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Chapter 3
Affected Environment and Environmental Consequences

3.1 INTRODUCTION

The first two chapters of this Final Environmental Impact Statement (EIS) have described the background and context of the United States (US) Highway 281 Corridor Project, Need and Purpose for improvements, and the reasonable alternatives being considered. This chapter examines how the Build Alternatives and the No-Build Alternative could affect the existing constructed and natural environments within the US 281 project corridor. The discussion in this chapter describes the potential environmental consequences of proposed transportation improvements in the US 281 project corridor for the Build Alternatives including the Preferred Expressway Alternative, as presented in **Chapter 2 - Alternatives Considered**. The resources and topics being evaluated include:

- land use
- farmlands
- socioeconomics
- pedestrian and bicycle facilities
- transportation facilities
- air quality
- traffic noise
- water quality (surface water and groundwater)
- groundwater
- floodplains
- waters of the U.S. including wetlands
- vegetation
- wildlife
- threatened and endangered species
- cultural resources
- Section 4(f) and 6(f) properties including parkland and recreational areas
- hazardous and regulated materials
- visual and aesthetic qualities

At the end of this chapter, **Table 3-54** provides a concise overview of the difference in costs, impacts, and benefits of the Build Alternatives including the Preferred Expressway Alternative and **Table 3-55** summarizes the potential mitigation and monitoring options.

3.2 LAND USE

This section describes existing land use within the land use study area, summarizes local government plans and policies that may help shape the land use along the US 281 project corridor, and considers the potential land use impacts that the Build Alternatives may have.

3.2.1 Methodology

The land use study area is located in northern Bexar County with a small portion in southern Comal County. The study area is defined as an area approximately one-half mile in width or one-quarter mile on either side of the centerline of the existing US 281 project corridor from Loop 1604 to the Bexar/Comal County line (**Figure 3-2a** through **Figure 3-2e**). An inventory of existing land uses in the land use study area was compiled from 2013 data provided by the Bexar Appraisal District and was then verified using aerial photography and field surveys. To quantify the potential direct impacts to land use, Geographic Information Systems (GIS) were used to calculate the number of acres, for each land use type, that could be impacted by the acquisition of additional acres of right-of-way (ROW) for the Build Alternatives. Field verification was conducted in February 2014 to capture changes to land use. This Final EIS reflects the current land use plans and polices affecting the US 281 project corridor.

3.2.2 Affected Environment and Future Projections/Plans

Northern Bexar County's existing land development pattern can be described as suburban residential development, which is spread somewhat uniformly over a large area with commercial services concentrated along major roadways like US 281 and Blanco Road. Existing land uses in the land use study area are presented from south to north in **Figure 3-2a** through **Figure 3-2e**. Existing land use along the US 281 project corridor consists of residential, commercial, educational, rangeland and forest uses. In general, the land uses adjacent to the US 281 project corridor south of Stone Oak Parkway include a quarry, commercial centers, multi-family residential development, and single-family residential development. North of Stone Oak Parkway, the developed uses tend to be smaller commercial properties adjacent to US 281 with single-family residential set back from the ROW.

There are several single-family residential subdivisions and two apartment complexes adjacent to the existing US 281 project corridor. Single-family residential subdivisions include: Encino Park, Big Springs, Stone Oak, The Oaklands, Mountain Lodge, Sendero Ranch, Summerglen, Lookout Canyon, The Estates at Stonegate and Trinity Oaks. Apartment complexes adjacent to the existing US 281 project corridor include The Ravinia and The View.

Local Government Plans and Polices

The following summarizes regional planning actions and joint development measures, which further support and identify the need for the US 281 Corridor Project. It should be noted that implementation of these planning actions may vary within the US 281 project corridor. This is because a portion of the corridor is located in the city of San Antonio, from Loop 1604 to approximately Marshall Road, and the unincorporated area north of Marshall Road is regulated by Bexar County. Unlike the City of San Antonio, Bexar County does not have the power to regulate zoning or the use or appearance of property in the county. Counties in Texas are also not legally bound to develop comprehensive plans like a municipality.

San Antonio Comprehensive Master Plan Framework

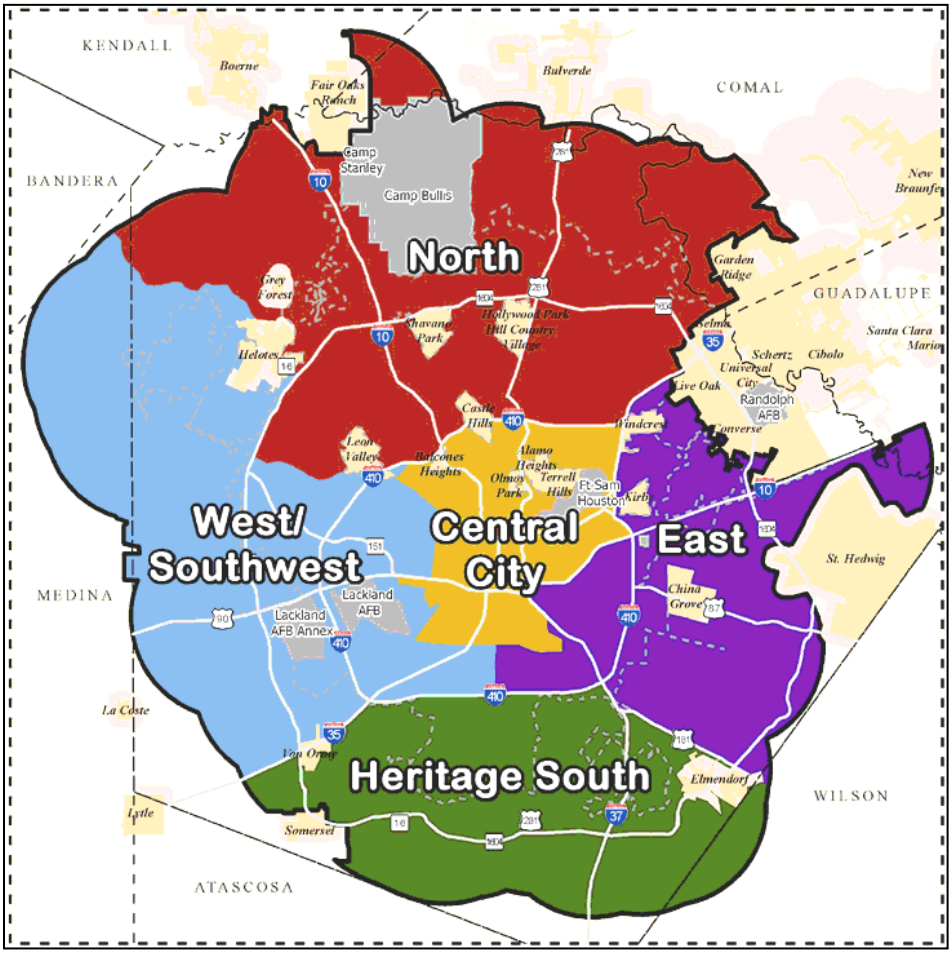
The *San Antonio Comprehensive Master Plan Framework* (*Master Plan*) provides the framework to coordinate the city's efforts, to plan for future growth and development, and promote a high quality of life for all residents over the next 25 years. The plan focuses primarily on the physical growth and development of the city.

These physical aspects of city growth; however, must be placed within the context of the overall social environment that is a part of life within the city. Decisions about the location and pattern of growth within the city have a profound effect on the city's social characteristics. To that extent, issues such as education, health care, and public safety are addressed in the *Master Plan*. However, it does not address these topics in a detailed manner.

The city of San Antonio is divided into five sectors and subsequent sector plans are being developed to support the policies of the adopted *Master Plan* and to provide appropriate guidance for land use, transportation, and public facilities planning efforts in each of the city's five sectors (**Figure 3-1**). Sector plans do not supersede adopted Neighborhood, Community or Perimeter Plans.

As of August 5, 2010, the City of San Antonio adopted the *North Sector Plan*, as a component of the City's *Master Plan*. The North Sector is generally bounded by: Loop 410, Grissom Road, and Culebra Road to the south; Loop 1604 and Texas Highway 16/Bandera Road to the west; the City of San Antonio extraterritorial jurisdiction boundary to the north; and the City of San Antonio extraterritorial jurisdiction boundary, Toepperwein Road and IH-35 to the east. The North Sector is the first of the five sector plans created for the city of San Antonio and its extraterritorial jurisdiction. This sector plan functions as the long-range guide to the preferred growth, conservation, and redevelopment for this area. The goals of this plan include: "preserving priceless natural resources, including the irreplaceable Edwards Aquifer, which provide a unique and valuable asset to the region today and in the future; enhancing the integration of scenic and recreational resources, outstanding educational opportunities, and diverse quality housing; while developing a compatible land use fabric that preserves military readiness, contributes high quality jobs to the regional economy, recognizes and respects private property rights, and integrates sustainable development patterns"(City of San Antonio 2010a).

Figure 3-1: City of San Antonio planning areas



Source: City of San Antonio, 2010a.

Alamo Regional Mobility Authority (Alamo RMA) Roadmap - 2011 – 2015 Strategic Plan

This updated *Strategic Plan* further defines the planning strategies established in the three previous *Strategic Plans* of the Alamo RMA, for congestion relief and acceleration of needed added capacity projects within the region. The five principles of the plan include: providing local leadership for transportation projects; advocating, supporting, and building multi-modal transportation projects to keep improving the quality of life for the community; leveraging resources – federal, state and local – to deliver needed infrastructure; increasing travel safety be decreasing congestions through operations and capacity improvements; and, adding new lane capacity and new relief to existing corridors – and if tolling is used, never reducing the number of non-toll lanes in place that the community uses today. The *Strategic Plan* is updated every two years to re-examine and establish the direction of the Alamo RMA.

San Antonio-Bexar County Metropolitan Planning Organization (MPO) - Mobility 2035 and Mobility 2040

This is a financially constrained, multi-modal transportation plan that identifies roadway, transit, and other transportation projects needed for the region. Transportation infrastructure, increasing congestion, funding issues, environmental concerns, and bicycle and pedestrian needs are key topics throughout this document. *Mobility 2035* varies from the previous plans by incorporating Scenario Planning. The Scenario Planning process included a series of public workshops in 2006, and was used to enhance the traditional transportation planning process and raise awareness of the factors that affect population and employment growth which impact the transportation system. *Mobility 2035* was locally adopted by the Transportation Policy Board on

December 7, 2009, and updated June 18, 2014. A comprehensive and formal update is required every five years. The MPO's Transportation Policy Board adopted *Mobility 2040* on December 8, 2014. The 2040 plan used the same Scenario Planning approach as was used in *Mobility 2035*; however, more current 2010 demographic and land use data and the 2010 transportation network were used to develop projections. In addition, *Mobility 2040* analyzed three growth scenarios: 1) the past 15-year trend would continue, 2) the past 5-year trend would continue, and 3) growth would occur in activity centers/along corridors. On March 24, 2014 the Transportation Policy Board adopted the 5-year trend scenario as its policy to guide growth. It assumes that infill development would occur in Bexar County, which would be medium to high density and would support increased use of alternative modes of transportation. It also assumes growth in Comal, Guadalupe and Kendall counties would continue to follow similar patterns experienced over the last 15 years. *Mobility 2040* acknowledges the groundwork that *Mobility 2035* initiated by adopting the Infill + TOD growth scenario and noted that the adoption of the 5-year trend scenario would to continue to advance these efforts. See **Chapter 1 - Need for and Purpose of Proposed Action** for a detailed discussion about *Mobility 2035* and *Mobility 2040* and the US 281 Corridor Project.

City of San Antonio's Major Thoroughfare Plan (Thoroughfare Plan)

The *Thoroughfare Plan* is a long-range transportation plan for both the City and Bexar County. Originally adopted in 1978 and substantially updated over the years, the *Thoroughfare Plan* designates the desired or future location, cross sections, and dedication requirements of roadways. This *Thoroughfare Plan* also incorporates the *Regional Bicycle Master Plan* which is currently being updated by the City and County and VIA Metropolitan Transit (VIA) public transportation plans. This plan was last updated on April 12, 2012.

San Antonio Bike Plan 2011

The first attempt at a bicycle master plan was made in 1975 by the City of San Antonio Department of Planning and Community Development. This plan evolved and eventually became the 2005 *Regional Bicycle Master Plan*. The *Regional Bicycle Master Plan* was envisioned to reflect the community's desire for a comprehensive network of on-road bicycle facilities and off-road hike and bike trails as part of the existing transportation infrastructure. The 2005 *Regional Bicycle Master Plan* was updated as the *San Antonio Bike Plan 2011* and was adopted in September 2011. While a stand-alone, fiscally-constrained document, this plan is an element of *Mobility 2035*, and San Antonio's *Thoroughfare Plan* and is reflected in the goals of the San Antonio's *Master Plan*.

VIA Metropolitan Transit 2035 Long Range Comprehensive Transportation Plan

VIA's *2035 Long Range Comprehensive Transportation Plan* (*LRCTP*) was adopted on July 26, 2011. It establishes policy structure, sets forth strategies, and provides a framework for directing future transit investments in Bexar County. In addition, the plan identifies the financial resources and tools necessary to implement and sustain these services. One key outcome of the *LRCTP* is a system plan, outlining a network of high-capacity corridors, each with a range of transportation alternatives. The alternatives for the selected corridors include a No-Build (or no-action) Alternative, one or more fixed guideway options, such as light rail, bus rapid transit, or busway (which may include provisions for use by carpools), and at least one non-guideway option, i.e., Transportation System Management (TSM). The plan utilizes the *Mobility 2035* land use scenario which promotes Infill Development (IND) and Transit Oriented Development (TOD) in the San Antonio area as a growth management strategy.

Mission Verde Sustainability Plan

The San Antonio City Council formally adopted the *Mission Verde Sustainability Plan* by resolution on February 4, 2010. The plan focuses on strategies to reduce energy use as a means to advance a sustainable environment and economy in San Antonio. The plan includes initiatives focused on the energy infrastructure, green technology, energy efficient buildings, mixed-use and transit-oriented land development, and multi-modal transportation.

Camp Bullis Joint Land Use Study (JLUS)

Camp Bullis is a military reservation located approximately four miles west of the US 281 project corridor. The *Camp Bullis JLUS* was a collaborative planning effort between the city of San Antonio, Bexar, Comal and Kendall counties, Camp Bullis and Fort Sam Houston, and other local agencies and stakeholders. The purpose of the study was to identify and resolve encroachment issues between the military base and the surrounding neighborhoods and to promote compatible land uses and growth management guidelines. The result of the study is a plan to manage development in the vicinity of Camp Bullis to ensure the ability of the base to achieve its mission and maintain military readiness as well as to provide for growth in an economically, environmentally and socially sustainable manner. The San Antonio City Council adopted this study on June 18, 2009.

Edwards Aquifer Authority Act and Rules

The *Edwards Aquifer Authority Act* was adopted on May 30, 1993 and was followed by the adoption of a set of rules and permitting requirements in order to protect the quality and quantity of water in the Edwards Aquifer. These rules and requirements are amended regularly with the most recent amendment occurring September 1, 2013. The rules and permit requirements in these documents are administered by the Edwards Aquifer Authority. The *Edwards Aquifer Authority Rules* regulate and contain permitting requirements for the use and conservation of the groundwater in the aquifer, and for the protection of the water quality in the aquifer, including the monitoring of potential sources of contamination within the recharge and contributing zones.

Existing Land Use

The US 281 land use study area, as defined above, is a diverse geographical area with pockets of developed and undeveloped land uses. As shown in **Table 3-1**, the study area is dominated by commercial use (22.36 percent), open space (19.76 percent), and residential use (17.75 percent). The land uses immediately adjacent to the US 281 project corridor are mixed with pockets of highly urbanized areas while the periphery of the land use study area is generally less densely developed. From south to north, **Figure 3-2a** through **Figure 3-2e** illustrate all land use categories identified within the US 281 land use study area as of 2014.

Table 3-1: Land Use Category - US 281 Land Use Study Area

Land Use Category	Acreage 2014	% of Total 2014
Commercial (Office, Retail, and Mixed)	605.94	22.36%
Open Space	535.27	19.76%
Residential (Single-Family and Multi-Family)	481.02	17.75%
Transportation/Utilities	426.94	15.75%
Range Land	391.1	14.44%
Mining	155.02	5.72%
Forest	55.11	2.03%
Place of Worship	33.47	1.24%
Educational	10.37	0.38%
Industry	9.68	0.36%
Government/Institution	5.53	0.20%
Parks	0.00	0.00%
Total	2709.44	100.00%

Source: Bexar Appraisal District, 2013b, US 281 EIS Team, March 2014.

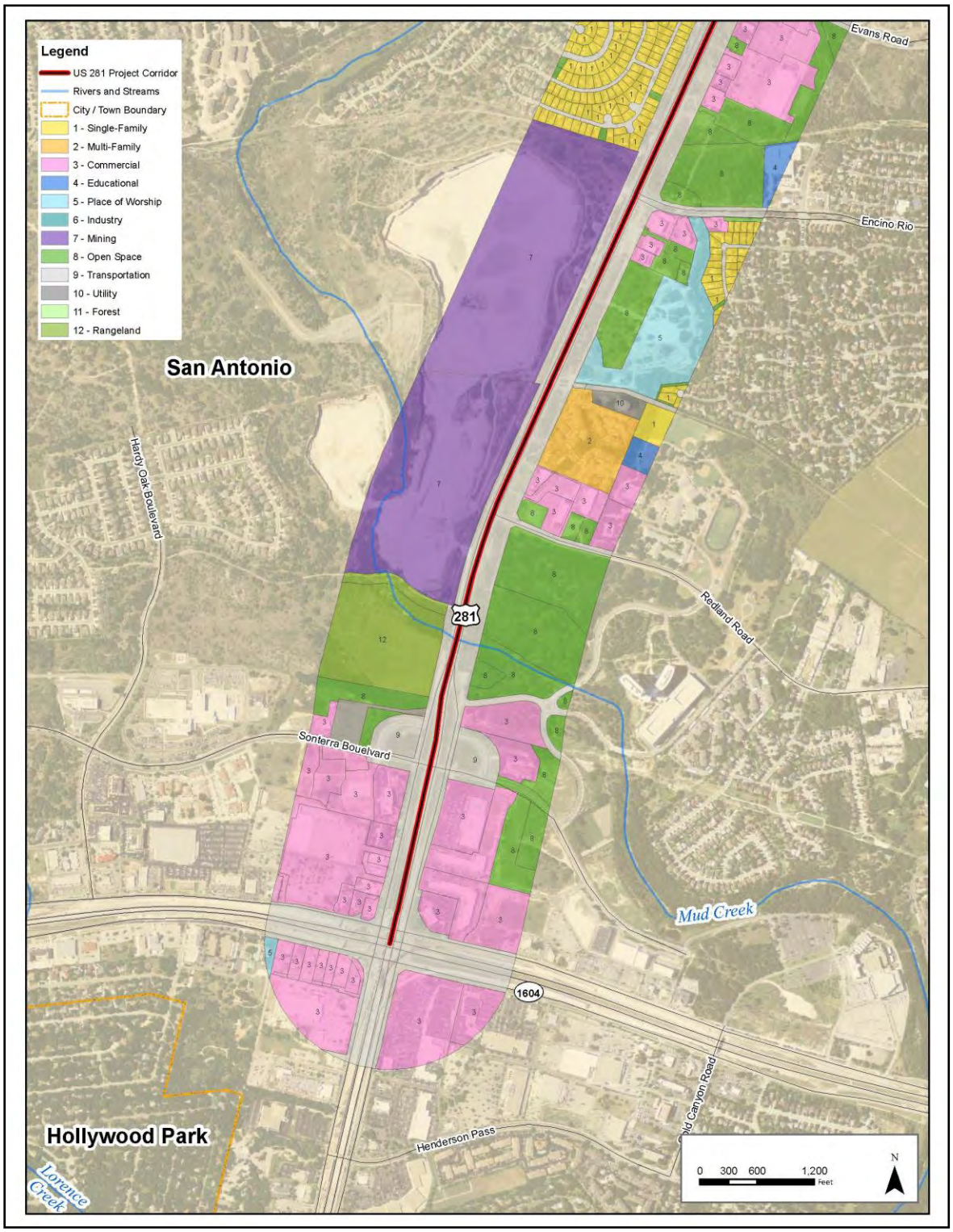
Undeveloped Land

Undeveloped land within the study area includes open spaces and range land. Of all the land uses within the study area, range land covers the greatest amount of area and is more abundant towards the northern limits of the study area. The observed range land includes mostly large areas of natural vegetation (native grasses, grass-like plants, forbs, shrubs and small woody vegetation). While largely developed, there are pockets of undeveloped land near the southern limits of the study area which are predominantly open spaces. Within the ROW of the US 281 project corridor, the vegetation is landscaped and maintained open space.

Development

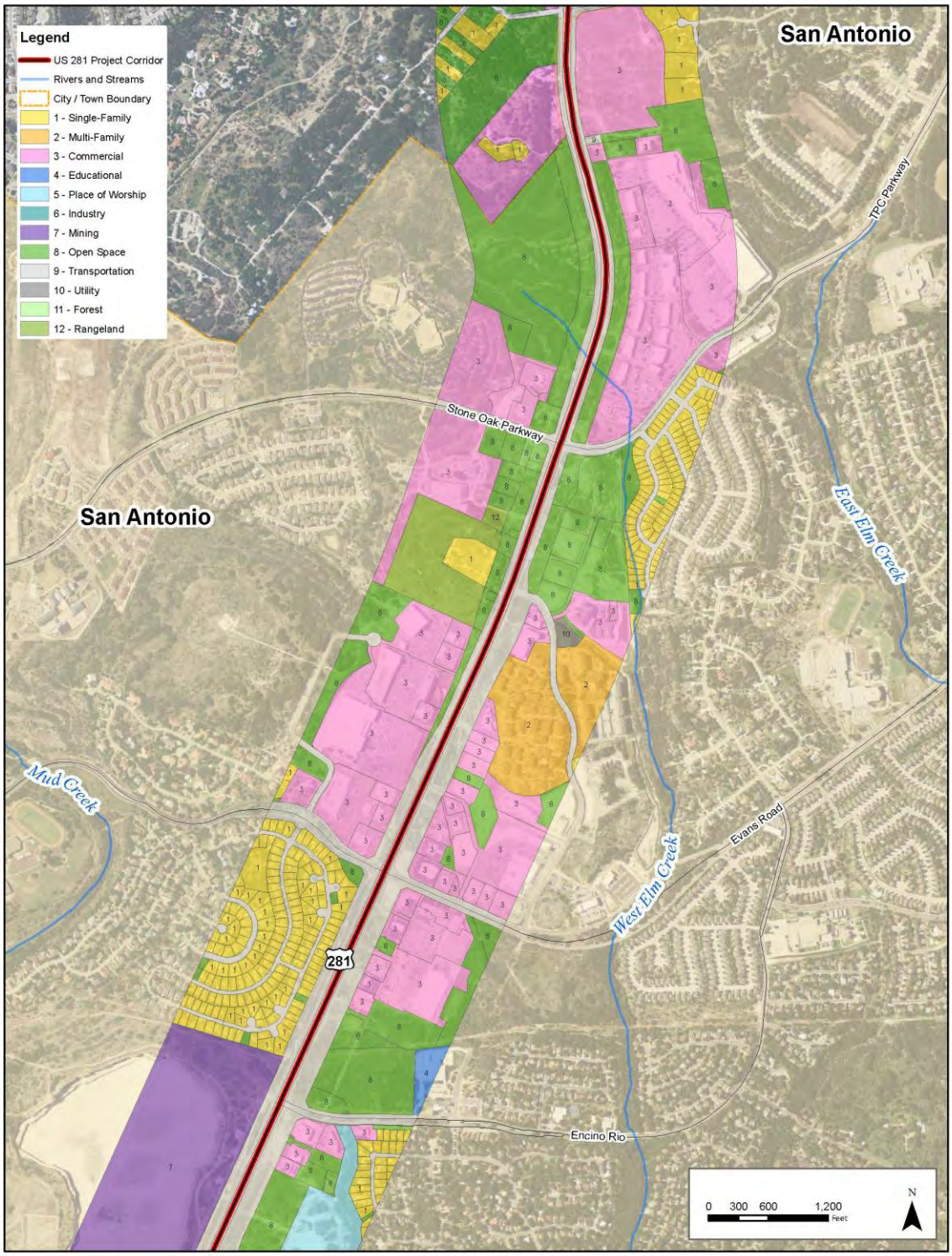
Urban development in the land use study area is primarily concentrated near the southern limits of the US 281 project corridor, between Loop 1604 and Marshall Road, and consists of, but is not limited to: commercial, residential, educational, industrial, transportation, utility, and mining operations. The second most abundant land use type in the land use study area is commercial use, followed by single-family residential land use. It should be noted, that land use development trends within the land use study area, particularly toward the northern limits, show increasing residential density extending into previously low-density areas.

Figure 3-2a: Existing land use in the land use study area



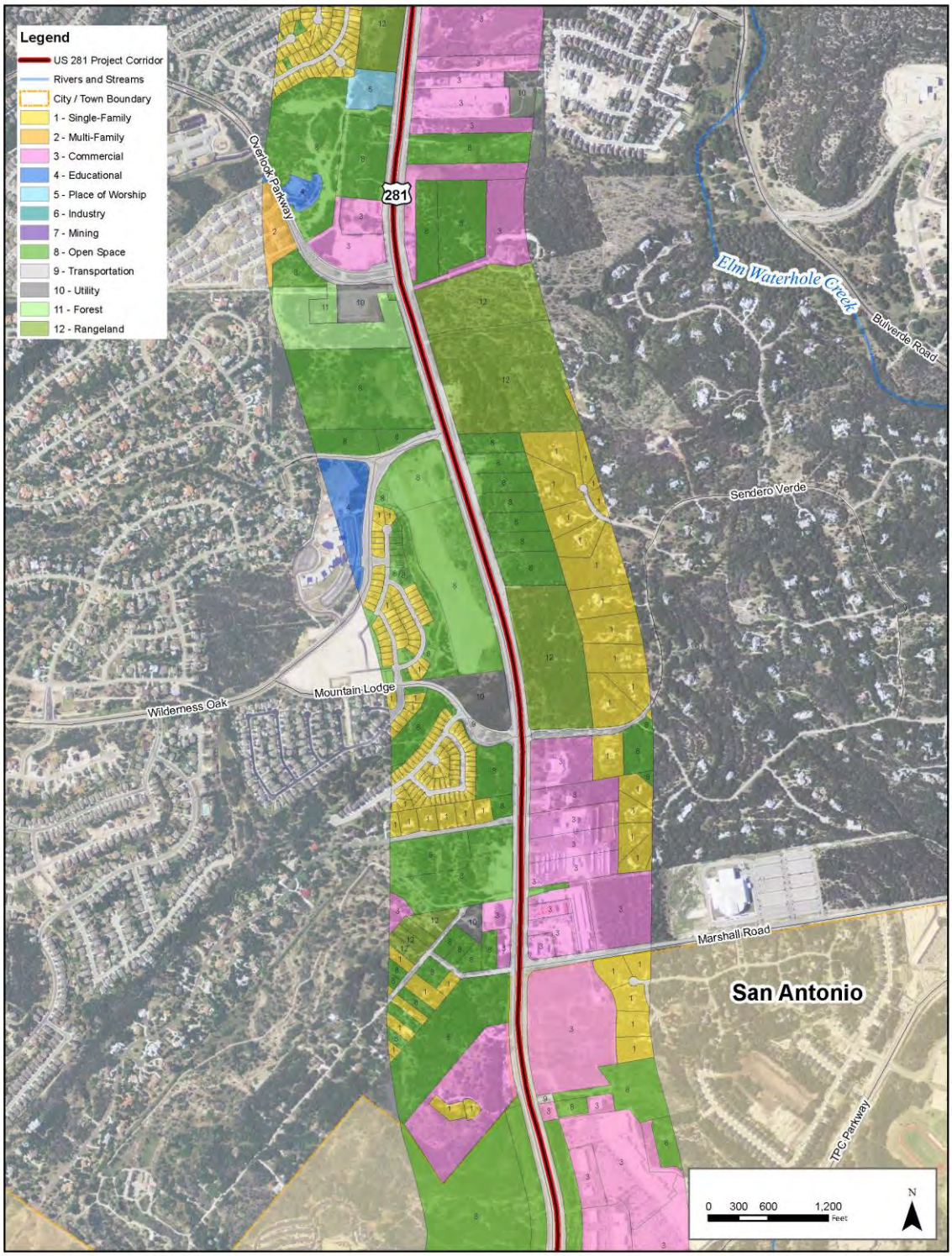
Source: Bexar Appraisal District, 2013b, US 281 EIS Team, March 2014.

Figure 3-2b: Existing land use in the land use study area



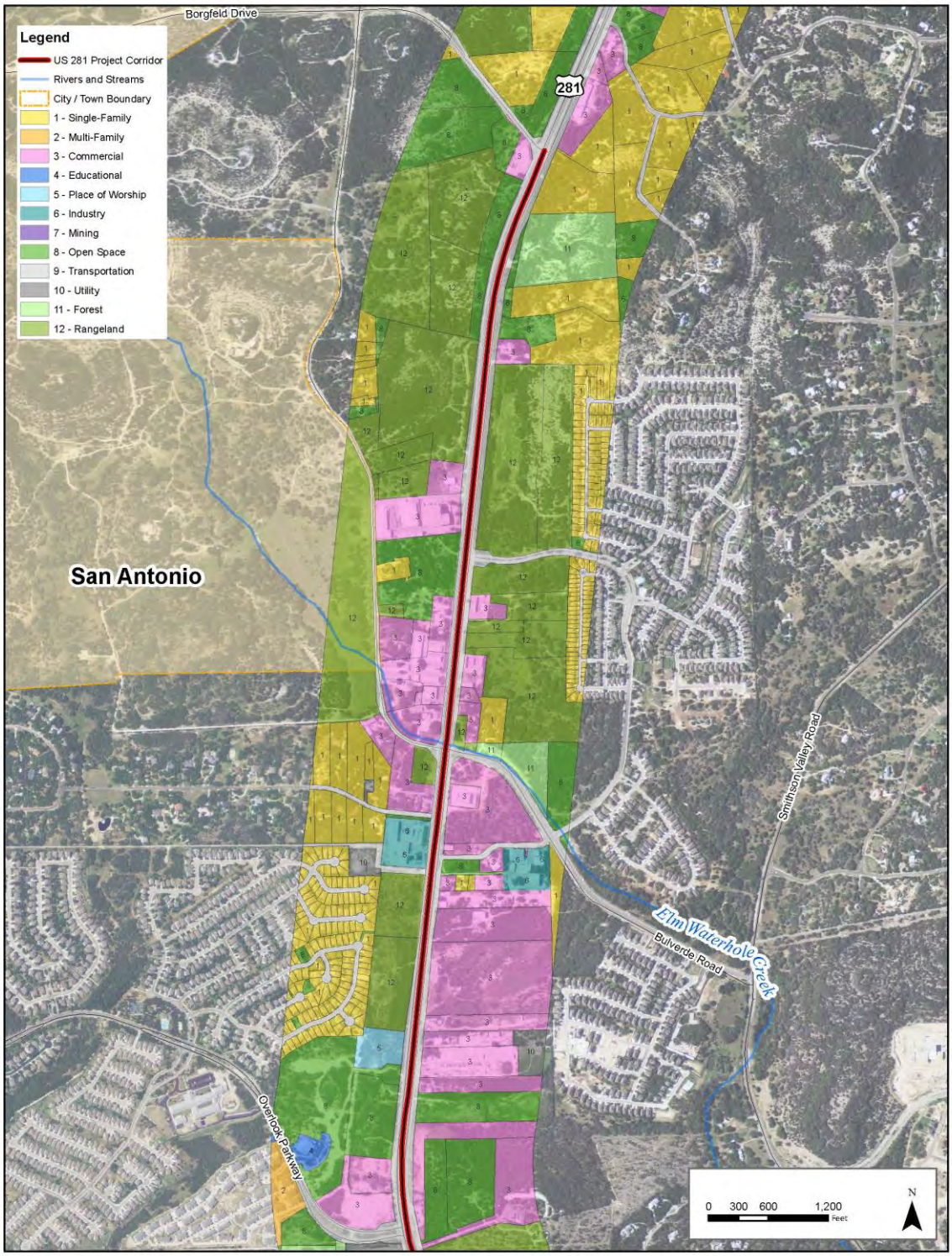
Source: Bexar Appraisal District, 2013b, US 281 EIS Team, March 2014.

Figure 3-2c: Existing land use in the land use study area



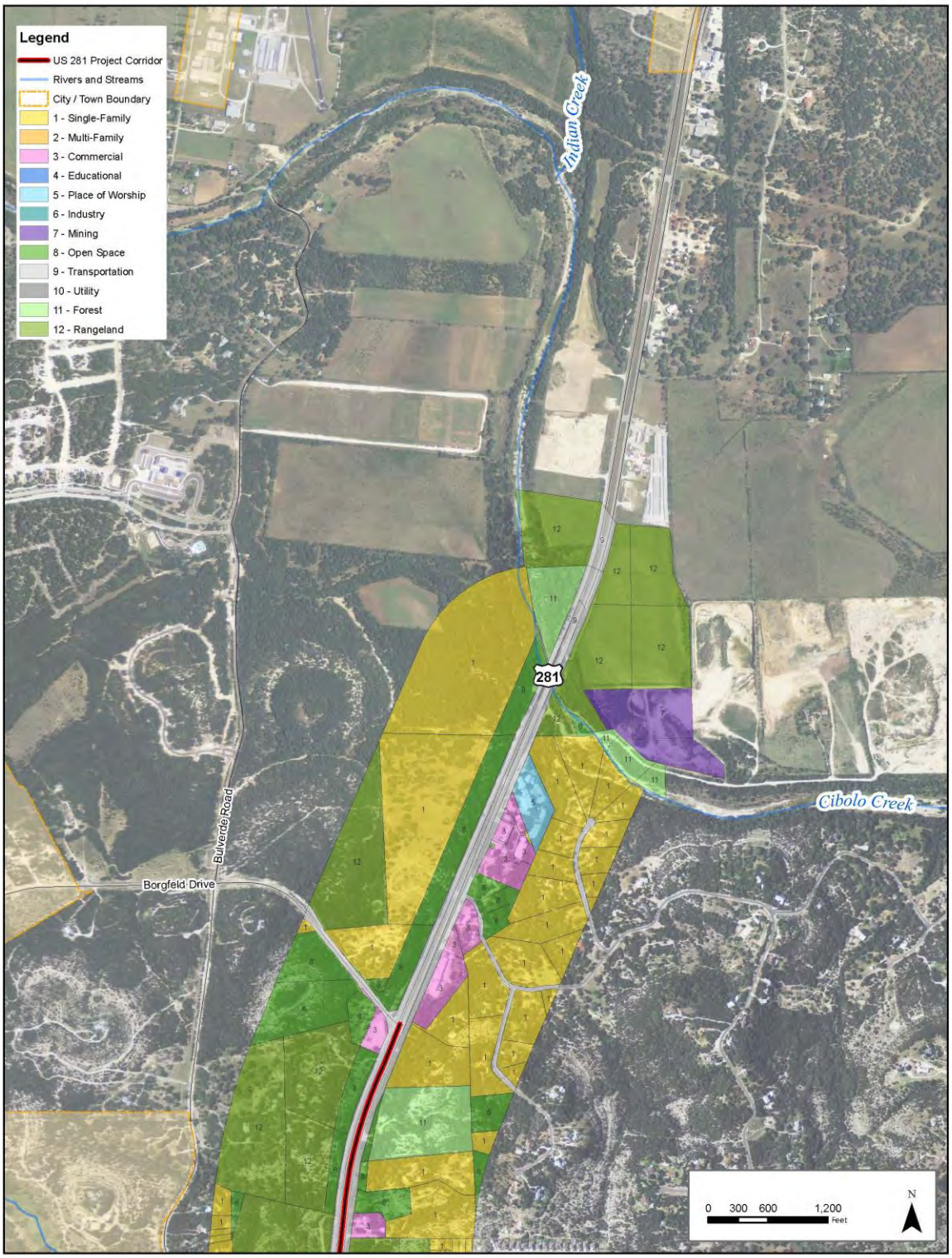
Source: Bexar Appraisal District, 2013b, US 281 EIS Team, March 2014.

Figure 3-2d: Existing land use in the land use study area



Source: Bexar Appraisal District, 2013b, US 281 EIS Team, March 2014.

Figure 3-2e: Existing land use in the land use study area



Source: Bexar Appraisal District, 2013b, US 281 EIS Team, March 2014.

3.2.3 Environmental Consequences

The following section focuses on the potential impacts to land use in the study area for each of the Build Alternatives. Criteria used to measure potential land use impacts include current development trends along the US 281 project corridor, state and/or local government plans and policies on land use and growth in the land use study area.

No-Build Alternative

The No-Build Alternative would not require the acquisition of land and would not result in direct land use impacts. If the No-Build Alternative is selected in the Record of Decision (ROD), land development trends are expected to continue as planned. The land use patterns along the US 281 project corridor would reflect these development trends, travel delays would increase, and vehicle access would deteriorate.

Build Alternatives

The potential direct land use impacts resulting from the acquisition of land for the Build Alternatives are shown in **Table 3-2.** The percentages represent the share of additional land, for each land use, that would be required for each Build Alternative relative to the total acres that currently exist within the land use study area. The potential impacts of ROW acquisition and relocations are discussed in **Section 3.4.5 Displacements and Relocation**.

Table 3-2: Land Acquisition (in Acres) by Build Alternative

Land Use Category	Total Acres in Land Use Study Area	Elevated Expressway Alternative		Preferred Expressway Alternative	
		Acres	%	Acres	%
Commercial (Mixed, Office, Retail)	605.94	29.0	4.8%	18.6	3.1%
Open Space	535.27	39.8	7.4%	31.8	5.9%
Residential (Single/Multi-family)	481.02	2.0	0.4%	1.3	0.3%
Transportation/Utilities	426.94	4.9	1.1%	5.3	1.2%
Range Land	391.1	17.0	4.3%	17.0	4.3%
Mining	155.02	0.0	0.0%	0.0	0.0%
Forest	55.11	2.2	4.0%	1.3	2.4%
Place of Worship	33.47	1.5	4.5%	1.3	3.9%
Educational	10.37	0.0	0.0%	0.0	0.0%
Industrial	9.68	2.7	27.9%	2.2	22.7%
Government/Institution	5.53	0.0	0.0%	0.0	0.0%
Parks	0.00	0.0	0.0%	0.0	0.0%
Total	2709.44	99.1	3.7%	78.8	2.9%

Source: Bexar Appraisal District, 2013b, US 281 EIS Team, March 2014.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative would include a combination of non-toll general purpose lanes and managed lanes. The ROW requirements for the non-toll, toll and managed lane options are the same; therefore, the impacts to land use would not change based on funding options.

3.2.4 Conclusion and Proposed Mitigation Measures

The implementation of a Build Alternative would require the acquisition of land along the US 281 project corridor in the land use study area while the No-Build Alternative would not. Overall the Build Alternatives would have the greatest impacts to open space and commercial land use. The Elevated Expressway Alternative has the potential to impact a total of 99.1 acres, and the Preferred Expressway Alternative has the potential to impact a total of 78.8 acres. In comparing the two Build Alternatives, the Preferred Expressway Alternative would impact more acres of range land, residential land use, and transportation and utilities land use than the Elevated Expressway Alternative; whereas the Elevated Expressway Alternative would impact more acres of forest and open space land uses in comparison to the Preferred Expressway Alternative. The impact of the Build Alternatives is relatively small, ranging between 2.9 and 3.7 percent of the total acreage in the land use study area.

It is not anticipated that any of the Build Alternatives would result in substantial direct impacts to the land uses along the US 281 project corridor within the land use study area. The proposed US 281 Corridor Project is consistent with the planning efforts of the City of San Antonio and Bexar County and is compatible with existing land use, existing zoning regulations, and the *Master Plan* for the City of San Antonio (which includes the *North Sector Plan*).

3.3 FARMLANDS

The *Farmland Protection Policy Act* (FPPA), Subtitle I of Title XV of the *Agricultural and Food Act of 1981*, Pub. L. 97-98, provides protection to prime and unique farmlands, all of which are classified into four distinct types. The four types of farmland as defined by Federal Highway Administration (FHWA) Technical Advisory T6640.8A are (1) prime, (2) unique, (3) other than prime or unique and of statewide importance, and (4) other than prime or unique that is of local importance (FHWA 1987).

The purpose of the FPPA is to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of prime, unique, and other farmlands of statewide or local importance to non-agricultural uses. Direct prime farmland impacts result from acquiring prime farmland for additional ROW and converting it from farmland to transportation use.

Prime farmland soils, as defined by the U.S. Department of Agriculture (USDA), are soils that are best suited to producing food, feed, forage, and oilseed crops. Such soils have properties that are favorable for the production of sustained high yields. Prime farmland soils typically produce the highest yields with a minimum of input of energy and economic resources, and farming these soils has been found to keep damage to the environment at a minimum.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water control structures. Public land is land not available for farming in national forests, national parks, military reservations, and state parks.

3.3.1 Methodology

The farmland study area includes all land within the proposed ROW for the Build Alternatives. The soil data used to describe the existing conditions in the farmland study area was obtained from the NRCS Soil Survey of Bexar County, Texas dated October 2009 (**Table 3-3**). This data was used to complete a Farmland Conversion Impact Rating Form for Corridor Type Projects (form NRCS-CPA-106) and the results were coordinated with the NRCS. The NRCS-CPA-106 form evaluates impacts to farmland soils based on a 260-point scale. One-hundred and sixty (160) points is the critical score for consideration for protection; those alternatives receiving scores totaling less than 160 points are given a minimal level of consideration for protection.

Coordination with the NRCS was initiated on July 13, 2010 for the Build Alternatives analyzed in the Draft EIS and on March 5, 2014 for the Preferred Expressway Alternative analyzed in the Final EIS. Please see **Appendix L1** for the correspondences and the completed Farmland Conversion Impact Rating Form for Corridor Type Projects.

3.3.2 Affected Environment

There are two soil associations located within the farmland study area: Tarrant-Brackett consisting of shallow soils over limestone on steep slopes and Crawford-Bexar made of moderately deep, stony soils over limestone on nearly level areas. A soil association is made up of individual soil series which can be mapped individually; however, due to the time and effort required these series are not delineated individually but rather shown as one map unit. The soils within the study area consist of six soil series. Generally, these six soil series are clayey loams to clays and are shallow to moderately deep soils over limestone. These soils are well drained and are moderately permeable.

The specific soil types that occur within the farmland study area, including a description and a hydric and prime farmland classification, are shown in **Table 3-3**.

Table 3-3: Mapped Soil Units in the Farmland Study Area

Map Abbreviation	Mapped Soil Unit	Drainage Classification	Percent Slope
BrE	Brackett gravelly clay loam	Well drained, loamy and clayey, occurs on undulating to hilly uplands, moderately permeable.	12 to 20
BtE	Brackett-Eckrant association	Well drained, clayey soils, occurs on tops and upper side of ridges, moderately permeable	20 to 60
Ca	Anhalt clay	Well drained, noncalcareous clays, clay loams and loams, occurs mainly in uplands, moderately permeable. Prime farmland if irrigated.	0 to 1
Cb	Crawford and Bexar stony soils	Well drained, noncalcareous loams, occur as broad, nearly level to gently undulating areas, variable permeability	0 to 5
Kr	Krum clay	Well drained, silty clay loam to gravelly clay loam, occurs in nearly level to rolling uplands, moderately permeable. Prime farmland if irrigated.	1 to 5
TaB	Eckrant cobbly clay	Well drained, very shallow, stony clay, occurs in limestone prairie, moderately slow permeable soils	1 to 5
TaC	Eckrant cobbly clay	Well drained, very shallow, stony clay, occurs in undulating limestone prairie, moderately slow permeable soils	5 to 15
TaD	Eckrant-Rock outcrop complex	Well drained, steep, rocky, shallow clay soils, occurs on broad ridgetops, moderately slow permeable soils	15 to 60
Tf	Tinn and Frio soils	Moderately well drained, clayey loam alluvium, occurs in floodplains. Hydric soil	0 to 1

Source: NRCS, 2010b and 2012.

3.3.3 Environmental Consequences

No-Build Alternative

The No-Build Alternative would not require acquisition of ROW and therefore would not directly impact prime and unique farmland soils.

Build Alternatives

The additional ROW required for the Build Alternatives would impact two soils designated as prime farmland, if irrigated; however, the NRCS determined that the US 281 project corridor is exempt from the FPPA requirements as it has previously been converted to urban uses; the FPPA excludes areas that are already converted to urban uses from the definition of "Farmland." As such, the NRCS determined that the Build Alternatives have a score of zero and would not directly impact prime farmland or unique farmland soils.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative would include a combination of non-toll general purpose lanes and managed lanes. The ROW requirements for the non-toll, toll and managed lanes options for each alternative are the same, therefore the impacts to farmland would not change based on funding options.

3.3.4 Conclusion and Proposed Mitigation Measures

According to the NRCS, the soils in the farmland study area may contain Important Farmland Soils; however, the project corridor has already been converted to urban uses. As such, the US 281 project corridor is exempt and will not require mitigation measures for farmland impacts.

3.4 SOCIOECONOMICS

The purpose of the National Environmental Policy Act (NEPA) is to ensure that environmental factors, including effects to the human environment, are considered in the decision-making process undertaken by federal agencies. There are several federal laws that have a nexus with NEPA and require analysis of socioeconomic factors. These laws prevent discrimination based on race, color, and national origin; they help ensure that the adverse effects of a federal action are not disproportionately borne by minority and/or low-income populations; and they help ensure that all people have access to meaningful communications about, and participation in any program or activity receiving federal assistance. Analyzing effects of a proposed action on the human environment requires an understanding of the effects that a project may have on socioeconomic characteristics of the community including land development activities, employment, access to community facilities, and land values; changes to these characteristics could affect the people who live, work and/or utilize the US 281 project corridor. This section describes the socioeconomic characteristics of the US 281 project corridor and presents potential impacts to neighborhoods and community cohesion; community and public resources; economic and employment conditions; effects related to displacements and relocations; impacts to minority and low-income populations; and the need for providing communications to limited English proficiency (LEP) populations.

3.4.1 Population and Demographics

Methodology

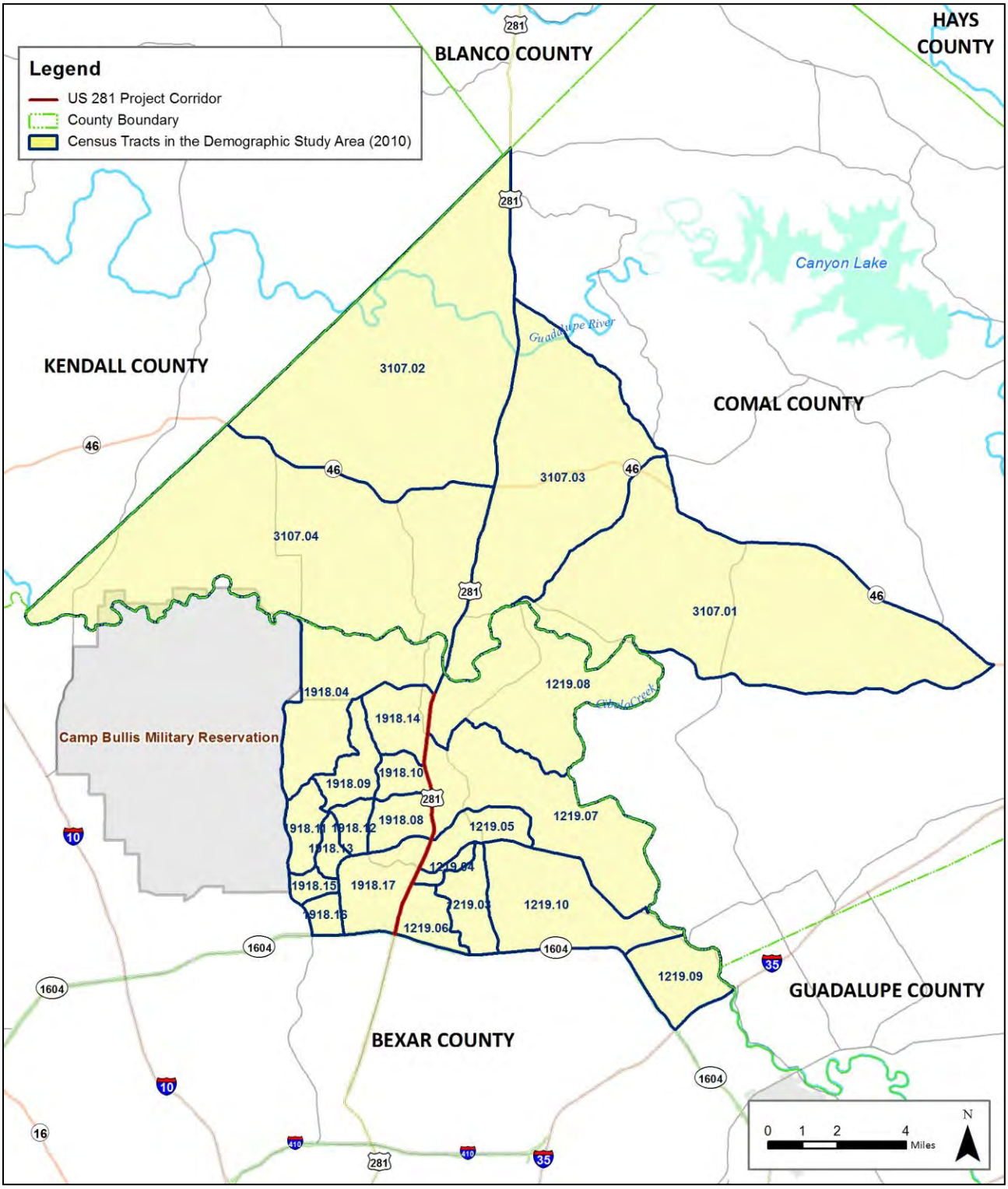
Historical data from the U.S. Census Bureau and forecasts from the MPO were analyzed using Census geographies (Tracts, Blocks Groups, and Blocks), and Traffic Analysis Zones (TAZ). TAZs are used by the MPO and other transportation agencies to model social and economic interactions for the purpose of transportation planning. The Census and the American Community Survey (ACS) provides a detailed look at the existing socioeconomic characteristics of the US 281 project corridor while the MPO forecast describes the changes that are forecasted to occur in the future.

