Beach community, is above the county-wide average for three of the seven MSATs measured. Census tract 50, which includes the Inner Harbor and Nueces Bay areas, was above the county-wide average for five of the seven MSATs. In San Patricio County, Census tracts 10601 and 10603 were above the San Patricio concentration average for three of the seven MSATs. These Census areas represent the areas west and east of Portland, respectively. Census tract 10604, encompassing the area south of Portland, was above the county-wide concentration average for four of the seven MSATs. Finally, Census tract 10602, located north of Portland, was at or under the county-wide average concentration for all seven of the MSATs measured.

Ambient air monitors in the project area have shown reductions in levels of certain MSATs since 2005. An overall trend of reduced ambient air concentrations of 1,3 butadiene, benzene and other volatile organic compounds (VOCs) is reflected in data from air quality monitoring stations operated in the project area by the TCEQ and the University of Texas. These include monitors in the Hillcrest, Dona Park, and Oak Park neighborhoods; another monitoring site is located west of the project area at Solar Estates. The locations of these air monitoring stations are shown in **Figure 3.6-1** in **Appendix A**. The trend in reduced benzene concentrations at ambient air monitors resulted in removal of Site 1402 from the TCEQ's Air Pollution Watch List (APWL) for benzene in 2010. This site, bounded on the south by I-37 and on the east by Nueces Bay Boulevard (located within Census tract 6), was the only site within Nueces and San Patricio Counties to be included on this list. Site 1402 was added to the watch list for benzene in 1998 for exceeding air monitoring comparison values (AMCVs); however, subsequent monitoring showed a steady decline from 2002 through 2008, and the site was removed from the list.

According to EPA, 1,3 butadiene is a known carcinogen to humans by inhalation (EPA 2009), while benzene is a known carcinogen to humans for all routes of exposure (EPA 2012). Hourly monitoring data for these two MSATs have been collected at two of the monitoring stations (Oak Park and Solar Estates) since March 2005, and at a third station (Palm) since June 2010. Ambient concentration data from these three stations for 2006, 2010, 2011 and 2012 are presented as average annual concentrations and annual maximum 1-hour concentrations in **Table 7.3-2**. The average annual concentrations may be compared to the long-term Air Monitoring Comparison Values (AMCVs) that have been set by the TCEQ, while the maximum 1-hour concentrations may be compared to the short-term AMCVs. AMCVs are used by the TCEQ to evaluate air quality monitoring results in order to identify potential health effects that may require more intensive evaluations. According to the TCEQ, "AMCVs are based on data concerning health effects, odor, and vegetation effects. They are not ambient air standards. If predicted or measured airborne levels of a constituent do not exceed the comparison value, adverse health or welfare effects would not be expected to result. If ambient levels of constituents in air exceed the comparison values, it does not necessarily indicate a problem, but rather, triggers a more in-depth review" (TCEQ 2013a).

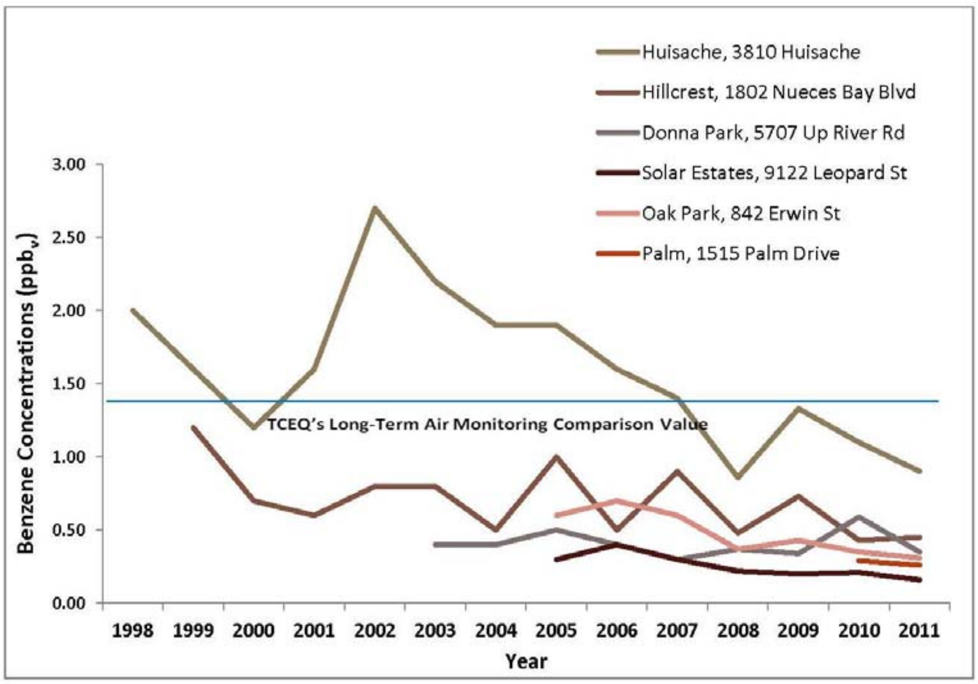
Table 7.3-2: Ambient Concentrations of Benzene and 1,3 Butadiene at Three TCEQ Air Monitoring Stations in the Project Area, showing Average Annual Concentrations and 1-hour Maximum Concentrations for 2006, 2010, 2011 and 2012

Monitoring Station	2006		2010		2011		2012		TCEQ Air Monitoring Comparison Value
	Ave. Annual Conc.	Max. 1-Hour Conc.	Ave. Annual Conc.	Max. 1-Hour Conc.	Ave. Annual Conc.	Max. 1-Hour Conc.	Ave. Annual Conc.	Max. 1-Hour Conc.	
Benzene (ppb-V)									
Oak Park	0.70	51.15	0.35	38.85	0.31	16.73	0.38	35.88	Long-Term AMCV: 1.4 ppb-V Short-Term AMCV: 180 ppb-V
Palm	No Data	No Data	0.29*	15.19*	0.26	28.15	0.27	87.41	
Solar Estates	0.37	11.66	0.21	5.70	0.16	3.69	0.15	3.39	
1,3 Butadiene (ppb-V)									
Oak Park	0.05	8.66	0.04	15.61	0.03	3.24	0.04	0.89	Long-Term AMCV: 9.1 ppb-V Short-Term AMCV: 1700 ppb-V
Palm	No Data	No Data	0.02*	0.91*	0.03	2.27	0.03	0.61	
Solar Estates	0.09	24.77	0.02	5.91	0.02	6.91	0.02	2.06	

Source: TCEQ 2012d

*2010 data for the Palm monitor covers the period of June 1, 2013, to December 31, 2010.

The latest monitoring results and trends for air toxics in Corpus Christi (including those shown in **Table 7.3-2**) are reported by the TCEQ Toxicology Division in the Health Effects Review of 2011 Ambient Air Network Monitoring Data in Region 14, Corpus Christi (TCEQ 2012d). This Health Effects Review concluded that annual average concentrations of VOCs evaluated by two different sampling methods were below their respective long-term AMCVs and would not be expected to cause chronic adverse health or vegetation effects. The review also reported that hourly concentrations of VOCs at the monitoring sites were below their respective short-term AMCVs and would not be expected to cause short-term or acute adverse health or vegetation effects. The ambient air sampling methods evaluate up to 86 VOCs, including the priority MSATs 1,3 butadiene and benzene. The trend of reduced annual average concentrations of benzene, in relation to the TCEQ's long-term AMCV, is shown in the following graph taken from the 2011 Health Effects Review (see **Illustration 7.3-1**).



Source: Health Effects Review of 2011 Ambient Air Network Monitoring Data in Region 14, Corpus Christi (TCEQ 2012d).

Illustration 7.3-1. Annual Average Benzene Concentrations at TCEQ and CCAP Air Toxics Monitoring Sites in Corpus Christi, Texas, 1998-2011

McDonald-Buller et al. (2011) examined dispersion model predictions of benzene and 1,3 butadiene concentrations in Corpus Christi in *The Neighborhood Air Toxics Modeling Project for Houston and Corpus Christi*. Emissions inventory information for the MSATs benzene and 1,3 butadiene is summarized **Table 7.3-3**. This includes the 2005 TCEQ Photochemical Modeling Inventory information for Nueces and San Patricio Counties, which was used for a dispersion modeling study of benzene and 1,3 butadiene using the models AEROMOD and CALPUFF. Modeling was conducted using only point source emissions and also using estimates of all anthropogenic emission sources, and model predictions were compared to observed levels of benzene and 1,3 butadiene at the Oak Park and Solar Estates monitoring sites. Another modeling study using the CAMx photochemical grid model allocated the 2005 emissions data by day of the week and month of the year to model six-month fall/winter periods. In the photochemical grid modeling study the four emission source categories (discussed below) were modeled individually in order to determine the dominant source category for each pollutant.

The emission source categories in these inventories include: point sources, which include refineries and chemical plants and other individually permitted major sources; area sources, which include dispersed smaller sources, such as dry cleaners, that have emissions below the major source threshold defined in the Clean Air Act for hazardous air pollutants, as well as certain sources related to petroleum product storage and transport and oil and gas production activities; on-road mobile sources, which are vehicles that use roads and highways (including cars, trucks, and buses); and non-road mobile sources, also referred to as off-road mobile sources, which include mobile sources not found on roads and highways, such as lawn tractors and mowers, aircraft, boats, trains, construction equipment, and farm machinery.

Table 7.3-3: Apportionment among Source Categories for Benzene and 1,3 Butadiene Emissions Inventories Used in Corpus Christi Air Toxics Modeling Studies

	2005 Photochemical Modeling Inventory used in NATMP Dispersion Modeling with AEROMOD & CALPUFF		2005 Emissions Inventories used in NATMP Photochemical Grid Modeling with CAMx			
			Benzene		1,3 Butadiene	
Source Categories	**Benzene (% of 610 tons/year)**	**1,3 Butadiene (% of 31.15 tons/year)**	**Weekday (% of 1567.38 kg/day)**	**Sunday (% of 1521.73 kg/day)**	**Weekday (% of 84.60 kg/day)**	**Sunday (% of 98.75 kg/day)**
Point Sources	42.0%	22.5%	40.5%	41.7%	20.4%	17.5%
Area Sources	26.2%	0.4%	26.2%	19.6%	1.2%	1.1%
On-road Mobile	26.2%	54.6%	26.7%	21.6%	55.1%	36.9%
Non-road Mobile	5.6%	22.5%	6.6%	17.1%	23.3%	44.5%

Source: McDonald-Buller et al. 2011

Based on emissions inventories for the two MSATs included in **Table 7.3-3**, stationary point sources are the dominant source of benzene in the Corpus Christi area. On-road mobile sources are the dominant source of 1,3 butadiene emissions on weekdays; however, the predominant source of 1,3 butadiene shifts from on-road mobile sources to non-road mobile sources on weekends. Non-road mobile sources have a notably higher contribution to total emissions on weekends for these two MSATs. According to a summary of information from the TCEQ Photochemical Modeling Inventory (McDonald-Buller 2011), the most significant 1,3 butadiene sources within the non-road mobile source category are gasoline-powered lawn and garden tractors and mowers, commercial generator sets, and inboard/sterndrive pleasure craft with four-stroke gasoline engines. The most significant benzene and 1,3 butadiene sources within the on-road mobile source category are light-duty gasoline vehicles and light-duty gasoline trucks on principal arterials and freeways. Area sources made up over a quarter of total estimated emissions of benzene, but accounted for only about one percent or less of emissions for 1,3 butadiene. The most significant benzene sources within the area source category are non-industrial solvent use, on-shore oil and gas production, petroleum product transport in marine vessels, and gasoline storage working losses.

The photochemical grid modeling study using the CAMx Model provides additional insights into the relative importance of the different emissions source categories by evaluating source contributions to predicted concentrations of benzene and 1,3 butadiene. This includes spatial analysis of each source category's contributions to peak pollutant concentrations in the vicinity of the Oak Park and Solar Estates air monitoring sites within the general area of the project as well as temporal analyses, including the number of hours that different source categories made substantial contributions to elevated ambient concentrations at these sites. The investigators concluded that point sources were the dominant emission source for benzene; 1,3 butadiene contributions were mainly from point sources near the ship channel and mainly from on-road mobile sources further away from the ship channel; and that off-road and area sources were not large contributors to any of the pollutants evaluated at either the Oak Park or Solar Estates site but could generate local concentration spikes elsewhere in the modeling domain.

The Corpus Christi area monitoring results reviewed above characterize past and recent levels of 1,3 butadiene and benzene that are below their respective comparison values, with the exception of benzene levels at the Huisache monitor before 2007. The data reviewed indicate ambient concentrations that are not expected to pose a threat to human health or otherwise cause adverse effects to vegetation. Modeled ambient concentrations from the 2005 NATA shown in **Table 7.3-1** are below the long-term AMCVs for 1,3 butadiene, acrolein, benzene, formaldehyde, and naphthalene (no AMCVs have been developed by TCEQ for diesel PM and POM). The monitoring data analysis reported by the TCEQ Toxicology Division shows a downward trend in ambient levels of benzene at area monitors generally since 2002. Correspondingly, the analysis of data from a subset of monitoring sites by the University of Texas as part of the Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project found that benzene levels for 2008 through 2011 were significantly lower than in 2006 and 2007 (Allen 2012).

Projected Future MSAT Conditions

Limited information is available on future trends in ambient levels of benzene or other MSATs. In their analysis of future changes in human health risk and inhalation exposure from MSATs, Cook et al. (2007) developed projections of mobile source and stationary source contributions to national average ambient concentrations of air toxics for future years as compared to 1999. The results of this analysis show that the 2030 estimated contribution of mobile sources to ambient concentrations of 1,3 butadiene, acrolein, benzene, and formaldehyde are expected to decrease to between 38 to 47 percent of the 1999 mobile source contributions. For ambient concentrations of naphthalene and POM, 2030 contributions from mobile sources are expected to be 74 to 78 percent of the 1999 mobile source contributions. Over the same period, stationary source contributions to ambient concentrations of 1,3 butadiene, benzene, formaldehyde, naphthalene and POM expected to increase between 2 and 26 percent, while stationary source contributions to ambient concentrations of acrolein are expected to decrease by 10 percent from

1999 to 2030. It should be noted that these projections by Cook et al. (2007) take into account emission reductions that are expected to result from EPA emission control programs that were promulgated as final rules as of 2005 (including federal reformulated gasoline standards and gasoline toxics emissions performance standards), but these projections do not take into account additional control programs promulgated since 2005.

Projections of national trends in emissions of MSATs have been made using the MOVES2010b model, which is the latest motor vehicle emissions model approved by the EPA. These projections are in general agreement with the projections of future reductions in mobile source contribution to ambient concentrations and human health risk associated with air toxics. In their guidance for MSAT analysis in NEPA documents, FHWA provides MOVES2010b modeling results that show projected changes in total annual emissions of the seven MSATs from 2010 through 2050 (FHWA 2012b). The graph of modeling results from the FHWA guidance is presented in **Illustration 3.6-1**, which also shows the projected increase in total vehicle miles traveled (VMT) over the same period. **Illustration 3.6-1**, which presents projected national MSAT emissions trends for vehicles operating on roadways using EPA's MOVES2010b model for the years 2010–2050, shows a decline in total projected emissions of all seven MSATs from 2010 to 2030, even as VMT increases by 40 percent over the same period. From 2030 to 2050, national emissions of the seven MSATs are projected to remain the same or increase gradually, while total national VMT is projected to increase by another 44 percent over the same period.

7.3.2 Water Resources

Water resources are considered in this cumulative effects analysis in terms of water availability as well as surface water quality within the RSA. Given that the issue of freshwater flows is a common and critical element for both water availability and water quality, it is possible to make an overall assessment of the current condition and apparent future sustainability of the resource. The bays and estuaries of the Coastal Bend are diverse and complex ecosystems that have historically demonstrated a remarkable capacity for recovery from natural and man-made threats. In many respects, the historical record shows substantial improvement, largely as a result of the acceptance in recent decades of more sustainable approaches to the management of economic uses of the resource.

For the longer term, the ability to meet the projected municipal and industrial water needs of a growing economy and provide the freshwater inflows to sustain the productivity of bays and estuaries could be affected by continued regional drought and the uncertainties of a changing climate. The health of the resource with respect to water availability is in decline. The trends in water quality have been positive over the last several decades but are likely to be affected as well by continued curtailment of freshwater inflows. The outlook for water quality is therefore considered stable.

7.3.2.1 Water Availability

The proposed project is not expected to contribute to drought conditions in the future due to the relatively minor amounts of water required for construction and long-term maintenance (as discussed in **Section 4.11.1**). However, the availability of fresh water has been identified as a potential limiting factor in development within the Corpus Christi area by the Collaborative Judgment Land Use Panel, and increasing demands and atmospheric conditions are anticipated to result in drought conditions in the future.

The annual streamflow for the Nueces River exhibited a declining trend in the period 1940-1996 due to construction of Choke Canyon Reservoir, evaporative loss, increased water use in the basin, and a long-term regional drought. Since completion of the Choke Canyon Reservoir in 1987 and Lake Corpus Christi in 1958 (City of Corpus Christi 2013b), freshwater diverted from the 5,529 square-mile Frio River watershed and 11,235 square-mile Nueces River watershed has reduced the amount flowing naturally into the Nueces Delta.

The declining rate of freshwater inflow affects the estuaries on the Texas Gulf Coast, including the Corpus Christi Bay system. The competition for fresh water between municipal and industrial users and estuarine ecosystems is expected to intensify over the long term, especially in light of probable increasing drought conditions exacerbated by changing climate conditions. For the Coastal Bend estuaries, the problem is somewhat moderated by the region's low population and projected growth, relative to the state and to other estuary regions. The population of the 11-county Coastal Bend Bays and Estuaries Program (CBBEP) area increased by 36 percent from 1960 to 2000. The region's rate of population growth was about 30 percent of the state's growth rate over the same period. Compared with other estuarine regions, the Coastal Bend area's growth was one-quarter the rate of the counties that comprise the Gulf Coast National Estuary Program (NEP) (133 percent), and was the second-lowest population growth rate in the Gulf NEP study area. Population density was 53 persons per square mile, compared with state wide density of 96 persons per square mile; the Coastal Bend had the lowest population density of any of the NEP Gulf study areas (EPA 2007).

Fresh water is in short supply in semi-arid southern Texas, with competing demands from increasing population, industrial development, and the environmental flows needed for the estuaries. Freshwater inflows to Coastal Bend bays and estuaries perform several vital functions: 1) fresh water blends with sea water to create a range of salinities; 2) stream inflows carry nutrients (nitrogen, phosphorous, decomposing organic matter) essential to estuarine productivity; 3) the inflows bring sediments, which replenish bays and prevent wave action from washing away existing wetlands.

As of August 2013, freshwater inflows into the entire system are the lowest on record, according to Ray Allen, Executive Director of the CBBEP (Spruill 2013a). Larry McKinney, Executive Director of the Harte Research Institute of Gulf of Mexico Studies, said that reefs in Nueces Bay at one time supported an oyster population that was tolerant to higher salinities, "but average salinity levels rose enough that disease and predators wiped them out." Commercial shrimping has been similarly affected in Corpus Christi Bay, where in the past more than two dozen trawlers berthed (i.e., remained long-term) at the marina. "Now there's only four, maybe six," according to Capt. Jerry Tungate (Spruill 2013a). Mr. Allen noted that, as drought increases, salinity levels in the bay will rise and increase bacteria compositions that affect the numbers of shrimp, clams and small fish in the water. Salinity in one part of Rincon Bayou, located northwest of Corpus Christi within the Nueces River delta, has reached 40 parts per thousand (ppt), making it saltier than the Gulf of Mexico. The *Caller Times* reported that javelina and wood rats have been observed gnawing on cactuses that grow in the delta; bees now live in wood duck boxes because the ducks have gone elsewhere, looking for more water (Spruill 2013b).

The demonstrable ecological effects of continued drought, reduced inflows, and increased salinity are expected to continue for the foreseeable future. Meanwhile, the fresh water needs of the region's human population also continue to grow. Residential and commercial water use is expected to increase by 50 percent by 2050; industrial demand is projected to double. To meet these needs, the Coastal Bend Regional Water Planning Group (CBRPG) has recommended water management strategies that emphasize water conservation and maximization of available resources, as well as construction of off-channel reservoirs and pipelines (CBRWPG 2010). A more detailed account of future water availability issues and long-term trends is provided in **Section 3.8.1.1.**

The possibility of protracted regional drought conditions is considered to be a potential barrier to long-term economic growth in the Corpus Christi area (see **Section 6.5.2.1**). The 2010 plan prepared by the Region N Regional Planning Group projected that currently available supplies will fall short of meeting 2060 demand by more than 60,000 acre feet/year. Strategies to meet this demand include conservation and various water development projects, including off-channel reservoirs. The economic social and economic cost of failing to address these shortages was estimated to be $7.8 billion and 55,000 fewer jobs in the Coastal Bend region (CBRWPG 2010, ES-26). Long-term water availability is an economic concern for the southern Texas coast, as it is throughout Texas. The Coastal Bend RWPG (Region N) 2010 update to the Texas Water Plan has laid out a credible strategy for meeting the region's 2060 needs. Early in the collaborative judgment process, the panel raised a concern about the potential economic consequences of future water shortages, but then also expressed confidence in the water management strategies devised to meet the region's long-term needs.

7.3.2.2 Surface Water Quality

The Coastal Bend region includes three of the seven estuaries on the Texas Gulf Coast, as delineated by the EPA's National Estuary Program (NEP) and its regional counterpart, the Coastal Bend Bays and Estuary Program (CBBEP). The Coastal Bend region is divided into three segments: north, middle, and south. The middle estuary, comprising Nueces and Corpus Christi Bays, which discharge into the Gulf of Mexico at Aransas Pass, is within the RSA (EPA 2007).

