Environmental Assessment

Interstate Highway 45
(FM 518 to FM 1764)
Galveston County, Texas
CSJs: 0500-04-096 and 0500-04-106

Prepared by:
U.S. Department of Transportation
Federal Highway Administration
and

Houston District

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INTRODUCTION

This Environmental Assessment (EA) presents the potential environmental effects of a project proposed by the Texas Department of Transportation (TxDOT)–Houston District and the Federal Highway Administration (FHWA) to improve 7.5 miles of Interstate Highway (IH) 45 in Galveston County. This EA presents the need for and purpose of the proposed project, a description of the proposed project, and an interdisciplinary evaluation of the potential effects to the human and natural environment for those issues of concern.

The proposed project consists of widening the existing six-lane facility to an eight-lane divided facility with two two-lane frontage roads from Farm-to-Market Road (FM) 518 to FM 1764 in northern Galveston County. The project corridor passes through the cities of Dickinson, League City, and Texas City. A map depicting the project location is shown in **Exhibit 1**. The project is located on the U.S. Geological Survey (USGS) 7.5 Minute Quadrangle Maps of the cities of Algoa, Dickinson, Friendswood, and League City, Texas, as shown in **Exhibit 2**.

This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, Council on Environmental Quality (CEQ) Regulations (40 Code of Federal Regulations {CFR} Section 1502.13), FHWA Technical Advisory T6640.8A, and the TxDOT Environmental Manual. The public has been and will continue to be afforded the opportunity to comment on this project.

CHAPTER 1. NEED FOR AND PURPOSE OF THE PROPOSED PROJECT

Need for the Project

The need for the proposed project is demonstrated by the following conditions:

- The demand exceeds or approaches capacity during both of the daily commute periods.
- Hurricane and emergency evacuation options are a documented concern.
- Congestion develops due to competing uses (i.e., local traffic use and through traffic use).
- The roadway has design deficiencies.
- Congestion occurs at intersections with access to the major employment and recreational generators, including Galveston and other beach communities, National Aeronautics and Space Administration (NASA) corridor communities, and nearby port facilities.

Currently, IH 45 is a paved highway that consists of six 12-foot main lanes (three in each direction) with two- to three-lane one-way frontage roads. The existing right-of-way (ROW) is approximately 300 feet wide from FM 518 to Holland Road and approximately 380 feet wide from Holland Road to FM 1764. Grade-separated intersections are found at FM 518, Calder Drive, FM 646, FM 517, Hughes Road, Holland Road, and FM 1764. The following sections provide detailed summaries of the transportation needs regarding congestion and deficiencies along the project corridor.

Growth Trends

Examining the projected growth (e.g., population, employment, and trips) within the project vicinity shows that the greatest growth is expected within the cities of Dickinson and League City (near the northern end of the project). Over a 10-year period, from 1990 to 2000, the total population within these

cities has increased approximately 29 percent while the population in Texas City (near the southern end of the project) has remained relatively constant (**Table 1**). By 2030, it is projected that the cities of Dickinson and League City will have grown more than twice as fast as Galveston County.

It is expected that development would progress in a manner consistent with suburban growth trends; jobs follow population growth to the extent that suburban areas become self-contained with their own residential, retail, and employment centers. According to the *IH 45 South Corridor Major Investment Study (MIS)*, this growth suggests that communities north of the study area (such as the older suburbs of Clear Lake and Friendswood) are reaching build-out, and the next ring of sub-urbanization is rapidly occurring within the project vicinity (TxDOT 1999). This new ring of growth affects travel patterns within the project vicinity and is a major reason for traffic volume increases.

Table 1: Population Trends

Area	Population					
	1980 Census	1990 Census	2000 Census	2010 Projection	2020 Projection	2030 Projection
Dickinson	7,505	9,497	17,093	19,955	22,425	23,888
League City	16,575	30,159	45,444	53,546	60,539	64,683
Texas City	40,878	40,822	41,521	41,891	42,211	42,400
Galveston County	195,738	217,399	250,158	268,714	284,731	294,218
Area	**Percent Change**					
	1980-1990	**1990-2000**	**2000-2010**	**2010-2020**	**2010-2030**	
Dickinson	26.5	80.0	16.7	12.4	19.7	
League City	82.0	50.7	17.8	13.1	20.8	
Texas City	-0.1	1.7	0.9	0.8	1.2	
Galveston County	11.0	15.1	7.4	6.0	9.5	

Source: U.S. Census Bureau (1980, 1990a/b, & 2000 data), Texas Water Development Board (2010, 2020, & 2030 data)

Mobility

Relatively high population and employment levels for a primarily suburban corridor are reflected by the estimated trip characteristics observed within the project vicinity. In 2008, the average daily traffic (ADT) on IH 45 was approximately 131,320 vehicles per day (vpd). By 2038, the ADT is expected to grow to approximately 160,620 vpd. This growth represents an increase in traffic of approximately 22 percent over the next 30 years. During the peak hour, IH 45 would carry approximately 13,526 vehicles in 2008 and 16,544 vehicles by 2038. **Table 2** presents the current and predicted range of traffic volumes for the peak hour and ADT. **Table 3** presents vehicle fleet mix for peak hour traffic.

Table 2: Current and Predicted Traffic Volumes

Description	Number of Vehicles	
	Current Year (2008)	Design Year (2038)
ADT	131,320	160,620
Peak Hour	13,526	16,544

Source: H-GAC 2008

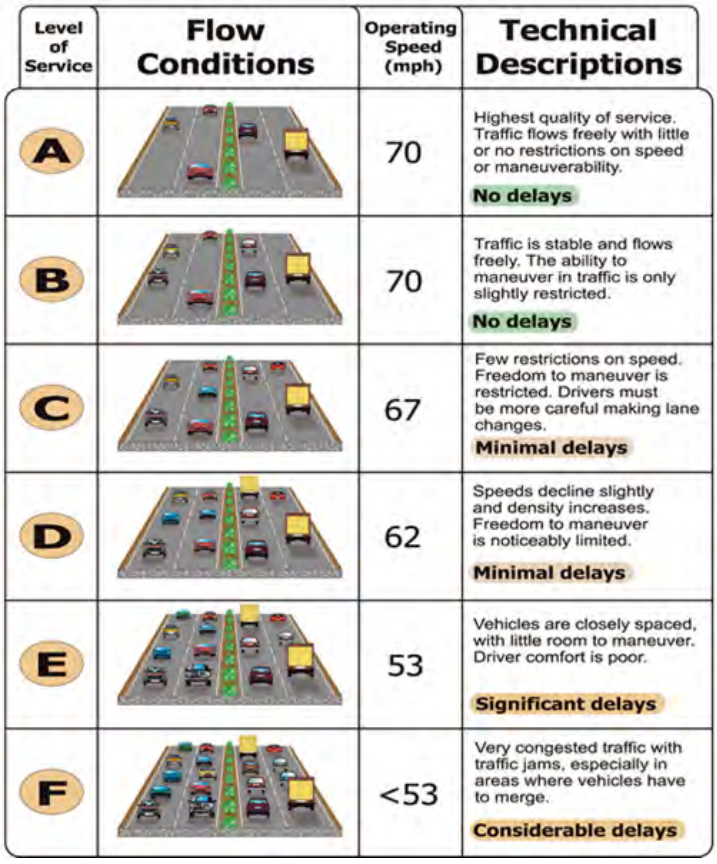
Table 3: Vehicle Fleet Mix for Peak Hour

Vehicle Type	Current Year (2008)	Design Year (2038)
Automobiles	12,651	15,816
Medium Trucks	304	381
Heavy Trucks	278	347

Source: H-GAC 2008

Level of Service (LOS) calculations were used to assess roadway operating conditions. LOS is a qualitative measure of the operating conditions of a traffic stream on a transportation facility (Transportation Research Board {TRB} 2000). There are six LOSs (A-F) defined for each type of facility. LOS A represents the free-flow or best operating conditions with no congestion, and LOS F denotes the forced-flow or worst operating conditions with heavy congestion. LOS D is considered an acceptable LOS, especially for urban areas such as the city of Houston. **Figure 1** illustrates the different LOSs.

Figure 1: Levels of Service for Freeways



Source: California Department of Transportation 2003

As shown in **Table 4**, the proposed facility currently operates at LOS D and is projected to operate at LOS F without the proposed roadway improvements. The determination of existing and projected traffic volume levels indicate that the main lane performance in 2027 will be slightly worse than it is under current traffic, but it will be substantially better than what it would be with no improvements.

Table 4: LOS Data

Location	Main Lane ADT (Northbound only)	K-factor [1]	D-factor [2]	Main Lane DDHV [3]	Percent Trucks	Vehicles/ Hour/ Lane	LOS
Existing 6 Main Lanes with 2007 Traffic							
FM 518 to FM 1764	42,038	10.3%	60.0%	5,196	2.00	1,732	D
Existing 6 Main Lanes with 2027 Traffic							
FM 518 to FM 1764	62,788	10.3%	60.0%	7,761	2.00	2,587	F
Proposed 8 Main Lanes with 2027 Traffic							
FM 518 to FM 1764	62,788	10.3%	60.0%	7,761	2.00	1,940	E

Source: TxDOT 2007

Note: Traffic data are for northbound main lanes between State Highway (SH) 646 and SH 96:

[1] K-factor = Proportion of the ADT expected to occur in the design hour

[2] D-factor = Peak directional volume (as percent DHV)

[3] DDHV = Directional Design Hourly Volume (DHV), the 30th highest hourly traffic volume in one direction for the design year commonly 20 years from the time of construction (i.e., 2027)

Safety

Travel safety is measured by the frequency of traffic accidents, which characterizes the conditions of many roadways. These roadways have a high number of intersections, traffic signals, and driveways, all of which may contribute to stop-and-go conditions, increased crash rates, and congestion during peak travel times and emergency events.

Accident rates along IH 45 were computed to determine the relative safety of the existing facility. Accident data collected by the Texas Department of Public Safety revealed that for the years 1999 to 2001 (most recent data available at time of analysis), accident rates along the project corridor, which represents both rural and urban characteristics, substantially exceeded statewide rural averages but did not exceed statewide urban averages. **Table 5** shows average accident rates for the project corridor and the state average of interstate highways. Overall, an average of 262 accidents (with an average ADT of 82,168 vehicles) along the project corridor was documented per year from 1999 through 2001.

Table 5: Accident Rates along IH 45

Roadway (FM 865)	1999	2000	2001	3-year Average
	Accident Rate [1]	Accident Rate [1]	Accident Rate [1]	Accident Rate [1]
IH 45				
FM 518 to FM 1764	86.9	86.2	98.8	90.6
State Average-Interstate Highways				
Rural	50.6	51.7	51.7	51.3
Urban	120.0	121.2	118.0	119.7

Source: TxDOT 2008

Note: [1] Accident rates express the number of accidents per 100 million vehicle miles traveled.

Although statewide accident rates appear to have remained relatively consistent over the observed three year period (1999 to 2001), accident rates along the project corridor have increased. According to the *IH 45 MIS*, historic traffic accident rates for IH 45 are generally higher than those recorded for other similar

roadways throughout the state of Texas. Unless improvements are made to the transportation system, safety will worsen as traffic increases along IH 45. Alternatives to address this issue included upgrading the existing facility's characteristics (i.e., additional travels lanes and protected left-turn lanes), which would result in a "safer" operating level. The proposed improvements to IH 45 would improve regional and local safety for the traveling public by minimizing conditions that contribute to stop-and-go conditions, increased crash rates, and congestion during peak travel times and emergency events.

Travel Patterns

Travel patterns within the study area reinforce the need to plan for improved roadway facilities. In 1990, trips remaining within the IH 45 South Corridor represented approximately 79 percent of the total trips generated by the corridor (TxDOT 1999). Only 21 percent of the total daily trips either left the corridor or entered the corridor from outside the project vicinity. However, this does not hold true for weekends and holidays when tourist attractions bring in a larger percentage of trips from outside the corridor. Overall, these travel patterns are expected to be maintained suggesting that regional travel facilities, such as IH 45, would continue to be used for shorter intra-corridor type trips as well as regional ones.

Travel demand exceeds capacity on a recurring basis during both of the daily commute periods, specifically near the northern end of the project. This demand causes severe congestion and bottlenecks along the IH 45 South Corridor (including locations at Beltway 8, Bay Area Boulevard, NASA Road 1, and FM 1959) and at inadequate driveway access points along the frontage roads. In the southern portion of the study area, seasonal recreational and special event directional demand exceeds capacity on a regular basis. This excess demand typically occurs during the weekends (morning travel to Galveston, beach communities, and opposing travel during evening) and is in addition to an underlying bi-directional travel commute demand between the cities of Galveston, La Marque, and Dickinson as well as Texas City. Furthermore, an excessive demand occurs between the mainland and the Port of Houston and other area attractions.

Hurricane Evacuation

Due to the facility's limited capacity, residents (generally located south of the study area), responding to warnings of approaching hurricanes, have experienced significant delays using the IH 45 South Corridor as a main evacuation route. Existing north-south roadways serving the corridor consist exclusively of IH 45 and SH 3. Evacuation from Galveston Island and the lower mainland is a concern during pre-storm conditions and emergency evacuations. Due to low elevation levels, emergency conditions are enhanced in the project vicinity due to flooding and congestion during weather of approaching storms. Flooding along IH 45 contributes to reduced highway capacity and increased levels of congestion. Other roadways, such as SH 146 and SH 6, provide limited relief to IH 45, which is a primary hurricane evacuation route. The Galveston Causeway on IH 45 provides the only access to Galveston Island from the lower mainland. When incidents obstruct the Causeway there are very limited alternatives routes, which results in a breakdown of the IH 45 freeway.

Purpose of the Proposed Project

The purpose of the proposed project is to expand capacity in order to enhance mobility and safety, address current and future traffic demand, and accommodate population and economic growth while minimizing adverse environmental effects. Therefore, the TxDOT–Houston District and FHWA propose to widen

IH 45 from FM 518 to FM 1764 in Galveston County, a distance of approximately 7.5 miles. The proposed expansion would consist of eight 12-foot main lanes (four in each direction) with two two-lane frontage road lanes (two 12-foot lanes in each direction). In some locations (such as at intersections and for driveway access), the frontage roads widen from two lanes to three lanes to four 12-foot lanes with left and right turning lanes. Grade-separated intersections are proposed at FM 518, Brittany Bay Boulevard (Future SH 96), FM 646, FM 517, Hughes Road, Holland Road, and FM 1764. A detailed description of the proposed project is included in Description of the Alternatives section. The overall goals of the proposed project are further discussed in the following:

- Expanded Capacity: The proposed project would address transportation demand, improve the LOS, reduce traffic congestion, and provide travel options.
- Safety: The proposed project would improve regional and local safety for the traveling public by minimizing conditions that contribute to stop-and-go conditions, increased crash rates, and congestion during peak travel times and emergency events.
- Economic Development: The proposed project would accommodate demographic and economic growth by improving the movement of persons and goods, thereby minimizing barriers between businesses, consumers, and transportation infrastructure.

Planning Process

Project Background

TxDOT initiated a MIS in February 1998 to identify and evaluate potential transportation improvements for the IH 45 South Corridor from Beltway 8 in Harris County to 61st Street in Galveston County. The MIS resulted in a recommended Preferred Alternative (the proposed project) that addressed the identified transportation needs and established priorities for potential future projects in the study area. Consensus was assured by establishing a range of agency, business, and public representatives, including the study's steering and municipal advisory committees, corridor stakeholders, and incorporating active public participation into the study process. A series of formal and informal meetings; the distribution of a newsletter with detailed information about the meetings, venues, and agendas; press releases; an internet website; and several other efforts achieved public involvement and interaction. For guidance and assistance in the study, technical and advisory committees were formed by TxDOT to provide ideas and solicit feedback at regular meetings held during the entire MIS. The committees assisted in the refinement of the goals and objectives for the MIS. The August 1999 *IH 45 South Corridor Major Investment Study: Final Report* is available at the TxDOT–Houston District Office and the MIS Executive Summary can be found in **Appendix A** of this EA. Specific objectives of the *IH 45 South Corridor MIS* included:

- Be consistent with regional highway, thoroughfare, and transit plans within the region
- Improve the evacuation capability of SH 3, SH 146, and SH 6 within the corridor
- Reduce or minimize any adverse impacts the transportation project may have on air quality and noise

The MIS is a planning tool used to evaluate possible transportation investments for meeting transportation needs. The MIS process involves defining mobility needs, considering multi-modal options, and scoping

out a transportation-planning project to focus on specific alternatives and their social, economic, and environmental impacts. The MIS results in a recommendation about the prudent investment of resources, which are then incorporated into the community's long-term land use and transportation planning process.

For the *IH 45 South Corridor MIS*, the following five goals were identified:

Goal 1. Reduce Traffic Congestion

Goal 2. Improve Hurricane Evacuation

Goal 3. Improve Safety

Goal 4. Provide Travel Options

Goal 5. Protect Natural and Social Environment

In addition to identifying needs and deficiencies, the MIS addressed three segments of the IH 45 South Corridor: north, middle, and south. The corridor's middle section extends from FM 518 to the "Texas City Wye" (the intersection of SH 6, IH 45, and Loop 197). Only a portion of the middle section from FM 518 to FM 1764 is the focus of this EA. A map depicting the project location is shown in **Exhibit 1**. The other two segments extend from Beltway 8 to FM 518 (north section) and from the "Texas City Wye" to Galveston (south section).

Project Funding

On August 24, 2007, the Houston-Galveston Area Council (H-GAC) adopted the 2035 Regional Transportation Plan (RTP) and Fiscal Year (FY) 2008-2011 Transportation Improvement Program (TIP). The U.S. Department of Transportation (USDOT, which includes FHWA/FTA) found the 2035 RTP and 2008-2011 TIP to conform to the State Implementation Plan (SIP) on November 9, 2007. The widening of IH 45 from FM 518 to FM 1764 (CSJs: 0500-04-096 and 0500-04-106) is listed in the 2035 RTP and is included in **Appendix D** (page D-63) of the 2008-2011 TIP.

Funding for the project would be through federal (80 percent) and state/local (20 percent) sources. The proposed improvements are Funding Category 2 (Metropolitan Area Corridor Projects). Estimated costs for construction of the proposed project are shown in **Table 6**.

Table 6: Proposed Improvement Cost Estimates

Alternative	IH 45 Widening Improvements		Total*
	FM 518 to FM 517	FM 517 to FM 1764	
	CSJ: 0500-04-096	CSJ: 0500-04-106	
Build Alternative	$132,000,000	$52,200,000	$184,200,000

Source: TxDOT 2008-2011 TIP, 2007
Note: * Dollars spent on ROW acquisition are not included.

Tolling

This project is being developed as a non-toll facility.

Public Involvement

MIS Planning Phase

TxDOT has been engaging the public since the beginning of the MIS process for the IH 45 South Corridor, in February 1998. Early in the MIS process, TxDOT adopted and initiated a Public Involvement Program (PIP) to offer the public a variety of formal and informal opportunities to interact with the MIS and the involved technical staff. Open house public meetings were the primary public involvement technique used to encourage the participation of agencies, businesses, public representatives, and concerned citizens. Regular meetings of a municipal advisory committee, presentations to community groups, and solicitations of written comments were used to gather input. Four series of public meetings were held during the MIS for a total of nine individual meetings:

- The first series of public meetings was held April 28, 29, and 30, 1998. These meetings gave the public an opportunity to provide input about transportation problems and needs within the IH 45 South Corridor. Public comments from this meeting helped the MIS team establish its corridor goals and objectives.
- The second series of public meetings was held September 15 and 16, 1998. Public input at these meetings was used to develop a range of conceptual alternatives and to help narrow the concepts to six viable alternatives for addressing corridor needs.
- The third series of public meetings was held March 23 and 24, 1999. These meetings gave the public an opportunity to comment on the six viable alternatives, which emerged from the MIS and earlier public comment. Public input from these meetings was used in the selection of a Preferred Alternative.
- The fourth series of public meetings was held June 22 and 23, 1999. These meetings gave the public an opportunity to comment on the recommended Preferred Alternative proposed by TxDOT. Public input from these meetings was used by decision-makers in finalizing plans for the IH 45 South Corridor.

Additionally, over 22,000 individual pieces of literature were distributed throughout the IH 45 South Corridor during the conduct of the MIS. Prior to each series of public meetings, several outreach activities were conducted including:

- Distributing a newsletter with detailed information about the meetings, venues, and agendas
- Informing residents about the meetings through press releases, fliers, and notices distributed to homes, libraries, civic centers, and vehicle windshields at corridor park-and-ride facilities, etc.
- Placing public notices and advertisements in the major Corridor newspapers
- Maintaining a continuously accessible TxDOT website about the *IH 45 South Corridor MIS*

In addition to the formal public meetings, numerous presentations were made to community groups, including Bay Area Transportation Partnership (formerly, Clear Lake Transportation Partnership); Galveston Rotary Club; Galveston City Council; NASA Senior Managers; Elected Officials State of the

Counties Forum (Brazoria, Galveston, and Houston Counties); Clear Lake Neighborhood Associations; and American Highway Defense Association.

Presentations to such groups typically included a brief slide-show presentation, display boards, and a question and answer session. In all, over 800 people attended the various small-group presentations facilitated by TxDOT over the life of the MIS.

Overall, the PIP initiated in support of the *IH 45 South Corridor MIS* was developed to provide a proactive means for developing and incorporating public participation in the study. Public participants were consulted for their opinions, preferences, and needs with regards to mobility needs, problems, alternative concepts, and evaluation procedures proposed for the corridor. Comments received during the public involvement process (both formal and informal) were integrated into the development of the recommended Preferred Alternative. Examples of this integration include:

- Development of the documented problems and needs based on public comment from the first series of meetings
- Inclusion of a reversible lane concept on the future Causeway based on comment received at the second and third series of public meetings
- Inclusion of a bicycle facility along SH 3 based on comments received from stakeholders and the Municipal Advisory Committee

The success of the PIP was voiced by many participants as an open, proactive process, one that matched the magnitude and importance of the *IH 45 South Corridor MIS*.

NEPA Planning Phase

The purpose of public involvement activities during the NEPA planning process was to ensure that every reasonable opportunity to participate was made available to interested citizens, civic groups, organizations, and public officials. Since initiation of the proposed project, TxDOT has maintained a public involvement effort for the project, including conducting a public meeting. TxDOT followed federally approved Technical Advisory Committee (TAC) public involvement procedures and policy's based on 43 TAC Sections 2.5 through 2.9 and 23 CFR Part 771.111. A public meeting was conducted in an open house format to inform the public of the proposed project and to gather feedback. The meeting was held on May 19, 2005 at the following location:

Victory Lakes Intermediate School
2880 West Walker
League City, Texas 77573

Preparation for the May 2005 public meeting included published announcements/notices in local newspapers, including a Spanish publication, *La Subasta*, which informed citizens of the opportunity to request an interpreter (for language or other special communication needs) to be present at the public meeting. Copies of the public meeting notice were also mailed to adjacent property owners and elected/public officials. The public meeting notice was published in the following papers:

1. *Houston Chronicle* – Notice published April 19 and May 9, 2005

2. *Galveston County Daily News* – Notice published April 19 and May 9, 2005
3. *La Subasta* – Notice published April 20 and May 4, 2005

A total of 38 citizens and five public officials registered at the meeting, which was held from 6:00 p.m. to 8:00 p.m. Plans, maps, and exhibits illustrating the proposed improvements were displayed for public review and comment at the meeting. These illustrations included the conceptual design plan depicting the layout of the TxDOT project and maps depicting the project location and environmental constraints. Copies of the TxDOT Relocation Assistance Booklet, TxDOT State Purchase of ROW Booklet, and handouts providing a description of the proposed project were also available. TxDOT and other project personnel knowledgeable about the proposed project were available at the exhibit areas to discuss comments and questions posed by the citizens.

Of the 43 individuals that attended the public meeting, two comments were received from public/agency officials and four comments were received from citizens, businesses owners, and other interested parties. Issues of concern included impacts to businesses on IH 45 and maintaining access to the businesses; traffic congestion; noise; future development; and comments regarding the bridge design to accommodate increased flow resulting for the U.S. Army Corps of Engineers (USACE) Clear Creek project. All written comments, letters, comment forms, and/or verbal comments from the public involvement have been reviewed and thoroughly analyzed, and additional analyses have been conducted and included as a result of this outreach.

The May 2005 *Public Meeting Summary* is available at the TxDOT–Houston District Office and can be found in **Appendix B** of this EA. Information presented at the public meeting, including the conceptual design plan and the EA, have also been available at the District Office for public review and inspection.

Overall, public input during the NEPA planning phase as well as the MIS PIP was used in finalizing plans for the recommended Preferred Alternative.

Related Studies

The following documents and studies are relevant to the proposed project:

- TxDOT completed an MIS in August of 1999 to evaluate transportation needs and assess the most efficient investment to meet these needs. A copy of the MIS Executive Summary is included in **Appendix A**.
- Other EAs are being prepared to assess effects from proposed improvements to the other segments of the IH 45 South Corridor.
- An "Environmental Assessment for a Bridge Replacement for IH 45 Galveston Causeway (CSJ: 0500-01-117)," was prepared in November 2002; the FHWA issued a Finding of No Significant Impact (FONSI) on January 23, 2003.
- Segment A of the Grand Parkway (SH 99) is planned from IH 45 to SH 146 in Galveston County (CSJ: 3510-01-002). An environmental study of possible alternatives is ongoing. Each of the proposed alternative alignments intersects IH 45 between SH 96 and FM 517. Letting for this project is estimated to occur in 2012.

- Segment B of the Grand Parkway (SH 99) is a planned highway from SH 288 to IH 45 through Brazoria and Galveston Counties (CSJs: 3510-02-001 and 3510-01-001). An environmental study of possible alternatives is ongoing. Each of the proposed alternative alignments intersects IH 45 between SH 96 and FM 517. Letting for this project is estimated to occur between 2009 and 2012.
- H-GAC completed the Draft FM 518 Corridor Access Management Plan in September 2004. The plan involved a study of FM 518 between SH 288 and IH 45 to identify measures that will improve safety and traffic flow, reduce motorist delay, improve air quality, and enhance bicycle and pedestrian access (H-GAC 2004a).

Agency Coordination and Consultation

The study team began early agency coordination in October 2003. A letter was sent to the following agencies: U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (USEPA), National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries), U.S. Coast Guard (USCG), Texas General Land Office (TGLO), Texas Parks and Wildlife Department (TPWD), Texas Commission on Environmental Quality (TCEQ), H-GAC, Metropolitan Transit Authority of Harris County (METRO), city of Houston, Galveston County, Texas City, city of Dickinson, League City, city of La Marque, Harris-Galveston Coastal Subsidence District, Galveston County Consolidated Drainage District, Waters Davis Soil and Water Conservation District, and Galveston County Historical Commission. These agencies were asked to provide information that would help the study team better evaluate potential effects to the natural and human environment. Copies of the early agency coordination letters and responses received are presented in **Appendix C**. The following agencies responded to early coordination:

- USFWS stated that no federally listed or proposed threatened or endangered species are likely to occur within the study area.
- METRO indicated they do not have service or any existing facilities within the proposed project limits.
- TPWD stated the following:
  - Revegetate disturbed areas of ROW with native grasses and forbs as much as possible and avoid the use of Bermuda grass.
  - Avoid clearing old timber and mature, native trees. TPWD generally requires a 3:1 ratio for replacement of the trees with an 80 percent survival rate.
  - Removed riparian vegetation should leave the root systems intact to reduce erosion, and this method is endorsed by FHWA.
  - Construction activities (including clearing and grubbing) should occur outside the April 1 to July 15 migratory bird nesting season and the site should be surveyed for migratory bird nesting sites prior to construction or future maintenance activities.
  - Construction activities should be excluded from a minimum zone of 100 meters around any raptor nest during the period of February 1 to July 15.

Congestion Management System

As required in 23 CFR 460.320 (b), no additional single occupancy vehicle (SOV) capacity may be built in a Transportation Management Area (TMA) within a nonattainment area unless the project complies with a Congestion Management System (CMS). The CMS is a systematic process for managing congestion that provides information on transportation system performance and on alternative strategies for alleviating congestion and enhancing the mobility of persons and goods to levels that meet state and local needs. This project was developed in accordance with H-GAC's operational CMS Plan, which meets all requirements of 23 CFR 500.109. The CMS was adopted by H-GAC in October 1997 and has been revised in December 1997, May 1998, and June 2005 (H-GAC 1997).

A congestion mitigation analysis (CMA) report for the IH 45 South Corridor from Beltway 8 in Harris County to 61st Street (including IH 45 and SH 3) in Galveston County was prepared in June 1999 (**Appendix D**), in conjunction with the *IH 45 South Corridor MIS* dated August 1999. Based on the findings of the analyses, by year 2020, Levels of Mobility (LOM) within the corridor are projected to deteriorate enough to justify added capacity. Implementation of planned and expanded Transportation Control Measures (TCM) within the corridor, such as regional computerized traffic signal system (RCTSS), traffic signal improvements, expanded automated traffic management systems (ATMS), and expanded park-and-ride facilities and services, would not provide sufficient relief of congestion to negate the need for additional capacity. The result of this analysis also suggests that implementation TCMs on the IH 45 South Corridor have a significant degree of impact on the congestion mitigation.

The CMS Plan stipulates that the implementing agencies must demonstrate their commitment to construction of any TCMs identified as having significant impact to the traffic flow within a candidate roadway project. The H-GAC requires a Letter of Commitment, which would include a firm assurance that the implementing agencies will execute these TCM projects along with or incremental to the added capacity project. It can be concluded that the widening of the IH 45 South Corridor is consistent with H-GAC's operational CMS Plan and is contingent to the considerations discussed in the CMA report. The MIS Steering Committee, compromised of representatives from regional funding agencies, concurred with this finding.

Furthermore, the final rule for Statewide and Metropolitan Planning Regulations was issued in the *Federal Register* (Volume 72, Number 30) on February 14, 2007. This final rule "revises the regulations governing the development of metropolitan transportation plans and programs for urbanized areas, State transportation plans and programs and the regulations for Congestion Management Systems" to be consistent with current statutory requirements (USDOT 2007). The revised Statewide and Metropolitan Planning regulations now reflect requirements for a Congestion Management Process (CMP) rather than a CMS. The CMP refers to several methods of roadway management including Intelligent Transportation Systems (ITS), Transportation System Management (TSM), and Travel Demand Management (TDM). These programs seek to improve traffic flow and safety through better operation and management of transportation facilities while also providing low cost solutions that can be constructed in less time and provide air quality benefits to the region. Although a CMP has not yet been adopted by the H-GAC, the program is in development following FHWA guidance to integrate the area's CMS into the CMP. Until H-GAC adopts a CMP, this section of the EA reflects the most recently adopted CMS and its provisions.

CHAPTER 2. DESCRIPTION OF THE ALTERNATIVES

TxDOT considered several conceptual alternatives using a systematic, interdisciplinary approach. This approach focused on input from the public as well as resource agencies during the MIS phase and the NEPA planning phase of the proposed project. The reasonable alternatives that were considered included those that satisfied the need for and purpose of the proposed project while minimizing potential effects to the environment. These alternatives were further evaluated based on determining an alignment that used the existing roadway as a portion of any future facility to maximize the existing resources and minimize adverse environmental effects, construction costs, utility adjustments, community disruptions, and ROW acquisitions. The range of alternatives considered by TxDOT is documented in the MIS. A copy of the MIS Executive Summary is included in **Appendix A**. The alternatives considered in this document are presented below.

No Build Alternative

The No Build Alternative would leave the existing facility as is; it would remain a mixed rural and urban facility. Normal routine maintenance would continue and all other pending, previously authorized actions would proceed as long as they do not require additional travel lanes. Typical maintenance activities under this alternative would include inspections of the roadway and bridges, minor rehabilitations, pavement edge repair, seal coats and overlays, and other activities such as striping, signing, and patchwork.

Although the No Build Alternative does not meet the need and purpose for the project, it is retained as a basis for comparison with the Build Alternative carried forward for detailed study as required by CEQ regulations (40 CFR 1502.14(d)).

- Existing Facility: The proposed project is approximately 7.5 miles in length. Currently IH 45 consists of six 12-foot travel lanes (three in each direction) with two- to three-lane one-way frontage roads. The existing ROW is approximately 300 feet wide from FM 518 to Holland Road and approximately 380 feet wide from Holland Road to FM 1764. Grade-separated intersections are found at FM 518, Calder Drive, FM 646, FM 517, Hughes Road, Holland Road, and FM 1764.

Build Alternative

The Build Alternative would consist of widening the existing facility to eight 12-foot main lanes (four in each direction) with two 12-foot frontage road lanes in each direction. In some locations (such as at intersections and for driveway access) the frontage roads would widen from two lanes to three to four 12-foot lanes with left and right turning lanes. The proposed ROW would consist of approximately 320 feet from FM 518 to Holland Road and would remain approximately 380 feet from Holland Road to FM 1764. IH 45 would have grade-separated intersections at FM 518, Brittany Bay Boulevard (Future SH 96), FM 646, FM 517, Hughes Road, Holland Road, and FM 1764. The proposed typical sections of the roadway are shown in **Exhibit 3**.

CHAPTER 3. AFFECTED ENVIRONMENT AND IMPACTS

Socioeconomic Data

Population Trends

The communities within the study area affected by the proposed project include the cities of Dickinson, League City, and Texas City. Over a 10-year period from 1990 to 2000, growth patterns in the study area jurisdictions ranged from a significant population increase in Dickinson and League City (80.0 and 50.7 percent, respectably) to a more moderate increase in Galveston County (15.1 percent) (see **Table 7**). By 2030, it is projected that the increase in population within these communities will begin to slow. In Dickinson, the 2030 population is projected at 23,888 persons, representing a 19.7 percent increase between 2010 and 2030. In League City, the 2030 population is projected at 64,683 persons, representing a 20.8 percent increase between 2010 and 2030. A smaller increase in population is projected within Texas City, representing a 1.2 percent increase between 2010 and 2030.

Table 7: Population Trends

Area	Population					
	1980 Census	1990 Census	2000 Census	2010 Projection	2020 Projection	2030 Projection
Dickinson	7,505	9,497	17,093	19,955	22,425	23,888
League City	16,575	30,159	45,444	53,546	60,539	64,683
Texas City	40,878	40,822	41,521	41,891	42,211	42,400
Galveston County	195,738	217,399	250,158	268,714	284,731	294,218
	Percent Change					
	1980-1990	1990-2000	2000-2010	2010-2020	2010-2030	
Dickinson	26.5	80.0	16.7	12.4	19.7	
League City	82.0	50.7	17.8	13.1	20.8	
Texas City	-0.1	1.7	0.9	0.8	1.2	
Galveston County	11.0	15.1	7.4	6.0	9.5	

Source: U.S. Census Bureau (1980, 1990a/b, and 2000 data) and Texas Water Development Board (2010, 2020, and 2030 data)

Employment and Income Data

In 2000, Galveston County had over 118,200 full and part-time jobs (U.S. Bureau of Economic Analysis {BEA} 2003). Employment growth has been steady over the past two decades with an average annual compounded growth rate of 1.7 percent. Total employment is projected to continue at an average annual compounded rate of 1.9 percent (H-GAC 2004c). Planned employment growth within the study area will occur with development of the Bay Colony Town Center and Victory Lakes near FM 646.