The most current data products from the U.S. Census Bureau are the 2010 Census and the 2008-2012 ACS, including population, race, and ethnicity from the 2010 Census at the block level and household income at the block group level from the 2008-2012 ACS.

Study Area

The demographic study area captures the demographic characteristics of individuals that currently use and/or are likely to use the US 281 project corridor in the future (**Figure 3-3**). The study area was determined based on the availability of alternate routes to downtown San Antonio and proximity to the US 281 Corridor Project. The demographic study area is made up of 23 Census Tracts in Bexar and Comal counties.

Figure 3-3: US 281 - Demographic study area



Source: U.S. Census Bureau, 2010b & US 281 EIS Team, January 2011.

Affected Environment

Historical Population Growth in the Region

While the US 281 Corridor Project is located in Bexar County, the MPO uses demographic data from a five-county region to understand the effects of regional growth on the transportation network; therefore, demographic trends in Bexar, Comal, Guadalupe, Kendall, and Wilson counties were considered. Over the past 100 years, this region has grown from almost 175,000 people in 1910 to over 2 million people in 2010, as shown in **Table 3-4**.

Bexar County has doubled its population almost four times over the past 100 years and Comal County has more than doubled three times.

Table 3-4: Historical Population Growth in the Region

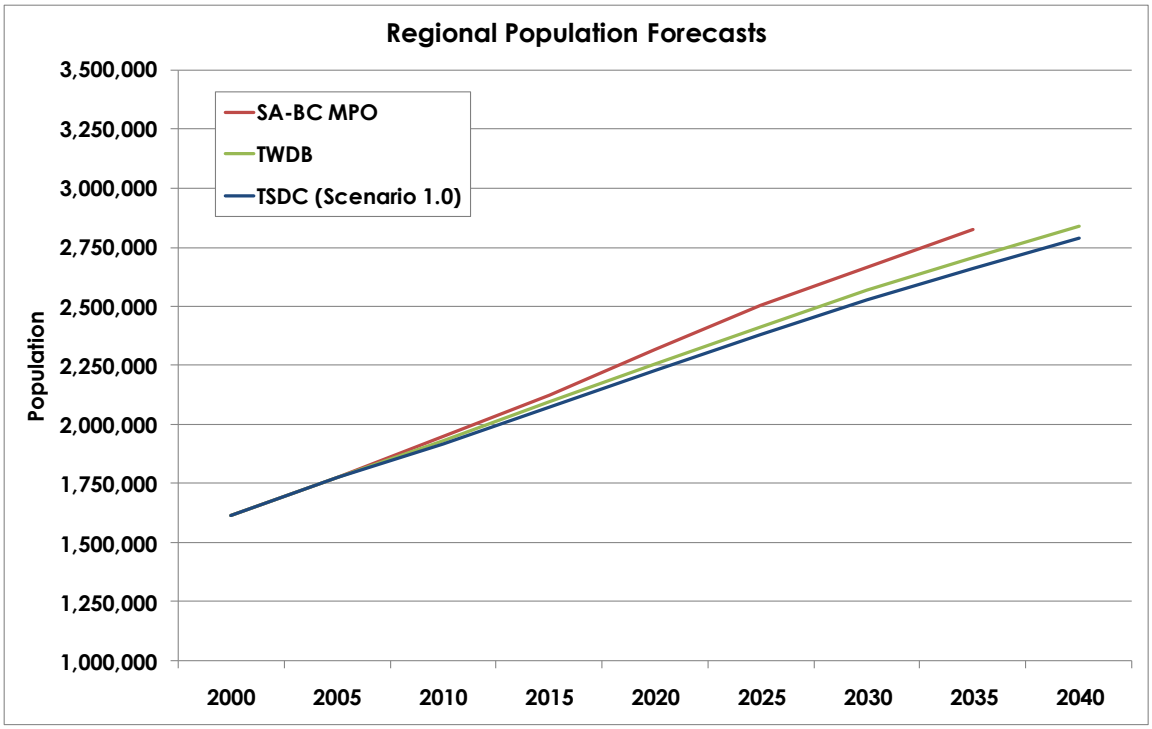
	Bexar	Comal	Guadalupe	Kendall	Wilson	Total
1910	119,676	8,434	24,913	4,517	17,066	174,606
1920	202,096	8,824	27,719	4,779	17,289	260,707
1930	292,533	11,984	28,925	4,970	17,606	356,018
1940	338,176	12,321	25,596	5,080	17,066	398,239
1950	500,460	16,357	25,392	5,423	14,672	562,304
1960	687,151	19,844	29,017	5,889	13,267	755,168
1970	830,460	24,165	33,554	6,964	13,041	908,184
1980	988,800	36,446	46,708	10,635	16,756	1,099,345
1990	1,185,394	51,832	64,873	14,589	22,650	1,339,338
2000	1,392,931	78,021	89,023	23,743	32,408	1,616,126
2010	1,714,773	108,472	131,533	33,410	42,918	2,031,106
1910-2010 % Change	1332.9%	1186.1%	428.0%	639.7%	151.5%	1063.3%

Source: U.S. Census Bureau, 1930, 1950, 1980, 1990, 2000a, and 2010a.

Forecasted Population Growth in the Region

According to a U.S. Census Bureau estimate of the 100 fastest growing counties in the U.S. between 2000 and 2008, three counties within the region of the US 281 Corridor Project make the list. Comal County ranks number 39 on the list at 40.5 percent growth; Kendall County ranks number 47 at 38.5 percent growth; and Guadalupe County ranks number 95 at 31.6 percent growth (US Census Bureau, 2009a). The growth trends in the region are anticipated to continue into the future. As shown in **Figure 3-4,** the MPO population forecast is comparable to those produced by other state agencies, such as the Texas Water Development Board (TWDB), and the Texas State Data Center (TSDC). The region was home to approximately 2 million people in 2010 and is forecasted to be between 2.75 and 3 million people by 2040.

Figure 3-4: Regional population forecasts comparison



Source: SA-BC MPO, 2009b, TWDB, 2009b, TSDC, 2008.
Note: TSDC Scenario 1.0 assumes that the growth rate of the 1990s will continue into the future.

Forecasted Growth in the Demographic Study Area

Table 3-5 shows the forecasted population, household and employment growth within the demographic study area used in *Mobility 2035*. Overall, the study area is anticipated to continue to grow and is forecasted to be home to over 47,000 households and over 142,000 people by 2035, which is an increase of over 111 percent from 2005. In addition, over 43,000 jobs are projected to be situated around the US 281 project corridor by 2035. Note the projections, used in *Mobility 2035*, assume a land use scenario of infill development and transit-oriented development, which would limit growth outside of Loop 1604. This land use assumption may not be fully implementable because counties in Texas have limited authority to control zoning and land use in their jurisdiction. In addition, 2005 demographic data was used as the base year for the 2035 projections. More recent data from the U.S. Census Bureau show that the 2010 population in the demographic study area was greater than the 2015 projections. For these two reasons, the 2035 projections are likely to be underestimations. MPO has updated population, household and employment projections, which it used for *Mobility 2040*; however, these data were not available at the time of this analysis. The 2035 projections were the best data available at the time.

Table 3-5: Forecasted Growth in the Demographic Study Area

	2005	2008	2015	2025	2035	2005-2035 % Change
Population	73,537	86,505	115,560	128,270	142,240	93.4%
Households	22,545	27,203	38,118	42,636	47,723	111.7%
Employment	25,635	29,320	37,963	40,265	43,762	70.7%

Source: SA-BC MPO, 2009b.

Socioeconomic Characteristics of the Region

To understand the US 281 project corridor in context with the region, socioeconomic characteristics such as race, ethnicity, and household income were analyzed within the demographic study area and were compared with those of Bexar and Comal counties.

Race and Ethnicity

The 2010 Census asks respondents to self-identify their race from the following options:

- White alone
- Black or African American alone
- American Indian and Alaska Native alone
- Asian alone
- Native Hawaiian and Other Pacific Islander alone
- Some Other Race alone
- Two or More Races

In addition, respondents were also given the option to identify themselves ethnically as Hispanic or Latino. Ethnicity represents a segment of the population sharing common characteristics such as religion, traditions, culture, language, or tribal/national origin which differs from race. As such, one might identify himself/herself ethnically as Hispanic or Latino, but can be of any race, and for this reason the U.S. Census Bureau does not include Hispanic or Latino as a designated race.

As shown in **Table 3-6**, over 60 percent of the people who live in the demographic study area identify themselves as white non-Hispanic or Latino, compared to 32.7 percent in Bexar and Comal counties. Overall, the demographic study area has a smaller share of minority population (all people except white non-Hispanic or Latino) and a smaller share of Hispanic or Latino of all races than Bexar and Comal counties. The demographic study area is 39.4 percent minority and 28.5 percent Hispanic or Latino compared to 67.3 percent minority and 56.7 percent Hispanic or Latino in Bexar and Comal counties combined. Race and ethnicity are discussed in more detail in **Section 3.4.6 Environmental Justice**.

Table 3-6: Race and Ethnicity – 2010 Census

	Bexar & Comal County Total	Percentage of Total	Demographic Study Area Total	Percentage of Total
Total 2010 Population	1,823,245	100.0%	120,212	100.0%
non-Hispanic or non-Latino				
White	596,510	32.7%	72,888	60.6%
Black or African American	120,066	6.6%	4,696	3.9%
American Indian/Alaska Native	4,164	0.2%	288	0.2%
Asian	40,374	2.2%	5,668	4.7%
Native Hawaiian/ Other Pacific Islander	1,851	0.1%	131	0.1%
Some Other Race	2,986	0.2%	163	0.1%
Two or More Races	23,347	1.3%	2,138	1.8%
Total non-Hispanic or non-Latino	789,298	43.3%	85,972	71.5%
Hispanic or Latino				
White	750,786	41.2%	26,752	22.3%
Black or African American	10,553	0.6%	313	0.3%
American Indian/Alaska Native	10,956	0.6%	192	0.2%
Asian	2,214	0.1%	145	0.1%
Native Hawaiian/ Other Pacific Islander	550	0.0%	31	0.0%
Some Other Race	220,211	12.1%	5,147	4.3%
Two or More Races	38,677	2.1%	1,660	1.4%
Total Hispanic or Latino	1,033,947	56.7%	34,240	28.5%
Total Minority*	1,226,735	67.3%	47,324	39.4%

Source: US Census Bureau, 2010a.
* All people except white non-Hispanic or non-Latino population.

Household Income

According to the 2008-2012 ACS, the median household income in Bexar County was approximately $49,000 and in Comal County was over $63,000. In comparison, the median household income in the demographic study area ranged from approximately $66,000 to $186,000 per year. In Bexar and Comal counties combined, 18.7 percent of the households earned less than $20,000 per year, 31.4 percent earned between $20,000 and $49,999, and 49.9 percent earned $50,000 or more. In the demographic study area, 5.8 percent of the households earned less than $20,000 per year, 16.2 percent earned between $20,000 and $49,999, and 77.9 percent earned $50,000 or more. Almost half of the population in the study area reported a household income of $100,000 per year or more. **Table 3-7** compares the household income of Bexar and Comal counties to the demographic study area.

Table 3-7: Household Income – 2008-2012 ACS

Household Income	Bexar & Comal County Total	Percent of Total	Demographic Study Area Total	Percent of Total
Total Households	637,974	100.0%	40,498	100.0%
Less than $10,000	51,956	8.1%	980	2.4%
$10,000 to $14,999	33,493	5.2%	706	1.7%
$15,000 to $19,999	33,645	5.3%	681	1.7%
$20,000 to $24,999	37,289	5.8%	859	2.1%
$25,000 to $29,999	36,748	5.8%	960	2.4%
$30,000 to $34,999	33,955	5.3%	992	2.4%
$35,000 to $39,999	30,759	4.8%	900	2.2%
$40,000 to $44,999	32,774	5.1%	1,624	4.0%
$45,000 to $49,999	28,762	4.5%	1,232	3.0%
$50,000 to $59,999	53,190	8.3%	2,469	6.1%
$60,000 to $74,999	66,027	10.3%	3,606	8.9%
$75,000 to $99,999	75,522	11.8%	5,412	13.4%
$100,000 to $124,999	47,693	7.5%	5,658	14.0%
$125,000 to $149,999	27,221	4.3%	3,974	9.8%
$150,000 to $199,999	25,309	4.0%	5,580	13.8%
$200,000 or More	23,631	3.7%	4,865	12.0%
Median Household Income	$49,141 (Bexar County) $63,480 (Comal County)		Ranges between $66,427 to $185,867	

Source: U.S. Census Bureau, 2012a and 2012g.

3.4.2 Neighborhoods and Community Cohesion

Methodology

Changes in community cohesion resulting from highway construction and improvements may be beneficial or adverse (FHWA Technical Advisory T6640.8A). An adverse impact to community cohesion occurs when an alternative severs or alters social interaction among groups or individual members of a community. This includes dividing or displacing a functioning neighborhood, or displacing that which allows for the members of the community to assemble and interact (such as an impact to a local place of worship or community recreational facility).

The study area for effects to neighborhoods and community cohesion included those neighborhoods and communities within one-half mile of the US 281 project corridor and adjacent to the construction limits of the US 281 Corridor Project. Household occupancy statistics from the U.S. Census Bureau were gathered from the 2008-2012 ACS for the demographic study area.

Affected Environment

Household Occupancy

Within the demographic study area approximately 92.1 percent of the total housing units are occupied leaving 7.9 percent of the total housing units vacant and available (**Table 3-8**). According to a multiple listing service (MLS) search conducted in February 2014, housing prices within the demographic study area ranged from $210,000 to over $5.5 million (San Antonio Board of Realtors 2014).

Table 3-8: Household Occupancy – 2008-2012 ACS

Geographic Area	Total Housing Units	Housing Unit: Occupied	Housing Unit: Vacant
Bexar County Census Tracts			
Tract 1219.03	1,749 100.0%	1,749 100.0%	0 0.0%
Tract1219.04	1,264 100.0%	1,214 96.0%	50 4.0%
Tract 1219.05	1,921 100.0%	1,641 85.4%	280 14.6%
Tract 1219.06	2,178 100.0%	1,999 91.8%	179 8.2%
Tract 1219.07	3,339 100.0%	3,171 95.0%	168 5.0%
Tract 1219.08	917 100.0%	701 76.4%	216 23.6%
Tract 1219.09	1,565 100.0%	1,469 93.9%	96 6.1%
Tract 1219.10	1,723 100.0%	1,418 82.3%	305 17.7%
Tract 1918.04	2,160 100.0%	2,052 95.0%	108 5.0%
Bexar County Census Tracts			
Tract 1918.08	1,369 100.0%	1,324 96.7%	45 3.3%
Tract 1918.09	2,127 100.0%	1,760 82.7%	367 17.3%
Tract 1918.10	1,988 100.0%	1,867 93.9%	121 6.1%
Tract 1918.11	1,153 100.0%	1,124 97.5%	29 2.5%
Tract 1918.12	1,205 100.0%	1,205 100.0%	0 0.0%
Tract 1918.13	2,286 100.0%	2,114 92.5%	172 7.5%
Tract 1918.14	1,542 100.0%	1,340 86.9%	202 13.1%
Tract 1918.15	1,901 100.0%	1,740 91.5%	161 8.5%
Tract 1918.16	1,397 100.0%	1,099 78.7%	298 21.3%
Tract 1918.17	4,010 100.0%	3,777 94.2%	233 5.8%

Geographic Area	Total Housing Units	Housing Unit: Occupied	Housing Unit: Vacant
Comal County Census Tracts			
Tract 3107.01	2,188 100.0%	2,039 93.2%	149 6.8%
Tract 3107.02	1,706 100.0%	1,625 95.3%	81 4.7%
Tract 3107.03	2,060 100.0%	1,972 95.7%	88 4.3%
Tract 3107.04	2,219 100.0%	2,098 94.5%	121 5.5%
Demographic Study Area			
Total	43,967 100.0%	40,498 92.1%	3,469 7.9%

Source: U.S. Census Bureau, 2012d.

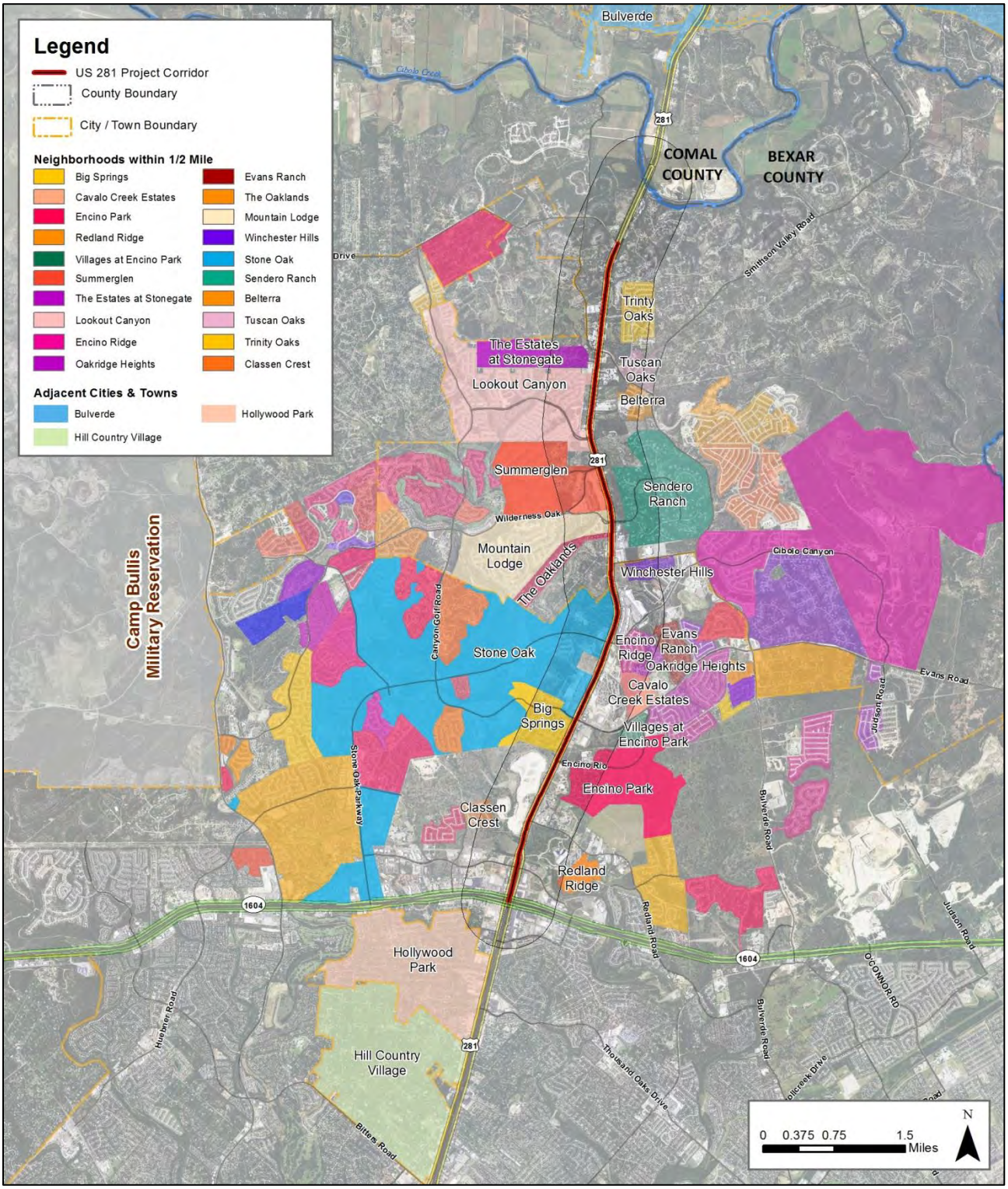
Neighborhoods

There are 20 named residential neighborhoods within one-half mile of the US 281 project corridor (shown in **Figure 3-5**). The named residential areas include: Big Springs, Cavalo Creek Estates, Encino Park, Redland Ridge, Villages at Encino Park, Summerglen, The Estates at Stonegate, Lookout Canyon, Encino Ridge, Oakridge Heights, Evans Ranch, The Oaklands, Mountain Lodge, Winchester Hills, Stone Oak, Sendero Ranch, Belterra, Tuscan Oaks, Trinity Oaks, and Classen Crest.

Communities Adjacent to the US 281 Project

There are three communities located adjacent to the construction limits of the US 281 Corridor Project that could be affected by the construction and operation of a Build Alternative. The incorporated communities of Hollywood Park and Hill Country Village are located southwest of the construction limits and west of US 281, and the city of Bulverde is located in Comal County north of the construction limits and west and east of US 281 (**Figure 3-5**).

Figure 3-5: Neighborhoods and schools located within ½ mile of US 281



Source: US 281 EIS Team, March 2014.

Environmental Consequences

Potential Effects on Neighborhoods and Community Cohesion

No-Build Alternative

The No-Build Alternative would negatively affect neighborhoods and community cohesion within the study area over time. As the population increases in neighborhoods adjacent to the US 281 project corridor, traffic would increase in these neighborhoods and result in increased congestion and reduced mobility. The No-Build Alternative would likely have severe adverse effects on access, ingress and egress for the citizens and businesses in the study area and adjacent communities as US 281 traffic congestion and travel time continue to worsen. If no improvements are made, it is possible that traffic would divert from the US 281 project corridor to parallel corridors and other local roadways. The diversion of traffic on to local streets could make these local streets less safe; which could change community cohesion, reduce access to local businesses, and result in a negative effect on property values and overall quality of life.

Build Alternatives

There are several single- and multi-family residential communities (as shown in **Figure 3-2a** through **Figure 3-2e**) in proximity to the US 281 project corridor. Neighborhoods in the city of San Antonio and unincorporated areas, communities adjacent to the project, and smaller communities such as apartment communities could be impacted by the Build Alternatives due to construction activities, in the short term (see **Effects of Construction** below for more details). However, in the long term, the Build Alternatives for the US 281 Corridor Project would provide more travel lanes, improve traffic flow to these communities, and would not restrict access to any existing public or community services, businesses, or commercial areas.

The Preferred Expressway Alternative would offer as many or more non-toll travel lanes on US 281 as exist today, making it very unlikely that motorists seeking to avoid paying a toll would divert off of US 281. Motorists are not likely to take a slower, more circuitous route, through communities such as Hollywood Park, because the additional distance and lower speed limits associated with such detours is not likely to offer an overall travel time savings when compared to the non-toll facilities on US 281. The Preferred Expressway Alternative would not divide, separate, or isolate any neighborhood or community; therefore, community cohesion would remain intact.

Potential Changes to Traffic Patterns

No-Build Alternative

The No-Build Alternative would not reconfigure the existing US 281 roadway. Under the No-Build Alternative, the 2035 forecasted travel demand would not be accommodated at an acceptable level of service, travel times would increase, travel speeds would decrease, and the existing conflicts between local and through traffic would remain. The No-Build Alternative would likely result in traffic diversion to other parallel roadways resulting in potentially adverse effects on neighborhoods through which such parallel routes run.

Build Alternatives

Preferred Expressway Alternative

The Preferred Expressway Alternative provides new, non-toll grade-separated lanes and overpasses between Loop 1604 and Stone Oak Parkway, as well as new, non-toll at-grade frontage road lanes for access to businesses and cross streets. Between Stone Oak Parkway and Borgfeld Drive, the Preferred Expressway Alternative provides the same number of non-toll at-grade lanes as today. The separation of through traffic (via grade-separated lanes and overpasses) from turning traffic (via the non-toll at-grade lanes) provides for safer, more efficient traffic operations. Some motorists may have to pass through signalized intersections and/or make U-turns to complete their trips. Overall, the Preferred Expressway Alternative would improve

mobility and accessibility along the US 281 project corridor. There would likely be a transition period whereby roadway users would have to adjust to the changes. The potential changes would be communicated to the public and affected businesses, and would be coordinated with emergency responders and other public service providers.

Elevated Expressway Alternative

The Elevated Expressway Alternative would consist of two-to-three access-controlled main lanes that would be elevated for the length of the US 281 project corridor. The existing US 281 roadway, including a portion of the US 281 Super Street, would remain in place as partially access-controlled lanes, crossing local streets at grade via signalized intersections for the length of the corridor. Like the Preferred Expressway Alternative, cross streets and driveways that currently intersect the existing US 281 roadway would not have direct access to the main lanes. Unlike the Preferred Expressway Alternative, the Elevated Expressway Alternative contemplates using the existing US 281 roadway and some new access roads, where needed, to serve local traffic and to provide direct access to businesses, neighborhoods and connecting streets. The main lane on and off ramps would be accessed to and from the existing US 281 roadway at several locations along the corridor; this change means that motorists may have to pass through signalized intersections on the existing roadway and/or make U-turns to reach their desired location.

Funding Options

The Build Alternatives would include managed lanes. The managed lanes could result in a change in traffic patterns as some motorists may choose different routes based on their willingness to pay a toll. It is possible that the motorists would choose to avoid the US 281 project corridor and select a parallel route to reach their destination. However, the non-toll lanes on US 281 would offer better speed, capacity and operations, such as fewer stop lights and stop signs, when compared to the parallel routes; as such traffic diversion onto local streets as a result of the managed lanes is not likely to occur. Mitigation for traffic diversion could include traffic calming techniques on affected roadways, which would further reduce speeds and which would make the parallel routes an even less attractive alternative.

Potential Effects of Construction

The US 281 project would be built in two phases. The first phase would occur between Loop 1604 and Stone Oak Parkway and the second phase would occur between Stone Oak Parkway and Borgfeld Drive. These two phases may overlap slightly and would depend upon when ROW acquisition is complete for the second phase of the project.

Prior to construction a traffic control plan would be prepared to manage and route traffic safely and efficiently and maintain access to driveways and cross streets. These plans are specific in location and specific to each step of construction activity. Traffic would not be routed on local streets or through neighborhoods. Roadside display signs would alert motorists to the time and day of lane closures.

In addition to a traffic control plan, construction activities would be scheduled to prevent and minimize traffic interruption. The first step of construction would include the preparation of ROW and the installation of storm water infrastructure. During this time, traffic would remain on the existing roadway with minimal interruption. The installation of drainage structures and stream bridges would follow, which would occur within the ROW of the existing roadway and may require some modification of traffic flow. The new US 281 main lanes would be built next; these lanes would accommodate through traffic and provide access to local businesses, residences, and cross streets. The new main lanes would provide equal capacity to the existing capacity on US 281 and traffic signals would be timed to prioritize through traffic. The construction of the main lanes would be built such that access to adjacent driveways would be available at all times. Measures such as temporary relocation of a driveway or partial blocking of a driveway may be required to ensure

access is provided at all times. When complete, the new main lanes would be used while connector ramps and managed lanes are built. Traffic that might seek an alternative route to avoid US 281 construction activity would have multiple parallel routes to choose from (e.g. Blanco Road, Bulverde Road, Stone Oak Parkway, etc.), but the additional distance and lower speed limits associated with these detours is not likely to offer an overall travel time savings. Even if some motorists seek detours to the west of US 281 during construction, their route back to US 281 would most likely be via Loop 1604. Motorists are not likely to take slower, more circuitous routes through nearby residential neighborhoods such as Hollywood Park and Hill Country Village; however, it is possible. The development of the traffic control plan will be coordinated with communities that could potentially be affected by temporary traffic diversion during construction. The commitments made in the traffic control plan will be communicated to and implemented by the construction contractor.

Conclusion and Proposed Mitigation Measures

The Build Alternatives would result in beneficial impacts to neighborhoods and community cohesion in the long term. They would:

- provide for safer, more efficient traffic operations;
- maintain access to all existing neighborhood, public facility, business or commercial areas;
- offer as many or more non-toll travel lanes on US 281 as exist today; and,
- ensure that community cohesion remains intact, by not dividing, separating, or isolating any neighborhood or community.

Construction activities would result in temporary effects such as temporary relocation of driveways and detours. Prior to construction, a traffic control plan would be prepared to manage and route traffic safely and efficiently and maintain access to driveways and cross streets. Traffic would not be routed on local streets or through neighborhoods and roadside display signs would alert motorists to the time and day of lane closures. Construction activities would be scheduled to prevent and minimize traffic interruption.

After construction is complete, roadway users would have to adjust to the changes in the roadway configuration. The potential changes would be communicated in advance to the public and affected businesses, and would be coordinated with emergency responders and other public service providers.

3.4.3 Community and Public Resources

Methodology

This section contains a discussion of the potential effects to existing schools, police, fire and medical service providers, and places of worship and cemeteries located within one-half mile and in close proximity to the US 281 project corridor. There are no parks located within one-half mile of the US 281 project corridor.

Affected Environment

Schools

The proposed US 281 Corridor Project is located within the boundaries of the North East Independent School District (NEISD) and Comal Independent School District (CISD). Various private schools and education centers are also located in the vicinity of the US 281 project corridor.

As shown in **Figure 3-6**, the public and private educational/school properties located within one-half mile of the US 281 project corridor, from south to north, include: St. Thomas Episcopal School, Harvest Schools, San Antonio Christian School, La Petite Academy, NEISD Transportation North Bus Satellite Facility, Tuscany Heights Elementary, Kiddie Koop Children's Enrichment Center, and M.H. Specht Elementary School.

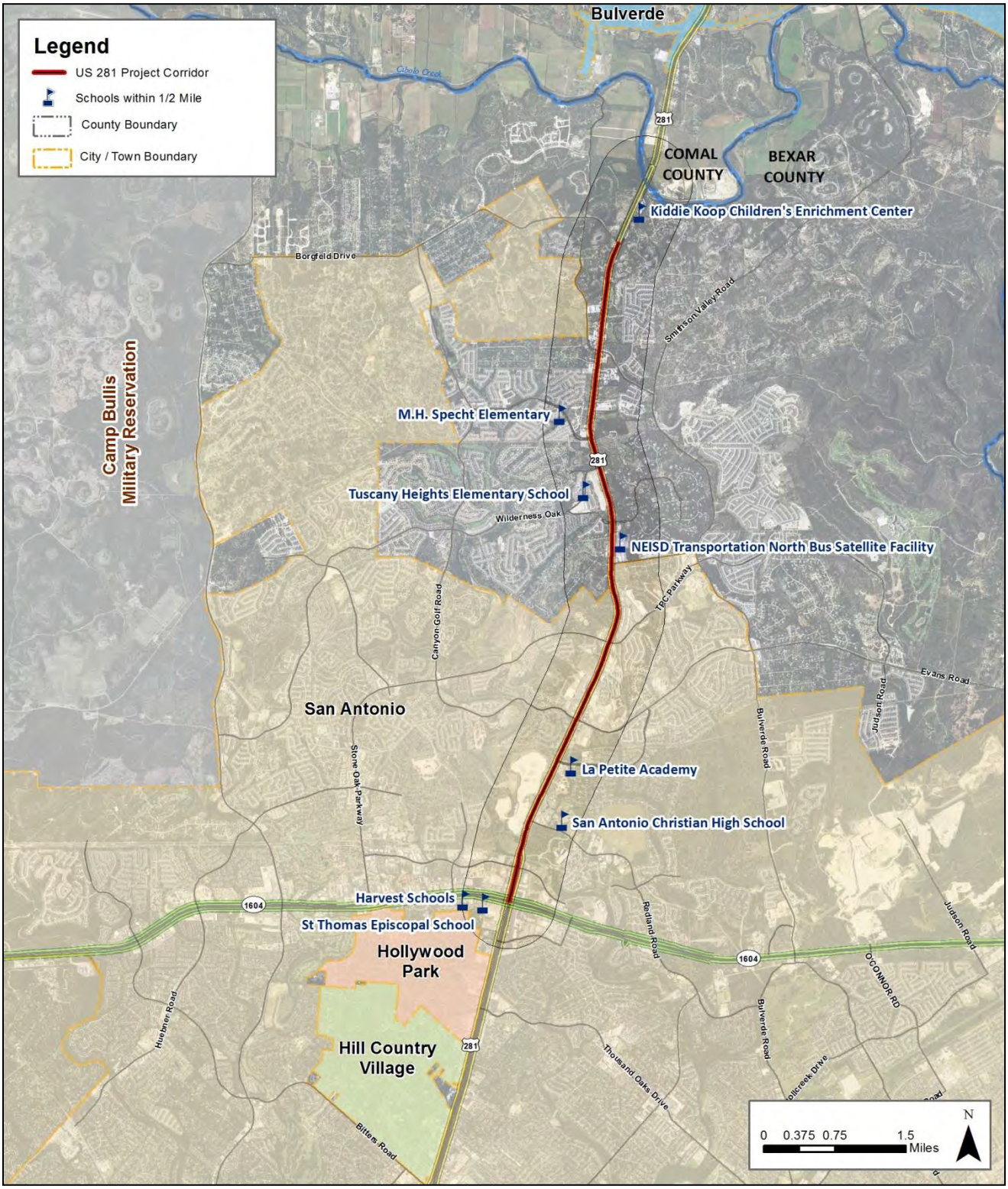
Police Protection, Fire Protection, and Medical Services

Several local, county, and elected law enforcement agencies, city and volunteer fire departments, and emergency medical facilities provide the emergency response services to the US 281 project corridor. Law enforcement services are provided by the San Antonio Police Department's North Substation, the Bexar County Sherriff's Office, the Bexar County Constable's Department - Precinct 3, the Hollywood Park Police Department and the Hill County Village Police Department. The City of San Antonio Fire Department (SAFD), Fire Stations 14, 43, 46 and 48, the Hollywood Park Fire Department, and the Bexar-Bulverde Volunteer Fire Department (VFD), which operates under the Bexar County Fire Marshal, provide fire and emergency medical services within the US 281 project corridor. Six hospitals are located near the US 281 project corridor; Methodist Stone Oak Hospital and South Texas Spine and Surgery Hospital are located on East Sonterra Boulevard, and North Central Baptist Hospital is located on Madison Oak Drive and Stone Oak Parkway. There are two Baptist Emergency Hospitals along US 281; one is located at US 281 and Overlook Parkway and the other is located on San Pedro Avenue. Big Spring State Hospital serves the city of Bulverde. **Figure 3-7** highlights the emergency and medical service providers located near the US 281 project corridor.

Places of Worship and Cemeteries

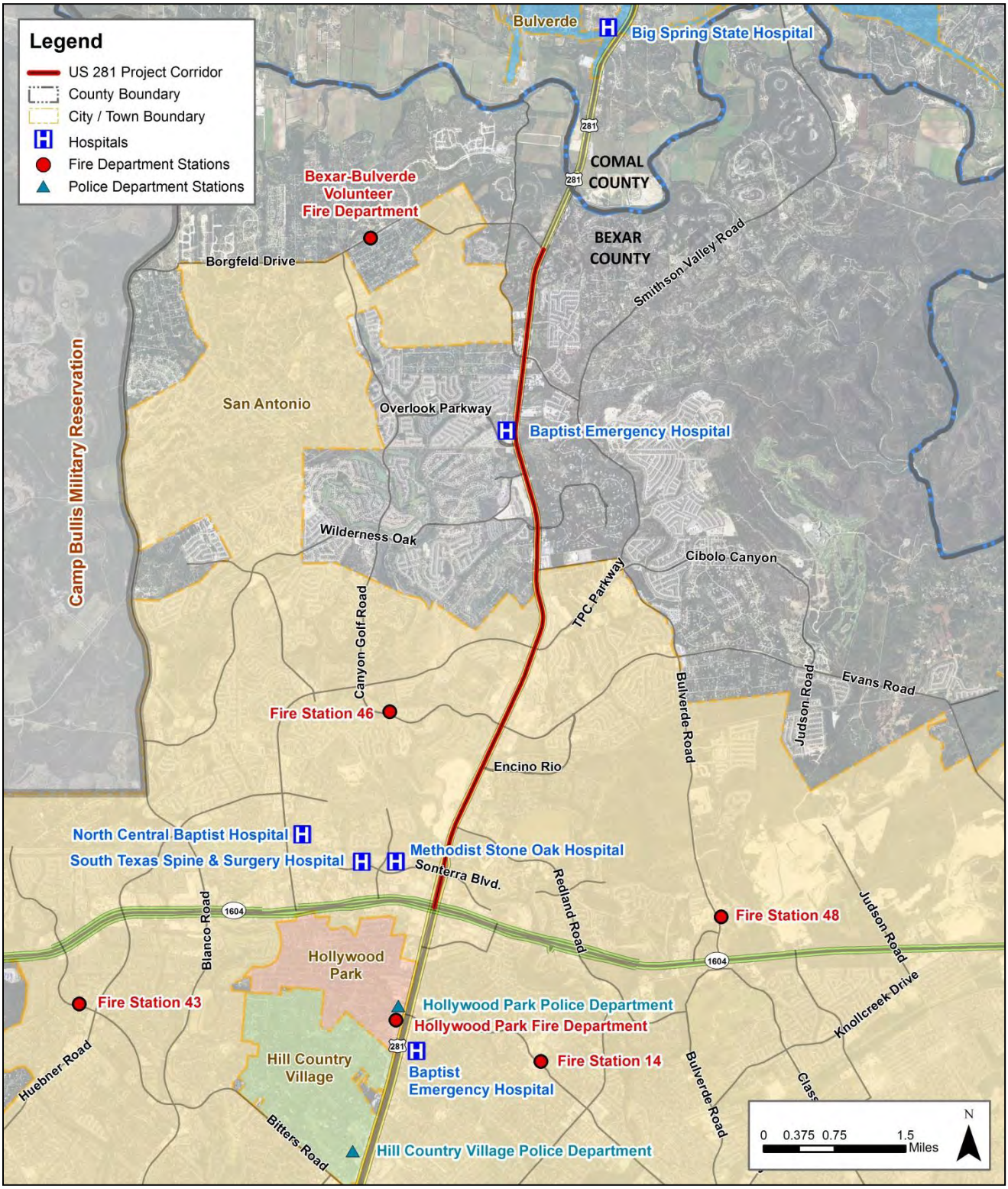
Fourteen places of worship and two cemeteries were identified along the US 281 project corridor. The churches identified include: Bulverde United Methodist Church, North Central Christian Church, St. Thomas Episcopal School, Summit Christian Center, Harvest Fellowship Community Church, Park Hills Baptist Church, Community Bible Church, Now World Christian Church, Church Alive, Calvary Chapel, Northern Hills United Methodist Church, Crossbridge Community Church of San Antonio, Vineyard Hills Church, and Northside Church of Christ (**Figure 3-8**).

1 **Figure 3-6: Schools within ½ mile**



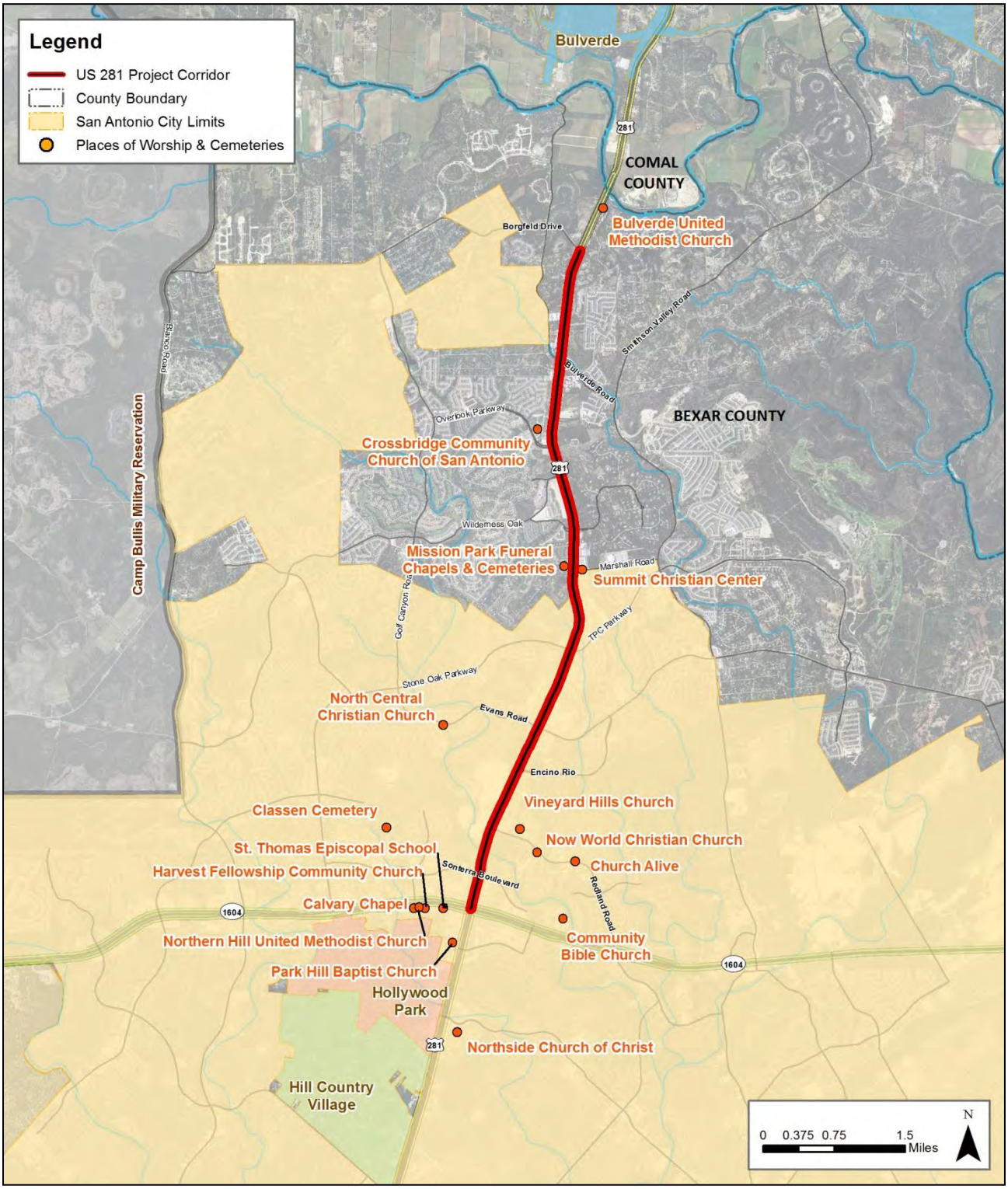
2
3 Source: US 281 EIS Team, March 2014.

1 **Figure 3-7: Fire and police protection and medical services**



2
3 Source: US 281 EIS Team, March 2014.

Figure 3-8: Places of worship and cemeteries



Source: US 281 EIS Team, March 2014.

Environmental Consequences

Schools

No-Build Alternative

The No-Build Alternative would not require additional ROW and therefore would not result in direct impacts to schools.

Build Alternatives

The Build Alternatives would not require ROW in areas where schools are located and would not interrupt or sever existing school bus routes. As such no direct impacts to the schools within one-half mile of the US 281 project corridor are expected. In the long term, the implementation of any of the Build Alternatives would improve access and mobility along the US 281 project corridor, thereby improving access to the schools in the project area.

Police/Fire Protection and Medical Services

No-Build Alternative

The No-Build Alternative would not change the US 281 roadway from what exists today, therefore, would not change the routes currently taken by emergency responders that serve the area along the US 281 project corridor. In the long term, however, the No-Build Alternative would result in declining Level of Service (LOS) on the US 281 project corridor and on the parallel corridors, such as Blanco Road and Bulverde Road during peak travel times, as discussed in **Chapter 2 - Alternatives Considered**. Continuing development within the corridor and the reduction of LOS could result in increased response times of emergency responders and delayed evacuation during emergencies.

Build Alternatives

No police stations, fire stations or medical service facilities would be displaced as a result of the Build Alternatives. In the short term, there would be changes in traffic patterns in the vicinity of the US 281 project corridor during construction, which may cause temporary delays for emergency responders. Emergency service providers (police protection, fire protection, and Emergency Medical Services) would receive notification and accommodations prior to roadway construction or ramp closings. With this information, emergency responders would be able to plan their routes in advance of an emergency situation.

In the long term, the implementation of the Build Alternatives would improve access and mobility along the US 281 project corridor which could improve emergency response time.

Places of Worship and Cemeteries

No-Build Alternative

There would be no direct impact to places of worship or cemeteries as a result of the implementation of the No-Build Alternative.

Build Alternatives

The Build Alternatives would not displace nor result in the relocation of any place of worship or cemetery. However, the ROW requirements for the Build Alternatives could directly affect portions of several properties owned by places of worship as identified in **Table 3-9.** In the long term, the implementation of the Build Alternatives would improve access and mobility along the US 281 project corridor thereby improving access to the places of worship and cemeteries in the project area.

Table 3-9: ROW Acquisition from Place of Worship Properties

Property Name	Property Address	Total Acreage of Parcel	Acres Impacted	Percentage of Parcel Impacted	Land use	Appraised Value
ROW Acquisitions for Preferred Expressway Alternative						
Northside Church of Christ	19818 N US 281 San Antonio, TX 78259	24.92	0.27	1%	Range Land (Vacant)	$3,557
Crossbridge Community Church of San Antonio	14650 N US 281 San Antonio, TX 78260	22.24	0.62	3%	Range Land (Vacant)	$3,268,860
Bulverde United Methodist Church	28300 N US 281 San Antonio, TX 78260	4.85	0.07	1%	Place of Worship	$1,440,620
ROW Acquisitions for Elevated Expressway Alternative						
Crossbridge Community Church of San Antonio	14650 N US 281 San Antonio, TX 78260	22.24	0.79	3%	Range Land (Vacant)	$3,268,860

Source: Bexar County Appraisal District, 2013b and US 281 EIS Team, 2014.

Conclusion and Proposed Mitigation Measures

The Build Alternatives would require some ROW from property owned by places of worship but would not result in a displacement. The acquisition of land would be conducted in accordance with the *Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970* (42 United States Code (USC) 4601 ET SEQ., P.L. 91-646), as amended by the *Uniform Relocation Act Amendments of 1987* (P.L. 100-17), (the Uniform Act). See **Section 3.4.5 Displacements and Relocation** for details about property acquisition. The acquisition of ROW would not prevent the continued use of these properties as places of worship.

The Build Alternatives would not restrict access to any community or public resource in the long term. During construction, driveways may be temporarily relocated and detours would occur. The traffic control plan would manage and route traffic safely and efficiently and maintain access to driveways and cross streets and roadside display signs would alert motorists to the time and day of lane closures. Construction activities would be scheduled to prevent and minimize traffic interruption.

After construction is complete, roadway users would have to adjust to the changes in the roadway configuration. The potential changes would be communicated in advance to the public and coordinated with emergency responders and other public service providers.

3.4.4 Economic Characteristics

Methodology

Economic characteristics were evaluated at a regional scale and within the demographic study area to describe the economics conditions in US 281 project corridor and its context in the regional economy.