<u>Historical Trends</u>

Historical data on water, sediment, and tissue quality in the Corpus Christi Bay system was compiled by Ward and Armstrong (1997) over a period of record from 1994 dating back to about 1965. The following summary regarding historical trends in surface water quality is based upon the 1997 Ward and Armstrong report.

The historical (1965–1994) data analysis by Ward and Armstrong (1997) provides a good perspective for evaluating current water quality conditions in the Corpus Christi Bay system, especially since it highlights the significant water and sediment quality improvements achieved in the Inner Harbor and other areas in the years since that intensive review. The study concluded that the most challenging trends for the bay system as a whole were the decline in suspended particulates and increasing concentrations of nutrients, and salinity. Declining concentrations were also documented for inorganic nitrogen and total organic carbon (TOC). Increased salinity was viewed as particularly problematic, given its importance as a measure of habitat quality and freshwater inflow. At a time when the City of Corpus Christi's water supply was increasingly threatened by drought, the historical data strongly supported the correlation between increased salinity and declining freshwater inflow.

The study area for the cumulative effects analysis includes the North and South Corpus Christi Bay watersheds. Water quality parameters include salinity, water temperature, dissolved oxygen (DO), biochemical oxygen demand (BOD), turbidity, nutrients, total organic carbon (TOC), and contaminants including coliforms, metals, and trace organics, such as pesticides and polycyclic aromatic hydrocarbons (PAH). Acknowledging the variable coverage and limited reliability of some of the early sampling and monitoring data sources, Ward and Armstrong (1997) characterized long-term trends for water and sediment phases as well as for organism tissues. Their findings are briefly summarized below.

Salinity is a key indicator of overall water quality in the Corpus Christi Bay system because it provides both a measure of the varying estuarine balance between fresh and salt water and a general indicator of habitat quality. No correlation was found between mean salinities and the presence of ship channels, indicating that channel currents as a mechanism for salt water intrusion is relatively unimportant in Corpus Christi Bay. In the bays most influenced by fresh water inflow—Nueces Bay and the main body of Corpus Christi Bay—salinity generally increased by about 0.1 ppt per year over the 30-year period of record, matched by a declining trend in monthly-mean fresh water inflows—a decline of over 50 percent in Nueces and Corpus Christi Bays.

Over the three-decade historical period ending in 1997, there was a slight decline in water temperature in the upper bays and the main body of Corpus Christi Bay, with relatively few exceedances of the TCEQ standard of 35 degrees Celsius. Ward and Armstrong (1997) concluded that hyperthermality was not an issue of concern in the bay system.

Dissolved oxygen consistently averaged near and above saturation throughout the study area. Exceptions in the data record occurred in areas of poorly flushed tributaries and areas affected by waste loads, especially the Corpus Christi Inner Harbor. Hypoxia (defined as DO less than 2 parts per million) was rare, again with the exception of the Inner Harbor, where hypoxia was indicated in about one-fourth of the samples.

BOD, which measures water phase organic contaminants such as oil and grease and volatile suspended solids, were found to have generally high concentrations in the Inner Harbor. Since the frequency of BOD sampling declined in the later years of the record period, trends are uncertain. BOD did appear to decline over time in the open waters of Corpus Christi Bay, probably as a result of improved waste water treatment.

The historical data compilation period (1965–1994) indicates that turbidity in the bays declined substantially over time, up to 50 percent in the lower bays. Ward and Armstrong (1997) note that suspended sediment is an "intrinsic and important aspect of the Corpus Christi Bay environment; its decline is not necessarily beneficial."

Measurement of nutrients in the water column was highly variable through the 1965–1994 period of data compilation. Ammonia nitrogen is higher in areas that were affected by waste discharges, especially the Inner Harbor, while nitrate and phosphorous were found to be higher in areas affected by runoff and inflow. The mean concentrations of nutrients in the bay system were found to be typical of other Texas bays. Generally, concentrations of nitrogen nutrients appeared to decline over the 30-year record period.

Water phase total organic carbon (TOC) concentrations generally decrease from north to south, with larger values recorded in the Inner Harbor. Sediment phase TOC exhibit the opposite tendency, increasing southward with the lowest values of sediment TOC concentrations in the Inner Harbor. The data indicated a substantially declining trend in water-phase TOC throughout the system, with the exception of the Inner Harbor, where concentrations appeared to be increasing over time up to the 1994 date of the compilation period.

Contaminants such as coliforms*,* metals and trace organics were typically highest in areas receiving runoff and waste discharges, with the highest values measured in the Inner Harbor and low values measured in open bay waters. The nearshore segments of Corpus Christi Bay exhibited the highest average coliforms in the system. Nueces Bay appeared consistently high in metals, in both the water and sediment phases. The trend in sediment metals appeared to decline in the latter years of the 1965–1994 data compilation period, with the exception of zinc.

During the 1965–1994 period, the data record for water phase semi-volatile organics such as pesticides, PCBs, and PAHs was uneven and could not reliably support observations of trends in water-phase or sediment-phase concentrations. High concentrations of PAHs and polychlorinated biphenyls (PCBs) were reported in the Inner Harbor.

For the historical period, the sampling of tissue data in the Corpus Christi Bay system proved to be similarly unreliable. The largest tissue data sets were from oysters, blue crab, and black drum, analyzed for metals and PCBs and averaged over the data compilation period by major TCEQ (then the Texas Natural Resource Conservation Commission [TNRCC]) water quality segment. The report concludes that the tissue data is too sparse for practical trend analysis, although the American oyster, the most sampled organism, showed systematically elevated levels of metals in samples from Nueces Bay (Ward and Armstrong 1997).

<u>Current Conditions</u>

In 2010, the CBBEP published its *Environmental Indicators Report,* which addressed six questions of interest to the community regarding the environmental health of Coastal Bend bays and estuaries (CBBEP 2010). The six focus areas are broken up into 19 environmental indicators**.**

The Environmental Indicators Report findings are based on the CBBEP's monitoring and sampling data, which were compiled and summarized in its report *Water and Sediment Quality Status and Trends in the Coastal Bend, Phase 2: Data Analysis* (CBBEP 2012c). This CBBEP data compilation is essentially a continuation and update of the Ward and Armstrong (1997) project, which collected virtually all extant water quality sampling data from 1965 through 1994.

The overall finding of the CBBEP report is that the health of the Coastal Bend estuaries is good, with recreationally and ecologically important fish populations increasing and seagrass and saltwater marsh habitats expanding. However, several focus areas are in need of improvement. A number of shellfish harvesting areas remain restricted, and a small number of water bodies in the CBBEP region are on the state's list for impaired water quality. Of immediate concern is the decline in blue crab populations, a key ecological indicator and the principal food source for the federally listed Endangered Whooping Crane. Underscoring this concern, on March 10, 2013, a federal judge ruled that the TCEQ violated the Endangered Species Act by failing to guarantee sufficient flows of water in the Guadalupe and San Antonio Rivers. The Court ordered the TCEQ not to approve or grant any new water permits affecting those two rivers until the State of Texas provides reasonable assurances that a new permit would not result in harm to the Whooping Crane.

Other indicators of concern are the impaired water body segments under TCEQ's 303(d) program, the decline of freshwater marshes, rookery islands, and populations of colonial water bird nesting populations. The report recommends that monitoring programs be continued and expanded to better support the joint efforts of agencies, programs, and the public to continue to work toward improving the health of the Coastal Bend estuarine environment.

A less promising Coastal Conditions report card was issued by the EPA NEP, in its *2007 National Coastal Condition Report* (EPA 2007). The 2007 report summarized the environmental conditions of all 28 nationally significant estuaries, of which the CBBEP is one, as part of its mandate under Section 320 of the 1987 amendments to the Clean Water Act. The ratings of the estuaries were based solely on EPA's National Coastal Assessment (NCA) monitoring data, and not on data collected by the individual estuary programs. These assessments were based on Indices of Estuarine Condition developed by the NCA program using data collected by TPWD and the NCA from 27 stations in the Coastal Bend bays in 2000 and 2001. Eleven of the stations were located in Corpus Christi Bay or Nueces Bay.

While the CBBEP's more recent (2010) *Environmental Indicators Report* rated the Coastal Bend estuaries' condition as "good," EPA/NEP's overall rating under the NCA Indices was "poor" based on four primary indices: water quality (fair); sediment quality (poor); fish tissue contaminants (poor); and benthic index (fair to poor) (EPA 2007, 312).

The NEP Coastal Conditions report summarizes by noting that in view of the finding that Coastal Bend's condition is poor, the attainment of CBBEP goals will require strong monitoring efforts and comprehensive pollution and resource management. An effective regional water management plan is critical to balancing environmental needs of people and living resources to maintain a sustainable freshwater system (EPA 2007).

7.3.3 Coastal Resources

Coastal resources are defined in this analysis as areas within the vicinity of the proposed project which could potentially serve as habitat for "species of concern," discussed in **Section 7.2.3**. The Coastal RSA incorporates the Corpus Christi, Nueces, and Oso Bay Systems, which includes the Inner Harbor and Rincon Channel and associated wetlands. Cumulative effects on aquatic species are measured based on changes to their respective habitats (habitat degradation) that would potentially occur, mostly with respect to cumulative effects to water quality. All of the species discussed below are considered to be at risk due to their federal or state listing status. Further description of each of these species can be found in **Sections 3.13.2** and **4.16.1.2**.

7.3.3.1 Wildlife Species of Concern

As stated in **Section 4.16.1.2**, no designated critical habitat for federally listed threatened or endangered species occurs within the immediate vicinity of the proposed project. Critical habitat for the Piping Plover occurs within the AOI and is discussed in **Section 6.5.1.2**; however, the proposed project would not have a direct or indirect effect on critical habitat for this species.

The proposed project may affect but is not likely to adversely affect five species of sea turtle. These include the loggerhead sea turtle; green sea turtle; Atlantic hawksbill sea turtle; Kemp's Ridley sea turtle; and leatherback sea turtle. All of these species are listed as endangered by the U.S. Fish and Wildlife Service (USFWS) with the exception of the loggerhead sea turtle, which is listed as threatened. Suitable habitats for each of these species are described in **Table 3.13-1**. The Inner Harbor, the Rincon Channel, and adjacent areas of open water could potentially provide suitable habitat for these sea turtles.

The proposed project may affect but is not likely to adversely affect the federally endangered West Indian manatee. This species can be found in the gulf and bay systems (as described in **Table 3.13-1**) and could potentially occur in the Inner Harbor and the Rincon Channel. This species has also been documented by the Texas Natural Diversity Database (TxNDD) as occurring within the proposed project area.

The Wood Stork, White-faced Ibis, and Reddish Egret are all listed as threatened species by the Texas Parks and Wildlife Department (TPWD). Suitable habitat for these species includes the wetland areas associated with the Rincon Channel and this habitat area would be impacted by the West Alternative. The Reddish Egret was observed during field investigations for the proposed project in March 2013.

The Opossum pipefish is a state-listed threatened species for which suitable habitat has been identified in the estuarine areas associated with the Rincon Channel. These areas would be impacted by the West Alternative only.

7.3.3.2 Habitat Conditions

Habitat conditions are discussed relative to their respective bay systems. The Inner Harbor is part of the Corpus Christi Bay system, while the Rincon Channel and associated wetlands are discussed in terms of the Nueces Bay system. The Oso Bay System, located south of Corpus Christi Bay, includes Oso Creek and wetlands associated with these waters.

The Inner Harbor serves as potential habitat for all five species of sea turtle and the manatee. As stated in **Section 4.11**, Corpus Christi Bay and the Inner Harbor are considered receiving waters for stormwater runoff within the Corpus Christi Bay Drainage Basin. Corpus Christi Bay was identified on the 2012 Texas 303(d) List as an impaired water due to pathogen indicator bacteria recorded at several recreational beaches along the bay. According to the 2012 303(d) List, the Inner Harbor is not listed as impaired, though nitrogen nutrients have been identified by the TCEQ as parameters of concern for the Inner Harbor since 2002. Further discussion regarding the water quality issues and trends for Corpus Christi Bay is included in **Section 3.8.1.4**.

Areas of open water adjacent to the Rincon Channel serve as potential habitat for the five sea turtle species. Also, the wetland areas associated with the Rincon Channel are identified as potential habitat for the three state-listed birds discussed above, while the adjacent estuarine areas serve as potential habitat for the opossum pipefish. The Rincon Channel and associated wetland and estuarine areas are part of the Nueces Bay System, which is also identified in **Section 4.11** as a receiving water for stormwater runoff within the Nueces Bay Drainage Basin. Nueces Bay is listed on the 2012 303(d) List as impaired under the parameters of increased zinc levels (addressed by an approved TMDL and TMDL Implementation Plan). Further discussion regarding water quality issues and trends for Nueces Bay is included in **Section 3.8.1.3**.

Oso Bay is identified as a receiving water for stormwater runoff within the Oso Bay Drainage Basin and is included on the 2012 303(d) List as impaired under the parameters of depressed dissolved oxygen and bacteria for oyster waters. Oso Creek, identified by the TCEQ as an environmentally sensitive area, is also identified as impaired for bacteria from the Oso Bay confluence in southern Corpus Christi to approximately three miles upstream of SH 44, west of Corpus Christi.

This cumulative effects analysis also considers potential impacts to black mangroves, which provide shoreline stabilization, water quality improvement, and habitat for fish and wildlife. Impacts to this marsh vegetation during construction of the proposed project would be mitigated onsite; however, the cumulative effects to black mangroves as a result of actions by others are considered within the Coastal RSA due to the uniqueness of the vegetation and the habitat it provides. Black mangrove vegetation along the South Texas coast is discussed further in **Section 4.13.1.1**.

7.3.4 Community Resources

Community resources are assessed within the boundaries identified in the Community Impact Assessment and as discussed in **Sections 4.6** and **6.6.1.2** with regard to potential direct and indirect effects of the proposed project alternatives. The "health" of the community resources discussed in the cumulative effects analysis is measured based on past and existing levels of community cohesion. This analysis also considers potential effects to the physical health of the community, particularly as it relates to air quality.

7.3.4.1 Community Cohesion

Potential cumulative effects to community cohesion within the North Beach, South Central, Northside, Westside, Refinery Row, and Portland communities are considered in this analysis. A brief summary of the current status of cohesion, considering both past and present actions, within each of these communities is included below and is discussed further in **Section 3.5.3**.

North Beach

While North Beach was a densely developed and very popular destination in the first several decades of the twentieth century, the opening of the Padre Island Causeway in 1950 provided access to the beaches of Padre and Mustang Islands as an alternative to North Beach. The construction of the Harbor Bridge in 1959 was also somewhat detrimental to the community. The infrastructure constructed as part of the bridge approaches required the demolition of blocks of existing development, and a 1980 hurricane also caused considerable damage. Based on data from the Census, the population in the census tract representing North Beach declined from 1,681 in 1960 to 415 in 1990 (the census tract geography was expanded considerably in 2000 and in 2010). Today, North Beach is mostly comprised of condominium buildings and tourism-oriented development. Although this type of development is not commonly associated with a high degree of community cohesion, active participation in the Corpus Christi Beach Association seen during community outreach for the project indicates that the community is relatively cohesive (see **Section 3.5.3.1**). As a peninsula, North Beach is geographically separated from the rest of Corpus Christi, and, as a result, relies on the Harbor Bridge to maintain connectivity to the city. Members of the community have expressed some feelings of isolation from the rest of the city. Overall, however, the status of the North Beach community is considered stable.

South Central

The South Central community includes the CBD, Evans Elementary neighborhood, and Crosstown East neighborhood (see **Section 3.5.3.2**). While this area includes the oldest development in Corpus Christi, residential densities have been spreading to the south and away from downtown over the past several decades. A census tract spanning all three neighborhoods declined in population density from around

7,500 people per square mile in 1960 to about 4,900 people per square mile in 1990, where it has hovered for the past two decades. As a mixed-use area, the CBD does not exhibit typical characteristics of strong community cohesion, though existing levels of cohesion are considered stable. The existing US 181 facility as acts as a physical barrier to accessibility downtown, particularly with regard to the SEA (Sports, Entertainment, and Arts) District. Within the Evans Elementary neighborhood, residences are mainly single-family homes, over half of which are owner-occupied. These and other characteristics of the Evans Elementary neighborhood indicate a community in relatively stable health. As reported by Shearin (2013), the tallied responses from the respondents to the community survey from the Evans Elementary neighborhood indicate “high cohesion” to “very high cohesion.” In the Crosstown East neighborhood, the majority of residences are also mainly single-family detached homes; community cohesion is considered neutral. The overall status of the neighborhoods in South Central is stable, with signs of increased investment in this area, including new high density residential developments.

Northside

The Northside community is comprised of two neighborhoods: Washington-Coles, located east of Port Avenue, and Hillcrest, located west of Port Avenue (see **Section 3.5.3.3**). This area was developed in the early twentieth century as jobs at the Port, and later the refineries, drew people to the area. Historically, there were two distinct neighborhoods, with African-Americans living in the Washington-Coles area and whites living in Hillcrest. Beginning in 1948, African-American residents were allowed to buy homes beyond Kennedy Avenue in the Hillcrest neighborhood (Associated Press 1999). Over the next two decades the racial make-up of the neighborhood gradually transitioned from predominantly white to predominantly African-American and Hispanic or Latino. Construction of I-37 through this area in 1961 and buyouts by adjacent refineries have contributed to an overall decline in community cohesion in the neighborhoods, which are also separated from downtown by the existing US 181 facility.

In 1994, 200 of 322 units in the DN Leathers public housing complex in the neighborhood were closed due to continual flooding problems and the structures were demolished in 1999 (Malan 2009b). A tank farm located immediately to the north of the development was removed in 1995; the demolitions left a large swath of vacant land between the Hillcrest and Washington-Coles neighborhoods. Over time, the population of this community has declined, and many homes are in disrepair. Approximately half of residences in the community are single-family homes, though only approximately 7 percent and 29 percent of units in Washington-Coles and Hillcrest, respectively, are renter-occupied. All but a few businesses in the once-vibrant commercial district in Washington-Coles have left the area over the past several decades, leaving the area with few neighborhood services. Only one of the three schools in the community is currently operating, and amenities at T.C. Ayers Park have been reduced over time due to lack of City funding. Some indicators of cohesion remain in these neighborhoods, however, primarily focused around the numerous neighborhood churches and the Oveal Williams Senior Center. Considering the declines in population, cohesion, and neighborhood resources, the overall status of the Northside community is considered unstable and declining.

Westside

The Westside community includes four neighborhoods: Oak Park, Leopard Street, Ben Garza, and Crosstown West (see **Section 3.5.3.4**). This area was developed early in Corpus Christi's history, and by the 1930s was densely developed with dwellings, commercial buildings, schools, churches, parks and industrial areas. Like South Central, many neighborhoods in the Westside community have experienced outmigration to the suburbs. The Oak Park neighborhood has seen a decline in community cohesion due to buyouts and demolitions associated with construction of I-37 in the mid-twentieth century, although its current status is considered stable. The Leopard Street neighborhood is primarily a commercial corridor with many vacant commercial buildings indicative of the shift in the late twentieth century away from smaller commercial centers and toward more suburban development. The Ben Garza and Crosstown West neighborhoods have relatively low vacancy rates and a high percentage of single-family homes. Input gathered through community meetings suggests that residents of Ben Garza and Crosstown West may not share a strong sense of community cohesion in geographically defined neighborhoods, while there are pockets of cohesion in the Leopard Street and Oak Park neighborhoods.

Refinery Row

The Refinery Row community includes two residential neighborhoods: Dona Park and Academy Heights (see **Section 3.5.3.5**). Dona Park was established in the 1950s, providing worker housing close to the existing industrial uses in the area, including ASARCO. Academy Heights was developed between 1963 and 1980, following the beginning of the construction of I-37. While some residents have moved out and owner-occupancy is lower than in previous decades, current cohesion within Dona Park is considered relatively high, as the neighborhood is still comprised of many multi-generational families as well as those seeking affordable housing. Just to the west, Academy Heights is comprised of both single-family homes and a moderate-sized apartment complex and also exhibits a relatively high level of community cohesion. Owner-occupancy rose in these neighborhoods between 2000 and 2010, and more than half of residents moved to their home prior to 1990. With regard to the distance of Refinery Row from downtown, some community survey respondents cite the seclusion of the area from the rest of Corpus Christi as a desired benefit. Overall, community cohesion within the Refinery Row neighborhoods is considered stable.

Portland

Portland was established in the late nineteenth century but has remained a relatively small community. The largest increases in population growth were observed in the 1960s (following the construction of a concrete causeway connecting the city to Corpus Christi) and in the 1970s and 80s, following growth patterns in Corpus Christi. The majority of residences in Portland are single-family homes, many residents of which moved to the area after the year 2000. According to the City of Portland, the area, which serves as a bedroom community for Corpus Christi, aims to maintain a "small town" feel. As discussed in **Section 3.5.3.6**, it is difficult to measure the community cohesion of an entire town. Overall, though, this area appears to possess a stable level of cohesion.

7.3.4.2 Community Health

<u>Background on Health-Related Effects of Air Quality</u>

As noted above in the discussion of air quality in **Section 7.3.1.2**, Corpus Christi area monitoring results indicate levels of benzene and 1,3 butadiene that are below their respective comparison values for protection of human health, with the exception of benzene levels at the Huisache monitor before 2007. The information on measured and modeled ambient concentrations of MSATs indicate ambient concentrations that are not expected to pose a threat to human health based on comparison to the TCEQ's AMCVs that have been established for MSATs. Emissions from mobile sources are expected to decrease in the future (FHWA 2012a).