In 2000, the major employment sectors in Galveston County were services (26 percent), government (25 percent), and trade (21 percent) (BEA 2003). The largest single employer within the study area is the Gulf Greyhound Park with over 890 employees (Texas A&M University {TAMU} 2003). Beyond the study area but within Galveston County, many major employers are associated with the aerospace industry or petrochemical companies (Bay Area Houston Economic Partnership 2003; TAMU 2003). Unemployment

trends for the Galveston-Texas City Primary Metropolitan Statistical Area (PMSA) generally follow state trends. Per capita personal income in Galveston County has also followed statewide trends.

Housing and Vacancy

Housing types range from apartments and small single-family residences to large custom-built homes. Housing is more concentrated in residential subdivisions behind the commercial development. **Table 8** presents housing unit characteristics. Between 1980 and 2000, Galveston County permitted over 37,900 new dwelling units, of which 72 percent were for single-family homes and 28 percent were for multi-family units (TAMU 2003). Within the cities in the study area, League City had the greatest increase in total housing units between 1990 and 2000 (U.S. Census Bureau 1990a/b and 2000). Neither the proposed project nor the No Build Alternative would affect availability of housing or housing characteristics.

Table 8: Housing Unit Characteristics

Characteristic	Dickinson	League City	Texas City	Galveston County
Total Housing Units	6,556	17,280	16,715	111,733
Median Year Built	1975	1986	1967	1974
Number of Occupied units	6,162	16,189	15,479	94,782
Owner-occupied	67%	77%	63%	66%
Renter-occupied	33%	23%	37%	34%
Median rent of renter-occupied units	$464	$673	$440	$477
Median value of owner-occupied units	$83,400	$112,000	$63,800	$85,200
Vacant units	394	1,091	1,236	16,951
Vacancy rate	6%	6%	7%	15%

Source: U.S. Census Bureau 2000

Tax Base and Land Value

The proposed project would result in the potential relocation of one business (Blockbuster Video, located along the northbound frontage road of IH 45, south of FM 518). It is likely that these businesses would relocate within the local community, and therefore the proposed project would not likely result in jobs lost. A minimal amount of land (approximately 11.3 acres) would be removed from the local tax base. Beneficial effects to highway-related businesses may occur with projected increased traffic levels. Some of the highway-related businesses may be sensitive to temporary construction impacts such as changes in access that would make reaching the businesses less convenient. The improvements associated with the proposed project would result in little to no change in the value of adjacent properties.

Under the No Build Alternative, there would be no acquisition or relocation of businesses. The No Build Alternative would not alter travel patterns or accessibility. With projected increased traffic levels, the No Build Alternative could hinder growth and have a long-term effect on businesses, and therefore negative effects to the local tax base.

Community Cohesion

The proposed project would follow the existing alignment of IH 45 and therefore would not introduce new social barriers between groups of people. Improved accessibility resulting from decreased congestion and increased safety on the roadway would enhance the potential for cohesion among communities. The

improvement of frontage roads would improve the circulation of local traffic and minimize the interaction between local and regional traffic.

No changes to community cohesion are anticipated with the No Build Alternative; however, current barriers to community cohesion resulting from traffic congestion would be perpetuated through the continued use of the existing roadway by regional through traffic.

Right-of-Way / Displacements

The implementation of the proposed project would acquire approximately 11.3 acres of additional ROW. The ROW acquisition for the proposed project would require residential, commercial, and recreational property. However, no residences would be displaced as a result of the proposed project and no ROW would be acquired from any parkland or cemeteries. **Table 9** describes potential displacements associated with the proposed project. No farmland or farm-related improvements, including barns, outbuildings, fencing, terraces, and ponds would be affected. The No Build Alternative would neither alter the existing ROW nor generate any residential or commercial displacements.

Table 9: Displacements Associated with the Proposed Project

Name	Location and Description
Strip Center	This strip center is located at the southwest corner of FM 518 and IH 45. It is likely that only the northernmost end of the strip center would be affected and the remainder of the building would remain intact.
Gulfway Texaco	This gas station is located at the southeast corner of FM 518 and IH 45. The pumps and underground storage tanks may be affected.
Blockbuster Video	This business is located along the northbound frontage road of IH 45, south of FM 518. The proposed ROW would clip the western corner of this structure. It is possible that the entire structure would be displaced.
Go-Kart Track	This facility is located along the northbound frontage road of IH 45, north of Dickinson Bayou. A portion of the go-kart track would be affected.
Boat dock	This residential boat dock structure is located along northbound frontage road of IH 45, on the south bank of Dickinson Bayou. It is likely that this structure could be relocated within the parcel.

Source: Study Team 2008

The adjustment or relocation of several utilities (including water lines, telephone cables, electrical lines, and other subterranean and aerial utilities) may be necessary and would be handled so that no substantial interruptions in service would occur. The precise location of the utilities was not determined during this study. Utility providers located within the study area include Southwestern Bell and other competitors who are responsible for providing telephone services. Centerpoint Energy and its competitors provide electricity and gas. The public water system is an approved system in compliance with federal and state rules. Water and wastewater services are available from the cities of Dickinson and La Marque as well as League City and Texas City.

History of the Project's ROW

IH 45 construction projects show that most of the existing ROW along the proposed project was acquired prior to 1970 and the Uniform Relocation Assistance and Real Property Acquisition Act (URARPAA). The original roadway, with limits as discussed in this EA, was constructed in the early 1950s.

Compliance with Uniform Relocation Assistance and Real Property Acquisition Act Policies of 1970 and Other Applicable Standards

The URARPAA requires that comparable, decent, safe, and sanitary replacement housing within a person's financial means be made available to all affected residents. The state's Relocation Assistance Program would be available to all individuals, families, businesses, farmers, ranchers, and nonprofit organizations displaced as a result of the proposed project. Acquisitions of businesses and residential relocations would be conducted in accordance with the URARPAA, as amended in 1987. Relocation assistance would be made available to all businesses and residences without discrimination, which is consistent with the requirements of the Civil Rights Act of 1964 and the Housing and Urban Development Amendment of 1974.

Environmental Justice

It is important to take into consideration the effects that the proposed project would have on minority and low-income groups. The effects on these groups are supported by several federal laws and regulations that require the evaluation of the effects of a transportation action on these communities that, historically, have not actively participated in the decision-making process.

Background

Title VI of the Civil Rights Act of 1964 and related statutes require that federal agencies ensure that no person is excluded from participation in, denied the benefit of, or subjected to discrimination under any program or activity that receives federal financial assistance on the basis of race, color, national origin, age, sex, disability, or religion.

The need to identify minority and low-income populations and include them in the project's decision-making process gained greater emphasis as a result of Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994). This order directs all federal agencies to determine whether a proposed action would have a disproportionately high and adverse impact on minority and/or low-income populations. It also requires consideration of whether these populations would share equally in the benefits of the proposed action.

Environmental justice refers to the equitable treatment of people of all races, cultures, and income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Implementation of environmental justice regulations for highway projects is governed by the 1997 USDOT *Order on Environmental Justice to Address Environmental Justice in Minority Populations and Low-Income Populations* (DOT Order 5610.2). The environmental justice guidance particularly emphasizes the importance of the NEPA public participation process, directing that "each federal agency shall provide opportunities for community input in the NEPA process." Agencies are further directed to "identify potential effects and mitigation measures in consultation with affected communities, and improve the accessibility of meetings, crucial documents, and notices." The FHWA guidelines regarding environmental justice are contained in *FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (FHWA 1998). This publication requires all programs and activities of FHWA to comply with Executive Order 12898 and DOT Order 5610.2.

There are three fundamental environmental justice principals that are to be considered in the application of this FHWA order:

- To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations
- To ensure the full and fair participation by all potentially affected communities in the decision-making process
- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations

For purposes of environmental justice, the USDOT defines "minority" as those persons identifying themselves as: Black or African American, American Indian and Alaska Native, Native Hawaiian and other Pacific Islander, Asian, Hispanic, or other non-white persons, including those persons of two or more races. Furthermore, the Department of Health and Human Services (DHHS) defines the poverty threshold (median household income) for low-income populations for a family of four in 2008 as $21,200 (DHHS 2008). "Low-income" is defined as persons with a median household income at or below the DHHS poverty guidelines. The data being examined in this report are the most recent available for the U.S. Census Bureau (1999), although the current poverty threshold is used for comparison. The 1999 poverty threshold was $16,700. The emphasis on populations in DOT guidance means that all populations should be identified and given meaningful opportunities for input and that impacts to these populations should be evaluated and compared to the impacts to non-environmental justice populations. The presence of environmental justice populations or impacts to those populations does not inherently establish disproportionality.

According to FHWA Order 6640.23 and DOT Order 5610.2, disproportionately high and adverse effects on minority or low-income populations are generally defined an adverse effect that is predominantly borne by a minority population and/or low-income population; or would be suffered by the minority population and/or low-income population. Furthermore, the adverse effect is appreciably more severe or greater in magnitude than the adverse effect that would be suffered by the non-minority population and/or non-low-income population (FHWA 1998, USDOT 1997).

The environmental justice methodology relies upon a combination of U.S. Census data, input from citizens and local officials, and windshield surveys to identify impacts to environmental justice populations. Locations of environmental justice populations were identified early in the project development process to facilitate avoidance and minimization of adverse impacts. Demographic characteristics pertaining to race and income for the project demographic study area were collected from the U.S. Census 2000 databases and are identified in **Table 10** and **Table 11**.

Identification of Environmental Justice Populations

Census Block Groups are the smallest Census data unit for which all parameters needed to conduct an environmental justice assessment are available. However, race and ethnicity is available at the Census Block level. These data combined with observations from public outreach and coordination enabled the assessment of community-level racial and ethnic composition.

Minority Populations: The proposed project encompasses a total of 117 blocks adjacent to or within 2,000 feet of the proposed project, which represents the demographic study area for minority populations. The racial and ethnic composition of the demographic area was examined in order to identify the presence or absence of minority populations in the vicinity of the project.

Table 10 shows the racial/ethnic composition of each Census Block within the demographic area and the corresponding Census Block Group in which each block is located. The 117 blocks are located within a total of 17 block groups. The white population within the entire demographic area is 66.6 percent, which is slightly lower than the 17 block group area (70.5 percent). Within the entire demographic area,

- The minority population ranges from approximately 8.0 percent in the area west of IH 45, just south of Clear Creek (Census Tract 7233, Block Group 3), to 60.6 percent in the area east of IH 45, just north of Clear Creek (Census Tract 7209, Block Group 4).
- Census Tract 7209, Block Group 4 has the largest percentage of minority populations (60.6 percent) and the largest Hispanic population of 37.0 percent.
- Census Tract 7219, Block Group 1, east of IH 45 near the end of the project, has the second largest minority population of 51.1 percent.
- Census Tract 7205, Block Group 3, west of IH 45 near the beginning of the project, has the second largest Hispanic population of 28.6 percent.
- Census Tract 7233, Block Group 3 has the largest white population (92.0 percent) within the demographic study area.

Exhibit 4a shows the density of minority populations throughout the demographic study area.

Table 10: Minority Populations

Geographic Area	Total Pop.	Not Hispanic or Latino							% Hispanic or Latino of Any Race	% Total Minority Pop.
		% White	% Black/ African America	% AIAN*	% Asian	% NHPI*	% Other Race	% Two or More Races		
Block Area [1]										
Blocks within Block Group 2 (Census Tract 7205)										
2000	71	84.5	0.0	0.0	0.0	0.0	0.0	0.0	15.5	15.5
2001	281	89.3	2.8	0.0	0.7	0.0	0.0	0.7	6.4	10.7
2004	59	84.7	0.0	0.0	6.8	0.0	0.0	0.0	8.5	15.3
2005	64	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	43	93.0	0.0	0.0	4.7	0.0	0.0	0.0	2.3	7.0
2007	58	91.4	0.0	0.0	0.0	0.0	0.0	0.0	8.6	8.6
2008	12	75.0	0.0	0.0	16.7	0.0	0.0	0.0	8.3	25.0
2009	41	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Block Total	*629*	*90.3*	*1.3*	*0.0*	*1.6*	*0.0*	*0.0*	*0.3*	*6.5*	*9.7*
Block Group Total	*1,581*	*85.4*	*2.4*	*0.2*	*3.0*	*0.0*	*0.3*	*1.4*	*7.3*	*14.6*
Blocks within Block Group 3 (Census Tract 7205)										
3000	508	73.6	4.5	0.2	1.8	0.0	0.2	1.0	18.7	26.4
3001	64	89.1	0.0	0.0	4.7	0.0	0.0	0.0	6.3	10.9
3002	61	83.6	0.0	0.0	3.3	0.0	0.0	0.0	13.1	16.4
3003	51	82.4	5.9	0.0	0.0	0.0	0.0	0.0	11.8	17.6

3015	108	34.3	14.8	0.9	0.0	0.0	0.0	0.0	50.0	65.7
3016	121	33.1	12.4	0.0	3.3	0.8	0.0	0.8	49.6	66.9
3017	116	64.7	9.5	0.0	4.3	0.0	0.0	0.0	21.6	35.3
3018	135	34.8	8.9	0.0	1.5	0.0	0.0	5.9	48.9	65.2
3019	140	44.3	16.4	0.0	0.0	0.0	0.0	0.0	39.3	55.7
Block Total	*1,304*	*60.2*	*7.9*	*0.2*	*1.9*	*0.1*	*0.1*	*1.1*	*28.6*	*39.8*
Block Group Total	*2,189*	*70.2*	*5.6*	*0.2*	*1.7*	*0.1*	*0.0*	*1.2*	*20.9*	*29.8*
Blocks within Block Group 4 (Census Tract 7205)										
4000	106	85.8	3.8	1.9	0.9	0.0	0.0	0.0	7.5	14.2
Block Total	*106*	*85.8*	*3.8*	*1.9*	*0.9*	*0.0*	*0.0*	*0.0*	*7.5*	*14.2*
Block Group Total	*2,971*	*71.3*	*7.0*	*0.7*	*4.4*	*0.0*	*0.5*	*1.0*	*15.1*	*28.7*
Blocks within Block Group 6 (Census Tract 7205)										
6000	231	54.1	10.8	0.0	2.6	0.0	0.0	1.7	30.7	45.9
6001	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6002	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6003	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6004	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6005	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6006	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6026	846	76.1	4.7	0.2	4.1	0.0	0.0	1.9	12.9	23.9
Block Total	*1,077*	*71.4*	*6.0*	*0.2*	*3.8*	*0.0*	*0.0*	*1.9*	*16.7*	*28.6*
Block Group Total	*3,130*	*71.9*	*7.6*	*0.3*	*5.7*	*0.0*	*0.2*	*1.5*	*12.8*	*28.1*
Blocks within Block Group 1 (Census Tract 7206)										
1000	19	73.7	0.0	0.0	0.0	0.0	0.0	0.0	26.3	26.3
1001	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1002	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1003	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1073	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1074	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1075	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1076	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1077	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1078	20	50.0	0.0	0.0	40.0	0.0	0.0	0.0	10.0	50.0
1082	342	71.6	9.9	0.0	3.5	0.0	0.0	1.8	13.2	28.4
1083	66	92.4	0.0	0.0	0.0	0.0	0.0	0.0	7.6	7.6
1089	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1090	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1091	509	28.5	39.3	0.2	0.4	0.0	0.0	2.4	29.3	71.5
1092	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1093	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1094	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

1095	5	40.0	0.0	0.0	0.0	0.0	0.0	40.0	20.0	60.0
1096	368	48.9	18.2	0.8	2.4	0.0	0.0	3.5	26.1	51.1
1097	27	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1098	89	89.9	0.0	0.0	1.1	0.0	0.0	2.2	6.7	10.1
1099	237	80.2	4.2	0.4	3.8	0.0	0.0	2.1	9.3	19.8
Block Total	*1,683*	*56.7*	*18.5*	*0.3*	*2.4*	*0.0*	*0.0*	*2.4*	*19.7*	*43.3*
Block Group Total	*3,406*	*69.0*	*11.1*	*0.2*	*2.5*	*0.0*	*0.0*	*1.9*	*15.3*	*31.0*
Blocks within Block Group 1 (Census Tract 7207)										
1001	454	65.4	11.2	0.0	3.7	0.4	0.0	4.0	15.2	34.6
Block Total	*454*	*65.4*	*11.2*	*0.0*	*3.7*	*0.4*	*0.0*	*4.0*	*15.2*	*34.6*
Block Group Total	*996*	*75.7*	*6.1*	*0.6*	*2.0*	*0.2*	*0.0*	*2.0*	*13.4*	*24.3*
Blocks within Block Group 2 (Census Tract 7207)										
2010	508	76.0	5.7	0.0	0.8	0.0	0.4	2.4	14.8	24.0
2018	698	79.2	5.0	0.1	2.1	0.0	0.3	0.9	12.3	20.8
2019	115	76.5	4.3	0.0	0.0	0.0	0.0	1.7	17.4	23.5
2020	16	93.8	0.0	0.0	0.0	0.0	0.0	0.0	6.3	6.3
2021	35	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2022	35	82.9	0.0	0.0	0.0	0.0	0.0	0.0	17.1	17.1
2023	33	90.9	0.0	0.0	0.0	0.0	0.0	0.0	9.1	9.1
2024	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2025	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Block Total	*1,440*	*78.9*	*4.8*	*0.1*	*1.3*	*0.0*	*0.3*	*1.4*	*13.3*	*21.1*
Block Group Total	*2,701*	*77.0*	*4.5*	*0.1*	*3.1*	*0.2*	*0.2*	*1.3*	*13.5*	*23.0*
Blocks within Block Group 3 (Census Tract 7207)										
3109	16	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3112	93	82.8	0.0	0.0	0.0	0.0	0.0	7.5	9.7	17.2
Block Total	*109*	*85.3*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*6.4*	*8.3*	*14.7*
Block Group Total	*1,424*	*53.2*	*5.0*	*0.4*	*3.2*	*0.1*	*0.0*	*1.9*	*36.3*	*46.8*
Blocks within Block Group 2 (Census Tract 7208)										
2054	16	75.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	25.0
Block Total	*16*	*75.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*25.0*	*25.0*
Block Group Total	*714*	*37.3*	*42.6*	*0.7*	*0.6*	*0.0*	*0.8*	*0.3*	*17.8*	*62.7*
Blocks within Block Group 4 (Census Tract 7208)										
4003	137	92.7	0.0	0.0	2.9	0.0	0.7	0.0	3.6	7.3
4004	44	93.2	2.3	2.3	0.0	0.0	0.0	0.0	2.3	6.8
4005	67	89.6	3.0	0.0	1.5	0.0	0.0	1.5	4.5	10.4
4006	76	82.9	6.6	0.0	1.3	0.0	0.0	2.6	6.6	17.1
4007	187	97.9	0.0	0.0	0.0	0.0	0.0	0.5	1.6	2.1
4009	32	81.3	0.0	3.1	0.0	0.0	0.0	0.0	15.6	18.8
4010	85	95.3	0.0	0.0	1.2	0.0	0.0	0.0	3.5	4.7

4011	53	79.2	13.2	0.0	0.0	0.0	0.0	0.0	7.5	20.8
4012	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4013	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4014	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Block Total	*681*	*91.5*	*2.2*	*0.3*	*1.0*	*0.0*	*0.1*	*0.6*	*4.3*	*8.5*
Block Group Total	*913*	*90.4*	*2.4*	*0.2*	*0.8*	*0.0*	*0.1*	*0.7*	*5.5*	*9.6*
Blocks within Block Group 4 (Census Tract 7209)										
4005	78	84.6	1.3	0.0	0.0	0.0	0.0	0.0	14.1	15.4
4006	278	57.6	17.3	0.0	0.4	0.0	0.0	0.7	24.1	42.4
4008	836	26.2	22.7	0.5	1.9	0.0	0.5	1.7	46.5	73.8
4009	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4010	5	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4011	182	38.5	28.6	0.5	0.5	0.0	0.0	1.6	30.2	61.5
4012	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4013	38	81.6	0.0	0.0	0.0	0.0	0.0	0.0	18.4	18.4
4014	13	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4997	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Block Total	*1,430*	*39.4*	*20.3*	*0.3*	*1.3*	*0.0*	*0.3*	*1.3*	*37.0*	*60.6*
Block Group Total	*1,603*	*44.7*	*18.2*	*0.4*	*1.4*	*0.0*	*0.2*	*1.2*	*33.9*	*55.3*
Blocks within Block Group 5 (Census Tract 7209)										
5010	124	98.4	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6
5011	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5012	59	86.4	6.8	0.0	0.0	0.0	0.0	0.0	6.8	13.6
5013	73	97.3	1.4	1.4	0.0	0.0	0.0	0.0	0.0	2.7
5014	77	90.9	0.0	0.0	0.0	0.0	0.0	0.0	9.1	9.1
5015	68	75.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	25.0
5016	80	88.8	0.0	0.0	0.0	0.0	0.0	2.5	8.8	11.3
5998	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Block Total	*481*	*90.6*	*1.0*	*0.2*	*0.0*	*0.0*	*0.0*	*0.4*	*7.7*	*9.4*
Block Group Total	*1,611*	*83.9*	*1.9*	*0.2*	*0.2*	*0.0*	*0.4*	*0.9*	*12.4*	*16.1*
Blocks within Block Group 1 (Census Tract 7219)										
1034	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1035	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1036	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1037	11	72.7	0.0	0.0	27.3	0.0	0.0	0.0	0.0	27.3
1038	149	87.2	4.0	0.0	1.3	0.0	0.0	1.3	6.0	12.8
1048	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1049	340	36.8	36.5	0.0	15.0	0.0	0.0	0.0	11.8	63.2
1050	93	29.0	24.7	0.0	9.7	0.0	0.0	2.2	34.4	71.0
1051	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1052	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Block Total	*593*	*48.9*	*25.8*	*0.0*	*11.0*	*0.0*	*0.0*	*0.7*	*13.7*	*51.1*
Block Group Total	*2,389*	*63.5*	*20.3*	*0.6*	*3.9*	*0.0*	*0.1*	*1.0*	*10.6*	*36.5*
Blocks within Block Group 3 (Census Tract 7231)										
3006	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3007	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3008	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Block Total	*0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Block Group Total	*877*	*48.1*	*30.1*	*0.1*	*1.5*	*0.0*	*0.5*	*1.9*	*17.8*	*51.9*
Blocks within Block Group 3 (Census Tract 7232)										
3001	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3002	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3003	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3004	2	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
3005	4	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Block Total	*6*	*66.7*	*33.3*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*33.3*
Block Group Total	*444*	*75.5*	*3.6*	*0.0*	*1.4*	*0.0*	*0.0*	*2.5*	*17.1*	*24.5*
Blocks within Block Group 2 (Census Tract 7233)										
2000	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2013	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Block Total	*0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Block Group Total	*1,058*	*88.3*	*0.9*	*0.9*	*0.1*	*0.0*	*0.0*	*0.4*	*9.4*	*11.7*
Blocks within Block Group 3 (Census Tract 7233)										
3000	2	50.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	50.0
3001	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3002	27	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3003	110	89.1	0.0	0.0	2.7	0.0	0.0	0.0	8.2	10.9
3011	35	97.1	0.0	2.9	0.0	0.0	0.0	0.0	0.0	2.9
Block Total	*174*	*92.0*	*0.0*	*0.6*	*1.7*	*0.0*	*0.0*	*0.6*	*5.2*	*8.0*
Block Group Total	*900*	*89.8*	*0.8*	*0.7*	*1.1*	*0.0*	*0.0*	*0.2*	*7.4*	*10.2*
117 Block Area										
Block Area Total [(1)]	**10,183**	**66.6**	**10.6**	**0.2**	**2.4**	**0.0**	**0.1**	**1.5**	**18.6**	**33.4**
17 Block Group Area										
Block Group Total	**28,907**	**70.5**	**9.2**	**0.4**	**2.7**	**0.0**	**0.2**	**1.3**	**15.7**	**29.5**

Source: U.S. Census Bureau, Census 2000: Summary Tape File 1

Note: Geographic area was determined to be a 17-block group area that encompasses all blocks (117) adjacent to or within 2,000 feet of the proposed project.

[(1)] Includes all Blocks (117) adjacent to or within 2,000 feet of the project although 43 of the blocks have zero population

* AIAN - American Indian and Alaska Native, NHPI - Native Hawaiian and Other Pacific Islander

Low-income Populations: The proposed project encompasses a total of 17 Census Block Groups adjacent to or within 2,000 feet of the proposed project, which represents the demographic study area for low-income populations. **Table 11** presents the median household income and persons of poverty status for each of the Census Block Groups within the demographic area as well as the corresponding Census Tract in which each block group is located. The demographic study area was analyzed for persons of poverty status based on the 2008 DHHS poverty threshold of $21,200. The proposed project encompasses a total of 17 Census Block Groups within nine Census Tracts.

Within the entire demographic study area, approximately 13.8 percent of the population is below the 2008 federal poverty level, which is slightly lower than the entire nine Census Tract areas (18.9 percent). Census Tract 7209, Block Group 4 and Census Tract 7231, Block Group 3 have the highest percentage of persons (37.6 and 37.8 percent, respectively) below the federal poverty level. Most of the remaining block groups in the demographic area have 20 percent or less of the population living below the federal poverty level. **Exhibit 4b** shows the distribution of median household incomes throughout the demographic study area.

Table 11: Median Household Incomes and Poverty Status (1999)

Geographic Area	Population [1]	Median Household Income [2]	Persons Below Poverty Level [3]	
			Number	Percent
17 Block Group Area				
Block Groups within Census Tract 7205				
2	537	$82,049	35	6.5
3	733	$61,771	58	7.9
4	1,028	$64,881	45	4.3
6	1,061	$67,260	67	6.3
Block Group Total	*3,359*	*$68,990*	*204*	*6.1*
Census Tract Total	*4,763*	*$67,230*	*289*	*6.1*
Block Groups within Census Tract 7206				
1	1,270	$55,556	158	12.5
Block Group Total	*1,270*	*$55,556*	*158*	*12.5*
Census Tract Total	*1,270*	*$55,556*	*158*	*12.5*
Block Groups within Census Tract 7207				
1	418	$40,167	69	16.5
2	997	$63,466	94	9.4
3	494	$47,404	93	18.9
Block Group Total	*1,909*	*$50,346*	*256*	*13.4*
Census Tract Total	*1,909*	*$53,321*	*256*	*13.4*
Block Groups within Census Tract 7208				
2	226	$45,000	69	30.7
4	332	$74,423	15	4.4
Block Group Total	*558*	*$59,712*	*84*	*15.0*
Census Tract Total	*1,184*	*$45,078*	*353*	*27.3*

Block Groups within Census Tract 7209				
4	638	$26,157	240	37.6
5	523	$55,848	65	12.4
Block Group Total	*1,161*	*$41,003*	*305*	*26.2*
Census Tract Total	*1,967*	*$36,672*	*559*	*28.4*
Block Groups within Census Tract 7219				
1	792	$51,000	136	17.1
Block Group Total	*792*	*$51,000*	*136*	*17.1*
Census Tract Total	*2,215*	*$31,516*	*711*	*32.1*
Block Groups within Census Tract 7231				
3	442	$24,722	167	37.8
Block Group Total	*442*	*$24,722*	*167*	*37.8*
Census Tract Total	*1,406*	*$31,429*	*398*	*28.3*
Block Groups within Census Tract 7232				
3	170	$31,923	37	21.8
Block Group Total	*170*	*$31,923*	*37*	*21.8*
Census Tract Total	*1,053*	*$33,412*	*319*	*30.3*
Block Groups within Census Tract 7233				
2	382	$52,692	42	11.1
3	319	$67,125	41	12.8
Block Group Total	*701*	*$59,909*	*83*	*11.8*
Census Tract Total	*1,519*	*$52,340*	*256*	*16.9*
17 Block Group Area				
Block Group Total	**10,362**	**$53,614**	**1,431**	**13.8**
9 Census Tract Area				
Census Tract Total	**17,286**	**$45,173**	**3,270**	**18.9**

Source: U.S. Census Bureau, Census 2000: Summary Tape File 3

Note: Geographic Area was determined to be a nine Census tract area that encompasses all block groups (17) adjacent to or within 2,000 feet of the proposed project.

(1) Population for whom poverty status has been determined

(2) The Median Household Income indicated in the Block Group/Census Tract Total cells are averages

(3) Persons below the poverty level were determined based on the 2000 Census and 2008 DHHS poverty threshold of $21,200

Summary

Minority Populations: As shown in **Table 10**, the proportion of minority residents varies greatly among the individual blocks within the demographic study area. Among the individual blocks, the minority population ranges from approximately 1.6 percent in the area east of IH 45, just south of Clear Creek (Census Tract 7209, Block Group 5, Block 5010) to 73.8 percent in the area east of IH 45, just north of Clear Creek (Census Tract 7209, Block Group 4, Block 4008). The minority population increases to 100 percent in one Census Block (Census Tract 7232, Block Group 3, Block 3004). This block is located in the area west of IH 45 at the end of the project and represents only one person, which is of Black/African American origin.

The Hispanic population ranges from approximately 2 to 20 percent in most of the demographic study area and increases to approximately 40 to 50 percent in an area south of Clear Creek (Census Tract 7205, Block Group 3, Blocks 3015, 3016, 3018, and 3019). The Census Blocks that have notably high Hispanic populations are located up to 0.75 miles to the west of the proposed project and would not be directly impacted by the proposed project.

Low-income Populations: As shown in **Table 11**, the proportion of low-income residents varies greatly among the Census Block Groups within the demographic study area ranging from 4.3 percent in an area located south of Clear Creek and west of IH 45 (Census Tract 7205, Block Group 4) to 37.6 percent in an area located north of Dickinson Bayou and east of IH 45 (Census Tract 7209, Block Group 4).

Census Tract 7231, Block Group 3 (located east of IH 45 at the end of the project) and Census Tract 7209, Block Group 4 are the only areas with a share of the population below the poverty level that is substantially above the corresponding Census Tract in which the block group is located. It should be noted, however, that the diversity of communities within the 10 blocks of Census Tract 7209, Block Group 4 and that the zero population within the three blocks of Census Tract 7231, Block Group 3, indicates the potential for effects to low-income populations is considered throughout the entire demographic study area. The relatively high low-income population percentages do not in this case reflect large numbers of minority individuals.

Additional Factors: The density of ethnic minorities is most apparent within and near the city of Dickinson and along the western side of IH 45 in the northern portion of the project (see **Exhibit 4a**). As shown in **Exhibit 4b**, ethnic minorities within and near Dickinson are concentrated in three block groups (Census Tract 7208, Block Group 4; Census Tract 7209, Block Group 4; Census Tract 7206, Block Group 1) that represent 15 to 240 persons of poverty status. Near the northern portion of the project, a cluster of ethnic minorities are apparent within two block groups (Census Tract 7205, Block Group 2; Census Tract 7205, Block Group 3) that represent 35 to 58 persons of poverty status. The median household incomes of these block groups range from $26,157 to $82,049, all greater than the total annual household low-income of $21,200 in 2008 (DHHS 2008). Additionally, these median household incomes exceed the poverty threshold even when compared to the total annual household low-income of $16,700 in 1999 (DHHS 1999).

In order to determine if the proposed project would result in “disproportionately high and adverse effects" on a minority or low-income population, or be denied benefits of the Build Alternative, several additional factors, in addition to the demographic profile of the study area, are also considered.

- Displacements: No residences would be displaced; therefore no minority or low-income populations would experience disproportionate adverse effects of residential displacement as a result of the Build Alternative. However, the proposed project would result in the potential relocation of one business (Blockbuster Video, located along the northbound frontage road of IH 45, south of FM 518). It is likely that these businesses would relocate within the local community, and therefore the proposed project would not likely result in jobs lost. However, if the business may choose to not re-open or decide to relocate in another area, the loss of jobs due to the business relocation or closing may occur as a result of the proposed project. It is possible that workers, including minority workers, with limited transportation options may encounter difficulty

maintaining employment with their present employer should the business relocate. The employees may be forced to seek employment opportunities within or outside of the study area.

- Transportation Needs: In addition to establishing locations of minority and low-income residents, transportation needs of these populations must also be considered. Minority and low-income populations are not expected to experience any reductions or significant delays of any benefits associated with increased access, nor are they expected to experience disproportionate adverse effects due to increased capacity. Greater access to employment centers, shopping, and the numerous recreational areas located within the vicinity of the project is anticipated to improve with additional capacity resulting from the Build Alternative.

Through field observations and data collected from the 2000 Census, it was determined that effects resulting from the Build Alternative are not associated with any one ethnic group or race and that the population along the project corridor is a mixed group. Although the demographic study area contains a total minority population of 33.4 percent and a low-income population of 13.8 percent, the project impacts would not be isolated within a limited number of Census Blocks or Block Groups, respectively, but would be distributed among all users of the IH 45 facility.

As described elsewhere in this section, the direct impacts to minority and low-income populations have been largely avoided, and at the same time, the project has been enhanced to facilitate the sharing of project benefits by minority and low-income populations. No residential displacements would occur as a result of the project; therefore minority and low-income residents would not be affected by direct impacts such as relocations. Therefore, no disproportionately high and adverse impacts, resulting from relocation activities, to low-income and/or minority residents would occur. Similarly, the project is not expected to result in disproportionately high and adverse impacts to the visual environment within neighborhoods surrounding the project corridor, as compared to the visual impacts that would be experienced throughout the entire project corridor. There may be short-term, localized effects to air quality (i.e., increase in dust) and noise levels (i.e., generated by construction equipment) in the immediate area adjacent to the project during construction. These effects would be temporary and would not be selectively limited to minority or low-income communities but would potentially affect residential and business communities located in the immediate area adjacent to the proposed project.

Over the long-term, the entire community would benefit from the proposed project. These benefits include accessibility and safety improvements, potential economic development opportunities, and decreased traffic congestion. The other project benefits are anticipated to be available to and shared by both environmental justice and non-environmental justice populations in the study area.

Based on the above discussion, the proposed project would not cause disproportionately high and adverse effects on any minority or low-income populations as discussed in the Executive Order 12898 regarding environmental justice.

Limited English Proficiency

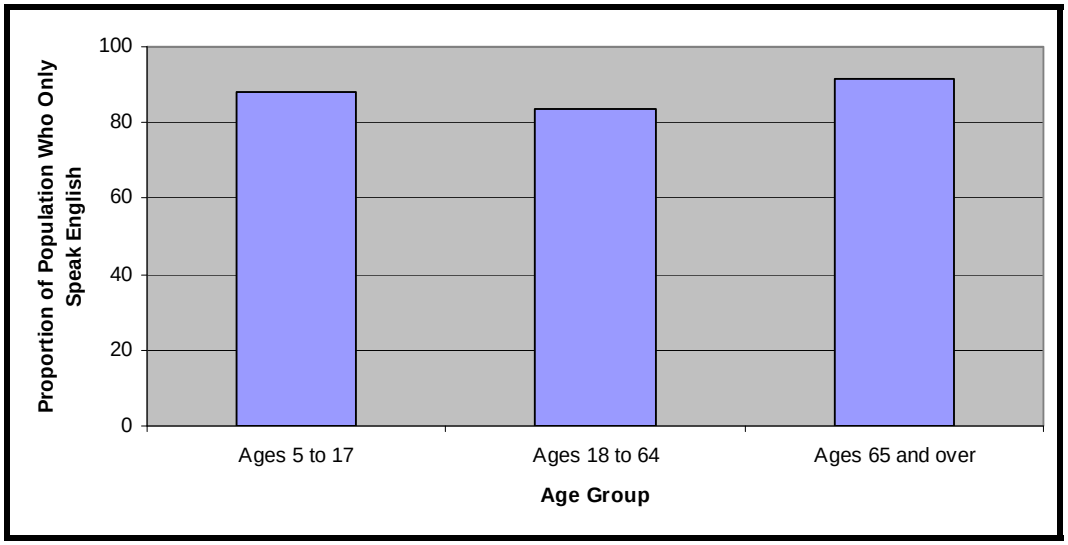
Executive Order 13166, entitled "Improving Access to Services for Persons with Limited English Proficiency," mandates that federal agencies examine the services they provide and develop and implement a system by which Limited English Proficiency (LEP) persons can meaningfully access those

services consistent with, and without unduly burdening, the fundamental mission of the agency. Each agency shall also work to ensure that recipients of federal financial assistance (recipients) provide meaningful access to their LEP applicants and beneficiaries (65 *Federal Register* 50123, August 16, 2000).