Affected Environment

Economic Activity

According to the Labor Market and Career Information (LMCI) department of the Texas Workforce Commission (TWC), the total 2012 civilian labor force (CLF) for Bexar County was 815,285 people, which is an increase of 47,563 people from since 2009. The total 2012 CLF for Comal County was 56,249 people, which was a decrease of 1,318 people from 2009. The LMCI economic diversification index measures the degree to which a county economy is diversified. "Significant concentrations of employment in only one or two industrial sectors makes an area less diversified and more susceptible to widespread economic decline should a key sector suffer a significant loss" (TWC 2011). In terms of economic diversity and of the three levels of diversification, ranging from below average, average and above average, both Bexar and Comal County had an economic base which is of average diversity (TWC 2011).

According to the 2008-2012 ACS, the total number of people, 16 years of age or older, employed in the demographic study area was almost 59,000. **Table 3-10** shows that educational and health care services provide the most number of jobs in demographic study area as well as in Bexar and Comal counties. Compared to Bexar and Comal counties, the demographic study area has a greater share of employed population working in the finance and insurance, real estate and rental and leasing, and professional, scientific, management, administrative and waste management services industries. According to the Texas Comptroller's Office, the top three industries for the San Antonio Metropolitan Statistical Area (MSA) include: government, education and health services, and professional and business services (2010).

Table 3-10: Employment by Industry

Industry	Demographic Study Area	Bexar County	Comal County
Total Employed Population 16 Years of Age and Older	58,983 100.0%	768,369 100.0%	50,923 100.0%
Agriculture, Forestry, Fishing & Hunting, and Mining	542 0.9%	5,890 0.8%	789 1.5%
Construction	3,196 5.4%	57,695 7.5%	4,657 9.1%
Manufacturing	3,584 6.1%	46,384 6.0%	4,208 8.3%
Wholesale Trade	2,233 3.8%	20,297 2.6%	1,604 3.1%
Retail Trade	7,112 12.1%	91,862 12.0%	6,931 13.6%
Transportation & Warehousing, and Utilities	1,713 2.9%	35,426 4.6%	2,284 4.5%
Information	1,810 3.1%	16,030 2.1%	1,277 2.5%
Finance & Insurance, Real Estate and Rental & Leasing	7,069 12.0%	70,502 9.2%	3,790 7.4%
Professional, Scientific, Management, Administrative and Waste Management Services	7,893 13.4%	84,377 11.0%	5,556 10.9%

Industry	Demographic Study Area	Bexar County	Comal County
Educational Services, Health Care and Social Assistance	13,124 22.3%	177,385 23.1%	10,672 21.0%
Arts, Entertainment, Recreation, and Accommodation & Food Services	4,829 8.2%	81,154 10.6%	4,634 9.1%
Other Services Except Public Administration	2,345 4.0%	39,706 5.2%	2,178 4.3%
Public Administration	3,533 6.0%	41,661 5.4%	2,343 4.6%

Source: U.S. Census Bureau, 2012h.

Table 3-11 shows the commute characteristics for workers 16 years and over for the demographic study area and Bexar and Comal counties. The majority of commuters in drives their cars to work alone or car-pooled. However, a greater share of people worked from home in the demographic study area, while a greater share of people used public transportation in Bexar County.

Table 3-11: Commute Characteristics for Bexar and Comal Counties

Commute Characteristics	Demographic Study Area	Bexar County	Comal County
Total Commuters	59,021 100.0%	776,516 100.0%	50,136 100.0%
Drove Alone	49,510 83.9%	612,822 78.9%	39,270 78.3%
Carpooled	4,227 7.2%	87,173 11.2%	6,067 12.1%
Public Transportation	234 0.4%	21,365 2.8%	47 0.1%
Bicycle	42 0.1%	1,194 0.2%	80 0.2%
Walk	354 0.6%	15,558 2.0%	606 1.2%
Taxi, Motorcycle or Other	460 0.8%	10,005 1.3%	774 1.5%
Work at Home	4,194 7.1%	28,399 3.7%	3,292 6.6%

Source: U.S. Census Bureau, 2012f.

Employment

Table 3-12 presents TWC and the U.S. Department of Labor's Bureau of Labor Statistics data describing the civilian labor force, total employment, and the unemployment rate in Bexar and Comal counties for the four-year period from 2009 to 2012. The data show that employment in Bexar County has increased by 6.3 percent; whereas, employment in Comal County has decreased by 2.3 percent. The unemployment rates in Bexar and Comal counties showed an increase from 2009 to 2010 and a decline from 2011 to 2012; this trend is consistent with statewide unemployment trends.

Table 3-12: Civilian Labor Force, Total Employment, and Unemployment Rate

Data Set	Employment Data*				
	2009	2010	2011	2012	Percent Change (2009-2012)
Bexar County					
Labor Force	767,722	797,187	810,269	815,285	6.2%
Employment	716,385	737,172	748,799	761,612	6.3%
Unemployment Rate	6.7	7.5	7.6	6.6	-1.5%
Comal County					
Labor Force	57,567	54,527	55,822	56,249	-2.3%
Employment	54,057	50,740	51,945	52,834	-2.3%
Unemployment Rate	6.1	6.9	6.9	6.1	0.0%

Source: TWC 2014.
*Estimates that reflect actual (not seasonally adjusted) data

Property Tax Revenues

Table 3-13 shows the major taxing jurisdictions that would be impacted by the US 281 project corridor where additional ROW would be required for the Build Alternatives and the fiscal year (FY) effective tax rate per $100 valuation. Potential economic effects that result from ROW acquisition include the permanent removal of taxable property from the tax rolls. The affected taxing jurisdictions include: Bexar County Road and Flood, San Antonio River Authority, Alamo Community College, Universal Health System, Bexar County, the City of San Antonio, North East ISD, Comal ISD and Bexar County Emergency District #3.

Table 3-13: Property Tax Rates for Major Taxing Jurisdictions

Taxing Jurisdiction	FY 2013 Effective Tax Rate (per $100 valuation)
Bexar County Road and Flood	0.030679
San Antonio River Authority	0.017798
Alamo Community College	0.149150
Universal Health System	0.276235
Bexar County	0.296187
City of San Antonio	0.565690
North East ISD	1.440600
Comal ISD	1.430000
Bexar County Emergency District #3	0.050877

Source: Bexar Appraisal District, 2013a.

Environmental Consequences

Potential Economic Effects

This section addresses potential effects to the local economy, employment growth and property tax revenues. This section also discusses direct and indirect effects on local, regional and state employment output and income, temporary impacts from the construction of the US 281 Corridor Project, and additional long-term impacts that would result from the operation of the Build Alternatives.

To isolate the potential economic effects of the US 281 Corridor Project on the local economy, it is necessary to distinguish those resources that are new to the economy from local resources that would still be spent in the region. **Table 3-14** describes the funding sources and expenditure percentages that are planned for the US 281 Corridor Project, in addition to which funds represent new resources that are being invested in the region because of the US 281 Corridor Project. The federal and state funds originate from outside the local economy; therefore, these funds represent new resources. The local funds originate within the boundaries of the MPO; therefore, they are considered existing revenue sources. **Table 3-14** provides a breakdown of funding categories, estimated funds, and funding shares by percentages.

Table 3-14: Summary of Funding Sources

Source	Categories	Funding	Funding Share
Federal/State	Category 2 Metro Corridor Texas Mobility Fund (TMF), Proposition 12 and District Discretionary Funds	$73,750,000	16.1%
Local	Bonds, Transportation Infrastructure Finance and Innovation Act, Advanced Transportation District and Local Contribution	$384,250,000	83.9%
Total Project Cost		$458,000,000	100.0%

Source: AAMPO, 2014a.

Funding mechanisms identified for the construction of the US 281 Corridor Project would be authorized under the various categories identified in **Table 3-14** and are defined as follow:

- Category 2 Metro Corridor (large MPOs) is addressed in the "Mobility Plan" Statewide Mobility Program (SMP), which is the statewide 'Build It' plan adopted by the Texas Transportation Commission (the Commission). The SMP outlines funding levels and projects for a ten-year time period and allows for development authority up to a certain amount for other projects. Texas voter approval in 2001 of Proposition 15 and enactment of legislation by the 77th Legislature in 2001 created the Texas Mobility Fund (TMF). The creation of the Mobility Fund allows Texas Department of Transportation (TxDOT) to issue bonds secured by future revenue. This allows the acceleration of mobility projects throughout the state. The Mobility Fund is administered by the Commission as a revolving fund to provide a method of financing for the construction, reconstruction, acquisition and expansion of state highways, including costs of any necessary design and costs of acquisition of ROW, as determined by the Commission in accordance with standards and procedures established by law.
- Bonds can be described as debt instruments issued for a period of more than one year, with the purpose of raising capital by borrowing with a promise to repay the principal along with interest (coupons) on a specified date of maturity. Municipality bonds, issued by a state, city, or local government, are generally used to raise capital for day-to-day activities and/or for specific projects proposed, usually pertaining to the development of local infrastructure such as roadways, drainage/sewerage, etc.

- An additional funding category considered for the US 281 Corridor Project is the Transportation Infrastructure Finance and Innovation Act (TIFIA) program. The TIFIA program provides federal credit assistance in the form of direct loans, loan guarantees, and standby lines of credit to finance surface transportation projects of national and regional significance. TIFIA credit assistance provides improved access to capital markets, flexible repayment terms, and potentially more favorable interest rates than can be found in private capital markets for similar instruments. TIFIA can help advance qualified, large-scale projects that otherwise might be delayed or deferred because of size, complexity, or uncertainty over the timing of revenues. Many surface transportation projects—highway, transit, railroad, intermodal freight, and port access—are eligible for assistance. Each dollar of federal funds can provide up to $10 in TIFIA credit assistance and leverage $30 in transportation infrastructure investment.
- Another funding category for the US 281 Corridor Project is the Advanced Transportation District (ATD) fund. On November 2, 2004, the voters of San Antonio approved the creation of an ATD for mobility enhancement and advanced transportation. The ATD authorized a sales and use tax of one-fourth of one percent (0.25 percent) to be allocated in the following percentages: 50 percent to VIA, 25 percent to TxDOT and 25 percent to the City of San Antonio.

Potential Effects to Employment and Income

No-Build Alternative

Under the No-Build Alternative, employment levels at currently established businesses could remain the same or change based on market factors. However, without improvements, the No-Build Alternative would likely have adverse effects on a business patron or employee's ability to access businesses in the study area and adjacent communities as US 281 traffic congestion and travel times continue to worsen.

Build Alternatives

The proposed US 281 Corridor Project would help generate both short-term (construction-related) and long-term economic benefits. Construction of the project would be a multi-year effort, which would help provide opportunities for short-term employment within the city of San Antonio, Bexar County, and the immediate region. In addition, a large portion of jobs generated by wage expenditures (wages paid for construction jobs) is also likely to be based in the region. Based on an estimated construction cost and multi-year construction duration, the proposed project could generate up to 10,000 jobs in the region (see **Regional Economic Effects of the Build Alternatives** below for more details). These jobs would include construction and manufacturing/vending jobs, as well as jobs created to meet the demand for goods and services by those employed to construct the proposed project. The US 281 Corridor Project is listed in the MPO's *FY 2015-2018 Transportation Improvement Program* as a 6-lane expressway (4 non-toll expressway lanes and 2 managed lanes) between Loop 1604 and Stone Oak Parkway, a 4-lane expressway with managed lanes from Stone Oak Parkway to the Bexar/Comal County line, and non-toll northern interchange connectors at Loop 1604. The total cost breakdown estimated for the proposed project in this plan is included in **Table 3-15**. The ultimate configuration between Stone Oak Parkway and the Bexar/Comal County line would be a 6-lane expressway (three managed lanes in each direction). The additional managed lane in each direction is included in *Mobility 2040* as a FY 2030 expenditure at a total cost of $63.5 million.

Table 3-15: Total Project Cost Breakdown

Project Cost Description	Loop 1604 to Stone Oak Parkway Cost	Stone Oak Parkway to Bexar/Comal County Line Cost	Total Cost	Percentage of Total
Preliminary Engineering	$9,016,000	$9,277,529	$18,293,529	4.0%
Construction Engineering	$13,321,600	$9,391,130	$22,712,730	5.0%
Construction Cost	$184,000,000	$189,337,319	$373,337,319	81.5%
Contingencies	$7,893,600	$3,767,813	$11,661,413	2.5%
Indirect Costs	$8,887,200	$9,144,993	$18,032,193	3.9%
Other Field Costs	$6,881,600	$7,081,216	$13,962,816	3.0%
Total Project Cost	**$230,000,000**	**$228,000,000**	**$458,000,000**	**100.0%**

Source: AAMPO, 2014a.
Note: The US 281 Project is two separate entries - CSJ 0253-04-138 (Stone Oak Parkway to Bexar/Comal County Line) and 0253-04-146 (Loop 1604 to Stone Oak Parkway).

Roadway construction activities resulting from the implementation of a Build Alternative are expected to generate a temporary direct increase in construction-related and other employment as well as local and statewide income. In addition, indirect increases in local income could result from spending by construction employees at businesses and restaurants along the US 281 project corridor. There is the potential for jobs losses due to the relocation of businesses along the US 281 project corridor, as discussed in **Section 3.4.5 Displacements and Relocation**; the Elevated Expressway Alternative could displace 28 businesses and 169 to 194 jobs and the Preferred Expressway Alternative would displace 21 businesses and 162 to 188 jobs. However, the US 281 Corridor Project is not expected to have a substantial adverse impact on local employment in the vicinity of the corridor. The number of construction-related jobs could vary depending on the phasing of the project construction.

Funding Options

The Build Alternatives include managed lanes that are tolled. According to the Alamo RMA Toll Policy, the toll rates could range between $0.17 per mile and $0.50 per mile; for a daily commuter the toll burden could be between $680 and $2,000 per year. The 2012 median household income in the socioeconomic study area is approximately $88,500. The financial burden for commuters in the demographic study area represents between 0.8 and 2.3 percent of the median household income assuming that a traveler uses the complete corridor for every work day (**Section 3.4.6 Environmental Justice** describes how this financial burden would impact minority and/or low-income households).

The Preferred Expressway Alternative is unlikely to adversely impact those that work and/or conduct business in the US 281 project corridor because access to their place of business would be improved. The Preferred Expressway Alternative would provide access to corridor area businesses via non-toll lanes, just like occurs today, although in the future overall congestion would be reduced and travel times and safety would be improved when compared with the No-Build Alternative. Employees and business patrons may choose to avoid the toll lanes and select a non-toll lane on US 281 or local street to reach their destination.

Potential Effects to Property Tax Revenues

No-Build Alternative

Under the No-Build Alternative, there would be no ROW acquisition and private and public property would not be removed from the tax rolls of local government entities and ISDs.

Build Alternatives

Long-term economic effects of the Build Alternatives would include the permanent removal of taxable property where additional ROW would be required. **Table 3-13** shows major taxing jurisdictions, and the associated tax rate per $100 valuation for fiscal year 2013.

Table 3-16 shows the number of potentially displaced properties, the acres of ROW need from impacted parcels and the total estimated appraised value of these acquisitions (See **Section 3.4.5 Displacements and Relocation** for more details about the acquisition of ROW and potential displacements). The total appraised value estimates were calculated using 2013 appraisal data from the Bexar Appraisal District based on the land and improvement (structure) appraised value for each parcel that would be acquired for ROW. The value of the land needed for ROW was added to the value of the potentially displaced structures for each Build Alternative. The Elevated Expressway Alternative would remove an estimated value of $21,497,862 of taxable property and the Preferred Expressway Alternative would remove an estimated value of $20,478,801 of taxable property.

Table 3-16: Estimated Appraised Value of Acquired Property

Alternatives	Potential Displacements	Additional ROW from Parcel Impacts (acres)	Total Estimated Value (2013 dollars)
Elevated Expressway	21 commercial 2 utility	99 acres	$21,497,862
Preferred Expressway Alternative	28 commercial	79 acres	$20,478,801

Sources: Bexar Appraisal District, 2013b, US 281 EIS Team, May 2014.

Table 3-17 shows the potential loss in tax revenue for the major taxing jurisdictions affected by the Build Alternatives. Potential tax revenue loss was calculated by multiplying the 2013 tax rates (tax rates shown in **Table 3-13**) by the appraised value of the property that could potentially be acquired.

Table 3-17: Potential Annual Loss in Tax Revenue per Build Alternative (2013 dollars)

Alternatives	Major Taxing Jurisdiction									Total
	Bexar County Road and Flood	San Antonio River Authority	Alamo Community College	Universal Health System	Bexar County	City of San Antonio	North East ISD	Comal ISD	Bexar County Emergency District #3	
Elevated Expressway	$6,114	$3,547	$29,724	$55,050	$59,027	$9,974	$134,926	$151,049	$9,141	$458,552
Preferred Expressway Alternative	$5,695	$3,304	$27,689	$51,281	$54,985	$9,190	$119,737	$150,980	$8,757	$431,619

Sources: Bexar Appraisal District, 2013a, US 281 EIS Team, May 2014.

Based on this analysis, the Preferred Expressway Alternative would have the less potential loss in property tax revenues at an estimated $431,619 per year than the Elevated Expressway Alternative which could result in a $458,552 loss in property tax revenue. Of the taxing jurisdictions that could be impacted, the Comal ISD stands to lose the most annual tax revenue regardless of Build Alternative.

Regional Economic Effects of the Build Alternatives

The Regional Input-Output Modeling System (RIMS II), produced by the Bureau of Economic Analysis (BEA), was used to analyze the effects that the Build Alternatives could have on the regional economy and on employment and earnings (BEA 2011). This input-output analysis uses two inputs: the projected cost required for the construction of the Build Alternatives, and a set of regional multipliers sourced from the RIMS II model that measure the economic effects of the construction industry in the San Antonio Metropolitan Statistical Area (MSA), which includes Atascosa, Bandera, Bexar, Comal, Guadalupe, Kendall, Medina, and Wilson counties.

The US 281 EIS team developed construction cost estimates based on 2014 bid history data from TxDOT. Construction costs include earthwork, pavement, retaining walls, bridges, traffic signals and controls, drainage, signage and striping, illumination, pedestrian and bicycle facilities, storm water management, utilities, as well as a 20 percent contingency factor and a 7 percent mobilization fee. The cost estimates also account for engineering and professional services and ROW acquisition. ROW costs are based on 2013 appraised values and include a 56 percent contingency to account for potential market fluctuations and uncertainties associated with the ROW acquisition process (see **Appendix K2** for more information on cost estimates). The tolling elements of the Build Alternatives include equipment costs and installation as well as a mobilization fee.

The RIMS II model provides multipliers for the construction sector overall, as such the multipliers used in this analysis are not specific to highway construction. The construction sector multipliers include the following activities: construction of buildings and other structures, heavy construction such as highways, power plants and pipelines, and construction activities by special trade contractors. The output of the type II multipliers is total economic effect of the input or cost including direct, indirect and cumulative effects. The potential regional economic effects of the Build Alternatives are therefore general estimates and should only be used for the purpose of comparing the Build Alternatives.

The direct and indirect impacts of the Build Alternatives on output, earnings, employment and value added are shown in **Table 3-18.**

- Output is the estimated value of the Build Alternatives, as constructed, on the San Antonio MSA economy overall
- Earnings are the total increase in profits that could be generated in the San Antonio MSA economy as a result of the construction of the Build Alternatives
- Employment represents the total number of jobs that could be created as a result of constructing the Build Alternatives. Employment supported by construction activities includes: new jobs (unemployed labor is hired), better jobs (currently employed workers that move into jobs with better compensation and/or full-time positions), and sustained jobs (current employees are retained with the expenditure)
- Value Added is the potential contribution of the construction of the Build Alternatives to the regional gross domestic product (GDP)

Table 3-18: Estimated Economic Effects of the Build Alternatives

Alternative	Option	Cost (Millions)	Total Effect			
			Output (Millions)	Earnings (Millions)	Employment	Value Added (Millions)
Preferred Expressway Alternative*	Non-Toll and Managed	$458.7 to $476.1	$1,029.9 to $1,068.9	$342.9 to $355.9	19,529 to 20,270	$563.1 to $584.4
Elevated Expressway Alternative	Non-Toll	$614.7	$1,380.1	$459.5	26,170	$754.5
	Toll	$633.1	$1,421.4	$473.3	26,954	$777.1
	Managed	$633.1	$1,421.4	$473.3	26,954	$777.1

Source: BEA, 2002, BEA, 2008 and US 281 EIS Team, May 2014.
* The range in costs for the Preferred Expressway Alternative is based on the construction material options (all concrete, hot mix asphaltic concrete, or a combination of the two options). See Appendix K2 for more details. Cost assumes ultimate configuration.

Conclusion and Proposed Mitigation Measures

The US 281 Corridor Project would have both short and long term economic effects. In the short term, the proposed project would generate engineering and construction jobs, as well as jobs created to meet the demand for goods and services by those employed to construct the proposed project. Long term economic effects from the Build Alternatives include the permanent removal of taxable property from the tax rolls where additional ROW would be required. This long term effect is not anticipated to be substantial when the potential property tax revenue loss is compared to the net property tax revenues collected each year in the major taxing jurisdictions.

In terms of mitigation measures that may offset any property tax losses, the US 281 Corridor Project is projected to introduce $458,000,000 (*Mobility 2035* and *Mobility 2040*) into the local economy which could have a net effect of increasing property values (Carey 2001; Iacono 2009), and introducing additional local and statewide income and local employment.

The US 281 Corridor Project is expected to contribute positively to the regional economy as well as increase employment in the short term. A total economic output of between $1.0 and $1.4 billion could be generated, and between 19 and 27 thousand jobs could be generated. Because the Preferred Expressway Alternative would cost the least to construct it is expected to generate less total economic effect than the Elevated Expressway Alternative.

The Preferred Expressway Alternative would ensure access to area businesses via non-toll lanes, just as occurs today. When compared to the No-Build Alternative, the Preferred Expressway Alternative would improve mobility and travel time through and within the US 281 project corridor thereby improving access to area businesses and residential neighborhoods.

3.4.5 Displacements and Relocation

Methodology

Legal and Regulatory Background

The Uniform Act contains specific requirements that determine the manner in which a government entity acquires private property for public use when federal funds are used for any phase of a project. The purpose of this act is to provide a uniform policy for fair and equitable treatment of persons and businesses displaced as a result of federal and federally-assisted programs in accordance with the following objectives:

A. To ensure that owners of real property to be acquired for federal and federally-assisted projects are treated fairly and consistently, to encourage and expedite acquisition by agreements with such owners, to minimize litigation and relieve congestion in the courts, and to promote public confidence in federal and federally assisted land acquisition programs.
B. To ensure that persons displaced as a direct result of federal or federally assisted projects are treated fairly, consistently, and equitably so that such persons will not suffer disproportionate injuries as a result of projects designed for the benefit of the public as a whole.
C. To ensure that agencies implement these regulations in a manner that is efficient and cost effective.

Methodology

Potential residential and commercial displacements and relocations for the Build Alternatives were identified based on a review of high-resolution aerial imagery (USDA's National Aerial Imagery Program, (NAIP) photographs, 2010), 2013 Bexar Appraisal District records, and field reconnaissance in 2010 and 2014.

The number of single-family and commercial displacements was counted based on the following criteria: (1) Single-family residential displacements were counted if a house is within the proposed ROW and/or if more than 50 percent of the property of a residence is within proposed ROW to be acquired; (2) Business displacements were counted if a building structure was located within the proposed ROW to be acquired or if more than 50 percent of the business's parking lot is within the proposed ROW to be acquired. Sheds, out buildings and carports were not counted.

At Risk ROW Acquisition

Although improvements for the US 281 Corridor Project would require additional ROW, no "at risk" early ROW acquisitions have been identified. "Early acquisition" is defined in 23 Code of Federal Regulations (CFR) 710.105(b) as acquisition in advance of any FHWA authorization or agreement. The term "at risk" is used to explain that the states bear the risk associated with acquiring parcels that may not be required for the project if not within the approved alignment following the environmental process. ROW acquisition would be performed in accordance with the Uniform Act, as amended.

Environmental Consequences

Potential Displacements

No-Build Alternative

As the No-Build Alternative would not require additional ROW, there would be no displacements or direct impacts to area housing or housing availability.

Build Alternatives

The ROW required for the Build Alternatives would not result in the displacement of a residence, school, fire or police station, hospital, library, or place of worship. Potential commercial and utility displacements are shown in **Table 3-19** by Build Alternative and a description of the potentially displaced commercial properties is found in **Table 3-20**. The locations of all potential displacements are shown in **Figure 3-9a**

through Figure 3-9j. A majority of the commercial displacements would occur on the west side of the US 281 project corridor and north of Stone Oak Parkway where most of the ROW would be required.

Table 3-19: Potential Displacements by Build Alternative

Build Alternative	Commercial	Utilities
Preferred Expressway Alternative	21	2
Elevated Expressway Alternative	28	0

Source: US 281 EIS Team, February 2014.

Table 3-20: Description of Potentially Displaced Commercial Properties

Potentially Displaced Commercial Properties	Approximate Number of Employees	Preferred Expressway Alternative	Elevated Expressway Alternative
Cactus Jack's Tacos & Subs Restaurant	0 (closed)		
DRB Aviation Consultants Design, program management and certification of aircraft interiors, avionics and structural repairs	12-16	X	
Mouse's BBQ Restaurant (closed)	0 (closed)		X
Horizons Building Unknown	N/A		X
Stone House Imports House ware, pottery and glass	2		X
Fireworks Fireworks	2		X
Advance Turf Service Commercial and residential landscaping	3	X	X
H&H Auto Sales Used car dealership	5	X	X
Bulverde Vet Clinic Veterinarian	6	X	X
Mark Drogin, MD Psychiatrist	2 to 5	X	X
RT Leasing Property Management	2 to 5	X	X
Mission Park Funeral Chapels Funeral and burial services	2 to 5	X	X
Alamo Fireworks – Location 183 Fireworks	2	X	X
LoneStar Fiberglass Pools Fiberglass pool sales	5	X	
Alamo Fireworks – Location 082 Fireworks	2	X	X
EMG Landscapes Supplies Landscape equipment and supplies	5	X	

Potentially Displaced Commercial Properties	Approximate Number of Employees	Preferred Expressway Alternative	Elevated Expressway Alternative
LMD Architects Architects	6		X
Daily Car Wash Car wash	2		X
Ace Lawn & Garden Landscaping equipment & repair	2 to 5		X
Southwest Farm & Home Center Hardware store and home & farm center	10	X	X
Weekley Homes LP - Model Home Home builder & general contractor	2	X	X
Ferrell Gas, Inc. Propane, natural gas and gasoline	15	X	X
Bracken Auto Body Auto body repair and paint	10	X	X
Powerhouse Cycle Motorcycle dealer	8	X	X
North Central Boat & RV Storage Storage Facility	2 to 5	X	X
Texas Soil & Stone Outfitters Bulk landscaping materials	4	X	X
Parrish & Company Residential homebuilder/remodeler, cabinet making, countertop and appliance vendor	43	X	X
Carlson's Carpets Carpet and flooring	15-25	X	X
Hanson Brick Brick manufacturer	7	X	X
AAA Storage Storage Facility	5		X
Fireworks Fireworks	2		X
BuiltSmart Resources Center Green Homebuilder	8		X
TOTAL		21 businesses 162 – 188 jobs	28 businesses 169 – 194 jobs

Source: US 281 EIS Team, 2014.

Figure 3-9a: Relocations and displacements – Preferred Expressway Alternative

Source: Bexar Appraisal District, 2013b, US 281 EIS Study Team March 2014.

Figure 3-9b: Relocations and displacements – Preferred Expressway Alternative

Source: Bexar Appraisal District, 2013b, US 281 EIS Study Team March 2014.

Figure 3-9c: Relocations and displacements – Preferred Expressway Alternative

Source: Bexar Appraisal District, 2013b, US 281 EIS Study Team March 2014.

Figure 3-9d: Relocations and displacements – Preferred Expressway Alternative

Source: Bexar Appraisal District, 2013b, US 281 EIS Study Team March 2014.

Figure 3-9e: Relocations and displacements – Preferred Expressway Alternative

Source: Bexar Appraisal District, 2013b, US 281 EIS Study Team March 2014.

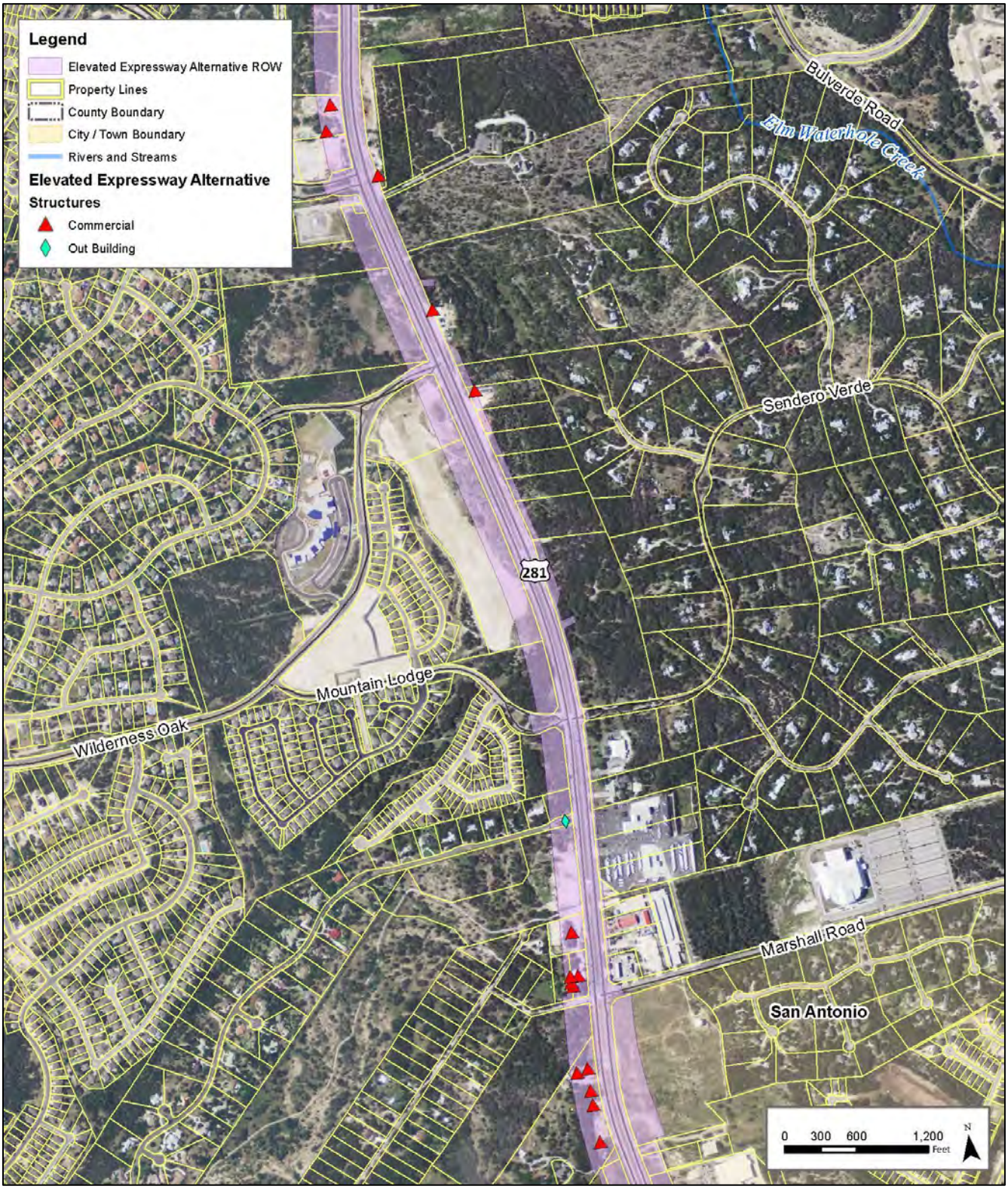
Figure 3-9f: Relocations and displacements – Elevated Expressway Alternative

Source: Bexar Appraisal District, 2013b, US 281 EIS Study Team March 2014.

Figure 3-9g: Relocations and displacements – Elevated Expressway Alternative

Source: Bexar Appraisal District, 2013b, US 281 EIS Study Team March 2014.

Figure 3-9h: Relocations and displacements – Elevated Expressway Alternative



Source: Bexar Appraisal District, 2013b, US 281 EIS Study Team March 2014.

Figure 3-9i: Relocations and displacements – Elevated Expressway Alternative

Source: Bexar Appraisal District, 2013b, US 281 EIS Study Team March 2014.

Figure 3-9j: Relocations and displacements – Elevated Expressway Alternative

Source: Bexar Appraisal District, 2013b, US 281 EIS Study Team March 2014.

Potential ROW Acquisition

Table 3-21 shows the anticipated ROW acreage needed for the Build Alternatives and number of parcels affected. The total ROW required for the Elevated Expressway Alternative would be 99 acres and 79 acres for the Preferred Expressway Alternative. Of the parcels affected by all Build Alternative, range land and commercial office-retail business parcels are affected the greatest, with the Preferred Expressway Alternative affecting the greatest number of parcels overall.

Table 3-21: ROW Impacts

Alternatives	Acreage of Impacts	Number of Parcels Affected												
		Range Land	Open space/Park	Single-Family	Multi-Family	Commercial-Retail	Commercial-Office	Commercial-Mixed	Industrial	House of Worship	Transportation	Utility	Forest	Total Parcels
Preferred Expressway Alternative	79	18	32	4	0	50	3	1	2	3	4	2	1	120
Elevated Expressway Alternative	99	36	6	7	1	23	5	3	2	1	4	3	2	93

Source: Bexar Appraisal District, 2013b, US 281 EIS Team, March 2014.

Availability of Replacement Property

A Multiple Listings Service (MLS) availability search was conducted using the zip codes located within the US 281 project corridor for available commercial, industrial, and undeveloped land properties that are comparable and suitable to the properties potentially being displaced. The number of properties for lease or sale within the identified zip code locations of the project area is presented in **Table 3-22** below.

Table 3-22: Commercial, Industrial, and Agriculture MLS Availability by City Zip Codes

	Zip Codes				Surrounding City*	Total
	78258	78260	78261	78259		
Commercial for Lease	3	0	0	0	30	33
Commercial for Sale	1	0	0	0	6	7
Industrial for Lease	0	0	0	0	0	0
Industrial for Sale	0	0	0	0	0	0
Undeveloped Land for Lease	0	0	0	0	0	0
Undeveloped Land for Sale	1	0	0	0	10	11
Total	5	0	0	0	46	51

Source: CIMLS, 2014.
*Surrounding City means within 10 miles of the US 281 project corridor.

The square footage of commercial and industrial facilities that could be displaced ranges from approximately 250 square feet to 125,000 square feet. A MLS search of available commercial and industrial properties ranging from 300 square feet to 560,000 square feet was conducted by city zip code location and surrounding city. The acreage of agricultural properties to be displaced ranges from 0.151 acre to 2 acres. A MLS search did not reveal available agricultural (farmland and ranch) properties within the zip codes in the US 281 project corridor or surrounding city. The estimated appraised values of business (commercial, industrial, and agricultural) displacements ranged from $100 to $4,125,000.

Conclusion and Proposed Mitigation

The Uniform Act, as amended (49 CFR Part 24) ensures that displaced persons are relocated to a property that is comparable in size, features, and location; is decent, safe, and sanitary; and is within the financial means of the displaced person(s) (49 CFR Part 24.204). Relocation assistance would be available to all individuals, families, businesses, farmers, and nonprofit organizations displaced as a result of the project. This assistance applies to tenants as well as owners occupying the real property needed for the project. Replacement structures must be located in the same type of neighborhood and be equally accessible to public services and places of employment. Alamo RMA in coordination with TxDOT would also provide assistance to displaced businesses and non-profit organizations to aid in their satisfactory relocation with a minimum of delay and loss in earnings. The US 281 Corridor Project would proceed to construction only when all displaced families and businesses have been provided the opportunity to be relocated to adequate replacement sites.

Consistent with the U.S. Department of Transportation (USDOT) policy as mandated by the Uniform Act, as amended, the Alamo RMA in coordination with TxDOT would provide relocation resources to all displaced persons without discrimination. All property owners from whom property is needed are entitled to receive just compensation for their land and property. Just compensation is based upon the fair market value of the property. Alamo RMA in coordination with TxDOT would also provide, through its Relocation Assistance Program, payment and services to aid in movement to a new location.

In addition, aerial and/or underground utilities would be adjusted and the required utilities would be handled so that no significant disruption of service would take place while the adjustments are being made. Utility adjustments would occur according to standard TxDOT and Alamo RMA procedures.

3.4.6 Environmental Justice

Methodology

Regulatory Background

Presidential Executive Order (EO) 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations,* mandates that federal agencies "identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of programs on minority and low-income populations" (59 *Federal Register* 7629-7633, February 16,1994). The three fundamental principles of environmental justice (EJ) are 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;
- ensure the full and fair participation by all potentially affected communities in the transportation decision-making process; and
- prevent the denial of, reduction in or significant delay in the receipt of benefits by minority and low-income populations

According to FHWA Order 6640.23A and the USDOT Order 5610.2(a), disproportionately high and adverse effects on minority or low-income populations generally means 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, and 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 (USDOT 2012).

A minority is defined in Order 5610.2(a) as a person who is:

- Black (having origins from any of the black racial group of Africa)
- Asian-American (having origins from of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, of the Pacific Islands)
- American Indian and Alaskan Native (having origins from any of the original people of North America and who maintain cultural identification through tribal affiliation or community recognition)
- Hispanic or Latino (of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race).

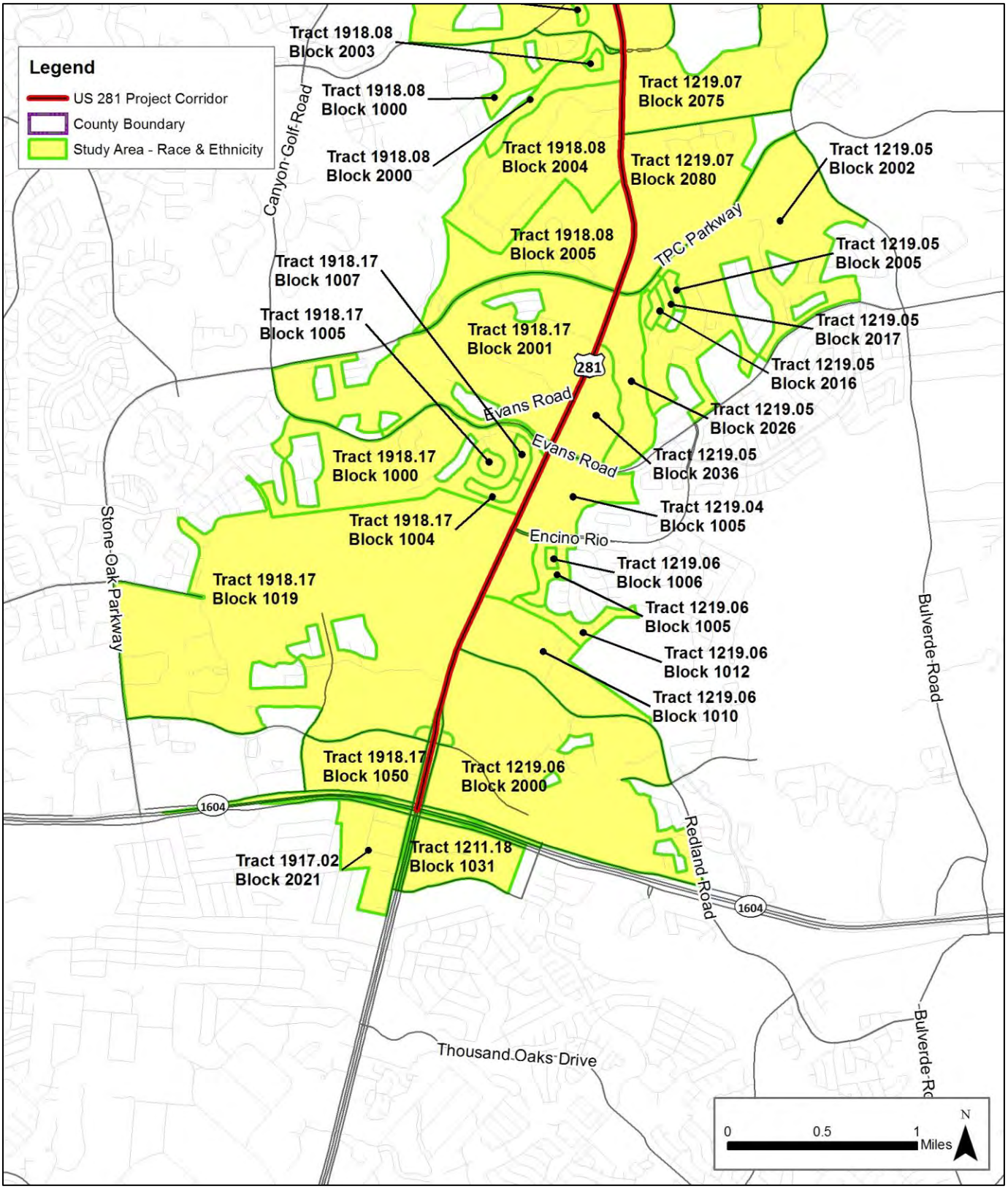
Low income is defined in Order 5610.2(a) as a person whose median household income is at or below the U.S. Department of Health and Human Services (USDHHS) poverty guidelines. The USDHHS poverty guidelines are categorized by the number of persons living in a household. The average household size in Bexar County was 2.75 people and in Comal County was 2.6 people in 2010 (U.S. Census Bureau 2010). The 2014 USDHHS poverty guideline for a 2-person household is $15,730 and for a 3-person household is $19,790 (USDHHS 2014).

Methodology

In accordance with EO 12898 and FHWA Order 6640.23A, data on the presence of minority and low-income populations should be analyzed at the project level to ensure that the Build Alternatives do not subject these populations to a "disproportionately high and adverse effect." As such, socioeconomic factors are analyzed using the most detailed geographies available; income and poverty are analyzed at the Census block group level and race and ethnicity are analyzed at the Census block level.

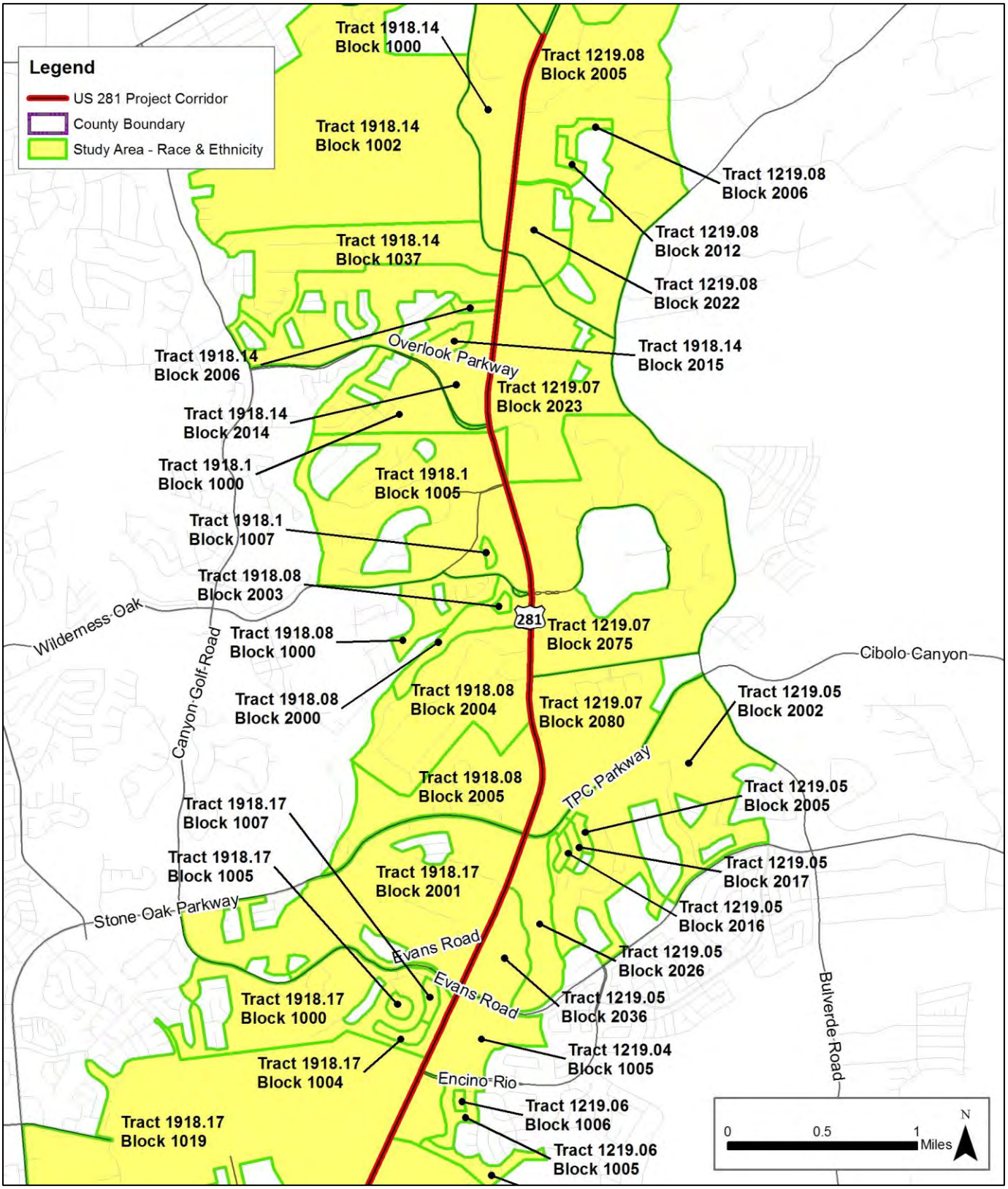
Direct effects are defined in 40 CFR 1508.08 as those caused by the proposed project and which occur at the same time and place. This means that the effects are likely to be experienced as a result of project activities, such as construction impacts, and are likely to be experienced at properties that are located at and adjacent to the project. For this analysis, direct effects to EJ populations are analyzed within and immediately adjacent to the ROW for the Build Alternatives; immediately adjacent is defined by a 500 foot buffer around the centerline of the existing US 281 corridor. The boundary of the Study Area for Income and Poverty are the Census block groups within or immediately adjacent to the ROW for the Build Alternatives and the boundary of the Study Area for Race and Ethnicity are the Census blocks within or immediately adjacent to the ROW for the Build Alternatives. As discussed in **Chapter 2 - Alternatives Considered**, the Build Alternatives follows the same general alignment of the existing US 281 project corridor. While the ROW requirements are slightly different, the Census geographies within or adjacent to the ROWs are the same; therefore, the study areas are the same for the Build Alternatives. There are 128 Census blocks within or adjacent to the proposed ROWs (**Figure 3-10a through Figure 3-10c**) and nine Census Block Groups within or adjacent to the proposed ROWs (**Figure 3-11**).