Decreasing ambient concentrations of air toxics do not translate directly to reductions in human exposure or to reductions in cancer risks or other health risks; however, there is a general association between ambient levels of air toxics and levels of health risk. While no future projections specific to Corpus Christi area health risks associated with air toxics are available, Cook et al. (2007) found that national average human health risk levels of MSATs are likely to decrease in the future, in association with projected decreases in emissions from mobile sources. Their study of modeled projections of emissions and human exposures from stationary and mobile sources concluded that EPA emission control programs will substantially reduce average inhalation cancer risks and potential noncancer health risks from exposure to MSATs between 1999 and 2030. The estimated total U.S. national average inhalation cancer risk associated with mobile sources, per one million individuals, was shown to go from 12.4 in 1999 to 5.31 in 2015 to 5.05 in 2020 to 5.52 in 2030. The estimated cancer risk associated with stationary sources increased over this same period (Cook et al. 2007).

<u>Concerns Related to Community Health</u>

Community concerns regarding air quality and related health effects have been identified within the neighborhoods along the south side of the Inner Harbor due to their proximity to area refineries. The most recent study of community health in the area was conducted by the U.S. Department of Health and Human Services' Agency for Toxic Substances and Disease Registry (ATSDR) in 2010, which tested personal air samples from the Hillcrest neighborhood in Northside and the Dona Park neighborhood in Refinery Row. The study concluded that there was no evidence of widespread exposure to elevated concentrations of environmental volatile organic compounds (VOCs) (Orloff et al. 2011, 1). Additional studies by ATSDR are currently underway regarding the health effects of outdoor air pollutants to residents within Refinery Row. Further discussion of the status and trends of community health as it relates to air quality is included in **Section 3.5.1.4**.

Before strict federal and state regulatory controls were in place, wastewater discharges from oil refineries, petrochemical plants, and smelters in the industrial area adjacent to the Port of Corpus Christi seeped into the ground water, resulting in a contaminated groundwater plume that eventually migrated beyond the plant boundaries (Rosengarten, Smith & Associates, Inc. 2010).[1] Since 1993, industry recovery wells have pumped out more than 15 million gallons of contaminated ground water, and more than 800 monitoring wells in the industrial area continue to gather information on the plume, under supervision of TCEQ (Malan 2010). Residents of the Hillcrest and Dona Park neighborhoods have expressed concerns for many years about odor and adverse health effects from VOC air emissions and possible vapor intrusion from contaminated ground water. A 2010 study by Texas A&M University (TAMU) and other organizations concluded that benzene concentrations in many of the residents' blood samples were elevated (TAMU 2010). However, a subsequent study by the US Department of Health and Human Services (DHHS) Agency for Toxic Substances and Disease Registry (ATSDR) concluded that the TAMU study did not use valid analytical or quality control procedures, and so ATSDR was unable to validate its results. The ATSDR exposure investigation, which included biological and environmental monitoring techniques, concluded that "the concentrations of benzene and other petroleum-related VOC's detected in [personal air samples and blood samples] from the exposure investigation participants were not higher than those detected in residents of the United States in a national survey (NHANES)" (Orloff et al. 2011, 1).

7.3.5 Economy

7.3.5.1 Overview of the Corpus Christi MSA

The Economic RSA encompasses Nueces, San Patricio, and Aransas Counties, all of which make up the Corpus Christi MSA as delineated by the U.S. Office of Management and Budget. The proposed project would potentially contribute to cumulative economic impacts within the Corpus Christi MSA. From an area-wide perspective, the economy of the Corpus Christi MSA is considered to be stable, with strong recent gains in employment. The overall health of the economy within the Corpus Christi MSA as indicated by regional employment statistics, employment rates, commuting patterns, and major area employers (including the military sector, healthcare industry, and the Port of Corpus Christi and Port Industries) is further discussed in **Section 3.4**.

Historically, the economy of the MSA has been tied to the petrochemical industry, and the activity surrounding the Eagle Ford Shale play is likely to continue to strengthen this connection. The 2013 Moody's Analytics Précis Report on the Corpus Christi MSA forecasts that the Eagle Ford Shale boom will be the most important driver of growth in the MSA over the report's forecast horizon (2043) (Moody's 2013). The report noted the strong employment trends but ranked the MSA 358 out of 384 U.S. MSAs for "vitality," with a relative score of 71 (Moody's 2013). The Moody's vitality index attempts to predict the average annual growth rate in an area's gross domestic product over the next 10 years and is based on the following four factors: industrial structure, excess labor supply, labor force quality, and labor force growth (Moody's 2013). As the Corpus Christi MSA's score of 71 is below 100 (pegged to the U.S.), the area is likely to see slower growth than the nation as a whole.

[1] Stricter water quality controls included Clean Water Act industrial wastewater discharge permits, Safe Drinking Water Act, locally enforced controls under City of Corpus Christi's MS4, and environmental standards established by the Port of Corpus Christi for its own operations and for its shipping customers under the Port's EMS tenant audit program (see **Section 7.8.2**). Considerable improvements to surface and ground water quality were achieved by the closure of the ASARCO zinc smelting facility in 1985 and the Nueces Bay Power Station in 2003 (see **Section 3.8.1.2**).

The closure of the Naval Station Ingleside in the 2005 round of base closures resulted in a direct loss of over 3,000 federal employee residents, plus more than 850 jobs in San Patricio County. Net out-migration from San Patricio County from 2001 to 2010 was 3,509 people. However, the community's response to the Naval Station Ingleside closure has become a clear example of the economic resilience of the regional economy. According to a study by TAMU, the "actual" amount of local job losses appears remarkably smaller than the "indirect" effect of 2,558 jobs forecast by the Department of Defense (DOD). Much of the impact was probably absorbed by areas outside San Patricio County. Also, effective strategic actions by local governments and workforce agencies mitigated many of the immediate effects. Other developments have helped resuscitate the local economy, including the $1 billion Tianjin Pipe Corporation (TPCO) Texas Mill project in Gregory and the burgeoning Eagle Ford Shale activity. By 2012, these efforts "seem to have overshadowed the effect of the [DOD Base Realignment and Closure (BRAC)] on the economy of the Coastal Bend" (Lee 2012).

As described in **Section 3.4.1,** the primary employment sectors in Nueces and San Patricio Counties are Education and Health Services followed by Trade, Transportation and Utilities (TTU). These two industries also dominate employment in the MSA as a whole, including Aransas County. The discussion of study area business trends in **Section 3.4.4** describes the primary employers in the healthcare industry and also describes activity at the Port, which contributes to the TTU sector. The third-largest employment sector in the MSA is Leisure and Hospitality, where the tourism industry plays an important role. This cumulative effects analysis focuses on the subsets of the two major facets of the Corpus Christi economy most likely to be cumulatively impacted by the proposed project: the tourism industry and the Port of Corpus Christi. The health of these sectors is further discussed below.

7.3.5.2 Tourism Industry

Tourism, described by the Corpus Christi MPO as a "mainstay of the Corpus Christi economy" (Corpus Christi MPO 2009, 87), is a major factor in the health of the economy throughout the entire MSA. According to a 2009 report by Dr. Jim Lee of TAMU-CC, visitors to the Corpus Christi MSA inject a total of over $1 billion each year into the local economy (Lee 2009, 2). Attractions such as the Texas State Aquarium, USS *Lexington* Museum, and Port Aransas draw approximately 7.2 million visitors to the area each year (Lee 2009, 2). Other attractions to the area include Corpus Christi and South Padre Island beaches, waterfront areas, and national and state parks. Together, nature-related activities accounted for 28 percent of local tourist activities in 2008, compared to 10 percent statewide (Lee 2009, 4).

The cruise ship industry has been considered a potential market for the Port of Corpus Christi, particularly since the construction of the Congressman Solomon P. Ortiz International Center in 2000. At the time of construction, the Ortiz Center was intended to serve as a conference facility as well as a "part-time cruise terminal to capture the swelling cruise market" (Caller Times 2001). In the early 2000s, the Ortiz Center was anticipated to help the Port position itself for an active role in the cruise ship industry (Caller Times 2001). However, as of 2013, the Ortiz Center is still lacking the necessary infrastructure to make it a viable option for cruise ships (Spruill 2012), and the original intent of the Ortiz Center as a part-time cruise ship terminal has yet to be fully realized.

According to the *U.S. 181 (Harbor Bridge) Feasibility Study*, "while the Port of Corpus Christi hopes to grow its business in many areas, it may be difficult for the Port to attract the largest cruise ships from their Florida homeports in Miami, Fort Lauderdale, and Cape Canaveral" (URS 2003, 4-23). In 2005, the Port of Corpus Christi commissioned a study regarding the potential for the Port to take advantage of the cruise ship industry. The results of the study indicated that ships are not likely to choose South Texas as a destination, citing weather concerns and a lack of "land-based diversions" for cruise ship passengers (Spruill 2012).

Still, discussions of the viability of Corpus Christi as a cruise ship destination as well as the potential implications for the area's tourism industry are ongoing amongst the Port of Corpus Christi, the Corpus Christi Convention & Visitors Bureau, and other interested parties. In October 2012, a joint committee of state lawmakers heard testimony from local government leaders and Port officials regarding the cruise ship industry in South Texas, and more studies regarding whether South Texas will be able to eventually take advantage of the cruise ship market are currently underway (Spruill 2012). Currently, however, the cruise ship industry does not play a major role in the tourism sector of the Corpus Christi economy, and the future role of cruise ships at the Port of Corpus Christi remains uncertain.

7.3.5.3 Port of Corpus Christi

The construction of a deepwater port at Corpus Christi was authorized by Congress in 1923, and in 1926 the USACE completed dredging of a 25-foot channel through the jetties at Port Aransas to a shallow bayou in Corpus Christi Bay, where four cargo docks had been constructed. For several years, cotton and other agricultural products were the principal commodities handled by the Port, then known as the Nueces County Navigation District. In 1930, oil was discovered in Nueces, San Patricio, and neighboring counties, resulting in 89 producing oil fields within a 125-mile radius of Corpus Christi within just a few years (Port of Corpus Christi 1998). Also in 1930, the channel was deepened to 30 feet, two turning basins were completed, and the first industrial plant in the Port area (Southern Alkali) was constructed. Over the next several decades, the Port continued to extend its channels and improve its shipping support facilities to accommodate a growing number of refineries, a grain elevator, and other industrial enterprises. In 1951, the Port extended its navigation activities beyond the Inner Harbor when Reynolds Metals, seeking to locate an aluminum plant on Corpus Christi Bay's north shore, reached an agreement with the Port that a channel would be built through the Ingleside Peninsula along the shore. That same year, the Harbor Bridge was constructed, replacing the "bascule bridge," which caused bottlenecks for both vehicular and shipping traffic. The project to deepen the Port of Corpus Christi to its present depth of 45 feet, first authorized in 1968, was completed in 1989 (Port of Corpus Christi 1998). By the 1990s, the Port had moved to diversify its shipping capabilities to attract cargoes of steel, refrigerators, military equipment, cruise ships, forest products, autos, and containers, among others.

Growth at the Port occurs with the attraction of industrial and commercial activity, private capital, and waterborne cargo shipments, which, in turn, creates employment opportunities, sustains existing jobs, and introduces new dollars to the area while broadening the tax base that supports public services (Corpus Christi MPO 2009, 52). A 2012 economic report prepared for the Port of Corpus Christi estimates the economic impacts of marine cargo activity at the marine terminals (both public and private) located within the Port District within the year 2011 (Martin Associates 2012, 7). The report states that seaport activity impacts the economy in four major ways: through creation of jobs, including direct, induced, and indirect jobs; generation of employee earnings, comprised of wages and salaries; generation of business revenue, associated with services provided in support of marine activity; and through state and local taxes, including taxes paid by individuals and by firms dependent on Port activity (Martin Associates 2012, 3).

The consequential economic benefits of growth at the Port rely almost entirely on global market conditions. During a period of diversification efforts in the 1990s, the Port aimed to "enhance [its] economic foundation" by attracting new cargoes beyond petroleum and agriculture, such as steel products, military equipment, cruise ships, automobiles, and more (Port of Corpus Christi 1998). Growth at the Port is anticipated to continue as shifts in the global energy market have brought Eagle Ford Shale activity to the forefront of economic discussions regarding the Corpus Christi MSA and the entire Coastal Bend Region. This shift is evidenced by planned developments on the north side of Corpus Christi Bay such as the La Quinta Gateway Terminal and the Cheniere Energy, Inc. liquefied natural gas (LNG) export terminal currently under development, as well as the TPCO Texas Mill project in Gregory. The La Quinta Gateway Terminal (discussed further in **Section 7.5.4**) is designed as a multi-purpose dock and container facility (Port of Corpus Christi 2009) aimed at supporting a number of industries that utilize the Port. Plans for the LNG terminal, though, are "underpinned by the significant resources under development in the Eagle Ford Shale" (Cheniere 2013a). According to a study by the Institute for Economic Development at the University of Texas at San Antonio (UTSA), the steel manufacturing industry, historically concentrated in the northeast and Midwest, has also undergone a "significant amount of growth due to shale gas production profitability" (UTSA 2012, 62). As evidenced by the TPCO Texas Mill project, "the convenience of the Port of Corpus Christi's location relative to the Eagle Ford has helped spur development in this sector along the Gulf Coast" (UTSA 2012, 62). With respect to the permanence of the current market shift toward Eagle Ford Shale-related industries, the Port states that "[s]eaborne trade of Eagle Ford products continues on a growth trend for the foreseeable future" (Port of Corpus Christi 2013a).

The UTSA study also indicates that, though not "producing counties" within the Eagle Ford Shale development area, Nueces and San Patricio Counties are considered areas where "significant non-production activity" is occurring, such as headquartering, refining, construction, and renovation (UTSA 2012, 4). According to the report, Nueces County underwent an estimated $4.9 billion output impact (revenues) in 2011 as a result of Eagle Ford Shale activities, while San Patricio County saw a $115 million output impact. Eagle Ford Shale activities in 2011 also resulted in creation of an estimated total of 3,880 and 517 full-time jobs in Nueces and San Patricio Counties, respectively. Future impacts in Nueces and San Patricio Counties in the form of auxiliary benefits are also anticipated to occur due to their proximity to counties with active drilling. The following projections for the year 2021 incorporate the future economic benefits anticipated to result from the Flint Hills and Valero facilities and include direct impacts as well as indirect jobs, which would, in turn, generate more impacts from induced spending. For the year 2021, Nueces County is anticipated to see approximately $24.2 billion in total output as a result of Eagle Ford Shale activity, with an estimated 19,000 jobs created. San Patricio County is projected to see a total economic impact of approximately $523.6 million with approximately 2,300 new jobs projected. While Aransas County is not included in the study, it is anticipated that its close proximity to the Eagle Ford Shale region would also result in an impact to the local economy.

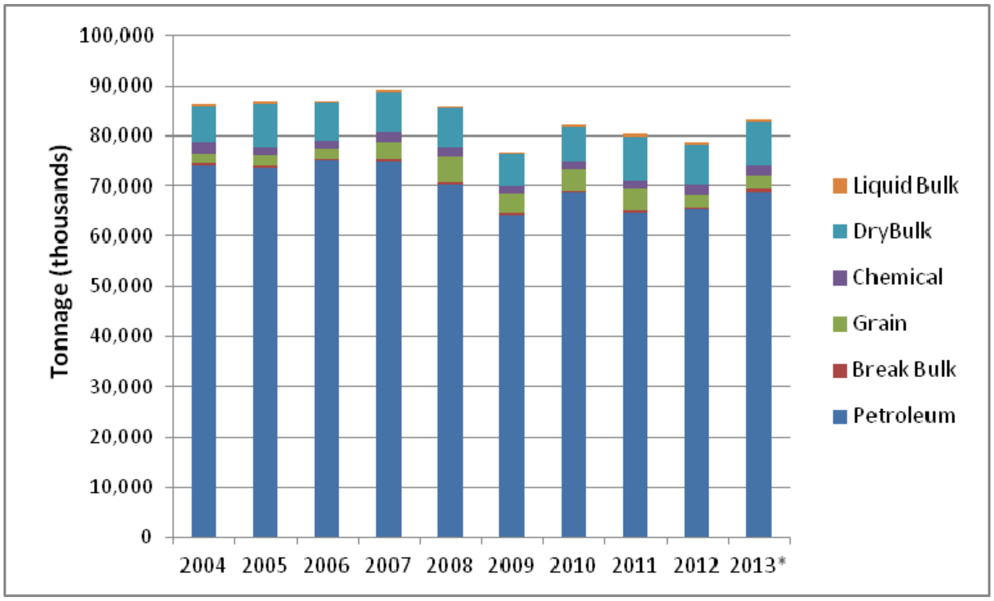
Role of Shipping and Navigation

The Port has long been recognized as the "engine" of the Corpus Christi region's economy; however, the Port experienced a 9-percent drop in tonnage between 2001 and 2011 (USDOT 2013). This period included the recession of 2008-2009, which affected global trade generally. Another contributing factor in the decline was the Eagle Ford Shale oil and gas boom, which, while a big economic benefit to the Corpus Christi region, altered the shipping requirements of some of the Port's refining customers on the Inner Harbor. Despite this slowdown, the Port's paramount role in the regional economy is expected to continue to lead the economic development prospects of Corpus Christi and the south Texas region (Martin Associates 2012).

Shipping trends at the Port clearly reflect the influence of the petrochemical industry. Petroleum dominates both inbound and outbound shipments and has represented the overwhelming majority of cargo passing through the Port between 2004 and 2013 (see **Illustration 7.3-2**). Total cargo tonnage in 2013 is on track to surpass levels observed in 2012, based on data through April 2013. The percentage of petroleum cargo has also been on the rise since 2010.

The Port has undertaken initiatives to better capture opportunities offered by the Eagle Ford Shale play, including increased demand to export crude and condensates, and sand for the hydraulic fracturing process. Facility upgrades include improvements to oil docks to handle larger and more frequent tanker barge calls (Port of Corpus Christi 2013a). A new barge loading dock (Oil Dock 5) was opened in 2013, and the conceptual design is complete for a new North Bank Public Oil Dock capable of serving several new customers (Port of Corpus Christi 2013a). Two additional barge mooring areas, as well as a fleeting area are being developed to serve increasing movements of sand and liquids related to the Eagle Ford Shale. Several port facilities are currently being utilized for handling sand and proppants—engineered sand for use in hydraulic fracturing—and a proposed barge unloading facility would import over one million tons of sand per year to be processed and trucked to drill sites (Port of Corpus Christi 2013a).

While the Port has historically relied on shipping related to the oil and gas industry, its leadership has aggressively pursued diversification of its maritime business. The opportunities represented by the Panama Canal improvements and the "post-Panamax era" of shifting global trade routes and larger vessel types has become a focal point for all the competitive ports in the southeastern U.S. and Gulf of Mexico, Corpus Christi included.



Source: Port of Corpus Christi Cargo Tonnage Reports by Commodity 2013
*Reflects projected annual figure based on data through April 2013
Illustration 7.3-2. Port of Corpus Christi Cargo Tonnage Reports by Commodity, 2004–2013

Whether or not the Port ultimately captures a major share of the post-Panamax trade, its efforts to respond to changing international trade patterns and the service requirements of a new generation of vessels provide a useful measure of its future prospects for growth. Various studies have identified a number of competitive factors that may qualify a port as "Panamax-ready" (USACE [2012b], Harrington & Cortelyou [2010], Texas Transportation Institute [2012], etc.). The most commonly cited factors and competitive criteria are listed below.

- <u>Channel depth and width of about 50 feet</u>
  Channel depth at the Port is currently 45 feet. The Channel Improvement Project to deepen to 52 feet has been approved and authorized but not funded.
- <u>Light (unloaded vessel) air draft of about 205 feet</u>
  The Panama Canal's air draft limitation (the unobstructed area between high water and an overhead clearance, such as a bridge) remains 201 feet at high tide under the Bridge of the Americas, allowing for 205 feet at low tide. The proposed project would increase the Inner Harbor's air draft limitation from 138 feet to at least 205 feet.
- <u>Adequate storage and dock facilities to handle larger dry bulk or container cargos</u>
  Port facility improvements are planned or underway at both the Inner Harbor and at La Quinta Ship Channel.
- <u>Sufficient available area for growth of related landside support facilities</u>
  Berthing and docking improvements are being implemented at the Inner Harbor and La Quinta Channel. Industrial acreage is available along the Inner Harbor and at La Quinta Channel.

- Channel and turning basin configurations, reflecting the greater length of vessels
  The maximum ship length that can currently be accommodated at the Port is approximately 1,150 feet.
- Intermodal transportation infrastructure with sufficient capacity and lack of congestion
  Planned highway and rail improvements are listed in **Table 7.5-1**. The Port is implementing rail improvement projects at both the Inner Harbor and La Quinta Channel (Port of Corpus Christi 2012c).
- Regional population and economic conditions and growth projections, reflecting export and import demand
  The Eagle Ford Shale play is expected to play a dominant role in determining economic conditions and growth projections.

Note that the proposed project, which would increase the current 138-foot air draft limitation, addresses only one of these post-Panamax desirable conditions and is not considered to have an indirect causal relationship to prospective growth in the Port's shipping business (see **Section 6.5.2.2**). An increase in the air draft at the Inner Harbor would be one of several factors that may enhance the Port's ability to take advantage of future changes in national and international trade. Along with the increased air draft factor, the Port has been actively pursuing improvements for most of the other competitive factors listed above. It should be added that most of the other major competitive ports for post-Panamax trade are also aggressively working toward "Post-Panamax" readiness. South of Norfolk, none of 22 ports identified by the USACE (2012b) on the U.S. Southeast or Gulf coasts have 50-foot channels.[2]

In evaluating a port's growth prospects, as generally indicated by its post-Panamax readiness, USACE (2012b) considers unused port capacity to be an asset. Available space for expansion of port facilities as well as for ancillary industrial or commercial enterprises provides for efficient development for a port and its potential customers. It also may minimize potential economic and natural resource costs when greenfield development sites become subject to accelerated development demands. The Port's deliberative planning and site development strategy has allowed them to make substantial acreage available along the Joe Fulton Corridor and the La Quinta Trade Gateway.