Information on Language Used by 12 Census Block Group Area Residents

- Nearly 90 percent of the population in the 17 block group area between 5 and 17 years old speak only English (see **Figure 2**). This proportion increases with age, with over 90 percent of individual's age 18 and over who speak only English.

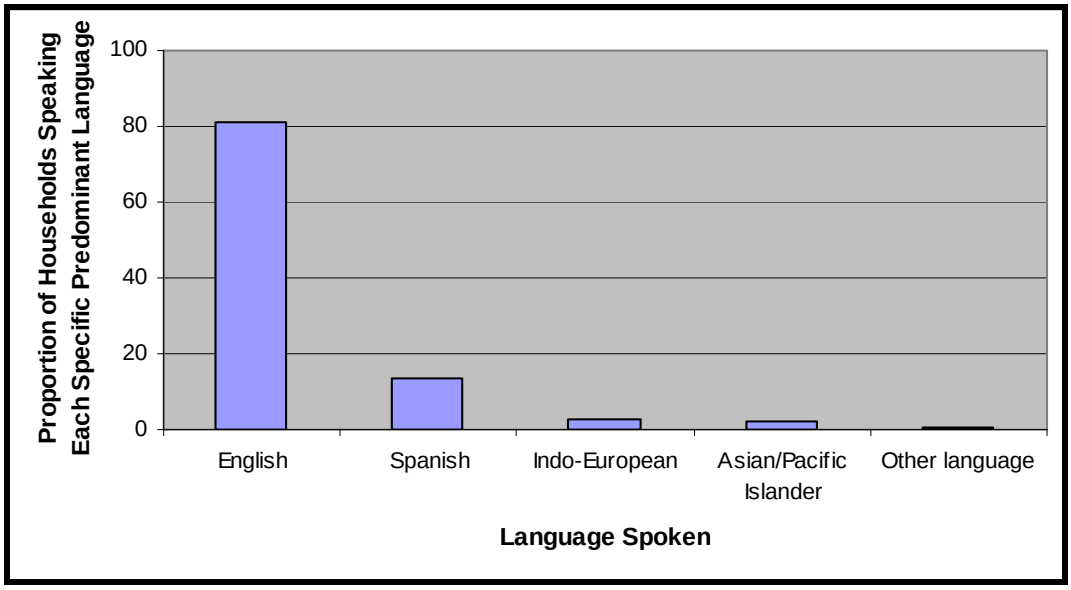
Figure 2: Proportion of Population by Age Group who Speak Only English



Source: U.S. Census Bureau, Census 2000: Summary Tape File 3

- Among the households identified in the 2000 U.S. Census, over 80 percent of those in the 17 block group area were predominately English speaking (see **Figure 3**).
- Nearly 14 percent of households in the 17 block group area were predominantly Spanish speaking households. Nearly three percent of the households were predominantly Indo-European speaking households. Approximately two percent of the households were predominantly Asian and Pacific Islander speaking households. Households speaking other languages (including languages such as Navajo, Cherokee, Hungarian, Arabic, and Hebrew) accounted for less than one percent of all households in the 17 block group area. These numbers represent a person's primary language, but do not necessarily preclude them from speaking English.

Figure 3: Proportion of Households by Predominant Language Spoken in the Household



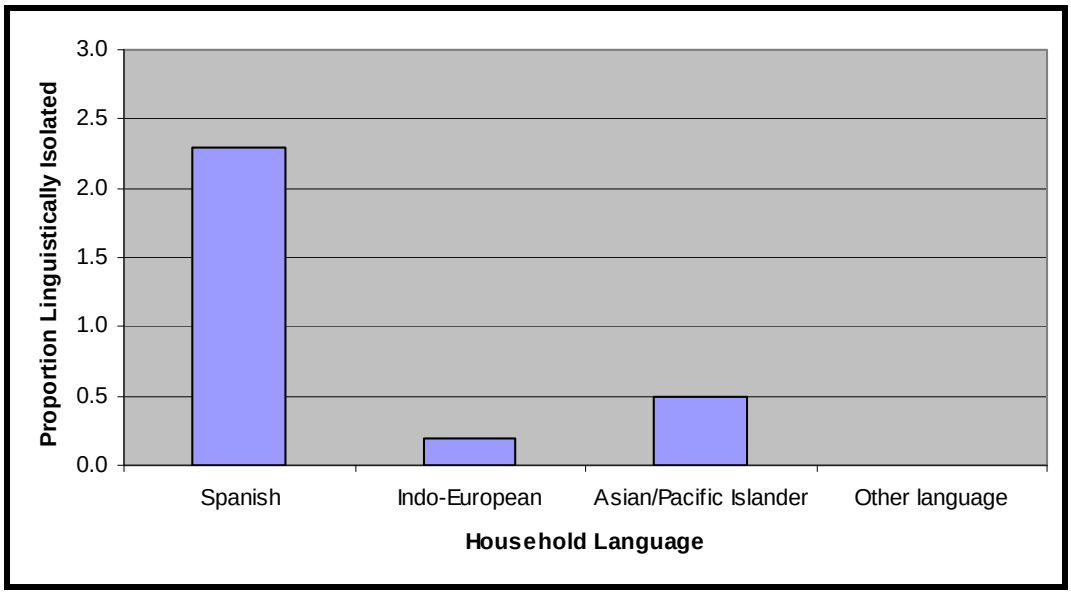
Source: U.S. Census Bureau, Census 2000: Summary Tape File 3

The following figure (**Figure 4**) represents the proportion of households that predominantly speak a language other than English and the proportion of those non-English speaking households which are linguistically isolated.

A household is linguistically isolated when no person 14 years old and over speaks only English and no person 14 years old and over who speaks a language other than English speaks English "very well." In other words, a household in which all members 14 years old and over speak a non-English language and also speak English less than “very well” (have difficulty with English and thus is considered LEP) is “linguistically isolated.” All the members of a linguistically isolated household are tabulated as linguistically isolated, including members under 14 years old who may speak only English.

- As a percentage of all households, an average of 2.9 percent is linguistically isolated.
- Approximately 2.3 percent of the Spanish speaking households in the 17 block group area are identified as linguistically isolated.
- Less than 0.5 percent of households speaking Indo-European predominantly were determined to be linguistically isolated.
- Approximately 0.5 percent of the Asian and Pacific Islander specific language speaking households were estimated to be linguistically isolated.
- No households speaking other languages (including languages such as Navajo, Cherokee, Hungarian, Arabic, and Hebrew) were determined to be linguistically isolated.

Figure 4: Proportion of Non-English Speaking Households that are Linguistically Isolated by Primary Household Language



Source: U.S. Census Bureau, Census 2000: Summary Tape File 3

Summary

Data collected from the 2000 Census and a field reconnaissance indicated that English was the main language used for signage on buildings and other forms of posted information/advertisements along the project corridor. No specific area or neighborhood was identified that would likely contain substantial concentrations of persons with LEP.

Based on the percentage of English speaking populations within the study area and the field reconnaissance, public involvement activities (i.e., public meetings) have been conducted in English. However, because the study area consists of a larger percentage of Spanish speaking households that are considered linguistically isolated as compared to other non-English speaking households, announcements for public meetings have been published in a Spanish-language paper, *La Subasta*. Furthermore, reasonable arrangements (e.g., interpreters) have been and would continue to be made for persons who have special communication or accommodation needs upon notification of TxDOT at least two days prior to a meeting or public hearing.

For this project, TxDOT would continue to comply with Executive Order 13166 by offering to meet the needs of persons requiring special communication or accommodations in all public involvement activities and notices. Therefore, the requirements of Executive Order 13166 have been met.

Land Use

Land use along IH 45 is comprised of vacant tracts (47 percent) agricultural / grazing (28 percent), commercial (13 percent), residential (8 percent), community (2 percent), parks (1 percent), transportation and utilities (1 percent), and water (1 percent) (see **Exhibit 5**). Commercial uses are the prevalent developed land uses; commercial land use consists of densely developed retail and services typically near the major interchanges and businesses such as car dealerships along the frontage roads. The businesses in

the study area generally serve local and/or regional needs and are somewhat highway-related. Residential land uses, including single-family subdivisions or multi-family apartment complexes, are found in the study area in the cities of Dickinson, League City, and Texas City. Residential developments adjacent to IH 45 include Clear Creek Village subdivision, single-family homes between Calder Drive and Main Street, the Ponderosa Forest Apartments, Bayou Village Apartments, Bayou Chantilly subdivision, Park Place subdivision, and Windsor Estates Apartments. Community facilities, including churches, childcare centers, schools, and a cemetery, are located along the existing frontage road as well as along FM 518 and FM 517. One park, League City Sports Complex, is located along IH 45.

Large tracts of undeveloped land both vacant and used for grazing are found along IH 45 in League City near the FM 646 interchange and in Texas City between Hughes Road and FM 1764. Future land uses for these areas are discussed below. The transportation infrastructure consists of the network of several intersecting FM roads, county roads, and local streets. SH 3 lies parallel to and one mile to the east of IH 45.

Local and Regional Plans

Land use plans for League City and Texas City along with transportation infrastructure/expansion plans were reviewed to determine land use effects resulting from the proposed project. The cities of Dickinson and La Marque do not currently have written land use plans. Improvements to the proposed project are consistent with local and regional land use plans.

According to League City, IH 45 bisects the city along a north-south axis, which segments the city "into areas of very different character, without a clearly defined "center" or unifying element which would provide a coherent citywide identity" (League City 2004b). The comprehensive plan for League City establishes this future vision for the city: a more integrated, diversified, and self-sufficient city, which maintains its small town character and quality of life, and offers a wide variety of employment and residential opportunities to its citizens. City weaknesses identified in the comprehensive plan include: traffic congestion, lack of alternative transportation opportunities, and the inability of infrastructure improvements to match growth demands, aesthetics, and shortage of bicycle trails.

The vision for the future of Texas City was developed concurrently through the Texas City Goals 2000 Comprehensive Plan and Vision 2020 (Texas City 1992 and The Vision 2020 Committee 1998). The comprehensive plan was created as a "long range plan intended to guide the growth and development of Texas City into the 21st century" (Texas City 1992) while Vision 2020 incorporates the strategic vision for the city. Together these plans strive to change the public perception of Texas City by providing a diverse economic and employment base, enhancing waterfront development for tourism and marine industry, supporting rapid changes through flexible infrastructure, and promoting quality community services to attract more middle and upper income residents.

H-GAC is conducting a study of the FM 518 corridor between SH 288 and IH 45 to identify transportation measures that will improve public safety, traffic flow, reduce motorist delay, enhance air quality, and enhance bicycle and pedestrian access (H-GAC 2004a). The entities involved in this study are Pearland, Friendswood, League City, and Kemah. Also, Brazoria and Galveston Counties as well as TxDOT all have a significant role. H-GAC is the voluntary association of local governments in the 13-county Gulf Coast Planning Region and is designated as the Metropolitan Planning Organization (MPO)

for the region. The MPO is responsible for coordinating the development of the long-range, 20-year transportation plan. The proposed project is identified in the RTP (H-GAC 2004b). Goals of the plan include:

- Reduce congestion and improve access to jobs, markets, and services
- Preserve and maintain existing transportation infrastructure
- Improve transportation safety and security
- Environmental responsibility

Development Trends and Future Land Use

Residential and commercial growth has followed two patterns within the study area; it has radiated outward from the small city centers of Dickinson, La Marque, League City, and Texas City and has extended linearly along major thoroughfares such as IH 45.

The study area is located just south of the Clear Lake/NASA area, a regional employment center with approximately 42,000 jobs in 2000 (H-GAC 2004c). This employment center and other employment opportunities in the Houston area have made League City a popular "bedroom-community" with large master-planned residential communities (League City 2004b). Over half of Galveston County's population growth between 1980 and 2000 occurred within League City (U.S. Census Bureau 2000). Additionally, commercial development is clustered in the southern portion of the study area within La Marque and Texas City, due in part to the direct access provided by the crossroads of IH 45, FM 1764, and FM 2004.

Planning documents and zoning regulations provide the best indication of future land uses. Zoning district maps for Dickinson, League City, and Texas City are shown in **Appendix E**. The city of La Marque does not currently have zoning designations. Development plans are currently in place for a 3,400-acre tract of land located to the east and west of IH 45 from Holland Road to just north of FM 1764 in Texas City. The master-planned community (known as Lago Mar) would include up to 10,000 single and multi-master-planned family homes with 300 acres of commercial development, including high-rise office space and retail (Wollam 2005). Construction of this master-planned community is anticipated to begin in 2008.

H-GAC predicts that Galveston County will gain over 95,000 people and 39,000 jobs between 2000 and 2025 (H-GAC 2004c). This growth will result in land use conversion of undeveloped lands for residential and commercial uses. In general, the now vacant land along the corridor is expected to develop into master-planned residential communities with commercial development along the frontage roads.

Soils and Farmlands

Three soil associations underlie the study area (United States Department of Agriculture {USDA} 1988). The Bernard-Verland type is somewhat poorly drained, very slow permeability, loamy and clayey soils that are used for cropland and pastureland. The Mocarey-Leton-Algoa type is somewhat poorly to poorly drained, moderately slow to slow permeability, loamy soils that are used for pastureland. The Lake Charles-Bacliff type is somewhat poorly to poorly drained, very slow permeability, clayey soils that are used for cropland and pastureland. Prime farmland, hydric, and statewide important soils within the study area are listed in **Table 12**.

Farmland Protection Policy Act

The Farmland Protection Policy Act (FPPA) requires that federal agencies identify and take into account the adverse effects of their programs on the preservation of farmlands; consider alternative actions, as appropriate, that could lessen adverse effects; and ensure that the project is compatible with state and local programs and policies to protect farmlands (7 CFR Part 658).

Early coordination with the Natural Resources Conservation Service (NRCS) determined that an estimated eight acres of prime and unique, statewide, and locally important farmland soils would be affected by the proposed project. Out of a possible 260 points, the farmland conversion impact ratings are 135 for the entire proposed project. Because the score is less than 160, further consideration for protection and further evaluation is not necessary. A copy of the coordination with NRCS is included in **Appendix C**.

Table 12: Prime Farmland, Hydric, and Statewide Important Soils within the Study Area

Soils	Prime Farmland Soils	Hydric Soils	Statewide Important Soils
Lake Charles clay, 0 to 1 percent slopes	Yes	No	No
Bernard clay loam	Yes	No	No
Mocarey loam	Yes	No	No
Mocarey-Algoa complex	Yes	No	No
Mocarey-Leton complex	Yes	Yes	No
Morey silt loam	Yes (if drained)	No	Yes
Bacilff clay	Yes (if drained)	Yes	No
Vamont clay	Yes	No	No
Mocarey-Cieno complex	Yes	Yes	No

Source: USDA 1988

Beneficial Landscape Practices

In accordance with the Executive Memorandum issued on August 10, 1995, all agencies shall comply with NEPA as it relates to vegetation management and landscape practices for all federally assisted projects. The Executive Memorandum directs that where cost-effective and to the extent practicable, agencies would (1) use regionally native plants for landscaping; (2) design, use, or promote construction practices that minimize adverse effects on the natural habitat; (3) seed to prevent pollution by, among other things, reducing fertilizer and pesticide use; (4) implement water-efficient and runoff reduction practices; and (5) create demonstration projects employing these practices. Landscaping included with this project would comply with the Executive Memorandum and the guidelines for environmentally and economically beneficial landscape practices.

Invasive Species

In accordance with Executive Order 13112 on Invasive Species, issued February 3, 1999, landscaping would be limited to seeding and replanting the ROW with native species of grasses, shrubs, or trees where practicable. No noxious species would be used to revegetate the ROW.

Vegetation

The proposed project lies within the Gulf Coast Prairies and Marshes Vegetation Region of Texas (Gould 1975). The Gulf Coast plain borders the Gulf of Mexico from the Sabine River to Corpus Christi Bay and encompasses approximately 13-million acres. The Gulf Prairies are nearly level with slow surface drainage and elevations ranging from sea level to approximately 250 feet above Mean Sea Level (MSL). They are used for crops, livestock grazing, wildlife production, and urban and industrial centers. It is estimated that as much as 99 percent of the coastal prairies in Texas have been converted to agricultural lands (Gould 1975 and McMahan, et al. 1984). The Gulf Marshes are low, wet, marshy coastal areas commonly covered with saline water, ranging from sea level to a few feet in elevation above MSL. These marshes support species of sedges, rushes, cordgrasses, reeds, and forbs.

Many areas within the study area have been invaded by noxious volunteer species, including honey mesquite (*Prosopis glandulosa*), eastern baccharis (*Baccharis halimifolia*), huisache (*Acacia minuta*), smutgrass (*Sporobolus indicus*), yankeeweed (*Eupatorium compositifolium*), McCartney rose (*Rosa bracteata*), flatsedge (*Cyperus entrerianus*), and Chinese tallow (*Triadica sebifera*). Bermuda grass (*Cynodon dactylon*) and Johnson grass (*Sorghum halepense*) are common on frequently mowed pastures and roadway ROW (Gould 1975).

The vegetation types identified by the Vegetation Types of Texas (McMahan, et al. 1984) within the study area include Bluestem Grassland and Crops. Bluestem Grassland is evident over much of the Gulf Prairies and Marshes and is particularly apparent south and west of the Houston area. This vegetation type is located in the northern portion of the proposed project. Species commonly associated with Bluestem Grassland include bushy bluestem (*Andropogon glomeratus*), slender bluestem (*Schizachyrium tenerum*), little bluestem (*Schizachyrium scoparium*), silver bluestem (*Bothriochloa longipaniculata*), buffalograss (*Buchloe dactyloides*), Bermuda grass, brownseed paspalum (*Paspalum plicatulum*), single-spike paspalum (*Paspalum monostachyum*), smutgrass, sacahuista (*Nolina texana*), windmill grass (*Chloris spp*.), southern dewberry (*Rubus trivialis*), live oak (*Quercus virginiana*), mesquite (*Prosopis juliflora*), huisache, eastern baccharis, and Macartney rose (McMahan, et al 1984).

Most of the proposed ROW occurs within the Crops vegetation type typified by cultivated cover crops or row crops providing food and/or fiber for either man or domestic animals. This type may also portray grassland associated with crop rotations.

Field investigations of the proposed ROW were conducted in November and December 2004 to identify the existing vegetation types. The proposed ROW is characterized by grasslands in varying stages of succession. Vegetation types identified include aquatic features, periodically inundated wetlands, riparian forest, managed pastureland, tallow forest, maintained ROW, and urban areas. Vegetative communities and effects from the proposed project are described in the following sections.

Summary

Native habitat types potentially affected by the proposed project include aquatic features, periodically inundated wetlands, and riparian forests. Based on preliminary project designs, the proposed project is expected to permanently affect less than 13.32 acres of native habitat. The final project design is anticipated to minimize or avoid effects to several aquatic features and periodically inundated wetlands.

Approximately 0.5 acres of trees is included within the 13.32 acres of permanent effects. The proposed project would permanently affect all of these trees by conversion to new roadway, maintained ROW, or feeder roads depending on their location. The riparian forest is the only native habitat type that has trees (0.3 acres).

The proposed ROW would be cleared of vegetation as required for the safety clear zone, travel lanes, and other project features. The vegetation cleared from the proposed ROW would be replaced with pavement surface, shoulders, drainage ditches/swales, and maintained vegetation. The No Build Alternative would have no effect to vegetation. **Table 13** presents the type, location, and area of each vegetation type affected by the proposed project.

Table 13: Comparison of Vegetation Types Affected

Vegetation Type	Location/Distribution	Area within ROW (acre)	Percentage of Total Area	Permanent Impacts (acre)	Temporary Impacts (acre)
Aquatic Features[(1)]	Magnolia Bayou, Borden's Gully, Dickinson Bayou, and four unnamed waterways	2.43	0.50	< 1.84	--
Periodically Inundated Wetlands [(1) (2)]	Common and scattered throughout the study area	12.34	2.53	< 9.86	--
Riparian	Located nearby aquatic features	1.62	0.33	1.62	0
Managed Pastureland	Scattered throughout study area	1.54	0.32	1.54	0
Tallow Forest	Two areas: south of the intersection with FM 1764 and east of IH 45, south of SH 96 intersection	0.16	0.03	0.16	0
Maintained ROW	Linear strip along the roadway	220	45.18	220	--
Urban	Very common and scattered throughout the study area	4.89	1.00	4.89	0
Roadway		244	50.11	--	--
Total		**486.98**	**100**	**< 239.91**	**--**

Source: Study Team 2006

Note: [(1)] For the purposes of this table, effects to aquatic features and periodically inundated wetlands are calculated to be permanent, which is likely to change after final roadway and bridge designs are complete. It is expected that some effects will be minimized.

[(2)] Periodically inundated wetlands include jurisdictional (2.53 acres) and non-jurisdictional wetlands (12.34 acres).

Vegetation Types

Aquatic Features

Aquatic features are waters of the U.S. occurring within the proposed ROW. Aquatic features include Magnolia Bayou (also referred to as Geisler Bayou), Borden's Gully, Dickinson Bayou, and several unnamed waterways that are hydrologically connected to waters of the U.S. These aquatic features are characterized by narrow-leaf cattail (*Typha angustifolia*), bull-tongue arrow-head (*Sagittaria lancifolia*), alligator weed (*Alternanthera philoxeroides*), marsh seedbox (*Ludwigia palustris*), green flatsedge

(*Cyperus virens*), common frog-fruit (*Phyla nodiflora*), sand spikerush (*Eleocharis montevidensis*), small spikerush (*E. parvula*), soft rush (*Juncus effusus*), white-edge sedge (*Carex debilis*), southern carpet grass (*Axonopus affinis*), coastal-plain penny-wort (*Hydrocotyle bonariensis*), seaside goldenrod (*Solidago sempervirens*), and black willow (*Salix nigra*).

The study area[1] includes 2.43 acres of aquatic features (0.50 percent of the total study area). Based on preliminary project designs, it is estimated that the proposed project would affect less than 1.84 acres of aquatic features. The final project design is anticipated to minimize or avoid effects to aquatic features. Permanent effects to the aquatic features include the filling of areas with material to create new roadway or ROW. Temporary effects to the aquatic features crossed by IH 45 include the construction of culverts or bridge structures. Effects to these areas would be limited to minimal sidebank fill and pilings. The No Build Alternative would have no effect to vegetation.

Periodically Inundated Wetlands

Periodically inundated wetlands are comprised of depressions meeting the three wetland criteria of hydrophytic vegetation, hydric soils, and wetland hydrology. Periodically inundated wetlands within the proposed ROW include channelized drainage ditches intersecting IH 45, roadside drainage ditches parallel to the ROW, and two detention ponds. Species include narrow-leaf cattail, delta arrow-head (*Sagittaria platyphylla*), bull-tongue arrow-head, alligator weed, marsh seedbox, green flatsedge, jointed flatsedge (*Cyperus articulatus*), common frog-fruit, seaside goldenrod, soft rush, little-tooth sedge (*Carex microdonta*), Cherokee sedge (*Carex cherokeensis*), coastal water-hyssop (*Bacopa monnieri*), erect coinleaf (*Centella erecta*), swamp smartweed (*Polygonum hydropiperoides*), sand spikerush, and small spikerush.

The study area includes 12.34 acres of periodically inundated wetlands (2.53 percent of the total study area). Based on preliminary project designs, it is estimated that the proposed project would affect less than 9.86 acres of periodically inundated wetlands. The final project design is anticipated to minimize or avoid effects to periodically inundated wetlands. Permanent effects include conversion of wetlands to new roadway, maintained ROW, or feeder roads, depending on their location. These wetlands occur throughout the existing and proposed ROW and cannot be avoided. Temporary effects include the construction of culverts and bridge structures with minimal sidebank fill and pilings.

Riparian Forest

Riparian forests are wooded areas adjacent to aquatic features and wetlands. Small areas of riparian forest occur adjacent to Magnolia Bayou and Dickinson Bayou. Species include sugarberry (*Celtis laevigata*), hackberry (*C. occidentalis*), white ash (*Fraxinus americana*), American elm (*Ulmus americana*), cedar elm (*Ulmus crassifolia*), green ash (*Fraxinus pennsylvanica*), water oak (*Quercus nigra*), live oak, Chinese tallow, black willow, peppervine (*Ampelopsis arborea*), saw greenbrier (*Smilax bona-nox*), greenbrier (*S. rotundifolia*), Drummond's rattlebush (*Sesbania drummondii*), deciduous holly (*Ilex decidua*), yaupon (*Ilex vomitoria*), eastern red cedar (*Juniperus virginiana*), Chinese privet (*Ligustrum sinense*), wax-leaved ligustrum (*L. licudum*), Japanese honeysuckle (*Lonicera japonica*), Virginia creeper

[1] The term *study area* used in this section is defined as the entire area within both existing and proposed ROW.

(*Parthenocissus quinquefolia*), loblolly pine (*Pinus taeda*), dwarf palmetto (*Sabal minor*), ironwood (*Bumelia lanuginose*), eastern baccharis, and poison ivy (*Toxicodendron radicans*).

The proposed project would affect 1.62 acres of riparian forest (0.34 percent of the total area). All 1.62 acres will be permanently affected. Riparian forest within the proposed project would be converted to maintained ROW and feeder roads, and the effects would be permanent in nature. The amount of ROW has been minimized to the greatest extent practicable while still achieving the stated project need, purpose, and design standards. Affected riparian forest areas are located immediately adjacent to the existing ROW.

Managed Pastureland

Managed pasturelands are comprised of former prairies that have been grazed, typically for several decades. They are located throughout the proposed ROW. Characteristic species include vasey grass, southern carpet grass, Bermuda grass, knotroot bristlegrass (*Setaria geniculata*), bushy bluestem, smutgrass, seaside goldenrod, flatsedge, Chinese tallow, cedar elm, Drummond's rattlebush, wax myrtle (*Myrica cerifera*), dwarf palmetto, southern dewberry, common pecan (*Carya illionensis*), live oak, cedar elm, yaupon, Paraguayan windmill grass (*Chloris canterai*), annual sumpweed (*Iva annua*), narrowleaf sumpweed (*Iva angustifolia*), rattail smutgrass, Kleberg's bluestem (*Dichanthium annulatum*), swamp sunflower (*Helianthus angustifolius*), Lindheimer's beeblossom (*Gaura lindheimeri*), and eastern baccharis.

The proposed project would affect 1.54 acres of managed pastureland (0.32 percent of the total area), all of which would be permanently affected. Managed pasturelands would be permanently converted to new roadway, maintained ROW, or feeder roads, depending on their location. Acquisition of additional ROW has been minimized throughout the proposed project and will be acquired immediately adjacent to the existing ROW.

Tallow Forest

Tallow forests were historically prairies but have become invaded and dominated by Chinese tallow trees. The dominance of Chinese tallow in these areas has resulted in significantly lower plant species diversity and diminished wildlife habitat value. Galveston County was historically dominated by little bluestem with forest and trees restricted to riparian areas. The introduction of Chinese tallow resulted in large-scale conversion of much of the native upper coastal prairie to woodlands. Although these locations in the proposed ROW are dominated by Chinese tallow, other vegetation present includes cedar elm, eastern red cedar, yaupon, Chinese privet, American beauty berry (*Callicarpa americana*), rattan vine (*Berchemia scandens*), southern dewberry, southern carpet grass, Bermuda grass, bushy bluestem, Paraguayan windmill grass, vasey grass, little bluestem, annual sumpweed, knotroot bristlegrass, and seaside goldenrod.

The proposed project would affect 0.16 acres of tallow forest (0.03 percent of the total area), all of which would be permanently affected. Permanent effects include the clearing and conversion of tallow forest to roadway or maintained ROW.

Maintained Right-of-Way

Maintained ROW is located adjacent to existing roadways. It is highly disturbed and does not generally support high-quality natural floral communities. Mowed and maintained ROW is characterized by Bermuda grass, St. Augustine grass (*Stenotaphrum secundatum*), perennial ryegrass (*Lolium perenne*), southern carpet grass, knotroot bristlegrass, southern dewberry, southern carpet grass, Johnson grass, common-evening primrose, crow poison, rattail smutgrass, jointed paspalum, giant ragweed, vasey grass, yaupon, crepe-myrtle, live oak, common pecan, and Chinese tallow.

The proposed project would affect 220 acres of maintained ROW (45.77 percent of the total area). Of the 220 acres affected, 54 acres would be permanently affected and 166 acres would be temporarily affected. Permanent effects to the maintained ROW include conversion to new roadway or feeder roads. Temporary effects to the maintained ROW include clearing of ROW for construction then re-vegetation of the ROW.

Urban

The urban habitat type includes commercial and residential properties. Most urban areas are highly disturbed and contain ornamental trees and shrubs, but they provide habitat for man-induced floral assemblages. The urban areas in the ROW are characterized by live oak, cedar elm, hackberry, Chinese tallow, yaupon, Chinese privet, southern carpet grass, Bermuda grass, Johnson grass, smutgrass, annual sumpweed, seaside goldenrod, saw greenbrier, and Paraguayan windmill grass. This ornamental vegetation benefits birds and insects such as butterflies.

The proposed project would affect 4.89 acres of Urban habitat (1.02 percent of the total area), all of which would be permanently affected. Urban areas would be permanently converted to new roadway, maintained ROW, or feeder roads depending on their location. Acquisition of ROW in these areas has been minimized and avoided to the greatest extent practicable as it is immediately adjacent to the existing ROW.

Tree Survey

TPWD requires that a tree survey be performed for projects that will affect special habitat or that require the acquisition of new ROW. Bayous and other water bodies are identified as special habitat features by TPWD. On November 19 and December 1, 2004, a tree survey was performed following guidelines prescribed by the 1998 Memorandum of Understanding and Memorandum of Agreement (MOU/MOA) between TxDOT and TPWD. This survey consisted of (1) determining the dominant species present by identification and calculation, (2) visually estimating tree height ranges, (3) measuring range and average diameter at breast height (DBH) with a diameter tape, and (4) visually estimating percent canopy cover of trees. Dominant species observed include hackberry, live oak, water oak, yaupon, Chinese tallow, common pecan, green ash, loblolly pine, and cedar elm. Twenty-eight sample areas were predetermined based on vegetation type analysis of 2002 H-GAC aerial photographs. Transects were used to collect data in each of the 28 areas surveyed.

The riparian forests support the majority of trees in the proposed ROW. The aquatic features vegetation community is primarily open water supporting very few trees. Periodically inundated wetlands support a mostly herbaceous layer of vegetation with few trees. Managed pasturelands support primarily herbaceous vegetation with few trees located along fence lines. The tallow forest community contains a

minor element of native herbaceous vegetation but is dominated by invasive Chinese tallow trees. The maintained ROW vegetation community consists primarily of an herbaceous layer with one area (Area 10) supporting trees. The urban vegetation community is primarily an open area supporting widely-spaced ornamental and native trees. The existing roadway does not support any trees. Results of the tree survey are summarized in **Table 14** and **Table 15**.

Table 14: Approximate Acreage of Trees in each Vegetative Community

Vegetative Community	Area of Trees (acre)
Aquatic Features	--
Periodically Inundated Wetlands	--
Riparian Forest	0.30
Managed Pastureland	0.02
Tallow Forest	0.03
Maintained ROW	0.05
Urban	0.06
Roadway	--
Total	**0.46**

Source: Study Team 2006

Rare Vegetation

The rare vegetation series rankings used by the TPWD Natural Diversity Database System to delineate the rarity and conservation status of natural communities (series level) are as follows: S1 series is critically imperiled in the state, extremely rare, very vulnerable to extirpation, and five or fewer occurrences within the state; S2 series are imperiled in the state, very rare, vulnerable to extirpation, and six to 20 occurrences within the state; and S3 series is rare in the state with 21 to 100 occurrences. There are no S1 or S2 series within the proposed ROW; two areas were determined to be suspect remnant S3 series. The proposed project would not affect the S3 or other rare vegetation series.

Coastal Live Oak – Pecan Series

The S3 series occurs within evergreen or deciduous upland woodlands of the upper Coastal Prairie, mostly on clays between the Colorado, San Bernard, and Brazos Rivers and their tributaries/bayous. It is characterized by post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*), water oak, yaupon, and hawthorn (*Crataegus spp*). Its status is S3 because of large-scale residential and industrial development and conversion to pasture (Texas Organization for Endangered Species 1992).

Areas supporting live oak and pecan are found within the proposed ROW. These two tree species are present together in Areas 10 and 11, a maintained ROW and managed pastureland, respectively. These areas are disturbed, are not dominated by either tree species, and do not include post oak or blackjack oak.

Table 15: Tree Survey Results

Area[(1)]	Vegetation Type	Survey Area (acre)	Areas of Trees Present (acre)	Percent Canopy Cover	Average DBH (inch)	Range of DBH (inch)	Range of Height (feet)	Percent Chinese Tallow	Dominant Tree Species
1	Urban	0.44	0.02	5	7	1.8-10.7	20-30	10	live oak, cedar elm, hackberry, Chinese tallow
5	Managed Pastureland	0.11	<0.01 (355.89 sq.ft.)	5	8.05	1.9-12	10-35	88	live oak, Chinese tallow
6	Tallow Forest	0.11	0.02	75	4.84	2.0-9.4	15-35	100	Chinese tallow
9	Managed Pastureland	0.58	<0.01 (134.43 sq.ft.)	5	6.28	1.8-8.5	15-20	83	Chinese tallow, cedar elm
10	Mowed ROW & Overpass	9.68	0.05	17	11.4	7.5-15.8	15-35	0	crepe-myrtle (50), live oak, pecan
11	Managed Pastureland	0.07	<0.01 (209.39 sq.ft.)	85	11.6	8.0-16	25-45	0	Live oak, pecan, cedar elm
12	Riparian	0.84	0.22	50	9.34	2-56.4	10-45	40	hackberry, Chinese tallow, black willow, loblolly pine, willow oak, pecan
13	Urban	1.34	<0.01	2	15.6	15.6	15	100	Chinese tallow
14	Riparian	0.31	0.08	85	7.98	1-46	15-50	30	hackberry, Chinese tallow, loblolly pine, willow oak, live oak
15	Urban	0.11	<0.01 (381.28 sq.ft.)	50	17.95	7.2-20.5	20-75	22	cedar elm, live oak, loblolly pine, Chinese tallow
17	Tallow Forest	0.05	<0.01 (327.05 sq.ft.)	85	6.83	2-10	15-35	95	Chinese tallow, cedar elm
20	Urban	1.87	0.03	7	8.52	2-40	25-40	0	loblolly pine, live oak, hackberry
21	Riparian	0.47	<0.01 (56.02 sq.ft.)	45	7.4	3-24	15-35	60	willow oak, water oak, live oak, hackberry, sweet gum, Chinese tallow
23	Managed Pastureland	0.20	<0.01 (9.19 sq.ft.)	5	8	8	15	100	Chinese tallow

25	Managed Pastureland	0.46	<0.01 (302.09 sq.ft.)	5	5.08	2-22	15-30	80	Chinese tallow, hackberry
26	Urban (recently cleared)	0.21	<0.01 (37.72 sq.ft.)	5	11	10-12	25-30	50	Chinese tallow, eastern red cedar
27	Urban	0.05	<0.01 (30.45 sq.ft.)	5	10	10	25	0	live oak
Total		**16.90**	**0.46**	**-**	**16.10 [(2)]**	**1-56.4**	**10-75**	**50**	**-**

Source: Study Team 2006

Note: [(1)] Areas 2, 3, 4, 7, 8, 16, 18, 19, 22, 24, and 28 are areas of new ROW. These areas were surveyed; however, no trees were observed and therefore are not included in this table.