Figure 3-10a: Study area for race and ethnicity – 2010 census blocks



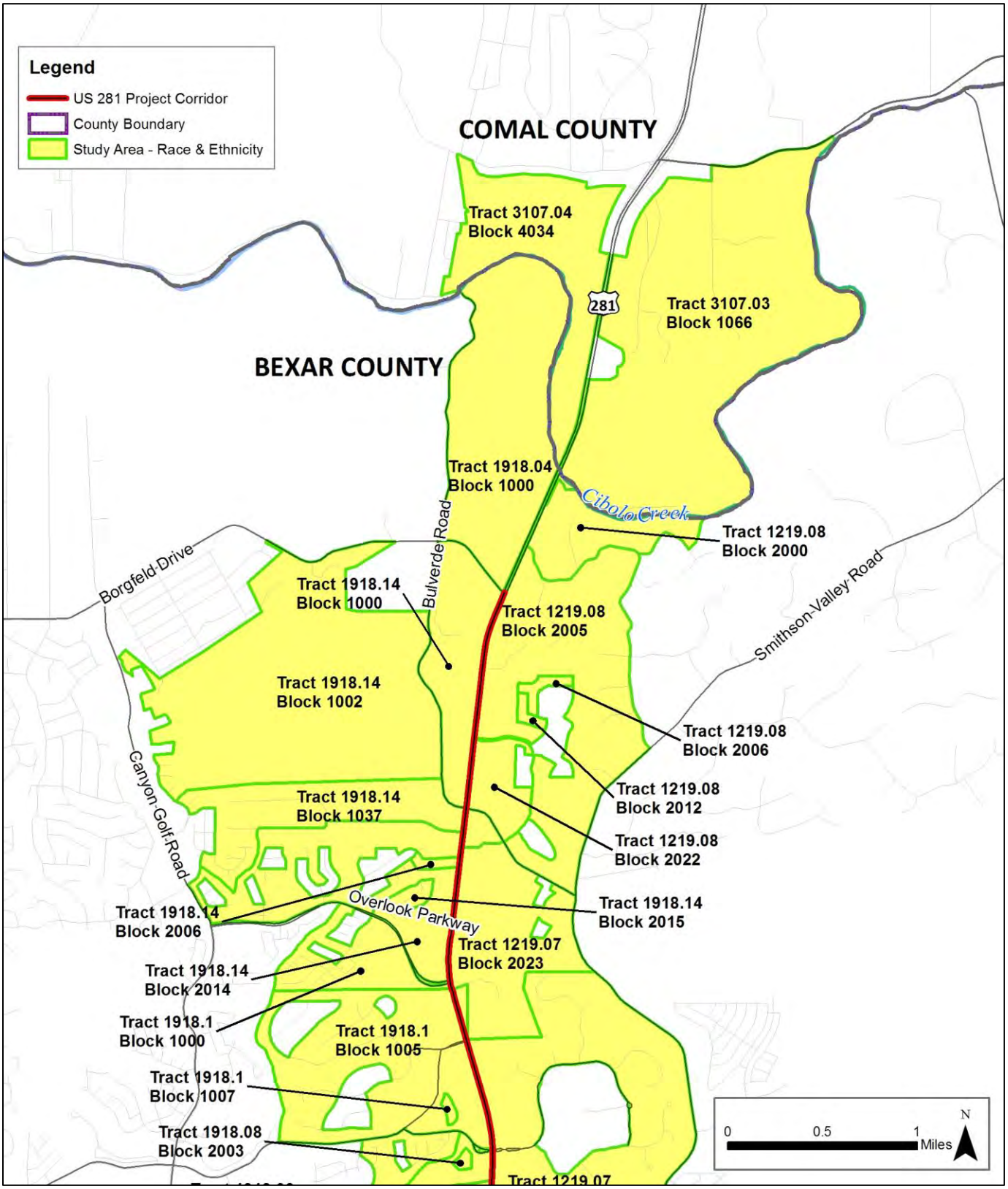
Source: U.S. Census Bureau, 2010b.

Figure 3-10b: Study area for race and ethnicity – 2010 census blocks



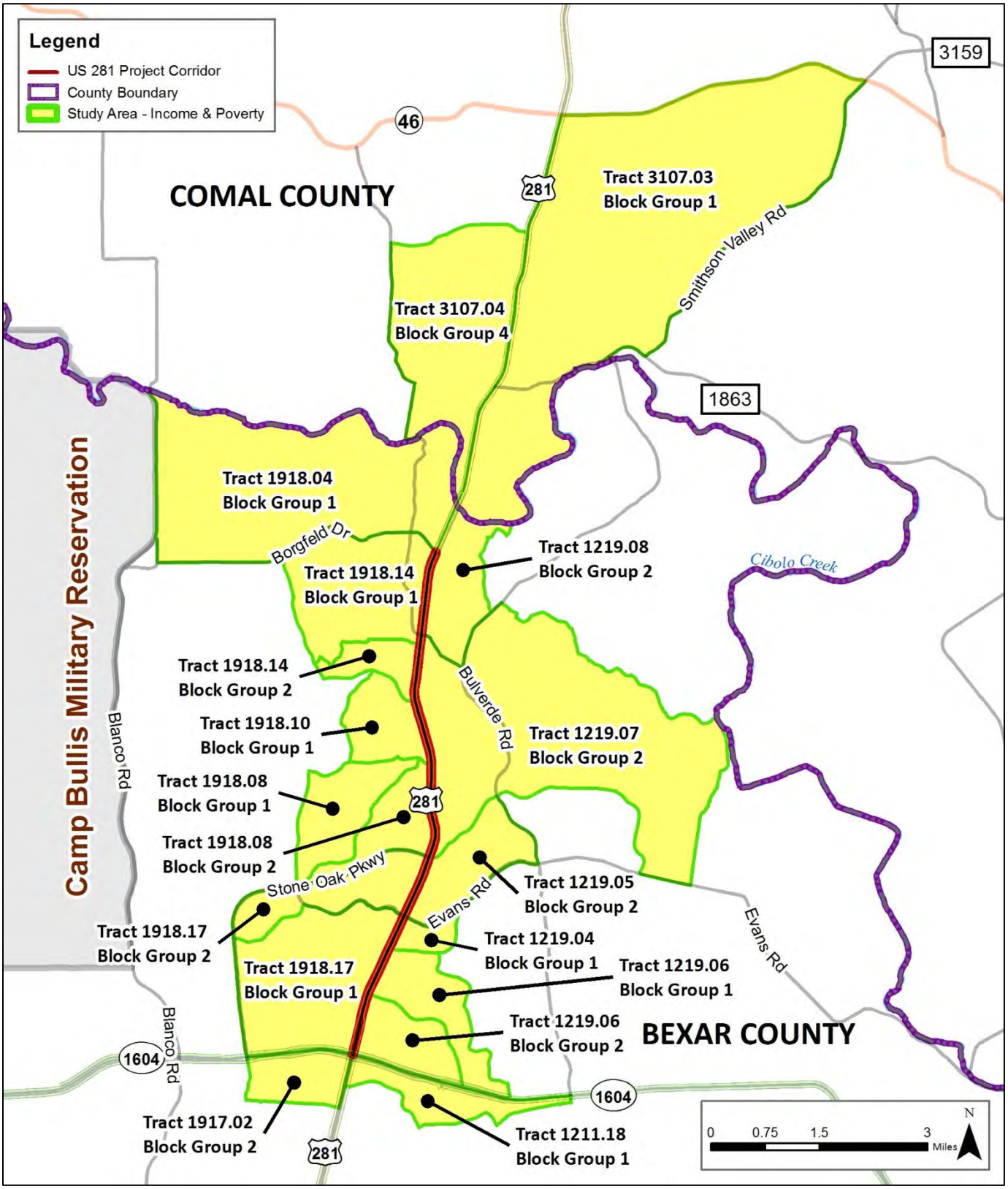
Source: U.S. Census Bureau 2010b.

Figure 3-10c: Study area for race and ethnicity – 2010 census blocks



Source: U.S. Census Bureau 2010b.

Figure 3-11: Study area for income and poverty – 2010 census block groups



Source: U.S. Census Bureau 2010b.

Based on existing guidance from the Council on Environmental Quality (CEQ) and the U.S. Environmental Protection Agency (EPA) a "minority population may be present if the minority population percentage in the affected area is 'meaningfully greater' than the minority population percentage in the general population or other appropriate unit of geographic analysis." The CEQ guidance suggests that minority populations will always be "meaningfully greater" when the percentage of minorities exceeds 50 percent, regardless of what the percentage of minority population is in the comparison geographic unit. And, that this same method can be used to determine the presence of low-income populations.

- Minority populations that could be affected by the Build Alternatives are identified by applying the 50 percent threshold to each census block within the Study Area for Race and Ethnicity. If the minority population comprises more than 50 percent of the total population within that respective census block then it is considered an environmental justice block.

As described above, low income is defined as a person whose median household income is at or below the USDHHS poverty guidelines. The average household size around the US 281 project corridor is between 2.60 and 2.75 people in 2010. In order to be more inclusive, the USDHHS guideline for a 3-person household ($19,790) was used. The USDHHS poverty guideline is reported in 2014 dollars; however, income data reported by the US Census Bureau is in 2012 dollars. In order to ensure a fair comparison, the poverty guideline was adjusted using the US Bureau of Labor Statistics' consumer price index. In 2012 dollars, $19,790 is equal to $19,229. The closest income bracket reported by the US Census Bureau is $19,999, this value was used to identify low-income household in the Study Area for Income and Poverty.

Low-income populations that could be affected by the Build Alternatives are identified if the median household income in a census block group within the Study Area for Income and Poverty is equal to or below $19,109. If any low-income population is identified then the census block group is considered an environmental justice block group.

Affected Environment

Race and Ethnicity

In the Study Area for Race and Ethnicity there are 83 blocks that contain no population; no population may signify that there are no residential land uses in that block. **Table 3-23** shows the racial and ethnic distribution of people within the Study Area for Race and Ethnicity for all populated census blocks. The red highlighting in the table signifies that the minority population within the respective census block exceeds the 50 percent threshold.

Table 3-23: Race and Ethnicity – 2010 Census

Geography	Total 2010 Population	White Only	Black or African American Only	American Indian/ Alaska Native Only	Asian Only	Native Hawaiian/ Other Pacific Islander Only	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Total Minority
Bexar County Blocks										
Tract 1219.05, Block 2001	9 100.0%	8 88.9%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 11.1%	0 0.0%	7 77.8%	7 77.8%
Tract 1219.05, Block 2002	1,324 100.0%	1,050 79.3%	108 8.2%	4 0.3%	93 7.0%	7 0.5%	31 2.3%	31 2.3%	396 29.9%	621 46.9%
Tract 1219.05, Block 2005	83 100.0%	58 69.9%	5 6.0%	0 0.0%	12 14.5%	0 0.0%	0 0.0%	8 9.6%	35 42.2%	56 67.5%
Tract 1219.05, Block 2016	89 100.0%	61 68.5%	0 0.0%	0 0.0%	22 24.7%	0 0.0%	1 1.1%	5 5.6%	28 31.5%	52 58.4%
Tract 1219.05, Block 2017	131 100.0%	101 77.1%	14 10.7%	0 0.0%	16 12.2%	0 0.0%	0 0.0%	0 0.0%	27 20.6%	57 43.5%
Tract 1219.05, Block 2026	438 100.0%	286 65.3%	26 5.9%	8 1.8%	87 19.9%	0 0.0%	10 2.3%	21 4.8%	148 33.8%	274 62.6%
Tract 1219.05, Block 2036	666 100.0%	399 59.9%	41 6.2%	1 0.2%	161 24.2%	1 0.2%	29 4.4%	34 5.1%	200 30.0%	424 63.7%
Tract 1219.06, Block 1005	164 100.0%	156 95.1%	1 0.6%	0 0.0%	7 4.3%	0 0.0%	0 0.0%	0 0.0%	22 13.4%	30 18.3%
Tract 1219.06, Block 1006	41 100.0%	41 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	7 17.1%	7 17.1%
Tract 1219.06, Block 1010	405 100.0%	309 76.3%	19 4.7%	2 0.5%	19 4.7%	0 0.0%	43 10.6%	13 3.2%	164 40.5%	211 52.1%
Tract 1219.06, Block 1012	140 100.0%	126 90.0%	3 2.1%	0 0.0%	6 4.3%	0 0.0%	1 0.7%	4 2.9%	30 21.4%	42 30.0%
Tract 1219.06, Block 2000	1,349 100.0%	1,083 80.3%	60 4.4%	1 0.1%	55 4.1%	0 0.0%	95 7.0%	55 4.1%	490 36.3%	634 47.0%
Tract 1219.07, Block 2023	196 100.0%	152 77.6%	24 12.2%	2 1.0%	9 4.6%	0 0.0%	6 3.1%	3 1.5%	50 25.5%	86 43.9%
Tract 1219.07, Block 2075	325 100.0%	300 92.3%	1 0.3%	1 0.3%	15 4.6%	0 0.0%	1 0.3%	7 2.2%	47 14.5%	70 21.5%
Tract 1219.07, Block 2080	201 100.0%	147 73.1%	16 8.0%	0 0.0%	12 6.0%	0 0.0%	11 5.5%	15 7.5%	65 32.3%	102 50.7%
Tract 1219.08, Block 2000	44 100.0%	44 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	14 31.8%	14 31.8%
Tract 1219.08, Block 2005	593 100.0%	505 85.2%	22 3.7%	1 0.2%	19 3.2%	0 0.0%	24 4.0%	22 3.7%	129 21.8%	184 31.0%

Geography	Total 2010 Population	White Only	Black or African American Only	American Indian/ Alaska Native Only	Asian Only	Native Hawaiian/ Other Pacific Islander Only	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Total Minority
Tract 1219.08, Block 2006	56	47	6	0	3	0	0	0	11	20
	100.0%	83.9%	10.7%	0.0%	5.4%	0.0%	0.0%	0.0%	19.6%	35.7%
Tract 1219.08, Block 2012	102	80	6	0	9	0	3	4	41	57
	100.0%	78.4%	5.9%	0.0%	8.8%	0.0%	2.9%	3.9%	40.2%	55.9%
Tract 1219.08, Block 2022	128	104	4	1	3	0	6	10	47	58
	100.0%	81.3%	3.1%	0.8%	2.3%	0.0%	4.7%	7.8%	36.7%	45.3%
Tract 1917.02, Block 2021	11	10	0	0	0	0	0	1	1	2
	100.0%	90.9%	0.0%	0.0%	0.0%	0.0%	0.0%	9.1%	9.1%	18.2%
Tract 1918.08, Block 1000	434	301	33	1	57	0	23	19	91	194
	100.0%	69.4%	7.6%	0.2%	13.1%	0.0%	5.3%	4.4%	21.0%	44.7%
Tract 1918.08, Block 2000	222	196	3	0	5	0	13	5	64	75
	100.0%	88.3%	1.4%	0.0%	2.3%	0.0%	5.9%	2.3%	28.8%	33.8%
Tract 1918.08, Block 2003	59	45	0	0	2	0	7	5	27	36
	100.0%	76.3%	0.0%	0.0%	3.4%	0.0%	11.9%	8.5%	45.8%	61.0%
Tract 1918.08, Block 2004	135	115	1	0	5	0	4	10	41	51
	100.0%	85.2%	0.7%	0.0%	3.7%	0.0%	3.0%	7.4%	30.4%	37.8%
Tract 1918.08, Block 2005	583	457	55	3	17	0	36	25	215	300
	100.0%	78.4%	9.4%	0.5%	2.9%	0.0%	4.5%	4.3%	36.9%	51.5%
Tract 1918.10, Block 1000	1,508	1,168	115	5	54	4	98	64	492	695
	100.0%	77.5%	7.6%	0.3%	3.6%	0.3%	6.5%	4.2%	32.6%	46.1%
Tract 1918.10, Block 1005	857	687	28	4	91	0	25	22	224	355
	100.0%	80.2%	3.3%	0.5%	10.6%	0.0%	2.9%	2.6%	26.1%	41.4%
Tract 1918.10, Block 1007	59	20	1	0	22	0	3	13	16	41
	100.0%	33.9%	1.7%	0.0%	37.3%	0.0%	5.1%	22.0%	27.1%	69.5%
Tract 1918.14, Block 1000	15	14	0	0	0	0	1	0	3	3
	100.0%	93.3%	0.0%	0.0%	0.0%	0.0%	6.7%	0.0%	20.0%	20.0%
Tract 1918.14, Block 1002	227	195	3	0	10	0	12	7	75	93
	100.0%	85.9%	1.3%	0.0%	4.4%	0.0%	5.3%	3.1%	33.0%	41.0%
Tract 1918.14, Block 1037	568	513	17	5	8	1	15	9	140	175
	100.0%	90.3%	3.0%	0.9%	1.4%	0.2%	2.6%	1.6%	24.6%	30.8%
Tract 1918.14, Block 2000	998	818	40	2	42	4	48	44	273	382
	100.0%	82.0%	4.0%	0.2%	4.2%	0.4%	4.8%	4.4%	27.4%	38.3%
Tract 1918.14, Block 2006	83	61	0	0	7	0	10	5	32	41
	100.0%	73.5%	0.0%	0.0%	8.4%	0.0%	12.0%	6.0%	38.6%	49.4%
Tract 1918.14, Block 2014	385	301	21	4	13	0	18	28	136	183
	100.0%	78.2%	5.5%	1.0%	3.4%	0.0%	4.7%	7.3%	35.3%	47.5%

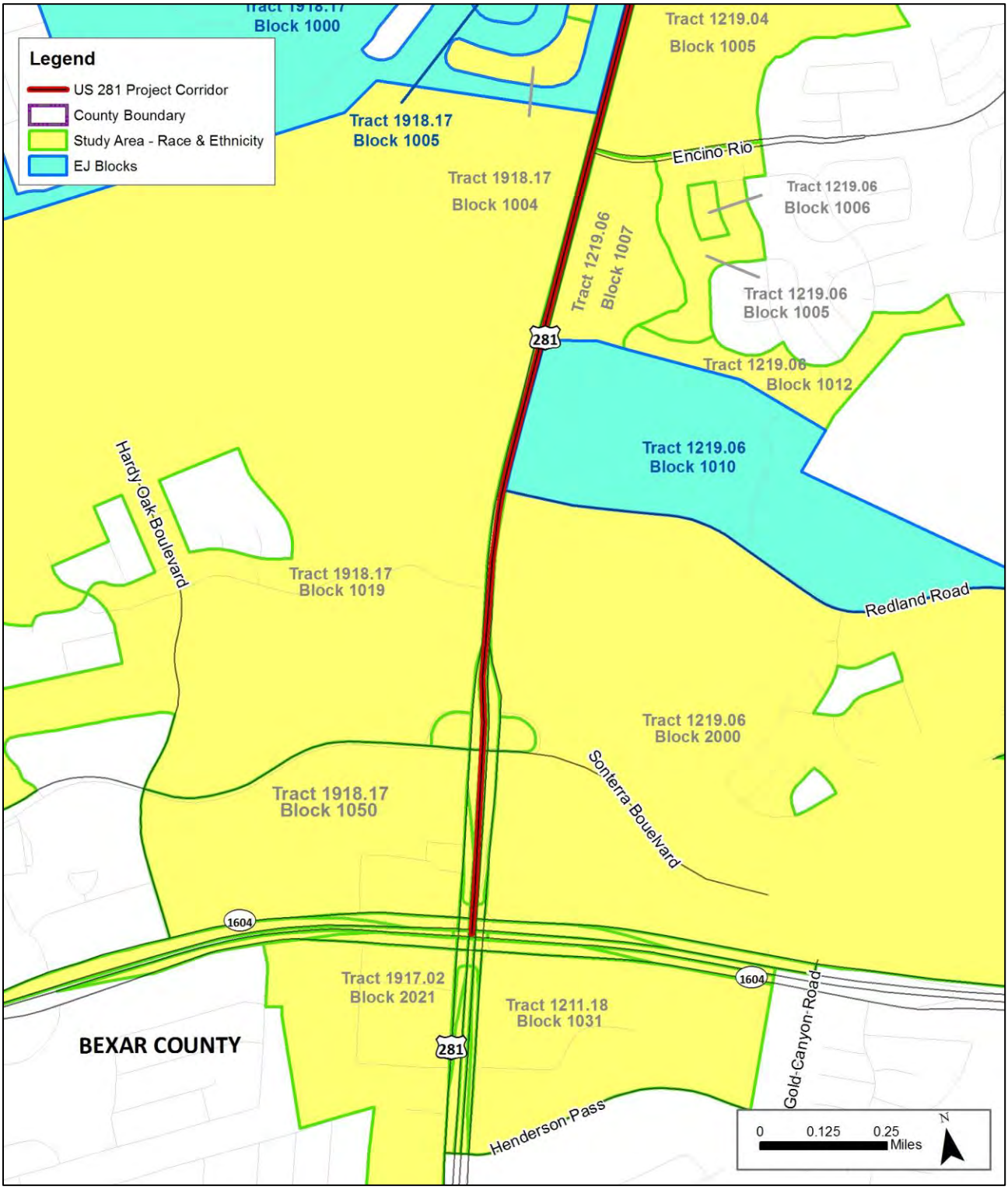
Geography	Total 2010 Population	White Only	Black or African American Only	American Indian/ Alaska Native Only	Asian Only	Native Hawaiian/ Other Pacific Islander Only	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Total Minority
Tract 1918.14, Block 2015	187 100.0%	115 61.5%	34 18.2%	2 1.1%	14 7.5%	0 0.0%	15 8.0%	7 3.7%	57 30.5%	109 58.3%
Tract 1918.17, Block 1000	1,103 100.0%	849 77.0%	50 4.5%	1 0.1%	116 10.5%	2 0.2%	45 4.1%	40 3.6%	374 33.9%	558 50.6%
Tract 1918.17, Block 1004	146 100.0%	130 89.0%	0 0.0%	0 0.0%	7 4.8%	0 0.0%	9 6.2%	0 0.0%	56 38.4%	63 43.2%
Tract 1918.17, Block 1005	88 100.0%	73 83.0%	1 1.1%	0 0.0%	11 12.5%	0 0.0%	0 0.0%	3 3.4%	31 35.2%	46 52.3%
Tract 1918.17, Block 1007	129 100.0%	101 78.3%	0 0.0%	3 2.3%	13 10.1%	0 0.0%	5 3.9%	7 5.4%	14 10.9%	34 26.4%
Tract 1918.17, Block 1019	1,281 100.0%	1,104 86.2%	39 3.0%	0 0.0%	72 5.6%	2 0.2%	19 1.5%	45 3.5%	212 16.5%	353 27.6%
Tract 1918.17, Block 1050	2 100.0%	2 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Tract 1918.17, Block 2001	986 100.0%	771 78.2%	61 6.2%	5 0.5%	76 7.7%	0 0.0%	51 5.2%	22 2.2%	364 36.9%	520 52.7%
Comal County Blocks										
Tract 3107.03, Block 1066	23 100.0%	23 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	12 52.2%	12 52.2%
Tract 3107.04, Block 4034	8 100.0%	4 50.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	4 50.0%	0 0.0%	8 100.0%	8 100.0%
Study Area for Race and Ethnicity										
Total	16,581 100.0%	13,130 79.2%	858 5.2%	56 0.3%	1,190 7.2%	21 0.1%	713 4.3%	613 3.7%	4,916 29.6%	7,335 44.2%

Source: U.S. Census Bureau, 2010a.

Note: Red-shading indicates greater than 50 percent minority population.

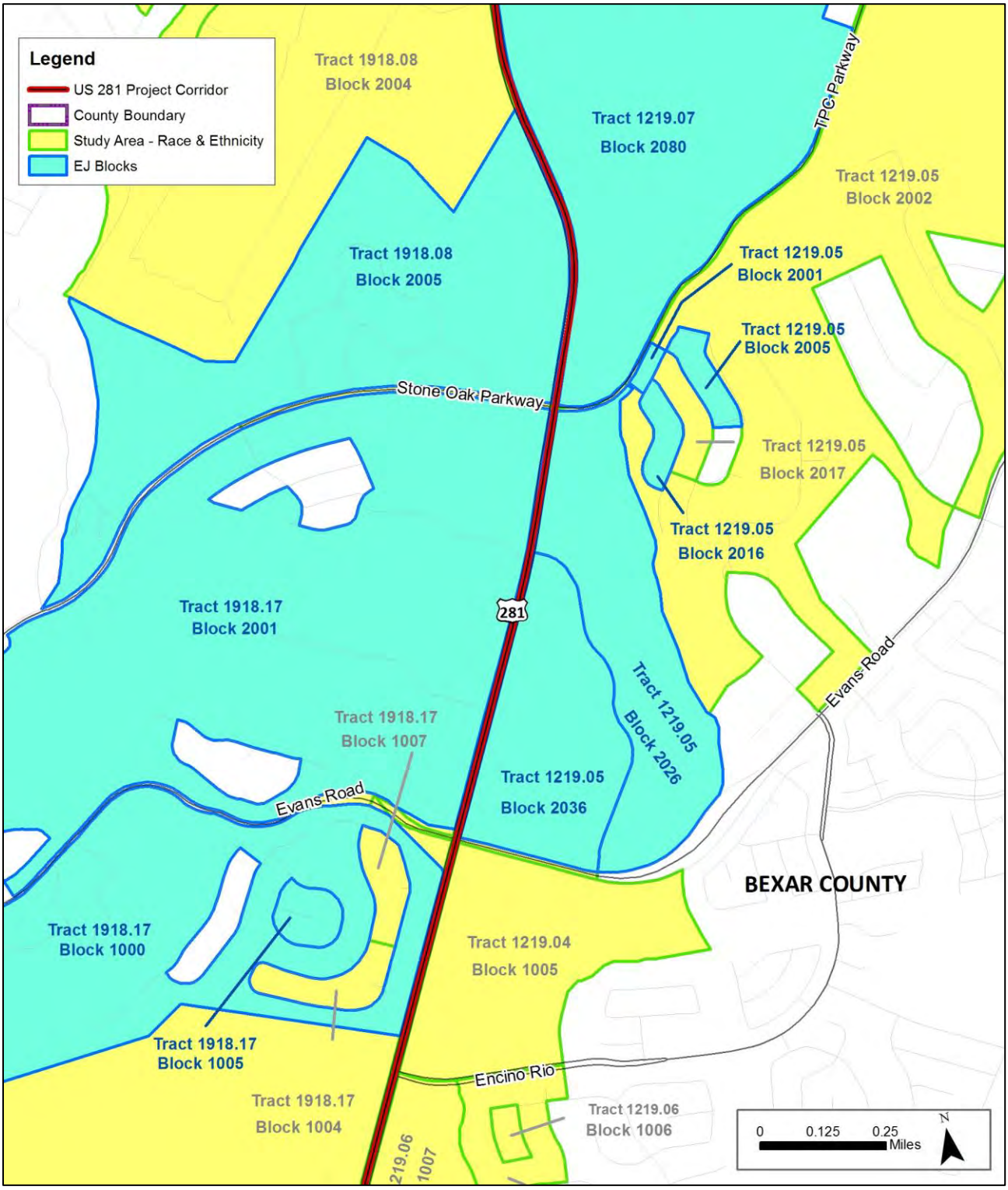
When applying the 50 percent threshold, 17 blocks, highlighted red in **Table 3-23** are identified as environmental justice blocks. **Figure 3-12a** through **Figure 3-12e** highlight where the environmental justice blocks have been identified in the Study Area for Race and Ethnicity.

Figure 3-12a: Environmental justice blocks in the study area for race and ethnicity



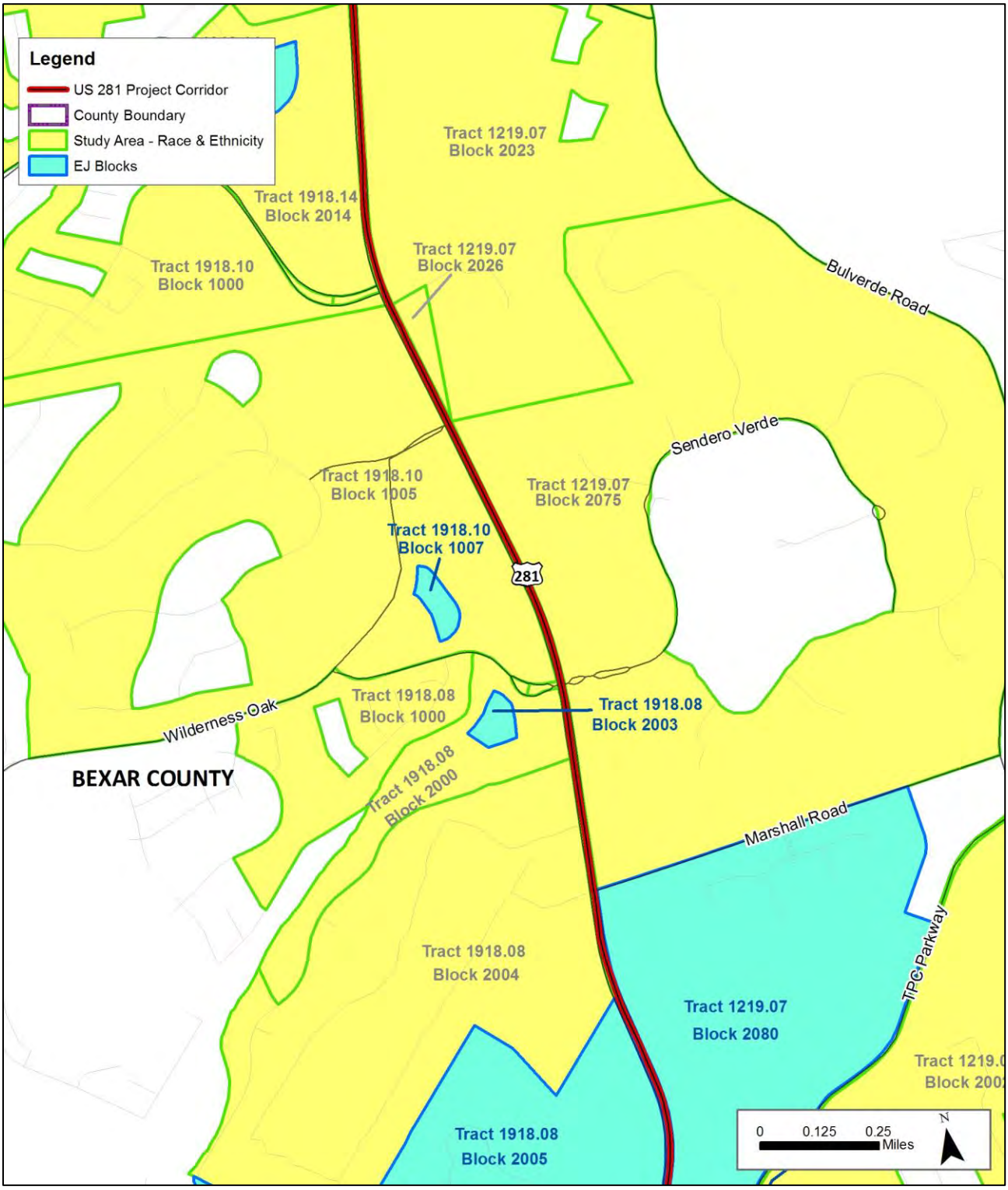
Source: U.S. Census Bureau, 2010a, US 281 EIS Team, December 2011.

Figure 3-12b: Environmental justice blocks in the study area for race and ethnicity



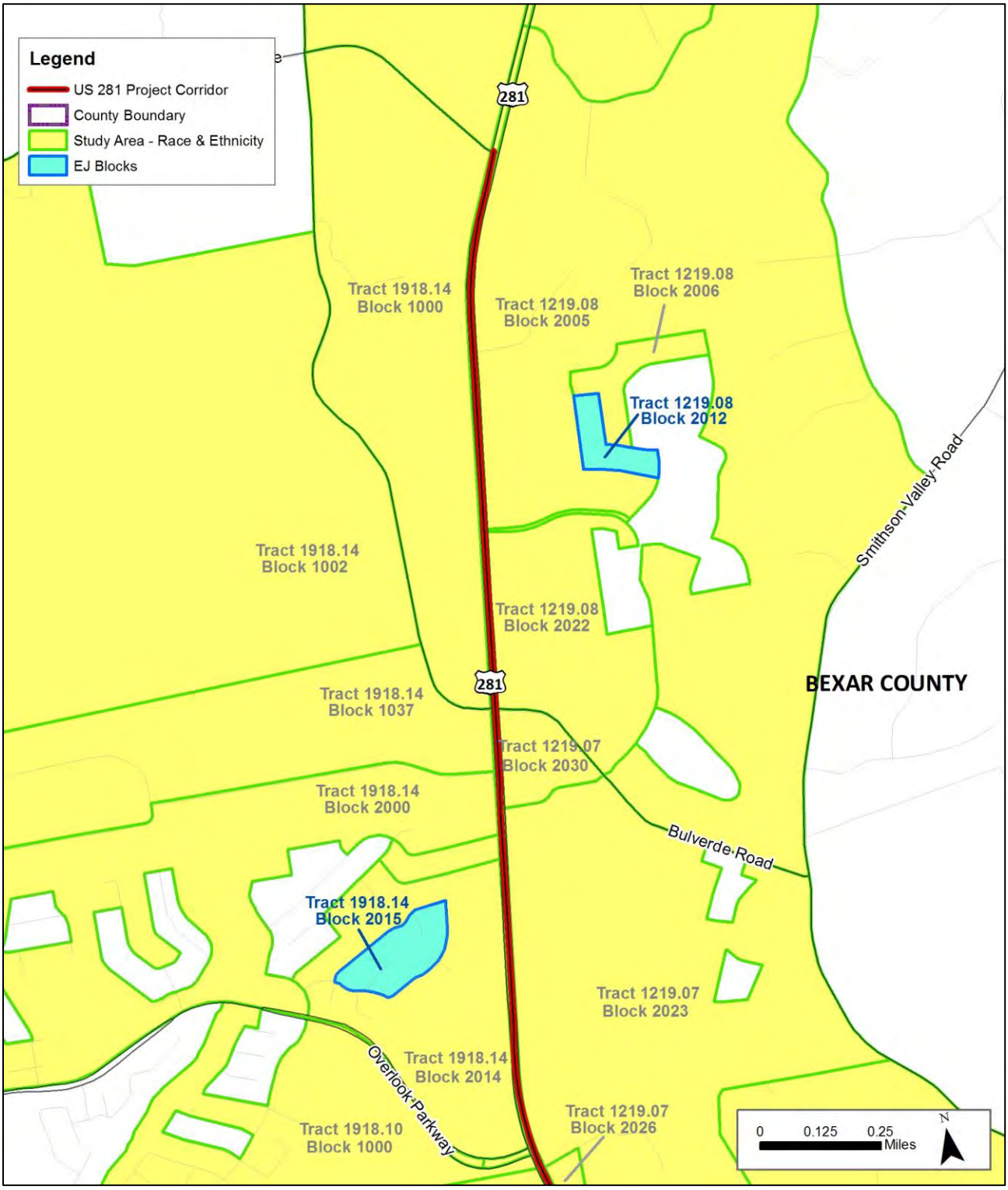
Source: U.S. Census Bureau, 2010a, US 281 EIS Team, December 2011.

Figure 3-12c: Environmental justice blocks in the study area for race and ethnicity



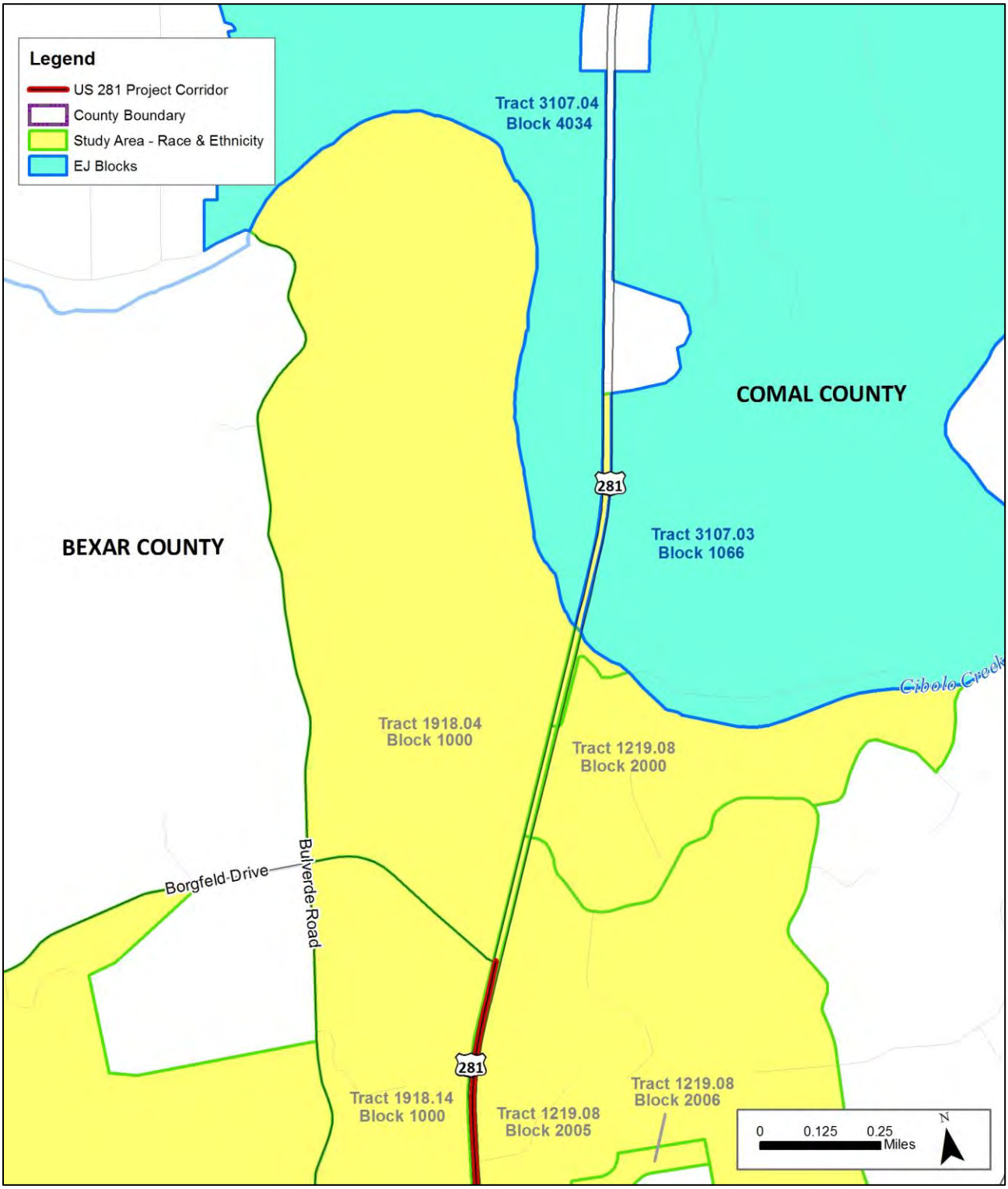
Source: US Census Bureau, 2010a, US 281 EIS Team, December 2011.

Figure 3-12d: Environmental justice blocks in the study area for race and ethnicity



Source: US Census Bureau, 2010a, US 281 EIS Team, December 2011.

Figure 3-12e: Environmental justice blocks in the study area for race and ethnicity



Source: US Census Bureau, 2010a, US 281 EIS Team, December 2011.

Low-Income Populations

Table 3-24 reviews the distribution of household income in the Study Area for Income and Poverty.

Table 3-24: Household Income in the Study Area for Income and Poverty – 2008-2012 ACS

Geography	Median Household Income	Total Households	Less than $10,000	$10,000 to $14,999	$15,000 to $19,999	Less than $19,999	$20,000 to $24,999	$25,000 to $29,000	$30,000 to $34,999	$35,000 to $39,999	$40,000 to $44,999	$45,000 to $49,999	$50,000 to $59,999	$60,000 to $74,999	$75,000 to $99,999	$100,000 to $124,999	$125,000 to $149,999	$150,000 to $199,999	$200,000 or More
Bexar County Block Groups																			
Tract 1211.18 Block Group 1	$109,545	482 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	12 2.5%	0 0.0%	37 7.7%	15 3.1%	23 4.8%	0 0.0%	55 11.4%	31 6.4%	41 8.5%	178 36.9%	26 5.4%	54 11.2%	10 2.1%
Tract 1219.04 Block Group 1	$78,542	337 100.0%	0 0.0%	0 0.0%	20 5.9%	20 5.9%	0 0.0%	37 11.0%	7 2.1%	40 11.9%	15 4.5%	0 0.0%	36 10.7%	11 3.3%	39 11.6%	62 18.4%	45 13.4%	0 0.0%	25 7.4%
Tract 1219.05 Block Group 2	$106,234	1,111 100.0%	24 2.2%	0 0.0%	0 0.0%	24 2.2%	0 0.0%	47 4.2%	71 6.4%	58 5.2%	29 2.6%	35 3.2%	23 2.1%	47 4.2%	176 15.8%	136 12.2%	142 12.8%	140 12.6%	183 16.5%
Tract 1219.06 Block Group 1	$107,944	1,040 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	26 2.5%	0 0.0%	23 2.2%	55 5.3%	63 6.1%	125 12.0%	207 19.9%	189 18.2%	162 15.6%	126 12.1%	64 6.2%
Tract 1219.06 Block Group 2	$59,392	959 100.0%	31 3.2%	54 5.6%	14 1.5%	99 10.3%	14 1.5%	0 0.0%	97 10.1%	23 2.4%	32 3.3%	116 12.1%	116 12.1%	85 8.9%	125 13.0%	58 6.0%	127 13.2%	39 4.1%	28 2.9%
Tract 1219.07 Block Group 2	$83,750	2,869 100.0%	0 0.0%	82 2.9%	56 2.0%	138 4.8%	24 0.8%	183 6.4%	58 2.0%	79 2.8%	87 3.0%	82 22.9%	235 8.2%	378 13.2%	497 17.3%	364 12.7%	268 9.3%	274 9.6%	202 7.0%
Tract 1219.08 Block Group 2	$117,105	394 100.0%	0 0.0%	5 1.3%	0 0.0%	5 1.3%	0 0.0%	0 0.0%	0 0.0%	7 1.8%	13 3.3%	12 3.0%	28 7.1%	32 8.1%	33 8.4%	85 21.6%	61 15.5%	68 17.3%	50 12.7%
Tract 1917.02 Block Group 2	$123,409	714 100.0%	0 0.0%	0 0.0%	40 5.6%	40 5.6%	15 2.1%	0 0.0%	0 0.0%	34 4.8%	14 2.0%	18 2.5%	69 9.7%	20 2.8%	75 10.5%	86 12.0%	15 2.1%	213 29.8%	115 16.1%
Tract 1918.04 Block Group 1	$79,756	332 100.0%	0 0.0%	12 3.6%	0 0.0%	12 3.6%	12 3.6%	0 0.0%	0 0.0%	0 0.0%	17 5.1%	18 5.4%	8 2.4%	62 18.7%	83 25.0%	18 5.4%	55 16.6%	25 7.5%	22 6.6%
Tract 1918.08 Block Group 1	$156,637	835 100.0%	6 0.7%	6 0.7%	0 0.0%	12 1.4%	0 0.0%	11 1.3%	18 2.2%	0 0.0%	0 0.0%	0 0.0%	38 4.6%	112 13.4%	62 7.4%	66 7.9%	61 7.3%	208 24.9%	247 29.6%
Tract 1918.08 Block Group 2	$99,226	489 100.0%	0 0.0%	20 4.1%	0 0.0%	20 4.1%	0 0.0%	0 0.0%	35 7.2%	0 0.0%	11 2.2%	8 1.6%	50 10.2%	0 0.0%	127 26.0%	170 34.8%	58 11.9%	0 0.0%	10 2.0%
Tract 1918.10 Block Group 1	$53,839	1,265 100.0%	92 7.3%	10 0.8%	57 4.5%	159 12.6%	33 2.6%	0 0.0%	61 4.8%	11 0.9%	243 19.2%	98 7.7%	34 2.7%	72 5.7%	227 17.9%	88 7.0%	84 6.6%	27 2.1%	128 10.1%
Tract 1918.14 Block Group 1	$72,961	637 100.0%	15 2.4%	68 10.7%	5 0.8%	88 13.8%	7 1.1%	24 3.8%	31 4.9%	70 11.0%	6 0.9%	0 0.0%	46 7.2%	62 9.7%	78 12.2%	84 13.2%	76 11.9%	43 6.8%	22 3.5%

Geography	Median Household Income	Total Households	Less than $10,000	$10,000 to $14,999	$15,000 to $19,999	Less than $19,999	$20,000 to $24,999	$25,000 to $29,000	$30,000 to $34,999	$35,000 to $39,999	$40,000 to $44,999	$45,000 to $49,999	$50,000 to $59,999	$60,000 to $74,999	$75,000 to $99,999	$100,000 to $124,999	$125,000 to $149,999	$150,000 to $199,999	$200,000 or More
Tract 1918.14 Block Group 2	$114,006	703 100.0%	0 0.0%	5 0.7%	8 1.1%	13 1.8%	0 0.0%	9 1.3%	0 0.0%	9 1.3%	9 1.3%	12 1.7%	11 1.6%	18 2.6%	157 22.3%	208 29.6%	64 9.1%	130 18.5%	63 9.0%
Tract 1918.17 Block Group 1	$72,000	2,616 100.0%	25 1.0%	130 5.0%	86 3.3%	241 9.2%	119 4.5%	25 1.0%	175 6.7%	15 0.6%	143 5.5%	139 5.3%	311 11.9%	266 10.2%	239 9.1%	253 9.7%	166 6.3%	301 11.5%	223 8.5%
Tract 1918.17 Block Group 2	$104,432	1,161 100.0%	0 0.0%	22 1.9%	39 3.4%	61 5.3%	8 0.7%	14 1.2%	0 0.0%	11 0.9%	80 6.9%	32 2.8%	151 13.0%	80 6.9%	135 11.6%	125 10.8%	183 15.8%	172 14.8%	109 9.4%
Comal County Block Groups																			
Tract 3107.03 Block Group 1	$64,167	820 100.0%	167 20.4%	50 6.1%	15 1.8%	232 28.3%	52 6.3%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	72 8.8%	48 5.9%	85 10.4%	46 5.6%	93 11.3%	28 3.4%	105 12.8%	59 7.2%
Tract 3107.04 Block Group 4	$53,792	581 100.0%	16 2.8%	0 0.0%	56 9.6%	72 12.4%	102 17.6%	22 3.8%	36 6.2%	18 3.1%	9 1.5%	0 0.0%	46 7.9%	39 6.7%	40 6.9%	49 8.4%	14 2.4%	134 23.1%	0 0.0%
Study Area for Income and Poverty																			
Study Area Total	$53,792 to $156,637	17,345 100.0%	376 2.2%	464 2.7%	396 2.3%	1,236 7.1%	398 2.3%	372 2.1%	652 3.8%	390 2.2%	754 4.3%	697 4.0%	1,368 7.9%	1,525 8.8%	2,387 13.8%	2,312 13.3%	1,635 9.4%	2,059 11.9%	1,560 9.0%

Source: U.S. Census Bureau 2012a and 2012g.
Note: Red shading indicates low-income households.

There are no block groups in the Study Area for Income and Poverty with median household incomes less than $19,999 and therefore none meet the EJ definition for income. There are households in the Study Area for Income and Poverty that are low-income. As highlighted in red in **Table 3-25**, there are a total of 1,236 households that earn an annual income less than $19,999 of which 376 earn less than $10,000, 464 earn between $10,000 and $14,999 and 396 earn between $15,000 and $19,999. However, there are no block groups in the Study Area for Income and Poverty with a majority share of low-income households.

Table 3-25 shows the ratio of the incomes earned by individuals living in the Study Area for Income and Poverty relative to the national poverty threshold. Note, the poverty thresholds used by the U.S. Census Bureau considered more factors than the poverty guidelines used by USDHHS and are therefore different. The USDHHS poverty guidelines are a simplified version of the US Census Bureau's poverty threshold. As highlighted in red, a ratio of less than 1.00 means that the income earned is less than the national poverty threshold. A ratio greater than 1.00 indicates that the income earned is greater than the poverty threshold.

Table 3-25: Ratio of Income to Poverty Threshold in the Study Area for Income and Poverty - 2008-2012 ACS

Census Track and Block Group	Total Population	Under 0.50	0.50 to 0.99	Less than 1.00	1.00 to 1.49	1.50 to 1.99	2.00 and Over
Bexar County Block Groups							
Tract 1211.18 Block Group 1	1,557 100.0%	0 0.0%	0 0.0%	0 0.0%	97 6.2%	149 9.6%	1,311 84.2%
Tract 1219.04 Block Group 1	1,063 100.0%	0 0.0%	161 15.1%	161 15.1%	0 0.0%	129 12.1%	773 72.7%
Tract 1219.05 Block Group 2	3,308 100.0%	45 1.4%	16 0.5%	61 1.8%	0 0.0%	99 3.0%	3,148 95.2%
Tract 1219.06 Block Group 1	2,841 100.0%	3 0.1%	7 0.2%	10 0.4%	72 2.5%	24 0.8%	2,735 96.3%
Tract 1219.06 Block Group 2	2,219 100.0%	61 2.7%	38 1.7%	99 4.5%	42 1.9%	199 9.0%	1,879 84.7%
Tract 1219.07 Block Group 2	8,838 100.0%	34 0.4%	137 1.6%	171 1.9%	181 2.0%	1,223 13.8%	7,263 82.2%
Tract 1219.08 Block Group 2	1,114 100.0%	10 0.9%	5 0.4%	15 1.3%	4 0.4%	0 0.0%	1,095 98.3%
Tract 1917.02 Block Group 2	2,046 100.0%	0 0.0%	0 0.0%	0 0.0%	37 1.8%	72 3.5%	1,937 94.7%
Tract 1918.04 Block Group 1	996 100.0%	6 0.6%	0 0.0%	6 0.6%	12 1.2%	0 0.0%	978 98.2%
Tract 1918.08 Block Group 1	2,547 100.0%	0 0.0%	24 0.9%	24 0.9%	73 2.9%	0 0.0%	2,450 96.2%
Tract 1918.08 Block Group 2	1,044 100.0%	0 0.0%	20 1.9%	20 1.9%	71 6.8%	0 0.0%	953 91.3%
Tract 1918.10 Block Group 1	3,361 100.0%	140 4.2%	72 2.1%	212 6.3%	115 3.4%	235 7.0%	2,799 83.3%
Tract 1918.14 Block Group 1	1,768 100.0%	20 1.1%	113 6.4%	133 7.5%	176 10.0%	262 14.8%	1,197 67.7%
Tract 1918.14 Block Group 2	2,315 100.0%	0 0.0%	31 1.3%	31 1.3%	60 2.6%	68 2.9%	2,156 93.1%

Census Track and Block Group	Total Population	Under 0.50	0.50 to 0.99	Less than 1.00	1.00 to 1.49	1.50 to 1.99	2.00 and Over
Bexar County Block Groups							
Tract 1918.17 Block Group 1	6,527	141	113	254	416	451	5,406
	100.0%	2.2%	1.7%	3.9%	6.4%	6.9%	82.8%
Tract 1918.17 Block Group 2	3,735	10	177	187	77	308	3,163
	100.0%	0.3%	4.7%	5.0%	2.1%	8.2%	84.7%
Comal County Block Groups							
Tract 3107.03 Block Group 1	2,378	468	269	737	56	0	1,585
	100.0%	19.7%	11.3%	31.0%	2.4%	0.0%	66.7%
Tract 3107.04 Block Group 4	1,409	33	37	70	62	343	934
	100.0%	2.3%	2.6%	5.0%	4.4%	24.3%	66.3%
Study Area for Income and Poverty							
Total	49,066	971	1,220	2,191	1,551	3,562	41,762
	100.0%	2.0%	2.5%	4.5%	3.2%	7.3%	85.1%

Source: U.S. Census Bureau, 2012e.