While petroleum continues to be a primary component of the Port's business, the Port's diversification initiatives, activity at La Quinta and Ingleside, plus its post-Panamax competitive prospects and improvements to accommodate increased exports from the Eagle Ford Shale play, would further support the economic viability of the Port of Corpus Christi.

7.4 IDENTIFICATION OF DIRECT AND INDIRECT IMPACTS THAT MAY CONTRIBUTE TO A CUMULATIVE IMPACT

A summary of potential direct and indirect impacts that could contribute to cumulative impacts is provided by resource in **Table 7.1-1**.

[2] Charleston, with a 45-foot channel and nearly five feet of tide, could handle most post-Panamax vessels. Charleston is also the port region with the largest forecast population and trade growth.

Direct and indirect impacts of the proposed project that could contribute to a cumulative impact to air quality include construction-phase emissions of dust and MSATs associated with equipment operation and materials transport, which could include diesel engine air emissions and batch plant air emissions. These activities would potentially generate a temporary increase in MSATs. Potential indirect effects to air quality would be insubstantial. Given the health protections implemented by the NAAQS and the attainment status of the two-county area, the proposed project is not considered to have community health impacts related to emissions of criteria pollutants.

For water resources, permanent impacts to waters of the U.S., vegetation, soils, and area hydrology would occur during construction of any of the proposed build alternatives, and increases in impervious cover as a result of construction of the proposed facility would potentially result in an increase in storm water runoff to receiving waters. These effects would be minimized through the use of Best Management Practices (BMPs) and implementation of regulatory control measures. Minor changes in water temperature in shaded areas beneath and adjacent to the bridged areas would also result from the West Alternative primarily and to a lesser extent from the Red Alternative (Preferred).

Coastal resources would potentially be affected by impacts to marsh vegetation during construction of any of the build alternatives, some of which could serve as habitat for wildlife species, including threatened and endangered species. Effects to water resources would also potentially affect coastal resources due to minor, incremental changes in water quality within areas that serve as potential habitat. Potential impacts to habitat for threatened and endangered species would be minor and would be limited to impacts to vegetation and water resources, the majority of which would be addressed through implementation of BMPs and other regulatory control measures.

Direct impacts to community resources would include residential displacements, changes in accessibility, traffic noise, changes in the aesthetic character, and the introduction of a physical barrier between the Hillcrest and Washington-Coles neighborhoods in the Northside community. Benefits would include the removal of the US 181 barrier downtown under the Red, Orange and West Alternatives, as well as potential for increased connectivity in the downtown area and the SEA District. The West Alternative would result in a reduction in access to major area highways (I-37 and US 181) for the Hillcrest neighborhood.

Economic resources would be affected by business displacements under all of the build alternatives, most notably as a result of the Green Alternative. Increased business exposure, potential loss in tax revenue during right of way acquisition, and increases in household earnings and jobs would also directly result from the proposed build alternatives. Indirect effects to the local and regional economy would be limited to the creation of potential economic opportunities that rely on the implementation of other actions in order to be realized.

7.5 IDENTIFICATION OF OTHER PAST, PRESENT AND REASONABLY FORESEEABLE FUTURE ACTIONS THAT MAY AFFECT RESOURCES

This step identifies other past, present, and reasonably foreseeable future actions considered in the cumulative effects analysis, focusing on actions or developments by others that are independent of the proposed action. Reasonably foreseeable actions are considered probable rather than merely possible, and, in accordance with guidance from FHWA (2003) and CEQ (40 CFR §1508.7), are based on informed professional judgment rather than speculation. Reasonably foreseeable actions within the 2035 timeframe are considered in this cumulative effects analysis. Information regarding reasonably foreseeable future actions was obtained through coordination with local agencies, review of adopted plans, and consultation with individuals with expertise in the study area, including participants in the Collaborative Judgment Land Use Panel. **Table 7.5-1** contains a list of transportation, industrial, and commercial development projects that have recently been constructed, are currently under construction, or are planned for future construction. Actions determined to be reasonably foreseeable within the 2035 cumulative effects timeframe (based on whether or not the project has progressed beyond the conceptual planning phase) are displayed on **Figures 7.5-1**–**7.5-3**, with corresponding map references included in the table when applicable. Further discussion of these actions is included in **Sections 7.5.1–7.5.6** below.

Reasonably foreseeable future actions by others are divided into three main categories: transportation projects, industrial development, and Corpus Christi development. The transportation projects discussed here include major improvements to the railroad, highway, and navigation systems. All of the railroad improvements listed here are included in the Port of Corpus Christi Authority's 2012 *Rail Master Plan*, which includes projects aimed at serving future increases of rail traffic at cargo terminals and Port Industries. Highway projects discussed in this analysis focus on major planned actions included in the *2035 MTP*. Information regarding plans for navigational improvements was obtained from the Port of Corpus Christi. Industrial developments, also sourced from the Port of Corpus Christi, include projects typically intended to increase capacity at the Port. These industrial developments also include redevelopment of the Naval Station Ingleside by Occidental Petroleum Corporation. Finally, Corpus Christi development plans include potential improvements by the City of Corpus Christi as well as private investors and are mainly focused on revitalizing the downtown area and expanding the SEA District.

7.5.1 Channel Improvement Project

The Final Environmental Impact Statement (EIS) for the Channel Improvement Project was approved by USACE in 2004. In 2007, Congress authorized the channel project, which included deepening the Corpus Christi Ship Channel to 52 feet; widening the channel to 530 feet; adding 200-foot-wide, 12-foot-deep barge shelves across Corpus Christi Bay; and extending the La Quinta channel for 1.4 miles at a depth of 39 feet, plus two feet of advance maintenance. The authorization also included ecosystem restoration features to protect endangered species, wetlands, and seagrasses. The Port and USACE finalized negotiations for a Project Partnership Agreement to construct the La Quinta extension and related ecosystem restoration features of the project. In 2012, the USACE Galveston District released an EA

7.5-1 Current and Proposed Transportation and Development Projects				
Figure	**Current or Planned Development Project**	**Location**	**Description**	**Status**
	Transportation Improvements			
7.5-1	Nueces River Rail Yard	North side and western end of Inner Harbor, adjacent to Joe Fulton Corridor, east of Viola Turning Basin	Siding for 110-car train and storage tracks	Final engineering in progress; received $10M TIGER grant in 2012; contract awarded June 2013 to Haas-Anderson Construction Ltd. for Phase I
7.5-1	Suntide Unit Train Sidings & Rail Yard	North side and western end of Inner Harbor, adjacent to Joe Fulton Corridor, northwest of Flint Hills Resources West Refinery	Existing line converted to unit train siding; new main line to be constructed adjacent to existing line	Preliminary engineering completed
--	Bulk Terminal Rail Reconfiguration & Loop Rail	North side of Inner Harbor	Reconfiguration to increase rail cargo handling capacity; includes new loop tracks and access roads	Port currently working with users to develop a plan
7.5-2	ADM Grain Elevator Track Improvements	North side of Inner Harbor, southwest corner of the Upland Confined Placement Area	New car storage track	Preliminary engineering completed
7.5-2	Northside Permian Rail Extension and Yard	North side of Inner Harbor and Corpus Christi Turning Basin, between the existing Harbor Bridge and the Nustar Storage Tanks	Extension of tracks and new loop track	Final engineering in progress
7.5-3	La Quinta Rail Line from Odem	From Odem (on Route 77) headed east to La Quinta Terminal	18 miles of new track	Planning dependent on La Quinta tenants
7.5-3	La Quinta Terminal Loop Track	La Quinta terminal	Loop track	Plans developed
7.5-3	Gregory Rail Relief Route	From La Quinta UP Kosmos Industrial Lead	3 miles of new track	Engineering study underway
--	Reliever routes around Driscoll, Odem, Sinton, and Taft	Driscoll located southwest of Corpus Christi; Odem, Sinton, and Taft located northwest of Corpus Christi	New roadways intended to bypass locations for efficient travel	Included as a significant 2035 network project in MTP
7.5-1	Joe Fulton International Trade Corridor	Corridor located north of Inner Harbor; project to connect the corridor to I-37 west of the Inner Harbor	Enhanced connection at I-37 at Carbon Plant Road; includes both rail and highway components along north side of Inner Harbor	Included as a significant 2035 network project in MTP; corridor opened in 2007; road connection to I-37 complete as of 2012
--	Upgrade of US 77	Project extent from the Corpus Christi connection with I-37 to US 83 in Rio Grande Valley	Upgrade to full interstate standards	Included as a significant 2035 network project in MTP
--	Southside Mobility Corridor	Roadway to cross the Laguna Madre to Padre Island to connect to Kleberg County road network	Alternative evacuation route for residents; considered critical to emergency transportation	Included as a significant 2035 network project in MTP; funding awaiting approval
--	Extension of SH 286 (Crosstown Expressway)	Extend past intersection of Saratoga Boulevard and Ayers Street (south end of SH 286/Crosstown Expressway) to South Side Mobility Corridor	New roadway to meet full freeway standards and connect roadway network	Included as a significant 2035 network project in MTP
--	Upgrade of SH 44	SH 44 parallel of and south to I-37 to connect to SH 358 to US 77 south of Robstown	Upgrade to full freeway standards	Included as a significant 2035 network project in MTP
--	Ingleside Industrial Highway (SH 200) Corridor	Corridor located northeast of Corpus Christi, around the southwest side of Ingleside to connect SH 361 to FM 1069	1.9-mile roadway to enhance safety and increase mobility by providing a relief route for industrial traffic	EIS Draft document to be complete in 2013; preferred alternative selected, though funding at this point is not identified

7.5-1 Current and Proposed Transportation and Development Projects				
Figure	**Current or Planned Development Project**	**Location**	**Description**	**Status**
7.5-2 7.5-3	Channel Improvement Project	Extend La Quinta Ship Channel, widen and deepen Corpus Christi Ship Channel from Port Aransas to Harbor Bridge	Extend La Quinta Ship Channel 1.4 miles to a total depth of 39 feet (though 45-foot depth being evaluated); widen Corpus Christi Ship Channel to 530 feet, deepen to 45-52 feet, add 200-foot-wide barge shelves at Corpus Christi Bay; construct ecosystem restoration features to protect endangered species, wetlands, and seagrass	FEIS/ROD complete in 2004; Environmental Assessment completed in October 2012 to deepen La Quinta Ship Channel from 39 feet to 45 feet; approved and authorized but not yet funded
	Industrial Development			
7.5-3	Naval Station Ingleside Redevelopment by Occidental Petroleum Corp.	915-acre site in San Patricio County on Corpus Christi Bay, south of Ingleside and southeast of La Quinta Terminal	First phase could include liquefied petroleum gas; other possible phases include a liquefied natural gas facility and storing crude oil, condensate or refined products	Sale completed April 2013
7.5-2	Upgrades to Bulk Terminal	Existing bulk terminals north of Tule Lake Channel (center of Inner Harbor)	Upgrades to existing facility	Currently planned by Port
7.5-3	Cheniere Energy, Inc. liquefied natural gas (LNG) export terminal	612 acres on the north side of Corpus Christi Bay in San Patricio County, along the La Quinta Ship Channel adjacent to the Container Terminal	To be primarily supplied by reserves from the Eagle Ford Shale; new pipeline to site also proposed	Exports could commence as early as 2017
7.5-3	Tianjin Pipe Corporation (TPCO) America Texas Mill	250-acre site east of Gregory in San Patricio County, northeast of La Quinta Terminal	Plant will manufacture seamless pipe and truck to Inner Harbor or La Quinta for shipping; will use rail or trucks for land transportation	Expected to be complete by 2015
7.5-1	M&G Group PET/PTA plant	400-acre plant on Joe Fulton International Trade Corridor along north side of Inner Harbor, east of the Flint Hills Resources West Refinery	PET production; creation of ~200 full-time jobs; considering desalination plant due to high levels of water consumption	Currently in permitting phase; to be in production mode by 2016
7.5-1	Flint Hills West Refinery upgrades	Suntide Road at existing refineries, western end of Inner Harbor	$250M investment; enhanced processing capability would reduce the plant's emissions of criteria air pollutants	Applied for permits in December 2012 (permitting process could take 4 years); submitted revised permit application to EPA in 2013
7.5-3	Voestalpine steel plant	La Quinta Terminal	$700 million iron ore processing facility fired by natural gas; plant will employ ~150 people and produce 2 million metric tons of iron per year from Canadian or Brazilian ore	Contingent on regulatory approval by state and federal environmental agencies; company signed agreement with Siemens Industry, Inc. and Midrex Technologies, Inc. for construction to be launched in 2016
7.5-1	Lyondell Petroleum (formerly TexStar/Equistar)	40-acre lot adjacent to the Equistar plant at 1501 McKinzie Road, southwest of the western end of Inner Harbor	Construction of two fractionation units used to separate the byproducts of the liquid natural gas refining process	Construction of facility began April 2013 to be completed by the end of 2013
7.5-3	Gulf Compress Cotton Storage Facility	La Quinta Terminal	Applied in 2010 to be designated point for cotton delivery	Currently in place; will use Port for shipping
7.5-3	La Quinta Container Terminal	North side of Corpus Christi Bay, east of Portland	40 acres of Port-related development including dock and Class I rail system	Complete as of 2012
7.5-2	Superior Weighting Products, LLC	Rincon Industrial Park along Canal A on the western side of North Beach	12 acres located on the Rincon Industrial Park to be developed	Port approved lease in March 2013
--	Petronila Wind Farm	Nueces County	DOD and Navy signed with E.ON Climate & Renewables North America LLC to build 100-turbine wind farm	Plans announced in November 2012; MOA signed January 2013, turbines set to be built in 2014
--	Baryonyx Corp Wind Farm	Between Corpus Christi and Brownsville (outside mapping area)	Mustang Project, Rio Grande Project, North Rio Grande Project (total of 3 offshore wind sites)	Permit submission to USACE for 3 offshore wind farm locations

7.5-1 Current and Proposed Transportation and Development Projects				
Figure	**Current or Planned Development Project**	**Location**	**Description**	**Status**
	Commercial/City Development			
7.5-2	Broadway Water Treatment Plant Redevelopment	Upgrades at northern end of existing facility, located south of Whataburger Field	Diversion project and interim improvements to aeration system; noise abatement and trickling filters arms replacement	Currently under construction
--	Destination Bayfront	34-acre area in downtown Corpus Christi, south of the Yacht Basin	Conceptual plans to redevelop area to include public pier and boardwalk along the seawall with shops, restaurants, shade structures, and restrooms	Project removed from 2012 bond list; bond issue for plan rejected by voters in November 2013
--	North Beach Development Plan	Proposed redevelopment of North Beach on either side of US 181	Conceptual plan for redevelopment of North Beach to beachside residential, tourist, and medium- and high-density uses	Approved by City Council in 2011; currently no funding in place for proposed development
7.5-2	SEA District	North end of downtown Corpus Christi, from Concrete Street Amphitheater to Ortiz Center	Long-term plans include a boardwalk along waterfront between Ortiz Center and Art Museum of South Texas; water taxi service; overall redevelopment of area into mixed-uses	Still in planning phase; much of land proposed for development currently owned by Port
7.5-2	The Palms on Leopard Street	Leopard Street across from Miller High School, south of I-37 and west of Crosstown Expressway	To serve as replacement housing for low-income Northside Manor Apartments	Project to receive $865k from HUD and additional funding from the State and City; construction expected by mid 2014; awaiting City Council approval
7.5-2	The Kinney Hotel	Near corner of Water and Born Streets in downtown Corpus Christi	51-room boutique hotel for business travel	Currently in the process of securing financing
7.5-2	The Cosmopolitan	Corner of Chaparral and Lawrence Streets	$29 million 5-story project featuring 165 apartments with 3,800 square feet of ground-floor retail space	Construction to begin November 2013
--	Texas A&M University–Corpus Christi Momentum Campus	92 acres of land; bound by Ennis Joslin Road to the east, Oso Golf Course on the north and west, and Pharaoh Valley on the south	Land donated by the City of Corpus Christi (referred to as South Guth Park land gift) for expansion of Texas A&M Corpus Christi campus. Expected to include an athletic complex, convocation center, and a mixed-use district (Islander Town)	Portions of expansion already complete; development currently underway
--	Del Mar College Southside Presence	Three parcels (95 acres) at Yorktown Boulevard and Rodd Field Road	As of September 2013, Del Mar College is planning to purchase land to better serve the neighborhoods on Corpus Christi's southside	Specific plans are not yet complete. Further planning for the Southside Presence is expected to be incorporated into the 2014–2019 Del Mar College Strategic Plan

Source: US 181 Harbor Bridge EIS Team 2013

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which assessed the feasibility of deepening the La Quinta Ship Channel Extension from 39 feet to 45 feet. The Channel Improvement Project has been approved and authorized but is not yet funded.

7.5.2 Joe Fulton International Trade Corridor

Completion of the Joe Fulton International Trade Corridor has served to increase road and rail access for Port-related cargo and has improved access to more than 2,000 acres of land, half of which is now accessible for the first time for use as marine terminals or industrial sites along the north side of the Inner Harbor (Corpus Christi MPO 2009, 53). The project was a joint effort by the Port, TxDOT, FHWA, and the Corpus Christi MPO and consists of 12 miles of existing and new roadway as well as seven miles of new rail line (Port of Corpus Christi 2007, 1). As part of the ongoing effort to encourage diversification and future development at the Port of Corpus Christi, the corridor provides an alternate route to the north side of the Inner Harbor by connecting US 181 north of the existing Harbor Bridge to I-37 at Carbon Plant Road. The corridor opened in 2007, with a direct connector from I-37 opened in 2011 and ramp improvements completed in 2012. According to the Port of Corpus Christi, the Joe Fulton Corridor represents the "most important infrastructure project [at the Port] since the construction of the Port's 45-foot channel project" (Port of Corpus Christi 2007, 1). The Port also stated that the corridor positions the Port for "economic expansion and vitality, a broader tax base and favorable job creation for generations to come" (Port of Corpus Christi 2007, 1).

7.5.3 Nueces River Rail Yard

Expansion of the Nueces River Rail Yard adjacent to the Joe Fulton International Trade Corridor at the west end of the Inner Harbor is intended to increase capacity and efficiency for unit trains used for shipping at the Port of Corpus Christi. The project includes an 8,000-foot-long unit train track, six shorter railcar siding tracks, a service road, drainage improvements, automatic indicator railcar readers, and a 2.5-mile bike trail for the general public along the Joe Fulton Corridor and the south shore of Nueces Bay (Port of Corpus Christi 2013b). These improvements are anticipated to "greatly improve the efficiency of existing cargo movements at the Port's multimodal facilities" (Port of Corpus Christi 2013b). Rail infrastructure is critical for operations at the Port, which has seen a 100-percent increase in rail operations since 2008 (Port of Corpus Christi 2013b). The construction contract for this project was awarded in June 2013. Funding is provided through a federal TIGER grant; the Union Pacific, Kansas City Southern, and Burlington Northern Santa Fe railways; the Port of Corpus Christi; and TxDOT.

7.5.4 Naval Station Ingleside

The Naval Station Ingleside was closed in 2010 following a DOD BRAC recommendation, which resulted in loss of almost 3,200 active duty military and civilian/contractor jobs and nearly 3,700 indirect jobs (Cambridge Systematics 2008). In late 2012, the property was purchased by Occidental Petroleum Corporation, which plans to redevelop the site in phases and utilize the former Navy docks. Flint Hills Refinery is planning expansion of its Ingleside facility, including its docks. The Ingleside Industrial Highway, now in planning and environmental review, will open up intermodal connectivity of the Ingleside area. Redevelopment would support as many as 200 direct and indirect jobs, and could include a liquefied petroleum gas or liquefied natural gas facility or store crude oil, condensate, or refined products (Collette 2012b).

7.5.5 La Quinta Trade Gateway Terminal

The Port of Corpus Christi is planning development of the La Quinta Trade Gateway Terminal, a 1,100-acre site on the north side of Corpus Christi Bay to be fully permitted to provide a 3,800-foot multi-purpose dock and container facility (Port of Corpus Christi 2008). The Port's plans for La Quinta also include extension of the La Quinta Ship Channel, which will provide 1.4 miles of deep-water access to more than 1,000 acres of Port properties (Malan 2009c). The first plant to undergo construction at La Quinta will be the Voestalpine steel plant, which is anticipated to be running by 2016 and will create 150 permanent jobs (Port of Corpus Christi 2013b). La Quinta will also support shipments of cargo for the Tianjin Pipe Group Corporation steel pipe mill planned in Gregory (Malan 2009c).

Also planned along the La Quinta Ship Channel is the Cheniere Energy LNG export terminal, a $10 billion investment on approximately 600 acres. The export terminal will be designed with three storage tanks and two berths large enough to accommodate QMax class vessels, some of the largest vessels in the industry (Cheniere 2013b).

7.5.6 SEA District

Public and private efforts are currently ongoing to develop the northern portion of downtown Corpus Christi into the SEA District. Plans for developing this area near the existing Harbor Bridge stem from private investors, the Durrill family, who developed the Brewster Street Ice House, Hurricane Alley Waterpark, and the Old Concrete Street Amphitheater (Savage 2013). Plans for the area include a boardwalk along the waterfront between the Ortiz Center and the Art Museum of South Texas and pedestrian-friendly infrastructure. Businesses in this area are collaborating with the Regional Transportation Authority (RTA) to operate a water taxi on weekends between Ortiz Center and Texas State Aquarium in North Beach (Savage 2013).