[(2)] Weighted average

Mitigation

In accordance with the TxDOT MOU, habitats given consideration for non-regulatory mitigation include: (1) habitat for federal candidate species (affected by the project) if mitigation would assist in the prevention of the listing of the species, (2) rare vegetation series (S1, S2, or S3) that also locally provide habitat for state-listed species, (3) all vegetation communities listed as S1 or S2, regardless of whether or not the series in question provide habitat for state-listed species, (4) bottomland hardwoods, native prairies, and riparian sites, and (5) any other habitat feature considered to be locally important that TxDOT chooses to consider. Coordination is needed between TxDOT and TPWD to determine mitigation requirements for non-regulated native plant communities being permanently affected or converted to Maintained ROW.

A portion of the proposed project would affect riparian areas adjacent to Magnolia Bayou and Dickinson Bayou. These riparian zones consist of invasive species, such as Chinese tallow, interspersed with native vegetation, such as live oak, willow oak, and loblolly pine. Within these riparian areas, Chinese tallow cover varies from 30 to 60 percent of the total cover. Since Chinese tallow is an invasive, non-native species, it is typically considered low quality habitat. The removal of Chinese tallow is generally encouraged by local, state, and federal agencies as well as non-governmental organizations. Because the woody vegetation within the riparian zones is generally of poor quality due to the predominance of an invasive, non-native species, compensatory mitigation is not being considered for effects to the proposed ROW.

Although the referenced riparian zones are low quality, it is recognized that there will be a loss of vegetative structure that provides for limited habitat (shelter and cover). To help reestablish habitat and encourage the natural revegetation of a more diverse riparian zone, vegetation enhancement within the study area is proposed. This enhancement would include the planting of trees, shrubs, and forbs native to the area and typical of riparian zones within the Gulf Coastal Prairie. The beautification/enhancement would enable and promote the natural revegetation process, while providing an immediate source of habitat to wildlife utilizing the area following construction.

If applicable, TxDOT would conduct coordination with TPWD to determine mitigation requirements for regulated plant communities within the proposed project ROW. Excluding the limited riparian areas, the

dominant vegetation that would be affected by this project is largely invasive and opportunistic. It has not been considered for compensatory mitigation.

In order to comply with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, compensatory mitigation measures for effects to aquatic resources and periodically inundated wetlands will be coordinated with the USACE for features under their jurisdiction. At the time of this document, potential compensatory mitigation measures have not been identified. Potential mitigation options are discussed in the Waters of the U.S., including Wetlands section of this EA.

Wildlife

Minor short-term and long-term adverse effects to wildlife would be due primarily to the construction of the proposed project. Although construction could remove and/or displace habitat and wildlife in certain areas, habitat loss and resulting effects on wildlife would not be significant. Direct effects on wildlife include the loss of habitat, decreased attractiveness of habitat adjacent to the roadway, and potential increases in wildlife-vehicle accidents.

The proposed project lies within the North American flyway; neo-tropical migrant birds pass over this area bi-annually. The proposed project would not restrict the migration of birds. No nesting birds, including swallows, were observed during numerous site inspections. TPWD recommended that construction activities occur outside the nesting season of April 1 through July 15 of each year of the project. Additionally, TPWD recommended that any construction activities remain a minimum of 100 meters from any raptor nests during the period of February 1 through July 15. To address these concerns, TxDOT will conduct the removal of migratory bird nests or nest structures, tree felling, and vegetation clearing outside the April 1 to July 15 migratory bird nesting season to the greatest extent possible.

The No Build Alternative would have no effect to wildlife within the study area. Existing residential and urban-related activities would continue within the study area with or without the proposed project, incrementally affecting wildlife communities.

Regional Wildlife Habitat

The study area is located in the Gulf Coast Prairies and Marshes vegetation region of Texas (Gould 1975). The proposed project lies in a transitional zone between the Texan and Austroriparian Biotic Provinces (Blair 1950). Faunal assemblages are characterized by species typical of these two biotic provinces. The Texan Biotic Province is a broad, ecologically transitional region (ecotone) between the Tamaulipan Biotic Province to the west and the Austroriparian Biotic Province to the east. The Texan Biotic Province supports a mixture of plant and animal species characteristic of both Tamaulipan and Austroriparian Biotic Provinces. Rivers and associated riparian strips in the Texan Biotic Province provide valuable habitat as well as corridors for migration. At least 49 species of mammals, six species of lizards, 39 species of snakes, five species of salamanders, and 18 species of frogs occur in the Texan Biotic Province. **Appendix F, Table F-1** presents typical species occurring within the Texan Biotic Province known to occur within Galveston County (Blair 1950; Dixon 2000; and Texas Tech University {TTU} 2005).

The Austroriparian Biotic Province includes the Gulf Coastal Plain from the Atlantic to eastern Texas. The vegetation is comprised of the same species of hardwoods and pines that characterize the province eastward to the Atlantic. At least 47 species of mammals, 10 species of common lizards, two species of turtles, 29 species of snakes, 18 species of salamanders, and 17 species of frogs occur in the

Austroriparian Biotic Province. **Appendix F, Table F-2** provides a table outlining typical species within the Austroriparian Biotic Province known to occur within Galveston County (Blair 1950; Dixon 2000; and TTU 2005).

Local Wildlife Habitat

Wildlife habitat correlates with vegetation types described above: riparian forest, tallow forest, periodically inundated wetlands, managed pastureland, aquatic features, urban, and maintained ROW. Lists of wildlife species potentially occurring within each habitat type are included in **Appendix F, Tables F-3 through F-9**. The vegetation species supported by each habitat are described above.

Aquatic Features

The channelized drainage ditches, Dickinson Bayou, Magnolia Bayou, Borden's Gully, and their associated bridges provide habitat for numerous wildlife species. The waterways vary from tidally influenced bayous with saltwater wedges to freshwater drainages. These waterways are steep-sided and slow moving except after a large storm event; they are typically bordered with a narrow fringe of wetland vegetation. This vegetation assemblage provides the ecological requirements for wildlife, including two species of mammals, 12 species of birds, and seven species of herptofauna.

Periodically Inundated Wetlands

Periodically inundated wetlands, located throughout the study area, receive moisture from precipitation and runoff and hold water for varying amounts of time. This seasonal, depressional pond water supports hydrophytic plant species capable of surviving during dry periods. This vegetation assemblage provides the ecological requirements for wildlife, including four species of mammals, nine species of birds, and 15 species of herptofauna.

Riparian Forest

The riparian forest found in the study area represents a transitional vegetative community between the aquatic habitats associated with bayous, drainages and drier uplands. In addition to migratory birds utilizing this habitat, the vegetation assemblage provides the ecological requirements for wildlife, including 15 species of mammals, nine species of birds, and eight species of herptofauna.

Managed Pastureland

Vegetation composition within the managed pastureland habitat type is highly variable due to periodic modifications, including cultivation, the application of herbicide, and/or intense grazing pressure. In general, various introduced grasses and invasive forbs dominate managed pasturelands. This vegetation assemblage provides the ecological requirements for wildlife, including seven species of mammals, 16 species of birds, and nine species of herptofauna.

Tallow Forest

The dominance of Chinese tallow in these areas has resulted in adverse environmental effects such as lowered plant species diversity and diminished quality of wildlife habitat. This vegetation assemblage provides the ecological requirements for wildlife, including 15 species of mammals, nine species of birds, and eight species of herptofauna.

Maintained Right-of-Way

Maintained ROW is highly disturbed and generally does not support high-quality natural floral or faunal communities. This vegetation assemblage provides the ecological requirements for some wildlife, including six species of birds and six species of herptofauna. Routine mowing significantly reduces plant species diversity and presents a danger to less mobile species. These two factors limit animal species diversity in maintained areas. Existing overpasses and bridges in the study area provide habitat for roosting bats. Six species of bats are commonly found in the region.

Urban

Urban areas are highly disturbed and generally do not support high quality natural floral or faunal communities. They provide the ecological requirements for some wildlife, including four species of mammals, six species of birds, and six species of herptofauna.

Summary

Wildlife habitat potentially affected by the proposed project is closely correlated with the vegetation types described in the Vegetation section of this document. Native habitat types potentially affected by the proposed project include aquatic features, periodically inundated wetlands, and riparian areas. The proposed project would affect approximately 10.08 acres of native habitat. Of these 10.08 acres, approximately 7.4 acres would be permanently affected and 2.68 acres would be temporarily affected by the proposed project. Permanent effects include the conversion of areas to new roadway, maintained ROW or feeder roads, depending on their location. Temporary effects to habitats include the clearing of maintained ROW for construction and subsequent revegetation of the ROW. Additional effects would be caused by placement of culverts or construction of bridge structures in aquatic features. Construction activities may permanently affect individuals of some species due to the conversion of habitat to transportation uses and the disturbance of normal wildlife behavior patterns.

No indirect effects resulting from the proposed project are expected. Potential indirect effects evaluated include habitat fragmentation, reduced habitat quality, loss of habitat connectivity, barrier effects, and edge effects. IH 45 is an existing roadway and, as such, is a formidable barrier to wildlife movement. No fragmentation, loss of connectivity, or barrier effect is anticipated. Minor effects to edges of waters of the U.S. may be caused by the loss of adjacent wetlands.

The potential effects to wildlife resources including construction noise, increased human activity, habitat loss, and potential sedimentation during construction would be minor. To minimize effects to wildlife, native vegetation would be re-established as soon as is practical to replace important forage and cover. The use of Best Management Practices (BMPs) to reduce potential erosion and stream sedimentation would minimize effects to all adjacent natural habitats. Cumulative effects on wildlife populations are not expected to occur because development in the study area is anticipated to continue with or without the proposed project.

Mitigation

Habitat loss would be mitigated by the use of BMPs to reduce potential erosion and stream sedimentation. TxDOT will conduct the removal of migratory bird nests or nest structures, tree felling, and vegetation clearing outside the April 1 to July 15 migratory bird nesting season to the greatest extent possible.

A portion of the proposed project would affect riparian areas adjacent to Magnolia and Dickinson Bayous. Although these riparian zones are relatively low quality due to an abundance of invasive Chinese tallow, it is recognized that there would be a loss of vegetative structure that provides limited habitat (shelter and cover). To help reestablish habitat and encourage the natural revegetation of a more diverse riparian zone, vegetation enhancement within the study area is proposed. This would include the planting of trees, shrubs, and forbs native to the area and typical of riparian zones within the Gulf coastal prairie. The enhancement would enable and promote the natural revegetation process while providing an immediate source of habitat to wildlife utilizing the area following construction.

Essential Fish Habitat

The Magnuson-Stevens Fishery Management and Conservation Act (MSFMCA) defines Essential Fish Habitat (EFH) as those waters and substrate necessary for fish to spawn, breed, feed, or grow to maturity. All estuaries and estuarine habitats in the northern Gulf of Mexico are considered EFH (Gulf of Mexico Fishery Management Council {GMFMC} 1998). The MSFMCA specifies that each federal agency shall consult with NOAA Fisheries when an activity proposed to be permitted, funded, or undertaken by a federal agency may have adverse effects on designated EFH. NOAA Fisheries is directed to comment on any state agency activities that would affect EFH.

Assessment of Managed Species

According to Fishery Management Plans for the GMFMC, suitable habitats for brown shrimp (*Farfantepenaeus aztecus*), juvenile pink shrimp (*Penaeus duorarum*), white shrimp (*Litopenaeus setiferus*), red drum (*Sciaenops ocellatus*), and Spanish mackerel (*Scomberomorus maculatus*) may be present within the study area. Other managed species known to occur in the Gulf of Mexico and in lower Galveston Bay are not known to occur in the study area.

The NOAA developed relative abundance distribution maps of managed fishery species in the Gulf of Mexico, and these maps were used to determine if a species would occur within Galveston Bay (GMFMC 1998). As shown in **Appendix F, Table F-10** summarizes relative abundance map information for each managed species within the study area with life stage and salinity season information (GMFMC 1998). The life stages are separated into juveniles and adults. The April-June season is a season of low salinity, July is a season with increasing salinity, August to October is a high salinity season, and November to March is a decreasing salinity season.

According to the Draft 2002 Texas Water Quality Inventory (TCEQ 2002), Magnolia Bayou, Borden's Gully, and Dickinson Bayou are tidally influenced and therefore were analyzed for the presence of EFH. Magnolia Bayou and Borden's Gully are tributaries of Dickinson's Bayou, which flows into Dickinson Bay and eventually into Galveston Bay. These waterways have silt mud bottom substrates. **Table 16** contains salinity range information collected by TCEQ for the three waterways (TCEQ 2005). The five unnamed, channelized drainage ditches and eight roadside ditches located within the study area would not provide EFH (Swafford 2005).

Table 16: Salinity Range Information Collected by TCEQ

Waterway	Location of Data Collection	Salinity Range (ppt [(1)])
Dickinson Bayou	IH 45	1-5.5
Magnolia Bayou	FM 517 Bridge (0.42 miles east of the proposed project)	1-6.2
Borden's Gully	FM 517 Bridge (0.3 miles east of the proposed project)	1-4.5

Source: TCEQ 2005. Data collected February 2002 – August 2003
Note: [(1)] ppt = parts per thousand

Marsh habitats adjacent to these waters are palustrine in nature. Typical vegetation observed includes black willow, green ash, water oak, seaside goldenrod, southern carpet grass, common frog fruit, narrow-leaf cattail (*Typha latifolia*), alligator weed, bull-tongue arrow-head (*Sagittaria lancifolia*), green flatsedge, soft rush, swamp smartweed, marsh seedbox, and coastal plain penny wort. No submerged aquatic vegetation (seagrasses), algal meadows, or oyster reefs/beds were observed within the study area.

Brown shrimp are found within estuaries and offshore up to depths of 110 meters throughout the Gulf of Mexico and are most abundant in the central and western Gulf. Brown shrimp larvae are demersal, occur offshore, and migrate to shallow vegetated habitats as well as silty sand and non-vegetated mud bottoms in estuaries at the postlarval stage. Post-larval brown shrimp migrate toward estuaries in the early spring between February and April with a minor peak in the fall. Juvenile and sub-adult brown shrimp prefer shallow estuarine areas, particularly the soft muddy areas associated with the plant-water interface. Tidal marshes, particularly those with smooth cordgrass (*Spartina alterniflora*), are important to juvenile brown shrimp (GMFMC 1998). Adult brown shrimp occur in water extending from mean-low tide to the edge of the continental shelf and are associated with silt, muddy sand, and sandy substrate. Based on the relative abundance maps (**Appendix F, Table F-10**) and habitats available at all three waterways, both juvenile and adult brown shrimp may be present within the study area; however, the habitat would be sub-optimal due to low salinities.

White shrimp are found in estuaries and out to depths of approximately 40 meters offshore in coastal waters extending from Florida's Big Bend area through the state of Texas and are most abundant in the central and western Gulf. Spawning takes place in offshore waters when salinities are at least 27 ppt (Perez-Farfante, 1969). White shrimp eggs are demersal and larvae stages are planktonic, occurring in near-shore habitats. Peak recruitment of post-larvae into estuaries occurs from June through September. Postlarval white shrimp are benthic in the estuaries where they seek muddy-sand bottoms and marshes with large quantities of decaying organic matter or vegetation. Juveniles are commonly found in all Gulf estuaries from Texas to the Suwannee River in Florida. Laboratory experiments have shown that larvae can be successfully reared at a salinity range between 18-34 ppt (Perez-Farfante 1969). However, Muncy (1984) reported white shrimp in the northern Gulf of Mexico at a salinity of 0.42 ppt. As juvenile white shrimp mature, they migrate in late August and September from the estuaries to coastal areas. The adult white shrimp are benthic and inhabit near shore Gulf waters to depths less than 30 meters on soft mud or silt bottoms. Based on relative abundance maps (**Appendix F, Table F-10**) and available habitats at all three waterways, both juvenile and adult white shrimp may be present in the study area. Due to the low

salinities of the waterways, juvenile white shrimp are more likely to be present in the study area than adult white shrimp.

Pink shrimp begin life as eggs in the Gulf and migrate to estuaries as post larvae. As juveniles, they are commonly found in estuarine areas supporting seagrasses. Here they burrow into the substrate by day and emerge at night. Preferred substrates include coarse sand/shell/mud mixtures. Adults inhabit offshore marine waters with highest concentrations being found between the depths of nine and 44 meters. Preferred substrates for adults are coarse sand and shell with a mixture of less than 1 percent organic matter. Throughout Texas, the pink shrimp is abundant in seagrass beds where salinity exceeds 20 ppt. (Hill 2002). Seagrass habitat preferred by juvenile pink shrimp is absent in the study area (GMFMC 1998). Based on the relative abundance maps (**Appendix F, Table F-10**) and available habitats within study area, it is unlikely that juvenile or adult pink shrimp will be present.

The red drum commonly occurs in all Gulf estuaries in a variety of habitats and substrates. Habitats range from depths of 40 meters offshore to very shallow estuarine wetlands and substrates that include sand, mud, and oyster reefs, varying by life stage. The red drum tolerates salinity ranges from freshwater to highly saline water. Spawning occurs in deeper water near the mouths of bays and inlets and on the Gulf side of barrier islands. Eggs hatch primarily in Gulf waters and larvae are transported into estuaries where the fish mature before moving back to the Gulf. Larval red drum are most abundant in estuaries from mid-August through November. Within the nursery areas of estuaries, larval, postlarval, and juveniles prefer areas protected from currents with submerged vegetation and a muddy bottom but tolerate non-vegetated hard and soft bottom areas. Subadult red drum prefers shallow bay bottoms and oyster reef substrates (Miles 1950). The adult red drum can be found in estuaries but generally spend more time offshore as they age with schools of fish in deep Gulf waters. Optimum red drum habitat has been identified as shallow water with 50 to 75 percent submerged vegetation growing on mud bottoms and fringed with emergent vegetation. Based on relative abundance maps (**Appendix F, Table F-10**), the juvenile and adult red drum may occur in the study area. However, the available habitat is sub-optimal for adult red drum because submerged vegetation is not present.

The Spanish mackerel is a pelagic species occurring in depths up to 75 meters throughout the coastal zone of the Gulf of Mexico. Adults spawn offshore and larvae and juveniles are found offshore and occasionally in estuaries. Although they occur in waters of varying salinity, juveniles prefer areas of marine salinity and are not considered estuarine dependent. Clean sand appears to be the substrate of preference for juveniles. Adults are usually found in neritic waters and along coastal areas. They will inhabit estuarine areas, especially in higher salinity areas. Both juveniles and adults feed on bony fish, such as anchovies (*Anchoa spp*.), herrings (*Opisthonema spp*.), and menhaden (*Brevoortia spp*.). In addition, they feed on squids (*Cephalopoda*) and shrimp (*Penaeus spp*.) (Finucane et al. 1990). These prey are found in marine environments, and it is unlikely that the Spanish mackerel will find food sources within the study area. Based on relative abundance maps (**Appendix F, Table F-10**), available habitat, and food sources, both juvenile and adult Spanish mackerel are unlikely to occur within the study area.

Summary

The proposed project has avoided and minimized effects to Magnolia Bayou, Borden's Gully, and Dickinson Bayou to the greatest extent practicable. The bridge designs are not yet finalized, and therefore

effects to EFH cannot be accurately determined at this time. Effects to EFH will be coordinated with NOAA Fisheries through the USACE permitting process when effects are more clearly known.

It is likely that the proposed project would have no long-term effect on EFH, including those managed species potentially present in the study area. Sub-optimal habitat exists within the study area for brown shrimp, white shrimp, and red drum. Both species of shrimp are unlikely to occur due to the low salinity waters found in these locations. Red drum are unlikely to occur due to a lack of preferred habitat.

The proposed project would temporarily affect EFH during construction. These effects would be of short duration and limited to the time period during installation or demolition of bridge columns or pilings, embankment fill, or culvert extensions as appropriate. Construction activities may increase turbidity of the water bodies in the immediate area and for a short distance downstream. It is assumed that the structures would not change existing channel widths and water bodies would be generally comparable to pre-construction conditions. BMPs would be implemented to prevent or minimize erosion, sedimentation, and turbidity. If adverse effects to EFH were discovered during completion of bridge design and finalization of wetland effects, coordination will occur with NOAA Fisheries and a mitigation plan to offset adverse effects to EFH will be completed. According to the EFH findings between TxDOT, FHWA, and NOAA Fisheries, the EFH coordination for adverse effects to EFH may occur during the NEPA review process or the USACE permitting process as appropriate.

The proposed project would have no indirect effects, such as habitat fragmentation, reduced habitat quality, loss of habitat connectivity, or barrier effects. The proposed project is not likely to have cumulative effects to EFH, as the construction areas are relatively small when compared to the tidal areas of each water body.

Mitigation

It is likely that, after construction, the waterways would offer EFH comparable to pre-existing conditions. Preliminary coordination with NOAA Fisheries was initiated in October 2003. Effects to EFH will be coordinated with NOAA Fisheries through the USACE permitting process, when effects are more clearly known. Mitigation, if any, would follow NOAA Fisheries guidelines. BMPs would be implemented to prevent or minimize erosion, sedimentation, and turbidity.

Threatened and Endangered Species

Databases of sensitive species maintained by the USFWS and TPWD were reviewed to determine state and/or federally listed threatened or endangered species that occur or have historically occurred in Galveston County (USFWS 2008 and TPWD 2008). The potential effects of the proposed project on these species were determined by reviewing the TPWD - Natural Diversity Database (NDD) Element of Occurrence Records (see **Appendix C** for the TPWD coordination letter) and by conducting habitat assessments with qualified biologists. No unique, critical, designated, or proposed designated habitat exists in or near the proposed project. No listed species were observed during field investigations.

According to the TPWD-NDD Element of Occurrence Records, no documented occurrences of state and/or federally threatened or endangered species are known within the limits of the proposed project. However, the TWPD-NDD revealed documented occurrences for the following species of concern within 1.5 miles of the proposed project: coastal gay-feather (*Liatris bracteata*) and Texas windmill-grass (*Chloris texensis*). Site investigations were performed twice to search for these species; however, no

habitat supporting these species and no occurrences of these species were observed. Furthermore, no colonial waterbird nesting areas are known to occur within or adjacent to the proposed project.

Summary

The No Build Alternative would have no effect on any state and/or federally listed threatened or endangered species. **Table 17** lists all state and/or federally listed threatened or endangered species identified as potentially occurring within Galveston County, a description of suitable habitat, and the effect of the proposed project on each species. The proposed project would not directly or indirectly effect or diminish the value of critical habitat for the survival or recovery of any listed species. The proposed project would have *no effect* on any population or individuals of state and/or federally listed threatened or endangered species.

Table 17: Potential Effects to Listed Species Potentially Occurring within Galveston County

Common Name (*Scientific Name*)	**State Status**	**Federal Status**	**Description of Suitable Habitat**	**Unique, Critical, or Designated Habitat Present**	**Effects Discussion**
Birds					
American peregrine falcon (*Falco peregrinus*)	E	DM †	Resident and nests in west Texas, potential migrant, winters along coast	No	No effect; rare transitory migrant
Arctic peregrine falcon (*Falco peregrinus tundrius*)	T	DM †	Potential migrant, winters along coast	No	No effect; rare transitory migrant.
Attwater's greater prairie-chicken (*Tympanuchus cupido attwateri*)	E	E	Thick one to three foot tall grass from 0 to 200 feet above sea level along the coast	No	No effect; habitat not affected by the proposed project. Proposed project does not acquire ROW from the Texas City Prairie Preserve.
Bald eagle [(1)] (*Haliaeetus leucocephalus*)	T	DM	Near water areas, in tall trees	No	No effect; no occurrences observed and no NDD occurrences for this species. No known nesting sites nearby or observed.
Brown pelican (nesting) (*Pelecanus occidentalis*)	E	DM, E	Roosts and nests on islands and near shore coastal areas	No	No effect. No occurrences observed and no NDD occurrences for this species. No known nesting sites nearby or observed.
Eskimo curlew (*Numenius borealis*)	E	E	Historic; non-breeding; grasslands, pastures, plowed fields, and less frequently, marshes and mudflats	No	No effect. No occurrences observed and no NDD occurrences for this species.
Peregrine falcon (*Falco peregrinus*)	E,T	DM †	Resident, nests in west Texas	No	No effect; rare transitory migrant.

Piping plover *(Charadrius melodus*)	T	E, T	Wintering in coastal areas, beach and bayside mud or salt flats	No	No effect; habitat not present.
Reddish egret (*Egretta rufescens*)	T	*	Brackish marshes and tidal flats	No	No effect; habitat not present.
White-faced ibis *(Plegadis chihi*)	T	*	Freshwater marshes, but some brackish or salt marshes	No	No effect; no occurrences observed and no NDD occurrences for this species.
White-tailed hawk *(Buteo albicaudatus*)	T	*	Coastal prairies; cordgrass flats, scrub-live oak	No	No effect; transitory migrant.
Whooping crane (*Grus Americana*)	E	E†	Winters in Aransas, Calhoun, and Refugio counties; potential migrant	No	No effect; habitat not present.
Mammals					
Louisiana black bear (*Ursus americanus luteolus*)	T	T†	Bottomland hardwoods; large, undisturbed forested areas	No	No effect; habitat not present.
Red wolf (*Canis rufus*)	E	E†	Extirpated; formerly eastern TX in brushy/forested areas, coastal prairies	No	No effect; extirpated.
West Indian manatee (*Trichechus manatus*)	E	E†	Gulf and bay system	No	No effect; habitat not present.
Reptiles					
Alligator snapping turtle (*Macroclemys temminckii*)	T	*	Deep water of rivers, canals, lakes, swamps, and bayous	No	No effect; habitat not present.
Atlantic hawksbill sea turtle (*Eretmochelys imbricata*)	E	E	Gulf and bay system	No	No effect; no habitat critical to the survival or recovery of this species was observed in the proposed ROW.
Green sea turtle (*Chelonia mydas*)	T	E, T	Gulf and bay system	No	No effect; no habitat critical to the survival or recovery of this species was observed in the proposed ROW.
Kemp's ridley sea turtle (*Lepidochelys kempii*)	E	E	Gulf and bay system	No	No effect; no habitat critical to the survival or recovery of this species was observed in the proposed ROW.
Leatherback sea turtle (*Dermochelys coriacea*)	E	E	Gulf and bay system	No	No effect; no habitat critical to the survival or recovery of this species was observed in the proposed ROW.
Loggerhead sea turtle (*Caretta caretta*)	T	T	Gulf and bay system	No	No effect; no habitat critical to the survival or recovery of this species was observed in the proposed ROW.
Texas horned lizard (*Phrynosoma cornutum*)	T	*	Open, semi-arid regions, with sparse vegetation, grass, cactus, and brush.	No	No effect; habitat not present.

Timber/canebrake rattlesnake (*Crotalus horridus*)	T	*	Swamps/floodplains of hardwood/upland pine	No	No effect; habitat not present.

Sources: TPWD 2008, USFWS 2008
Note:
* These species occur on the TPWD listing of threatened or endangered species (updated June 2008, accessed July 2008); however, they are not federally listed by the Clear Lake office of the USFWS (accessed July 2008).
† These species are listed by the U.S. Fish and Wildlife Service; however, they are not listed to occur within Galveston County by the Clear Lake office of the USFWS (accessed July 2008).
(1) The bald eagle was delisted by the USFWS on August 8, 2007 and is no longer a federal threatened species; however, it will be monitored closely for at least the next five years, and is still afforded special protection under the MBTA and Eagle Act.

E = Endangered
T= Threatened
DM = Delisted
PDM = Proposed for Delisting

Migratory Birds

Several of the bird species listed in **Table 17** are considered migratory; however, the Build Alternative would not affect the migration patterns of these species. In the event that migratory birds or their nests are observed prior to construction activities, measures would be taken to avoid harm to migratory birds, their nests, eggs, or young. To ensure compliance with the Migratory Bird Treaty Act (MBTA), clearing and grubbing vegetation within the study area would not take place during the migratory bird nesting season (April 1 to July 15) or measures would be taken to discourage birds from nesting in existing structures. The site should be surveyed for migratory bird nesting sites prior to construction or future maintenance activities.

Cultural Resources

Historic Structures

A review of the National Register of Historic Places (NRHP), the list of State Archeological Landmarks (SAL), and the list of Recorded Texas Historic Landmarks (RTHL) indicated that no historically significant properties have previously been documented within the area of potential effects (APE). It has been determined through consultation with the State Historic Preservation Officer (SHPO) that the APE for the proposed project is 300 feet beyond the current and proposed ROW. A cultural resource survey conducted by TxDOT personnel revealed there are 11 buildings, 28 structures, one cemetery, and one site (built prior to 1961) located within the project APE. No Official State Historical Markers (OSHM) are located within the project APE.

In compliance with Section 110 of the National Historic Preservation Act and the Memorandum of Understanding (MOU) between TxDOT and the Texas Historical Commission (THC), TxDOT historians evaluated the 28 bridges, bridge-class culverts, and culverts to establish their historical significance. Three of the bridges (NBI Numbers: 120850050001362, 120850050004029, and 120850050004030) are historic-age, and the remaining 25 bridges were built in 1977 or later. In accordance with the registration evaluation criteria established by THC and TxDOT for the 1999 Non-Truss Bridge Inventory, these structures were determined not eligible for the NRHP. The structures do not possess sufficient design or engineering significance to meet NRHP eligibility under Criterion C, engineering at the state level of significance. Additionally, a number of the structures have been modified and widened since original

construction. Because the structures may have local or regional significance, TxDOT consulted with the Galveston County Historical Commission, which revealed no local or regional historic significance with respect to the structures. Additionally, in accordance with the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), the bridges are exempt from 36 CFR 800 (Section 106) review as they are not considered to be historically significant elements of the Interstate System. Therefore, these structures are determined not eligible for listing in the NRHP.

TxDOT historians evaluated the Mt. Olivet Catholic Cemetery and the Galveston County Water Company Canal for NRHP eligibility. TxDOT historians determined both resources to be not eligible for inclusion into the NRHP. TxDOT historians determined that none of the identified buildings or structures were eligible for inclusion into the NRHP.

In a memorandum dated August 8, 2007, TxDOT Historians determined that pursuant to Stipulation VI "Undertakings with Potential to Cause Effects" of the First Amedned Programattic Agreement Regarding Implementation of Transportation Understakings and the Memorandum of Understanding (PA-TU), no historic properties are located within the proposed project's APE. Therefore, individual coordination with the SHPO is not required. This Memorandum is included in **Appendix C**.

Archeological Resources

Prior to field survey, a review of records and literature was conducted for known sites, historic structures, and properties currently listed on the NRHP. None were located within the study area. Records housed at the Texas Archeological Research Laboratory (TARL) were examined along with the Texas Archeological Sites Atlas. Sites closest to the study area include 41HR635, a mid-19th century home located on private property; 41HR529, a defunct power plant likely associated with the Galveston, Houston, and Henderson Railroad; and 41HR969, a prehistoric lithic scatter (TARL 1984, 1990; TxDOT 1999; Mooney et al. 2004). All of these sites are located on the north side of Clear Creek, approximately one-third mile (0.5 kilometers) north of the north end of the study area.

High probability areas for historic and prehistoric archeological resources within the study area were determined from historic mapping and the Potential Archeological Liability Mapping of the Houston District (Abbott 2001) (as shown in **Exhibit 6**). Approximately 4.7 acres (1.9 hectares) of archeological high probability areas were identified within the study area. In June 2004, qualified cultural resource personnel conducted an intensive pedestrian survey and deep testing of 78 percent of these high probability areas (where access was granted from landowners).

One previously unidentified locality was recorded during the intensive survey. This locality consisted of a mid to late 20th Century historic component containing concrete pads, a dry decorative pond, a driveway, and some brick and whiteware fragments. This locality was evaluated as not being able to add any significant data to better the understanding of the historic period in this area and is evaluated as not eligible for nomination to the NRHP. For the areas of denied access, no mounds were observed during visual examination of the property from the existing ROW. The probability of significant artifact concentrations or intact features being present on these properties was evaluated to be very low. No further cultural resource investigations were recommended for this area.

In accordance with the Programmatic Agreement between FHWA, THC, the Advisory Council on Historic Preservation, and TxDOT and the MOU between TxDOT and THC, TxDOT consulted with the

SHPO regarding the eligibility of historic properties for inclusion in the NRHP. On March 31, 2005, the SHPO concurred with TxDOT's recommendation of no historic properties affected; no further archeological investigations needed; and project should be allowed to proceed to construction (see **Appendix C**). Pursuant to Stipulation VI of the PA-TU, TxDOT finds that the APE does not contain archeological historic properties (36 CFR 800.16(l)), and thus the proposed undertaking would not affect archeological historic properties. The project does not merit further field investigations. Project planning can also proceed in compliance with 13 TAC 26.20(2) and 43 TAC 2.24(f) (1) (C) of the MOU. If unanticipated archeological deposits were encountered during construction, work in the immediate area will cease, and TxDOT archeological staff will be contacted to initiate post-review discovery procedures under the provisions of the PA and MOU.

Parkland and Section 4(f) Properties

The proposed project would not affect or substantially impair any publicly owned land, such as public parks, recreational areas, wildlife and water fowl refuge lands, or historic sites of national, state, or local significance as determined by the federal, state, or local officials having jurisdiction. A Section 4(f) evaluation is not required for the proposed project. No direct effects to public lands would result from the No Build Alternative.

Public lands may be reserved for public recreational usage under a Section 4(f) designation. Section 4(f) is part of the Department of Transportation Act of 1966 that was designed to reserve the natural beauty of the countryside. Property eligible for Section 4(f) must be a publicly owned public park, wildlife and waterfowl refuge, or any significant historic site. Use of Section 4(f) eligible sites may not be approved unless a determination is made that there is no feasible and prudent alternative to the use of land from the property.

Waters of the U.S., Including Wetlands

An investigation to identify jurisdictional waters of the U.S., including wetlands, within the study area was conducted pursuant to Executive Order 11990 (Protection of Wetlands), Section 404 of the Clean Water Act, and Section 10 of the Rivers and Harbors Act (RHA) of 1899. The term "waters of the U.S." has broad meaning and incorporates both deepwater aquatic habitats and special aquatic sites, including wetlands. According to the USACE, the federal agency having authority over waters of the U.S., wetlands are defined by three criteria: 1) the presence of hydrophtyic vegetation; 2) hydric soil characteristics; and 3) wetland hydrology. The limits of the USACE jurisdiction in other aquatic habitats lies within the boundary of the ordinary high water mark (OHWM) or mean high tide line (MHT).

Field wetlands delineations for the study area were completed using the methods outlined in the USACE 1987 Wetland Delineation Manual (USACE 1987). Field investigations were conducted in March, August, and October 2004. A jurisdictional determination was issued by the USACE on March 7, 2007.

Twelve jurisdictional areas encompassing 4.96 acres were identified within the study area: seven of these areas are waters of the U.S. (2.43 acres) and five are wetlands (2.53 acres). These areas were delineated and determined to be jurisdictional because they are named waters of the U.S., they have hydrologic connections to named waters of the U.S., and/or they lie within a 100-year floodplain. Jurisdictional areas are shown in **Exhibit 5** and described in detail in the sections below. The actual affected area may be less than is estimated in this document because design plans have not been finalized to include design details

of proposed drainage structures. Temporary effects, as well as fill, excavation, or draining of waters of the U.S., including wetlands, would be restored following construction.