Note: Red shading indicates income less than the national poverty level.

According to **Table 3-25**, there were 2,191 people in the Study Area for Income and Poverty in 2012 that earned an income less than the national poverty threshold.

Environmental Consequences

Improvements to US 281 could potentially adversely affect EJ populations if ROW acquisition displaces or adversely affects the property where EJ populations live and/or work. An affected property is one where the ROW acquisition does not adversely affect a structure and/or does not reduce the economic viability of the remaining land. This type of ROW acquisition is generally acquired through an easement or purchased in fee-simple. A displacement occurs if a structure is impacted by the acquisition of ROW and/or the remaining land after ROW acquisition would not be useful for its intended use. A displacement could also occur if access to the property is permanently restricted. This type of ROW acquisition is generally purchased in fee-simple. All ROW acquisition will be conducted in compliance with the Uniform Act.

The Uniform Act was established to ensure equitable treatment of all persons displaced as a direct result of federal actions and to maintain the economic and social well-being of the community. The policies of the Uniform Act ensure that displaced persons do not suffer disproportionate injuries as a result of a project designed for the benefit of the public as a whole. Relocation assistance must, to the maximum extent feasible, assure that the unique circumstances of any displaced person are taken into account and that persons in essentially similar circumstances are afforded equal treatment. In addition, it mandates that available housing must be within the financial means of all displaced persons, including low-income families, and open to all persons regardless of race, color, sex, religion, or national origin (42 USC 4621).

Impacts to Residential Properties

The Elevated Expressway Alternative has the potential to:

- incorporate a portion of land from seven single-family residential parcels; one affected parcel is located in an environmental justice block
- incorporate a portion of land from one multi-family residential parcel; the affected parcel is located in an environmental justice block
- no residences would be displaced

The Preferred Expressway Alternative has the potential to:

- incorporate a portion of land from 3 single-family residential parcels; 1 affected parcel is located in an environmental justice block
- incorporate a portion of land from 1 multi-family residential parcel; the affected parcel is located in an environmental justice block
- no residences would be displaced

A displacement and relocation alternative analysis was conducted in accordance with the Uniform Act (see **Section 3.4.5 Displacements and Relocation**). Based on this analysis the acquisition of residential property would not result in a displacement and would not preclude the use of the affected properties for residential use.

Displaced Businesses

Improvements to US 281 have the potential to impact environmental justice populations through the displacement of businesses, thereby removing employment and/or services that may be relied upon by low-income and/or minority populations. According to a parcel level review of the businesses that could be displaced by the Build Alternatives:

- All of the potentially displaced businesses employ and provide goods and services for all people, environmental justice and non- environmental justice populations alike.
- The Elevated Expressway Alternative has the potential to displace 28 businesses. Combined, businesses employ approximately 169 to 194 people. 15 of the 28 businesses are located in environmental justice blocks. None of the potentially displaced businesses provide for the basic needs of the community, such as a supermarket does. All of the potentially displaced businesses employ and provide goods and services for all people, environmental justice and non- environmental justice populations alike.
- The Preferred Expressway Alternative has the potential to displace 21 businesses. Combined, businesses employ approximately 162 to 188 people. 11 of the 21 businesses are located in environmental justice blocks. None of the potentially displaced businesses provide for the basic needs of the community, such as a supermarket does. All of the potentially displaced businesses employ and provide goods and services for all people, environmental justice and non- environmental justice populations alike.

The displacements and relocations analysis conducted for the US 281 Corridor Project shows that a sufficient amount of commercial, retail, office and industrial space, appropriately zoned, would likely be available to absorb the relocation of the displaced businesses. It is possible that the displaced businesses may not wish to relocate in the US 281 project corridor and/or may discontinue business operations. As such, there is a potential for some lost employment opportunities. The loss of employment could adversely affect both environmental justice and non-environmental justice populations alike; as such these effects are unlikely to have a disproportionately high and adverse impact on environmental justice populations. The Alamo RMA will partner with the Texas Workforce Commission (TWC) to assist the potentially displaced businesses and their employees with relocation.

Financial Options

Toll roads have the potential to disproportionately affect EJ populations because a low-income person would have to use a larger percentage of his or her income to pay tolls when compared to the general population, given the same level of use. The Elevated Expressway Alternative was considered for non-toll, toll and managed lane options and the Preferred Expressway Alternative would include managed lanes. Therefore, consideration was given to determine if there would be a disproportionately high and adverse effect resulting from the operation of US 281 with toll and/or managed lanes.

The MPO studied the effects of the existing and planned regional network of toll and managed lanes on EJ populations (see **Appendix F** to review the MPO's findings in *Regional Toll and Managed Lane Analysis*, July 2014). The findings from the *Regional Toll and Managed Lane Analysis* were used to evaluate the potential effects of the toll/managed lanes proposed for the US 281 Corridor Project on EJ populations (see **Appendix E**). The findings from the project level analysis are summarized below.

Under the No-Build Alternative traffic congestion on the US 281 project corridor is expected to worsen. The average speed of traffic in 2035 is expected to be 9 to 10 miles per hour (mph) during peak hours; these conditions will affect both EJ and non-EJ populations alike. If the Preferred Expressway Alternative were to be implemented, the managed lanes would be subject to tolls and the at-grade outer lanes would be non-toll. All people could choose to travel along the at-grade non-toll outer lanes to avoid paying tolls or could choose to use the managed lanes. Both the at-grade non-toll outer lanes and the managed lanes would offer improved traffic speeds over the No-Build Alternative. As such, all motorists, EJ and non-EJ alike, stand to benefit from the creation of new capacity whether or not tolls are used to finance the improvements.

The *Amended and Restated Policies for Toll Collection Operations on the Alamo RMA Turnpike System* (April 2012) outlines the tolling policies for the US 281 Corridor Project as well as other proposed regional toll facilities. The updated toll prices range from $0.17 per mile to $0.50 per mile. The financial burden of the upper and lower values of this range, as well as a mid-range ($0.32 per mile) was analyzed for its effect on EJ populations (**Table 3-26**).

Table 3-26: Toll Cost Analysis

Toll Cost per mile	Daily Round Trip Cost	Yearly Cost*	Percent of Median Household Income		
			Bexar County ($49,141)	Comal County ($63,480)	Poverty Line ($19,229**)
$0.17	$2.72	$680	1.4%	1.1%	3.5%
$0.32	$5.12	$1,280	2.6%	2.0%	6.7%
$0.50	$8.00	$2,000	4.1%	3.2%	10.4%

Source: SA-BC MPO Traffic Model, 2009, US Census Bureau, 2008-2012 American Community Survey, Median Household Income in the Past 12 Months (2012 Dollars), USDHHS 2014 Poverty Guidelines, US 281 EIS Team, 2012.
* Assumes 5 rounds trips per week for 50 weeks out of the year.
**$19,109 represents the 2014 USDHHS poverty guideline for a 3-person household, as adjusted to 2012 dollars using the Consumer Price Index.

A person with a household income at the 2014 USDHHS poverty guideline would spend between 3.5 and 10.4 percent of their annual income on tolls, assuming that they use the toll/managed lanes for both inbound and outbound trips along the complete corridor, 5 days per week for 50 weeks out of the year. This financial burden to low-income populations is unlikely to be realized because the Preferred Expressway Alternative would provide non-toll direct connector ramps at US 281/Loop 1604, non-toll expressway lanes between Loop 1604 and Stone Oak Parkway, and non-toll, at-grade outer lanes from Loop 1604 to Borgfeld Drive, which would offer better travel speeds than if no improvements were made. After considering the potential burdens and benefits of the toll/managed lanes options of the Build Alternatives, the project level toll analysis concludes that there would not be disproportionately high and adverse effects to EJ populations.

While there are no EJ block groups within the demographic study area that meet the definition of low-income, low-income populations do exist in the larger region who use the US 281 project corridor; therefore, disproportionately high and adverse impacts are considered on the regional scale (see **Appendix F**). The regional level analysis conducted by the MPO concludes that there would likely be no adverse impacts to EJ populations resulting from the implementation of the toll/managed lane roadway system, in conjunction with the other non-toll facilities planned in *Mobility 2035*. As such, it is unlikely that low-income populations in the region would be disproportionately burdened under a toll/managed lane scenario.

Conclusion and Proposed Mitigation Measures

Potential Effects to Minority and Low-Income Populations

Under the No-Build Alternative it is unlikely that low-income or minority populations would experience disproportionately high and adverse impacts. The No-Build Alternative could result in reduced mobility along the US 281 project corridor, as discussed in **Section 3.6 Transportation Facilities**. A reduction in mobility could, in turn, result in adverse effects to all people, including EJ populations. For example, slow travel speeds could require more time to commute to and from work.

No disproportionately high and adverse impacts to minority and/or low-income populations are likely to occur as a result of either of the Build Alternatives under consideration for the US 281 Corridor Project. The Build Alternatives have the potential to displace businesses and could have the effect of displacing jobs within the US 281 project corridor, which could in turn have an adverse effect on the EJ population. However, none of the potentially displaced businesses are major employers nor do they provide for the basic needs of the community overall. The displacement and relocation analysis conducted for the US 281 Corridor Project shows there would be a sufficient amount of commercial, retail, office and industrial space available to absorb the relocation of the displaced businesses.

As described in **Chapter 2 - Alternatives Analysis**, the Build Alternatives were considered for non-toll, toll and managed lanes options and the Preferred Expressway Alternative would include managed lanes. The effects of the toll/managed lanes options on the EJ population were analyzed in two technical memos (**Appendix E** at the project level and **Appendix F** at the regional level). The project level analysis concludes that the Build Alternatives offer a net benefit to all people when compared to the No-Build Alternative, regardless of whether a person chooses a toll or non-toll route. And, the regional level analysis concludes that no disproportionately high and adverse impacts to EJ populations would likely result from the implementation of the regional toll/managed lane roadway system, in conjunction with the non-toll facilities and other regional transportation alternatives, as planned in *Mobility 2035*.

No disproportionately high and adverse effects are anticipated to result from implementation of the Build Alternatives. Public outreach efforts will continue throughout the project development process to ensure the full and fair participation of all people, including EJ populations, in the decision-making process.

Limited English Proficiency

Background

NEPA requires that projects undergoing scoping and environmental analysis and review communicate with local residents who could be affected by the construction and operations of a proposed project. Meaningful communication includes conveying messages, reports, and other materials in language(s) that local citizens can understand to the greatest extent practical. LEP is defined as having "limited ability to read, write, speak, or understand English" (67 Federal Register (FR) 41459).

Methodology

Data from the 2008-2012 ACS were gathered at the Census tract level to identify if there are LEP populations in the demographic study area that could be affected by the US 281 Corridor Project. As Census data is self-reported, an individual's ability to speak English represents the respondent's own perception about his/her ability to speak English.

Two approaches were taken to determine if those that speak languages other than English have limited ability to read, write or speak English. The first approach looks at the languages spoken in the demographic study area and identifies individuals living in the demographic study area that speak English less than very well, as highlighted in **Table 3-27**. The second approach focuses on identifying households within the demographic study area that are linguistically isolated (**Table 3-28**). See **Appendix G** for detailed tables by Census tract.

Affected Environment

As **Table 3-27** shows, approximately 76.6 percent of the people who live in the demographic study area speak English only. Of those that speak a language other than English and speak English less than very well, most speak Spanish or Spanish Creole (19,146 people), followed by: German (892 people); Hindi (732 people); Chinese (588 people); and Korean (449 people). Of those that speak a language other than English and speak English less than very well, most (3.9 percent) speak Spanish or Spanish Creole, followed by French including Patois and Cajun (0.2 percent); Korean (0.2 percent); Hindi (0.2 percent); and Chinese (0.2 percent).

Table 3-27: Population within the Demographic Study Area that Speak English Less than Very Well

Language		Demographic Study Area Total
	Total Population	110,629 100.0%
English Only	Total Speakers	84,751 76.6%
Spanish or Spanish Creole	Total Speakers	19,146 17.3%
	Speaks English Less than Very Well	4,305 3.9%
German	Total Speakers	892 0.8%
	Speaks English Less than Very Well	105 0.1%
Hindi	Total Speakers	732 0.7%
	Speaks English Less than Very Well	220 0.2%

Language		Demographic Study Area Total
Chinese	Total Speakers	588 0.5%
	Speaks English Less than Very Well	217 0.2%
Korean	Total Speakers	449 0.4%
	Speaks English Less than Very Well	228 0.2%
Gujarati	Total Speakers	442 0.4%
	Speaks English Less than Very Well	92 0.1%
Tagalog	Total Speakers	409 0.4%
	Speaks English Less than Very Well	108 0.1%
Vietnamese	Total Speakers	395 0.4%
	Speaks English Less than Very Well	219 0.2%
French (including Patois and Cajun)	Total Speakers	389 0.4%
	Speaks English Less than Very Well	248 0.2%
Urdu	Total Speakers	352 0.3%
	Speaks English Less than Very Well	117 0.1%
African Languages	Total Speakers	342 0.3%
	Speaks English Less than Very Well	14 0.0%
Other Asian Languages	Total Speakers	296 0.3%
	Speaks English Less than Very Well	29 0.0%
Russian	Total Speakers	265 0.2%
	Speaks English Less than Very Well	58 0.1%
Persian	Total Speakers	175 0.2%
	Speaks English Less than Very Well	0 0.0%
Thai	Total Speakers	169 0.2%
	Speaks English Less than Very Well	32 0.0%

Language		Demographic Study Area Total
Portuguese or Portuguese Creole	Total Speakers	120 0.1%
	Speaks English Less than Very Well	18 0.0%
Japanese	Total Speakers	105 0.1%
	Speaks English Less than Very Well	53 0.0%
Other West Germanic Languages	Total Speakers	95 0.1%
	Speaks English Less than Very Well	5 0.0%
Italian	Total Speakers	80 0.1%
	Speaks English Less than Very Well	0 0.0%
Greek	Total Speakers	80 0.1%
	Speaks English Less than Very Well	0 0.0%
Other Indic Languages	Total Speakers	72 0.1%
	Speaks English Less than Very Well	0 0.0%
Other Pacific Island Languages	Total Speakers	66 0.1%
	Speaks English Less than Very Well	30 0.0%
Arabic	Total Speakers	64 0.1%
	Speaks English Less than Very Well	18 0.0%
Hebrew	Total Speakers	58 0.1%
	Speaks English Less than Very Well	10 0.0%
Hungarian	Total Speakers	57 0.1%
	Speaks English Less than Very Well	0 0.0%
Polish	Total Speakers	18 0.0%
	Speaks English Less than Very Well	0 0.0%
Other Slavic Languages	Total Speakers	12 0.0%
	Speaks English Less than Very Well	0 0.0%

Language		Demographic Study Area Total
Serbo-Croatian	Total Speakers	10 0.0%
	Speaks English Less than Very Well	0 0.0%

Source: U.S Census Bureau, 2012b.

The US Census Bureau uses the term "linguistically isolated" to refer to those households where all members, 14 years of age and older "have at least some difficulty with English." These data are important to understand as they reveal the need for translation services to ensure LEP populations are offered full and fair participation in the decision-making process for the US 281 Corridor Project.

Table 3-28 shows that there are linguistically isolated households in the demographic study area; 675 households or 1.7 percent of all households in the demographic study area, speak Spanish; 185 households (0.5 percent) speak an Indo-European language; and 121 households (0.3 percent) speak an Asian or Pacific Islands language.

Table 3-28: Linguistically Isolated Households in the Demographic Study Area

Geography	Total Households	English Only	Spanish			Other Indo-European Languages			Asian and Pacific Island Languages			Other Languages		
			Total	Isolated	Not Isolated	Total	Isolated	Not Isolated	Total	Isolated	Not Isolated	Total	Isolated	Not Isolated
Bexar County Tract 1219.03	1,749 100.0%	1,265 72.3%	366 20.9%	6 0.3%	360 20.6%	94 5.4%	0 0.0%	94 5.4%	24 1.4%	0 0.0%	24 1.4%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1219.04	1,214 100.0%	870 71.7%	170 14.0%	11 0.9%	159 13.1%	36 3.0%	0 0.0%	36 3.0%	89 7.3%	0 0.0%	89 7.3%	49 4.0%	0 0.0%	49 4.0%
Bexar County Tract 1219.05	1,641 100.0%	1,154 70.3%	298 18.2%	14 0.9%	284 17.3%	95 5.8%	24 1.5%	71 4.3%	80 4.9%	24 1.5%	56 3.4%	14 0.9%	0 0.0%	14 0.9%
Bexar County Tract 1219.06	1,999 100.0%	1,263 63.2%	617 30.9%	38 1.9%	579 29.0%	63 3.2%	0 0.0%	63 3.2%	19 1.0%	0 0.0%	19 1.0%	37 1.9%	0 0.0%	37 1.9%
Bexar County Tract 1219.07	3,171 100.0%	2,147 67.7%	786 24.8%	73 2.3%	713 22.5%	89 2.8%	26 0.8%	63 2.0%	88 2.8%	10 0.3%	78 2.5%	61 1.9%	0 0.0%	61 1.9%
Bexar County Tract 1219.08	701 100.0%	501 71.5%	189 27.0%	23 3.3%	166 23.7%	11 1.6%	0 0.0%	11 1.6%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1219.09	1,469 100.0%	932 63.4%	436 29.7%	13 0.9%	423 28.8%	14 1.0%	0 0.0%	14 1.0%	87 5.9%	11 0.7%	76 5.2%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1219.10	1,418 100.0%	1,035 73.0%	313 22.1%	12 0.8%	301 21.2%	7 0.5%	0 0.0%	7 0.5%	56 3.9%	4 0.3%	52 3.7%	7 0.5%	0 0.0%	7 0.5%
Bexar County Tract 1918.04	2,052 100.0%	1,549 75.5%	366 17.8%	0 0.0%	366 17.8%	70 3.4%	0 0.0%	70 3.4%	59 2.9%	0 0.0%	59 2.9%	8 0.4%	0 0.0%	8 0.4%
Bexar County Tract 1918.08	1,234 100.0%	900 68.0%	27 2.0%	363 27.4%	34 2.6%	0 0.0%	34 2.6%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.09	1,760 100.0%	1,272 72.3%	379 21.5%	36 2.0%	343 19.5%	94 5.3%	0 0.0%	94 5.3%	15 0.9%	0 0.0%	15 0.9%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.10	1,867 100.0%	1,112 59.6%	522 28.0%	12 0.6%	510 27.3%	90 4.8%	0 0.0%	90 4.8%	143 7.7%	0 0.0%	143 7.7%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.11	1,124 100.0%	768 68.3%	236 21.0%	44 3.9%	192 17.1%	50 4.4%	0 0.0%	50 4.4%	70 6.2%	0 0.0%	70 6.2%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.12	1,205 100.0%	682 56.6%	311 25.8%	11 0.9%	300 24.9%	124 10.3%	0 0.0%	124 10.3%	88 7.3%	14 1.2%	74 6.1%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.13	2,114 100.0%	1,437 68.0%	539 25.5%	24 1.1%	515 24.4%	97 4.6%	15 0.7%	82 3.9%	41 1.9%	0 0.0%	41 1.9%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.14	1,340 100.0%	726 54.2%	441 32.9%	62 4.6%	379 28.3%	78 5.8%	18 1.3%	60 4.5%	74 5.5%	50 3.7%	24 1.8%	21 1.6%	0 0.0%	21 1.6%

Geography	Total Households	English Only	Spanish			Other Indo-European Languages			Asian and Pacific Island Languages			Other Languages		
			Total	Isolated	Not Isolated	Total	Isolated	Not Isolated	Total	Isolated	Not Isolated	Total	Isolated	Not Isolated
Bexar County Tract 1918.15	1,740 100.0%	1,191 68.4%	392 22.5%	10 0.6%	382 22.0%	101 5.8%	55 3.2%	46 2.6%	45 2.6%	0 0.0%	45 2.6%	11 0.6%	0 0.0%	11 0.6%
Bexar County Tract 1918.16	1,099 100.0%	744 67.7%	230 20.9%	21 1.9%	209 19.0%	85 7.7%	0 0.0%	85 7.7%	40 3.6%	0 0.0%	40 3.6%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.17	3,777 100.0%	2,418 64.0%	921 24.4%	85 2.3%	836 22.1%	275 7.3%	42 1.1%	233 6.2%	131 3.5%	8 0.2%	123 3.3%	32 0.8%	0 0.0%	32 0.8%
Comal County Tract 3107.01	2,039 100.0%	1,815 89.0%	216 10.6%	0 0.0%	216 10.6%	8 0.4%	0 0.0%	8 0.4%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Comal County Tract 3107.02	1,625 100.0%	1,365 84.0%	230 14.2%	14 0.9%	216 13.3%	30 1.8%	5 0.3%	25 1.5%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Comal County Tract 3107.03	1,972 100.0%	1,414 71.7%	290 14.7%	93 4.7%	197 10.0%	268 13.6%	0 0.0%	268 13.6%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Comal County Tract 3107.04	2,098 100.0%	1,736 82.7%	277 13.2%	46 2.2%	231 11.0%	31 1.5%	0 0.0%	31 1.5%	54 2.6%	0 0.0%	54 2.6%	0 0.0%	0 0.0%	0 0.0%
Demographic Study Area Total	40,498 100.0%	28,296 69.9%	8,915 22.0%	675 1.7%	8,240 20.3%	1,844 4.6%	185 0.5%	1,659 4.1%	1,203 3.0%	121 0.3%	1,082 2.7%	240 0.6%	0 0.0%	240 0.6%

Source: U.S Census Bureau, 2012c.

Conclusion and Proposed Mitigation

In order to provide meaningful communication to the people living in the demographic study area, project materials were made available in the dominant languages spoken (English and Spanish), and reasonable accommodation was available for speakers of other languages, as detailed in **Chapter 6 - Public and Agency Coordination**. In compliance with EO 13166, the public involvement activities and communications for the US 281 Corridor Project are conducted to ensure full and fair participation.

3.5 PEDESTRIAN AND BICYCLE FACILITIES

3.5.1 Methodology

Information about the existing and proposed pedestrian and bicycle facilities along the US 281 project corridor was obtained via field reconnaissance and through review of the Pedestrian and Bicycle chapters in *Mobility 2035,* which includes current and proposed bicycle corridor maps, and MPO's *Regional Bicycle Master Plan*. The data collected was used to ascertain the environmental consequences to pedestrian and bicycle facilities as a result of the Build Alternatives and the No-Build Alternative.

3.5.2 Affected Environment

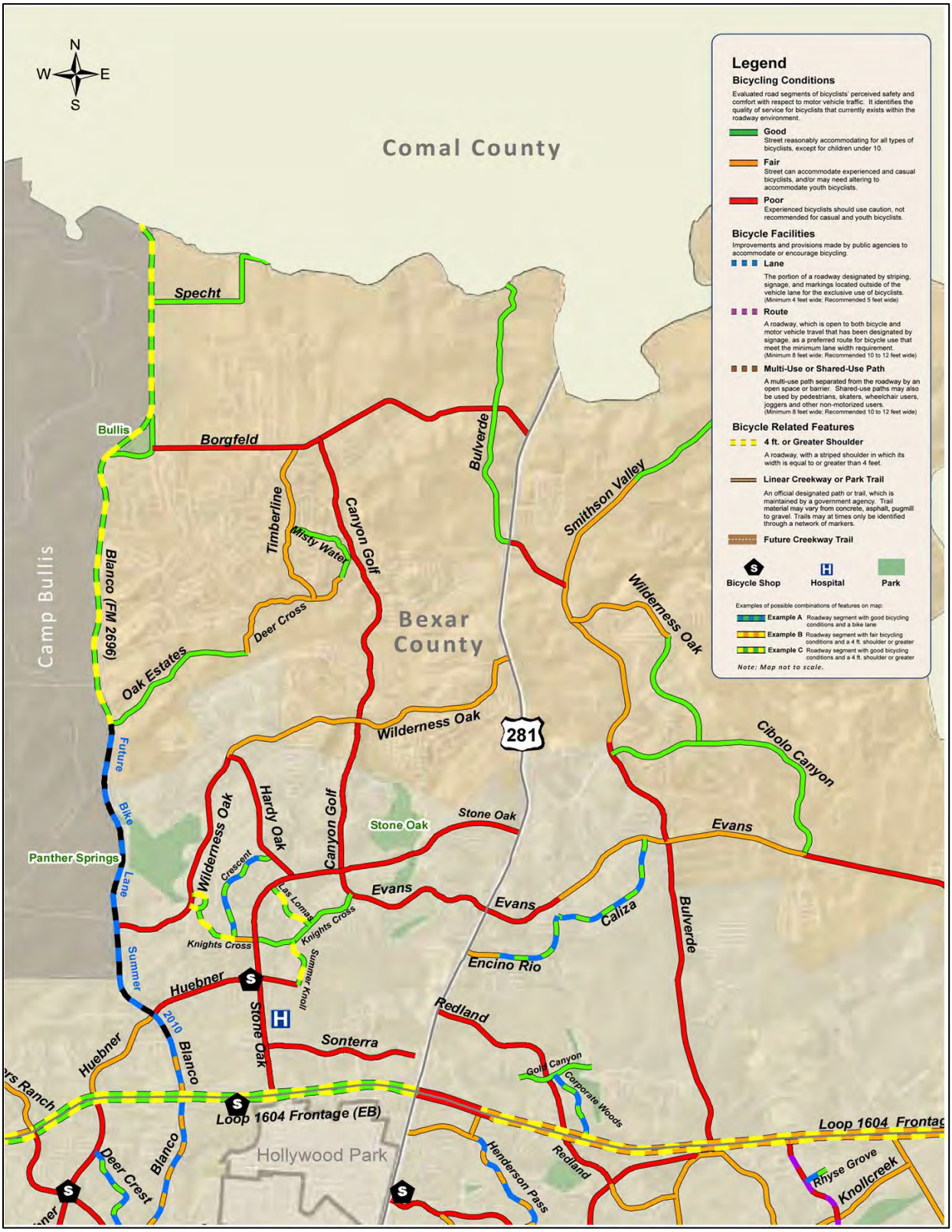
Currently, there are limited pedestrian facilities (i.e. sidewalks) within the US 281 project corridor. Several cross walks have been built in conjunction with the US 281 Super Street. The MPO identified five goals and objectives which would "support comprehensive, coordinated and continuous regional planning for pedestrian facilities". The five goals include:

1) develop a regional pedestrian system
2) provide a safe pedestrian system
3) employ accessible, barrier-free, state-of-the-art design
4) engage the public in the transportation planning process
5) identify and efficiently use available funding

The MPO's Pedestrian Mobility Advisory Committee (PMAC) supports several unfunded sidewalk projects; one project is located at Evans Road and Bulverde Road, approximately 1.5 miles east of US 281. According to *Mobility 2035*, there are no other planned sidewalk projects located in the US 281 project corridor.

There is one bike facility with a dedicated bike lane in the corridor, which is located at US 281 and Encino Rio, east of US 281. The MPO defines a bike lane as "the portion of a roadway designated by striping, signage, and markings located outside of the vehicle lane for the exclusive use of bicycles" (SA-BC MPO 2009c). The MPO's *Regional Bicycle Master Plan* has been adopted and has conducted three data collection efforts in 2001, 2006 and 2009, resulting in a series of *Bicycle Route Sustainability Maps*. As of 2009, there are approximately 136 miles of on-road bicycle facilities in San Antonio; an increase of approximately 70 miles from 2004. The *2009 Bicycle Conditions Map* shows road segments that have been evaluated based on bicyclists' perceived safety and comfort with respect to motor vehicle traffic. It identifies the quality of service that currently exists within the roadway environment for bicyclists. The map shows "poor" bicycling conditions at all intersections within the US 281 project corridor, north of Loop 1604, except for at Encino Rio. **Figure 3-13** shows the existing bicycle conditions and the proposed bicycle facilities around the US 281 project corridor. Bicycle facilities have been planned on most streets that cross US 281, but not on the US 281 project corridor itself, as approved by the San Antonio City Council and Bexar County in 2005.

Figure 3-13: Recommended bicycle corridor map



Source: SA-BC MPO, 2009e.

3.5.3 Environmental Consequences

No-Build Alternative

Under the No-Build Alternative no additional pedestrian or bicycle facilities beyond the planned improvements would be developed. Pedestrian and bicycle safety could decline due to an increase in vehicle congestion on the US 281 project corridor and existing cross streets.

Build Alternatives

The Build Alternatives include a provision for bicycle and pedestrian facilities within the US 281 project corridor ROW on both the east and west side of the project. These facilities would include a 15-foot outer lane on the frontage roads to accommodate bicycles and a 6-foot wide sidewalk with crosswalks. The bicycle and pedestrian facilities would extend the length of the US 281 project corridor and would be built on both the west and east sides of US 281 (see **Appendix K1** or **Chapter 2 - Alternatives Considered, Figure 2-11** and **Figure 2-13** for more details). The configuration of the pedestrian and bicycle amenities are preliminary and are subject to change; for example mitigation measures such as the placement of sound walls could affect the design and/or location of the sidewalk.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative would include a combination of non-toll general purpose lanes and managed lanes. All Build Alternatives would include pedestrian and bicycle facilities along the length of US 281, from Loop 1604 to Borgfeld Drive, therefore the impacts to pedestrian and bicycle facilities would not change based on funding options.

3.5.4 Conclusion

Construction of proposed pedestrian and bicycle facilities would increase the safety of the existing conditions and would help fulfill the "Complete Streets" resolution adopted by the Transportation Policy Board (TPB) and supports the goals of the MPO's adopted *Regional Bicycle Master Plan*. "Complete Streets" are defined as roadways that enable safe and convenient access to all users, including pedestrians, bicyclists, transit riders and drivers and are conducive to efficient movement of people.

3.6 TRANSPORTATION FACILITIES

This section analyzes the Build Alternatives and the No-Build Alternative for their effects on future traffic conditions. Several measures of effectiveness (MOEs) were used to establish a benchmark of existing traffic conditions and to measure and compare future traffic conditions on the US 281 project corridor. The MOEs evaluated include Average Peak Period Speed, Average Daily Traffic (ADT), and Peak Period LOS—widely accepted quantitative measures that help gauge the operational abilities of a transportation system in addressing existing and future travel demands.

The traffic analysis conducted for the No-Build Alternative and the Elevated Expressway Alternative relies on data from the MPO travel demand model from June 2010. The Preferred Expressway Alternative analysis uses March 2014 traffic data produced specifically for the US 281 Corridor Project by TxDOT Transportation Planning and Programming Division (TPP). While these two models are similar, they are based on different assumptions and use slightly different input data which results in different traffic predictions. The following presents the results of the two traffic analyses separately. The technical memoranda in **Appendix D1** and **Appendix D2** discuss the methodologies used and detailed results of each traffic analysis.

3.6.1 Methodology

The MPO's travel demand model, as updated in June 2010, was used to benchmark existing traffic conditions and to forecast the 2035 traffic conditions for the No-Build Alternative and the Elevated Expressway Alternative, as presented in the Draft EIS. This model uses validated traffic data from 2008 as its base year which was used to describe the existing traffic conditions on the US 281 project corridor. The existing conditions on the US 281 project corridor assume that the roadway is as currently configured with the completion of the US 281 Super Street. The existing condition was established for the US 281 main lanes, frontage road lanes and two corridors parallel to the US 281 project corridor, Blanco Road and Bulverde Road.

The traffic forecasts in the MPO's travel demand model are based on the 2035 planning horizon used in *Mobility 2035.* As part of this plan, a future land use scenario was adopted which calls for a combination of transit-oriented development and development which emphasizes infill within the core of the metropolitan area. This land use scenario assumes population and employment growth outside of Loop 1604 in Bexar County will plateau by 2015. Traffic data from the TPP travel demand model is current as of March 2014 and forecasts traffic conditions specific to the configuration of the Preferred Expressway Alternative. The model output forecasts traffic conditions on the non-toll general purpose lanes, managed lanes, frontage road lanes and non-toll outer lanes for the year the project is expected to open (2018) and design year of the project (2038).

3.6.2 Affected Environment

The existing traffic conditions on the US 281 project corridor are used to establish a baseline for comparison with the Build Alternatives and the No-Build Alternative. The same three MOEs used to establish the existing traffic conditions were used to forecast the likely future traffic conditions for each alternative analyzed in this Final EIS.

Existing Average Peak Period Speed on US 281

Average peak period speed measures the average miles per hour a vehicle can travel on the US 281 project corridor during morning rush hour, between 7:00 a.m. and 9:00 a.m., and evening rush hour, 4:00 p.m. to 6:00 p.m. Under existing conditions, traffic moves during the peak period at approximately 15 miles per hour (mph) on the southern segment of the US 281 project corridor, between Sonterra Boulevard to Marshall Road, and approximately 22 mph on the northern segment of the US 281 project corridor, between Marshall Road and Borgfeld Drive.

Existing ADT on US 281 and the Parallel Corridors

ADT is an estimate of the number of vehicles on the roadway each day. Two locations within the US 281 project corridor were used to compare ADT information and to represent traffic conditions in the northern and southern portion of the corridor. A point near the intersection of US 281 and Bulverde Road represents conditions along the northern segment of the corridor while a point near the intersection of US 281 and Sonterra Boulevard represents conditions in the southern segment. Under existing conditions, approximately 40,000 vehicles use the northern segment of the US 281 project corridor each day and 80,000 vehicles use the southern segment. In addition, approximately 15,000 vehicles use a parallel corridor, Blanco Road or Bulverde Road, in the north and approximately 55,000 vehicles use a Blanco Road or Bulverde Road corridor in the south.

Existing LOS during Peak Period on US 281 and the Parallel Corridors

LOS is a measure of traffic flow and a driver's perception of how easy it is to change lanes. It is graded on a scale of A to F, A representing the best conditions and F the worst. Different segments of a roadway could

potentially have different LOS, for example, in an area where a stop light exists, LOS may be reduced as traffic flow is stopped when the light is red. As such, LOS was measured for this analysis as the percentage of total roadway miles operating at each LOS scale (A through F). Under existing conditions, 25 percent of the miles of the US 281 project corridor operate at LOS D or better during the peak period and 75 percent of the roadway operates at LOS E or F. Blanco Road and Bulverde Road currently have better LOS than the US 281 project corridor with 75 percent of the miles along these parallel corridors operating at LOS D or better during the peak period and 25 percent at LOS E or F.

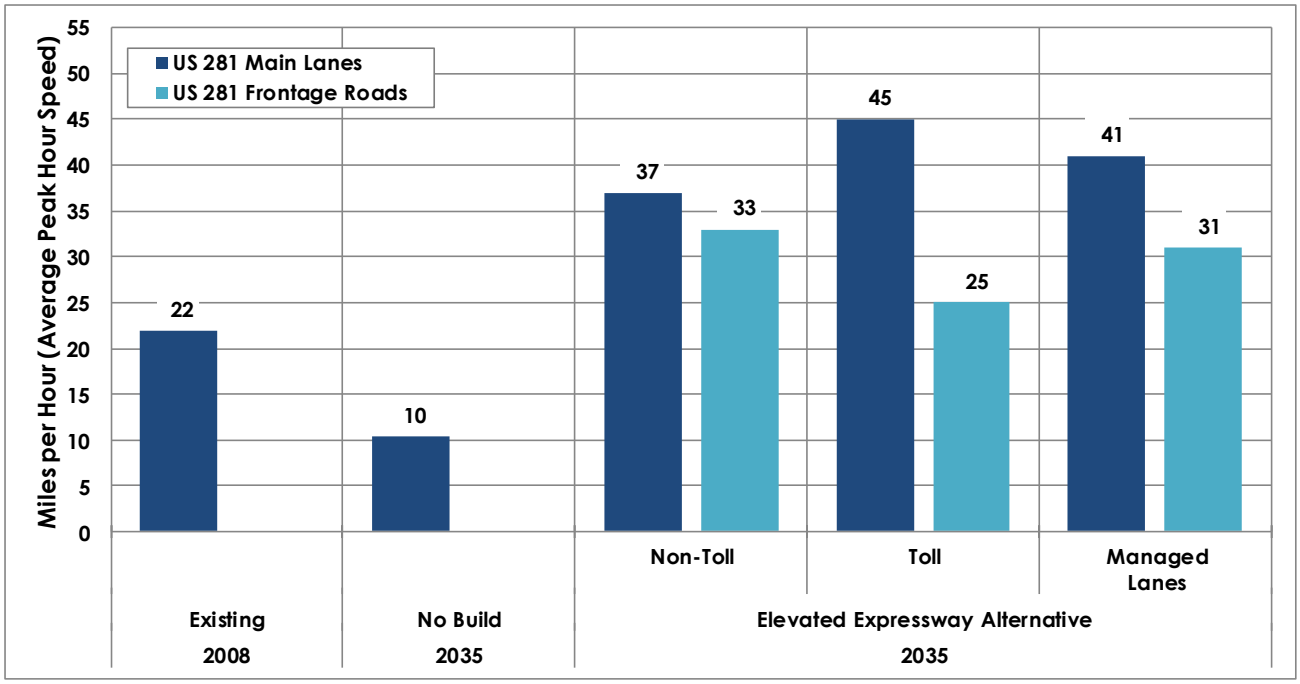
3.6.3 Environmental Consequences

Existing Condition Compared to the No-Build and the Elevated Expressway Alternative

2035 Average Peak Period Speed on US 281

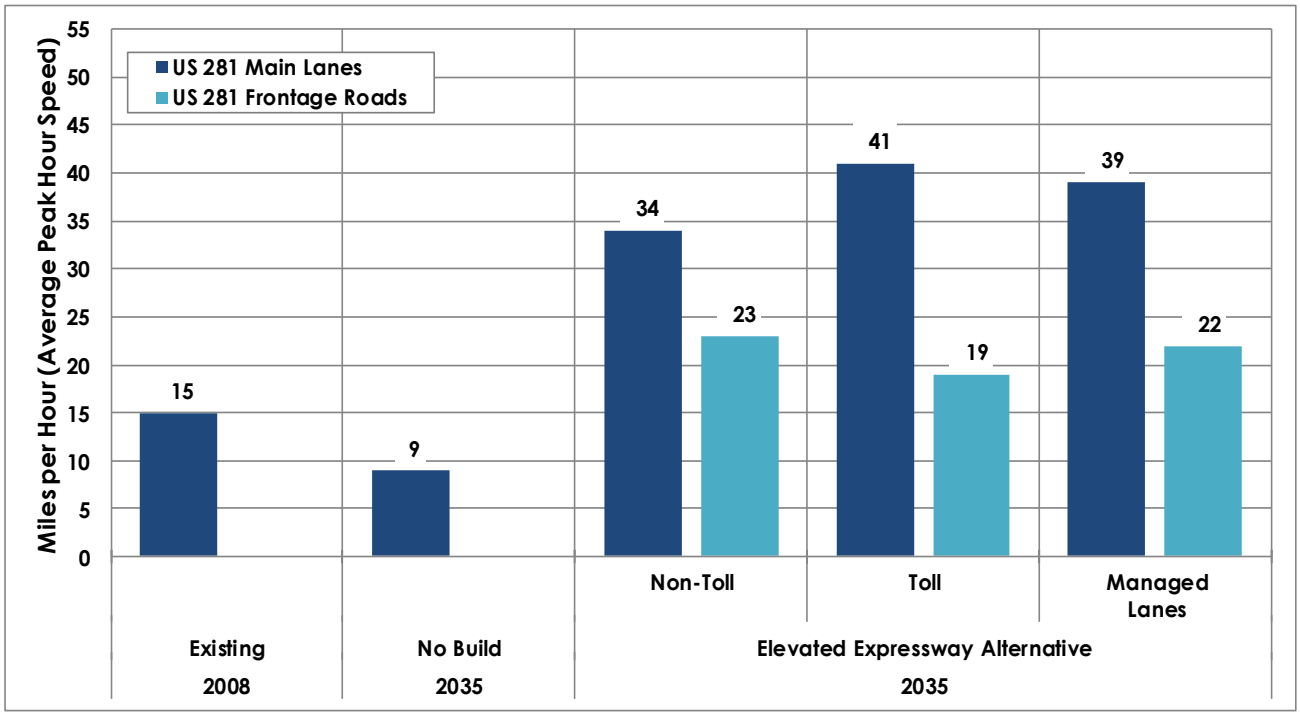
Figure 3-14 and **Figure 3-15** highlight the forecasted 2035 average peak period speeds along the US 281 project corridor and compare it with the 2008 existing conditions. **Figure 3-14** focuses on the northern segment of the US 281 project corridor, between Marshall Road and Borgfeld Drive, and **Figure 3-15** focuses on the southern segment of the US 281 Project Corridor, between Sonterra Boulevard and Marshall Road. As shown, the Elevated Expressway Alternative has the potential to improve average peak period speed on the US 281 main lanes over the existing conditions. If no improvements are made, it is likely that the average peak period speed would be reduced on the US 281 project corridor and along the parallel corridors by 2035.

Figure 3-14: 2035 average peak period speed – northern segment (between Marshall Road and Borgfeld Drive)



Source: SA-BC MPO, 2009f, US 281 EIS Team, 2010-2011.

Figure 3-15: 2035 average peak period speed – southern segment (between Sonterra Boulevard and Marshall Road)

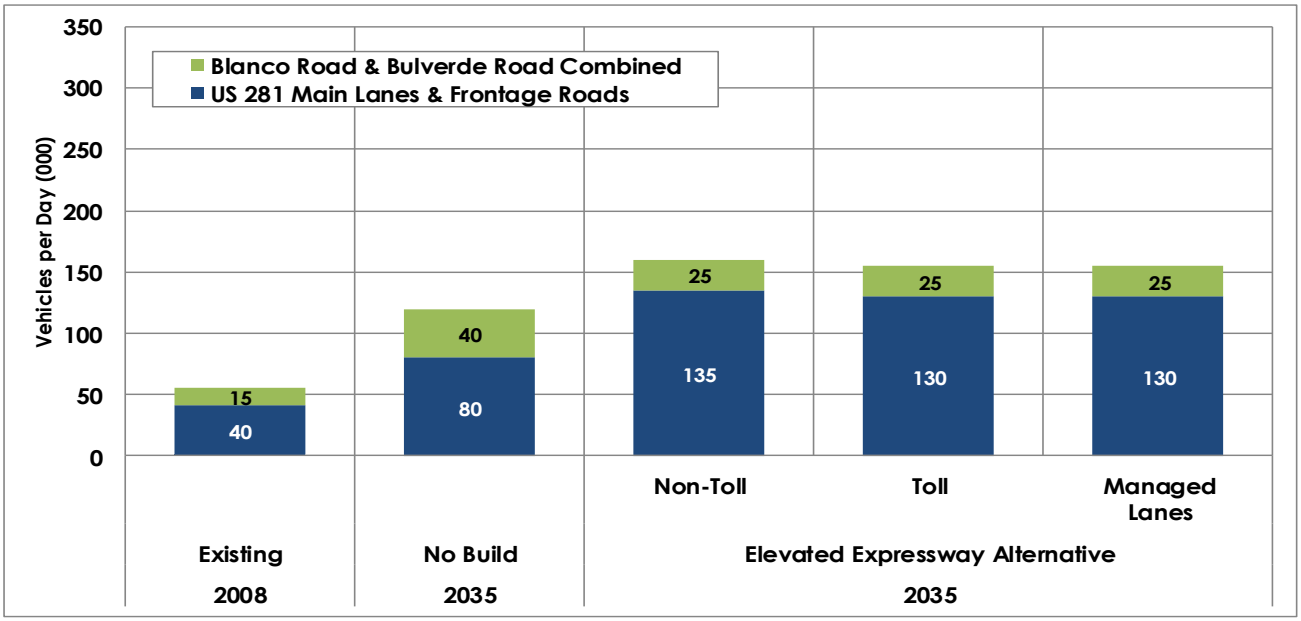


Source: SA-BC MPO, 2009f, US 281 EIS Team, 2010-2011.

2035 ADT on US 281 and the Parallel Corridors

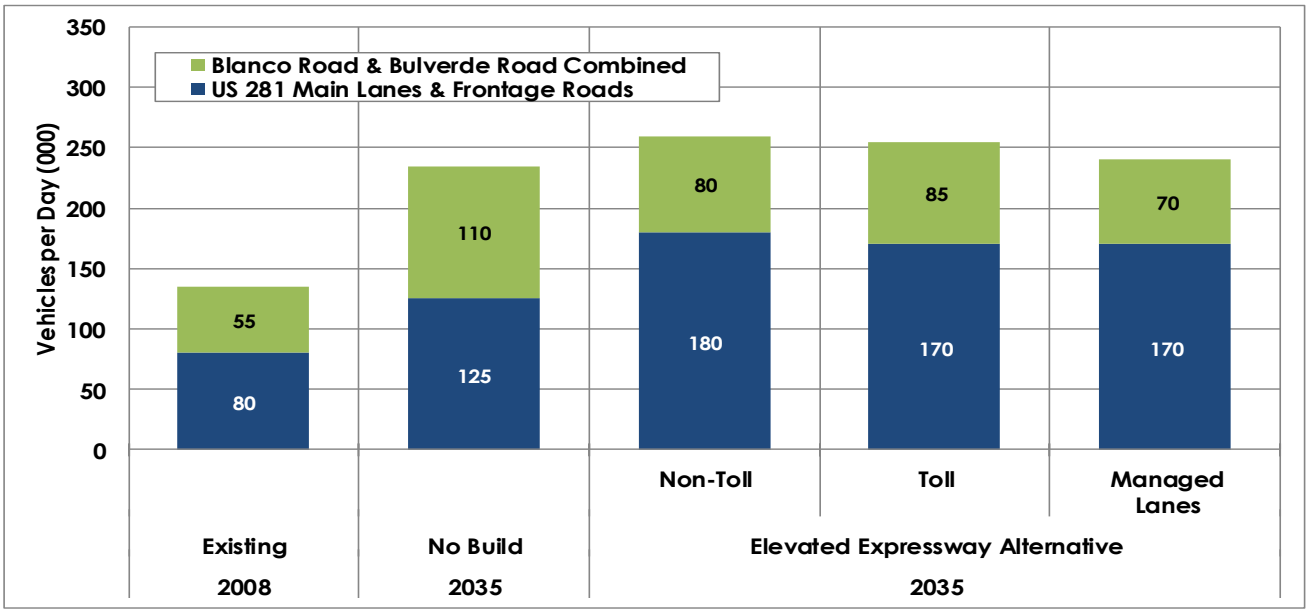
Traffic using the US 281 project corridor and the parallel corridors is anticipated to increase substantially by 2035. If no improvements are made to the US 281 project corridor, the parallel corridors are likely to carry a larger portion of the 2035 daily traffic volume in comparison to the Build Alternatives. Under the No-Build Alternative, the northern segment could see 40,000 vehicles per day (vpd) on the parallel corridors and 80,000 vpd on the main lanes of the US 281 project corridor and along the southern segment, 110,000 vpd and 125,000 vpd respectively in 2035. **Figure 3-16** and **Figure 3-17** compare the 2035 ADT for the Elevated Expressway Alternative and the No-Build Alternative with each other and the existing conditions. **Figure 3-16** highlights the northern segment of the corridor while **Figure 3-17** highlights the southern segment.