The 2013 *SEA District Development Concept*, a privately funded future development concept created for the SEA District, depicts new hotels, outdoor retail spaces, and high-rise apartments within the northern portion of downtown (City of Corpus Christi 2013d). City planners created planning concepts for the SEA District "to help developers see the potential for revitalizing the 4.64 square miles of the city's downtown, uptown, Hillcrest, Washington-Coles, and [SEA] District areas and neighborhoods around CHRISTUS Spohn hospitals Shoreline and Memorial" (Savage 2013). These plans are intended to encourage private developers to invest in plans for the SEA District and will be developed into detailed neighborhood plans in the future. The central goal of the redevelopment concepts is integration of private (Brewster Street Ice House, the Old Concrete Street Amphitheater) and taxpayer-owned facilities (Whataburger Field, the American Bank Center). One key component of this revitalization of downtown includes overall pedestrian improvements in the area. In November 2012, Corpus Christi voters agreed to add curbs, gutters, sidewalks, and street lighting in the area (Savage 2013).

Special interest groups working toward a more defined and larger SEA District include PATCH—Positive Action Towards Cultural Heritage—a local community activist group which aims to revitalize downtown through restoration of the Ritz Theater on Chaparral Street, facilitate a cohesive entertainment district through promotion of relationships between new and existing downtown venues, and connection of the SEA District to the Downtown area through a pedestrian-friendly passage (Corpus Christi PATCH 2013).

The City's *Integrated Community Sustainability Plan* also identifies the need for revitalization of the Downtown/Uptown areas in order to foster compact, energy-efficient land use and development. The plan suggests actions such as coordination of the physical, economic, and functional aspects of Downtown redevelopment; capitalization on opportunities for vacant lot and building rehabilitation and reuse; and enhancement of the market economy in the Central Business District (HDR, Inc. 2011).

7.6 ASSESS POTENTIAL CUMULATIVE EFFECTS TO EACH RESOURCE

This step focuses on the proposed project's incremental effect on the long-term sustainability of the area's resources, taking into account the past, present, and reasonably foreseeable future conditions that were the basis for the assessment of resource health in **Section 7.3.** This process begins with a discussion of the types of impacts that are generally associated with transportation and industrial infrastructural development, with emphasis on the ways in which those impacts are likely to interact with the most vulnerable elements of each particular resource. A closer look at the reasonably foreseeable actions by others identified in Step 5 will address the extent to which they may adversely or beneficially affect the long-term sustainability trend—sometimes referred to as the "no-action trajectory" (McGee and Nesbitt 2008). Then, with the CEQ's definition of "cumulative impacts" in mind, the proposed project's direct and indirect impacts on each resource are factored in to determine if these "individually minor" impacts might amount to a "collectively significant" cumulative impact.

7.6.1 Air Quality

The Air Quality RSA is classified as being in attainment for all NAAQS, and the proposed project would not result in direct or indirect effects to air quality that would contribute to an adverse cumulative effect on air quality as it relates to criteria pollutants. There are two types of NAAQS for criteria pollutants: primary standards, which set limits to protect public health (including sensitive populations such as asthmatics, children, and the elderly); and secondary standards, which set limits to protect public welfare, including protection against visibility impairment and damage to animals, crops, vegetation, and buildings (EPA 2013a). Air quality would continue to be monitored to compare the levels of criteria pollutants to the allowable concentrations established by the NAAQS. Additional efforts such as participation of the CCAQG in the Ozone Advance Program (discussed in **Section 7.3.1.1**) would further serve to protect the Corpus Christi area from falling into nonattainment for the NAAQS. A change in air quality attainment status is not anticipated to occur as a cumulative effect of the proposed project.

There are no ambient air quality standards or classification of attainment status for MSATs; therefore, this cumulative effects analysis primarily focuses on potential cumulative effects to air quality as it relates to MSATs.

7.6.1.1 Potential Cumulative Effects of the Proposed Project Related to MSATs

Due to the high level of industrial activity in the area around the Port of Corpus Christi, including petrochemical refining, community concerns have been expressed about potential exposure to air toxics in the residential neighborhoods in the project area. Ambient concentrations of MSATs that may be potentially affecting community health are the result of emissions from various existing sources. Emissions inventories developed by TCEQ for air quality modeling (discussed in **Section 7.3.1.2**) provide information on the contributions of the various sources of air pollution. Such emissions inventories and observations from air quality modeling studies about the relative influence of different source categories provide a means of characterizing cumulative air quality effects, including effects attributable to the on-road mobile source category, of which the proposed project is one component within the larger transportation network.

However, distinguishing the relative contribution of different sources of MSATs in the project area is complex because of the large number of industrial sources in the area, and the assessment of transportation-related sources is complicated by the multi-modal nature of highway, rail, and maritime transportation associated with the Port of Corpus Christi. The proposed project can be characterized as being a component of the overall on-road mobile source category of emissions that influence MSAT concentrations in the project area and the Corpus Christi airshed; however, there is not information on the project-specific contribution of the US 181 Harbor Bridge project alternatives within the overall on-road mobile source category.

Information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives, such as those evaluated in this Draft EIS (FHWA 2012b). The proposed US 181 Harbor Bridge project would contribute a minor amount of MSATs in consideration of its projected traffic volume and other traffic and roadway characteristics; however, MSAT emissions from transportation sources, including the proposed project, are expected to decrease in the future as a result of the EPA's rules for fuels and vehicle emissions. In addition to the EPA's national control programs, state regulations and local voluntary measures will also reduce criteria pollutant concentrations in the future. Provided that necessary data are available from the MPO, a quantitative MSAT analysis will be conducted for the Preferred Alternative (Red Alternative), the results of which will be included in the Final EIS.

The projected future traffic levels on roadways of the US 181 Harbor Bridge project are less than the 140,000 AADT (annual average daily traffic in vehicles per day) level that is normally used as the threshold for conducting more intensive quantitative analysis of project-level MSAT emissions. As stated in FHWA's December 2012 Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA, the use of a 140,000 to 150,000 AADT threshold for conducting quantitative MSAT analysis is recommended based on emissions modeling using EPA's MOVES2010b model (FHWA 2012b). The FHWA analysis determined that this range of AADT would result in emissions significantly lower than the Clean Air Act definition of a major hazardous air pollutant (HAP) source, which is defined as emitting 25 tons/yr for all HAPs or 10 tons/yr for any single HAP (FHWA 2012b). Therefore, based on its projected traffic levels of less than 140,000 AADT, the proposed project is not expected to have emissions of a single or multiple MSATs that would approach the level for consideration as a major source of HAPs.

7.6.1.2 Potential Effects of the Proposed Project Related to Greenhouse Gases

Climate change is an important national and global issue. While the earth has gone through many natural changes in climate over time, there is general agreement that the earth's climate is currently changing at an accelerated rate and is expected to continue to do so for the foreseeable future. Greenhouse gas (GHG) emissions contribute to this change by trapping heat in the earth's atmosphere. Since many GHGs remain in the atmosphere for periods ranging from decades to centuries, the atmospheric concentration of GHGs continues to climb. As a result, our planet experiences warmer global temperatures, which can cause changes in precipitation and sea levels.

Some GHGs occur naturally; water vapor is the most abundant GHG and makes up approximately two-thirds of the natural greenhouse effect. However, human activities, including the burning of fossil fuels, add to the concentration of GHGs in the atmosphere. Human-sourced, transportation-related GHG emissions include carbon dioxide (CO_2) (the largest contributor to GHG emissions), methane (CH_4), and nitrous oxide (N_2O).

To date, no national standards have been established regarding GHGs, nor has EPA established criteria or thresholds for ambient GHG emissions pursuant to its authority to establish motor vehicle emission standards for CO_2 under the Clean Air Act. However, there is a considerable body of scientific literature addressing the sources of GHG emissions and their adverse effects on climate, including reports from the Intergovernmental Panel on Climate Change, the US National Academy of Sciences, EPA, and other federal agencies. GHGs are different from other air pollutants evaluated in federal environmental reviews because their impacts are not localized or regional due to their characteristic rapid dispersion into the global atmosphere. The entire planet can be considered the *affected environment* for CO_2 and other GHG emissions. In addition, from a quantitative perspective, global climate change is the cumulative result of numerous emissions sources (in terms of both absolute numbers and types), each of which represents a relatively small addition to global atmospheric GHG concentrations. In contrast to broad-scale actions, such as those which involving an entire industry sector or very large geographic area, it is difficult to isolate and understand the GHG emissions impacts for a particular transportation project. Furthermore, there is currently no scientific methodology for attributing specific climatological changes to a particular transportation project's emissions.

Under NEPA, detailed environmental analysis should be focused on issues that are significant and meaningful to decision-making.[3] FHWA has concluded, based on the nature of GHG emissions and the exceedingly small potential GHG impacts of the proposed action, that the GHG emissions from the proposed action would not result in "reasonably foreseeable significant adverse impacts on the human environment" (40 CFR 1502.22(b)). The GHG emissions from the proposed build alternatives would be

[3] See 40 CFR 1500.1(b), 1500.2(b), 1500.4(g), and 1501.7.

insubstantial and would not play a meaningful role in a determination of the environmentally preferable alternative or the selection of the preferred alternative. More detailed information on GHG emissions "is not essential to a reasoned choice among reasonable alternatives" (40 CFR 1502.22(a)) or to making a decision in the best overall public interest based on a balanced consideration of transportation, economic, social, and environmental needs and impacts (23 CFR 771.105(b)). For these reasons, no alternatives-level GHG analysis has been performed for this project.

Mitigation for Global GHG Emissions

To help address the global issue of climate change, USDOT is committed to reducing GHG emissions from vehicles traveling on our nation's highways. USDOT and EPA are working together to reduce these emissions by substantially improving vehicle efficiency and shifting toward lower-carbon intensive fuels. The agencies have jointly established new, more stringent fuel economy and first-ever GHG emissions standards for model year 2012–2016 cars and light trucks. A notice to propose even more stringent standards has been proposed for model year 2017–2025 vehicles, with an ultimate fuel economy standard of 54.5 miles per gallon for cars and light trucks by model year 2025. Further, on August 9, 2011, the agencies jointly proposed the first-ever fuel economy and GHG emissions standards for heavy-duty trucks and buses.[4] Increasing use of technological innovations that can improve fuel economy, such as gasoline- and diesel-electric hybrid vehicles, will improve air quality and reduce CO_2 emissions in future years.

Consistent with its view that broad-scale efforts hold the greatest promise for meaningfully addressing the global climate change problem, FHWA is engaged in developing strategies to reduce transportation's contribution to GHGs—particularly CO_2 emissions—and to assess the risks to transportation systems and services from climate change. In an effort to assist states and MPOs in performing GHG analyses, FHWA has a project underway to develop a *Handbook for Estimating Transportation GHG Emissions for Integration into the Planning Process.* The handbook will present methodologies reflecting good practices for the evaluation of GHG emissions at the transportation program level and will demonstrate how such evaluation may be integrated into the transportation planning process. FHWA also refined a web-based tool, the Energy and Emissions Reduction Policy Analysis Tool (EERPAT), for use at the statewide level to model a large number of GHG reduction scenarios and alternatives for use in transportation planning, climate action plans, scenario planning exercises, and meeting state GHG reduction targets and goals. To assist states and MPOs in assessing climate change vulnerabilities to their transportation networks, FHWA has developed a draft vulnerability and risk assessment conceptual model and piloted it in five locations.

Even though project-level mitigation measures would not have a substantial impact on global GHG emissions because of the exceedingly small amount of GHG emissions involved, measures could be taken during construction that would have the effect of reducing GHG emissions. These measures could include: limits on idling engines, reduction of travel activity during construction, use of lower-carbon

[4] For more information on fuel economy proposals and standards, see the National Highway Traffic Safety Administration's Corporate Average Fuel Economy website: Hhttp://www.nhtsa.gov/fuel-economy/H.

fuels, and use of equipment with increased fuel efficiency (FHWA 2012b). These activities are part of a program-wide effort by FHWA to adopt practical means to avoid and minimize environmental impacts in accordance with 40 CFR 1505.2(c).

Summary of Potential GHG Issues

This document does not incorporate an analysis of the GHG emissions or climate change effects of each of the alternatives because the potential change in GHG emissions is very small when considered within the context of the affected environment. Because of the insubstantial nature of potential GHG impacts, these impacts would not be meaningful to a decision on the preferred alternative or to a choice among alternatives. As outlined above, FHWA is working to develop strategies to reduce transportation's contribution to GHGs—particularly CO_2 emissions—and to assess the risks to transportation systems and services from climate change. FHWA will continue to pursue these efforts as productive steps to address this important issue. Finally, the measures described above represent practicable project-level measures that, though they may not substantially reduce global GHG emissions, may help reduce GHG emissions on an incremental basis and could contribute in the long term to a meaningful cumulative reduction when considered across the federal-aid highway program.

7.6.1.3 Potential Contribution of Other Actions to Cumulative Air Quality Effects

Reasonably foreseeable future actions by others independent of the proposed project would also potentially contribute to MSAT emissions within the Air Quality RSA, the most notable of which include Eagle Ford Shale-related activity and Port-related transportation improvements and development. The potential contributions of these future actions are discussed below.

Potential Effects of the Eagle Ford Shale Play on Air Quality

As discussed in **Section 7.3.5.1**, the Eagle Ford Shale play boom is expected to be the most significant driver of growth within the Corpus Christi MSA over the next three decades (Moody's 2013). According to the Railroad Commission of Texas, which exercises jurisdiction over oil and gas production in the state, "production of oil, gas, and petroleum liquids in the Eagle Ford Shale has accelerated at a record pace...[and] the volume of drilling permits issued by the commission and the number of oil and gas wells in the region have surged to previously unseen levels" (2013, 6). Regulation of air quality effects of Eagle Ford Shale production falls under the jurisdiction of the TCEQ, which reviews permits in order to confirm "that operators use the best available emission controlling technologies, and considers the effects of each permit's specified emissions on public health and welfare" (Railroad Commission of Texas 2013, 81). In 2011, a total of 3,541 air permits were issued by the TCEQ, one-third of which were issued to operators in the Eagle Ford Shale.

Extraction of oil from the Eagle Ford Shale through oil wells produces a natural gas, referred to as casinghead gas, in conjunction with crude oil. Options for managing this gas include transportation through pipelines, flaring of the gas at the wellhead, or use of the gas onsite. Due to the rate of drilling, demand for pipeline infrastructure has exceeded supply, which results in increased instances of flaring casinghead gas. Flaring is permitted to occur for a period of up to ten producing days and is measured and reported to the Railroad Commission of Texas. However, venting of this gas directly into the atmosphere is also allowed for a period of up to 24 continuous hours or 72 hours in one month, or if gas cannot be safely flared (Railroad Commission of Texas 2013, 77). Proper flaring should be ensured by regulatory bodies, according to the Railroad Commission of Texas's Eagle Ford Shale Task Force; otherwise, flares will produce smoke and unburned VOC gases. According to the Task Force, "the increase of such emissions could raise public health issues in nearby areas" (Railroad Commission of Texas 2013, 83).

Various studies have been published in the last several years regarding ozone precursor emissions associated with shale operations, though Eagle Ford Shale emissions have yet to be accurately estimated. In 2012, the Alamo Area Council of Governments (AACOG), through funds provided by the TCEQ, produced a draft report entitled *Oil and Gas Emission Inventory Improvement Plan, Eagle Ford* (AACOG 2012). The report was developed in response to concerns regarding high concentrations of ground-level ozone in the San Antonio area, which saw an uptick in levels around the period that Eagle Ford Shale activity began to increase in South Texas. The report outlines development of an Eagle Ford Shale emissions inventory protocol for submission to the TCEQ in order to determine if Eagle Ford activity could be contributing to higher levels of ozone in the San Antonio area. As stated in the report, ozone precursor emissions are produced by five main phases of Eagle Ford activity: exploration and pad construction, drilling operation, hydraulic fracturing and completion operation, production, and mid-stream sources. Sources of emissions include drill rigs, compressors, pumps, heaters, other non-road equipment, process emissions, flares, storage tanks, and fugitive emissions (AACOG 2012, ii). According to the study, "[e]missions from the Eagle Ford are projected to continue to grow as development increases over the next few years" (2012, ii). As of August 2013, the results of the first phase of estimates of Eagle Ford Shale emissions have not been publicly released (Satija 2013).

<u>Potential Effects of Port-Related Development on Air Quality</u>

Many of the current and potential planned developments in **Table 7.5-1** are related to activity at the Port of Corpus Christi, such as transportation infrastructure improvements aimed at supporting movement of Port-supported commodities, construction of facilities at the La Quinta Terminal, and expansion of the Flint Hills Refinery properties, among others. The potential cumulative effects related to these developments are addressed in the sections below.

<u>Highway Improvements.</u> Expansion of the transportation network through highway improvements in support of Port activity would potentially contribute to higher MSAT emissions compared to the existing condition. Such improvements include the Joe Fulton International Trade Corridor (see **Section 7.5.2**) and the various area roadway projects listed in **Table 7.5-1**. However, decreased congestion and increased speeds would somewhat offset these emissions. According to EPA's MOVES2010b model, emissions of all the priority MSAT decrease as speeds increase. Also, regardless of the proposed highway improvements, emissions will likely be lower than present levels as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by over 80 percent between 2010 and 2050. Local conditions may differ from these national projections in terms of fleet mix and

turnover, growth in vehicle-miles travelled, and local control measures. However, the magnitude of the EPA-projected reductions is so great that MSAT emissions are likely to be lower in the future in nearly all cases.

Railroad Improvements. Increased rail capacity in the area would serve to increase rail-related emissions compared to the existing condition but would also improve efficiency for transport of Port-related commodities, resulting in a potentially reduced reliance on trucking. Planned actions by the Port include the Nueces River Rail Yard (see **Section 7.5.3**) and rail expansion in support of development of the La Quinta facility (see **Section 7.5.5**).

According to the Association of American Railroads, per gallon of fuel, trains move the same ton of freight more than three times as far as trucks and produce nearly one-quarter fewer carbon dioxide emissions per ton-mile than trucks (Association of American Railroads 2011). In March 2008, EPA issued new locomotive emissions standards which, when compared to the previous standards, are expected to reduce particulate matter emissions by 90 percent and reduce nitrogen oxide emissions by 80 percent (Association of American Railroads 2013). In 2012, freight railroads nationwide moved a ton of freight an average of 476 miles per gallon of fuel, compared to 235 miles in 1980; this represents a 102 percent improvement in efficiency. Given the higher fuel efficiency rates of freight transportation as compared to trucking, expansion of the freight rail network in the area would be expected to contribute to overall beneficial effects to air quality within the region.

Increased Shipping. Planned industrial development included in **Table 7.5-1** and Port facility expansion plans such as the Channel Improvement Project (see **Section 7.5.1**) indicate that an increase in shipping activity at the Port can be expected in the reasonably foreseeable future. As with other transportation network expansion projects, increased shipping would also result in emissions that could contribute to a cumulative effect to air quality within the RSA. According to EPA, marine diesel engines emit substantial amounts of nitrogen oxides and particulate matter (EPA 2013e), and large ships are considered "significant contributors to air pollution in many of our nation's cities and ports" (EPA 2013e).

While increased shipping would likely result in increased emissions from marine diesel engines, ongoing efforts by EPA would be expected to help minimize potentially adverse air quality effects. In 2004 as part of the Nonroad Diesel Tier 4 Rule, new rules were finalized that decrease the allowable levels of sulfur in marine diesel fuels by 99 percent. These improvements have created "significant environmental and public health benefits by reducing PM from new and existing engines" (EPA 2013e). In 2008, EPA finalized a three-part program to further reduce emissions from marine diesel emissions with per-cylinder displacement below 30 liters, which includes both propulsion engines and auxiliary engines. This rule is expected to reduce PM emissions by as much as 90 percent and nitrogen oxide emissions by up to 80 percent when fully implemented. In 2010, EPA adopted standards that apply to Category 3 engines, which include some of the largest marine vessels, and marine diesel fuels produced and distributed in the U.S. These standards are being applied in phases, the final phase of which will be implemented in 2016. Further efforts by EPA to prevent marine pollution from ships are discussed in **Section 7.8.1.3**.

Development of Industrial Facilities. Development of industrial facilities and refineries expected to occur in the future would be anticipated to contribute to a cumulative effect on air quality within the RSA. According to EPA, petroleum refineries emit a wide range of pollutants, including: criteria air pollutants such as sulfur dioxide, nitrogen oxides, carbon monoxide, and particulate matter; volatile organic compounds; carcinogenic hazardous air pollutants (HAP) including benzene, naphthalene, 1,3 butadiene, and polycyclic aromatic hydrocarbons; non-carcinogenic (HAP) including hydrogen fluoride and hydrogen cyanide; persistent bioaccumulative HAP, including mercury; and other pollutants such as greenhouse gases and hydrogen sulfide (EPA 2011b, 4).

Under the Clean Air Act, the EPA is required to regulate emissions of toxic air pollutants from a published list of industrial sources referred to as “source categories” (EPA 2013f). In September 2012, a final rule was issued for the EPA’s Standards of Performance for Petroleum Refineries (40 CFR Part 60, Subpart J). Under these New Source Performance Standards (NSPS), petroleum refineries are required to comply with standards for particulate matter, carbon monoxides, and sulfur dioxides, and installation of continuous monitoring systems are required. Also, Section 112(d) of the Clean Air Act requires EPA to set emissions standards for HAP emitted by major stationary sources based on the performance of the maximum achievable control technology (MACT), which is aimed at protecting the human health and the environment (EPA 2011b). Further efforts by EPA to regulate emissions by refineries are discussed in **Section 7.8.1.4**.