Forty-two other non-jurisdictional aquatic resource areas lie within the study area. These areas consist of several man-made roadside ditches that generally lie parallel to the roadway and a concrete-lined ditch. It is anticipated that some of these non-jurisdictional areas, such as roadside drainage ditches used for storm water capture, attenuation, and runoff, would be relocated and/or recreated as part of the proposed project.

Waters of the U.S.

Seven jurisdictional waters of the U.S. lie within the study area as described in **Table 18**. These waterways include named waters of the U.S., roadside or drainage ditches that have hydrologic connections to waters of the U.S., and are historic intermittent streams and roadside or drainage ditches that are at the same elevation as the water of the U.S. hydrologic connection. The total estimated area of effect to waters of the U.S. is less than 1.84 acres.

Table 18: Potential Effects to Jurisdictional Waters of the U.S.

Designation	Water of the U.S.	OHWM (inch)	Area within ROW (acre)	Estimated Effect (acre)*	Description of Effect	Dominant Vegetation
A	Hydrologic connection to water of the U.S. or historically intermittent stream	11	0.22	0.22	Widening bridge and extension of drainage structures	Narrow leaf cattail, alligator weed, bull-tongue arrow-head, green flatsedge, soft rush, swamp smartweed, marsh seedbox, common frog-fruit
K		24	0.35	0.35	Extension of drainage structure	
O		19	0.53	0.53		
XX		4	<0.01 (2.13 sq.ft.)	<0.01 (2.13 sq.ft.)	Fill	
BBB	Magnolia Bayou	15	0.15	<0.15	Fill, widening bridge structures, installation of pilings, shoreline stabilization	Green ash, black willow, water oak, seaside goldenrod, southern carpet grass, common frog-fruit
CCC	Borden's Gully	4	0.09	<0.09		
DDD	Dickinson Bayou	173	1.09	<0.50		
Total	--	--	**2.43***	**<1.84****	--	--

Source: Study Team 2006

Note: * Area of permanent and temporary impact within Section 404 jurisdictional limits
**Totals have been rounded

Wetlands

Five jurisdictional wetlands and 42 non-jurisdictional wetlands were identified within the study area, as described in **Table 19**. The total estimated area of effect to jurisdictional wetlands is 0.05 acre. The total estimated area of effect to non-jurisdictional wetlands is 2.48 acres.

Table 19: Potential Effects to Wetlands

Designation	Description	Area of feature within ROW (acre)	Estimated Effect (acre)*	Description of Effect	Dominant Vegetation
Jurisdictional Wetlands					
E	Detention basin created under mitigation plan for USACE nationwide permit SWG-98-26-024	1.36	0.00	None	Broad-leaf cattails (*Typha latifolia*), seaside goldenrod, sand spikerush, round-head rush (*Juncus validus*).
UU		0.99	0.00	None	Sand spikerush, broad-leaf cattails, soft rush, busy bluestem, seaside goldenrod.
F	Roadside ditches within 100-yr floodplain	0.13	0.00	None	Sand spikerush, common frog-fruit, green flatsedge
K Fringe	Fringe wetlands with a hydrologic connection to a water of the U.S.	0.01	0.01	Fill, extension of drainage structure	Bull-tongue arrow-head, green flatsedge, soft rush, swamp smartweed
O Fringe		0.04	0.04	Fill, extension of drainage structure	Green flatsedge, marsh seedbox, little-tooth sedge (*Carex microdonta*)
Subtotal	--	**2.53**	**0.05**	--	--
Non-Jurisdictional Wetlands					
--	Roadside ditches above 100-yr floodplain	9.81	2.48	Fill, expansion of ROW	Sand spikerush, common frog-fruit, green flatsedge
Subtotal	--	**9.81**	**2.48**	--	--
Total	--	**12.34**	**2.53**	--	--

Source: Study Team 2006

Note: *Area of permanent and temporary impact within Section 404 jurisdictional limits

Permitting

It is anticipated that an Individual Permit (IP) from the USACE would be required for the proposed project. The proposed project does not qualify for permitting under a Nationwide Permit (NWP) because it would affect more than the allowable threshold acreages in tidal and non-tidal waters. Dickinson Bayou (DDD) is a tidally-influenced water with effects estimated to be greater than 0.33 acres. Area O is a non-tidal water with effects estimated to be greater than 0.5 acres.

At the time of this document, potential compensatory mitigation measures for effects to waters of the U.S., including wetlands have not been identified. Compensatory mitigation will be coordinated with the USACE and performed in accordance with the terms of the approved permit. Consultation will be

conducted to determine which issues would affect the decision to avoid or fill aquatic features. The final authority to determine if the project complied with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act rests with the USACE and the USEPA. TxDOT will provide all pertinent information necessary for these agencies in order to make final determinations.

Mitigation

In accordance with the provisions of Section 404(b)(1) Guidelines, an applicant must demonstrate that the proposed project has avoided and minimized effects to waters of the U.S. to the greatest extent practicable before compensatory mitigation can be proposed. Part of the 404(b)(1) Guidelines indicates that an alternatives analysis must be performed to determine if the proposed project had, in fact, reduced, avoided, and minimized effects to waters of the U.S. A majority of the proposed project has been aligned within or immediately adjacent to the existing ROW, thus avoiding and minimizing effects to surrounding areas to the greatest extent practicable. The new ROW is needed to meet current highway safety standards and design criteria. Additionally, adverse effects to wetlands were minimized through designing roadway structures to avoid disrupting existing ditches in locations within the study area.

Restoring minor wetlands within the ROW is not generally compatible with TxDOT goals, where shedding water from the road is essential to prevent hazards during precipitation events. On-site mitigation within the ROW is not feasible due to the long-term commitments associated with mitigation sites; placement of a mitigation area within the proposed ROW would effectively prohibit the use of the site for future projects. Mitigation for effects to non-jurisdictional wetlands is not required by the Clean Water Act.

Several mitigation options may be available to compensate for unavoidable effects associated with the proposed project. These options include in-lieu fee (ILF) agreements, mitigation banking, and preservation/conservation off-site. TxDOT and FHWA guidance recommends mitigation banking be used for mitigation as much as practicable, followed by ILF agreements, and then other options such as restoration, enhancement, creation, preservation, and/or conservation.

Mitigation banking options available include the use of the Coastal Bottomlands Mitigation Bank, available for use by TxDOT for non-tidal impacts to waters of the U.S. The ILF options available include the Armand Bayou Nature Center, Galveston Bay Foundation, and The Nature Conservancy of Texas. Coordination with the USACE and other agencies will be conducted to determine whether any of the options listed above are feasible and reasonable to compensate for the proposed project effects.

Water Quality

Watersheds

The Build Alternative would have a negligible effect with regard to changes in surface runoff quantifies and the amount of impervious cover added to the San Jacinto-Brazos Coastal Basin or its associated watersheds. The greatest potential for adverse effects to water quality exists during the construction phase of the project due to the quantity of soil being disturbed. With the Build Alternative, every effort would be made to protect the water quality within the study area. The No Build Alternative would not increase the amount of impervious cover in the study area and would not alter the existing drainage conditions.

The proposed project is located in the San Jacinto-Brazos Coastal Plain, an area covering approximately 1,440 square miles and incorporating portions of Brazoria, Fort Bend, Galveston, and Harris Counties. This area is generally characterized as a flat coastal plain between the San Jacinto and Brazos River barriers that include numerous small tidal streams draining toward Galveston Bay in the east and directly to the Gulf of Mexico in the west. The principal tributaries in this basin include Clear Creek, Armand Bayou, Dickinson Bayou, Chocolate Bayou, and Oyster Creek (H-GAC 2001). The topography of the region varies from nearly flat terrain immediately along the Gulf Coast to a gently undulating plane that extends inland 50 miles to 100 miles. Annual precipitation in the study area ranges from 35 inches to 70 inches (H-GAC 2001).

The proposed project is located within several watersheds: Clear Creek Tidal, Dickinson Bayou Tidal, Moses Lake, and West Bay. Clear Creek Tidal is located in the northern portion of the study area, Dickinson Bayou Tidal is centrally located in relation to the proposed project, and Moses Lake and West Bay are located near the southern end of the study area.

Clear Creek Tidal Watershed: This segment of Clear Creek is tidally influenced; it drains to Clear Lake and thence Galveston Bay. In the northern portion of the study area, channelized ditches provide drainage in the immediate area of IH 45.

Dickinson Bayou Tidal Watershed: This watershed surrounds the proposed project from the confluence of Dickinson Bayou with Dickinson Bay to a point 2.5 miles downstream of FM 517, approximately 15 miles long and 60 square miles in area. The entire watershed, including those areas above the tidal segment, is approximately 63,830 acres in size (99.7 square miles).

Moses Lake Watershed: This watershed borders the study area just north of the intersection of IH 45 and FM 1764. This watershed includes a 3.3 square mile-lake (Moses Lake) near the west shoreline of Galveston Bay, Moses Bayou, and several incised flood control and/or industrial ditches flowing east towards Moses Lake and Galveston Bay.

West Bay Watershed: This watershed borders the proposed project west of the intersection of IH 45 and FM 1764. This watershed extends generally southwest of the study area and includes the bay systems of West Bay, Chocolate Bay, Bastrop Bay, Christmas Bay, Drum Bay, and portions of Lake Jackson and Freeport.

Groundwater

Subsurface water would not be required for this project; therefore no adverse effects to the quality and quantity of groundwater in the study area are expected due to the proposed project. Additionally, any existing wells encountered during construction or located on properties potentially requiring acquisition would be sealed utilizing currently accepted methods to protect local groundwater quality. The No Build Alternative would not result in effects on groundwater in the study area.

Coordination with the Water Quality section of TCEQ was initiated on January 9, 2004, to obtain additional information on potential sensitive groundwater features, including sole source aquifers and surface waters, aquifer protection zones, and wellhead protection areas that could be affected by the proposed project. Information by TCEQ was gathered within a one-mile buffer of the proposed project. No sole-source aquifers are present within the study area. The nearest sole-source surface water body is

the Gulf Coast Water Authority Canal, which is located approximately five miles east-southeast of the proposed project. Five public supply systems have water wells within the 100-year capture zones that intersect the proposed project (TCEQ 2004). None of these water systems are a participant in the Source Water Protection Program, which requires pollution prevention measures be implemented to protect the groundwater resource. **Table 20** presents the wells with 100-year capture zones that are within the proposed project vicinity. Well Number G0840001C (Galveston County WCID 1) is the only well that has been located with a 100-year capture zone within the proposed project. **Exhibit 5** shows the locations of the water wells within the study area.

Table 20: Water Wells

Public Water System ID	Water System Name	Water Source ID	Owner Designation	Well Depth (feet)	Aquifer
0840001	Galveston County WCID 1	G0840001A	5 - Hollywood	663	Chicot
0840001	Galveston County WCID 1	G0840001B	6 - 26th & Ave H	590	Chicot
0840001	Galveston County WCID 1	G0840001C	7 – Sunset & IH 45	554	Chicot
0840001	Galveston County WCID 1	G0840001D	8 – 45th & Dakota	734	Chicot
0840003	City of Galveston	G0840003P	13 - 1009 Ave J	810	Chicot
0840003	City of Galveston	G0840003V	9220 FM 517	750	Chicot
0840007	League City	G0840007A	1 - Walker St.	760	Chicot
0840007	League City	G0840007B	2 – 3rd St @ Park	710	Chicot
0840128	Chapparrel Recreational Association	G0840128A	Golf Course	465	Chicot
0840241	Beacon Lakes Golf Club	G0840241A	1	500	Chicot

Source: TCEQ Water Supply Division 2004

Section 303(d) Listed Impaired Water Bodies

The MOU between TxDOT and TCEQ requires TxDOT to coordinate with TCEQ on projects that may encroach upon threatened or impaired stream segments designated under Section 303(d) of the Clean Water Act and/or are five miles upstream from the designated segment.

The proposed project is not anticipated to adversely affect the water quality of Clear Creek, Dickinson Bayou, Bensons Bayou, Borden's Gully, and Geisler Bayou. To minimize effects to water quality during construction, the proposed project would utilize BMPs to control erosion and sedimentation within the study area. Where appropriate, these temporary erosion and sedimentation control measures (i.e., silt fences, rock berms, reseeded areas, and drainage swales) from the TxDOT Manual "Standard Specifications for the Construction of Highways, Street, and Bridges" would be in place before and maintained during construction.

The proposed project is not anticipated to contribute or exacerbate current coliform bacteria levels and dissolved oxygen levels within any of these impaired segments. The proposed project is not expected to have an adverse effect to any of the identified stream segments. The No Build Alternative would have no effects to water quality in the study area.

Clear Creek Tidal Watershed: Most streams in the basin are heavily urbanized and receive treated domestic and industrial wastewater as well as agricultural and urban runoff. Segment 1101 (Clear Creek

Tidal) is listed on the 2004 Clean Water Act Section 303(d) list as an "impaired and threatened" stream segment because of elevated bacteria concentrations. Fecal coliform densities are frequently elevated throughout the basin and cause nonsupport of contact recreation use (TCEQ 2004). The Clear Creek Watershed empties into Clear Lake and eventually into Galveston Bay.

Dickinson Bayou Tidal Watershed: This watershed consists of several tidally influenced streams that empty into Dickinson Bayou, Dickinson Bay, and eventually into Galveston Bay. Development in the basin is centered along Dickinson Bayou within the city of Dickinson. Segment 1103 (Dickinson Bayou Tidal) is listed on the 2008 Clean Water Act Section 303(d) list as an impaired and threatened stream segment due to depressed dissolved oxygen levels and elevated bacteria concentrations. A special study to evaluate water quality from July 2000 to August 2001 confirmed that salinity, ambient temperature, and rainfall runoff as well as algal blooms and organic loading influences dissolved oxygen levels in Dickinson Bayou (Galveston County Health District 2004).

Segment 1103A (Bensons Bayou): This segment extends from the confluence with Dickinson Bayou Tidal to 0.37 miles upstream of FM 646. A tributary to this segment intersects near IH 45 approximately one mile south of the IH 45 and SH 96 intersection and one mile north of the intersection of IH 45 and FM 646. This segment is listed as an impaired water body on the 2008 Clean Water Act Section 303(d) list since the stream does not support contract recreational use because of elevated bacterial concentrations.

Segment 1103B (Borden's Gully): This segment extends from the confluence with Dickinson Bayou Tidal to upstream of Calder Road. Borden's Gully intersects IH 45 immediately south of Deats Road. This segment is listed as an impaired water body on the 2008 Clean Water Act Section 303(d) list due to elevated bacteria concentrations. There is some concern for aquatic life use due to depressed dissolved oxygen levels observed in the segment.

Segment 1103C (Geisler Bayou): This designated stream segment runs from the confluence with Dickinson Bayou Tidal to IH 45 but extends well west of the proposed project. This stream is commonly referred to as Magnolia Bayou on maps and in historical texts as this was named as such by the Perkins Family in 1854 due to the presence of magnolia trees on its banks (North Galveston Chamber of Commerce {NGCC} 2004). This segment is listed as an impaired water body on the 2008 Clean Water Act Section 303(d) list due to the stream not supporting contract recreation use due to elevated bacteria concentrations.

Segment 2424C (Marchand Bayou): This tidally influenced segment runs from the confluence with Highland Bayou to 0.45 miles north of IH 45. This stream segment is listed on the on the 2008 Clean Water Act Section 303(d) list due to the stream not supporting contract recreation use due to elevated bacteria concentrations and aquatic life use due to depressed dissolved oxygen levels.

Floodplains

Areas associated with the proposed project, which are located within the 100-year floodplain as identified by FEMA, are shown in **Exhibit 5**. The hydraulic design of the proposed project would be in accordance with the current TxDOT and FHWA policy standards. The roadway will be designed to prevent inundation at recurrence intervals of at least 100 years and inundation of the roadway being acceptable without causing significant damage to the roadway, stream, or other property. The proposed project will

not increase the base flood elevation (BFE) to a level that would violate applicable floodplain regulations and ordinances. Approximately one acre (9 percent) of the proposed ROW lies within the 100-year floodplain, largely within the Magnolia Bayou floodplain. Executive Order 11988, "Floodplain Management," requires that federal agencies avoid activities, to the extent practicable, which directly or indirectly results in development of floodplain areas. Any construction equipment required for this project will be located so as not to interfere with flood prone areas. The No Build Alternative would not result in further encroachment on the floodplains and would not change the existing conditions of floodplains in the study area.

Based on a review of the FEMA Flood Insurance Rate Maps (FIRMs) for Galveston County, a large portion of the study area is located within the Regulatory Floodway Zone of the 100-year floodplain. Portions of the proposed project are located within Zone AE as identified on the FIRM Map No. 48201C1090K and 4854880010D within the floodplain of Clear Creek, Zone A3 as identified on FIRM Map No. 4815690005B within the floodplain of Borden's Gully and 4854880030E within the floodplain of Magnolia (Geisler) Bayou, and Zone A6 as identified on FIRM Map No. 4855140005C within the floodplain of Dickinson Bayou. Galveston County is a participant in the National Flood Insurance Program.

Because the placement of above-grade fill is expected in the 100-year floodplain, coordination with FEMA would be required. Specific design features, including the volume and type of fill and structures proposed, would be determined prior to coordination with FEMA representatives.

Coastal Zone Management Plan

The proposed project is located within a coastal county and within the Coastal Zone Boundary; therefore the Texas Coastal Management Program (TCMP) does apply. The TCMP requires that federal actions that occur within the TCMP boundary be consistent with the goals and policies of the TCMP. To demonstrate compliance, federal agencies responsible for these actions must prepare a Consistency Determination and submit it to the state of Texas for review.

Coastal Natural Resources Area

Texas Administrative Code (31 TAC § 501.3) identifies the different types of coastal natural resource areas, which include coastal barriers, coastal historic areas, coastal preserves, coastal shore areas, coastal wetlands, critical dune areas, critical erosion areas, gulf beaches, hard substrate reefs, oyster reefs, submerged aquatic vegetation, tidal sand or mud flats, waters of the open Gulf of Mexico, and waters under tidal influence.

Portions of the proposed project are located within designated special hazard areas. Special hazard areas are defined as those areas identified on the FIRM maps as being within zones A, AE, AO, A1-30, A99, AH, VO, V1-30, VE, V, M, or E. As outlined in the Floodplains section, the proposed project lies primarily within Zone AE, Zone A3, and Zone A6.

The proposed project would be designed in accordance with state and local regulations so that natural drainage and/or ponding would remain unchanged in the surrounding area. No effects to the base flood elevations (BFEs), beyond those allowed by regulation in the study area, are anticipated. Coordination with floodplain administrators from the cities of Dickinson and La Marque as well as League City, Texas City and Galveston County would be conducted and all appropriate permits/authorizations would be

obtained prior to construction. The proposed project would not have an adverse effect on designated special hazard areas. The following goals and policies of the TCMP were reviewed for compliance:

Compliance with § 501.14 (p) – Transportation Projects

The proposed project is consistent with the goals and policies of § 501.14(p) of the Coastal Management Plan (CMP). The proposed project would incorporate pollution prevention procedures into the construction and maintenance to minimize pollution loading to coastal waters from erosion and sedimentation. More details regarding these procedures, also referred to as BMPs, can be found in the Water Quality section of this document. The use of pesticides and herbicides for maintenance of ROW and other pollutants from storm water runoff would be minimized as practicably feasible.

The proposed project has been located at sites that would avoid the direct release of pollutants from oil or hazardous substance spills, contaminated sediments, or storm water runoff. An evaluation of the potential for releasing hazardous substances, contaminated sediments, and storm water runoff are addressed in the Hazardous Materials and Water Quality section of this document.

The proposed project would require a minimal amount of additional ROW. The proposed project has been sited either within, adjacent to, or immediately near the existing IH 45 ROW with new ROW acquisitions either occurring to the east and west of the existing ROW depending on its location and project constraints. The additional ROW needed is located in areas that have already been disturbed by previous activities.

The proposed project has avoided and minimized, to the greatest extent practicable, effects to the environment. Effects to the proposed project would not require development in coastal wetlands, and would not impound or drain coastal wetlands that may be located in the project vicinity. Coordination with the USFWS, NOAA Fisheries, and the TPWD has been initiated so that any effects to recreational uses, nesting seasons, or seasonal migrations of terrestrial and/or aquatic species have been minimized and avoided to the greatest extent practicable.

Compliance with § 501.15 – Policy for Major Actions

The proposed project does not constitute a major action and would not require an Environmental Impact Statement (EIS). The proposed project is in compliance with § 501.15 of the CMP.

Permits

U.S. Army Corps of Engineers

Effects to jurisdictional wetlands or waters of the U.S. will require permitting by the USACE under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. It is anticipated that the activities associated with the proposed project will require permitting under an IP.

Texas General Land Office

The proposed project may affect state owned submerged lands. Further coordination with TGLO will be required prior to construction.

U.S. Coast Guard

The proposed project crosses Dickinson Bayou; therefore coordination with FHWA and the USCG was initiated for a navigability determination and bridge permit requirements. Through coordination with

FHWA and the USCG, it was determined that the IH 45 bridge over Dickinson Bayou meets the criteria for the Surface Transportation Authorization Act (STAA) and qualifies for exemption from USCG bridge permit requirements. Bridges that fall into this excluded category include those that cross waterways, such as Dickinson Bayou (a tidal waterway used by vessels less than 21 feet in length). The USCG coordination letter is included in **Appendix C**.

U.S. Environmental Protection Agency

The Clean Water Act is the principal law governing pollution control and water quality in the United States and mandates to restore and maintain the chemical, physical, and biological integrity of those waters. Section 402 of the Clean Water Act regulates the discharges of pollutants into these surface waters from industrial or storm water related activities. The authority for these programs has been delegated from the USEPA to the TCEQ.

In Texas, many of the National Pollution Discharge Elimination System authorizations required have been delegated from the USEPA to the TCEQ and are referred to as the Texas Pollutant Discharge Elimination System (TPDES). Any construction activity that disturbs greater than one acre of land is required to comply with the TPDES Construction General Permit TXR150000.

In accordance with TxDOT policies, a Notice of Intent and Storm Water Pollution Prevention Plan (SW3P) would be prepared before construction and followed during construction. Pollution from storm water would be minimized through adherence to measures in the project's SW3P. Construction of the proposed action would include temporary erosion control measures to minimize effects to water quality during construction as specified in the TxDOT manual "Storm Water Management and Guidelines for Construction Activities" (TxDOT 2002b). These may include, but are not limited to, the use of silt fencing, inlet protection barriers, hay bales, seeding or sodding of bare areas, or other suitable means of containment. Temporary erosion control structures would be built before construction begins (where appropriate) and maintained during construction. Upon completion of construction, a Notice of Termination would be provided to TCEQ. If the project affected any Municipal Separate Storm Sewer System (MS4) operators, the contractor would need to coordinate the project with the appropriate MS4 operator and the TCEQ prior to discharge into the MS4 system. The BMPs and erosion controls used would also coincide with those identified in the Section 401 Water Quality Certification request from TCEQ.

Vegetation would be cleared only as needed, and clearing may be phased to maintain soil integrity and minimize exposure of an erosive surface. When construction is completed, disturbed areas would be restored and reseeded according to the TxDOT specification "Seeding for Erosion Control." Seeding would also conform to Executive Order 13112 (Invasive Species) and subsequently modified in Executive Order 13286 and the Memorandum on Beneficial Landscaping (FHWA 1999).

Texas Commission on Environmental Quality

The TCEQ is responsible for conducting Section 401 certification reviews for Section 404 permit applications regarding the discharge of dredged or fill material into waters of the U.S., including wetlands. The TCEQ has conditionally approved the Section 401 water quality certification for many of the NWPs issued under Sections 10 and 404 of the Clean Water Act provided that they follow certain BMPs and sediment controls (pre and post project).

The TCEQ review for 401 Certification for either NWPs or IPs uses a two-tiered approach. Tier I projects are those projects that will result in a direct impact to three acres or less of water in the state (including wetlands) or 1,500 linear feet or less of streams, with one acre of impact equaling 500 linear feet of stream impacts. For projects that affect ecologically significant wetlands of any size, are greater than 1,500 linear feet of stream, are greater than three acres of water in the state (including wetlands), or do not qualify for a Tier I review, the TCEQ requires that Tier II analysis be performed. Tier II projects are subject to individual certification review by TCEQ.

Tier I

Depending on the extent of impacts proposed, the project may qualify for a Tier I authorization provided the project implements and maintains certain BMPs and sediment controls. The TCEQ has three categories of BMPs for projects:

- Category I: Erosion Control
- Category II: Sedimentation Control
- Category III: Post-Construction TSS Control

Category I would be addressed by applying temporary seeding (native vegetation) and mulch to disturbed areas. Category II would be addressed by the installation of silt fences and/or rock berms across drainage swales and/or upstream of water bodies to prevent turbid discharges from adversely affecting ambient water quality. Category III would be addressed by planting native vegetation to create grass-lined ditches (vegetative strips/wet basins). These ditches would accept storm water runoff as sheet flow from the adjacent roadway and filter it along the slopes and bottom of the ditch. These measures would minimize potential adverse effects to water quality and with the implementation of these measures; no long-term effects to water quality are anticipated.

The TCEQ has identified that in order to qualify for this Tier I authorization; the proposed project must contain at least one BMP from all three categories. The proposed project will utilize the use of temporary vegetation, silt fences, and grassy swales and/or vegetation lined drainage ditches as BMPs. If this requirement could not be achieved due to project constraints, then an individual 401 certification must be performed which consists of a detailed review of the project.

Tier II

Tier II Section 401 Certification by TCEQ requires the submission of: a completed 401 Certification Questionnaire, a completed Alternatives Analysis Checklist, a project location map, and photographs of the study area and any associated disposal areas. The 401 Certification Questionnaire describes how the project would affect wetlands/waters of the U.S., disposal of waste materials, short and long-term effects to water quality, and an alternatives analysis. The Tier II Checklist provides additional detail regarding the project. In particular, the applicant must demonstrate that wetland effects have been avoided and minimized to the extent practicable.

The Section 401 Certification process involves filing a joint application with the USACE for both the Section 404 permit and the 401 Certification processes. After receipt of a completed application, a Joint Public Notice is issued by the USACE and the TCEQ to inform the public and other government agencies of the proposed activity. The Public Notice is followed by a 30-day comment period. The TCEQ may

hold a public hearing to consider the potential adverse impacts of the proposed project on water quality. The TCEQ may request additional information from the application, persons submitting comments or requesting a hearing, or other resource agencies. A final 401 Certification decision will be provided following the end of the comment period.

Air Quality

The proposed project is located within Galveston County, which is designated as a "severe" ozone nonattainment area under the 8-hour National Ambient Air Quality Standards (NAAQS); therefore the transportation conformity rules apply. Traffic data (2035) are estimated to be 156,200 vehicles per day; therefore a Traffic Air Quality Analysis (TAQA) is required. This project is adding SOV capacity; therefore a Congestion Management System (CMS) analysis is also required.

All projects in the H-GAC's TIP that are proposed for federal or state funds are initiated in a manner consistent with federal guidelines in Section 450 of Title 23 CFR and Section 613.200, Subpart B of Title 49 CFR. Energy, environment, air quality, cost, and mobility considerations are addressed in the programming of the TIP. On August 24, 2007, H-GAC adopted the 2035 RTP and FY 2008-2011 TIP. USDOT (FHWA/FTA) found the 2035 RTP and 2008-2011 TIP to conform to the SIP on November 9, 2007.

The widening of IH 45 from FM 518 to FM 1764 is consistent with the area's financially constrained 2035 RTP and is included in Appendix D (pages D-63) of the 2008-2011 TIP, as proposed by the H-GAC.

Transportation Air Quality Analysis

Topography and meteorology of the area in which the project is located would not seriously restrict dispersion of the air pollutants. The traffic data used in the analysis is based on future volumes of traffic projected by the H-GAC travel model. Peak traffic volumes between FM 518 and SH 96 were used in this analysis, which was performed for the years 2019 and 2035 (the estimated time of completion and the farthest future year also used for Mobile Source Air Toxics (MSAT)). The ADT values modeled along the FM 518 to SH 96 segment were 142,300 vehicles per day (vpd) for 2019 and 156,200 vpd for 2035.

Carbon monoxide concentrations for the proposed action were modeled using the CAL3QHC computer program and factoring in peak hour traffic volumes, adverse meteorological conditions, and sensitive receptors at the ROW line in accordance with the TxDOT Air Quality Guidelines. Local concentrations of carbon monoxide are not expected to exceed national standards at any time. **Table 21** summarizes the results of the analysis.

Table 21: Project Carbon Monoxide Concentrations

Year	1-HR CO Standard 35 ppm[(1)]	1 HR % NAAQS	8-HR CO Standard 9 ppm	8-HR % NAAQS
2019 Build	6.2	17.7%	3.9	43.1%
2035 Build	6.5	18.6%	4.0	44.4%

Source: Study Team 2008

Note: The NAAQS for CO is 35 ppm for one hour and 9 ppm for eight hours. Analysis includes a one-hour background concentration of 4.5 ppm and an 8-hour background concentration of 2.8 ppm.

(1) ppm = parts per million

Congestion Management System

The proposed project is adding SOV capacity; therefore a CMS analysis is required. The CMS is a systematic process for managing congestion that provides information on transportation system performance and on alternative strategies for alleviating congestion and enhancing the mobility of persons and goods to levels that meet state and local needs. This project was developed from H-GAC's operational CMS, which meets all requirements of 23 CFR 500.109. The CMS was adopted by H-GAC in October 1997 and has been revised in December 1997, May 1998, and June 2005 (H-GAC 1997).

As discussed in the Planning Process: Congestion Management System section of this EA, the revised Statewide and Metropolitan Planning regulations (*Federal Register*, February 14, 2007) now reflect requirements for a CMP rather than a CMS so as to include current statutory conditions (USDOT 2007). The CMP refers to several methods of roadway management including ITS, TSM, and TDM. These programs seek to improve traffic flow and safety through better operation and management of transportation facilities while also providing low cost solutions that can be constructed in less time and provide air quality benefits to the region. Although a CMP has not yet been adopted by the H-GAC, the program is in development following FHWA guidance to integrate the area's CMS into the CMP. Until H-GAC adopts a CMP, this section of the EA reflects the most recently adopted CMS and its provisions.

Operational improvements and travel demand reduction strategies are commitments made by the region at two levels: program level and project level implementation. Program level commitments are inventoried in the regional CMS, which was adopted by H-GAC; they are included in the financially constrained 2035 RTP, and future resources are reserved for their implementation.

The CMS element of the plan carries an inventory of all project commitments (including those resulting from major investment studies) detailing type of strategy, implementing responsibilities, schedules, and expected costs. At the project programming stage, travel demand reduction strategies and commitments would be added to the regional TIP or included in the construction plans. The regional TIP provides for programming of these projects at the appropriate time with respect to the SOV facility implementation and project specific elements. Committed congestion reductions strategies and operational improvements within the study boundary consist of various improvements. Individual projects are listed in **Table 22**.

Table 22: Congestion Management Strategies - Operational Improvements in the Travel Corridor

Location	Type	Implementation Date
SH 96 at SH 3	Construct Grade Separation	1/1/2018
FM 646 AT IH 45 S	Additional Grade Separation	1/1/2006
IH 45 S at SH 96	Construct Overpass on New Location	8/1/2007
FM 521 at IH 45	Park and Ride Facility	11/1/2012
SH 96 at IH 45 S	Park and Ride Facility	1/1/2010
FM 518 from Galveston/Brazoria County Line to IH 45	Smart Street Improvements	1/1/2023
FM 2004 from SH 6 to FM 1764	Smart Street Improvements	1/1/2023
SH 96 from IH 45 to SH 146	Smart Street Improvements	1/1/2023
FM 517 from SH 3 to SH 146	Smart Street Improvements	1/1/2023
FM 517 from IH 45 to SH 146	Smart Street Improvements	1/1/2023

Source: H-GAC – 2035 RTP, 2007

In an effort to reduce congestion and the need for SOV lanes in the region, TxDOT and H-GAC would continue to promote appropriate congestion reduction strategies through the Congestion Mitigation and Air Quality (CMAQ) program, the CMS, and the 2035 RTP. The congestion reduction strategies considered for this project would help alleviate congestion in the SOV study boundary but would not eliminate it.

Therefore, the proposed project is justified. The CMS analysis for added SOV capacity projects in the Transportation Management Area (TMA) is on file and available for review at H-GAC.

Mobile Source Air Toxics

Background

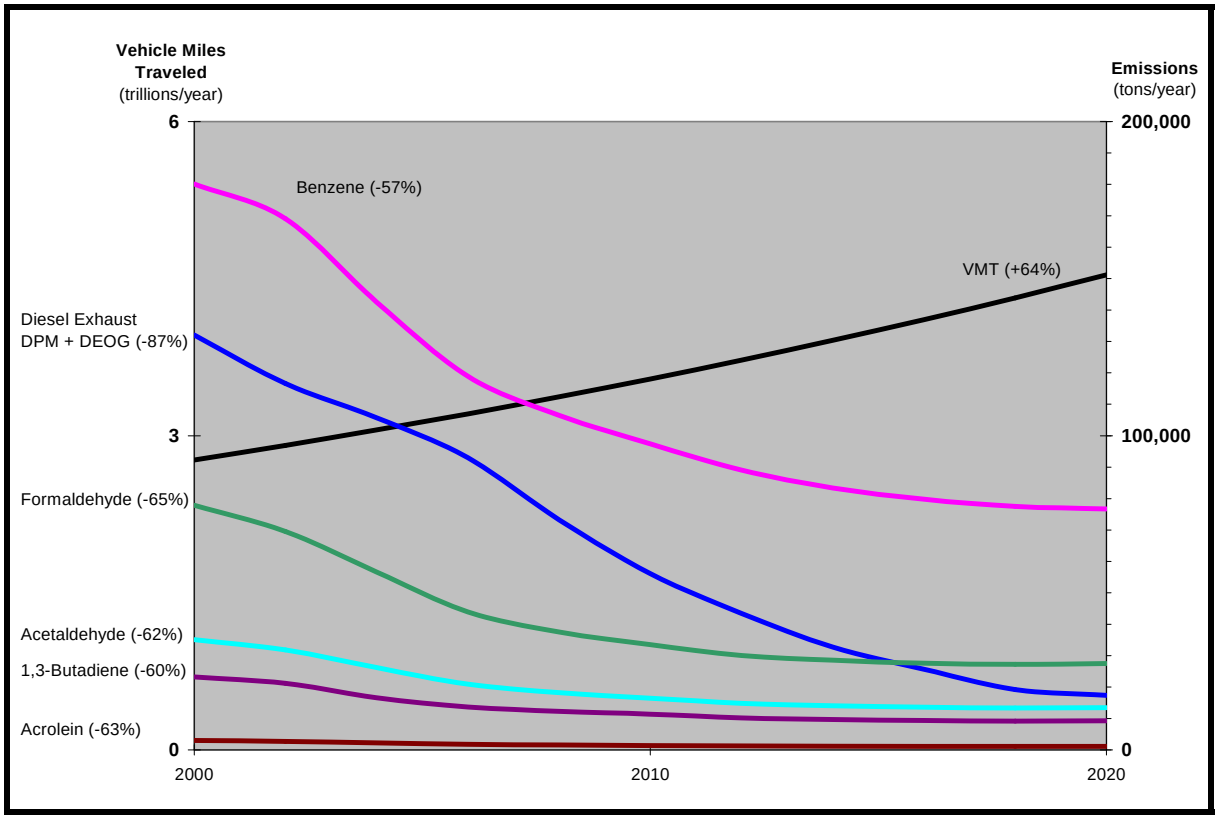
In addition to the criteria air pollutants for which there are NAAQS, The USEPA also regulates air toxics. Air toxics are pollutants known or suspected to cause cancer or other serious health or environmental effects. Most air toxics originate from human-made sources, including on-road mobile sources (e.g., cars, light trucks, motorcycles, and 18-wheelers), non-road mobile sources (e.g., bulldozers, locomotives, aircraft, boats, etc.) area sources (e.g., dry cleaners, gas stations), and stationary/point sources (e.g., electric utilities, petrochemical refining, and other industry).