Figure 3-16: 2035 average daily traffic – northern segment (near the intersection of US 281 and Bulverde Road)



Source: SA-BC MPO, 2009f, US 281 EIS Team, 2010-2011.

Figure 3-17: 2035 average daily traffic – southern segment (near the intersection of US 281 and Sonterra Boulevard)

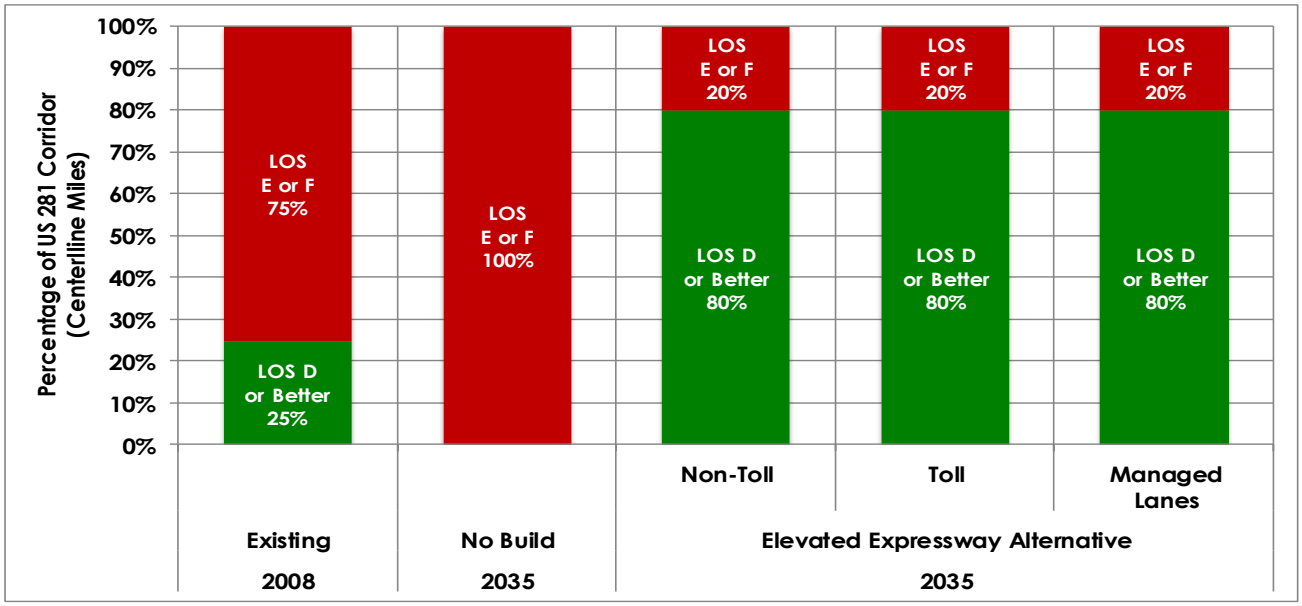


Source: SA-BC MPO, 2009f, US 281 EIS Team, 2010-2011.

2035 Peak Period LOS on US 281 and the Parallel Corridors

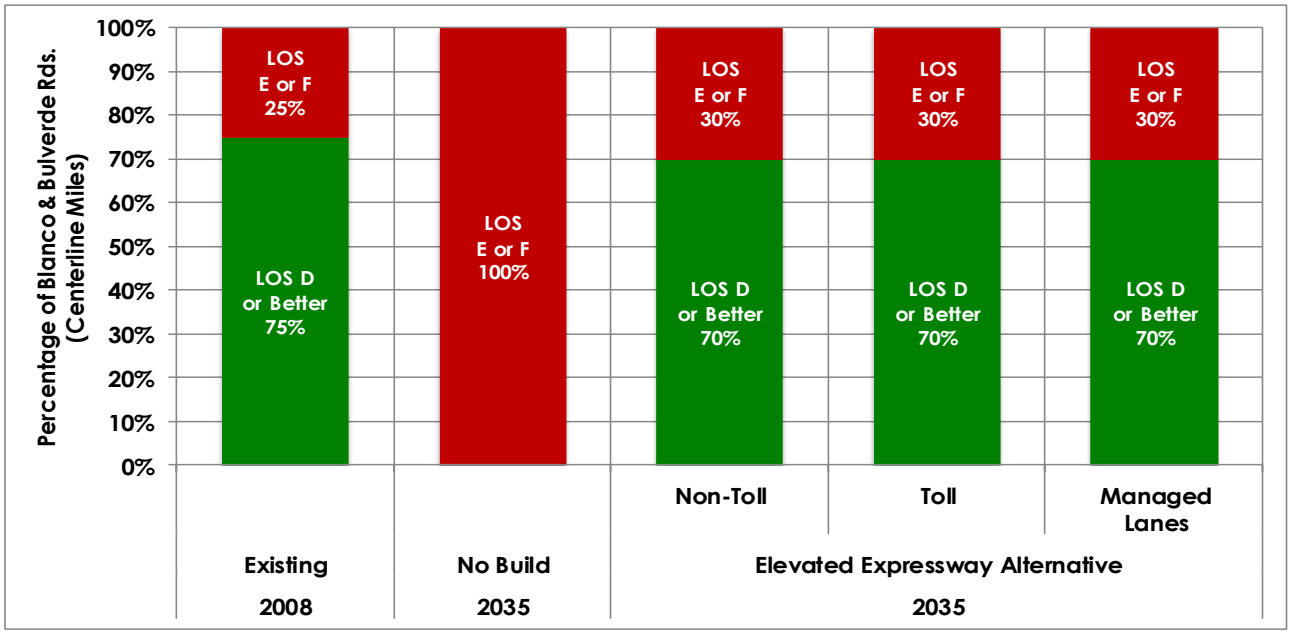
Figure 3-18 compares the peak period LOS that each alternative is likely to offer the driving public along the main lanes of the US 281 project corridor in 2035 and **Figure 3-19** compares the 2035 peak period LOS likely to be experienced on the parallel corridors. As shown, the No-Build Alternative would likely result in 100 percent of the US 281 project corridor and the parallel corridors to be operating at LOS E or F during the peak period by 2035. The Elevated Expressway Alternative would improve the peak period LOS on the US 281 main lanes compared to existing conditions as well as the No-Build Alternative.

Figure 3-18: Peak period LOS – US 281 main lanes



Source: SA-BC MPO, 2009f, US 281 EIS Team, 2010-2011.

Figure 3-19: Peak period LOS– parallel corridors combined – Blanco Road & Bulverde Road



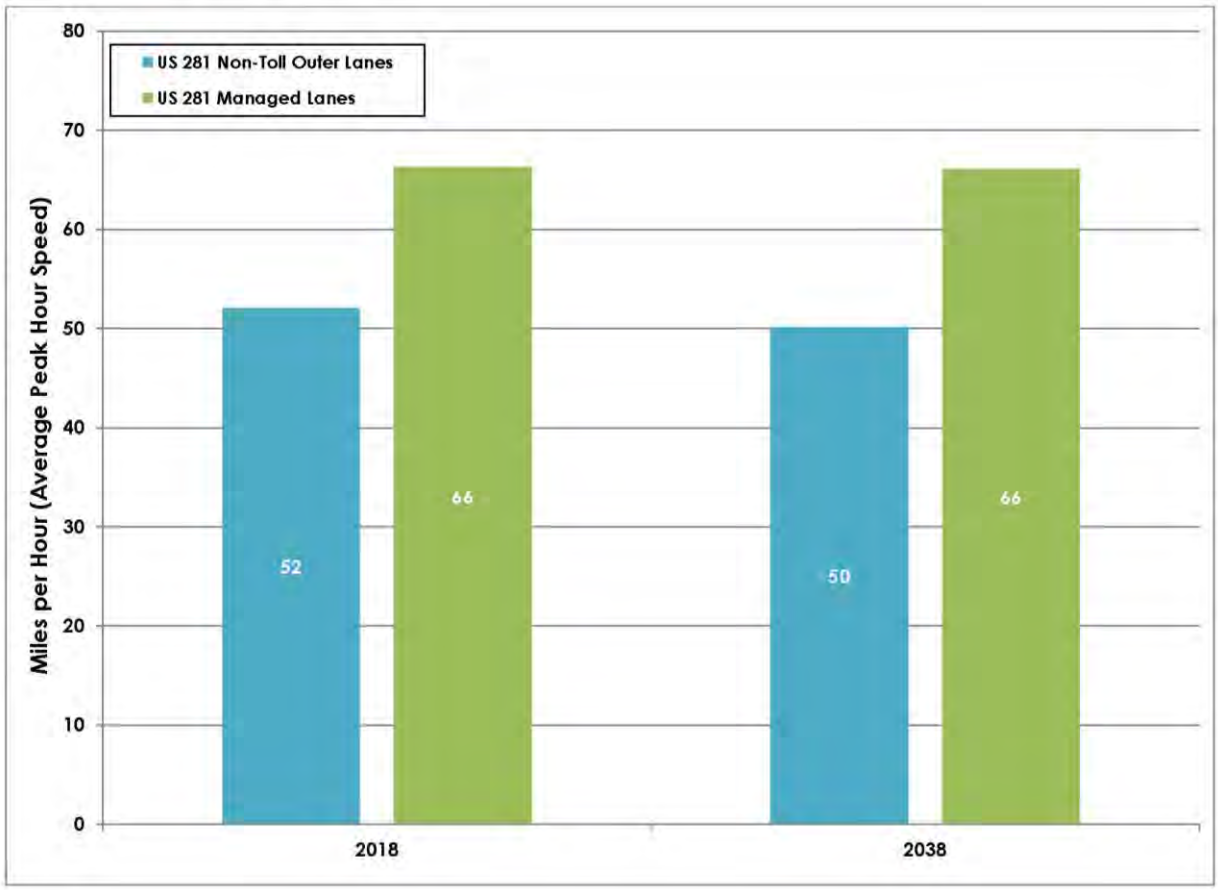
Source: SA-BC MPO, 2009f, US 281 EIS Team, 2010-2011.

Preferred Expressway Alternative

2018 and 2038 Average Peak Period Speed on US 281

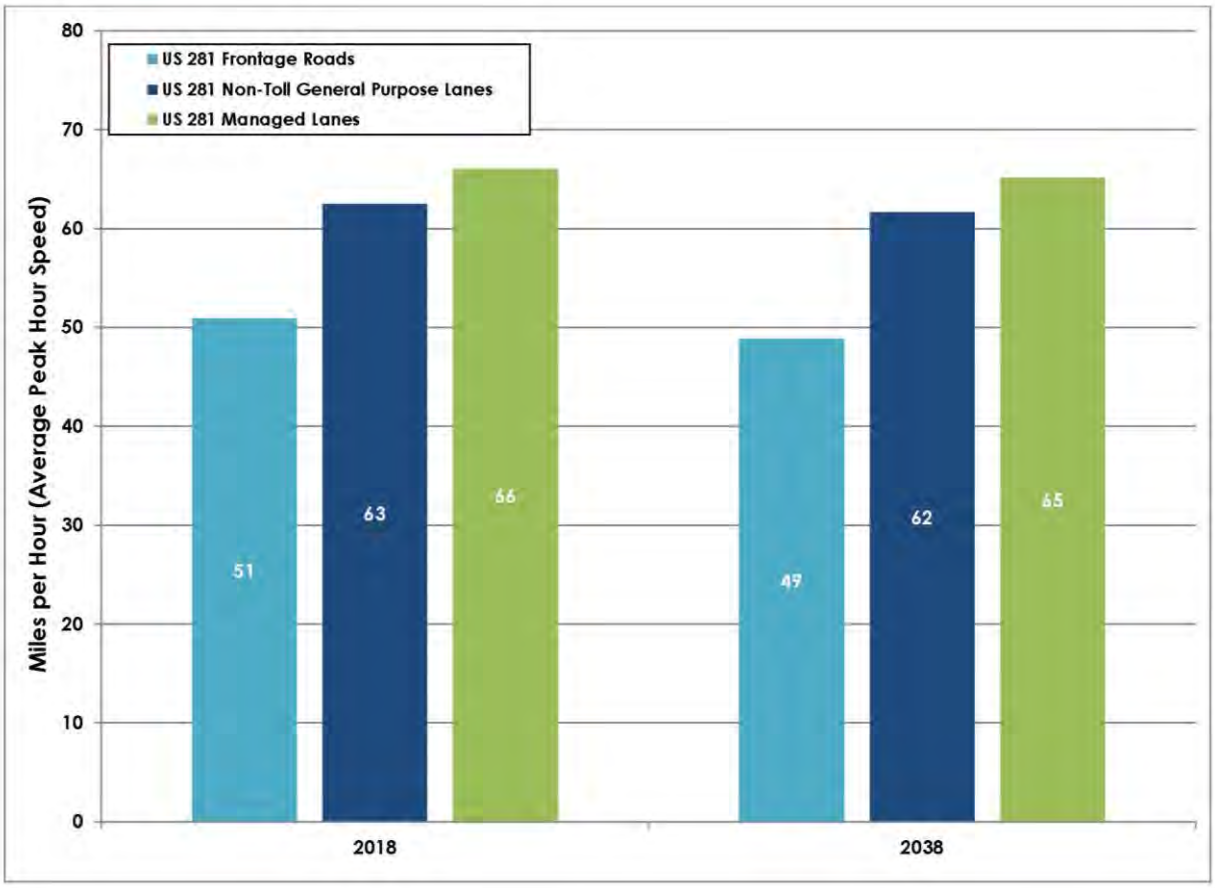
The Preferred Expressway Alternative would offer peak hour travel speeds that are consistent with the posted speed limits in both the opening year (2018) and design year (2038). **Figure 3-20** shows the forecasted 2018 and 2038 average peak period speeds along the northern segment of the US 281 project corridor and **Figure 3-21** highlights the speeds on the southern segment of the corridor.

Figure 3-20: 2018 and 2038 average peak period speed – northern segment (between Stone Oak Parkway and Borgfeld Drive)



Source: TxDOT, 2014b, US 281 EIS Team, 2014

Figure 3-21: 2018 and 2038 average peak period speed – southern segment (between Loop 1604 and Stone Oak Parkway)

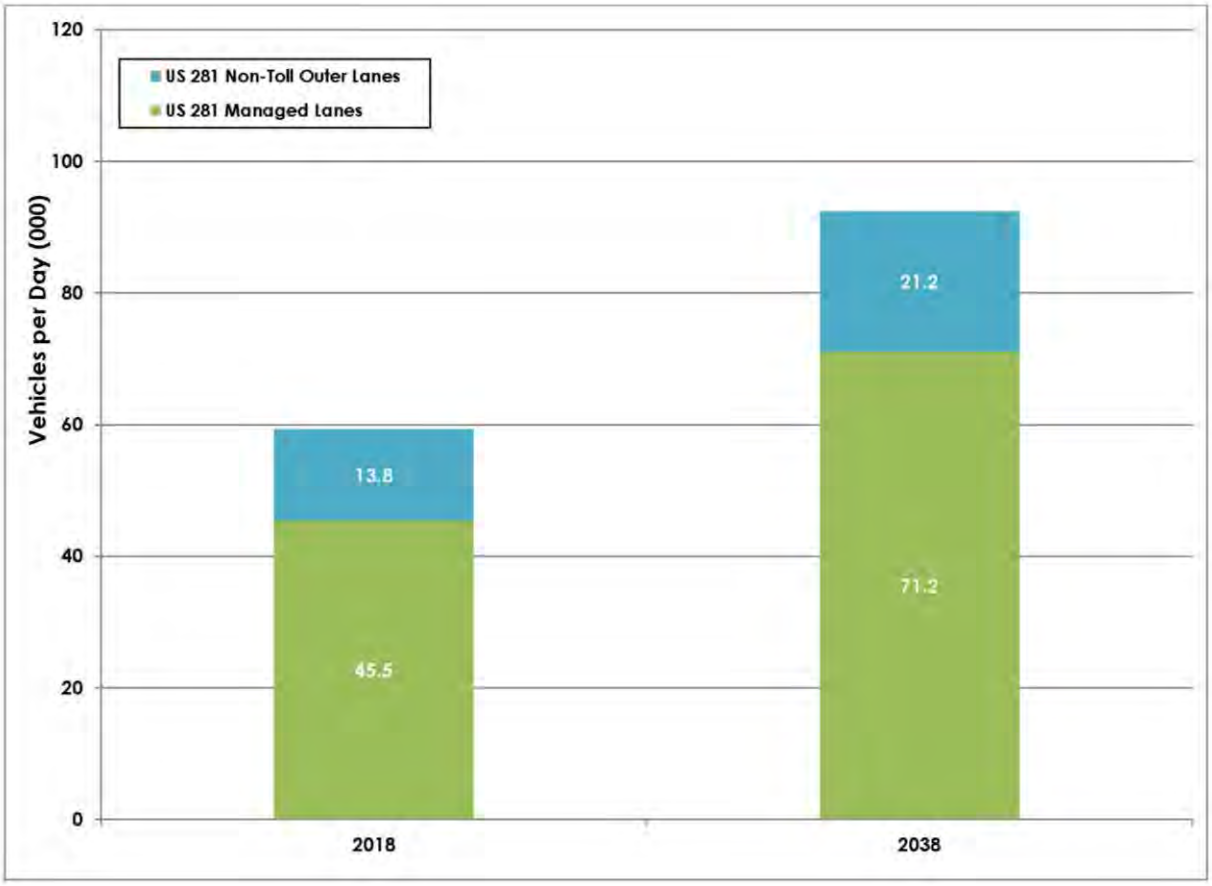


Source: TxDOT, 2014b, US 281 EIS Team, 2014.

2018 and 2038 ADT on US 281

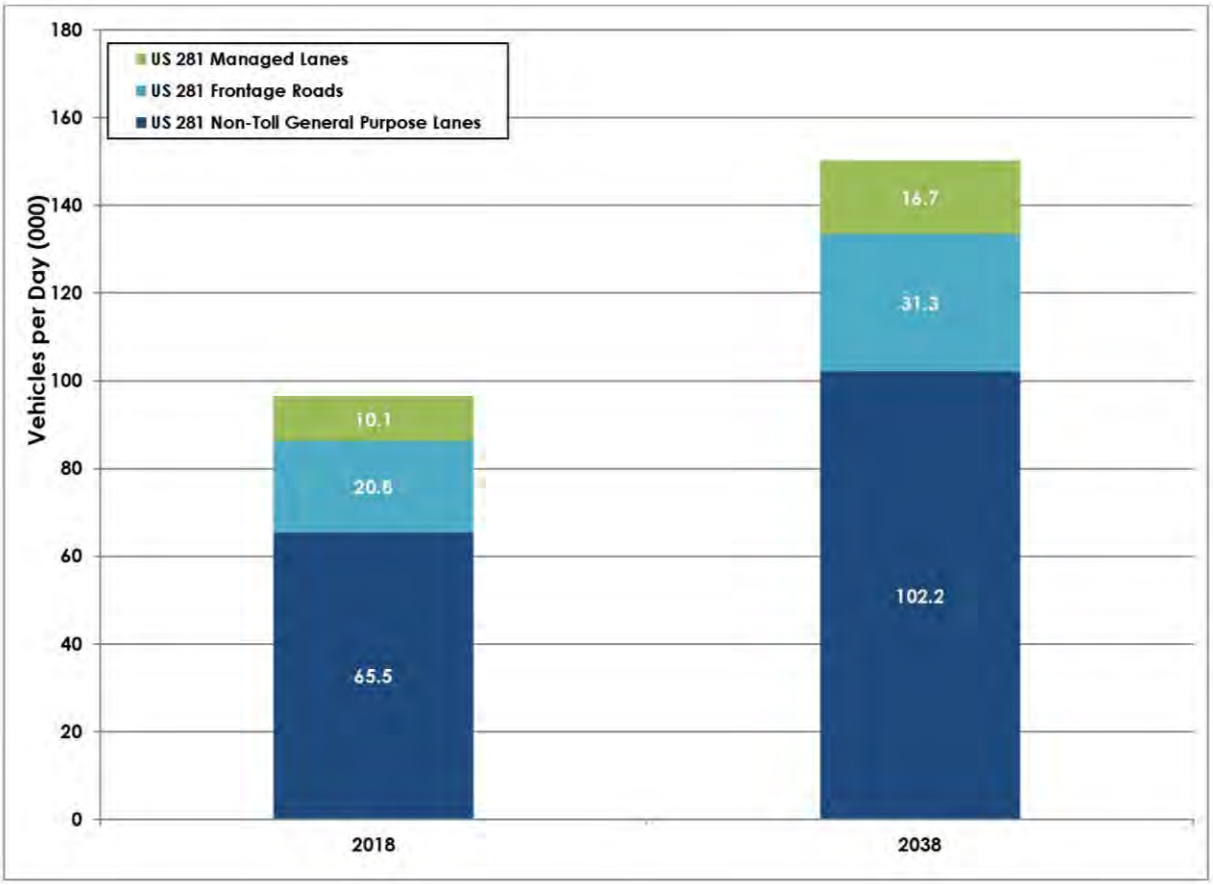
In 2018, the Preferred Expressway Alternative is forecast to accommodate more than 59,000 vpd on the northern segment of the US 281 project corridor of which 76.8 percent would be on the managed lanes and 23.2 percent would travel on the non-toll outer lanes. More than 96,000 vpd are forecasted to use the southern segment of the corridor in 2018 of which 67.9 percent of the traffic would use the non-toll general purpose lanes, 10.5 percent would use the managed lanes and 21.6 percent would use the frontage roads. By 2038, ADT is anticipated to grow to more than 92,000 vpd along the northern segment (77.1 percent would use the managed lanes and 22.9 percent would use the non-toll outer lanes), and more than 150,000 vpd would travel along the southern segment (68.0 percent on the non-toll general purpose lanes, 11.1 percent on the managed lanes and 20.9 percent on the frontage roads). **Figure 3-22** shows the forecasted 2018 and 2038 ADT on the northern segment of the corridor by lane type and **Figure 3-23** shows the southern segment ADT.

Figure 3-22: 2018 and 2038 peak period ADT – northern segment (between Stone Oak Parkway and Borgfeld Drive)



Source: TxDOT, 2014b, US 281 EIS Team, 2014.

Figure 3-23: 2018 and 2038 peak period ADT – southern segment (between Loop 1604 and Stone Oak Parkway)

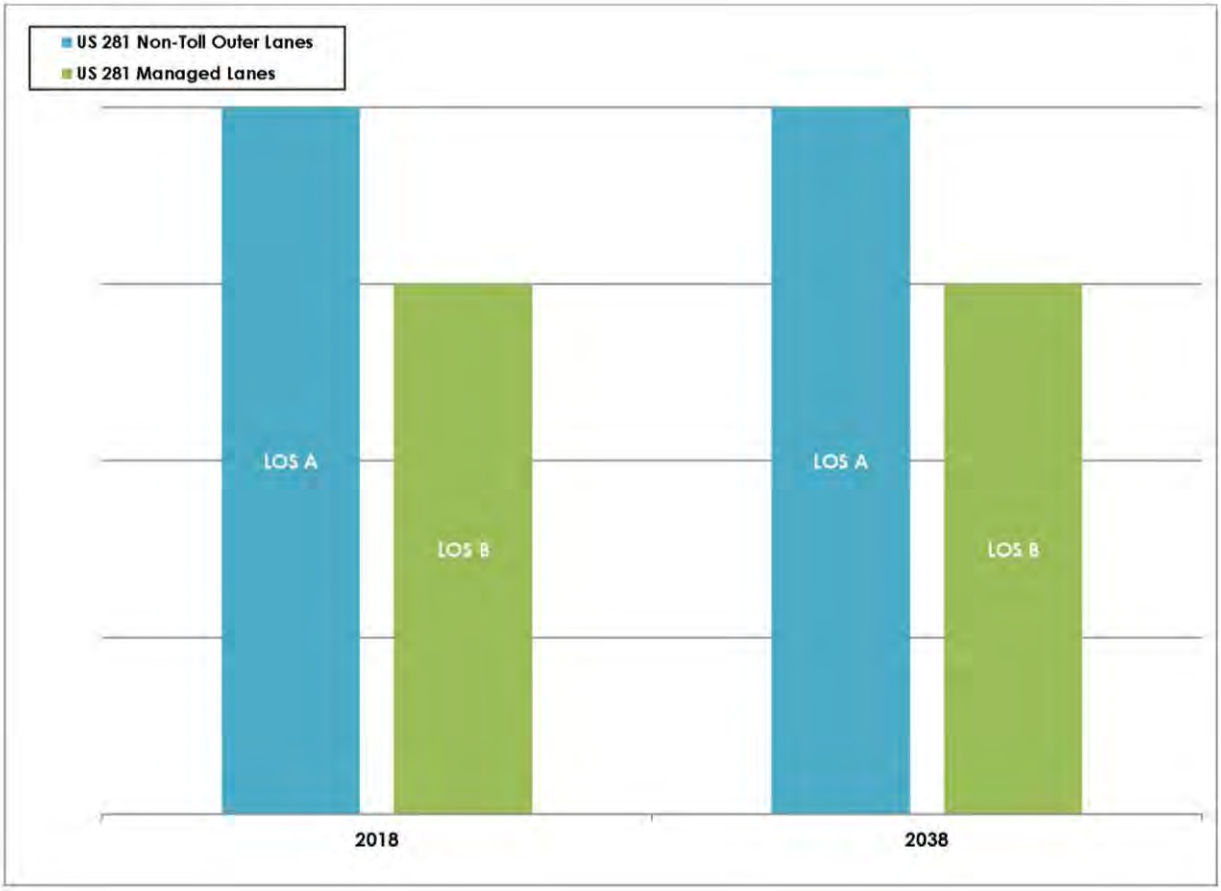


Source: TxDOT, 2014b, US 281 EIS Team, 2014.

2018 and 2038 LOS on US 281

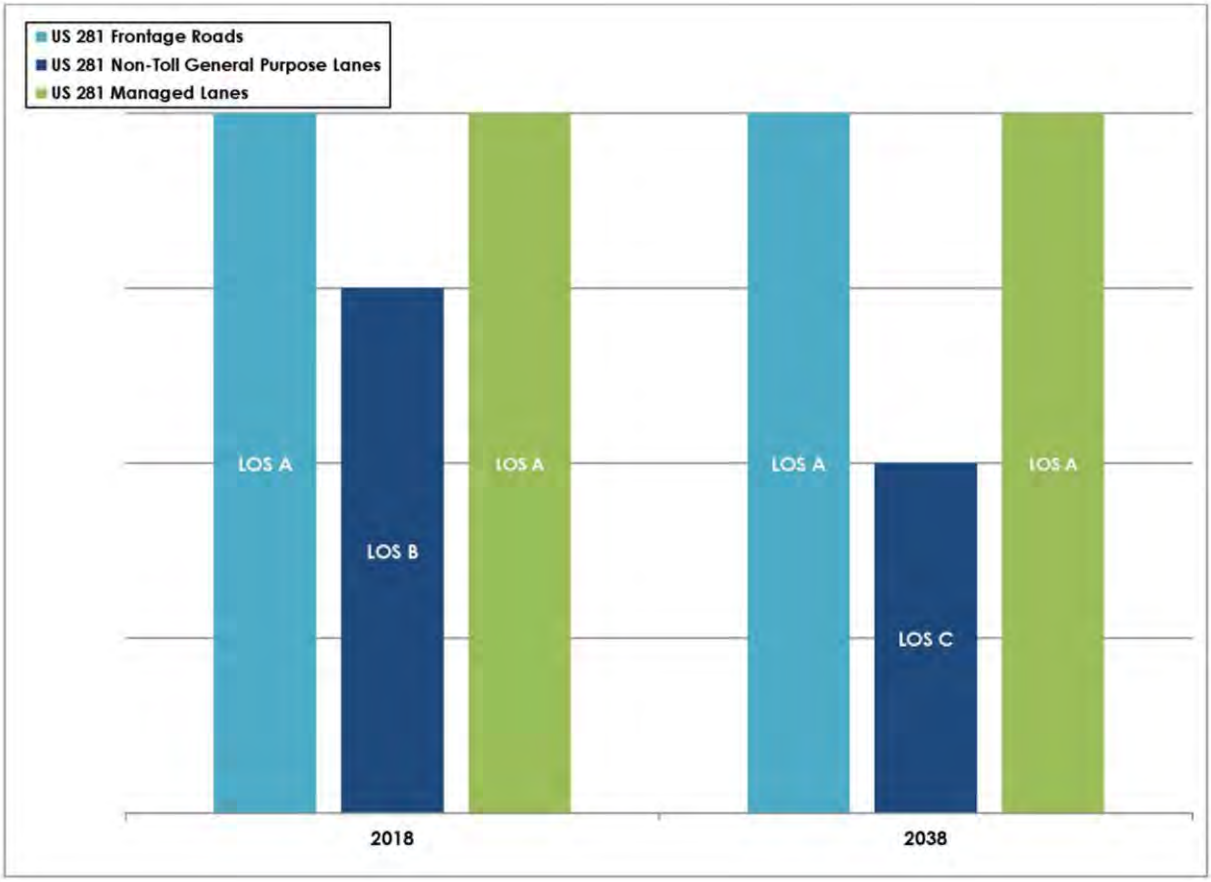
The Preferred Expressway Alternative would operate at a LOS allowing for free flowing traffic conditions on the non-toll main lanes, managed lanes, frontage roads and non-toll outer lanes (**Figure 3-24** and **Figure 3-25**). These conditions will largely be maintained through the design year of 2038. The 102,200 vpd forecast to travel on the non-toll general purpose lanes in 2038 (**Figure 3-23**) would impact LOS on these lanes somewhat; however, the LOS would be substantially improved over the existing condition and the No-Build Alternative.

Figure 3-24: 2018 and 2038 peak period LOS – northern segment (between Stone Oak Parkway and Borgfeld Drive)



Source: TxDOT, 2014b, US 281 EIS Team, 2014.

Figure 3-25: 2018 and 2038 peak period LOS – southern segment (between Loop 1604 and Stone Oak Parkway)



Source: TxDOT, 2014b, US 281 EIS Team, 2014.

3.6.4 Conclusion

Compared to the Build Alternatives, the No-Build Alternative is the least effective at improving traffic speeds and traffic flow during peak period travel times on the US 281 project corridor. A summary of the three MOEs follows:

Average Peak Period Speeds: The Preferred Expressway Alternative would provide the fastest speeds on all lanes of the US 281 project corridor when compared to the No-Build Alternative and the Elevated Expressway Alternative. Peak hour travel speeds in 2018 and 2038 would be consistent with the posted speed limits for each lane type.

ADT: If no improvements are made, traffic would likely divert from the US 281 project corridor to the parallel corridors and other regional roadways by 2035. The Elevated Expressway Alternative is likely to carry the highest ADT on the main lanes and frontage roads throughout the US 281 project corridor; however, some traffic would still divert to the parallel corridors.

LOS: The Preferred Expressway Alternative would provide the best future LOS on all lanes throughout the US 281 project corridor when compared to the No-Build and Elevated Expressway Alternatives.

Overall, the Preferred Expressway Alternative would provide the best travel conditions on the US 281 project corridor of the Build Alternatives evaluated. And, it would provide a substantial improvement over the existing condition.

3.7 AIR QUALITY

Motor vehicles, industries, construction equipment and some commercial operations are among the sources of air pollution in the San Antonio area. The main air pollutants emitted from motor vehicles are volatile organic compounds (VOC), nitrogen oxides (NOx), carbon monoxide (CO), particulate matter (PM) and a class of compounds called mobile source air toxics (MSAT). VOC and NOx can react in the air in sunlight to form ground-level ozone (O_3). Because the reactions take place over several hours, maximum concentrations of ozone are often far downwind of the precursor sources (VOC and NOx). Thus, ozone is a regional problem and not a local condition.

3.7.1 Methodology

This analysis was accomplished in accordance with *TxDOT's Air Quality Guidelines 2006, Amended 2011* (TxDOT 2006, 2011). CO Concentrations were estimated using CAL3QHC and MOVES2010b for the Build Alternatives and the No-Build Alternative. A MSAT analysis was conducted for the Preferred Expressway Alternative.

Regional Compliance

The NEPA of 1969 and the Clean Air Act of 1970 (CAA), as amended, resulted in federal requirements for USDOT to consider the impact proposed highways, such as the US 281 Corridor Project, may have on the local air quality. Under the CAA, the EPA sets national ambient air quality standards (NAAQS) for seven air pollutants to protect public health and the environment, with an adequate margin of safety. NAAQS exist for seven pollutants: CO, O_3, NO_2, sulfur dioxide (SO_2), PM for both 10 and 2.5 microns and less (PM_{10} and $PM_{2.5}$), and lead (Pb). The CAA amendment of 1990 establishes specific milestones toward attaining the NAAQS, depending on the severity of the air pollution problem in the region. EPA classifies the status of a county's ambient air with respect to conformity to the NAAQS (**Table 3-29**). The designations are as follows:

Table 3-29: NAAQS Attainment Designations

Designation	Definition
Nonattainment	Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant.
Attainment	Any area (other than an area identified as nonattainment) that meets the national primary or secondary ambient air quality standard for the pollutant.
Unclassifiable	Any area that cannot be classified on the basis of available information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant.

Source: EPA 2011.

3.7.2 Conformity

The project is located in Bexar County, which is in an area in attainment or unclassifiable for all NAAQS; therefore, the transportation conformity rules do not apply.

3.7.3 CO Traffic Air Quality Analysis (TAQA)

Design year traffic for this project is 213,500 vehicles per day (vpd) therefore triggering the need for a traffic 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 was obtained from the TxDOT TPP Division. Traffic for the estimated time of completion year (2018) and design year (2038) is estimated to be 137,100 vpd, and 213,500 vpd, respectively.

CO concentrations for the US 281 Corridor Project were modeled using CAL3QHC and MOVES2010b and factoring in adverse meteorological conditions and sensitive receptors at the ROW line in accordance with the TxDOT's Air Quality Guidelines (TxDOT 2011). Local concentrations of CO are not expected to exceed national standards at any time (See **Table 3-30**).

Table 3-30: CO Concentrations

Traffic Analysis	Alternative	One-Hour CO Standard 35 ppm	One-Hour % NAAQS	Eight-Hour CO Standard 9 ppm	Eight-Hour % NAAQS
Stone Oak Parkway					
Estimated Time of Completion	No-Build	2.7	8%	1.7	19%
	Elevated Expressway	2.0	6%	1.3	15%
	Preferred Expressway	2.8	8%	1.8	20%
Design Year	No-Build	2.8	8%	1.8	20%
	Elevated Expressway	2.1	6%	1.3	15%
	Preferred Expressway	2.9	8%	1.8	20%
Bulverde Road					
Estimated Time of Completion	No-Build	2.4	7%	1.5	17%
	Elevated Expressway	2.1	6%	1.3	15%
	Preferred Expressway	1.9	5%	1.2	14%
Design Year	No-Build	3.1	9%	1.9	22%
	Elevated Expressway	2.4	7%	1.5	17%
	Preferred Expressway	2.0	6%	1.3	15%

Source: US 281 EIS Team June 2014.
Note: The NAAQS for CO is 35 ppm for one-hour and 9 ppm for eight-hours. Analysis included a one-hour background concentration of 0.5 ppm and eight-hour background concentration of 0.3 ppm.

3.7.4 Mobile Source Air Toxics (MSAT)

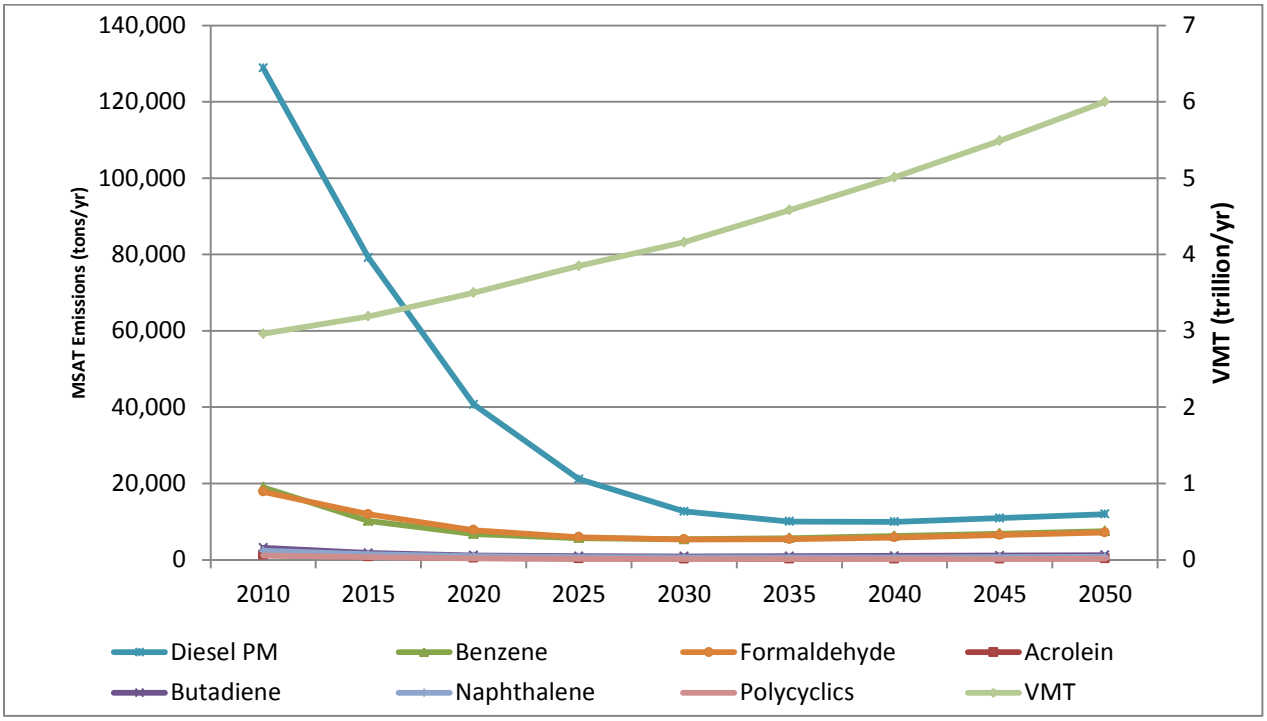
In addition to the seven criteria air pollutants, the EPA also regulates MSAT. Most MSAT originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., bulldozers), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries).

Background

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (http://www.epa.gov/iris/). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (http://www.epa.gov/ttn/atw/nata1999/). These are acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the priority MSAT, the list is subject to change and may be adjusted in consideration of future EPA rules.

The 2007 EPA MSAT rule mentioned above requires controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. Based on a FHWA analysis using EPA's MOVES2010b model, as shown in **Figure 3-26** and **Table 3-31**, even if vehicle-miles travelled (VMT) increases by 102 percent as assumed from 2010 to 2050, a combined reduction of 83 percent in the total annual emissions for the priority MSAT is projected for the same time period.

Figure 3-26: Projected national MSAT emission trends 2010 – 2050 for vehicles operating on roadways using EPA's MOVES2010b model



Source: Table 3-31 below.
Note: Trends for specific locations may be different, depending on locally derived information representing vehicle-miles traveled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.

Table 3-31: Projected National MSAT Emissions and Percent Reduction for 2010-2050 for Vehicles Operating on Roadways Using EPA's MOVES2010b Model

Pollutant/VMT	Pollutant Emissions (tons) and Vehicle-Miles Traveled (VMT) by Calendar Year									Reduction
	2010	2015	2020	2025	2030	2035	2040	2045	2050	2010 to 2050
Acrolein	1,244	805	476	318	258	247	264	292	322	-74
Benzene	18,995	10,195	6,765	5,669	5,386	5,696	6,216	6,840	7,525	-60
Butadiene	3,157	1,783	1,163	951	890	934	1,017	1,119	1,231	-61
Diesel PM	128,847	79,158	40,694	21,155	12,667	10,027	9,978	10,942	11,992	-91
Formaldehyde	17,848	11,943	7,778	5,938	5,329	5,407	5,847	6,463	7,141	-60
Naphthalene	2,366	1,502	939	693	607	611	659	727	802	-66
Polycyclics	1,102	705	414	274	218	207	219	240	262	-76
Trillions VMT	2.96	3.19	3.5	3.85	4.16	4.58	5.01	5.49	6.0	102

Source: EPA MOVES2010b model runs conducted during May – June 2012 by FHWA

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how the potential health risks posed by MSAT exposure should be factored into project-level decision-making within the context of the NEPA. The FHWA, EPA, the Health Effects Institute (HEI), and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA will continue to monitor the developing research in this emerging field.

Added capacity projects with FHWA involvement that have a high potential for meaningful MSAT impacts within the existing ROW (a project of MSAT concern), or have an annual average daily traffic (AADT) volume of over 140,000 vpd are required to complete a quantitative MSAT analysis. The US 281 Corridor Project has a forecasted AADT volume over 140,000 vpd, and is therefore subject to a quantitative MSAT analysis.

Project Specific MSAT Information

The process for completing a quantitative MSAT analysis began with a MSAT conference call between TxDOT, FHWA and the MPO held January 2014. This call established the parameters for the analysis, including the base year, the design year and whether an interim year should be included in the modeling. The interim year was determined to have minor value. The ultimate build out of the Preferred Expressway Alternative is anticipated to be complete in 2030, which is within five years of the 2035 design year. The schedule for the analysis including the availability of the relevant MPO travel demand model to be used to establish the transportation network affected by the US 281 Corridor Project was defined during this coordination. Once the appropriate traffic and other data were available, modeling was conducted to determine the potential MSAT emissions that would be expected from the Preferred Expressway Alternative.

The methodology employed by the US 281 EIS Team to determine the affected network for the quantitative MSAT modeling effort involved identifying those roadway links in the 2035 MPO transportation network that experienced a change of +/- 5 percent in the traffic volume between the No-Build Alternative and Preferred Expressway Alternative. This affected network was then used as an input for the project-specific

MOVES2010b model along with emission rates derived through a separate, regional MOVES modeling effort undertaken by TxDOT.

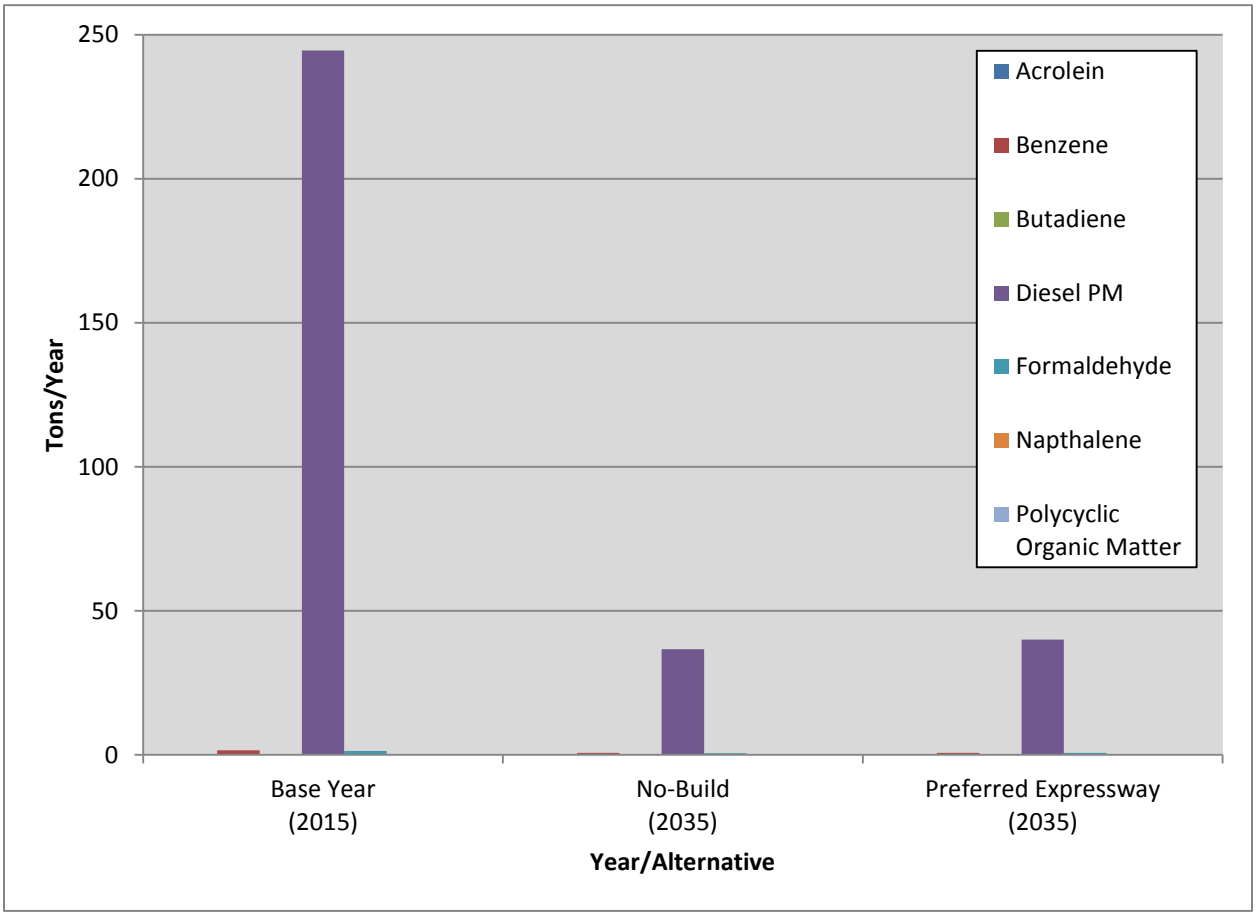
For the US 281 Corridor Project MSAT modeling, a base year of 2015 and a design year of 2035 were used; no interim year was chosen for analysis. The numeric results of the MSAT modeling are shown below in **Table 3-32**. These results are represented graphically in **Figure 3-27**, which shows emissions for each primary MSAT for each affected network (i.e., base year and design year for Preferred Expressway Alternative and No-Build Alternative), and **Figure 3-28**, which shows total MSAT emissions as compared to total VMT for each affected network.