7.6.1.4 Summary of Potential Cumulative Effects on Air Quality

Given the current attainment status of the Corpus Christi area, the cumulative effects of the proposed project would not be expected to result in increases in criteria pollutants that would adversely affect human health. While the contribution of the proposed project to emissions that would adversely affect air quality within the RSA would be minimal, reasonably foreseeable actions by others would potentially contribute to an adverse cumulative effect on air quality, particularly with regard to MSATs for which there are no NAAQS. These actions include continued Eagle Ford Shale activities, expansion of the transportation network, increased shipping, and development of industrial facilities in response to current and future market conditions. It should be noted, though, that regulatory control measures exist for these activities at both the state and federal level, and it is assumed that these actions will not contribute to an overall increase in MSATs in the future. Therefore, the cumulative effects of the proposed project would not be anticipated to alter the overall health of air quality within the Corpus Christi area.

7.6.2 Water Resources

7.6.2.1 Sources of Potential Cumulative Impacts to Water Resources

Future trends in the conditions of water resources in the RSA will be affected by natural and human activities. Natural forces can affect the long term reliability of supplies of water for both economic and ecological uses; they include drought, which may be compounded by uncertain changes in global and regional climate systems, and occasional high magnitude weather events. Human activities will also play a role in future water supplies through, for example, the water management strategies prescribed for the Coastal Bend region under the Texas Water Plan. Human activities are also associated with impacts to water quality, in the form of point and non-point pollutant discharges, and physical changes to shoreline and coastal habitats. This classification leads to a simplified set of criteria for assessing the cumulative effects to water resources:

1. Are the activities highly consumptive of fresh water for municipal and industrial uses or likely to indirectly diminish freshwater inflow into RSA bays and estuaries? Or, like some of the measures recommended by the Coastal Bend Regional Water Planning Group (RWPG), are they intended to enhance long term supplies and/or in-stream flow to the estuaries?
2. Will the activities result in point or non-point pollutant discharges, especially to sensitive or at-risk receiving waters (as identified in **Section 4.11**)? Waste or pollutant discharges can be further classified as construction phase and operations phase.
3. Will the actions require physical changes at or near the shoreline or in the coastal environment, such as dredging, excavation, berth or dock construction, construction in waterways, rip-rap or other shoreline protection?

Environmental effects related to these criteria are described generally below, followed by a summary of reasonably foreseeable transportation or other commercial/industrial developments (listed in **Table 7.5-1**) to which the criteria might apply. Other potential actions relevant to future water resource conditions are addressed as well, such as water management strategies recommended by the Coastal Bend RWPG and beneficial use and conservation initiatives by the USACE and CBBEP.

Highway and Rail Infrastructure

Since the proposed project involves highway construction that is in support of other modes of transportation, infrastructure development is an important consideration in understanding future resource conditions. The USACE Institute for Water Resources (2012) has provided a useful approach for assessing characteristic suites of impacts for the key freight transport modes: highways, rail, and ports.

Highways generally have a greater impact than railroads or ports because they have a much greater geographic reach than the other modes. Highway improvements, whether new location or widening projects, can alter hydrology and contribute to increased contaminated runoff. Storm water runoff is the most prevalent medium for discharge of sediments, total suspended solids, oil and grease, and other potential contaminants; full compliance with the Clean Water Act and effective maintenance of BMPs serve to minimize degradation of surface water quality. As stated in **Section 4.11.4**, the substructure of the proposed US 181 Harbor Bridge project would be constructed utilizing methods design to limit the impact on existing ground water conditions. Procedures which represent best practices to construct piles and drill shafts without allowing intrusion into the local water table would be utilized, such as lined casings and slurry displaced drill shafts. Where the potential for interaction between surface and subsurface construction activities and shallow ground water resources exists during the proposed project or other potential highway improvements, temporary storm water control BMPs could be employed to prevent or minimize impacts to ground water or to treat any ground water that is released. In order to minimize the conveyance of runoff contaminants to possible ground water resources, post-construction BMPs such as vegetated filter strips and grassy swales could be implemented. By employing these measures, the risk of adverse impacts related to the water table could be minimized.

Major improvements to freight rail infrastructure are less common than highway projects, and generally require a much smaller footprint within which construction impacts may occur. Noise and vibration effects of rail operations on adjacent communities, however, can be more intense than those of typical highway improvements. From a statewide perspective, TxDOT's policy goal of eventually shifting freight rail corridors out of more densely populated urban areas offers long-term environmental benefits for the populace as a whole (TxDOT 2010). From the perspective of communities affected by individual projects, however, changes to rail infrastructure can represent either the introduction of substantial new impacts (in the case of new location projects) or impacts of greater frequency and/or duration (as when shifts in commodities markets require more frequent cargo deliveries or increased tonnage of bulk raw materials shipments).

Port Infrastructure

The cumulative effects of past transportation system development and operations have left a substantial mark on the coastal environment. While the geographical footprint of harbor and waterway infrastructure is not as extensive as land-based transportation infrastructure, its effects are often intense, since they are typically concentrated in coastal and estuarine environments. The Port of Corpus Christi has made considerable progress in environmental compliance and management of port construction and operations. Future improvements to port and transportation infrastructure will occur in the context of increasing scarcity of tidal wetlands, for example, which continue to bear the cumulative effects of dredging, channelization, sediment deprivation, and other human impacts, as well as hurricanes and rising sea levels.

Dredging effects. In general, dredging causes a temporary reduction in bottom organism abundance except in highly altered environments, such as contaminated sediment and deep channels where depressed productivity and altered species composition often persist. In some areas of harbors and channels, maintenance dredging results in the periodic reoccurrence of these effects over time. Maintenance dredging in some areas of harbors and channels requires the periodic reoccurrence of these effects over time. Environmental laws now require proper treatment and containment (USACE 2012b).

Operations effects*.* Ports, waterways, and port-related industry operations may result in shore erosion, accidents, and point and non-point source discharges from calling vessels or port-related industries. Vessel wakes can contribute to shoreline erosion, including wetland and bottom community changes. For example, a feasibility study was recently completed for the Port to assess methods to protect wetlands, seagrass and other related aquatic and coastal habitat at Indian Point from erosion associated with shoreline retreat. A review of historical photographs of Indian Point, located at the north end of the Nueces Bay Causeway, shows that shorelines along both sides (east and west) of the point "have experienced significant erosion." On the west side, the retreat was measured at up to 470 feet from 1958 to 1985 (exacerbated by hurricane impacts from Beulah, Celia, and Allen). On the east side, erosion loss was about 85 feet of retreat from 2005-2011 (14 feet/year in some areas (CBBEP 2012).

Vessel-caused turbulence also disturbs bottom communities and contributes to turbidity, which deprives submerged plants and sight-feeding species of necessary light. However, vessel traffic is considered a minor source of turbidity compared to nutrient enrichment and sediment runoff resulting from human activities in the watersheds.

Vessel cargo and ballast water (i.e., water stored to provide stability to a vessel) have been major vectors for non-native invasive species with adverse environmental effects. If the proposed project is implemented, the Inner Harbor air draft limitation would be raised to at least 205 feet, and few vessels would have to ballast (i.e., take on water in order to lower the vessel) after off-loading cargo in order to exit the Port (Harrington & Cortelyou, Inc. 2010).

Spills, leaks and accidents. Vessel passages, like highways and railways, are often sources of oil, metals, and other water pollutants. Unlike the terrestrial transport modes, however, vessel leaks usually discharge directly into the water with little feasible recovery opportunity. Accidents resulting in oil or petrochemical spills can threaten human safety and health as well as scarce ecosystems and species. Accidents and collisions in and around ports are a function of increasing traffic rates and the effectiveness of traffic regulations. Limitation of vessel speeds has been shown to reduce the risk of collisions, which are also the source of mortality to endangered species (USACE 2012b, 65).

New habitat from dredged material disposal. Beneficial use of dredged materials has been an established practice by ports and government authorities for many years. Disposal on nearshore uplands or islands has created new habitat that can be more or less desirable than original habitat, depending on the site and its management. Islands created incidentally from dredged material disposal were observed to provide beneficial refuges for birds, and in 1992, the USACE was authorized to beneficially use dredge material for environmental improvement. About 20 to 30 percent of dredged material is now being used beneficially (USACE 2012b, 64 note 68)

The USACE Institute for Water Resources concluded that, "while the impacts of harbor expansion could be substantial, there are potential environmental benefits from increasing capacity for post-Panamax vessels if, as expected, it moderates impacts on air and water quality per ton of freight shipped" (USACE 2012b, 68).

7.6.2.2 Potential Cumulative Impacts to Water Resources

Highways and Rail Intermodal Transportation Improvement

The Joe Fulton Corridor opened in October 2007 and is a vital intermodal link between the Port and I-37. Five other planned highway upgrades are designated as "significant" network projects in the Corpus Christi 2035 MTP (**Table 7.5-1**). Another important extension of the Port's intermodal network will be the Ingleside Industrial Highway Corridor, which is in the planning and environmental review stage but is not funded as of 2013. These improvements to the Port's intermodal network will further improve the connectivity of the Port and port industries, particularly to markets in San Antonio and South Texas, thereby improving the Port's competitive position.

Most of the Port or Port-related rail infrastructure improvements listed in **Table 7.5-1** involve extensions or upgrades to existing rail facilities within the Port or on nearby industrial sites. Two longer rail connections have also been proposed: The Gregory rail relief route planned to link La Quinta to the UPRR Kosmos Industrial Lead will involve construction of three miles of track on new right of way. The planned Gregory route would allow La Quinta rail traffic to travel around the west side of Gregory, reducing delays, inconvenience, noise, and safety issues faced by residents inside the city. In addition, an 18-mile rail link from La Quinta to Odem has been proposed, which would relocate both the Union Pacific Railroad's main lines out of the center of Odem, eliminating conflicts with the traffic on US 77 and local streets. The Port's Rail Master Plan includes TxDOT constructing a US 77 bridge over the new track north of Odem (Port of Corpus Christi 2012c). This intermodal connection is in the conceptual planning stage as of August 2013; its implementation will depend on future requirements of La Quinta industrial tenants.

Reasonably foreseeable highway improvement projects will result in varying levels of water quality effects, principally storm water runoff. These reasonably foreseeable transportation projects' water quality impacts are not expected to be substantial, provided they are built in full compliance with Clean Water Act rules and BMPs are maintained.

Port Infrastructure and Port-related Industries Improvements

As of August 2013, the USACE is completing dredging at La Quinta to deepen the channel to 39 feet, and the Port plans to construct a multi-purpose terminal with 3,800 linear feet of dock. The channel deepening project involves dredging, excavation, and placement of structures in the water. The Final EIS Reevaluation Project Partnership Agreement between the Port and the USACE provides for beneficial uses of dredged materials for seagrass propagation and shoreline protection.

The Project Partnership Agreement between the Port and the USACE calls for a beneficial use site south of the La Quinta channel extension creating about 200 acres of shallow water habitat using dredged materials. The agreement also provides for creation of a 2,400 foot breakwater and shoreline revetment near Ingleside-on-the-Bay to protect and enhance existing seagrass habitat.

The La Quinta Trade Gateway is an upland site development project that will provide more than 1,000 acres of industrial property with deep water access and intermodal rail and highway connectivity. Tenants developing major facilities include the Cheniere Energy, Inc. LNG export terminal, TPCO Texas Mill, Voestalpine steel plant, and Gulf Compress cotton storage.

Corpus Christi Channel Improvement Project. The project to deepen the ship channel from offshore to the Inner Harbor has an approved Final EIS and has received Congressional authorization, but funding is not secured. Water resource impacts would include those described for dredging, dredged material disposal, and operational impacts, all of which are addressed in the USACE's 2004 Final EIS, which will require reevaluation when funding allows initiation of the project. Additional mitigation requirements may be added under the reevaluation agreement.

Inner Harbor Port industry expansion or new development. Proposed new development includes Flint Hills refinery improvements, Harbor Wind Project next phase expansion, upgrade to an oil dock for Plains Eagle Ford Pipeline Company, a NuStar Energy project that will bring Eagle Ford crude to NuStar's port facilities, and M&G Group polyethylene terephthalate (PET)/purified terephthalic acid (PTA) plant. The M&G project, which will be the world's largest manufacturer of food-grade PET, will use a highly water consumptive process requiring 6 million gallons of water per day. M&G is working with the Port to investigate desalination options. Before any manufacturing, power, or processing plant can be built or expanded, air, water, and dredged material disposal permits will have to be obtained by the site developers.

Naval Station Ingleside Redevelopment. Proposed new developments include Occidental Petroleum and the Flint Hills Naval Station Ingleside project. These development projects will require air, water, wetlands, and other permits as appropriate. (The source for some of the above information is the Corpus Christi Caller Times, September 26, 2012, "Infrastructure improvements will prepare Port for future opportunities" including an interview with Mike Carrell, Port Board Chairman, and Frank Brogan, Port Deputy Director, personal communication, August 16, 2013).

Beneficial Uses, Conservation Projects, and Water Management/Development Plans

Nueces Delta Preserve. The Nueces Delta Preserve is the centerpiece of the CBBEP's estuarine conservation program. With the recent addition of a key 253-acre property, the Preserve now totals 5,800 acres of estuarine wetlands and adjacent uplands located on the north shore of Nueces Bay, off SH 77 near Odem (CBBEP 2012b). The site includes Rincon Bayou, and important freshwater inflow pathway from the Nueces River into Nueces Bay. Its proximity to rookery islands in the bay make it a valuable feeding habitat for colonial water birds, like the Roseate Spoonbill, Great Blue Heron, Clapper Rail, White-faced Ibis, and Fulvous Whistling Duck. Planning for the Preserve began in 2000, with the first property acquired in 2003. In addition to its value in preserving a critical estuarine resource, the Preserve is used for research and educational activities. Through conservation easements, the CBBEP would like to add an additional 8,000 acres to the preserve, along with an education center and improved visitor facilities. The CBBEP's long range preservation goals also include other areas, including

Whooping Crane habitat in the northern Coastal Bend and barrier island habitat on Mustang and North Padre Islands (CBBEP 2012b).

Coastal Bend RWPG Texas Water Plan – Recommended Water Development Strategies. The Coastal Bend RWPG (Region N) 2010 Water Plan investigated 20 water management strategies intended to address the water shortages predicted for the 10-county region in 2060 (CBRWPG 2010). The Plan recommends strategies that emphasize water conservation; maximize utilization of available resources, water rights and reservoirs; engage the efficiency of conjunctive use of surface and groundwater; and limit depletion of storage in aquifers. Each strategy was evaluated according to four criteria: (1) additional water supply; (2) unit cost of treated water; (3) degree of water quality improvement; and (4) environmental issues and special concerns (CBRWPG 2010, 4B.1-2). These criteria are similar to the cumulative effects criteria described in **Section 7.6.2.1,** above, and provide a means of approximating the long term cumulative effects of future Texas Water Plan strategies on water resources in the RSA. According to the Region N Plan, implementation of the recommended strategies "could produce new supplies in excess of the projected regional need of 75,744 acre feet in Year 2060. Supplies exceed shortages in case water growth patterns and demands exceed TWDB projection." (CBRWPG 2010, ES-18). Several of the strategies involving municipal water conservation and reclaimed wastewater supply were found to result in possible reduction in return flows to bays and estuaries.[5]

These conservation and wastewater reclamation strategies, however, represent relatively minor contributions to the Plan's projected overall increase in water supply. Strategies involving manufacturing water conservation show substantial improvement in water quality, although the most productive of these, the pipeline from Lake Corpus Christie to Calallen, also is indicated as having potentially significant environmental impacts. Desalination of seawater and brackish groundwater would both show significant water quality improvement, assuming appropriate disposal of brine from desalination plants. The Plan includes future reservoir construction, including several small off-channel storage reservoirs within the RSA and one on-channel reservoir that is proposed as part of Stage II of the Lake Texana project. Reservoir construction will have direct impacts to terrestrial and aquatic resources, which will be subject to more intensive environmental assessment and permitting if and when they are developed (CBRWPG 2010, ES-19).

The Coastal Bend RWPG's 2010 Plan indicates that implementation of its recommended water management and development strategies will address the predicted 2060 water shortages and meet the municipal, industrial, and environmental flow requirements of the region. The proposed Harbor Bridge project will not require appreciable amounts of fresh water for construction or operation, nor will it indirectly cause industrial or other development activities with high water needs. Nonetheless, the

[5] The Region N Plan states: "Environmental impacts from water conservation measures in the Coastal Bend Region are not associated with direct physical impacts to the natural environment. Some of the indoor conservation measures recommended could reduce the amount of treated wastewater available to send to the Nueces Bay and Estuary during low flow times, which could be offset by possible positive impact resulting from higher reservoir levels (CBRWPG 2010, 4C.1-12)." With respect to reclaimed wastewater, the Region N Plan notes that "[i]n the Corpus Christi area, significant treated effluent quantities are discharged into streams that flow into the bays and meet a part of the freshwater needs of the Nueces Estuary." Diversion of these discharges to other non-potable water uses, like golf course irrigation or industrial uses, could affect the biological productivity of the Nueces estuary by curtailing some of the desired freshwater inflows (CBRWPG 2010, 4C.5-1).

prospects for future Port-related industrial growth, some of it highly water-consumptive, could alter the water supply-demand balance on which the 2060 projections are based.

7.6.2.3 Cumulative Effects Summary

The direct and indirect water resource impacts of the proposed US 181 Harbor Bridge project would not be substantial and are primarily related to storm water runoff, constituents of which would be managed through compliance with the Clean Water Act, specifically the Texas Pollutant Discharge Elimination System. Resource vulnerabilities and potential long-term water quality problems stemming from continued future decline in fresh water flows will require continued and enhanced monitoring, planning, and conservation efforts. Water quality may be considered stable, solutions to longer term deficiencies in freshwater inflows to the Texas Coastal region are not readily apparent at present. The cumulative effects of the proposed US 181 Harbor Bridge project, when added to other past, present and reasonably foreseeable actions, are not likely to substantially alter this long-term trajectory.

7.6.3 Coastal Resources

Direct impacts to protected species (described in **Section 4.16.1**) would be primarily related to construction activities and demolition of the existing bridge. Indirect impacts to these species would be minor and would relate to potential effects to water resources and vegetation (see **Section 6.5.1.2**). Cumulative effects to habitats for the identified species of concern, then, are discussed in terms of potential impacts to vegetation and water resources.

7.6.3.1 Changes in Water Quality

Minor, incremental changes in water quality within the Corpus Christi and Nueces Bay systems would potentially impact wildlife habitat, including potential habitat for protected species. The cumulative effects of water quality changes within these coastal habitats are discussed below.

Corpus Christi, Nueces, and Oso Bays are identified as receiving waters for stormwater runoff within their respective drainage basins. The reasonably foreseeable future actions in **Table 7.5-1**, as well as the proposed project, would result in increases in impervious cover, which could in turn result in increased runoff that would enter these receiving waters. The *Nationwide Urban Runoff Study* by EPA (1999) indicates that there is not a substantial difference in pollutant concentrations in runoff between different urban land use categories; however, there is a substantial difference in runoff pollutant concentrations between non-urban and urban areas (EPA 1999). In addition, highway runoff is considered similar to urban runoff, but with higher mean and maximum concentrations (Horner et al. 1994). Because the proposed actions discussed in **Section 7.5** would increase the urban nature of the area, through either new or expanded land development or transportation network expansion, it is assumed that these actions would lead to increases in storm water runoff that could adversely affect water quality in areas potentially providing habitat for protected species. The contribution of the proposed project to these cumulative water quality effects would be minimal, as discussed in **Section**

7.6.2, above. Nonetheless, the implications of potential cumulative effects to water quality on protected species included in this analysis are discussed below.

Sea Turtles

Food sources vary for each of these sea turtles, as discussed in **Section 3.13.2.1**, with the green sea turtle feeding on seagrasses and algae and the leatherback, loggerhead, Atlantic hawksbill, and Kemp's Ridley sea turtles feeding on a variety of invertebrates. The most endangered of these turtles, the Kemp's Ridley sea turtle, primarily feeds on crabs, jellyfish, and mollusks (NMFS 2013) and is also the smallest of all these species. According to the National Marine Fisheries Service (NMFS) Office of Protected Species, all species of sea turtle are threatened by environmental contamination, which can include development of marinas and docks in inshore waters, increased water noise and boat traffic, coastal runoff, dredging, and oil and gas exploration and extraction (NMFS 2011b). While the proposed US 181 Harbor Bridge project's contribution to water quality effects would be minimal, reasonably foreseeable future actions within the RSA would potentially contribute additional effects, which would potentially pose a threat to protected sea turtles. Other major threats to sea turtles within the RSA can include poaching; entanglement in fishing nets, line, and other debris; and mortality due to boat propeller strikes. As recreational water bodies, Corpus Christi, Nueces, and Oso Bays are also subject to further effects from boat traffic.

While the proposed project, when added to other past, present, and reasonably foreseeable future actions, could potentially contribute to adverse impacts to habitats for these species, the potential contribution from the project would be minimal and would not be expected to affect the health of these species or their habitats. Potential cumulative effects to the aquatic habitat for the Green, Leatherback, Loggerhead, Kemp's Ridley, and Atlantic Hawksbill sea turtles, likewise, would not be substantial.

West Indian Manatee

As an herbivorous species, the manatee would potentially be affected by changes in water quality affecting the shallow grass beds on which it feeds. For example, recent habitat changes in Florida have resulted in nearly 300 manatee deaths over a single year between 2012 and 2013, caused by "unprecedented blooms of algae" that blanket estuaries and kill underwater seagrasses (Wines 2013). These algae blooms are expected to be the result of decades of pollution caused by coastal Florida's "explosive development" (Wines 2013). Seagrasses, whether in Florida or along the Texas Gulf Coast, serve as breeding grounds for fish and are a primary food source for the manatee. Seagrasses have been in decline due to high nitrogen levels attributed to nonpoint sources of pollution like lawn fertilizer and septic tanks (Wines 2013).