MSATs are a subset of the 188 air toxics defined by the Clean Air Act. MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted into the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline (see EPA420-R-00-023 [USEPA 2000a] for more details on MSATs). Studies have found up to 50 percent of the monitored amounts of formaldehyde and acetaldehyde in the atmosphere are not directly emitted by mobile sources but are formed secondarily in the atmosphere (South Coast Air Quality Management District [SCAQMD] 2000).

In 2006, the FHWA and TxDOT issued new guidance on completing MSAT assessments of highway projects. Quantitative assessments of MSATs can provide some information on the quantity of MSATs emitted from passenger cars, light trucks, and heavy trucks. However, simple quantification of these emissions, coupled with other considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, would not give enough information to reach meaningful conclusions about project-specific health impacts.

The USEPA is the lead federal agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. The USEPA issued a final rule on *Controlling Emissions of Hazardous Air Pollutants from Mobile Sources* (66 FR 17229, March 29, 2001). This rule was issued under the authority in Section 202 of the Clean Air Act. In its rule, the USEPA examined the impacts of existing and newly promulgated mobile source control programs, including reformulated gasoline (RFG) program, national low emission vehicle (NLEV) standards, Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and proposed heavy duty engine and vehicle standards and on-road diesel fuel sulfur control requirements. Between 2000 and 2020, Even with a 64 percent increase in VMT, these mobile source control programs will reduce on-road emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent and will reduce on-road diesel PM emissions by 87 percent, as shown in **Figure 5**.

Figure 5: Vehicle Miles Traveled (VMT) vs. MSAT Emissions, 2000-2020



Source: FHWA 2006

Note: For on-road mobile sources, emissions factors were generated using MOBILE6.2. MTBE proportion of market for oxygenates is held constant at 50%. Gasoline RVP and oxygenate content are held constant. VMT: Highway Statistics 2000, Table VM-2 for 2000, analysis assumes annual growth rate of 2.5%. "DPM + DEOG" is based on MOBILE6.2-generated factors for elemental carbon, organic carbon and SO4 from diesel-powered vehicles with the particle size cutoff set at 10.0 microns.

In an ongoing review of MSATs, the USEPA finalized additional rules under authority of Clean Air Act Section 202(l) to further reduce MSAT emissions that are not reflected in the above graph. The USEPA issued *Final Rules on Control of Hazardous Air Pollutants from Mobile Sources* (72 FR 8427, February 26, 2007) under Title 40 CFR Parts 59, 80, 85 and 86. The rule changes are effective on April 27, 2007. As a result of this review, the USEPA adopted the following new requirements to significantly lower emissions of benzene and the other MSATs by: (1) lowering the benzene content in gasoline, (2) reducing evaporative emissions that permeate through portable fuel containers, and (3) reducing non-methane hydrocarbon (NMHC) exhaust emissions from passenger vehicles operated at cold temperatures (under 75 degrees Fahrenheit).

Beginning in 2011, petroleum refiners must meet an annual average gasoline benzene content standard of 0.62 percent by volume for both reformulated and conventional gasoline nationwide, which would be a 38 percent reduction from 2007. The USEPA standards to reduce NMHC exhaust emissions from new gasoline-fueled passenger vehicles will become effective in phases. Standards for light-duty vehicles and trucks (≤ 6,000 pounds [lbs]) become effective during the period of 2010 to 2013, and standards for heavy light-duty trucks (6,000 to 8,000 lbs) and medium-duty passenger vehicles (up to 10,000 lbs) become

effective during the period of 2012 to 2015. Evaporative requirements for portable gas containers become effective with containers manufactured in 2009. Evaporative emissions must be limited to 0.3 grams of hydrocarbons per gallon per day.

The USEPA has also adopted more stringent evaporative emission standards (equivalent to current California standards) for new passenger vehicles. The new standards become effective in 2009 for light vehicles and in 2010 for heavy vehicles. In addition to the reductions from the 2001 rule, the new rules will significantly reduce annual national MSAT emissions. The USEPA estimates that emissions in the year 2030, when compared to emissions in the base year prior to the rule, will show a reduction of 330,000 tons of MSATs (including 61,000 tons of benzene), more than one million tons of volatile organic compounds, and more than 19,000 tons of $PM_{2.5}$.

Sensitive Receptors within the Study Area

FHWA has completed a review of several studies that have attempted to address how MSAT concentration levels may behave based on the distance from a roadway. FHWA notes that both models and experimental data predict short-term concentrations of air toxics and can be elevated for receptors downwind of and very near roadways. The tendency for pollutant levels to drop off substantially as the distance from the roadway increases is well documented. The distance where the highest decrease in concentration starts to occur is approximately 328 feet (100 meters). By 1,640 feet (500 meters), most studies have found difficulty distinguishing between background levels of a given pollutant and the elevated levels that may have been found directly adjacent to the roadway. Finally, wind direction and speed, vehicle traffic levels, and roadway design can further increase or decrease the distance at which elevated levels of any given pollutant can be distinguished as directly associated with a roadway.

Dispersion studies have shown that the MSAT emissions from vehicles on a "roadway" (roadway emissions) start to drop off at about 328 feet (100 meters). By 1,640 feet (500 meters), most studies have found it very difficult to distinguish the roadway emissions from background levels of air toxics in any given area. Sensitive receptors include those facilities most likely to contain large concentrations of the more sensitive population (hospitals, schools, licensed day care facilities, and elder care facilities). An assessment of potential sensitive receptors within both 328 feet (100 meters) and 1,640 feet (500 meters) is provided in **Table 23** and **Table 24**. The study team identified and mapped 10 sensitive receptors within the IH 45 study area (**Table 23**, **Table 24**, and **Exhibit 7**). There were no sensitive receptors within 328 feet (100 meters) and 10 sensitive receptors within 1,640 feet (500 meters) of the Build Alternative.

Table 23: Sensitive Receptors within the Study Area

Map ID # (1)	Name	Address	City	Zip Code
EC1	Maplewood Senior Active Living	600 Hobbs Street	League City	77573
D1	NASA Korean Presbyterian Church / Day Care	215 Newport Boulevard	League City	77573
D2	School Zone Day Care	1860 W Main Street	League City	77573
D3	Metro City Kids-School	2047 W Main Street Suite B2	League City	77573
D4	Mainland Christian School / Day Care	2600 IH 45	Dickinson	77591
D5	First United Methodist Church / Day Care	200 FM 517 Road	Dickinson	77539

S1	League City United Methodist Church Church / School	1411 W Main Street	League City	77573
S2	Shrine of the True Cross School	300 Pine Drive	Dickinson	77539
S3	Mainland Christian School	3210 IH 45	Texas City	77591
S5	Bay Area Charter Middle School	215 FM 517 W	Dickinson	77539

Source: Study Team 2008
Note: (1) Map ID # refers to EC as Elder Care Facility, D as Day Care Facility, and S as School

Table 24: Sensitive Receptors by Distance

Alternative	Length (miles)	Number of Receivers within:	
		328 feet (100 meters)	1,640 feet (500 meters)
Build Alternative	7.5	0	10

Source: Study Team 2008

Unavailable Information for Project Specific MSAT Impact Analysis

This EA includes a basic analysis of the likely MSAT emission impacts of this project. However, available technical tools do not enable the prediction of project-specific health impacts resulting from the emission changes associated with the alternatives addressed in this EA. Due to these limitations, the following discussion is included in accordance with CEQ regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information:

Information that is Unavailable or Incomplete. Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several key elements, including emissions modeling, dispersion modeling in order to estimate ambient concentrations resulting from the estimated emissions, exposure modeling in order to estimate human exposure to the estimated concentrations, and then final determination of health impacts based on the estimated exposure. Each of these steps is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of this project.

1. Emissions*:* The USEPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of highway projects. While MOBILE6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE6.2 is a trip-based model – emission factors are projected based on a typical trip of 7.5 miles, and on average speeds for this typical trip. This means that MOBILE6.2 does not have the ability to predict emission factors for a specific vehicle operating condition at a specific location at a specific time. Because of this limitation, MOBILE6.2 can only approximate the operating speeds and levels of congestion likely to be present on the largest-scale projects. For particulate matter (PM), the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Also, the emission rates used in MOBILE6.2 for both particulate matter and MSATs are based on a limited number of tests of mostly older technology vehicles. Lastly, in its discussion of PM under the conformity rule, the USEPA has identified problems with MOBILE6.2 as an obstacle to quantitative analysis.

   These deficiencies compromise the capability of MOBILE6.2 to estimate MSAT emissions. MOBILE6.2 is an adequate tool for projecting emissions trends and performing relative analyses

between alternatives for very large projects, but it is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations. However, MOBILE6.2 is currently the only available tool for use by FHWA/TxDOT and may function adequately for larger scale projects for comparison of alternatives.

2. Dispersion*:* The tools to predict how MSATs disperse are also limited. The USEPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of carbon monoxide to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. Along with these general limitations of dispersion models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.

3. Exposure Levels and Health Effects*:* Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emission rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSATs because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision-makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.

Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs. Research into the health impacts of MSATs is ongoing. For different emission types there are a variety of studies that show that some either are statistically associated with adverse health outcomes through epidemiological studies (frequently based on emission levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses.

Exposure to toxics has been a focus of a number of USEPA's efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or state level.

The USEPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The USEPA Integrated Risk Information System (IRIS) is a database of human health effects that may result

from exposure to various substances found in the environment. The IRIS database is located at http://www.epa.gov/iris. The following toxic information for the six prioritized MSATs was taken from the IRIS database Weight of Evidence Characterization summaries and represents the agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- **Acetaldehyde** is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.
- **Acrolein:** The potential carcinogenicity of acrolein cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure.
- **Benzene** is characterized as a known human carcinogen.
- **1,3 Butadiene** is characterized as carcinogenic to humans by inhalation.
- **Diesel Exhaust (DE)** is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases. Diesel exhaust also represents chronic respiratory effects, possibly the primary non-cancer hazard from MSATs. Prolonged exposure may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.
- **Formaldehyde** is a probable human carcinogen, based on limited evidence in humans; and sufficient evidence in animals.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by USEPA, FHWA, and industry has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes – particularly respiratory problems. Much of this research is not specific to MSATs, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, the studies do not provide information that would be useful to alleviate the uncertainties listed above and enable performance of a more comprehensive evaluation of the health impacts specific to the project.

Relevance of Unavailable or Incomplete Information. While available tools do allow the reasonable prediction of emission changes between alternatives for larger projects, the amount of MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by each of the project alternatives cannot be predicted with enough accuracy to be useful in estimating health impacts. Therefore, the relevance of the unavailable or incomplete information is that it is not possible to make a determination of whether any of the alternatives would have "significant adverse impacts on the human health and the environment."

Mobile Source Air Toxics

The approach used in the analysis of MSATs within the IH 45 study area considers the on-road sources for the six priority MSATs (i.e., acetaldehyde, acrolein, benzene, 1,3 butadiene, diesel particulate matter (DPM), and formaldehyde). This analysis is based on existing or base year (2007) and future volumes of traffic (2019 and 2035) that have been projected by the eight county H-GAC travel model. An affected transportation network was derived from the 2035 No Build Scenario compared to the 2035 Build Scenario to determine which roadway links in the model achieve a ± 5 percent volume change. The affected transportation network was then compared to the 2007 and 2019 models in order to extrapolate the baseline and interim year model. Speeds were modeled as average speeds and weighted by both the type of roadway and by the amount of total VMT that occur at that speed.

This analysis uses MOBILE6.2 inputs that are appropriate to the Houston-Galveston area. These inputs are consistent with those used for other modeling activities in the area (e.g., SIP inventories, conformity analyses). Emission reductions due to USEPA's 2007 MSAT rule are not programmed into MOBILE6.2 and therefore are not accounted for in this analysis.

MSAT Results

The proposed project will let in 2016 (CSJ: 0500-04-096) and 2017 (CSJ: 0500-04-106); therefore, the resulting emission inventory for the six priority MSATs was compiled and modeled for the base year (2007), interim year (2019), and the 2035 design year. The emission inventory is summarized in **Table 25** and **Figure 6.** The 2035 scenario had two alternatives, the No Build and the Build for the project.

Table 25: MSAT Emissions for IH 45 by Alternative (Tons/Year)

Compound	Year / Scenario				% Difference	
	2007	2019	2035	2035	2007 to 2035	2007 to 2035
	Base	Build	No Build	Build	No Build	Build
DPM	1,133.3	179.6	133.3	158.9	**-88%**	**-86%**
1,3 Butadeine	108.7	58.4	66.7	79.4	**-39%**	**-27%**
Acetaldehyde	264.5	146.3	174.1	207.6	**-34%**	**-21%**
Acrolein	18.3	11.0	13.3	15.9	**-27%**	**-13%**
Benzene	723.8	373.9	418.4	497.1	**-42%**	**-31%**
Formaldehyde	390.5	240.9	294.1	351.9	**-25%**	**-10%**
Total MSAT	**2,639.0**	**1,010.0**	**1,099.9**	**1,310.9**	**-58%**	**-50%**
Total VMT (Miles/Year)	**122,060,161**	**167,348,975**	**223,956,600**	**267,066,633**	**83%**	**119%**

Source: Study Team 2008

Note: Results were calculated using the USEPA MOBILE6.2 model, which does not include the emission reductions associated with USEPA's 2007 final rule, "Control of Hazardous Air Pollutants from Mobile Sources," as published in the *Federal Register* (USEPA 2007).

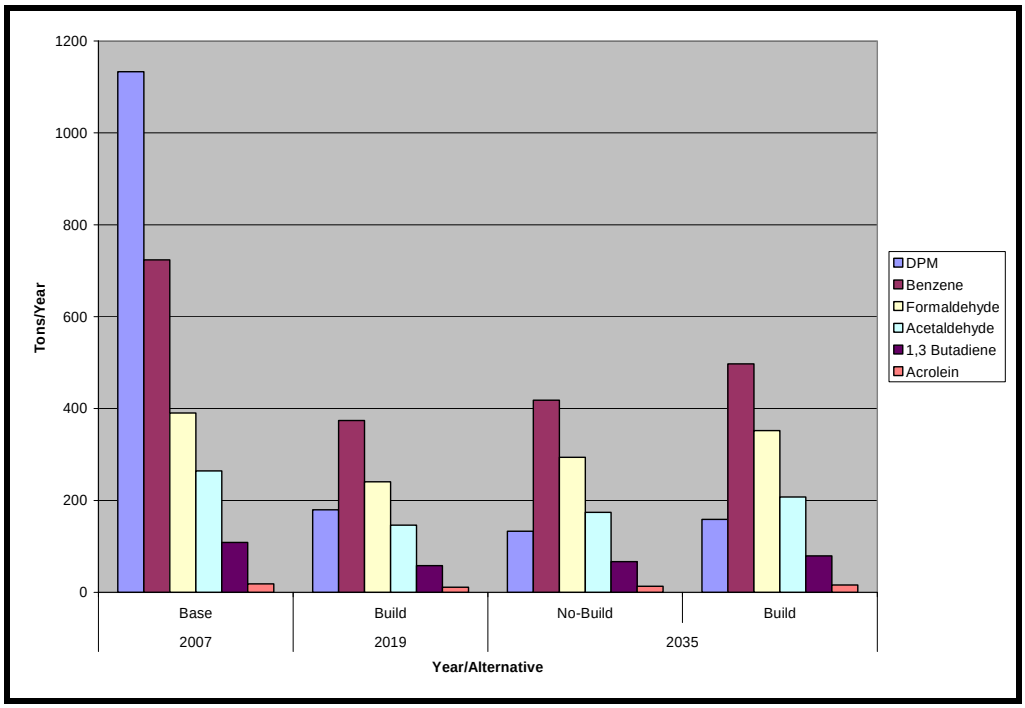
* Total MSATs may not appear to equal the sum of air toxic compounds because of rounding.

The analysis indicates a decrease in MSAT emissions can be expected for both the Build and No Build Alternatives (2035) versus the base year (2007) (**Figure 7**). Emissions of total MSATs are predicted to decrease by 50 percent in 2035 Build Scenario compared with 2007 levels. The 2035 Build Scenario is expected to generate a 19 percent increase in VMT as compared to the 2035 No Build and the resulting

change in MSATs; while the comparison of the 2035 Build Scenario to the 2007 base year generates a 119 percent increase in VMT, as can be seen in **Table 25**.

Of the six priority MSAT compounds, benzene and DPM contribute the most to the emissions total in 2007 (see **Table 25** and **Figure 6**). The amount of DPM emitted in 2007 is higher than the amount of benzene emitted. In future years, a decline in benzene is anticipated (31 percent reduction in benzene from 2007 to 2035, Build Scenario), and an even larger reduction in DPM emissions is predicted (86 percent decrease from 2007 to 2035, Build Scenario). As can be seen with the anticipated growth in future VMT, MSAT compounds will rebound and gradually begin to rise (**Figure 7**).

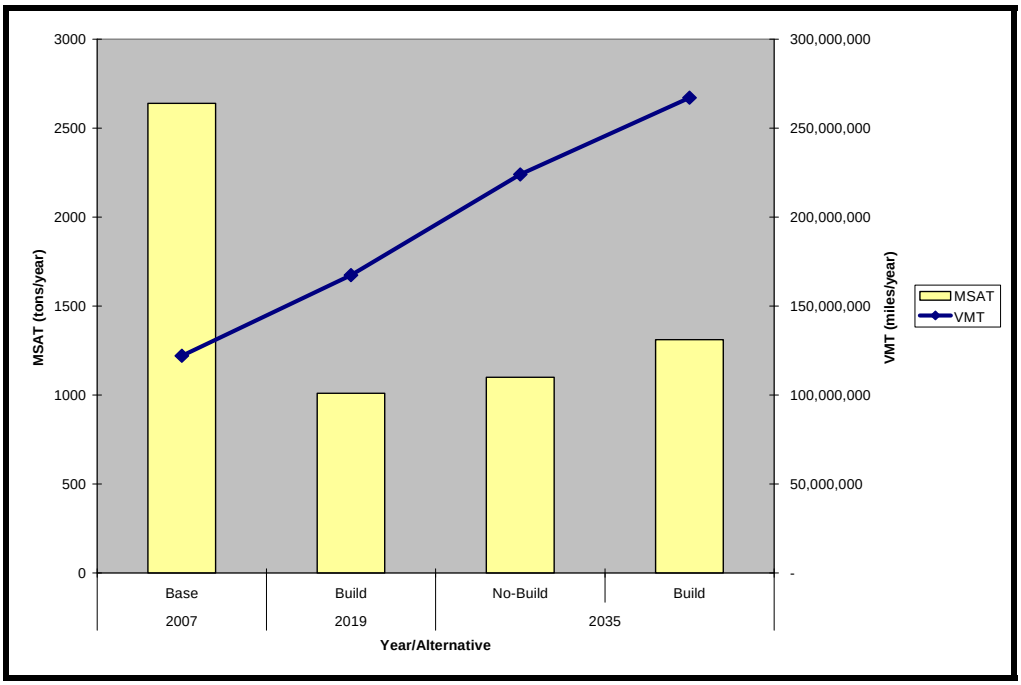
Figure 6: Projected Changes in MSAT Emissions by Scenerio for IH 45 Over Time



Source: Study Team 2008

Note: Results were calculated using the USEPA MOBILE6.2 model, which does not include the emission reductions associated with USEPA's 2007 final rule, "Control of Hazardous Air Pollutants from Mobile Sources," as published in the *Federal Register* (USEPA 2007).

Figure 7: Comparison of MSAT Emissions vs. VMT by Scenario



Source: Study Team 2008

These emission levels are for all the MSATs evaluated and are mostly a reflection of the total VMT. The reasons for these dramatic improvements are two fold, a change in vehicle fuels, both gasoline and diesel fuel, and a change in emission standards that both light-duty and heavy-duty on-road motor vehicles must meet. The USEPA predicts substantial future air emission reductions as the agency's new light-duty and heavy-duty on-road fuel and vehicle rules come into effect (Tier II, light-duty vehicle standard, Heavy-Duty Diesel Vehicle (HDDV) standards and low sulfur diesel fuel, and the USEPA's proposed Off-Road Diesel Engine and Fuel Standard). These projected air emission reductions will be realized even with the predicted continued growth in VMT. See USEPA's Tier II Regulatory Impact Analysis (RIA) and USEPA's HDDV RIA; Regulatory Impact Analysis (USEPA 2001; USEPA 1999). IH 45 is estimated to emit the following total amounts of the six priority air toxics in **Table 26**.

Table 26: MSAT Emissions Per Year

Year	IH 45 (Affected Traffic Network)
2007 Base	5,278,000 lbs or 2,639 tons
2019 Build	2,020,000 lbs or 1,010 tons
2035 No Build	2,199,800 lbs or 1,099.9 tons
2035 Build	2,621,800 lbs or 1,310.9 tons

Source: Study Team 2008

MSAT Conclusions

The ability to discern differences in MSAT emissions among transportation alternatives is difficult given the uncertainties associated with forecasting travel activity and air emissions 28 years or more into the future. The main analytical tool for predicting emissions from on-road motor vehicles is the USEPA's

MOBILE6.2 model. The MOBILE6.2 model is regional in scope and has limited applicability to a project-level analysis. However, the effects of a major transportation project extend beyond its corridor and an evaluation within the context of an affected transportation network can be accomplished.

When evaluating the future options for upgrading a transportation corridor, the major mitigating factor in reducing MSAT emissions is the implementation of the USEPA's new motor vehicle emission control standards. Decreases in MSAT emissions will be realized from the base year (2007) through an estimated time of completion for a planned project and its design year some 28 years in the future. Accounting for anticipated increases in VMT and varying degrees of efficiency of vehicle operation, total MSAT emissions were predicted to decline approximately 50 percent from 2007 to 2035. While benzene emissions were predicted to decline 31 percent, emissions of DPM were predicted to decline even more (i.e., 86 percent).

MSATs, especially benzene, have dropped dramatically since 1995 and are expected to continue dropping. The introduction of reformulated gasoline has lead to a substantial part of this improvement. In addition, Tier II automobiles introduced in model year 2004 will continue to help reduce MSATs. Diesel exhaust emissions have been falling since the early 1990s with the passage of the Clean Air Act Amendments (CAAA). The CAAA provided for improvement in diesel fuel through reductions in sulfur and other diesel fuel improvements. In addition, the USEPA has further reduced the sulfur level in diesel fuel, which took effect in 2006. The USEPA also has called for dramatic reductions in nitrogen dioxide (NOx) emissions, and PM from on-road and off-road diesel engines.

Noise

This analysis conforms to FHWA Regulation 23 CFR 772, “Procedures for Abatement of Highway Traffic Noise and Construction Noise,” and TxDOT’s 1996 Guidelines for Analysis and Abatement of Highway Traffic Noise (revised July 1997).

Sound from highway traffic is generated primarily from a vehicle's tires, engine, and exhaust. It is commonly measured in decibels and is expressed as "dB." Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dBA." Also, because traffic sound levels are never constant due to the changing number, type, and speed of vehicles, a single value is used to represent the average or equivalent sound level and is expressed as "Leq."

The traffic noise analysis typically includes the following elements:

- Identification of land use activity areas that might be impacted by traffic noise
- Determination of existing noise levels
- Prediction of future noise levels
- Identification of possible noise impacts
- Consideration and evaluation of measures to reduce noise impacts

Noise Abatement Criteria

The FHWA has established the following Noise Abatement Criteria (NAC) for various land use activity areas that are used as one of two means to determine when a traffic noise impact will occur. These criteria are outlined in **Table 27**.

Table 27: FHWA Noise Abatement Criteria

Activity Category	dBA Leq	Description of Land Use Activity Areas
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance that serve an important public need where the preservation of those qualities is essential if the area were to continue to serve its intended purpose
B	67 (exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals
	72 (exterior)	Developed lands, properties, or activities not included in Categories A or B above
	--	Undeveloped lands
E	52 (interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums

Note: Primary consideration is given to exterior areas (Category A, B or C) where frequent human activity occurs. However, interior areas (Category E) are used if exterior areas were physically shielded from the roadway, or if there were little or no human activity in exterior areas adjacent to the roadway.

A noise impact occurs when either the absolute or relative criterion is met:

- *Absolute Criterion*: The predicted noise level at a receiver approaches, equals, or exceeds the NAC. "Approach" is defined as one dBA below the NAC. For example, a noise impact would occur at a Category B residence if the noise level were predicted to be 66 dBA or above.
- *Relative Criterion*: The predicted noise level substantially exceeds the existing noise level at a receiver even though the predicted noise level does not approach, equal, or exceed the NAC. “Substantially exceeds” is defined as more than 10 dBA. For example, a noise impact would occur at a Category B residence if the existing level were 54 dBA and the predicted level is 65 dBA (11 dBA increase).

When a traffic noise impact occurs, noise abatement measures must be considered. A noise abatement measure is any positive action taken to reduce the impact of traffic noise on an activity area.

Noise Analysis Summary

The FHWA traffic noise modeling software was used to calculate existing and predicted traffic noise levels. The model primarily considers the number, type, and speed of vehicles; highway alignment and grade; cuts, fills, and natural berms; surrounding terrain features; and the locations of activity areas likely to be impacted by the associated traffic noise.

Existing and predicted traffic noise levels were modeled at receiver locations (see **Table 28** and **Exhibit 5**) that represent the land use activity areas adjacent to the proposed project that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement.

Table 28: Traffic Noise Levels (dBA Leq)

Receiver #	Description	NAC Category	NAC Level	Modeled Results			
				Existing Year Noise Level	Design Year Noise Level	Change + [-]	Noise Impact
R1	Commercial	E	52	44	46	2	No
R2	RV Park	B	67	70	71	1	Yes
R3	Single Family Home	B	67	60	63	3	No
R4	Single Family Home	B	67	67	69	2	Yes
R5	Single Family Home	B	67	72	74	2	Yes
R6	Single Family Home	B	67	64	68	4	Yes
R7	Commercial	E	52	45	48	4	No
R8	Single Family Home	B	67	59	62	3	No
R9	Commercial	E	52	40	43	3	No
R10	Single Family Home	B	67	54	57	3	No
R11	Commercial	E	52	45	46	1	No
R12	Single Family Home	B	67	66	67	1	Yes
R13	Single Family Home	B	67	62	62	0	No
R14	Single Family Home	B	67	53	54	1	No
R15	Single Family Home	B	67	56	57	1	No
R16	Single Family Home	B	67	58	59	1	No
R17	Multi-Family Apartments	B	67	67	68	1	Yes
R18	Single Family Homes	B	67	58	59	1	No
R19	Single Family Homes	B	67	64	65	1	No
R20	Multi-Family Apartments	B	67	63	64	1	No
R21	Single Family Homes	B	67	60	62	2	No
R22	Single Family Homes	B	67	60	63	3	Yes
R23	Single Family Homes	B	67	66	68	2	Yes
R24	Single Family Homes	B	67	70	73	3	Yes
R25	Single Family Homes	B	67	70	73	3	Yes
R26	Church	E	52	41	45	4	No
R27	Commercial	E	52	43	44	1	No
R28	Single Family Homes	B	67	54	57	3	No
R29	Chruch	E	52	40	40	0	No
R30	Single Family Homes	B	67	58	60	2	No
R31	Single Family Homes	B	67	57	59	2	No
R32	Multi-Family Apartments	B	67	55	56	1	No

Source: Study Team 2008

As indicated in **Table 28**, the proposed project would result in traffic noise impacts, and the following noise abatement measures were considered: traffic management, alteration of horizontal and/or vertical alignments, acquisition of undeveloped property to act as a buffer zone, and the construction of noise barriers. The No Build Alternative would not directly result in impacts to noise receivers throughout the study area; however, as projected traffic on IH 45 increases, noise levels would also increase.

Before any abatement measure can be incorporated into the project, it must be both feasible and reasonable. In order to be feasible, the measure should reduce noise levels by at least five dBA at impacted receivers, and to be reasonable, it should not exceed $25,000 for each benefited receiver.

Traffic Management: Control devices could be used to reduce the speed of the traffic; however, the minor benefit of one dBA per five mph reduction in speed does not outweigh the associated increase in congestion and air pollution. Other measures, such as time or use restrictions for certain vehicles, are prohibited on state highways.

Alteration of horizontal and/or vertical alignments – Any alteration of the existing alignment would displace existing businesses and residences, require additional ROW, and not be cost effective/reasonable.

Buffer Zone: The acquisition of sufficient undeveloped land adjacent to the highway project to preclude future development that could be impacted by highway traffic noise would not be cost effective/reasonable.

Noise Barriers: This noise abatement measure is the most commonly used. Noise barriers were evaluated for each of the impacted receiver locations. Results of the evaluation for the Build Alternative are discussed below:

- R2: This receiver represents the Space Center RV Park business. Noise barriers would have a detrimental affect on this receiver by restricting views and access by potential customers.
- R4 through R6: These receivers represent a total of forty-eight residences. Commercial properties are present between these receivers and the highway. Noise barriers would have a detrimental affect on the commercial businesses by restricting views and access by potential customers.
- R12: This receiver represents eight residences. A continuous noise barrier would restrict access to these residences. Vacant properties are present between these receivers and the highway. Noise barriers may have a detrimental affect on any future commercial businesses by restricting views and access by potential customers.
- R17: This receiver represents multi family residences. Gaps in a noise barrier would satisfy access requirements but the resulting non-continuous barrier segments would not be sufficient to achieve the minimum, feasible reduction of 5 dBA.
- R23: This receiver represents two residences. This receiver represents two residences. Noise barriers that would achieve the minimum feasible reduction of 5 dBA in noise at each of these receivers would exceed the reasonable, cost-effectiveness criterion of $25,000.
- R24 and R25: These receivers represent seven residences. A continuous noise barrier would restrict access to these residences. Commercial properties are present between these receivers and the highway. Noise barriers may have a detrimental affect on commercial businesses by restricting views and access by potential customers.

None of the above noise abatement measures would be both feasible and reasonable, and therefore no abatement measures are proposed for this project.

Noise Contours

Land use activity areas between Hughes Road and FM 1764 are currently Category D, undeveloped land. Also, no new development is currently planned, designed, or programmed in those areas. There is no NAC for undeveloped land; however, to avoid noise impact that may result from future development properties adjacent to the project, local officials responsible for land use control programs should ensure, to the maximum extent possible, no new activities are planned or constructed along or within the design year noise impact contours, as shown in **Table 29**.

Table 29: Noise Impact Contours

Undeveloped Area	Land Use	Impact Contour	Distance from Edge of Nearest through Travel Lane
Hughes Rd. to FM 1764	Residential	66 dBA	340 feet
Hughes Rd. to FM 1764	Commercial	71 dBA	100 feet

Source: Study Team 2008

Construction Noise

Noise associated with the construction of the proposed project is difficult to predict. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns; however, construction normally occurs during daylight hours when occasional loud noises are more tolerable. None of the receivers are expected to be exposed to construction noise for a long duration; therefore any extended disruption of normal activities is not expected. Provisions will be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through measures such as work-hour controls and proper maintenance of muffler systems.

Local Official Coordination

A copy of this traffic noise analysis will be made available to local officials to ensure, to the maximum extent possible, future development are planned, designed, and programmed in a manner that would avoid traffic noise impacts. On the date of approval of this document (Date of Public Knowledge), FHWA and TxDOT are no longer responsible for providing noise abatement for new development adjacent to the proposed project.

Hazardous Materials

Forty-six hazardous material sites were identified in the study area, three of which warrant further consideration due to the documented presence of contamination. The No Build Alternative would not result in effects to or from hazardous material sites.

A Hazardous Materials Initial Site Assessment utilizing Environmental Data Resources (EDR), Inc. and TCEQ was conducted to determine the location of known hazardous material sites within the study area. A study area of approximately 500 feet on either side of existing IH 45 was applied for the assessment. General background investigations utilizing existing project information, available project mapping, a regulatory database search, and field reconnaissance were performed to identify evidence of operations and historical occurrences that may have resulted in the release of hazardous material contaminants within the study area. An exhaustive American Society for Testing and Materials (ASTM) Standard Phase I Environmental Site Assessment for individual parcels was not performed; therefore no title and deed research was performed. Formal utility location surveys were not performed.

The study area primarily consists of large tracts of undeveloped land with commercial development predominantly located around the cities of Dickinson, League City, and Texas City. Commercial development is principally highway-related and serves local and/or regional needs.

The EDR regulatory database search generated 38 listings for potential hazardous material sites in the study area, a summary of which is included in **Appendix G**. The study team identified an additional eight potential sites during field reconnaissance in April 2004. Of these sites, six fall within the ROW of the proposed project and, as indicated earlier, three sites warrants further consideration. These sites are identified in **Table 30**, and their locations are shown in **Exhibit 5**.

Sites not warranting further investigation were eliminated based upon one or more of the following criteria:

- The facility was located outside of the proposed ROW.
- No reported environmental concerns that would affect the proposed project were documented for the facility.

Table 30: Identified Hazardous Material Sites with the Study Area

Map ID #	EDR Map ID #	Property Name	Address	Database Listing	Within ROW	Phase I ESA Recommended	Comments
1	2	Gulfway Texaco, former Shell	1690 W Main	UST	Yes	Yes	Pumps and USTs would possibly be affected as ROW would be acquired from the west and north sides of this site.
2	NA	Former Exxon	101 FM 517	None	Yes	No	Abandoned
3	21	Shell	105 FM 517	UST	Yes	No	No effect
4	NA	CVS Pharmacy, former gas station	3703 Gulf Freeway	LUST	Yes	Yes	Site Assessment status (LPST #115733)
5	NA	Former Shell Gas Station, abandoned	2020 Gulf Freeway, Texas City	None	Yes	Yes	TCEQ case closed (LPST # 115489)
6	NA	Mobil	NW corner of IH 45 and FM 1764	UST	Yes	No	No effect

Source: Study Team 2007

Site #1: Portions of the Gulfway Texaco (formerly Shell) gas station property, located at the southeast corner of FM 518 and IH 45 or 1690 W. Main, would be within the proposed ROW. The site is a documented UST site, though no record of leakage exists. Storage drums with unknown material were observed during field observations.

Site #4: This former gas station, located at the southeast corner of IH 45 and FM 517, has been redeveloped as a CVS Pharmacy. The study team did not observe evidence of hazardous materials during

field investigations because the old structures had been removed, and the site was under construction. TCEQ has received a request for case closure and is currently reviewing the case.

Site #5: This former Shell gas station, located at the southeast corner of IH 45 and FM 517 (2020 Gulf Freeway in Texas City), has been abandoned. A LPST was reported at this site. The groundwater gradient is to the north-northeast or northwest (sources vary in their direction). No visible evidence of hazardous materials was found during field investigations. TCEQ has issued a case closed status.

Recommendation

A certified ASTM Standard Phase I environmental site assessment is recommended for Site #1 (Gulfway Texaco, formerly Shell), Site #4 (CVS Pharmacy, formerly Exxon), and Site #5 (former Shell gas station). A UST is present at Site #1 and ROW would be acquired, and therefore real estate transaction level studies are appropriate. Closure of the LUST at Site #4 at the time of writing is pending. The presence of groundwater impacts at Site #5 warrants further study.