Table 3-32: MSAT Emissions for the Preferred Expressway Alternative (Tons/Year)

Compound	Year/Scenario			% Difference 2015-2035	
	2015 Base Year	2035 Design Year		No-Build	Preferred Expressway
		No-Build	Preferred Expressway		
Acrolein	0.083	0.026	0.029	-68.7%	-65.1%
Benzene	1.529	0.687	0.735	-55.1%	-51.9%
Butadiene	0.282	0.121	0.130	-57.1%	-53.9%
Diesel PM	244.503	36.657	40.065	-85.0%	-83.6%
Formaldehyde	1.322	0.580	0.642	-56.1%	-51.4%
Napthalene	0.179	0.072	0.078	-59.8%	-56.4%
Polycyclic Organic Matter	0.065	0.018	0.019	-72.3%	-70.8%
Total MSAT (Tons)	**247.963**	**38.161**	**41.698**	**-84.6%**	**-83.2%**
Total VMT (Miles/Year)	**468,193,535**	**517,619,647**	**585,441,706**	**10.6%**	**25.0%**

Source: AAMPO and US 281 EIS Team 2014

Figure 3-27: Projected changes in MSAT emissions for the Preferred Expressway Alternative over time



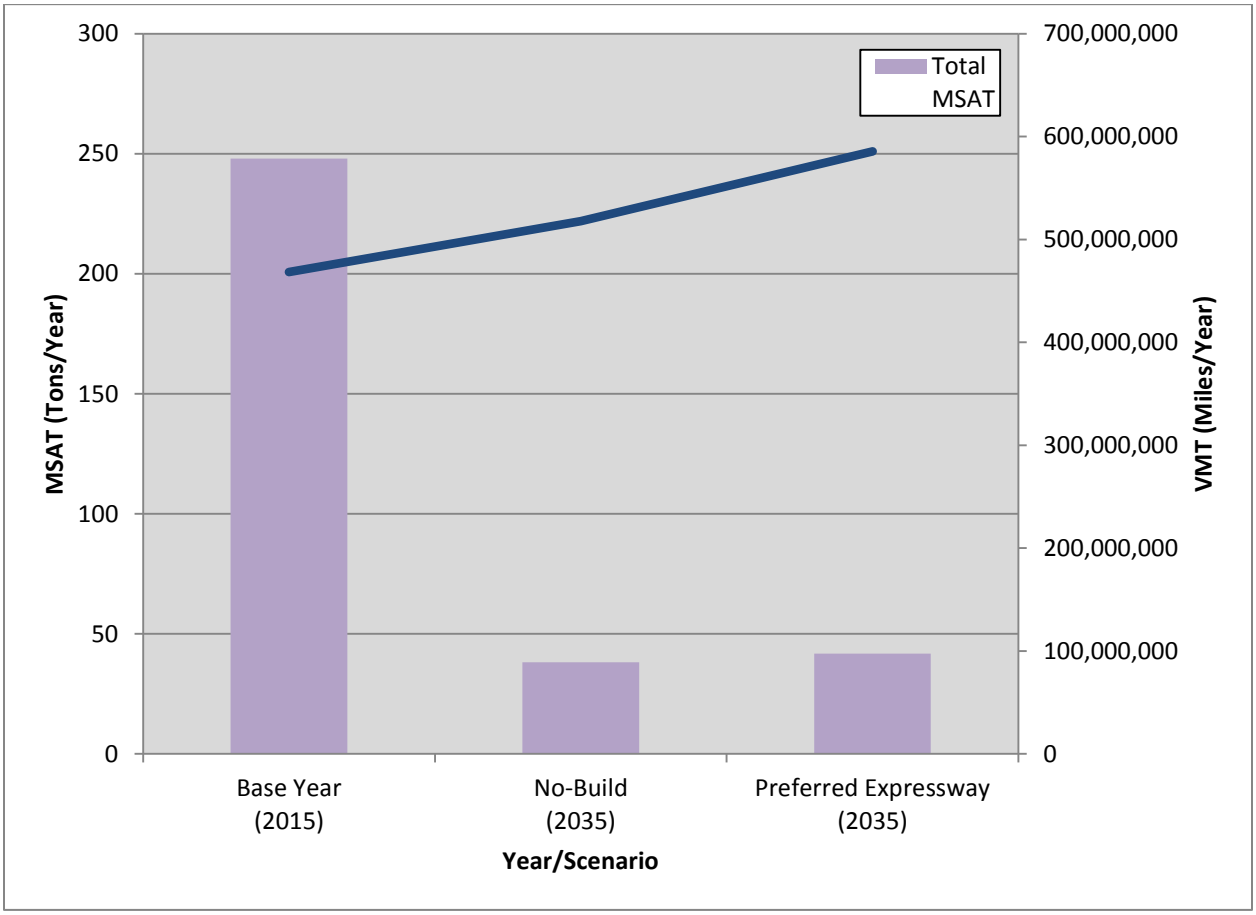
Source: AAMPO and US 281 EIS Team 2014

The analysis indicates a decrease in total MSAT emissions can be expected for both the Preferred Expressway Alternative and No-Build Alternative (2035) relative to the base year (2015). Emissions of total MSAT are predicted to decrease by approximately 83.2 percent in the 2035 Preferred Expressway Alternative compared with 2015 levels.

Of the seven priority MSAT compounds, diesel PM contributes the most to the emissions total in 2015 as well as in 2035 (see **Table 3-32** and **Figure 3-27**). In future years, a substantial decline in diesel PM is anticipated (83.6 percent reduction from 2015 to 2035 Preferred Expressway Alternative; 85.0 percent reduction from 2015 to 2035 No-Build Alternative). The amount of benzene is expected to decrease by 51.9 percent for the 2035 Preferred Expressway Alternative and 57.1 percent for the 2035 No-Build Alternative.

When total emissions are plotted over time, a substantially decreasing level of MSAT can also be seen (**Figure 3-28**) while overall VMT continues to rise. The 2035 Preferred Expressway Alternative is expected to generate a 83.2 percent decrease in total MSAT emissions while the total VMT increases 25.0 percent; the 2035 No-Build Alternative has a similar 84.6 percent decrease in total MSAT and a 10.6percent increase in VMT.

Figure 3-28: Total MSAT emissions and VMT by Preferred Expressway Alternative (tons/year)



Source: AAMPO and US 281 EIS Team 2014

Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a US 281 Corridor Project.

The EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the IRIS, which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (EPA 2014, http://www.epa.gov/iris/). Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the HEI. Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on MSAT in NEPA Documents (2012). Among the adverse health effects linked to MSAT compounds at high exposures are; cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory

tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI 2007, http://pubs.healtheffects.org/view.php?id=282) or in the future as vehicle emissions substantially decrease (HEI 2009, http://pubs.healtheffects.org/view.php?id=306).

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts – each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine the portion of time that people are actually exposed at a specific location; and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI 2007 (http://pubs.healtheffects.org/view.php?id=282). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA 2014 (http://www.epa.gov/risk/basicinformation.htm#g) and the HEI 2013 (http://pubs.healtheffects.org/view.php?id=395) have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two-step decision framework.

Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable. Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts.

3.7.5 Conclusion

Both of the Build Alternatives expand the ROW and locate traffic closer to sensitive receptors, and neither would alter or restrict the dispersion of air pollutants. The Build Alternatives would reduce or have similar CO levels to the No-Build Alternative and modeling indicates that local concentrations of CO are not expected to exceed national standards at any time for the US 281 Corridor Project.

A quantitative MSAT analysis relative to the Preferred Expressway Alternative has been provided acknowledging that both the Preferred Expressway Alternative and No-Build Alternative may result in increased exposure to particular MSAT emissions in certain locations, although diesel PM would decrease substantially between 2015 and 2035 under either alternative. The concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover are expected, over time, to cause region-wide MSAT levels to be significantly lower than today. Overall, total MSAT emissions for the US 281 Corridor Project are expected to decrease 83.2 percent between the base year 2015 and the design year 2035 for the Preferred Expressway Alternative and therefore mitigation strategies for further reductions are not proposed.

3.7.6 Mitigation

During the construction phase of this project, temporary increases in PM and MSAT emissions may occur from construction activities. The primary construction-related emissions of PM are fugitive dust from site preparation, and the primary construction-related emissions of MSAT are diesel particulate matter from diesel powered construction equipment and vehicles. The potential impacts of particulate matter emissions will be minimized by using fugitive dust control measures contained in standard specifications, as appropriate. The Texas Emissions Reduction Plan (TERP) provides financial incentives to reduce emissions from vehicles and equipment. TxDOT encourages construction contractors to utilize this program and other local and federal incentive programs to the fullest extent possible to minimize diesel emissions. Information about the TERP program can be found at: http://www.tceq.state.tx.us/implementation/air/terp/. However, considering the temporary and transient nature of construction-related emissions, as well as the mitigation actions to be utilized including compliance with applicable regulatory requirements, it is not anticipated that emissions from construction of this project will have any significant impact on air quality in the area.

3.8 TRAFFIC NOISE

3.8.1 Methodology

This analysis was completed in accordance with 23 CFR 772 and used FHWA's traffic noise model (TNM 2.5). The analysis is consistent with FHWA's published guidance, *Highway Traffic Noise: Analysis and Abatement Guidance* (FHWA 2010), TxDOT's *Environmental Handbook – Traffic Noise* (TxDOT 2014), and TxDOT's *Guidelines for Analysis and Abatement of Roadway Traffic Noise* (TxDOT 2011b). Traffic volumes were developed by the US 281 EIS Team based on the MPO's current travel demand model (2010) for the Elevated Expressway Alternative. TxDOT TPP division (2014) generated the traffic for the existing noise levels and the Preferred Expressway Alternative.

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 "dB(A)."

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

FHWA has established the 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 (see **Table 3-33**). 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 dB(A) below the NAC. For example: a noise impact would occur at a Category B residence if the noise level is predicted to be 66 dB(A) 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 dB(A). For example: a noise impact would occur at a Category B residence if the existing level is 54 dB(A) and the predicted level is 65 dB(A) (an 11 dB(A) increase).

Table 3-33: FHWA Noise Abatement Criteria

Activity Category	FHWA dB(A) (Leq)	Description of Land Use Activity Areas
A	57 (exterior)	Lands on which serenity and quiet are of extra-ordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Residential
C	67 (exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools , television studios, trails, and trail crossings
D	52 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A-D or F
F	--	Agricultural, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	Undeveloped lands that are not permitted

Note: Commercial/retail s structures are classified as Category F, which has no established noise abatement criteria. Primary consideration is given to exterior areas (Category A, B C, or E) where frequent human activity occurs.

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.

3.8.2 Affected Environment and Environmental Consequences

The FHWA traffic noise modeling software (TNM 2.5) 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 (**Table 3-34, Figure 3-29a-e, and Figure 3-30a-e**) that represent the land use activity areas adjacent to the US 281 Corridor Project that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement.

Table 3-34: Noise Impacts for the US 281 Corridor Project by Alternative

Representative Receiver	Description	NAC Category	FHWA NAC dB(A)	Elevated Expressway Alternative (Non-Toll, Toll, or Managed)				Preferred Expressway Alternative (Non-Toll and Managed)				Equivalent Receivers Represented (#)
				Existing dB(A)	Predicted 2035 dB(A)	+/- Change dB(A)	Noise Impact	Existing dB(A)	Predicted 2038 dB(A)	+/- Change dB(A)	Noise Impact	
R1	Residential	B	67	63	71	+8	Yes	63	66	+3	Yes	12
R2	Residential	B	67	63	69	+6	Yes	63	64	+1	No	12
R3	Non-profit	D	52 (interior)	39	45	+6	No	39	43	+4	No	1[1]
R4	Residential	B	67	68	74	+6	Yes	68	70	+2	Yes	8
R5	Residential	B	67	69	74	+5	Yes	69	71	+2	Yes	8
R6	Residential	B	67	67	73	+6	Yes	67	67	0	Yes	8
R7	Restaurant	E	72	61	69	+8	No	61	66	+5	No	4
R8	Residential	B	67	62	71	+9	Yes	62	72	+10	Yes	8
R9	Residential	B	67	54	69	+15	Yes	54	59	+5	No	5
R10	Residential	B	67	55	69	+14	Yes	55	62	+7	No	4
R11	Residential	B	67	51	64	+13	Yes	51	56	+5	No	5
R12	Residential	B	67	51	63	+12	Yes	51	56	+5	No	7
R13	Residential	B	67	51	62	+11	Yes	51	57	+6	No	5
R14	School	C	67	47	56	+9	No	47	54	+7	No	10[1]
R15	Residential	B	67	51	59	+8	No	51	53	+2	No	4
R16	Residential	B	67	53	67	+14	Yes	53	62	+9	No	6
R17	Residential	B	67	53	67	+14	Yes	53	60	+7	No	8
R18	Residential	B	67	53	67	+14	Yes	53	63	+10	No	6
R19	Residential	B	67	53	66	+13	Yes	53	62	+9	No	1
R20	Residential	B	67	56	64	+8	No	56	62	+6	No	1
R21	Residential	B	67	47	54	+7	No	47	53	+6	No	12
R22	Residential	B	67	49	56	+7	No	49	59	+10	No	12
R23	Residential	B	67	53	60	+7	No	53	64	+11	Yes	1

Table 3-34: Noise Impacts for the US 281 Corridor Project by Alternative

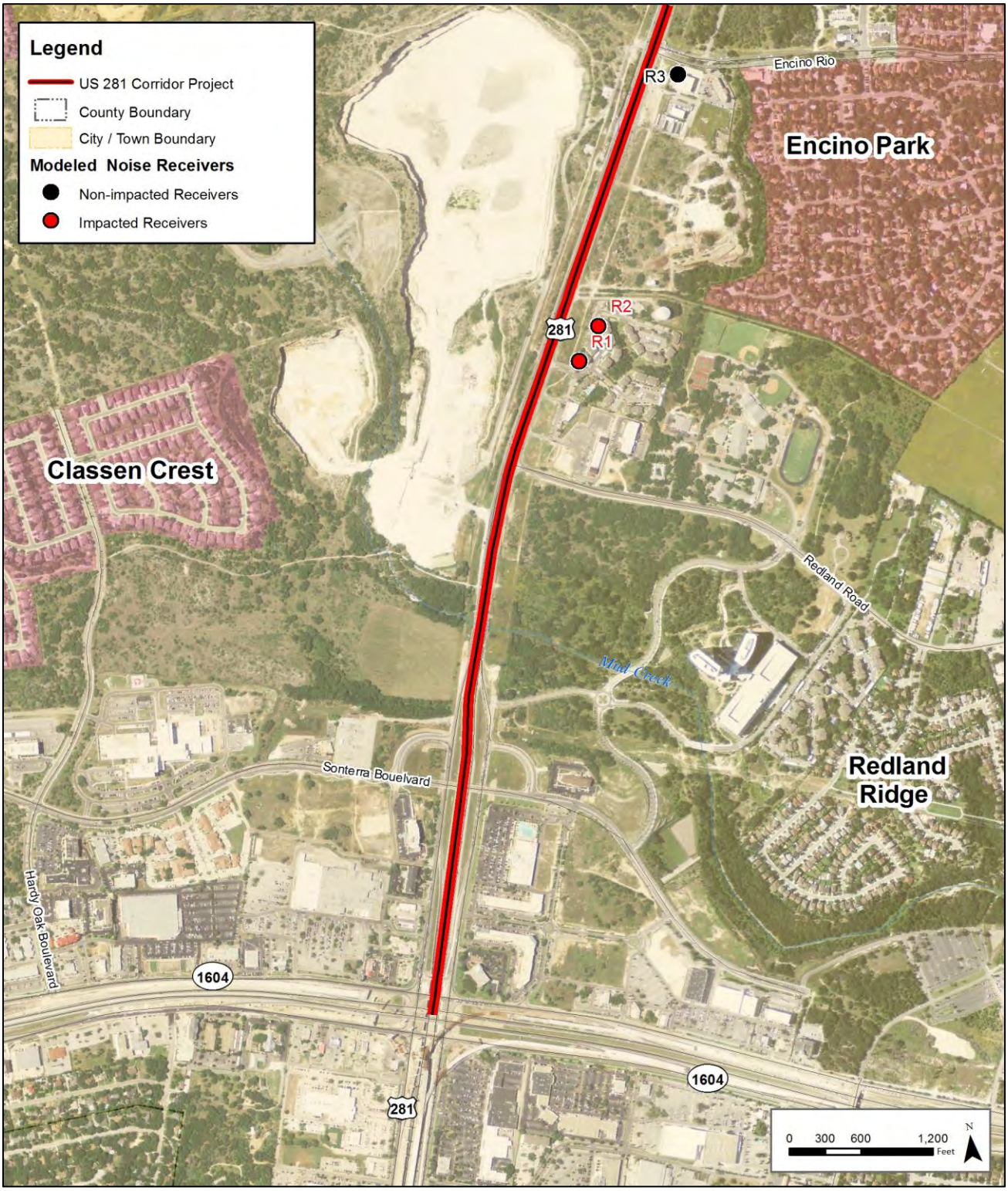
Representative Receiver	Description	NAC Category	FHWA NAC dB(A)	Elevated Expressway Alternative (Non-Toll, Toll, or Managed)				Preferred Expressway Alternative (Non-Toll and Managed)				Equivalent Receivers Represented (#)
				Existing dB(A)	Predicted 2035 dB(A)	+/- Change dB(A)	Noise Impact	Existing dB(A)	Predicted 2038 dB(A)	+/- Change dB(A)	Noise Impact	
R24	School	C	67	58	63	+5	No	58	60	+2	No	1[1]
R25	Place of Worship	C	67	69	66	-3	Yes	69	66	-3	Yes	3[1]
R26[2]	Hospital	D	52 (interior)	-	-	-	-	40	42	+2	No	2[1]

Source: US 281 EIS Team, 2012, 2014

[1]The land use activity areas of Category C or Category D were divided by representative receivers using single-family residential development lot sizes within the study area (TxDOT 2011 - Guidelines for Analysis and Abatement of Roadway Traffic Noise).

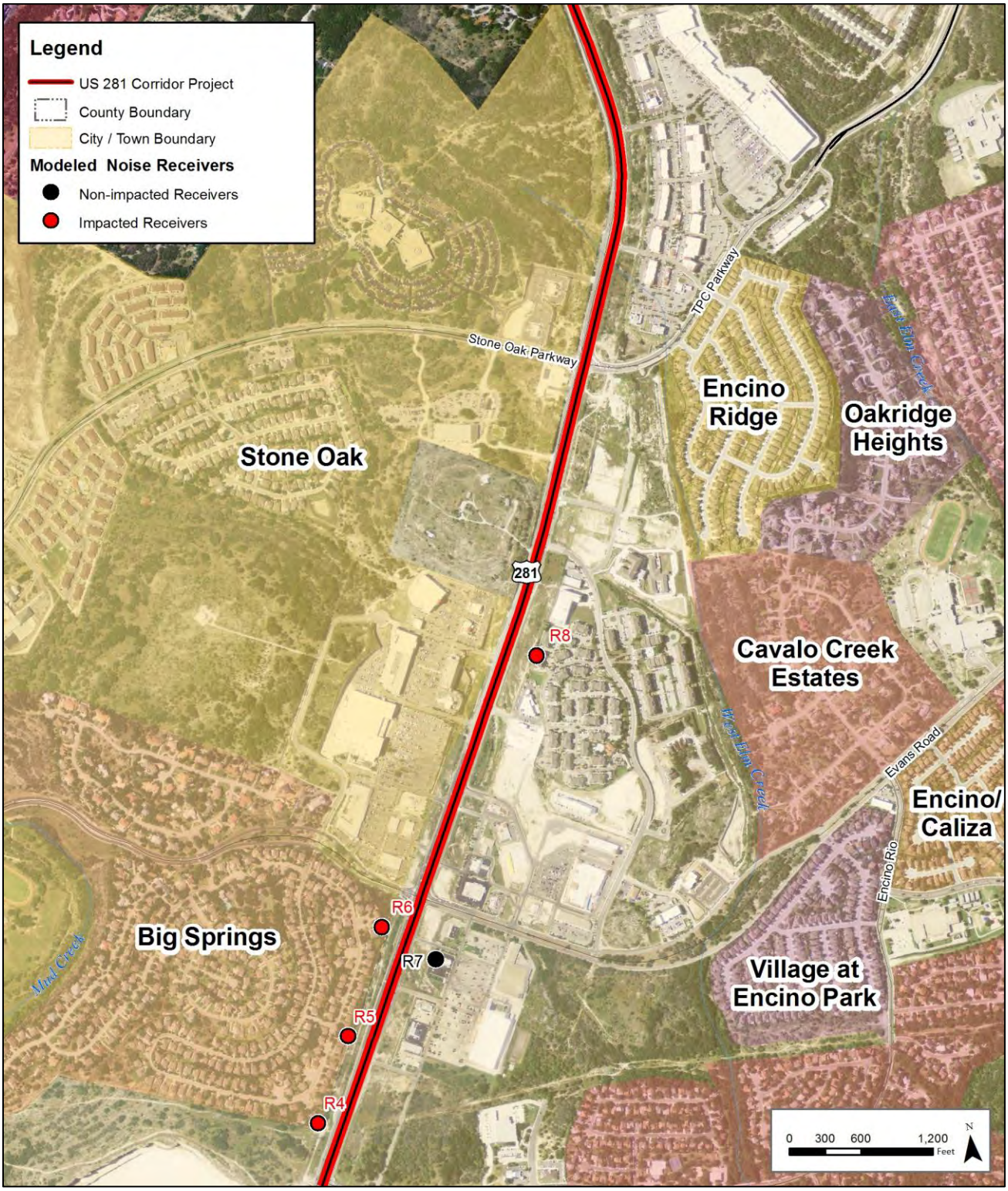
[2]R26 – The hospital would be displaced by the Elevated Expressway Alternative, therefore noise impacts are irrelevant under that alternative.

Figure 3-29a: US 281 noise receiver locations and potential abatement – Elevated Expressway Alternative



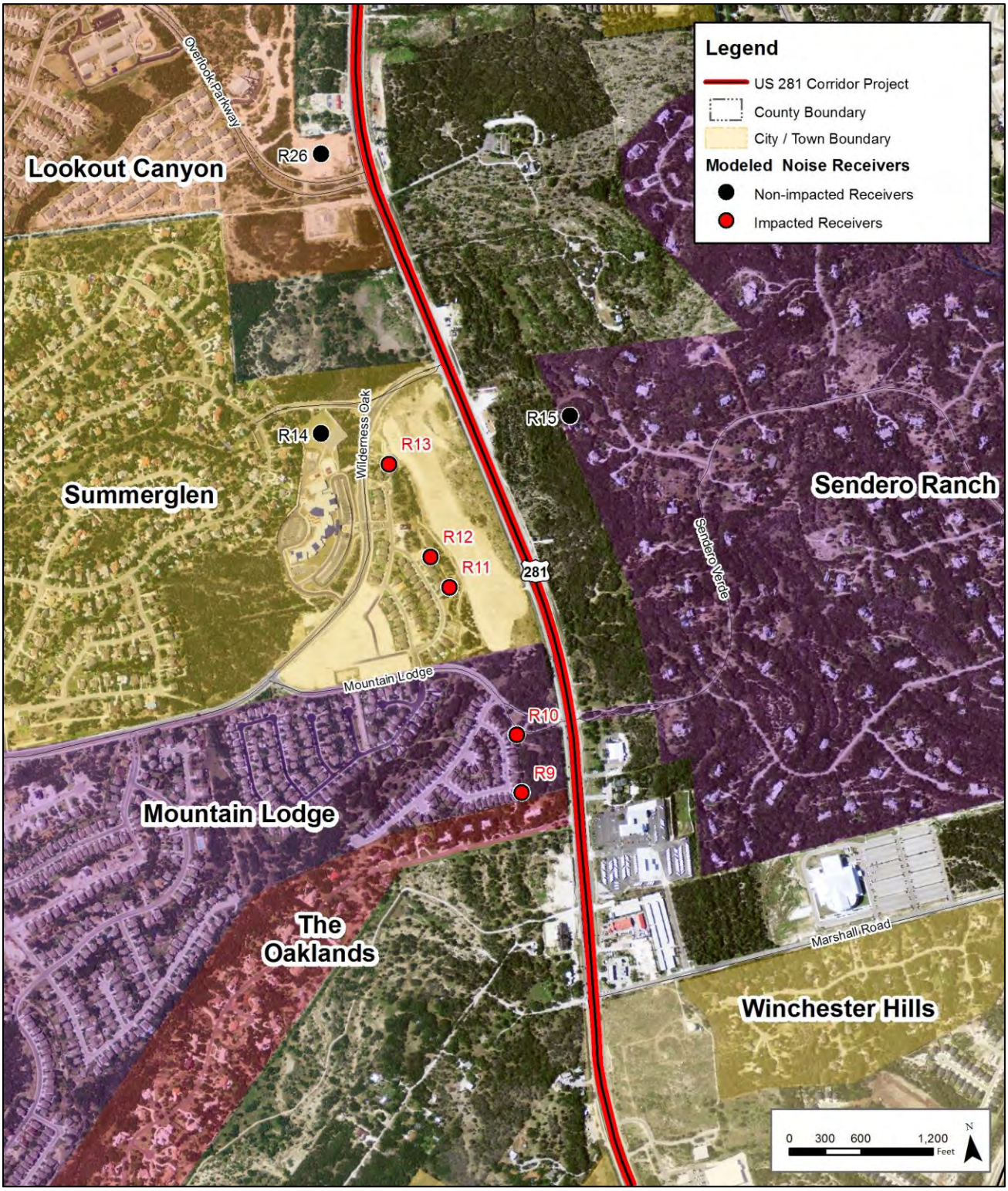
Source: US 281 EIS Team, 2014.

Figure 3-29b: US 281 noise receiver locations and potential abatement – Elevated Expressway Alternative



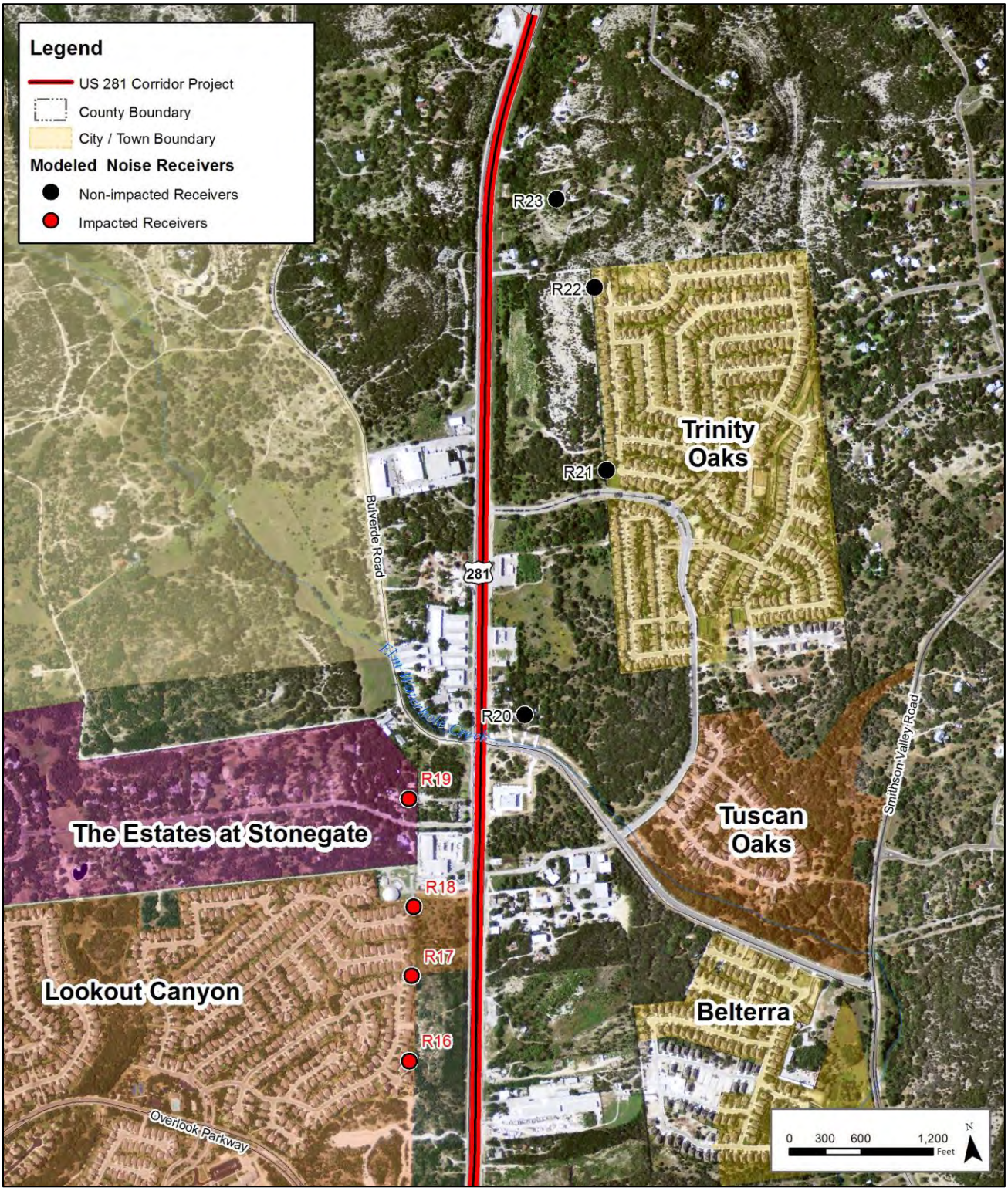
Source: US 281 EIS Team, 2014.

Figure 3-29c: US 281 noise receiver locations and potential abatement – Elevated Expressway Alternative



Source: US 281 EIS Team, 2014.

Figure 3-29d: US 281 noise receiver locations and potential abatement – Elevated Expressway Alternative

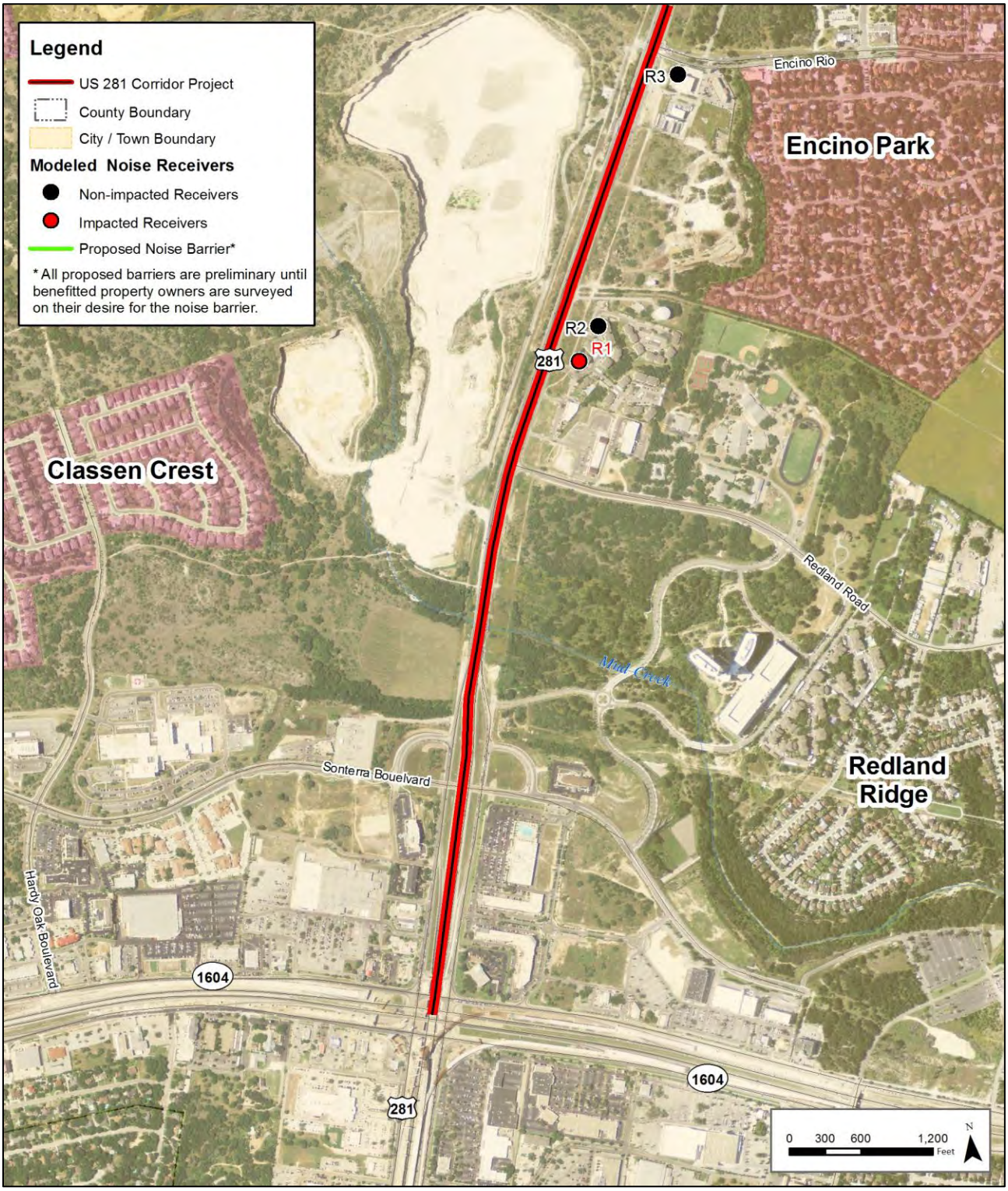


Source: US 281 EIS Team, 2014.

1 **Figure 3-29e: US 281 noise receiver locations and potential abatement – Elevated Expressway Alternative**

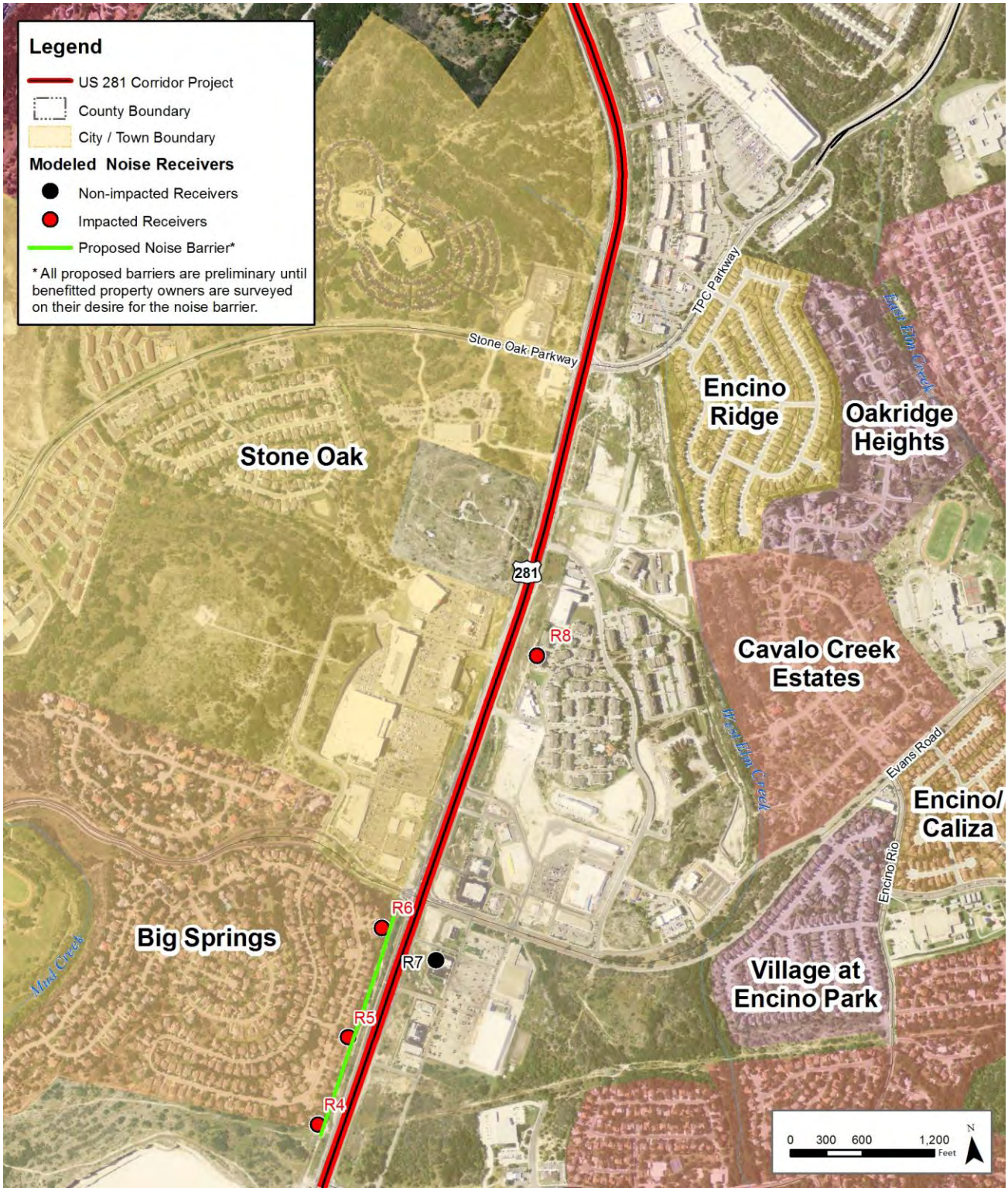
2
3 Source: US 281 EIS Team, 2014.

Figure 3-30a: US 281 noise receiver locations and potential abatement – Preferred Expressway Alternative



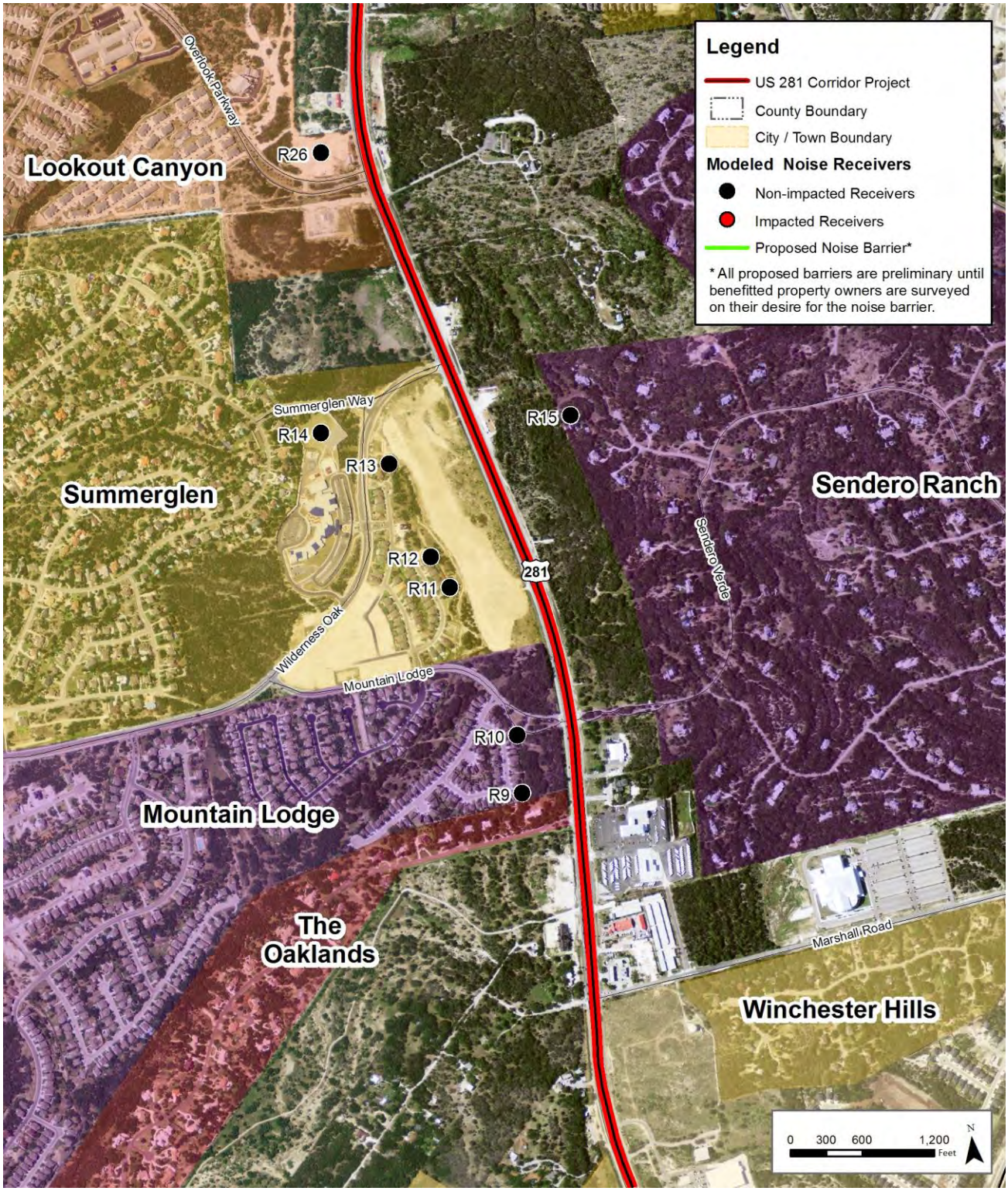
Source: US 281 EIS Team, 2014.

Figure 3-30b: US 281 noise receiver locations and potential abatement – Preferred Expressway Alternative



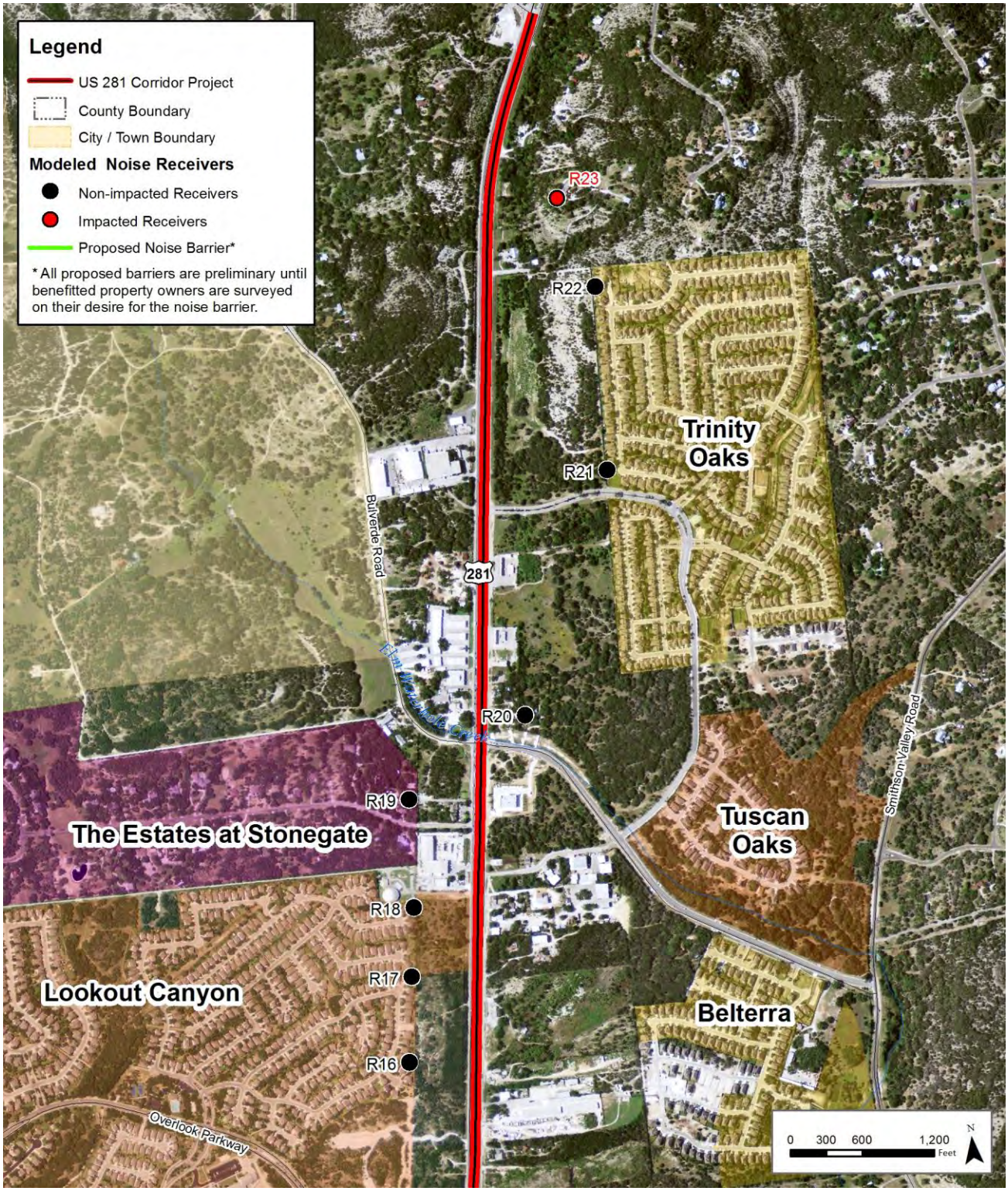
Source: US 281 EIS Team, 2014.

Figure 3-30c: US 281 noise receiver locations and potential abatement – Preferred Expressway Alternative



Source: US 281 EIS Team, 2014.

Figure 3-30d: US 281 noise receiver locations and potential abatement – Preferred Expressway Alternative



Source: US 281 EIS Team, 2014.

Figure 3-30e: US 281 noise receiver locations and potential abatement – Preferred Expressway Alternative

Source: US 281 EIS Team, 2014.

Table 3-35: Summary of the Total Noise Impacts for the US 281 Corridor Project

Alternative	NAC Category					Residential and Community Facilities Affected
	B	C	D	E	Total	
Elevated Expressway (Non-Toll, Toll, or Managed)	103	3	0	0	106	Ravinia Apartments, Big Springs, View At Encino Commons, Mountain Lodge, Summerglen, Lookout Canyon, The Estate at Stonegate, and Bulverde United Methodist Church
Preferred Expressway Alternative (Non-Toll and Managed)	37	3	0	0	40	Ravinia Apartments, Big Springs, View At Encino Commons, and Bulverde United Methodist Church

Source: US 281 EIS Team, 2014.

Table 3-35 indicates the number of residences (NAC Category B) and Bulverde United Methodist Church (NAC Category C) that could potentially be impacted by traffic noise for each alternative. The number of homes potentially impacted by Elevated Expressway Alternative is greater than number that would be potentially impacted by Preferred Expressway Alternative, 103 and 37 respectfully. This is a result of the elevated main lanes located on the outside of the existing US 281 lanes south of Stone Oak Parkway and on the west side north of Stone Oak Parkway in the Elevated Expressway Alternative. These elevated main lanes would have higher traffic volumes and speeds than the frontage roads (existing US 281) therefore moving traffic noise closer to residential receivers.

Traffic Noise Abatement Measures

As indicated in **Table 3-35**, the US 281 Corridor Project would result in a traffic noise impact 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.

Before any abatement measure can be proposed for incorporation into the project, it must be both feasible and reasonable. In order to be "feasible," the abatement measure must be able to reduce the noise level at greater than 50 percent of impacted, first row receivers by at least five dB(A); and to be "reasonable," it must not exceed the cost-effectiveness criterion of $25,000 for each receiver that would benefit by a reduction of at least five dB(A) and the abatement measure must be able to reduce the noise level at least one impacted, first row receiver by at least seven dB(A). The following abatement measures were considered for inclusion in the design of the Build Alternatives:

- **Traffic management** - Control devices could be used to reduce the speed of the traffic; however, the minor benefit of one dB(A) 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 right of way and not be cost effective/reasonable.
- **Buffer zone** - the acquisition of undeveloped property to act as a buffer zone is designed to avoid rather than abate traffic noise impacts and, therefore, is not feasible.
- **Noise barriers** - This is the most commonly used noise abatement measure. Noise barriers were evaluated for each of the impacted receiver locations.

Elevated Expressway Alternative

Noise barriers were evaluated for each potential impacted receiver for the Elevated Expressway Alternative. The following is a list of impacted receivers where noise barriers determined to not be feasible and reasonable, therefore, are not proposed for incorporation into the US 281 Corridor Project under the Elevated Expressway Alternative.

- R1 and R2: these receivers represent 24 residences at a three-story multi-family complex called the Rivinia Apartments. Based upon the modeling, a noise barrier in front of the Rivinia Apartments, 560 feet in length and 20 feet in height would reduce noise levels by at least seven dB(A) for four benefitted receivers at R1 and would achieve a maximum noise reduction of four dB(A) at four receivers at R2. This insertion loss at Site R2 is predicted to be less than the five dB(A) noise reduction required to consider a receiver benefitted per the TxDOT Noise Guidelines (TxDOT, 2011). Of the 24 impacted first-row receivers, 17 percent (4 of 24 receivers) are benefitted. Total cost of the noise barrier would be $201,600 or $50,400 for each benefitted receiver. Therefore, it was determined a noise barrier in front of Rivinia Apartments is not acoustically feasible or cost effective for the Elevated Expressway Alternative.
- R4-R6: these receivers represent a total of 24 residences in Big Springs. A noise barrier 20 feet tall and 2,020 feet in length would only achieve the minimum feasible reduction of five dB(A) at R5 (8 of 24 receivers or 33 percent of the first row receivers), but would not achieve a seven dB(A) noise reduction at any receiver, which is required noise reduction of seven dB(A) required per the TxDOT Noise Guidelines (TxDOT 2011). The total cost of the noise barrier would be $727,200 or $90,900 for each benefitted receiver. Therefore, it was determined that a noise barrier near Big Springs is not acoustically feasible or cost effective for the Elevated Expressway Alternative.
- R8: this receiver represents eight residences at a two-story multi-family residence called View at Encino Commons. A noise barrier 500 feet long and 20 feet high would achieve the seven dB(A) noise reduction design goal at 4 of 8 impacted first floor receivers or 50 percent. Total cost of the noise barrier would be $180,000 or $45,000 for each benefitted receiver. Therefore, it was determined that a noise barrier adjacent to the View at Encino Commons is acoustically feasible, but not cost effective for the Elevated Expressway Alternative.
- R9 and R10: these receivers represent a total of nine residences in Mountain Lodge. A continuous noise barrier would restrict access to Mountain Lodge Road (the main access point to this subdivision). Gaps in a noise barrier would accommodate access requirements but the resulting non-continuous barrier segments would not be sufficient to achieve the minimum, feasible reduction of five dB(A).
- R11, R12, and R13: these receivers represent 17 residences in Summerglen. A noise barrier 1,893 feet in length and ranging from 16 to 20 feet in height could only achieve the minimum feasible reduction of five dB(A) at R12 (7 of 17 benefitted receivers or 41 percent) and could not achieve a seven dB(A) noise reduction at any one receiver. Total cost of the noise barrier would be $308,782 or $44,112 for each benefitted receiver. Therefore, it was determined that a noise barrier near Summerglen is not acoustically feasible or cost effective for the Elevated Expressway Alternative.
- R16-R18: these receivers represent 20 residences in Lookout Canyon. A noise barrier 1,700 feet in length and 20 feet in height would achieve a maximum noise reduction of one dB(A) at all the receivers due to the elevated main lanes in close proximity to the residences of Lookout Canyon. This insertion loss is predicted to be less than the five dB(A) noise reduction required to consider a receiver benefitted per the TxDOT Noise Guidelines (TxDOT 2011). Total cost of the noise barrier would be $612,000. Therefore, it was determined that a noise barrier near Lookout Canyon is not acoustically feasible or cost effective for the Elevated Expressway Alternative.
- R19: this receiver represents a separate, individual residence in The Estate at Stonegate. A noise barrier 710 feet in length and 20 feet in height would achieve a maximum noise reduction of less than one dB(A), again due to the elevated main lanes in close proximity to the residence. This insertion

loss is predicted to be less than the five dB(A) noise reduction required to consider a receiver benefitted per the TxDOT Noise Guidelines (TxDOT 2011). Total cost of the noise barrier would be $255,600. Therefore, it was determined that this noise barrier near The Estate at Stonegate is not acoustically feasible or cost effective for the Elevated Expressway Alternative.