Beyond impacts to food sources, changes in water temperatures can serve as a threat to the manatee, which is particularly susceptible to the effects of cold waters. An unusually cold winter along the South Texas coast could result in adverse impacts to this species. Other changes in habitat quality that could pose a threat to the manatee include the availability of freshwater. As stated in **Section 7.6.2.3**, freshwater flows are anticipated to decline in the future, which could in turn adversely impact potential habitat for the manatee. However, this anticipated reduction of freshwater flows would occur independent of the proposed project as a result of perpetually growing water demands.

Existing regulatory measures and federal and state laws protecting the manatee and its habitat would prevent adverse cumulative effects to this species. While cumulative effects to water resources could affect habitat for the manatee, these effects would be minor and would not represent substantial impacts to this species.

Opossum Pipefish

Habitat for the opossum pipefish would potentially occur in the Rincon Channel and surrounding areas. This species feeds on crustaceans and small fish and is often found in areas with emergent vegetation. Not much is known about the population size or annual variation in population size of the opossum pipefish because this species is difficult to monitor; however, declines in habitat quantity and quality over time are expected to have resulted in a drastic decrease in population size (NOAA 2009). Factors that contribute to decline of habitat for the opossum pipefish include herbicide treatments to the vegetation used for breeding; destruction of habitat during construction of seawalls, docks, and riprap; and water control structures which prevent migration and alteration of hydrologic regime. Also, poor water quality and unnatural flow rates pose a threat to this species (NOAA 2009).

Potential changes in vegetation during construction or minor, incremental changes in water quality could potentially affect habitat within the RSA for the opossum pipefish. However, regulatory controls currently in place to protect state-listed species and water quality would serve to mitigate these impacts, and substantial cumulative effects to the opossum pipefish are not anticipated to occur.

Birds

The Reddish Egret, White-faced Ibis, and Wood Stork could all potentially utilize the wetlands associated with the Rincon Channel for feeding. All of these species feed on fish, while the Reddish Egret and White-faced Ibis also feed on frogs and crustaceans. All of these food sources would potentially be affected by minor changes in water quality, which could, in turn, affect these state-listed birds. However, Clean Water Act control measures would prevent degradation of water quality within the RSA, and cumulative effects to the food sources for these species would not be substantial. Potential cumulative effects to foraging and nesting habitat for these species are discussed in **Section 7.6.3.2**, below.

7.6.3.2 Impacts to Vegetation

Potential direct and indirect effects of the proposed project on vegetation would be mitigated through implementation of BMPs, vegetation clearing techniques, and replanting (as discussed in **Sections 4.16.1** and **6.5.1.2**). These measures would serve to prevent cumulative effects to vegetation and are expected to be employed during construction of reasonably foreseeable future developments. Nonetheless, given the uniqueness of mangrove vegetation and its identification as a rare vegetation species, potential impacts to mangrove vegetation as a result of other planned developments independent of the proposed project are considered here.

Black Mangroves

Reasonably foreseeable future development projects could potentially result in clearing of some portions of marsh vegetation in the RSA, which could result in adverse effects to black mangroves. According to U.S. Geological Service (USGS) Texas Ecological Systems (TES) data, a total of 1,370 acres of marsh vegetation exist within the AOI, some of which could potentially serve as habitat for black mangroves and dependent wildlife species.

Mangrove marshes are considered a rare vegetation species by the USACE and projects affecting mangroves are excluded from coverage by a nationwide permit (NWP). Four species of mangroves are common to the Gulf of Mexico, only one of which, the black mangrove, is able to sufficiently tolerate winters in Texas. This species also has the highest salt tolerance of any mangrove species. This species mainly occurs on warm bay shores that are protected from exposure to high waves or strong currents. Species dependent on the unique function of black mangroves include mollusks, larger crustaceans (mainly crabs and shrimp), juvenile fish, and preying shorebirds (such as herons, egrets, and bitterns). Despite its ecological importance, the black mangrove species is a lesser-studied habitat (Rayburn).

Potential cumulative effects to black mangroves could pose a risk to certain species that are dependent on this vegetation for habitat. However, current regulations in place to protect rare vegetative species would minimize adverse effects to black mangroves.

The cumulative effects of the proposed project when considered with other past, present, and reasonably foreseeable future actions would not result in a substantial degradation of habitat for black mangroves. Continued changes in climate would also be expected to support further encroachment of black mangroves northward, as temperatures rise and conditions become more favorable along the South Texas coast for this vegetation species.

Effect of Vegetation Impacts on Birds

The Reddish Egret, White-faced Ibis, and Wood Stork all have potential foraging and nesting habitat within the RSA. As discussed in **Section 3.13.2.2**, the Reddish Egret is associated with salt and brackish wetlands and tidal flats and typically nests on the ground as well as in bushes and trees. The White-faced Ibis frequents freshwater marshes, swamps, ponds, and rivers and nests in low trees, on floating mats, or on the ground in bulrushes and reeds. Finally, the Wood Stork is typically found in freshwater habitats such as marshes, swamps, ponds, ditches, and flooded fields and nests in upper areas of cypress trees, mangroves, or dead hardwoods near water. Reasonably foreseeable future development in the area could potentially result in vegetation removal during construction, which could impact habitat for these state-listed birds.

Corpus Christi is located on the Great Texas Coastal Birding Trail, as designated by TPWD, and includes boardwalks, observation platforms, and landscaping intended to attract native wildlife (TPWD 2013). This portion of the trail is referred to as the Central Texas Coastal Birding Trail and extends from Matagorda Bay through Victoria and Corpus Christi to Kingsville. Designated bird-watching areas along the trail include Blucher Park on N. Shoreline Drive and the Texas State Aquarium in Corpus Christi and Indian Point/Sunset Lake and the Fred Jones Nature Sanctuary in Portland. Given the role of birding in the Corpus Christi tourism industry, habitat for these and other birds is considered a particularly valued resource in this area. In addition to federal and state regulatory protections, discussed further in **Section 4.16.1**, the significance of the Central Texas Coastal Birding Trail would also be anticipated to serve as further protection for these species and their habitats. The proposed project when added to other past, present, and reasonably foreseeable future actions, would not cause substantial impacts to these birds or their habitats.

7.6.4 Community Resources

Potential cumulative impacts to community resources include changes to community cohesion and community health. The evaluation of cumulative effects to community cohesion incorporates the determinations regarding potential direct and indirect effects of the proposed project to communities as discussed in **Sections 4.6** and **6.6.1.2**, respectively. Discussion of potential cumulative effects to health as a result of air quality conditions considers the conclusions in **Sections 4.8** and **4.9**.

7.6.4.1 Community Cohesion

<u>North Beach</u>

As shown in **Table 4.6-1**, direct impacts to the North Beach community cohesion or values would be minor. The identity of the area as a "beach community" would not change as a result of any of the build alternatives, and the attractiveness of North Beach as a tourist destination would remain (see **Section 6.6.1.2** for further discussion). Implementation of the West Alternative would contribute to feelings of isolation for some residents, based on input received at stakeholder meetings (see **Section 4.6.1.4**).

The 2011 *North Beach Development Plan* is intended to "provide a vision for City Council decisions concerning rezoning, capital improvement projects, legislative goals, and funding strategies" (City of Corpus Christi 2011b). The plan illustrates the North Beach community's desire to expand tourism-focused developments into currently Port-owned land as well as convert existing low- to medium-density residential and commercial areas to mixed-use, "beachside residential" areas. The plan depicts the future location of the US 181 facility to be further west than the existing location, most closely resembling the alignment of the Red Alternative (Preferred). However, the elements of the *North Beach Development Plan* are considered to be possible rather than probable due to local funding constraints and are not viewed as reasonably foreseeable.

Cumulative effects to community cohesion in North Beach related to the proposed project are not expected under any of the build alternatives.

South Central

Residential neighborhoods within South Central include Evans Elementary and Crosstown East, neither of which would undergo adverse direct or indirect effects to community cohesion as a result of any of the build alternatives (see **Table 4.6-2**). Community cohesion within these neighborhoods is considered to be stable and would not be expected to undergo cumulative effects related to the proposed project. Therefore, cumulative effects to South Central would be limited to the CBD/downtown area, as discussed below.

Comprised of primarily commercial land uses, the downtown area does not demonstrate typical characteristics of community cohesion, and the location of US 181 was cited by the Collaborative Judgment Land Use Panel as a barrier to cohesion in the downtown area. Relocation of US 181 further west under the Red, Orange or West Alternatives would present the City with the opportunity to further its objectives to create a more vibrant downtown that is continuous with the SEA District (discussed further in **Section 7.5.6**).

The City's *Integrated Community Sustainability Plan* describes a City goal to transform existing land uses into high-density residential uses on the east side of downtown along Shoreline Boulevard, as well as promote expansion of the SEA District and encourage mixed- uses throughout the downtown area. The plan also introduces a Green City campaign in which sustainable practices are interwoven into the redevelopment concepts proposed in the plan, including a "green gateway" into the city if the existing US 181 facility were relocated. The concepts developed in the plan assume the removal of the "barrier between the northern and southern sectors of Downtown" (HDR, Inc. 2011), which would occur under the Red, Orange, and West Alternatives. Construction of one of these alternatives would support the redevelopment concepts discussed in the *Sustainability Plan*. The Green Alternative would leave the existing US 181 barrier in place and would therefore not support the goals described in the *Sustainability Plan*. In either case, this would not be expected to result in substantial cumulative effects within the Downtown/CBD area.

Similarly, the conceptual *Destination Bayfront* plan (2010) indicates a desire on the part of the City to redevelop and repurpose 34 acres along Shoreline Boulevard in the southeastern portion of the Community RSA. This concept of new public space includes parks, beaches, a pier, and arts and culture square. While the Red, Orange, and West Alternatives would not conflict with the vision of *Destination Bayfront* to promote "positive change in all of Downtown" (Destination Bayfront Organization 2010, 1), the ultimate realization of this type of redevelopment would be dependent more so on local real estate market conditions and political decisions than the location of US 181. In November 2013, Corpus Christi voters rejected the bond issue for Destination Bayfront, indicating that infrastructure repairs were more critical (Associated Press 2013).

The Cosmopolitan development, located at the corner of Chaparral and Lawrence Streets in the CBD and expected to begin construction in November 2013, is a reasonably foreseeable action anticipated to have a positive impact on the neighborhood. As noted in **Section 7.3.4.1**, the CBD has lost population to the suburbs over the past several decades; the 165-unit apartment project could draw additional households as downtown residents. The retail component would be anticipated contribute to the vibrant, mixed-used environment envisioned for the downtown area.

Overall, the cumulative effects of the proposed project within the South Central community would be limited to potential increased connectivity downtown as a result of removal of the existing barrier created by the US 181 facility under the Red, Orange, and West Alternatives. Development and redevelopment downtown within the 2035 timeframe would be consistent with local land use plans.

The Green Alternative would not result in cumulative effects to community cohesion within the South Central area, since this alternative does not represent a substantial change from the existing condition, although this alternative is inconsistent with the City's future land use and community sustainability plans.

<u>Northside</u>

Direct and indirect impacts to community cohesion within the Northside community would be primarily related to the Red and Orange Alternatives, both of which would be placed between the Hillcrest and Washington-Coles neighborhoods. As discussed in **Section 7.3.4.1**, the construction of I-37 contributed to a decline in community cohesion for this area, which is separated from downtown by the existing US 181 facility. Under the Red and Orange Alternatives, the existing barrier between the Northside neighborhoods and downtown would be removed; however, accessibility between these areas would be dependent on local actions to improve transportation options. The separation effects of a new barrier between the Hillcrest and Washington-Coles neighborhoods, which are relatively interconnected and share community resources, would contribute to the further decline of community cohesion in the Northside community over time.

Both the Green and West Alternatives would result in changes in access in the Northside community. With construction of the Green Alternative, community cohesion in the Hillcrest and Washington-Coles neighborhoods would be relatively unchanged. The Green Alternative would not be expected to contribute to a substantial cumulative effect to community cohesion within the Northside neighborhoods. The West Alternative would represent a loss of accessibility to major highways, which could result in further decline of community cohesion for the Hillcrest and Washington-Coles neighborhoods.

Although the reasonably foreseeable future actions indentified in **Section 7.5** would not adversely affect cohesion in the Northside community, the trajectory of community cohesion is in decline. The direct and indirect effects of construction of the Red (Preferred) and Orange Alternatives, therefore, would contribute to a substantial cumulative effect to community cohesion within these neighborhoods. Measures to mitigate these potential effects are discussed in **Section 7.8.4**. The measures discussed in this document are conceptual in nature, and the Joint Lead Agencies will continue to solicit input from Cooperating and Participating Agencies and the public with regard to potential for implementation.

Westside

Cumulative effects to cohesion in the Westside community are not anticipated. While the existing barriers of I-37 and the Crosstown Expressway would remain under all of the build alternatives, the relationship of the community to these facilities would not change, and community cohesion within the Oak Park, Leopard Street, Ben Garza, or Crosstown West neighborhoods would not be adversely affected by reasonably foreseeable future actions, most of which are focused north of the Inner Harbor or in San Patricio County.

Refinery Row

The Refinery Row community would not be directly impacted as a result of the proposed project, and potential indirect impacts in this community would be insubstantial. Cumulative effects to cohesion in this community would be related to reasonably foreseeable future actions.

Plans for development by the Port and port industries along with transportation projects aimed at supporting the expansion of Port-related commerce indicate that shipping activity at the Port of Corpus Christi is likely to increase in the future. Developments are being planned in response to market conditions, such as the prominence of Eagle Ford Shale activity in the region. These types of developments, including the planned expansion of the Flint Hills West Refinery on the south side of the Inner Harbor (see **Figure 7.5-1**) aimed explicitly at taking advantage of the Eagle Ford Shale play (Flint Hills 2013), would collectively result in an increase in the industrial nature of the project area. Moreover, intermodal transportation improvements associated with the Joe Fulton International Trade Corridor are anticipated to attract increased industrial development and are described by the Corpus Christi MPO as "an impetus for industries to locate near the harbor and intermodal transfer facilities" (Corpus Christi MPO 2009, 54).

The arrival of new industries or expansion of existing facilities could potentially affect the neighborhood aesthetic of the residential Dona Park and Academy Heights areas. These neighborhoods generally post-date the initial arrival of refineries in the area, and portions were constructed as housing for refinery workers. Over time, the community cohesion within the residential neighborhoods of Refinery Row could see a decline if expansion of industrial activities in the area were to occur. According to neighborhood respondents to the community survey, the seclusion of the neighborhoods is an attractive characteristic of Dona Park and Academy Heights. While these neighborhoods may remain relatively removed from urban development nearer to downtown, the expansion of industrial developments near the Inner Harbor could lessen the secluded nature of the area.

Reasonably foreseeable development and transportation projects, such as those shown on **Figures 7.5-1** and **7.5-2**, indicate that the Inner Harbor is likely to continue to develop. The degree to which the proposed project would contribute to increased industrial development and potential alteration of the seclusion of the neighborhoods in the Refinery Row community is considered minimal. Therefore, cumulative effects to community cohesion within the Refinery Row neighborhoods are not considered substantial.

Portland

Portland would not be directly affected by the proposed project and indirect effects to this community would be insubstantial. Reasonably foreseeable future actions shown on **Figure 7.5-3** are located north and east of Portland and would not affect community cohesion. Increases in Port-related development in the general area could help to support future growth in Portland, since new employment opportunities would be created in an area where many residents currently commute to Corpus Christi for work. These potential changes would be expected to benefit the Portland community as a whole.

In preparation for future regional growth, the *City of Portland Comprehensive Plan* outlines a vision for "how the community wishes to grow and mature into the next century and beyond" (City of Portland 2006, 45). Goals of the City include efficient and orderly growth and development; promotion of a small-town atmosphere; and affordable housing with a variety of housing choices for all ages and income levels. The emphasis on a small-town feel for the community indicates that future regional growth would not likely affect cohesion in the Portland community. Potential cumulative effects to community cohesion in Portland are not considered substantial.

7.6.4.2 Community Health

Ambient concentrations of air toxics, discussed in **Section 7.3.1.2**, do not translate directly to either human exposure concentrations or to inhalation cancer risks or other health risks. Human exposure concentrations result from how ambient outdoor concentrations penetrate into the different microenvironments, particularly indoor environments, and how much time individuals spend in different microenvironments and their activity levels. Exposure concentrations, such as those modeled for the NATA health risk estimates, tend to be lower than ambient concentrations, because pollutant penetration rates from outdoor to indoor environments are less than 100 percent. Results of exposure modeling have found that mobile sources make a greater relative contribution to average population exposure than they make to average ambient concentrations, because of the elevated exposure levels that occur inside the microenvironment of operating vehicles (Cook et al. 2007). As discussed in **Section 7.3.4.2**, human health risk levels associated with MSATs, and the contribution to risk levels from MSAT emissions attributed to mobile sources such as transportation projects, are projected to decrease in the future (e.g., 2030 risk levels from mobile sources were projected to be less than half of estimated 1999 risk levels).

It is not possible to attribute a particular level of risk to the cumulative effects of the proposed project due to the limitations of techniques available to make air toxics exposure and risk assessments, and the assumptions and uncertainties inherent in the estimation and modeling tools used (including emissions estimation, ambient concentration modeling, human exposure modeling, and health risk determination). Uncertainties associated with determining health risk associated with MSAT emissions in general and for project-level impact determinations are discussed further in **Section 4.9.2.2**. The U.S. 181 Harbor Bridge project is only one component of the overall on-road mobile source category, and emissions from on-road mobile sources may potentially contribute to cumulative effects on community health. The project's incremental contribution to the overall community health effects, while not quantifiable, is expected to be minor. Because of the limitations in the methodologies for forecasting health impacts, it is not possible to reliably identify or estimate any difference in potential health impacts between the proposed build alternatives and the No Build Alternative.

Continuation of Eagle Ford Shale activity would potentially contribute to emissions within the Corpus Christi region, though these emissions would be expected to be minimized through TCEQ air quality monitoring and regulations. Potential expansion of Port-related facilities would result in increased point sources for MSATs. In the event that such development were to occur, potential emissions would be regulated at the state and federal level, which would be expected to minimize any adverse community health effects associated with point-source emissions. Additionally, expansion of the transportation network—including highway, railroad, and maritime modes—would potentially contribute to MSATs in the Corpus Christi region; however, emissions from mobile sources are expected to decrease in the future overall (FHWA 2012b).

7.6.5 Economic Resources

7.6.5.1 Contribution of the Proposed Project to a Cumulative Effect on the Regional Economy

Estimates of the direct economic and employment effects of the proposed Harbor Bridge project are described in **Section 4.5.6.1**. The Bureau of Economic Analysis RIMS II final-demand multipliers for construction industry were applied to project construction costs estimated for each of the build alternatives, which range from $558 million (Green) to $679 million (West). The multipliers show a total direct, indirect, and induced output effect of between $1.019 billion (Green) to $1.242 billion (West) and a direct, indirect, and induced earnings effect of between $340 million (Green) to $414 million (West) (see **Table 7.6-1**). The indirect and induced results for earnings and employment are explained in **Section 6.5.1.1**.

Table 7.6-1 Direct, Indirect, and Induced Economic Effects of the Proposed Build Alternatives

	Green	Red	Orange	West
Construction ($)	557,530,443	636,527,734	629,819,315	679,131,890
Direct Economic Effects				
Output ($)	557,530,443	636,527,734	629,819,315	679,131,890
Earnings ($)	208,119,689	237,608,467	235,104,292	253,512,108
Indirect Economic Effects				
Output ($)	200,989,725	229,468,284	227,049,863	244,827,046
Earnings ($)	57,878,085	66,078,915	65,382,504	70,501,717
Induced Economic Effects				
Output ($)	261,426,024	298,467,855	295,322,277	318,444,943
Earnings ($)	74,207,302	84,721,841	83,828,951	90,392,455

Total Direct + Indirect + Induced Effects				
Output ($)	**1,019,946,192**	**1,164,463,873**	**1,152,191,455**	**1,242,403,879**
Earnings ($)	**340,205,076**	**388,409,223**	**384,315,747**	**414,406,280**

Source: U.S. Bureau of Economic Analysis, RIMS II Multiplier System, Table 2.5, 2010 Total Multipliers for Output, Earnings, and Employment, by Industry Aggregation for Nueces and San Patricio County, Texas (Types I and II).

In terms of employment, the proposed project would result in a combined direct, indirect, and induced employment effect ranging from 7,674 jobs (Green) to 9,348 jobs (West) (see **Table 7.6-2**).

Table 7.6-2 Direct, Indirect, and Induced Employment Effects of the Proposed Build Alternatives

	Green	Red	Orange	West
Construction ($)	557,530,443	636,527,734	629,819,315	679,131,890
Direct Employment Effects				
Employment (jobs)	4,303	4,913	4,861	5,242
Indirect Employment Effects				
Employment (jobs)	1,206	1,377	1,363	1,469
Induced Employment Effects				
Employment (jobs)	2,165	2,472	2,446	2,638
Total Direct + Indirect + Induced Employment Effects				
Employment (jobs)	**7,674**	**8,762**	**8,670**	**9,348**

Source: U.S. Bureau of Economic Analysis, RIMS II Multiplier System, Table 2.5, 2010 Total Multipliers for Output, Earnings, and Employment, by Industry Aggregation for Nueces and San Patricio County, Texas (Types I and II).

The economic benefits to the Corpus Christi region must be weighed against the lost annual tax revenues resulting from the potential transfer of project right of way to public ownership. These lost revenues range from $72,478 (Red) to $153,398 (Orange), depending on the amount of acreage removed from the tax rolls (see **Section 4.5.5.1**).