The contractor would take appropriate measures to prevent, minimize, and control the spill of hazardous materials in the construction area. The use of construction equipment within sensitive areas should be minimized or eliminated. All construction materials used for this project should be removed as soon as the work schedule permits. Any unanticipated hazardous materials and/or petroleum contamination encountered during construction would be handled according to applicable federal and state regulations and TxDOT Standard Specifications and Guidelines for handling emergency discovery of hazardous materials.

Asbestos Management

The proposed project includes the [demolition and/or relocation] of one structure (building), which may contain asbestos containing materials. Asbestos inspections, specifications, notification, abatement, and disposal, as applicable, should be conducted in compliance with federal and state regulations.

Construction Impacts

Construction of the proposed project may permanently affect individuals of some wildlife species due to the conversion of habitat to transportation uses; however, it is anticipated that construction activities would primarily have minor short-term adverse effects during the construction phase. The use of construction machinery would temporarily increase fugitive dust, emit other air pollutants, raise ambient noise levels, generate silty runoff water, and cause occasional traffic delays. Construction activities associated with the project would include removing the existing pavement, clearing/grading the surface, preparing a new roadbed, paving the roadway and shoulders, installing new culverts, fencing, and revegetating and restoring portions of the ROW.

Contractors would be required to follow applicable federal, state, and local regulations and ordinances to ensure minimal construction effects in the study area. The following measures would minimize adverse effects during construction:

Water Resources and Erosion Control

- Storm water erosion and surface water runoff would be monitored and controlled during construction. A SW3P and erosion and sedimentation controls would be implemented.

- The clearing of vegetation along stream channels, wetlands, and forest areas would be kept to a minimum. Where vegetation is removed, watering exposed areas would control dust in the construction area and placing silt fences around construction areas would reduce the amount of silt-laden water for entering waterways.

Transportation Safety

- Measures would be taken to minimize traffic disruptions during the construction phase with detours, alternating closures, and temporary reductions in lane widths.
- Construction at road crossings would be scheduled during off-peak hours whenever possible.
- Construction signs would be posted well in advance to minimize travel delays and provide alternative access to affected residences and businesses in the area. Work on IH 45 would be phased in such a manner that would allow the roadway to remain open to two-way traffic during construction.

Air Quality

- Construction contractors would be required to comply with TCEQ regulations on air pollution control.
- Measures would be implemented to control or abate fugitive dust emissions created during construction of the proposed project. Measures such as wind barriers and dampening construction area soils would be used to control excessive dust emissions.

Noise

- Measures would be implemented to minimize noise levels anticipated in areas within and adjacent to the project construction site. Effects to any given receptor would be relatively short term in nature and extended disruption of normal activity is not likely.
- Unnecessary idling of construction vehicles would be limited and construction vehicles that are not in use would be shut down to reduce both noise and air pollution.
- Construction activities within residential areas would be limited to weekdays between 6 a.m. and 6 p.m.

Indirect Effects

The purpose of this section is to assess the indirect effects related to the proposed project. Indirect effects, as defined by CEQ regulations, are those:

> *"…effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (40 CFR 1508.8).*

The indirect impacts analysis was conducted in accordance with TxDOT's *Guidance on Preparing Indirect and Cumulative Impacts Analysis* (Draft Revised, November 2008) and the *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects*, Report 466, National Cooperative

Highway Research Program (NCHRP) 2002 (Report 466). The NCHRP report specifics an eight-step process for determining indirect effects. Each step of the eight-step process has been applied to the proposed project and the findings documented in this report. The eight steps are listed in **Table 31**.

Table 31: Eight Step Approach to Estimate Indirect Impacts

Step	Guidelines
1	**Scoping:** The basic approach, effort required, and geographical boundaries of the study are determined.
2	**Identify the Study Area's Direction and Goals:** Information regarding the study area is compiled with the goal of defining the context for assessment.
3	**Inventory the Study Area's Notable Features:** Additional data on environmental features are gathered and synthesized with a goal of identifying specific environmental issues by which to assess the project.
4	**Identify Impact-Causing Activities of Proposed Action and Alternatives:** Fully describe the component activities of each project alternative
5	**Identify Potentially Significant Indirect Effects for Analysis:** Indirect effects associated with project activities and alternatives are cataloged, and potentially significant effects meriting further analysis are identified.
6	**Analyze Indirect Effects:** Qualitative and quantitative techniques are employed to estimate the magnitude of the potentially significant effects identified in Step 5 and describe future conditions with and without the proposed transportation improvement.
7	**Evaluate Analysis Results:** The uncertainty of the results of the indirect effects analysis is evaluated for its ramification on the overall assessment.
8	**Assess Consequences and Develop Mitigation:** The consequences of indirect effects are evaluated in the context of the full range of project effects. Strategies to avoid or lessen any effects found to be unacceptable are developed. Effects are reevaluated in the context of those mitigation strategies.

Source: TxDOT 2008.

Indirect effects can be linked to direct effects in a casual chain (NCHRP Report 466). The chain can be extended as indirect effects produce further consequences. Examples of direct and indirect effects of several types of transportation projects are summarized in **Table 32**.

Table 32: Examples of Indirect Effects

Project Action	Direct Effects	Indirect Effect
Bypass Highway	Improved Access	Farmland converted to residential use. New residences produce new labor force attracting new businesses.
New Light Rail	Improved Access	New businesses open producing jobs/taxes. Traditional businesses/residents priced out.
New Highway	Improved Access	Development alters character of historic area. Visitors increase to historic area.

Source: NCHRP Report 466, Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects (2002).

Probability also helps distinguish indirect effects from direct effects; direct effects are often inevitable while indirect effects are probable. Each step of the eight-step process to estimate indirect effects has been applied to the proposed project and the findings documented in this report.

Step 1. Scoping

Approach

Analyzing the likelihood of development in the study area once construction is completed is a key component of evaluating the potential for indirect effects. General information identifying the study area's direction and goals should also be ascertained, including:

- How has the area developed?
- Are people building in the area?
- Are there plans/plats in the area currently under review?

An inventory of notable environmental features should also be done to identify specific environmental issues, including socio-economic features, by which to assess the project. The indirect impact-causing activities of the proposed action are then detailed. The outcome is identification of potentially significant indirect effects for further analysis (it should be noted that indirect effects to a resource might occur even in the absence of direct effects, e.g. water quality may not be a direct impact of a transportation project but subsequent development spurred by the transportation improvement may result in impacts to water quality). Qualitative and quantitative techniques, including analysis of GIS (Geographic Information System) data, would be employed to estimate the magnitude of the potentially significant effects. Finally, strategies that avoid or lessen any effects found to be unacceptable are reported, if warranted.

Geographic Boundaries of Study Area

The geographical boundaries of the indirect effects study area for the indirect impact analysis extends up to 7.5 miles from the proposed project, the boundary formed by adjacent major roadways (mainlanes or arterial roadways). Because of the similarity of their respective indirect effects, it is reasonable to assume that the indirect effects of one major roadway would largely become eclipsed by those of nearby major roadways as one neared those roadways; therefore, nearby major roadways are a reasonable choice for the study area boundary. The indirect effects study area extends between FM 528 to the north, SH 3 to the east, SH 6 to the west, and to the south where IH 45, SH 3 and SH 6 merge. The indirect effects study area encompasses 73,798 acres.

Step 2. Identify the Study Area's Direction and Goals

Residential and commercial growth has followed two patterns within the study area; it has radiated outward from the small city centers of Dickinson, La Marque, League City, and Texas City and has extended linearly along major thoroughfares such as IH 45.

The study area is located just south of the Clear Lake/NASA area, a regional employment center with approximately 42,000 jobs in 2000 (H-GAC 2004c). This employment center and other employment opportunities in the Houston area have made League City a popular "bedroom-community" with large master-planned residential communities (League City 2004b). Over half of Galveston County's population growth between 1980 and 2000 occurred within League City (U.S. Census Bureau 2000). Additionally, commercial development is clustered in the southern portion of the study area within La Marque and Texas City, due in part to the direct access provided by the crossroads of IH 45, FM 1764, and FM 2004.

Planning documents and zoning regulations provide the best indication of future land uses. Zoning district maps for Dickinson, League City, and Texas City are shown in **Appendix E**. The city of La Marque does not currently have zoning designations. Development plans are currently in place for a 3,400-acre tract of land located to the east and west of IH 45 from Holland Road to just north of FM 1764 in Texas City. The master-planned community (known as Lago Mar) would include up to 10,000 single and multi-master-

planned family homes with 300 acres of commercial development, including high-rise office space and retail (Wollam 2005). Construction of this master-planned community is anticipated to begin in 2008.

H-GAC predicts that Galveston County will gain over 95,000 people and 39,000 jobs between 2000 and 2025 (H-GAC 2004c). This growth will result in land use conversion of undeveloped lands for residential and commercial uses. In general, the now vacant land along the corridor is expected to develop into master-planned residential communities with commercial development along the frontage roads.

Step 3. Inventory of Study Area's Notable Features

Notable features evaluated in the indirect impact analysis are provided below in **Table 33**.

Table 33: Notable Features for Indirect Impact Analysis

Resource Category	Resource Evaluated	Amount of Evaluated Resource in Study Area
Water Resources	Floodplains Waters of the U.S., including wetlands	12,637 aces of 100-year floodplains 8 jurisdictional streams 2,670 acres of wetlands
Biological Resources	Vegetation and Wildlife Habitat	29,067 acres pastureland
Air Quality	Air Quality MSATs	Galveston County

Step 4. Identify Impact-Causing Activities of the Proposed Action

Indirect effects are commonly related to changes in land use, including the conversion of land to transportation use. Changes in travel patterns may occur in conjunction with transportation projects. For example, when a transportation project is constructed, increased access (direct effect) may make an area more attractive for new development, redevelopment of already developed areas, or accelerate already planned development in the area. The development may occur in the form of convenience stores, gas stations, retail strip centers, restaurants, office buildings, and residences, including apartments.

Generally, it would be reasonable to expect that projects on new location or larger scale projects (e.g., improvements that involve a significant increase in capacity such as increasing from a two to six-lane facility with grade separations) would have more potential to cause indirect effects than smaller scale projects or projects being constructed in already developed areas.

Examples of indirect effects that could potentially occur or may have already occurred as a result of the proposed project include the influx of businesses that depend upon the proximity to freeways with frontage roads and/or from improved access at intersections along the project corridor (such as FM 518, Brittany Bay Boulevard (Future SH 96), FM 646, FM 517, Hughes Road, Holland Road, and FM 1764). The indirect effects of this process of conversion are most notable as businesses, such as convenience stores and gas stations, seek financial opportunities associated with development and increased business patronage due to improved access. Similarly, residential development may result because of community growth and improved access to nearby job markets.

Alternatively, the increased access anticipated to be provided by the project could be a sufficient condition for the intensification of development already occurring or planned. This might be particularly true of the southern portion of the study area, which has a lower density of development, and therefore the greatest potential for additional growth.

Historically, roadway projects (particularly large-scale projects or those on new location) have been thought to indirectly spur development in surrounding areas as a result of the increased access to adjacent land that they provide. This is supported by the construction of mainlanes in the 1950's that were believed to be a catalyst for the expansion of suburban areas that developed at the same time (Handy 2002).

More recent studies of the relationship between land use and transportation projects agree that a link exists. However, the research is mixed as to whether transportation improvements spur development, or if development creates the need for transportation improvements (Handy 2002). For widening of existing roadways, as in the case of IH 45, studies conducted by the University of Texas Center for Transportation Research (UT CTR) (Kockelman 2000) and University of California at Davis (UC Davis) (Handy 2002) found little relationship between this type of activity and local development permitting. The UC Davis study concluded that urban highway expansion shows no evidence of generating new growth; however, it affects the pattern or distribution of existing growth.

Local land use planning reflects the ongoing local rural to urban land use transition. Commercial and industrial land uses are influenced by transportation improvements as mobility and accessibility are key factors in the determination of transportation costs for businesses. Commercial land uses represent a substantial percentage of developed land within the study area and the transition of rural areas to commercial along the proposed project would be expected to continue.

IH 45 has been a transportation corridor in Galveston County since the 1950s and land use planning for the region reflects the presence of IH 45. Current and future land uses have been developed around the exiting roadway, driven by the availability of land, transportation, and resources. Furthermore, it should be recognized that the IH 45 ROW was acquired under authority granted through previous environmental approvals; sections of IH 45, including frontage roads through Galveston County, that have been constructed and the proposed project would not alter the footprint of the roadway. The proposed improvements would provide the infrastructure to support the communities' future land use plan.

As evidenced above, the study area is undergoing a transition toward more intense urbanization and this trend is expected to continue well into the foreseeable future. According to the Urban Land Institute, transportation improvements are factored into planning but are not the driving force in these processes (Urban Land Institute 2004). The general consensus is that regional economics is the primary driving force for regional development. The major effect of highways is seen in the distribution of the development within a region (FHWA 2004). The proposed project would enhance the safety and mobility, as well as indirectly enhance the rate of development within the region. However, if improvements were not implemented, the development rate within the area would likely continue, but at a potentially slower rate.

Step 5. Identify Potentially Significant Indirect Effects for Analysis

For each of the study area's notable features, Step 5 examines the potential for significant indirect effects potentially associated with the proposed project.

Water Resources

Loss of jurisdictional stream channel associated with induced development would be an example of a potential indirect effect from construction of the proposed project. Specifically, streams could be indirectly affected by the project if the roadway improvements encouraged or influenced an increase in

development involving stream channelization or lining stream channels with concrete on surrounding lands.

Other *examples* of potential water quality indirect effects could include:

- Increased local construction spurred by the proposed project could affect water quality of local streams by generating soil erosion with associated sediment loading into streams, increasing non-point pollution generators such as parking lots or widespread pesticide and fertilizer application in association with increased commercial and residential landscaping.
- Increased rainfall runoff rate from induced development-related increase in impervious cover, including construction of structures that impede flow, could result in increased local flooding by raising peak flood elevations. However, this effect would be mitigated by inclusion of stormwater retention ponds in the construction project, which would serve to increase local flood storage capacity and counter the increased runoff rate. Measures such as these are a general requirement for most local construction activity.

The above examples, however, are dependent on changes in local land use, namely, conversion of undeveloped land to developed uses; however, increased accessibility associated with the proposed improvements is not, by itself, viewed as sufficient to induce additional development. Moreover, local development construction effects would be mitigated by detention/retention ponds or other permanent BMP installations, which would serve to remove pollutants and suspended solids from soil erosion added by new development; permanent BMPs such as detention/retention ponds are required in conjunction with all development construction in the study area.

In summary, indirect effects to water resources such as those listed above from the proposed project would be negligible. However, potential indirect effects to water resources from the project could potentially include the degradation of water quality should roadway contaminants or chemical spills impact water resources downstream of the study area. These indirect effects could occur during the construction of the improvements or due to accidental spills during the use of the facilities. Because of these potential indirect effects from the proposed improvements, these water quality resources will be evaluated further in Steps 6-8.

Biological Resources

Development can alter the landscape, increase impervious cover, modify species composition of any remaining habitats, and introduce fertilizers and anthropogenic chemicals into the biotic system. To the extent the proposed project would induce local land use changes, indirect effects to biological resources from the project could occur.

Examples of potential indirect effects to biological resources could include:

- Loss of vegetation and wildlife habitat by the proposed project if the roadway improvements encouraged or influenced an increase in development in the study area.
- Effects to aquatic species due to pollutant loading from hazardous materials contamination in the study area from any development induced by the proposed project.

- Loss of vegetation and wildlife habitat would be an example of a potential indirect effect from roadway improvements. Specifically, wildlife habitat could be indirectly impacted by the proposed project if the roadway improvements encouraged or influenced an increase in development in the study area.

As discussed previously (Step 4), the indirect impacts study area continues to undergo a transition toward more intense urbanization. The activities associated with urbanization (including agricultural, residential, and commercial uses) have permanently and irreversibly changed vegetation and wildlife habitat within the indirect impacts study area. Consequently, only wildlife species that have been able to adapt to the impacts of human encroachments have survived the area and species abundance and diversity has declined and would be expected to decline further as natural habitat is replaced by urban development. T**able 17** lists all state and/ or federally listed threatened or endangered species identified as potentially occurring within Galveston County.

The proposed project and resulting potential induced developments/redevelopments would not change the capacity of the environment to support these species. Even under the No Build Alternative, as Texas continues to grow, the conversion of vegetation to accommodate development would likely continue due to future projected population and employment growth rates. In addition, it is expected that the cities of Dickinson, League City, and Texas City landscaping requirements for site development would mitigate the loss of grassland areas and may benefit wildlife with the addition of landscaping trees.

Conversely, potential indirect effects to aquatic biological resources from the proposed project could potentially include the degradation of water quality should roadway contaminants or chemical spills impact water resources downstream of the study area. These indirect effects could occur during the construction of the improvements or due to accidental spills during the use of the facilities. Because of these potential indirect effects from the proposed project and resulting potential induced developments/redevelopments, these potential indirect effects to biological resources will be evaluated further in Steps 6-8.

Air Quality

The proposed project is located in Galveston County, which is part of the 8-hour, eight county “severe” ozone nonattainment area for the pollutant ozone. The network of future roadways and subdivision streets within the study area are expected to contribute to further traffic improvements, which could result in indirect air quality impacts. These effects are further evaluated in Steps 6-8.

Step 6. Analyze Indirect Effects and Step 7. Evaluate Analysis Results

Water and Biological Resources

- Floodplains – In their natural condition, floodplains serve vital functions including temporary storage of floodwaters, moderation of peak flood flows, maintenance of water quality, groundwater recharge, prevention of erosion, and habitat for wildlife. In total approximately 12,637 acres of floodplains are present with the indirect impacts study area and include 100-year floodplains associated with Dickinson Bayou, Clear Creek, Moses Bayou, Chigger Creek, Benson Bayou, Highland Bayou, Marchand Bayou, and Magnolia Creek. These local floodplains have been affected by land clearing, soil compaction, riparian corridor encroachment, and modifications to the

surface water drainage network as a result of past and present agricultural practices and urban development.

Within the study area, floodplain encroachment has been limited such that nearly all of the floodplain areas within the watershed remain vacant even though urban development has occurred immediately adjacent to the floodplains. Where encroachments have occurred, the encroaching land use has been generally compatible with the floodplains (i.e. parks and open space).

- Waters of the U.S., including wetlands – Determinations subject to USACE jurisdiction under Section 404 of the Clean Water Act were only performed on those features which intersected the project limits. Waters of the U.S., including wetlands are regulated by the USACE under authority of Section 404 of the Clean Water Act. Section 404 of the Clean Water Act authorizes the USACE to issue permits for the discharge of dredged or fill material into waters of the U.S, including wetlands.

  Based on information from USGS maps, field observations, and aerials there are up to eight jurisdictional streams in the indirect impacts study area. These are Dickinson Bayou, Clear Creek, Moses Bayou, Chigger Creek, Benson Bayou, Highland Bayou, Marchand Bayou, and Magnolia Creek. Each of these are intermittent or perennial stream systems with an associated woody riparian corridor. Several intermittent and ephemeral tributaries of these streams are also within the indirect impacts study area.

  With the indirect impacts study area there are approximately 2,670 acres of wetlands. The wetlands are adjacent to the stream systems and other drainage features. They are primarily emergent wetlands with some located within open areas of wooded riparian corridors. Many of the wetland areas have been disturbed from agricultural practices and urban development.

- Water Quality – As previously discussed, several streams are located within the indirect impacts study area. According to the 2008 Clean Water Act Section 303(d) list, each of these streams, except Moses Bayou and Magnolia Bayou, are listed as threatened or impaired water in the indirect impacts study area due to depressed dissolved oxygen levels and elevated bacteria concentrations.

- Vegetation and Wildlife Habitat – The indirect impacts study area is located within the Gulf Coast Prairies and Marshes Vegetation Region of Texas (Gould 1975). The Gulf Coast plain borders the Gulf of Mexico from the Sabine River to Corpus Christi Bay and encompasses approximately 13-million acres. The Gulf Prairies are nearly level with slow surface drainage and elevations ranging from sea level to approximately 250 feet above Mean Sea Level (MSL). They are used for crops, livestock grazing, wildlife production, and urban and industrial centers. It is estimated that as much as 99 percent of the coastal prairies in Texas have been converted to agricultural lands (Gould 1975 and McMahan, et al. 1984). The Gulf Marshes are low, wet, marshy coastal areas commonly covered with saline water, ranging from sea level to a few feet in elevation above MSL. These marshes support species of sedges, rushes, cordgrasses, reeds, and forbs.

Water and Biological Resources Summary

Because the indirect effects of the proposed project on water and biological resources stem from potential impacts to water quality, both resources will be grouped in this indirect effects analysis. Indirect effects to

water and biological resources from the proposed project, as described in Step 5 above, could likely be manifested by the deterioration in water quality. Examples of water quality deterioration would be increased pollutant loading of stormwater runoff or accidental chemical/fuel spills occurring after the roadway is opened to traffic. Because these impacts are separated from the construction of the proposed project in time, they are considered indirect effects. Effects from accidental spills or runoff would vary depending on the contaminants involved, the volume of chemical runoff, and the distance from the roadway. The farther away from the spill, the more diluted the runoff becomes, and the less impact the roadway has on the water and biological resources.

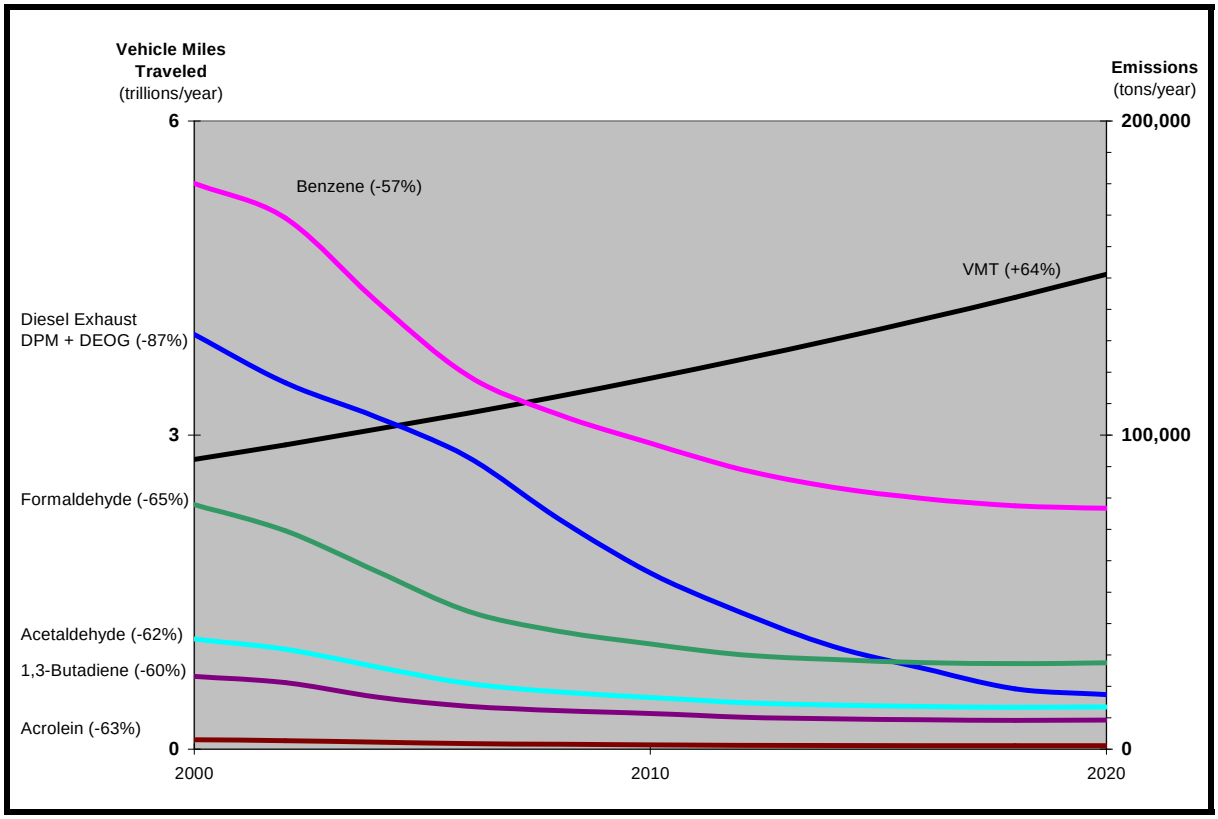
However, the indirect effects analysis for water and biological resources has a large level of uncertainty. It is difficult to quantify uncertain events such as accidental spills of chemicals/fuel or to determine the rate and transport of constituents associated with stormwater runoff. Because of this level of uncertainty, indirect effects of water and biological resources are carried through to further assessment in Step 8.

Air Quality

- Ozone – The amount of pollution emitted into the local atmosphere throughout the years is the net effect of one primary factor, population growth. The CMSA has seen significant population growth, and the trend is for the growth to continue. With growth comes increased development, followed by an increase in vehicles, and therefore an increase in daily vehicle miles traveled on the area's transportation systems. The network of future roadways and subdivision streets within the study area is expected to contribute to further traffic improvements. Any new transportation projects proposed in the Houston-Galveston-Brazoria CMSA would be required to be analyzed and added to a conforming plan prior to construction. Other potential indirect effects of air quality could occur with increased industrial development spurred by the surrounding oil refiners as well as other transportation projects in the area. Generally, industrial facilities that emit air pollutants would be governed and permitted through the TCEQ.
- MSATs – In addition to the criteria air pollutants for which there are NAAQS, The EPA also regulates air toxics. Air toxics are pollutants known or suspected to cause cancer or other serious health or environmental effects. Most air toxics originate from human-made sources, including on-road mobile sources (e.g., cars, light trucks, motorcycles, and 18-wheelers), non-road mobile sources (e.g., bulldozers, locomotives, aircraft, boats, etc.) area sources (e.g., dry cleaners, gas stations), and stationary/point sources (e.g., electric utilities, petrochemical refining, and other industry).

  MSATs are a subset of the 188 air toxics defined by the Clean Air Act. MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted into the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline (see EPA420-R-00-023 [EPA, 2000a] for more details on MSATs. Studies have found up to 50 percent of the monitored amounts of formaldehyde and acetaldehyde in the atmosphere are not directly emitted by mobile sources but are formed secondarily in the atmosphere (SCAQMD 2000).

The EPA is the lead federal agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. The EPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources (66 FR 17229, March 29, 2001). This rule was issued under the authority in Section 202 of the Clean Air Act. In its rule, the EPA examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline (RFG) program, its national low emission vehicle (NLEV) standards, its Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and its proposed heavy duty engine and vehicle standards and on-road diesel fuel sulfur control requirements. Between 2000 and 2020, FHWA projects that even with a 64 percent increase in VMT, these programs will reduce on-road emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent, and will reduce on-road diesel PM emissions by 87 percent, as shown in the following graph:



Source: FHWA 2006

Note: For on-road mobile sources, emissions factors were generated using MOBILE6.2. MTBE proportion of market for oxygenates is held constant at 50%. Gasoline RVP and oxygenate content are held constant. VMT: Highway Statistics 2000, Table VM-2 for 2000, analysis assumes annual growth rate of 2.5%. "DPM + DEOG" is based on MOBILE6.2-generated factors for elemental carbon, organic carbon and SO4 from diesel-powered vehicles with the particle size cutoff set at 10.0 microns.

In an ongoing review of MSATs, the EPA finalized additional rules under authority of Clean Air Act Section 202(l) to further reduce MSAT emissions that are not reflected in the above graph. The EPA issued Final Rules on Control of Hazardous Air Pollutants from Mobile Sources (72 FR 8427, February 26, 2007) under Title 40 Code of Federal Regulations Parts 59, 80, 85 and 86. The rule changes are effective on April 27, 2007. As a result of this review, the EPA adopted the following

new requirements to significantly lower emissions of benzene and the other MSATs by: (1) lowering the benzene content in gasoline; (2) reducing evaporative emissions that permeate through portable fuel containers; and (3) reducing non-methane hydrocarbon (NMHC) exhaust emissions from passenger vehicles operated at cold temperatures (under 75 degrees Fahrenheit).

Beginning in 2011, petroleum refiners must meet an annual average gasoline benzene content standard of 0.62 percent by volume, for both reformulated and conventional gasoline, nationwide. This would be a 38 percent reduction from 2007. The EPA standards to reduce NMHC exhaust emissions from new gasoline-fueled passenger vehicles will become effective in phases. Standards for light-duty vehicles and trucks (≤ 6,000 pounds [lbs]) become effective during the period of 2010 to 2013, and standards for heavy light-duty trucks (6,000 to 8,000 lbs) and medium-duty passenger vehicles (up to 10,000 lbs) become effective during the period of 2012 to 2015. Evaporative requirements for portable gas containers become effective with containers manufactured in 2009. Evaporative emissions must be limited to 0.3 grams of hydrocarbons per gallon per day.

The EPA has also adopted more stringent evaporative emission standards (equivalent to current California standards) for new passenger vehicles. The new standards become effective in 2009 for light vehicles and in 2010 for heavy vehicles. In addition to the reductions from the 2001 rule, the new rules will significantly reduce annual national MSAT emissions. The EPA estimates that emissions in the year 2030, when compared to emissions in the base year prior to the rule, will show a reduction of 330,000 tons of MSATs (including 61,000 tons of benzene), more than one million tons of volatile organic compounds, and more than 19,000 tons of $PM_{2.5}$.

Step 8. Assess Consequences and Develop Mitigation

Water and Biological Resources

- Floodplains – Detention ponds could mitigate the indirect effects to floodplains in the study area resulting from increased surface runoff from new land development. Detention ponds are designed to temporarily store a portion of surface water runoff during storm events and slowly release the water over a period of time. Detention ponds are commonly used to control flooding.

  The local floodplain administrator (NFIP coordinator) and FEMA would have jurisdiction over mitigation activities for indirect effects to floodplains, and as such, would determine the mitigation responsibilities of TxDOT and the individual developers.

- Waters of the U.S., including wetlands – Avoidance or minimization of impacts to waters of the U.S., including wetlands should be performed during the development design phase so that only the least amount of impacts occurs. Mitigation is only conducted when impacts to waters of the U.S., including wetlands cannot be avoided. Typical mitigation for impacts to waters of the U.S. includes the construction of mitigation areas or purchasing credits from a mitigation bank. Mitigation is frequently conducted as a one of the requirements for obtaining a Section 404 permit. The USACE decides what the ratio of the mitigation area would be relative to the acreage of impacts to waters of the U.S. A typical mitigation ratio is three times the amount of acreage impacted, while the minimum mitigation ratio is one time the amount of acreage impacted (i.e. 1:1 ratio). A mitigation bank is a wetland, stream, or other aquatic resource area that has been restored, established, enhanced, or in certain circumstances, preserved for the purpose of providing compensation for

unavoidable impacts to aquatic resources permitted under Section 404 or a similar state or local wetland regulation. Mitigation banks are used in situations where the construction of a mitigation area is not practical. Mitigation banks are a form of "third-party" compensatory mitigation, in which the responsibility for compensatory mitigation implementation and success is assumed by a party other than the permittee. The USACE would have jurisdiction over mitigation activities for indirect effects to waters of the U.S., and as such, would determine the mitigation responsibilities of the developers.

- Water Quality – The potential of the proposed project to indirectly affect the water quality downstream during construction activities will be mitigated by the development and implementation of a SW3P and the use of BMPs such as the use of silt fence, rock berms, and/or detention/retention ponds. The construction of permanent BMPs would serve to remove pollutants and sediments. Providing or enhancing vegetative buffers along streams and ponds would provide some filtration to storm water runoff and help to mitigate impacts to water quality.

  At the state level, the TCEQ has jurisdiction over mitigation activities for impacts to water quality. Developers are required to comply with the TPDES General Permits for Construction Activities requirements that are administered by the TCEQ. In addition, the TCEQ monitors the water quality of water bodies in Texas, prepares reports that describe the status of the waters based on historical data on surface water and groundwater quality, identifies water bodies that are not meeting standards set for their use, and prepares and implements remedial action plans for those water bodies that are not meeting standards set for their use.

- Vegetative and Wildlife Habitat – Non-regulated portions of vegetative communities affected by the proposed project could be mitigated through avoidance and minimization efforts and through collaboration with local, county, and regional planners, the public, private developers, and other conservation groups dedicated to protection and preservation of this natural resource. Future cumulative impacts to this resource would continue if land use and conservation plans were not developed and maintained to protect and preserve the remaining acreage of this important ecosystem.

<u>Air Quality</u>

- Ozone – The effect of air emission increases from development serving as point sources, area sources, on-road mobile sources, and non-road mobile sources would be minimized as these forms of development are required to comply with state and federal regulations, mandated and enforced by the EPA and TCEQ. These regulations are designed to ensure that growth and urbanization do not prevent regional compliance with the ozone standard or threaten the maintenance of the other air quality standards.

- MSATs – Research has found that the ability to discern differences in MSAT emissions among transportation alternatives is very difficult given the uncertainties associated with forecasting travel activity and air emissions 28 years or more into the future. When evaluating the future options for upgrading a transportation corridor, the major mitigating factor in reducing MSAT emissions is the implementation of EPA's new motor vehicle emission control standards. Substantial decreases in MSAT emissions will be realized from the base year (2007) through an estimated time of

completion and its design year some 28 years in the future. Even accounting for anticipated increases in VMT and varying degrees of efficiency of vehicle operation, total MSAT emissions were expected to decline approximately 50 percent from 2007 to 2035. While benzene emissions were expected to decline about 31 percent, emissions of DPM were expected to decline even more (i.e. 86 percent).

Cumulative Impacts

As addressed by the CEQ, cumulative impacts are defined as:

> *"the impact on the environment which results from the incremental impact of the action (project) when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).*

This cumulative impact analysis follows the requirements and processes outlined in TxDOT's *Guidance on Preparing indirect and Cumulative Impacts Analysis* (Draft Revised, November 2008) as well as 23 CFR 771, the FHWA Technical Advisory T 6640.8A (1987); the CEQ handbook *Considering Cumulative Effects Under the National Environmental Policy Act* (1997); FHWA's *Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process* (FHWA 2003); and CEQ's *Memorandum and Guidance on the Consideration of Past Actions in Cumulative Effects Analysis* (2005).

The following table compares cumulative impacts to direct and indirect effects in the context of the nature, cause, timing, and location of the effect (**Table 34**).

Table 34: Type of Direct, Indirect, and Cumulative Impacts

Type of Effect	Direct	Indirect	Cumulative
Nature of Effect	Typical/Inevitable/Predictable	Reasonably Foreseeable/Probable	Reasonably Foreseeable/Probable
Cause of Effect	Project	Project's Direct and Indirect Effects	Project's Direct and Indirect Effects and Effects of Other Actions
Timing of Effect	Project Construction and Implementation	At Some Future Time than Direct Effect	At Time of Project Construction or in the Future
Location of Effect	At the Project Location	Within Boundaries of System Affected by the Project	Within Boundaries of System Affected by the Project

Source: NCHRP Report 466, Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects (2002).

Cumulative impacts are the incremental impacts that the project's direct or indirect effects have on a resource in the context of the myriad of other past, present, and future effects on that resource from unrelated activities. In order for a cumulative impact on a resource to be evaluated, the proposed action must have either a direct or indirect effect on that resource. It should be noted that relatively minor individual impacts (direct or indirect) may collectively result in significant cumulative impacts, and project-related direct and indirect effects must be analyzed in the context of non-project-related impacts that may affect the same resources.

The cumulative impact analysis focuses on those resources impacted by the proposed action, which are currently in poor or declining health, even if the impacts resulting from the action are relatively small (less than significant). Additionally, for those resources that are not in poor or declining health, the cumulative impact analysis focuses on those resources that are substantially impacted by the proposed action.

This analysis of cumulative impacts of the proposed project relies heavily on the land use changes anticipated to occur in the study area and the effects these changes will have on the resources considered in this analysis.

Methods

Based on TxDOT's *Guidance on Preparing indirect and Cumulative Impacts Analysis* (Draft Revised, November 2008), the following eight-step approach was used to identify and evaluate potential cumulative impacts of the proposed project in combination with other past, present, and reasonably foreseeable actions (**Table 35**).

Table 35: Guidelines for Identifying and Assessing Cumulative Impacts

Step	Guidelines
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 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
8	Assess and discuss mitigation issues for all adverse impacts

Source: TxDOT 2008.

Step 1. Identify Resources to Consider in the Analysis

TxDOT *Guidance on Preparing Indirect and Cumulative Impacts Analysis* states that "if a project will not cause direct or indirect impacts on a resource, it will not contribute to a cumulative impact on the resource." Therefore, if the proposed project would not have a direct or indirect impact on a resource, then that resource would not be carried forward for detailed cumulative impact analysis. Furthermore, this cumulative impacts analysis "should focus on 1) those resources substantially impacted by the project, and 2) resources currently in poor or declining health or at risk even if the project impacts are relatively small." The results of the Step 1 evaluation identified the following resources/ issues that warrant more detailed discussion. These include:

- Water Resources
- Biological Resources
- Air Quality

Step 2. Define the Study Area for Each Resource

For the purpose of assessing cumulative impacts, Step 2 identifies the geographic extent of the resource study area (RSA) and the temporal RSA considered in this cumulative impact analysis.

Geographic Resource Study Area

Water Resources

- Floodplains – The cumulative impact RSA for floodplains was developed by the study team by identifying the watersheds that intersect the proposed project. The RSA boundary for floodplains was formed by connecting the outermost limits of each of the watersheds that intersect the project corridor and includes the Clear Creek Tidal, Dickinson Bayou Tidal, Moses Lake, and West Bay Watersheds. Clear Creek Tidal is located in the northern portion of the study area, Dickinson Bayou Tidal is centrally located in relation to the proposed project, and Moses Lake and West Bay are located near the southern end of the study area.
- Waters of the U.S., including wetlands – The cumulative impact RSA for waters of the U.S., including wetlands (both jurisdictional and non-jurisdictional), was developed by the study team also using the watershed approach. Watersheds were used to establish the wetlands study area boundary because effects to wetlands can affect the overall health of a watershed. Wetlands are important elements of a watershed because they serve as the link between land and water resources. This link has been demonstrated in practice by resource agency requirements for compensatory mitigation for wetland effects within the same watershed whenever possible. Effects to wetlands can greatly affect watershed health because wetlands are directly connected to watershed hydrology through sheet flow or direct hydrologic connections. Collectively, wetlands provide many watershed benefits, including pollutant removal, flood storage, wildlife habitat, groundwater recharge, and erosion control. The RSA for waters of the U.S., including wetlands is the watershed boundary that includes Clear Creek Tidal, Dickinson Bayou Tidal, Moses Lake, and West Bay Watersheds.
- Water Quality – The cumulative impact RSA for water quality was developed by the study team using the watershed approach. Since the late 1980s, watershed organizations, tribes, and federal and state agencies have moved toward managing water quality by using a watershed approach (USEPA 2005). In Texas, the TCEQ manages the Water Pollution Control Program, the primary regulatory program to maintain, restore, and enhance water quality, by watershed (TCEQ 2002). The RSA for water quality is the watershed boundary that includes Clear Creek Tidal, Dickinson Bayou Tidal, Moses Lake, and West Bay Watersheds.

Biological Communities

- Vegetation and Wildlife Habitat – The study team identified the cumulative impact RSA for vegetation as the area common to the selected *Vegetation Types of Texas* (McMahan et al. 1984), the boundaries of the Gulf Coast Prairies and Marshes ecoregion (Gould 1975), and riparian vegetation scattered throughout the study area.

  Based on the *Vegetation Types of Texas* (McMahan et al. 1984), the cumulative impact RSA considered for vegetation incorporates an area that is described as Bluestem Grassland and Crops. Bluestem Grassland is prominent throughout the Gulf Prairies and Marshes ecoregion, is particularly apparent south and west of the Houston area, and includes species such as bushy bluestem, smut grass, windmill grass, and mesquite. The Crops vegetation type is a statewide vegetation category that includes cultivated cover crops and row crops utilized for food and/or fiber

for humans or domesticated animals (McMahan et al. 1984). This vegetation type may also include grassland associated with crop rotations.

The boundary of the Gulf Coast Prairies and Marshes ecoregion is outlined by a narrow band about 60 miles wide along the Texas coast from the Louisiana border to Brownsville. The area is supported by a tapestry of shallow bays, estuaries, salt marshes, dunes, and tidal flats. Because of this proximity to the Gulf of Mexico, the plants of this region are highly salt tolerant or halophytic. This coastal area supports species of sedges, rushes, cordgrasses, reeds, and forbs, which provide beneficial wildlife habitat for numerous birds and marine fisheries.

Within the project vicinity, natural vegetation communities are prevalent, which include aquatic features, periodically inundated wetlands, riparian forest, managed pastureland, and tallow forest. Grasslands in varying stages of succession primarily characterize the proposed ROW.

Air Quality

- Ozone – The cumulative impact RSA for air quality encompasses the eight-county transportation planning region that includes Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties. The EPA established limits on atmospheric pollutant concentrations through enactment of the NAAQS for six principal pollutants (i.e., criteria pollutants). The EPA designated the eight counties in the Houston-Galveston-Brazoria (HGB) area as "severe" nonattainment for the 8-hour ozone standard in accordance with NAAQS.
- MSATs – The roads used for the MSAT traffic analysis includes all major roadways potentially affected by the proposed project, as discussed in this EA. This analysis considers the on-road sources for the six priority MSATs (i.e., acetaldehyde, acrolein, benzene, 1,3 butadiene, diesel particulate matter [DPM], and formaldehyde) and is based on future volumes of traffic that have been projected using the eight county H-GAC travel model that includes all the roadway links within the total traffic study area.

Temporal Resource Study Area

The CEQ definition (40 CFR 1508.7) of cumulative impacts states that past conditions and activities must be considered along with present and reasonably foreseeable actions. Therefore, a temporal RSA for this cumulative impact analysis was defined and spans as far back as the 1950s, when IH 45 was first constructed. The early date was determined as the construction of IH 45 established a development or urbanization baseline for the cumulative effects analysis; however, specific historical information was often not available to establish a baseline for each resource. Unless noted, the temporal boundaries span from 1980 to 2035 for all resources, which more accurately documents past effects and the prediction of future outcomes. The following sources were used to analyze the potential for cumulative impacts.

- Data sources, providing key patterns that date back to 1980, were accessible for this report.
- Demographic forecasts available in Galveston County and the time horizon of local comprehensive plans are available up to 2035, which represents the furthest extent of transportation and land use planning efforts reasonably available for future activity.

- Available information on development plans and population trends is provided in previous sections of this EA.
- Statutes, regulations, and ordinances, discussed throughout this EA, have been designed by federal, state, and local governments to ensure the sustainability of resources by requiring project sponsors to avoid, minimize, and mitigate for the environmental effects of their actions.

Step 3. Describe the Current Health and Historical Context for Each Resource

Patterns or activities that have contributed to the current condition of the resources/ issues considered in this cumulative impact analysis would not differ greatly with the proposed project because growth and development is taking place independently, and to varying degrees, regardless of project construction. The health of each resource considered in this analysis is summarized below.

Water Resources

- Floodplains – Historically, floodplains within the RSA have been utilized for crops and livestock grazing. Developed land uses are minimal within mapped floodplains. The current health of floodplains within the RSA is considered "stable".
- Waters of the U.S., including wetlands – According to the Texas Environmental Almanac (1995), inland wetlands (including bottomland hardwood forests, riparian vegetation, and playa lakes {shallow lakes}) account for 80 percent of the total wetland acreage in Texas. Most of the inland wetlands are on privately held properties. In the last 200 years, the state of Texas has lost over 60 percent of its most valuable inland wetlands, primarily from agriculture, timber production, reservoir construction, and urban and industrial development. Within the study area, increased development has resulted in channelization, excavation, and the filling of natural streams and wetlands. The current health of waters of the U.S. within the RSA is considered "stable".
- Water Quality – According to the TCEQ Water Quality Inventory, Clear Creek Tidal (Segment 1101), Dickinson Bayou Tidal (Segment 1103), Bensons Bayou (Segment 1103A), Borden's Gully (Segment 1103B), Geisler Bayou (Segment 1103C), and Marchand Bayou (Segment 2424C) are within five miles downstream of the proposed project and have designated uses, including contact recreation, public water supply, and aquatic life. These segments are listed on the 2004 Clean Water Act Section 303(d) list as impaired due to depressed dissolved oxygen levels and elevated bacteria concentrations. Several factors (including storm water runoff, municipal discharges, and an increase in development and impervious surfaces) have contributed to the current condition of water quality. However, since the Clean Water Act was implemented in 1972, overall water quality has been improving nationwide. The current health of water quality within the RSA is considered "in decline".

Biological Communities

- Vegetation and Wildlife Habitat – About 99 percent of the coastal prairies in the state of Texas have been converted to agricultural land. Subsequently, some of the croplands have been converted to grazing land or have been left fallow. Woody brush species or trees have since invaded a significant percentage of the tracts not in cultivation. The current health of wildlife habitat and vegetation within the RSA is considered "in decline".

Air Quality

- Ozone – The enactment of the Clean Air Act of 1970 authorized the development of comprehensive federal and state regulations to limit emissions from both stationary (industrial) sources and mobile sources. Four major regulatory programs affecting stationary sources were initiated: the NAAQS, SIPs, New Source Performance Standards (NSPS), and National Emission Standards for Hazardous Air Pollutants (NESHAPs). The EPA was created on May 2, 1971 to implement the various requirements included in the Clean Air Act of 1970.

  Major amendments were added to the Clean Air Act in 1977. The 1977 Amendments primarily concerned provisions for the Prevention of Significant Deterioration (PSD) of air quality in areas attaining the NAAQS. The 1977 Clean Air Act Amendments also contained requirements pertaining to sources in non-attainment areas for NAAQS. A non-attainment area is a geographic area that does not meet one or more of the federal air quality standards. Both of these 1977 Clean Air Act Amendments established major permit review requirements to ensure attainment and maintenance of the NAAQS.

  The 1990 Clean Air Act Amendments established specific criteria which must be met for air quality. The EPA was authorized to designate areas in "non-attainment" or failing to meet established NAAQS. In July 1997, the EPA announced a new NAAQS for ground-level ozone. The EPA phased out and replaced the previous one-hour standard with an 8-hour standard to protect public health against longer exposure to this air pollutant.

  The HGB area is currently classified as a "severe" non-attainment area for ozone (EPA 2008). Galveston County is located within the designated non-attainment area for ozone. Although the HGB area remains in non-attainment for ozone, the number of daily exceedances of the federal standards for ozone has decreased within the past decade. There have been year-to-year fluctuations in ozone levels; however, the ozone trend continues to show improvement. This trend is attributable in part to the effective integration of highway and alternative modes of transportation, cleaner fuels, improved emission control technologies, and H-GACs regional clean air initiatives. The current health of the air quality within the RSA is considered "improving".

- MSATs – Results of MSAT modeling were found to be substantially lower in the future years (2019 and 2035) compared to the year 2007. MSAT will continue to improve over time due to dramatic improvements in vehicle technology, fuels, and traffic flow improvements realized over time. The current health of MSATs within the RSA is considered "improving".

Step 4. Identify Direct and Indirect Impacts that May Contribute to a Cumulative Impact

The study team identified direct and indirect effects that could contribute to a cumulative impact. Additional information on the direct and indirect effects for each of the resources/ issues carried forward in this cumulative impact analysis is discussed in previous sections of this EA.

Water Resources

- Floodplains – The Build Alternative would cross the floodplain associated with Dickinson Bayou, Magnolia Bayou, Clear Creek, and Borden's Gully. The Build Alternative would not adversely

affect the floodplain. There would be no effect on the status of the NFIP and no additional need for floodway or floodplain ordinance amendments.

The Build Alternative would contain approximately eight acres of additional impervious concrete surface relative to the existing roadway facility. Storm water runoff from impervious surfaces associated with the induced development would impact the floodplains. Based on aerial photograph review of similar developments in the cities of Dickinson, League City, and Texas City, it is estimated that the percentage of impervious surfaces associated with a typical development (structures, driveways, parking lots, and streets) is approximately 70 percent with the remaining 30 percent consisting of open ground. Using a 70 percent impermeable surface factor, it is anticipated that the induced development resulting as an indirect effect of the Build Alternative would add approximately 36,161 acres of impermeable surfaces to the indirect impacts study area.

- Waters of the U.S., including wetlands – Twelve jurisdictional areas encompassing 4.96 acres were identified within the study area, seven of these areas are waters of the U.S. (2.43 acres), and five are wetlands (2.53 acres). The Build Alternative would permanently or temporarily affect less than 1.89 acres of the jurisdictional areas. This alternative would also affect 42 non-jurisdictional aquatic resources.

  The potential indirect effects on waters of the U.S., including wetlands include fill and degradation from roadway projects and induced development, which has the potential to affect up to approximately eight jurisdictional streams and 2,670 acres of wetlands within the indirect impacts study area.

- Water Quality – Approximately 11.3 acres of land would be disturbed during construction of the Build Alternative. The greatest potential for direct impacts to water quality as a result of the Build Alternative would be sediment runoff from precipitation events during construction. Storm water runoff from construction sites can also include pollutants other than sediment such as phosphorous, nitrogen, pesticides, petroleum derivatives, construction chemicals (e.g. concrete sealant) and solid wastes (trash, plastic floatables) that may become mobilized when land surfaces are disturbed. The Build Alternative would contain approximately eight acres of additional impervious concrete surface relative to the existing roadway facility.

  Storm water runoff during construction would primarily consist of sediments and other previously described pollutants. After construction is completed, there is still the potential that water quality would be impacted by the developments. According to the Center for Watershed Protection, storm water runoff from urban development typically contains suspended solids, nitrogen, phosphorus, bacteria (fecal coliforms), petroleum hydrocarbons, copper, lead, zinc, pesticides, and herbicides.

<u>Biological Communities</u>

- Vegetation and Wildlife Habitat – The proposed project would result in the removal or conversion of less than 239.91 acres of vegetation within the existing and proposed ROW. Of this total, approximately 13.32 acres are considered native vegetation types.

  Roadway projects and induced development has the potential to affect up to approximately 29,067 acres of vegetation within the indirect impacts study area.

Air Quality

- Ozone – According to studies conducted by H-GAC and TCEQ, and based on ambient air monitors managed by TCEQ and approved by EPA, the 1-hour and 8-hour ozone design values for the HGB area for 1991 to 2005 have decreased over the past 15 years. The 2005 1-hour design value was 169 ppb, representing a 23 percent decrease from the value for 1991 (220 ppb). The 2005 8-hour design value was 103 ppb, a 13 percent decrease from the 1991 value of 119 ppb. These decreases occurred despite a 36 percent increase in area population.

  The proposed action's traffic projection exceeds 140,000 vehicles per day for either the existing or design year and thus a Traffic Air Quality Analysis for carbon monoxide was conducted (see **Table 21** for results).

  The proposed project is consistent with the area's financially constrained 2035 RTP and the 2008-2011 TIP. On August 24, 2007, H-GAC adopted the 2035 RTP and FY 2008-2011 TIP. The U.S. Department of Transportation (FHWA/FTA) found the 2035 RTP and 2008-2011 TIP to conform to the SIP on November 9, 2007. Roadway projects and induced development has the potential to increase air emissions from point sources (large industrial facilities), area sources (smaller businesses such as gas stations, paint and body shops, bakeries), on-road mobile sources (motorized vehicles), and non-road mobile sources (lawn mowers, construction equipment).

  Any new transportation projects proposed in the Houston metropolitan area would be required to be analyzed and added to a conforming plan prior to construction.

- MSATs – The proposed project potentially could contribute 1,310 tons/year of MSAT in 2035. Indirect effects of air quality could occur with increased industrial development spurred by the surrounding oil refiners as well as other transportation projects in the area.

Step 5. Identify Other Reasonably Foreseeable Actions that May Affect Resources

Reasonably foreseeable actions are those that are likely to occur, or are probable, rather than those that are possible. Reasonably foreseeable actions within the vicinity of the proposed project include linear transportation projects, which could potentially affect the same resources as the proposed project. These actions are summarized in **Table 36**.

Table 36: List of Actions by Federal, State, and Local Agencies/ Other Interests

Action	Type of Action	Estimated Effect
Transportation Actions		
IH 45 South from Nyack to Medical Center Blvd.	Widen to 10 main lanes, two 3-lane frontage roads and two HOV lanes	44 acres
IH 45 South from Medical Center Blvd. to 0.48 miles south of NASA Road 1	Widen to 10 main lanes, two 3-lane frontage roads and one reversible HOV lane	
IH 45 South from 0.210 miles south of NASA 1 Bypass to Galveston County Line	Widen to 10 main lanes, two 3-lane frontage roads and two HOV lanes	
IH 45 South from Harris County Line to 0.452 miles south of FM 518	Widen to 10 main lanes, two 3-lane frontage roads	
FM 646 from IH 45 to SH 3	Widen from 2 lanes to 4-lane divided	4 acres
FM 646 from SH 3 to FM 1266	Widen from 2 lanes to 4-lane divided	1 acre

FM 646 from IH 45 to FM 517		Widen from 2 lanes to 4-lane divided	3 acres
IH 45 South from north of FM 519 to north of FM 1764		Widen to 8 main lanes and two 2-lane frontage roads	8 acres
Holland Road from IH 45 to Attwater Avenue		Construct 4-lane roadway on new location	6 acres
IH 45 South at SH 96		Construct new interchange	6 acres
FM 1764 at Willow Street Extension		Construct grade separation, FM 1764 overpass at Willow Street exit	1 acre
Grand Parkway	SH 99 from IH 45 South to Brazoria County Line (Segment B)	Construct 4-lane tollway with limited two 2-lane frontage roads and interchanges	380 acres
	SH 99 from SH 146 to IH 45 South (Segment A)	Construct 4-lane tollway with limited two 2-lane frontage roads and interchanges	313 acres
Other Actions			
Spirit and Faith Family Worship Center		Project is underway to design and construct this facility along IH 45 just north of FM 646	5 acres
League City United Methodist Church		Project is underway to design and construct this church facility at the southwest corner of IH 45 and Calder Street in League City.	
Lowe's, Target, Home Depot, 24-Hour Fitness, PETCO		Project is underway to design and construct these businesses near the intersection of IH 45 and FM 646	45 acres
Lago Mar		Development plans are currently in place for this master-planned community located east and west of IH 45 from Holland Road to just north of FM 1764 in Texas City. The master-planned community would include up to 10,000 single and multi-family homes with 300 acres of commercial development, including high-rise office space and retail. Construction is anticipated to begin in 2008	3,400 acres
		Total	4,216 acres

Source: TxDOT - 2008-2011 TIP, 2007; H-GAC - 2035 RTP, 2007.

Potential effects from the reasonably foreseeable actions listed in **Table 36** were also qualitatively assessed based on available information. Overall, it was found that effects from the actions could include the following:

- The conversion of vacant and unused agricultural land for residential, commercial, institutional, industrial, and/ or recreational use;
- Potential temporary and permanent degradation or loss of water resources from surface runoff;
- A change in the economic and social environment due to increased employment and housing opportunities;
- An increase in usage of park and recreational activities related to development; and
- Potential degradation of habitats and wildlife populations from construction and ongoing operation.

Step 6. Assess Potential Cumulative Impacts to Each Resource and the Results

The study team's analysis on the potential for cumulative impacts to each specific resource category of interest is summarized below.

Water Resources

- Floodplains – Potential cumulative impacts considered and discussed include floodplain impacts as related to the Build Alternative in combination with the effects of other past, present, and reasonably foreseeable public and private actions. The Clear Creek Tidal, Dickinson Bayou Tidal, Moses Lake, and West Bay Watersheds RSA was considered sufficient to capture most cumulative impacts of the Build Alternative on floodplains.

  Floodplain acreage was determined using NFIP maps. Impervious surface acreage was determined by using an aerial photograph to measure the impervious surfaces (structures, driveways, parking lots, and streets) of similar developments in the cities of Dickinson, League City, and Texas City, calculating an average percentage of impervious surfaces relative to open ground (30 percent), and multiplying that percentage by acres of development in the RSA.

  The amount of storm water runoff that would impact floodplains would be dependent upon the severity and duration of the precipitation event, type of soil, water holding capacity of the soil, permeability of the soil, and the distances of the floodplains relative to the storm water outfalls. Hydrologic modeling would be required to estimate the volume of storm water that would impact the floodplains, which is beyond the scope of this floodplain cumulative impacts analysis. Therefore, the acreage of impervious surfaces was the unit of measurement used to quantify the effects of the Build Alternative.

- Waters of the U.S., including wetlands – Potential cumulative impacts considered and discussed include impacts on waters of the U.S. resulting from the direct impacts and indirect effects of the Build Alternative, in combination with the effects of other past, present, and reasonably foreseeable public and private actions. The Clear Creek Tidal, Dickinson Bayou Tidal, Moses Lake, and West Bay RSA was considered sufficient to capture most cumulative effects of the Build Alternative on waters of the U.S. because the majority of waters within the study area are included in these watersheds. Impacted streams and acres of impacted wetlands were determined by using development overlays for the Build Alternative.

- Water Quality – Potential cumulative impacts considered and discussed include direct and indirect effects to the water quality as a result of implementation of the Build Alternative in combination with the effects of other past, present, and reasonably foreseeable public and private actions. The Clear Creek Tidal, Dickinson Bayou Tidal, Moses Lake, and West Bay Watersheds RSA was considered sufficient to capture most cumulative effects of the Build Alternative on water quality because storm water runoff from the project would primarily drain into these sub-basins.

  Impervious surface acreage was determined by using an aerial photograph to measure the impervious surfaces (structures, driveways, parking lots, and streets) of similar developments in the cities of Dickinson, League City, and Texas City, calculating an average percentage of impervious surfaces relative to open ground (30 percent), and multiplying that percentage by acres of development in the RSA.

  The amount of storm water runoff from induced development that would impact water bodies would be dependent upon the severity and duration of the precipitation event, type of soil, water

holding capacity of the soil, permeability of the soil, and the distances of the water bodies relative to the storm water outfalls. Hydrologic modeling would be required to estimate the volume of storm water that would impact the water bodies. Storm water sampling and chemical analysis would be required to determine the types and concentrations of pollutants in the storm water. Hydrologic modeling, storm water sampling, and chemical analysis are beyond the scope of this water quality indirect effects analysis. Therefore, typical storm water pollutants were discussed in a qualitative manner and the acreage of impervious surfaces was the unit of measurement used to quantify the effects on water quality.

Biological Communities

- Vegetation and Wildlife Habitat – Potential cumulative impacts considered and discussed include direct and indirect effects to the vegetation and wildlife habitat as a result of implementation of the Build Alternative in combination with the effects of other past, present, and reasonably foreseeable public and private actions. The Clear Creek Tidal, Dickinson Bayou Tidal, Moses Lake, and West Bay Watersheds RSA was considered sufficient to capture most cumulative effects of the Build Alternative on vegetation and wildlife habitat because these sub-basins contain the streams, floodplains, and the associated vegetative habitat that wildlife (including the Texas horned lizard and Timber/ Canebrake rattlesnake) depends on for food, water, and shelter. Acreages of vegetation types in the RSA were determined from aerial photographs and topographic maps. Acreages of impacted vegetation types were determined by using development overlays for the Build Alternative. For the purposes of this analysis, it was assumed that any of the other past, present or reasonable foreseeable development would displace all the native vegetation and wildlife habitat within the confines of the development.

Air Quality

- Ozone – Potential cumulative impacts considered and discussed include direct and indirect effects on air quality as a result of implementation of the Build Alternative in combination with the effects of other past, present, and reasonably foreseeable public and private actions. The eight-county ozone non-attainment area for the HGB area, which includes Galveston County, was considered as a RSA sufficient to capture most cumulative effects of the Build Alternative on air quality.
- MSATs – Carried forward for further consideration in the Step 7.

Step 7. Report the Results

Water and Biological Resources

- Floodplains – Under the Build Alternative, the direct impacts (eight acres of impermeable surfaces) and indirect effects (36,161 acres of impermeable surfaces), in combination with 2,951 acres of impermeable surfaces associated with 4,216 acres of previously described other past, present, and reasonably foreseeable public and private actions, result in a total of 39,120 acres of impermeable surfaces in the RSA. These impermeable surfaces would have the potential to increase the base flood elevations of the floodplains in the RSA due to increased surface runoff during storm events.
- Waters of the U.S., including wetlands – Cumulative impacts to wetlands and waters of the U.S. would include direct and indirect effects to the resource as discussed in Step 4 as well as effects

caused by projects identified in **Table 36**. The direct impacts of the project would permanently or temporarily affect less than 4.96 acres of the jurisdictional areas. Roadway projects and induced development within the indirect impacts study area has the potential to impact up to approximately eight jurisdictional of streams and 2,670 acres of wetlands. The previously described 4,216 acres of other past, present, and reasonably foreseeable public and private actions has the potential to impact up to eight jurisdictional streams and 152 acres of wetlands. The cumulative impacts of the Build Alternative on waters of the U.S. could be up to eight jurisdictional streams and 2,827 acres of wetlands in the RSA.

The most common cause and effect issue is land conversion from wetlands to other uses, primarily urban/developed land. As a result of such development, stresses on wetlands may include water quality effects, changes in water levels, and overall effects from urban development.

Effects to wetlands from construction and associated indirect development would be limited based on the current regulations as well as compensatory mitigation required from the USACE for wetland effects. Because of the federal mandate with regard to wetlands, "no net loss" of wetlands from future proposed land use would be anticipated. The proposed project would not contribute to significant cumulative impacts to the area's wetlands and waters of the U.S.

- Water Quality – Local and regional governments (including Galveston County as well as the cities of Dickinson, League City, and Texas City) include the management of storm water (SW3P) in their comprehensive planning efforts to control the discharge of pollutants. As urbanization in the study area continues at its current and projected rate and new roadway projects are constructed, stringent requirements for storm water management as well as BMPs are enforced to prevent cumulative impacts on water quality and quantity.

  In regards to construction impacts, under the Build Alternative, the direct impacts (11.3 acres of disturbed ground) and indirect effects (51,659 acres of disturbed ground), in combination with the disturbed ground associated with 4,216 acres of previously described other past, present, and reasonably foreseeable public and private actions, result in a total of 55,886 acres of disturbed ground in the RSA. During storm events, sediments and pollutants in the storm water runoff from the disturbed ground would have the potential to impact water quality.

  In regards to post-construction impacts, under the Build Alternative, the direct impacts (eight acres of impermeable surfaces) and indirect effects (36,161 acres of impermeable surfaces), in combination with 2,951 acres of impermeable surfaces associated with 4,216 acres of previously described other past, present, and reasonably foreseeable public and private actions, result in a total of 39,120 acres of impermeable surfaces in the RSA. During storm events, pollutants in the storm water runoff from these impervious surfaces would have the potential to impact water quality.

  With appropriate implementation of regulation and control strategies, as discussed in more detail in the Water Quality section of this EA, it is expected that future potential effects to the areas water quality would be substantially reduced. The proposed project would not contribute to significant cumulative impacts to the area's water quality.

- Vegetation and Wildlife Habitat – Cumulative impacts to vegetative communities would include direct and indirect effects to vegetation as discussed in Step 4, as well as effects caused by projects identified in **Table 36**. The cumulative impacts on vegetation and wildlife habitat resulting from the 240 acres of direct impacts and the 29,067 acres of indirect effects, in combination with the 4,216 acres of impact to pasture and open land from the previously described other past, present, and reasonably foreseeable public and private actions, would decrease the amount of vegetation and wildlife habitat in the RSA by approximately 33,523 acres.

  The conversion of vegetative communities to developed land primarily results from population and employment growth. Even under the No Build Alternative, as the state of Texas continues to grow, the conversion of vegetation to accommodate development would likely continue due to future projected population and employment growth rates. Transportation projects may influence land conversion by inducing development in some locations, which could also accelerate the conversion of rural land.

  With appropriate implementation of the TxDOT/TPWD MOU and availability of park, floodplain, and existing vacant lands for mitigation strategies, the proposed project would not contribute to significant cumulative impacts to the area's vegetative communities.

Air Quality

- Ozone – The cumulative impact on air quality from the proposed project and other reasonably foreseeable transportation projects are addressed at the regional level by analyzing the air quality impacts of transportation projects in the 2035 RTP and the TIP. The proposed project and other reasonably foreseeable transportation projects were included in the RTP and TIP and have been determined to conform to the SIP. Planned transportation improvements are intended to cumulatively reduce congestion on a regional scale with a resultant decrease in pollutant emissions; therefore when combined, the proposed improvements in the study area are anticipated to have a cumulatively beneficial impact on air quality.
- MSATs – The cumulative impacts projected by the MSAT analysis indicates a substantial decrease in MSAT emissions can be expected for the No-Build and Build Alternatives (2019 and 2035) versus the base year (2007). Emissions of total MSAT are expected to decrease by more than 50 percent in 2035 compared with 2007 levels due to newer technology vehicles, a change in vehicle fuels, both gasoline and diesel fuel, and a change in emission standards that both light-duty and heavy-duty on-highway motor vehicles.

Step 8. Assess and Discuss Mitigation Issues for All Adverse Impacts

Consideration of potential mitigation measures, as specified in 40 CFR 1508.20, for this project included:

- Avoiding the impact altogether by not taking a certain action or parts of an action
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action

- Compensating for the impact by replacing or providing substitute resources or environments

Potential mitigation measures for all project resources have been discussed in previous sections of this EA. Step 8 of this cumulative impact analysis provides a summary of mitigation discussions for those resources carried through this process. A more detailed discussion regarding mitigation measures for water and biological resources in provide in Step 8 of the *Indirect Impacts* section of this EA.

The magnitude and significance of adverse cumulative impacts are expected to be limited and controllable. Efforts have been made to avoid and minimize project effects to all resources during the alternative alignment development phase of the project (see the *Description of the Alternatives* discussion in Chapter 2). Mitigation measures would be implemented where practicable. When project alternatives were developed, several environmental issues were considered that influenced the location of the proposed alignment, including the potential for involvement with Section 4(f) and 6(f) resources, avoiding and minimizing the filling of wetlands and floodplains, and sensitive biological communities. Other factors affecting the proposed project were also studied, including compatibility with local land use plans/ policies, housing and business displacements, socioeconomic issues, and community interests. The alternatives evaluation process was based on the sequential practice of avoidance, minimization, and mitigation. All project-specific commitments and conditions of approval, including resource agency permitting, compliance, and monitoring requirements, are stated in this EA. Mitigation monitoring would be conducted by TxDOT and other appropriate federal, state, and local agencies to ensure compliance with the agreed upon mitigation measures.

Water and Biological Resources

Construction activities associated with the proposed project would directly affect wetlands and aquatic systems to varying degrees. Land clearing during construction activities would remove vegetative cover. These activities may increase surface runoff during storm events and could lead to erosion. If runoff were allowed to flow into streams without erosion and sediment control measures, increased turbidity and sedimentation may modify water chemistry due to elevated levels of sediments, nutrients, and pollutants, which would also diminish suitable habitat for aquatic species, including littoral zone plants. To aid in minimizing such effects, placement and monitoring of erosion control measures at the start of, during, and after construction would be incorporated into project plans according to SW3P guidelines. In addition, the proposed project operates within a MS4 (Phase II) area; therefore, a Phase II MS4 Permit is required for construction activity and the contractor would need to coordinate the project with the appropriate MS4 operator and the TCEQ prior to any discharge into the MS4 system. Re-vegetation along the existing and proposed ROW would adhere to TxDOT re-vegetation guidelines. Indirect and cumulative impacts to wetland resources would be similar.

Effects to wetlands, whether direct, indirect or cumulative, are regulated through the USACE Section 404 permit process. Natural resource agencies (including TPWD, USFWS, USACE, USEPA, and TCEQ) would be involved in decisions regarding appropriate wetland mitigation ratios and the location, size, and character of the mitigation. A compensatory mitigation plan would be submitted to the USACE as part of the Section 404 permit review process.

Non-regulated portions of vegetative communities affected by the proposed project could be mitigated through avoidance and minimization efforts and through collaboration with local, county, and regional

planners, the public, private developers, and other conservation groups dedicated to protection and preservation of this natural resource. Future cumulative impacts to this resource would continue if land use and conservation plans were not developed and maintained to protect and preserve the remaining acreage of this important ecosystem.

Air Quality

- Ozone – The effect of air emission increases from development serving as point sources, area sources, on-road mobile sources, and non-road mobile sources would be minimized as these forms of development are required to comply with state and federal regulations, mandated and enforced by the EPA and TCEQ. These regulations are designed to ensure that growth and urbanization do not prevent regional compliance with the ozone standard or threaten the maintenance of the other air quality standards.
- MSATs – Research has found that the ability to discern differences in MSAT emissions among transportation alternatives is very difficult given the uncertainties associated with forecasting travel activity and air emissions 28 years or more into the future. When evaluating the future options for upgrading a transportation corridor, the major mitigating factor in reducing MSAT emissions is the implementation of EPA's new motor vehicle emission control standards. Substantial decreases in MSAT emissions will be realized from the base year (2007) through an estimated time of completion and its design year some 28 years in the future. Even accounting for anticipated increases in VMT and varying degrees of efficiency of vehicle operation, total MSAT emissions were expected to decline approximately 50 percent from 2007 to 2035. While benzene emissions were expected to decline about 31 percent, emissions of DPM were expected to decline even more (i.e., 86 percent).

Indirect and Cumulative Impacts Conclusion

In conclusion, projects occurring in the general vicinity of the proposed activities within the IH 45 study area are part of the continued urbanization and industrialization of the CMSA. The potential cumulative impacts of these projects accompany this trend and would affect environmental, social, and economic receptors. However, existing governmental regulations, in conjunction with the goals and coordination of community planning efforts, address the many and varied issues that influence the local and ecosystem-level conditions. The vision, goals, and ultimately, the coordination of the numerous stakeholder groups by local organizations and the regulatory powers of state and federal programs, in addition to regulations such as the Texas Coastal Management Program, the Clean Water Act, and the Clean Air Act, serve to safeguard resources and prevent or minimize negative impacts that would threaten the general health and sustainability of the region.

The proposed project would support and compliment the historical growth rates, patterns, and land use changes found in the CMSA. The analysis provided concludes that there are no significant adverse indirect and cumulative impacts to the resources in the project study area, when taken into consideration with other past, present, and reasonable foreseeable actions.

CHAPTER 4. SUMMARY AND CONCLUSION

Based on the information in this EA, TxDOT recommends implementation of the Build Alternative. The engineering, social, economic, and environmental studies conducted thus far indicate that the proposed project would result in no significant effects to the quality of the human or natural environment.

TxDOT recommends that FHWA find that implementing the Build Alternative would not be a major federal action significantly affecting the quality of the human or natural environment and thus issue a FONSI for this project.

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