The direct, indirect, and induced economic and employment benefits related to the proposed project can be evaluated in the context of the overall economic projections for the Corpus Christi MSA and the state of Texas. Another point of context is provided in an economic analysis by Martin Associates measuring the impact of the Port on the overall Corpus Christi economy. That study concluded that the Port's "maritime activity at the public and private terminals located in the Port of Corpus Christi" is estimated to generate 46,120 direct, induced, and indirect jobs and about $4 billion in direct, induced, and indirect personal wages and salaries. Overall, Port maritime activity generated a total of $13.1 billion of total economic activity in the State of Texas in 2011 (Martin Associates 2012). Compared to the Port's role in the regional and statewide economy, the proposed Harbor Bridge project is expected to make a relatively small but positive contribution to the overall prospects for stability and growth in the Economic Resources RSA.

7.6.5.2 Economic Effects of the Port of Corpus Christi

Cumulative effects to economic resources would relate primarily to the Port of Corpus Christi, the major economic driver for the region. As discussed in **Section 6.5.2.2**, an increase in the current 138-foot navigational restriction would not independently increase maritime traffic but would potentially allow for shipment of cargoes with greater economic efficiency, which could, in turn, lower unit transportation costs. Lower transport costs would be expected to increase the attractiveness of the Port to current and potential new maritime businesses and better position the Port to take advantage of current and future economic opportunities. It should be noted, though, that the Port's primary commodities—petroleum and petroleum-related products—are shipped on barges that would not be affected by a higher air draft clearance.

The 2010 *Harbor Bridge Clearance Study* points out that an increased air draft clearance would increase efficiency for larger vessels calling the Port that are currently required to take on ballast water after unloading in order to reduce air draft and clear the bridge when exiting the Inner Harbor. This process represents "cost and time lost" and "makes the use of these larger vessels unprofitable" (Harrington & Cortelyou, Inc. 2010, 5). The study suggests that increased clearance would "possibly bring tremendous savings to all users of the Port of Corpus Christi, and possibly lower the final price of gasoline" (Harrington & Cortelyou, Inc. 2010, 5).

As noted in **Section 6.5.2.2**, raising the current air draft clearance of the bridge under the proposed project addresses only one of the post-Panamax desirable conditions and is not considered to have an indirect causal relationship to prospective growth in the Port's shipping business. An increase in the air draft clearance at the Inner Harbor would be one of several factors contributing to the Port's ability to take advantage of future changes in national and international trade. However, additional future actions such as facility and transportation network expansion could aid in the Port becoming ready to host post-Panamax vessels, including efforts such as the Channel Improvement Project discussed in **Section 7.5.1** (see **Figures 7.5-2** and **7.5-3** in **Appendix A**) and the Joe Fulton International Trade Corridor discussed in **Section 7.5.2** (see **Figure 7.5-1** in **Appendix A**). As the leading goods export state in the country, Texas "is well positioned to take advantage of the Panama Canal expansion and other opportunities to increase the export of dry bulk, liquid bulk, general and break bulk cargo, and containers to existing and new markets" (Texas Transportation Institute 2012). In 2011, a Memorandum of Understanding (MOU) between the Panama Canal Authority and the Port of Corpus Christi Authority stated that it is in the interest of both parties to "establish an alliance of cooperation aimed at facilitating international trade and generating new businesses by promoting the all water route between Asia and the Port of Corpus Christi…via the Panama Canal" (Pancanal 2011). This new business is intended to increase economic growth by providing job opportunities and revenues within the Port and by increasing revenues at the Panama Canal (Pancanal 2011).

Other substantial economic contributions associated with the Port would be expected with the construction of new industrial facilities, including the La Quinta Trade Gateway (see **Section 7.5.5**). As discussed in **Section 6.2.2.2**, projections of employment for the full build-out of La Quinta are estimated at up to 14,000 jobs by the year 2035. While the MPO states that "there is some question of whether the full amount of estimated employment will be reached," the economic impact of La Quinta is expected to be substantial. Currently planned facilities at the La Quinta include the Voestalpine steel plant and Cheniere Energy LNG export terminal, a $10 billion investment.

Other Port-related investments that would be anticipated to have a cumulative economic effect within the RSA include redevelopment of the Naval Station Ingleside property by Occidental Petroleum Corporation and Flint Hills Refinery expansion at its Ingleside facility (see **Section 7.5.4**). Planned developments along the Inner Harbor (see **Table 7.5-1** and **Figures 7.5-1** and **7.5-2** in **Appendix A**) would also result in positive economic benefits within the RSA. For example, the planned M&G PET/PTA plant along the Joe Fulton Corridor on the north side of the Inner Harbor is anticipated to result in creation of approximately 200 permanent jobs, while the planned Flint Hills West Refinery upgrades represents a $200M investment along the south side of the Inner Harbor. Existing plans for Port-expansion are reflective of the current market conditions, which are expected to continue to improve, particularly in response to the Eagle Ford Shale boom within the Coastal Bend region. As the Port of Corpus Christi continues to grow in response to favorable market conditions, current and future Port-related industrial developments will continue to contribute both jobs and earnings within the local and regional economy.

7.6.5.3 Community Sustainability Plan Initiatives

The *Corpus Christi Integrated Sustainability Plan* (HDR, Inc. 2011) illustrates the City's desire to redevelop downtown into a cohesive, mixed-use urban center. The plan points out that the replacement of the Harbor Bridge "would create an opportunity to establish a new green gateway" into the city and would allow the City to build upon the visions of the *Bayfront Master Plan* (2007), *Downtown Vision Plan* (2008), and *Destination Bayfront* (2010) (HDR, Inc. 2011). The concept of a strengthened SEA District (discussed in **Section 7.5.6**) is also highlighted, which, the plan points out, will require coordination with both public and private investors.

Beyond relocation of US 181 under the Red (Preferred), Orange, and West Alternatives, the proposed project would not make a substantial contribution to redevelopment of the downtown area into a mixed-use urban center. Potential development within the SEA District would be expected to result in an increase in economic activity in this portion of downtown and would have positive effects on the economy throughout the Corpus Christi MSA. Other actions that could potentially result in beneficial economic effects include solicitation of proposals for residential projects in the CBD; development of a parking master plan to encourage downtown activity; and City coordination with the Downtown Management District to identify candidate buildings for rehabilitation (HDR, Inc. 2011). These and other initiatives in the *Corpus Christi Integrated Sustainability Plan* would help to support the economic health of the Corpus Christi area.

7.7 REPORT THE RESULTS

This cumulative effects analysis follows detailed guidance from TxDOT, FHWA, CEQ, and applicable case law. The collection and analysis of information varied by resource or issue but were generally derived from current and historical reports, records, databases, and mapping.

The results of the cumulative effects analysis are summarized in **Table 7.7-1**, below. The direct and indirect effects considered to potentially contribute to a cumulative effect on the resources discussed in this analysis are identified in the table, along with other activities that could modify future cumulative conditions for each resource.

7.8 ASSESS AND DISCUSS MITIGATION ISSUES FOR ALL ADVERSE EFFECTS

This section discusses the governmental regulations and guidance that currently exist to protect the resources assessed in the cumulative effects analysis. Additional mitigation measures that could serve to potentially reduce negative effects to resources are also discussed below.

7.8.1 Mitigation of Potential Cumulative Effects to Air Quality

7.8.1.1 Rules and Regulations for Controlling Air Emissions

Most of the air emission sources accounted for in emissions inventories discussed in this analysis are subject to existing air quality rules and regulations intended to limit emissions. These include emission controls applicable to major permitted industrial sources, EPA's federal fuel and vehicle emission standards, and rules applicable to certain smaller emission sources included in the area source category. For example, the TCEQ lists the following rules that apply to stationary sources in the Corpus Christi area and that are part of the State Implementation Plan (SIP) strategy to meet the NAAQS.

- Rules for controlling ozone levels by limiting emissions of the ozone precursor nitrogen oxides (NOx) and volatile organic compounds (VOCs) include:
  - Rules that limit NO_x emissions from the following sources:
    - Nitric Acid Manufacturing (rules apply statewide)
    - Utility Electric Generation in East and Central Texas (rules apply in Nueces County)
    - Water Heaters, Small Boilers, and Process Heaters (rules apply statewide)
  - Rules that limit VOC emissions from the following sources:
    - Automotive Windshield-Wiper Fluid rules (apply statewide)
    - Cutback Asphalt rules (apply in Nueces County)
    - Degreasing Processes rules (apply in Nueces County)
    - Flexographic and Rotogravure Printing rules (apply in Nueces County)
    - Fugitive Emissions rules (apply in Nueces County)
    - Loading and Unloading Operations rules
    - Pharmaceutical Manufacturing rules (apply in Nueces County)
    - Process Unit Turnaround and Vacuum-Producing Systems in Petroleum Refineries rules (apply in Nueces County)
    - Storage Tanks rules
    - Surface Coating Processes rules (apply in Nueces County)
    - Transport Vessel rules
    - Vent Gas rules
    - Water Separation rules
- Statewide rules limit particulate matter emissions and opacity from affected sources.
- Statewide rules limit sulfur dioxide emissions and ground level concentrations from affected sources.

7.7-1 Summary of Cumulative Effects				
Resource	**Contributing Direct Effects**	**Contributing Indirect Effects**	**Reasonably Foreseeable Future Actions**	**Potential Cumulative Effects**
Air Quality	Potential construction phase emissions and long-term reduction of MSAT emissions as a result of pollution control strategies (including national control programs, state regulations, and voluntary measures as discussed in **Section 7.6** and **7.8.1**) under all of the build alternatives.	Long-term reduction of MSAT emissions as a result of pollution control strategies (including national control programs, state regulations, and voluntary measures as discussed in **Section 7.6** and **7.8.1**) under all of the build alternatives.	Development of transportation projects which would increase AADT within the transportation network; overall expansion of the transportation network (highway, rail, maritime); continued Eagle Ford Shale activity; development or expansion of point sources such as refineries and other industrial sources	Expansion of the transportation network could result in minor increases in MSATs, which are projected by FHWA to see an overall decrease in the future. Eagle Ford Shale activity and potential Port-related development could result in increases in point source emissions of MSATs.
Water Resources	Storm water runoff from construction and operations phases would discharge via the City of Corpus Christi MS4 to receiving waters listed as impaired under TCEQ Sec. 303(d) list. In compliance with state and federal regulations and appropriate BMPs, none of the build alternatives would contribute to the impairment of Nueces Bay, Corpus Christi Bay, or the Inner Harbor. The proposed project alternatives would not have adverse impacts on ground water.	Encroachment-alteration effects on surface water resources in the form of runoff would potentially occur as a result of increased temporary vegetation removal during construction and increased impervious cover. These effects would be minimized through regulatory compliance and BMPs. Potential direct effects on surface water would not result in encroachment-alteration impacts on ground water.	Transportation network improvements; Port development activities (including dredging, operation effects, etc.); continued drought and curtailment of freshwater inflows.	Construction and operation of the proposed project would not be a highly consumptive use of water or affect future water availability. Overall, the decline in water availability on the relative stability of water quality conditions would not be substantially affected by the cumulative effects of the proposed project. However, resource vulnerabilities and potential long-term water quality problems stemming from continued future decline in fresh water flows will require continued and enhanced monitoring, planning, and conservation efforts.
Coastal Resources	Potential impacts/effects to threatened and endangered species during construction phase; alteration of vegetation, soils, and hydrology; minor water temperature effects in shaded areas; impacts to WOTUS during construction under all of the build alternatives.	Vegetation clearing could result in potential habitat removal during construction phase; removal of black mangrove vegetation under West could result in impacts to wildlife habitat; potential increases in impervious cover and localized erosion that could result in adverse surface water quality impacts would be mitigated through use of BMPs and regulatory control measures.	Development that would contribute to runoff into receiving waters; development within low marsh vegetation that could contain black mangroves	There is potential for degradation of habitat due to cumulative water quality effects, though it is anticipated that most would be mitigated through regulatory control measures; potential development could lead to removal of marsh vegetation which could contain black mangroves, a rare vegetation species, and potential wildlife habitat.
Community Resources (including Health)	Removal of barrier to SEA District and downtown under Red, Orange, and West; perpetuation of barrier under Green; new barrier between Washington-Coles and Hillcrest neighborhoods under Red and Orange Alternatives; new encroachment in Hillcrest neighborhood under West Alternative; potential for increased connectivity between Northside and downtown to some degree under all of the build alternatives, more so with the Red, Orange and West Alternatives. Increased separation and loss of community cohesion in Northside under Red and Orange Alternatives; loss of access to major highways for Hillcrest under West Alternative.	Potential for increased connectivity downtown under all build alternatives to some degree. Long-term severance effects to Northside under Red and Orange Alternatives. Potential for increased isolation in North Beach under West; potentially less seclusion in Refinery Row.	Relocation of existing bridge further west under Red, Orange, and West Alternatives; placement of facility between Hillcrest and Washington-Coles under Red and Orange Alternatives; potential increased industrial development as a result of increased activity at the Port; increases in AADT within transportation network	The Red, Orange, and West Alternatives are consistent with plans to redevelop areas to higher-density uses. Contribution to declining community cohesion in Northside as a result of separation under Red and Orange Alternatives and loss of access and mobility under West Alternative. Potential increases in industrial development could result in loss of community cohesion within Refinery Row neighborhoods. Minimal contribution to MSATs as a result of on-road mobile sources that could affect overall community health; overall decrease in MSATs expected over time.

7.7-1 Summary of Cumulative Effects				
Resource	**Contributing Direct Effects**	**Contributing Indirect Effects**	**Reasonably Foreseeable Future Actions**	**Potential Cumulative Effects**
Economic Resources	Business displacements under all build alternatives; increased business exposure; potential loss in tax revenue during right of way acquisition; increases in household earnings and jobs.	Creation of potential economic opportunities which rely on implementation of other actions.	Increased efficiency at the Port of Corpus Christi; Port-related transportation improvements and industrial developments; continued influence of the Eagle Ford Shale play; public and/or private investment in redevelopment downtown	The proposed project would have a minor but positive impact on the local and regional economy. Reasonably foreseeable future actions associated with the Port would be expected to benefit the economy by providing additional employment opportunities and increased household earnings. Redevelopment of downtown could result in increased economic activity within the MSA.

Source: US 181 Harbor Bridge EIS Team 2013

While implemented primarily to maintain attainment of the NAAQS for criteria pollutants, many of these rules also have the effect of limited emissions of air toxics, including MSATs (e.g., control of VOC emissions). More information on the rules listed above may be found at the TCEQ's State Implementation Plan website for stationary source rules for the Corpus Christi area: http://www.tceq.texas.gov/airquality/stationary-rules/cc.

Mitigation measures for global greenhouse gas emissions are discussed in **Section 7.6.1.2**.

7.8.1.2 Efforts to Control Eagle Ford Shale-Related Air Pollution

In order to ensure the requirements of the Clean Air Act (CAA) are met, the TCEQ monitors the effects to air quality resulting from Eagle Ford Shale activity through air permit authorizations and the State Implementation Plan (SIP). The TCEQ permit review process ensures that operators employ the best available emission controlling technologies and also evaluates the effects of each permit's specified emissions on public health and welfare (Railroad Commission of Texas 2013, 81).

In addition to regulatory control measures, the AACOG (in cooperation with the TCEQ) produced a report in 2012 developed in response to concerns regarding high concentrations of ground-level ozone in the San Antonio area. This report was developed in support of an Eagle Ford Shale emissions inventory protocol, the results of which can be utilized to determine the contribution of the Eagle Ford Shale play to ozone precursor emissions.

7.8.1.3 Efforts to Control Maritime Pollution

In addition to the national standards recently adopted by the EPA to aid in control of maritime pollution (discussed in **Section 7.6.1.3**), EPA participates in the U.S. delegation to the International Maritime Organization (IMO), a United Nations agency "concerned with maritime safety and security and the prevention of marine pollution from ships" (EPA 2013g). International air pollution standards under Annex CI of the International Convention for the Prevention of Pollution from Ships (referred to as MARPOL) are implemented by the IMO. MARPOL set new international standards for marine diesel engines and their fuels and also set more stringent emission requirements for ships that operate in "designated coastal areas where air quality problems acute," referred to as Emission Control Areas. Effective August 2012, North American seas have been identified as an Emission Control Area with regard to air pollution as a result of sulfur dioxide, nitrogen oxide, and particulate matter.

7.8.1.4 Efforts to Control Refinery Emissions

EPA is responsible for enforcing national emission standards for petroleum refineries. These rules are codified in 40 CFR §63 Subpart CC and Subpart UUU and 40 CFR 60 Subparts J and Ja. Additional information regarding petroleum refinery rulemaking can be found here: http://www.epa.gov/ttn/atw/petref.html.

In conjunction with regulatory control measures, efforts on behalf of refineries can serve to mitigate adverse air quality effects from industrial sources. For example, Flint Hills Resources, a major refinery in Corpus Christi, conducts daily air quality monitoring within its facilities, at the fenceline, and in nearby neighborhoods (Flint Hills Resources 2012, 3). These efforts offer additional monitoring of refinery emissions at a more frequent interval than is required for compliance with EPA regulations. In addition, refineries could employ voluntary control measures to help reduce emissions. In a draft report by the TCEQ's Flare Task Force (2009), it was determined that use of alternative control devices such as vapor combustors; diversion or elimination of streams vented to flares; use of redundant equipment to increase reliability; and implementation of leak source monitoring can all help to reduce emissions from flares, one of the main sources of refinery-related emissions (TCEQ 2009).

At the community level, the Department of Community Outreach at TAMU-CC operates the Pollution Prevention Partnership (P3), which provides free services to businesses to help prevent air and stormwater pollution; provides environmental education; and provides environmental compliance assistance to citizens, schools, businesses, industries, and governments (Texas A&M University 2013). As part of their air pollution prevention initiative, P3 developed the Hydrocarbon Emissions Detection and Remediation (HEDR) project to illustrate the advantages of reduction VOC emissions from the production side of the oil and gas industry in the Corpus Christi area. The project aimed to demonstrate the effectiveness of using a vapor recovery system in capturing fugitive emissions (Texas A&M University 2013). These and other efforts could prompt industries to adopt newer processes that result in fewer air emissions.

7.8.2 Mitigation of Potential Cumulative Effects to Water Resources

An important factor affecting current and future water and coastal resource conditions is the environmental performance of the Port itself, as exemplified by the implementation of an ISO-certified Environmental Management System (EMS). An EMS is a set of management processes and procedures that allow an organization to analyze, control, and improve the environmental consequences of its activities. In 2007, the Port's EMS was approved and received third-party certification under the ISO 14001 standard; its fifth consecutive certification was issued in 2012 (Port of Corpus Christi 2012d). The EMS includes a Tenant Audit Program, which consists of a scheduled annual review of Lessee/Port User's operations and activities, environmental management programs, and tours of leased premises. The program is a valuable tool enabling the Port to cooperatively influence the environmental compliance and stewardship performance of many industrial facilities having potentially high impacts to water and air quality. The Port considers the EMS a success with respect to these goals, and has realized tangible cost savings in several areas, for example its port-wide recycling program and a 95 percent improvement in the quality of storm water runoff from the facility. The Port's leadership efforts in developing the EMS as well in other areas of environmental performance have been recognized by a number of conservation organizations, including the Coastal Bend Bays Foundation, which bestowed its environmental stewardship award in 2005 for the Port's EMS efforts and again in 2009 for its role in the Port Pelican Island project, which constructed a new breakwater to protect rookery habitat from erosion (Port of Corpus Christi 2012e).

In addition to the EMS efforts described above, potential storm water constituents would be managed through compliance with the Clean Water Act, specifically the Texas Pollutant Discharge Elimination System. Effective maintenance of BMPs would also serve to minimize potential degradation of surface water quality.

7.8.3 Mitigation of Potential Cumulative Effects to Coastal Resources

All of the federally listed threatened or endangered species included in this analysis fall under the regulatory authority of the USFWS and NMFS, the federal authorities responsible for enforcing the Endangered Species Act of 1973 and its subsequent amendments. Regulations supporting this act are codified in Sections 17.11 and 17.12 of Title 50 of the Code of Federal Regulations.

State-listed species have limited regulatory protection. While these species cannot be taken, collected, held, or possessed without a permit, their habitat is afforded no regulatory protection, except on tracts managed by state, federal, or private interests for conservation purposes.

Potential threats to sea turtles are regulated through a variety of international, federal, and state protections. In addition, NMFS and USFWS have joint jurisdiction for marine turtles, with NMFS leading efforts for the marine environment, and the USFWS serving to protect nesting beaches (NMFS 2013). Measures in the Gulf of Mexico aimed at protecting these species include fishing gear modifications and changes to fishing practices.

As discussed with the sea turtles above, "[s]peeding boats can injure and kill manatees that are submerged just below the surface" (USFWS 2008). As the population of the area grows and these waters continue to be used for recreational purposes, boat traffic will pose a threat to this species. USFWS (2008) notes that in response to this threat, speed limits have been implemented in order to minimize boat-related mortality.

7.8.4 Mitigation of Potential Cumulative Effects to Community Resources

Mitigation options for adverse effects to community resources related to the proposed project are discussed in **Sections 4.7.5.2** and **6.7.2.** TxDOT would continue to work with the community throughout the development of the proposed project, including further consideration and refinement of the mitigation proposals herein. The proposed commitments made in this document are conceptual in nature, and the Joint Lead Agencies will continue to solicit input from Cooperating and Participating Agencies and the public with regard to potential for implementation.

7.8.5 Mitigation of Potential Cumulative Effects to the Economy

The cumulative effects analysis concluded that the net effects of the proposed project along with other reasonably foreseeable future actions would positively impact the economy of the Corpus Christi MSA; therefore, no mitigation is recommended.

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