- R25: this receiver represents a total of three equivalent receivers for Bulverde United Methodist Church. A noise barrier 420 feet in length and ranging from 10 to 20 feet in height could achieve the minimum feasible reduction of five dB(A) and a seven dB(A) noise reduction for all three equivalent receivers or 100 percent. Total cost of the noise barrier would be $137,156 or $45,718 per receiver. Therefore, it was determined that a noise barrier near Bulverde United Methodist Church is acoustically feasible, but not cost effective for the Elevated Expressway Alternative.

Preferred Expressway Alternative

A refined evaluation of the traffic noise analysis was performed for the Preferred Expressway Alternative. The Preferred Expressway Alternative is a refined version of the Expressway Alternative considered in the Draft EIS. The traffic data used to characterize potential noise impacts caused by this alternative was developed by TxDOT's TPP Division.

Noise barriers were evaluated for each potential impacted receiver for the Preferred Expressway Alternative. The following is a list of impacted receivers where noise barriers determined to not be feasible and reasonable, therefore, are not proposed for incorporation into the US 281 Corridor Project under the Preferred Expressway Alternative.

- R1: this receiver represents 12 residences at the Rivinia Apartments (three-story apartment building). A noise barrier in front of the Rivinia Apartments, 560 feet in length and 20 feet in height would achieve a maximum noise reduction of four dB(A) at all 12 receivers at R1 due to the location of the driveway into Rivinia Apartments. This insertion loss at Site R1 is predicted to be less than the five dB(A) noise reduction required to consider a receiver benefitted per the TxDOT Noise Guidelines (TxDOT 2011). Total cost of the noise barrier would be $201,600. Therefore, it was determined that a noise barrier near Rivinia Apartments is not acoustically feasible or cost effective for the Preferred Expressway Alternative.
- R8: this receiver represents eight residences at View at Encino Commons (two-story apartment building). A noise barrier 500 feet long and 13 feet high would achieve the seven dB(A) noise reduction at 4 of 8 impacted first floor receivers or 50 percent. Total cost of the noise barrier would be $117,000 or $29,250 for each benefitted receiver. Therefore, it was determined that the noise barrier near the View at Encino Commons is acoustically feasible, but not cost effective for the Preferred Expressway Alternative.
- R23: this receiver represents an individual residence on the east side of US 281, south of Borgfeld Drive (27320 N US 281). A noise barrier 540 feet in length and 20 feet in height would achieve a maximum noise reduction of less than one dB(A) because the residence is situated on the hillside above the US 281 roadway. This insertion loss is predicted to be less than the five dB(A) noise reduction required to consider a receiver benefitted per the TxDOT Noise Guidelines (TxDOT 2011). Total cost of the noise barrier would be $194,400. Therefore, it was determined that this noise barrier near this residence is not acoustically feasible or cost effective for the Preferred Expressway Alternative.
- R25: this receiver represents a total of three equivalent receivers represented for Bulverde United Methodist Church. A noise barrier 390 feet in length and ranging from 14 to 19 feet in height could achieve the minimum feasible reduction of five dB(A) and the noise reduction design goal of seven dB(A) for all three receivers or 100 percent. Total cost of the noise barrier would be $114,256 or $38,085 per receiver. Therefore, it was determined that the noise barrier near Bulverde United Methodist Church is acoustically feasible, but not cost effective for the Preferred Expressway Alternative.

A noise barrier would be feasible and reasonable for the following impacted receivers and, therefore, is proposed for incorporation into the Preferred Expressway Alternative (**Table 3-36**).

- R4-R6: these receivers represent a total of 24 residences in Big Springs. A noise barrier 2,200 feet in length and ranging in height from 14 feet on the southern end near R4 to 18 feet in height on the northern end near R6, would reduce noise levels at all 24 receivers by seven dB(A) or greater at a total cost of $599,507 or $24,979 for each benefited receiver for the Preferred Expressway Alternative.

Table 3-36: Proposed Noise Barriers

Barrier	Representative Receivers	Total # Benefited	Length (feet)	Height (feet)	Total Cost	$/Benefited Receiver
Big Springs (Preferred Expressway Alternative)	R4 through R6	24	2,200	14 to 18	$599,507	$24,979

Source: US 281 EIS Team, 2014.

Any subsequent project design changes may require a reevaluation of this preliminary noise barrier proposal. The final decision to construct the proposed noise barrier will not be made until final design, utility evaluation and polling of adjacent property owners during a traffic noise workshop that would occur after the Record of Decision.

The traffic noise workshop would be offered to property owners adjacent to the proposed noise barrier. At the workshop, property owners adjacent to proposed noise barrier may provide input on the traffic noise abatement to be included in the final design, including whether the abatement measures are desirable (TxDOT Environmental Handbook – Traffic Noise, April 2014).

To avoid noise impacts that may result from future development of properties adjacent to the project, local officials responsible for land use control programs must ensure, to the maximum extent possible, no new activities are planned or constructed along or within the following predicted noise impact contours (**Table 3-37**).

Table 3-37: Noise Impact Contours by Build Alternatives

Alternative	Approximate Distance from Roadway (ft)			
	71 dB(A) Impact Contour		66 dB(A) Impact Contour	
	Westside	Eastside	Westside	Eastside
Elevated Expressway (Non-Toll)	163	61	350	300
Elevated Expressway (Toll)	118	70	320	250
Elevated Expressway (Managed Lanes)	150	72	329	290
Preferred Expressway Alternative (Managed and Non-Toll)	35	36	151	160

Source: US 281 EIS Team, 2014.

Highway Construction Noise

Noise associated with the construction of a project is difficult to predict. Heavy machinery (a 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 abatement measures such as work-hour controls and proper maintenance of muffler systems.

3.8.3 Conclusion and Proposed Mitigation Measures

A noise analysis was performed to determine worst-case predicted impacts from future traffic-generated noise levels at sites affected by each of the alternatives. Impacts are predicted to occur along all alternatives at several receiver locations, both individual and in groups. The Preferred Expressway Alternative is predicted to impact 40 receivers; the Elevated Expressway Alternative is predicted to impact 106 receivers, the majority residential properties.

Under the No-Build Alternative, increases in population and employment growth are projected throughout the study area. It is expected that ambient noise levels would continue to increase within areas of concentrated development associated with this projected growth. The noise analysis indicates areas along the US 281 Corridor Project will meet or exceed the NAC noise level by the design year. Mitigation was not considered for the No-Build Alternative.

Abatement measures were analyzed for impacted receiver locations within the project area for the Preferred Expressway Alternative. During this analysis of abatement measures, primary consideration was given to exterior areas where frequent human use occurs and lower noise levels would be of benefit. A noise barrier is proposed near Big Springs (R4, R5, and R6) for the Preferred Expressway Alternative. The final decision to construct this noise barrier will not be made until after the ROD, during final design, and subject to utility evaluation and polling of adjacent property owners at a traffic noise workshop.

A copy of the traffic noise analysis conducted in the Final EIS will be made available to local officials to ensure, to the maximum extent possible, future developments are planned, designed and programmed in a manner that would avoid traffic noise impacts. On the date of approval of the ROD (Date of Public Knowledge), TxDOT, and Alamo RMA are no longer responsible for providing noise abatement for new development adjacent to the US 281 Corridor Project.

3.9 WATER QUALITY

3.9.1 Surface Water

The TCEQ *Permanent Rules Chapter 307, Texas Surface Water Quality Standards (TSWQS) Subsections 307.2 – 307.10*, effective June 30, 2010, presents surface water quality standards that apply to all surface waters in the State. These standards are designed to establish goals for water quality throughout the State and provide a basis from which TCEQ regulatory programs can establish reasonable methods to implement and attain these goals. In compliance with Section 303(d) of the federal Clean Water Act (CWA), the TCEQ identifies water bodies in the State that do not meet the TSWQS. The compilation of these water bodies is called the 303(d) List. The major surface waters of the State are classified in the TSWQS as "segments" for the purposes of water quality management and designation of site-specific standards (TCEQ 2010b).

Methodology

A baseline and potential impacts to surface water quality include an inventory of surface waters in the US 281 project corridor, as well as listing 303(d) stream segments per TCEQ's TSWQS, which complies with Section 303(d) of the CWA.

In compliance with the Edwards Aquifer Rules, coordination with TCEQ will be initiated for Phase I storm water permits, which include a Texas Pollutant Discharge Elimination System (TPDES) permit and a Notice of Intent (NOI) General Permit. In addition, and in accordance with TCEQ policies, TxDOT's *Storm Water Management Guidelines for Construction Activities* will provide guidance for temporary erosion control measures during construction. Best management practices (BMPs) will be identified to avoid/minimize impacts to water quality. Low Impact Development (LID) was considered for the Preferred Expressway Alternative following RG-348, *Complying with the Edwards Aquifer Rules Technical Guidance on Best Management Practices.* According to this guidance, the LID techniques currently approved by TCEQ are bioretention, permeable friction course pavement, vegetative filter strips, biological media filter vault, storm water filter cartridge, and hydrodynamic storm separator wet vault (TCEQ 2005).

Affected Environment

Classified water bodies are defined by TCEQ as those listed and described in Appendix A (Site-Specific Uses and Criteria for Classified Segments) or Appendix C (Segment Descriptions) of the TSWQS. Water bodies in the State are grouped into 25 basins with each basin assigned a number. The US 281 project corridor is located in Basin 19, the San Antonio River Basin. A portion of the surface waters within the project corridor drain into Segment 1908, Upper Cibolo Creek, which is located within five (5) miles upstream of the project corridor. The length of Segment 1908 extends from the Missouri-Pacific Railroad Bridge west of Bracken Drive in Comal County to a point 1.5 kilometer (0.9-mile) upstream of the confluence of Champee Springs in Kendall County.

Segment 1908, Assessment Unit 108_02 is listed on the 2012 Texas Water Quality Inventory and 303(d) List and classified as a freshwater stream, which is designated for aquatic life use, fish consumption use, general use and public water supply use. This segment is affected by urban and rural storm water runoff. The TCEQ is required, under Section 303(d) of the CWA, to identify water bodies that do not meet, or are not expected to meet, applicable water quality standards for their designated uses. These water bodies are then placed on the previously mentioned 303(d) List. Segment 1908 is listed on the 2012 Texas Water Quality Inventory and 303(d) List due to bacteria contamination upstream of Boerne. In 2012 chloride was found to exceed acceptable minimum levels in three segments with the longest stretch occurring in the lower 43 miles of the stream and the other two segments occurring upstream of Boerne. The sources of contamination are indicated by the TCEQ to be unknown point and nonpoint sources. The US 281 project corridor is located approximately 0.70-mile downstream of Segment 1908, Upper Cibolo Creek, but the portion of the creek that is impaired is located upstream approximately 19 miles from US 281.

Environmental Consequences

No-Build Alternative

The No-Build Alternative would have no impacts to existing surface water quality conditions and would provide no additional improvements, BMPs, or protection measures to reduce existing direct or indirect surface water quality impacts.

Build Alternatives

Both of the Build Alternatives would result in short-term construction-related water quality impacts and long-term water quality impacts. An increase in impermeable surface resulting from the additional pavement would result in direct water quality impacts by way of the resultant increased storm water runoff (see **Table 3-38).** Surface water runoff from roadways frequently contains automobile pollutants such as oil, grease, antifreeze, particles from brake linings and tires, and municipal trash and debris.

Table 3-38: Impervious Cover per Build Alternative

Surface Water Quality Impacts	Preferred Expressway Alternative	Elevated Expressway Alternative	No-Build Alternative
Increased Impervious Surface Area (acres)	118	92	0

Source: US 281 EIS Team, March 2014.

In regard to increased impervious surfaces and as displayed in **Table 3-38**, the Preferred Expressway Alternative consists of the largest amount of increased impervious surface area compared to the Elevated Expressway Alternative. Thus, the Elevated Expressway Alternative would be expected to result in fewer impacts to water quality.

In addition to the increase in impervious surface area, each of the Build Alternatives has the potential to impact surface water quality in other ways. The construction of any of the Build Alternatives would result in soil disturbances during construction, resulting in temporary water quality impacts by temporarily increasing the level of suspended particles in storm water runoff. Each of the Build Alternatives has the potential to impact surface water quality at stream crossings. All of the water crossings in the project area are ephemeral streams that only flow for short durations after rain events and runoff from rainfall is the primary source of flow. Aquatic life is typically absent or extremely scarce. It is anticipated that the greatest potential total impact to surface waters would occur with the Preferred Expressway Alternative.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative is being considered for non-toll/managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same and storm water management improvements are proposed for all lane options; therefore the impacts to surface water quality would not change based on funding options.

Conclusion and Proposed Mitigation Measures

Since the project corridor is within five (5) miles upstream of Segment 1908, a 303(d) listed water; coordination with the TCEQ will be required prior to any construction activities in association with the review of the storm water pollution and prevention plan.

Based on the additional acreage of impervious surface area, the Preferred Expressway Alternative would have the greatest potential to impact surface water quality in the project corridor. The increase in impervious surfaces could lead to non-point source pollution (i.e., vehicle residues) due to runoff during rain events and flooding as a result of either of the Build Alternatives. Roadway runoff can have potentially substantial impacts to the water quality of streams as well as water quality downstream. Numerous constituents may be found in roadway runoff from multiple sources. These constituents can include: particulates, nitrogen, phosphorous, metals, salts, petroleum, pesticides, polychlorinated biphenyls (PCBs) and rubber. Any storm water runoff would either be allowed to run off the roadway, or it would be collected by retention/detention

areas and redirected by drainage ways or culverts. Localized runoff contributed by the Build Alternatives would represent an increase over existing conditions.

Under the authority of the EPA, the State of Texas has authority to implement the Federal National Pollutant Discharge Elimination System (NPDES) program, which is the TPDES. The TCEQ administers Phase I storm water permits for construction projects disturbing five acres or more within the State of Texas. Since this project would include five or more acres of earth disturbance, TxDOT will comply with the TCEQ TPDES Construction General Permit (CGP).

Construction activities typically impact wetlands and aquatic systems. The initial clearing of the land during construction activities would remove vegetative cover, which could lead to increased surface runoff and erosion. If this runoff is allowed to flow into streams, it could increase turbidity and sedimentation, or modify water chemistry due to an increase in sediments, nutrients and pollutants while diminishing suitable habitat for aquatic species and plants.

To address water quality issues during construction, a *Storm Water Pollution Prevention Plan* (SW3P) will be prepared prior to construction. The SW3P will be followed throughout construction phases to minimize sediment-laden storm water discharge to project corridor streams. The SW3P will be prepared pursuant to the TxDOT manual, *Storm Water Management and Guidelines for Construction Activities*. The SW3P may include, but is not limited to, silt fences, inlet protection barriers, hay bales, and seeding or sodding of excavated soils. Exposure of the soil surface will be minimized during all clearing activities in order to maintain soil integrity. All temporary erosion control measures will be implemented prior to the start of construction and maintained throughout the phases of construction. At the completion of construction, the TxDOT specifications, *Seeding for Erosion Control*, will be followed to restore and reseed all disturbed areas.

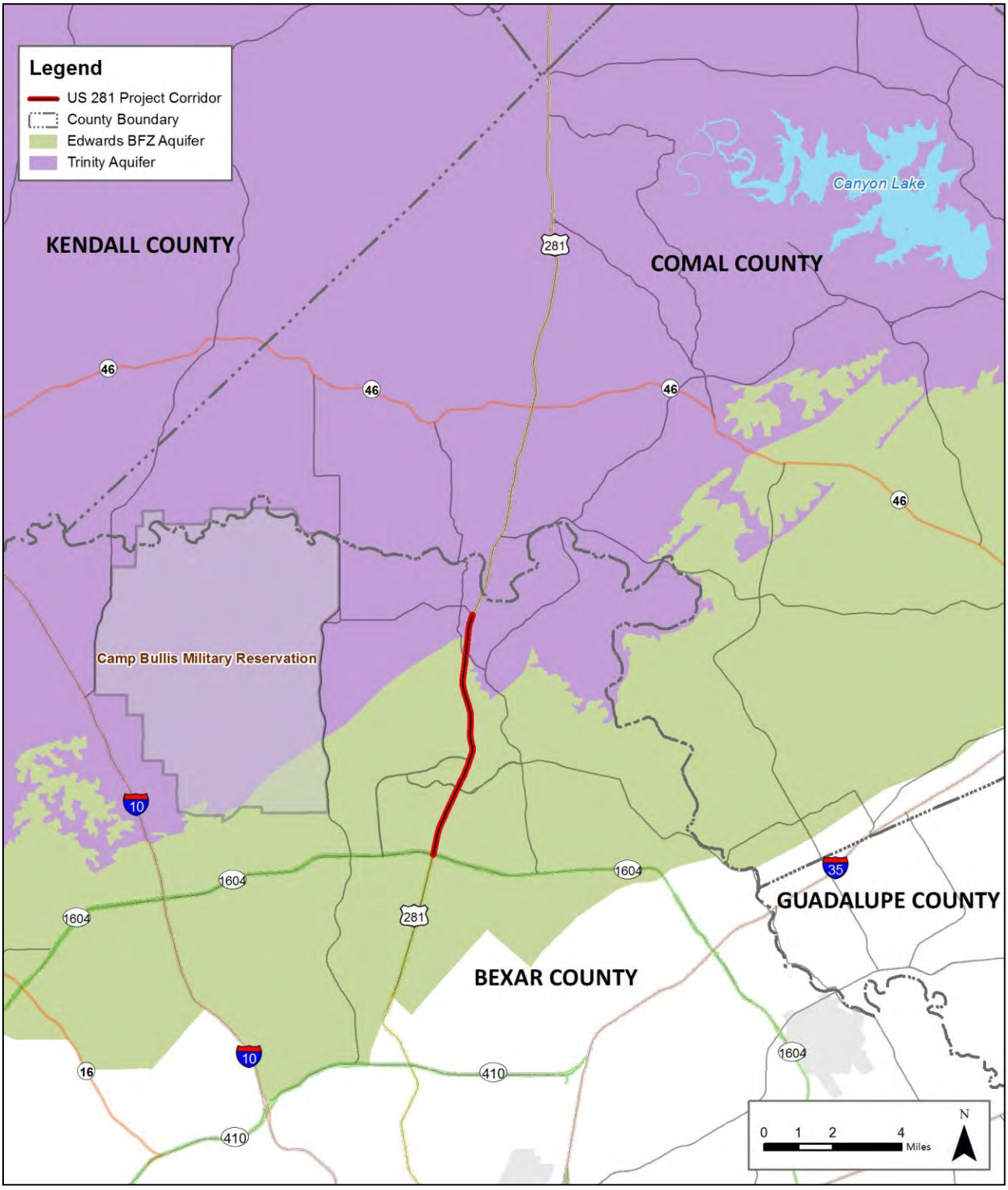
For post-construction controls, a combination of vegetative filter strips and bioretention will be utilized to control total suspended solids (TSS). Other areas of the ROW will be planted with native species of grasses, shrubs, or trees. The Hydrologic and Hydraulic Analysis Report is included in **Appendix K3** and provides detailed information on TSS calculations.

3.9.2 Groundwater

This section outlines the affected environment and groundwater resources associated with the surface and sub-surface geology within and surrounding the US 281 project corridor in northern Bexar County. The US 281 project corridor crosses the Edwards and Trinity aquifers that supply water to millions of people in Central Texas (**Figure 3-31**).

The US 281 project corridor is located in the southeastern portion of the Edwards Plateau Physiographic Province of Central Texas, along the Balcones Fault Zone (BFZ) and within the Hill Country. The BFZ forms the Balcones Escarpment, which is a highly eroded region bordering the Edwards Plateau on its southern and western boundaries. The project corridor typically has higher elevations to the north and west and generally slopes in a southeasterly direction. Canyons and drainage basins were formed by surface flow of the San Antonio River Basin.

Figure 3-31: Location of the project area in relation to local aquifers



Source: TWDB, Aquifer database, July 2011.

Methodology

This section provides a groundwater quality and quantity assessment including analysis of geology, karst recharge features, aquifer flowpaths, aquifer discharge, sources of contamination, and proposed runoff treatment BMPs. In addition, a search of the Texas Water Development Board records for public and private water wells was conducted, including a review of water supply wells in the US 281 project corridor or near the corridor and downgradient from it. Previously published groundwater reports that have been conducted in the area were reviewed.

Groundwater impacts for the Preferred Expressway Alternative are analyzed below; however, in compliance with the Edwards Aquifer Rules, coordination with TCEQ will be initiated for Phase I storm water permits, which include a TPDES permit and a NOI General Permit. In addition, and in accordance with TCEQ policies, *Storm Water Management Guidelines for Construction Activities* would provide guidance for temporary erosion control measures during construction. BMPs would be identified to avoid or minimize impacts to water quality. LID would also be considered for the Preferred Expressway Alternative following TCEQ document RG-348, *Complying with the Edwards Aquifer Rules Technical Guidance on Best Management Practices*. According to this guidance, the LID techniques currently approved by TCEQ are bioretention, vegetative filter strips, permeable friction courses, biological media filters, storm water filter cartridges, and hydrodynamic storm water separator wet vaults (TCEQ 2005). **Appendix K3** includes more information on compliance with Edwards Aquifer Rules related to the Preferred Expressway Alternative and the details of the hydrologic and hydraulic analyses.

Regulatory Background

The Edwards and Trinity aquifers are regulated by a variety of entities primarily focused on either protecting water quality of water entering the aquifer or the quantity of water removed from the aquifer. Water quality in the Edwards Aquifer is primarily protected by the TCEQ's Chapter 213 rules, which took effect in 1996, covering the Recharge Zone and Transition Zone, and were expanded in 1999 to include the Contributing Zone. The TCEQ's rules require Edwards Aquifer Protection Plans to be submitted for all types of development where ground disturbance may have the potential to pollute the Edwards Aquifer and hydrologically connected surface streams. The Plans must include a Geologic Assessment detailing the current condition of the property and the presence of any sensitive karst features that may serve as a conduit for recharge into the aquifer. The Plans must also document temporary and permanent water quality BMPs that allow for no more than a 20 percent increase in suspended solids in storm water runoff from the incremental increase of impervious cover resulting from the project. Other water quality protection may also take the form of local development regulations enforced by municipalities and county governments; however, within the vicinity of the 281 project corridor, the TCEQ rules are currently the most protective of water quality in the Edwards Aquifer.

The Edwards Aquifer gains some degree of protection from federal actions due to its designation as a Sole Source Aquifer by the EPA under Section 1424(e) of the Safe Drinking Water Act. The Edwards Aquifer was the first to be designated a Sole Source Aquifer in 1975, meeting the criteria of supplying more than 50 percent of the drinking water for an area with no reasonably available alternative sources of water, should the aquifer become contaminated. The Sole Source Aquifer program is intended to prevent federally funded projects from causing contamination to a Sole Source Aquifer through a review process.

The Source Water Protection Program was created by the 1996 Amendments to the Safe Drinking Water Act and is administered by the TCEQ to help protect groundwater quality for public drinking water systems. The program provides proactive steps and assistance to local governments and suppliers of drinking water for the protection of local drinking water supplies. The protective actions are intended to prevent costly treatment or enhancement. Source Water Protection Programs have been implemented for public water supply wells owned by San Antonio Water System and New Braunfels Utilities.

Water quantity in the Edwards and Trinity aquifers is managed through the issuance of withdrawal permits by groundwater conservation districts. Within the vicinity of the 281 project corridor there are two districts, the Trinity Glen Rose Groundwater Conservation District and the Edwards Aquifer Authority (EAA). The Trinity Glen Rose Groundwater Conservation District was created by the legislature in 2001 and confirmed by its constituents in 2002 to conserve, preserve recharge, and protect and prevent the waste of groundwater from the Trinity Aquifer in northern Bexar County. The District was also created in response to the designation of the Trinity Aquifer within Bexar Country as a Priority Groundwater Management Area due to the rapid growth in north Bexar and surrounding counties.

In 1993, the Texas Legislature created the EAA by passage of the EAA Act to manage, conserve, preserve, and protect the southern segment of the aquifer and to increase the recharge of, and prevent waste or pollution of water in, the aquifer. Although the legislation was passed in 1993, litigation delayed agency start up by three years, until 1996. In 2007, the Texas Legislature mandated the EAA to allow regular permitted withdrawals from the southern segment of the Edwards Aquifer of up to 572,000 acre-feet per year subject to mandated reductions in pumping of up to 40 percent during critical drought periods. These mandates may be further modified by aquifer management strategies currently being developed as part of a Habitat Conservation Plan (HCP) also mandated in 2007 by the Texas Legislature, as part of the Edwards Aquifer Recovery Implementation Program (EARIP). The EARIP and HCP identifies conservation measures developed and agreed to by the EARIP stakeholders (EAA, the City of New Braunfels, the City of San Marcos, the City of San Antonio through the San Antonio Water System (SAWS), Texas State University – San Marcos, and Texas Parks and Wildlife Department) to protect the threatened and endangered species whose habitats are found in the Edwards Aquifer-fed Comal and San Marcos springs. The goal of the HCP is to protect those species from harm during the most severe drought to the extent required by state and federal law and would shield the region from litigation under the Endangered Species Act if harm were to come to the protected species as a result of plan implementation. The EARIP and HCP allow the region to avoid federal intervention and assure those with water rights and pumping permits that they would be able to have access to groundwater for the 15-year term of the HCP.

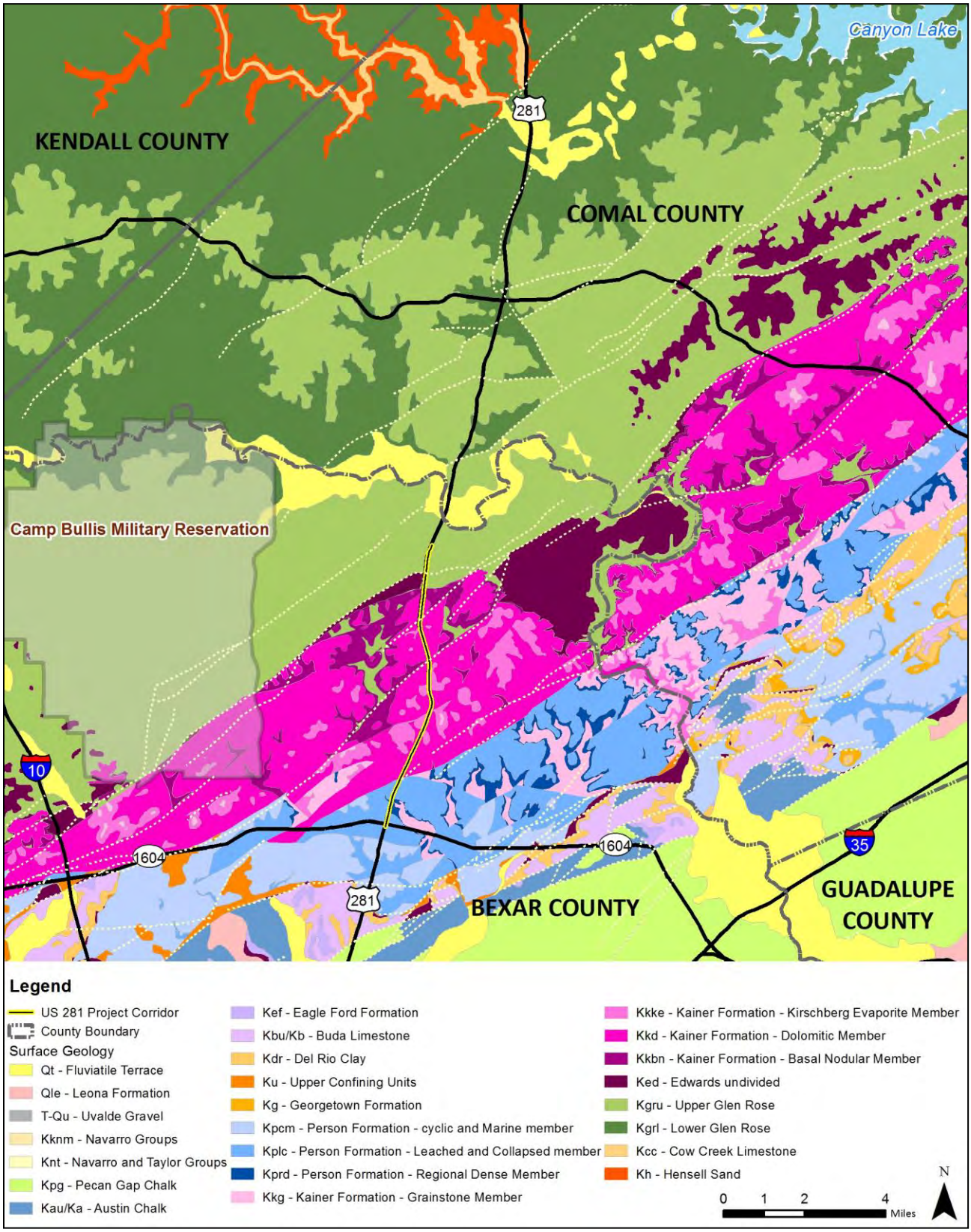
Affected Environment

Geology

The geologic formations occurring within and surrounding the project corridor are comprised mostly of Cretaceous age limestone bedrock with some overlaying Quaternary alluvium along surface drainages (**Figure 3-32**). The soils that have formed on top of these limestones are relatively thin and offer very minimal filtering capability. The limestone bedrock developed from the accumulation of thick sequences of marine sediments deposited in a lagoon environment on the San Marcos Platform, which was protected by a barrier reef during the Cretaceous age about 100 million years ago. In Central Texas, the Cretaceous bedrock dips slightly to the southeast at about 10 to 15 feet-per-mile toward the Gulf of Mexico.

Major tectonic uplifting of the Edwards Plateau occurred about 15 million years ago, which resulted in the accelerated erosion of the Hill Country topography seen today. The boundary between the Edwards Plateau and Gulf Coastal Plain occurs along the trace of the BFZ. The BFZ is comprised mostly of northeast-southwest normal faults with displacement toward the southeast. The accumulative displacements for some of these fault sets can be greater than 1,000 feet. The Miocene faulting permitted water from precipitation and accumulated surface water to percolate into the limestone allowing for extensive karstic diagenesis (alteration of the bedrock after its formation) that resulted in interconnected, sometimes cavernous porosity of the prolific Edwards Aquifer. See **Appendix J2** for detail on the hydrostratigraphy of the Edwards and Trinity aquifers.

Figure 3-32: Geologic map of region surrounding the US 281 project



Source: USGS Geologic Map of the Edwards Aquifer Recharge Zone (Blome et al., 2005); TNRIS 1:250,000 Geologic Atlas of Texas; USGS 1:24,000 National Hydrography dataset; July 2011.

Groundwater Aquifers

The area of consideration for groundwater expands beyond the proposed ROW for the Preferred Expressway Alternative because of the nature and extent of the Trinity and Edwards aquifers. These aquifers are laterally extensive, covering an area of central Texas several hundred miles long and wide. The project corridor is within the sensitive Edwards Aquifer Recharge Zone where much of the recharge to this aquifer is focused and channeled through several creeks that cross the outcrop areas. The remaining surface water flow eventually drains into the San Antonio River within Bexar County. Both the Trinity and Edwards aquifers in this area have karst characteristics meaning that they were formed by the dissolution of minerals by groundwater flow. The voids created by the dissolved rock made pathways for the water to move through the limestone. Effective porosity within both aquifers is primarily the result of dissolution of the original rock matrix along bedding planes, joints, and fractures after deposition. This process has created heterogeneous or uneven flow and storage of groundwater.

Flow in karst aquifers occurs over a wide range of hydraulic conductivity, from flow through the rock matrix (least permeable), flow in planar fractures and bedding planes (moderately permeable), to turbulent flow through integrated conduit systems (most permeable). Surface landforms commonly seen in this terrain are (1) recharge features such as fractures enlarged by the dissolution of limestone along their surfaces, sinkholes and losing streambed sections, (2) transmission features such as active and relict caves, and (3) discharge features such as permanent and ephemeral springs (those that appear briefly after precipitation events, quickly dry up, and disappear). In general, most storage occurs in the matrix, while most flow occurs in the fractures/faults and conduits. Matrix and conduit components may or may not mix effectively. Thus, groundwater in some components of the aquifer may have very long residence times and be relatively resistant to surface contamination, while other components of the aquifer may have extremely rapid travel times and be very vulnerable to contamination. The vulnerable parts of the aquifer include discrete recharge features and also the most productive zones, feeding major springs and wells.

In addition to the range of flow velocities, flow directions are also variable in karst aquifers. Flow directions are influenced by both regional and local hydraulic gradients, but they are also controlled by the location and orientation of conduit systems. Karst aquifers may be influenced by development and changes in geologic formations that occurred under previous water flow regimes; thus flow paths may not follow local topography or surface watersheds. It is common for flow in karst aquifers to cross watershed boundaries, which are typically considered to be groundwater divides in other types of aquifers. Furthermore, the pattern and direction of flow in karst aquifers is often water-level dependent, as high water levels can utilize older flow paths and travel in non-linear directions using conduits formed under older groundwater regimes, which may differ from modern ones.

Trinity Aquifer

The Trinity Aquifer is major aquifer of Texas and regionally spans most of Central Texas. However, it plays a lesser role than the Edwards Aquifer; yields in the Trinity Aquifer are up to 250 times lower than in the Edwards Aquifer (Mace et al. 2000). The quantity of groundwater in the Trinity Aquifer is variable and is used as a water supply in some areas of northern Bexar and northwestern Comal counties. It has historically been a source of groundwater for agricultural and residential use. Development over the aquifer has resulted in declining well production in many locations and water shortages during drought conditions.

The Trinity Aquifer is located within lower Cretaceous rocks underlying the Edwards Group, including the Hosston Formation, the Sligo Limestone, the Hammett Shale, the Cow Creek Limestone, the Hensel Sand and the Glen Rose Formation (Ashworth 1983). The stratigraphic, lithologic, and hydrologic characteristics of the rocks in Bexar County are summarized in **Appendix J2**. This aquifer is bounded to the east and south by the Edwards Aquifer; to the west has presumed flow paths between the Trinity and the Edwards-Trinity Aquifers; and to the north by variations in bedrock geology and deeply incised rivers.

The Trinity Aquifer is divided into three units based on hydrogeologic differences (Upper, Middle, and Lower Trinity) that form a leaky, primarily confined aquifer system (Ashworth 1983). The Middle Trinity Aquifer ranges from 60 to 200 meters thick (Mace et al. 2000) and discharges through springs, pumping directly into the Edwards Aquifer to the south and east. The lower member of the Glen Rose Limestone contains more secondary porosity than the upper member (Ashworth 1983; Veni 1997). The middle unit of the Trinity Aquifer is the most utilized portion of this groundwater resource in the project corridor, and is found about 500 to 1,000 feet below the Edwards limestone.

Edwards (Balcones Fault Zone) Aquifer

The Edwards Aquifer is one of the most permeable and productive limestone aquifers in the United States. It is the primary source of water for a large portion of Central Texas including cities, towns, rural communities, farms, and ranches. The water is used for a range of purposes, including municipal, industrial, manufacturing, steam electric, irrigation, mining, livestock, and recreational uses. In the San Antonio region, the aquifer supplies drinking water to more than 1.7 million people and provides habitat for several endangered aquatic species.

The Edwards Aquifer occurs in rocks of the Edwards Group, which include the Kainer and Person Formations. Geographically, the Edwards (Balcones Fault Zone) Aquifer is divided into three segments: the San Antonio Segment, the Barton Springs Segment, and the Northern (Balcones) Segment. The San Antonio Segment is pertinent to the US 281 Corridor Project and stretches from central Kinney County in the west to central Hays County in the northeast. The San Antonio Segment is separated from the Barton Springs Segment by a groundwater divide running west-northwest from the city of Kyle, in Hays County. Generally, groundwater north of the divide flows north, while groundwater south of the divide flows south. To the northwest, the San Antonio Segment is bounded by the Trinity Aquifer, and to the south and southeast it is bounded by less permeable, younger rocks down thrust by the Balcones Fault Zone.

The length of the Edwards Aquifer in the San Antonio region extends approximately 180 miles from the groundwater divide near Brackettville in the west to the groundwater divide north of Kyle in the northeast. The Edwards Aquifer varies in width from five (5) to 40 miles from the northern limit of the Recharge Zone to the southern limit of fresh water. The southern boundary of the aquifer is a marked by a zone of increasing salinity from 350 parts per million (ppm) to over 300,000 ppm total dissolved solids (TDS).

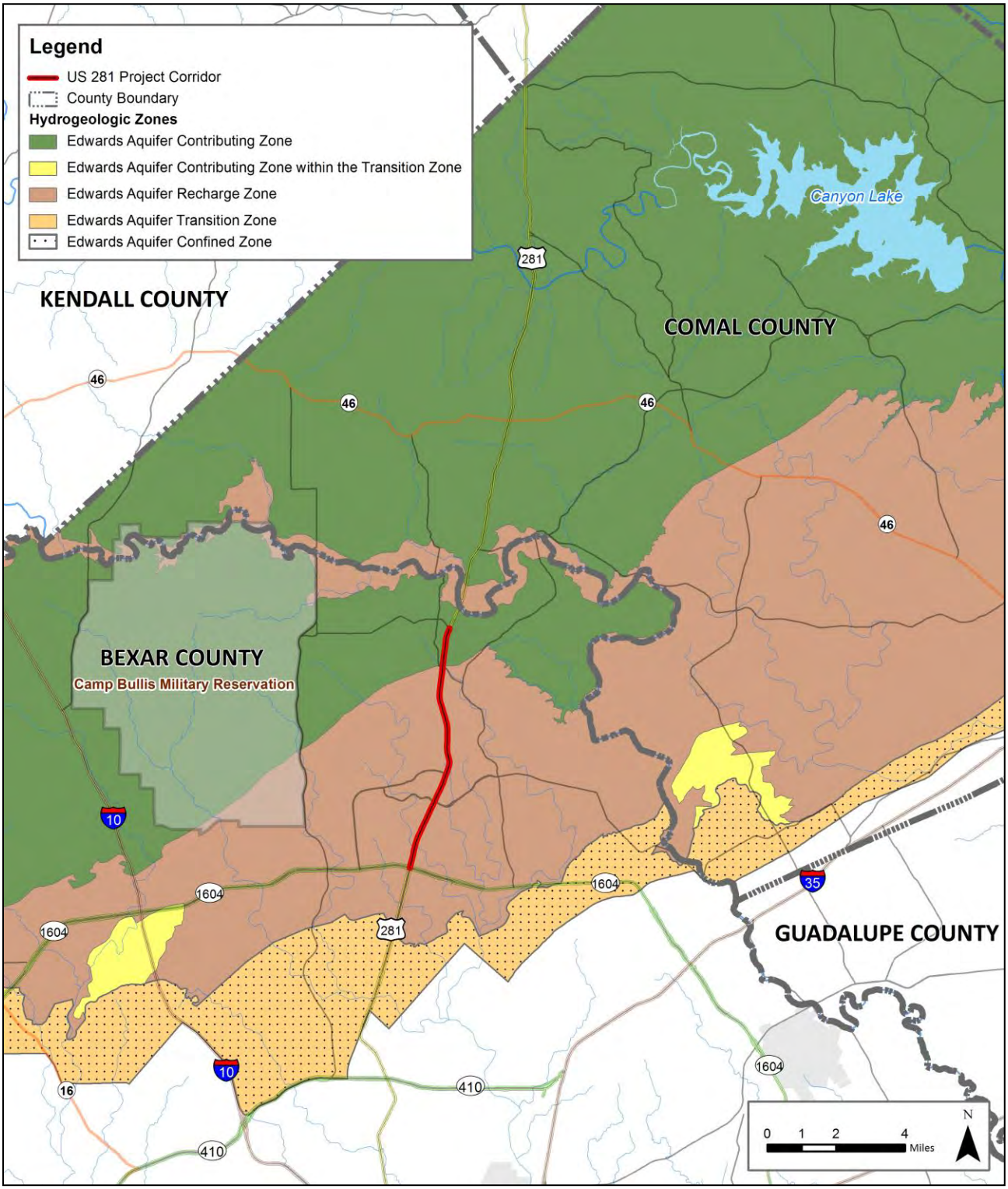
Two distinctive zones, fresh and saline, can be found in the Edwards Aquifer with a transition area between them. Locally, the point at which TDS reaches 1,000 ppm is referred to as the "bad-water line" and is the approximate southern extent of potable water. The freshwater zone has gone through extensive changes since deposition, whereas the saline zone has retained more of its original depositional lithology, as it is buried beneath the surface, where it is protected from surface impacts such as erosion and drought, and is not consumed as a source of drinking or irrigation water, impacting its subsurface quantities. The high productivity of the Edwards Aquifer freshwater zone is a result of dissolution along fractures associated with Balcones faulting.

The Edwards Aquifer has five zones: (1) the Contributing Zone, (2) the Recharge Zone, (3) the Transition Zone, (4) the Confined Zone and (5) the Contributing Zone within the Transition Zone (**Figure 3-33**). The Contributing, Recharge and Transition Zones are regulated by TCEQ.

1. *The Contributing Zone*. Water flows over less permeable bedrock and is routed onto the Recharge Zone. The Contributing Zone is composed of drainage areas and catchments of surface streams that flow over the Recharge Zone. Much of the Contributing Zone lies over the older Glen Rose Limestone Formation.

2. *The Recharge Zone*. This is a relatively narrow band of outcrops of heavily faulted and karstified Edwards limestone. In the Recharge Zone, surface water flows underground to contribute to the Edwards Aquifer. Water stored in the Recharge Zone as part of the Edwards Aquifer is unconfined, meaning that there are no overlying rock units protecting the aquifer; it is exposed at the ground surface wherever bedrock is exposed and open to the surface environment. Water in this portion of the aquifer is at the same pressure as the atmosphere at the ground surface and forms a water table at the level of the water in the aquifer. Areas above the water table in the aquifer are dry and this area is known as the vadose zone. The flow of water in the Recharge Zone is driven by gravity to discharge at water-table springs, to enter deeper flow systems and discharge at artesian springs like Comal and San Marcos springs, or to contribute to the Confined Zone of the Aquifer.
3. *The Transition Zone*. This consists primarily of younger bedrock overlying the Confined Zone. These younger and generally less permeable rocks of the Transition Zone overlie and form the upper confining cap to the artesian portions of the Edwards Aquifer, in the Confined Zone. While the surface bedrock in the Transition Zone is generally less permeable and karstified than the rocks of the Edwards Group, it is also extensively fractured and faulted by the BFZ, and hosts some high-permeability pathways into the Confined Zone.
4. *The Confined Zone*. Also termed the Artesian Zone, this is the area where the Edwards limestone is confined between two layers of impermeable rock which traps water inside the aquifer. Water flowing into the aquifer in the Recharge Zone pressurizes the water in the Confined Zone, forcing water upwards, against gravity, in wells that penetrate the confining cap. These wells are known as artesian wells. In the Confined Zone, there is no water table and no vadose zone, as the entire aquifer is saturated.
5. *The Contributing Zone within the Transition Zone*. These very small areas occur south and southeast of the Recharge Zone where limestones other than the Edwards formation crop out at a higher elevation than the Edwards limestone. Here water drains to stream courses that overlie the Recharge Zone. Eventually the stream courses reach areas where units of the Edwards formation crop out and water is allowed to infiltrate the more permeable Edwards limestone.

Figure 3-33: Map of the four Edwards Aquifer Zones in the region surrounding the project area



Source: TCEQ Edwards Aquifer Hydrographic Zone dataset, 2011a.

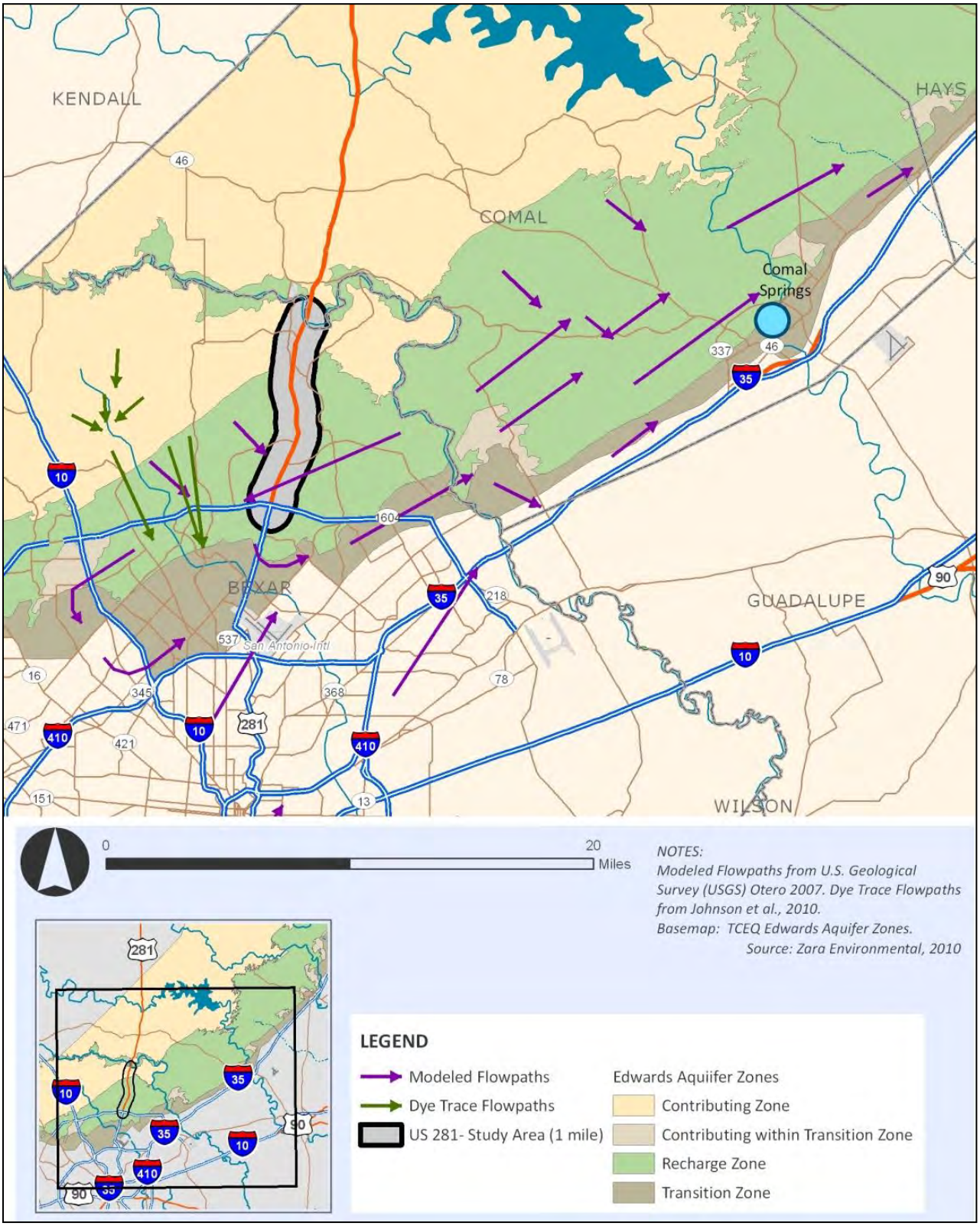
Aquifer Flowpaths

Groundwater flow paths in northern Bexar and southern Comal counties have been modeled using geologic and hydrologic data (Otero 2007), and flow generally from the US 281 project corridor northeasterly to Comal Springs. Multiple flowpaths are identified and some directly cross the project corridor, although one of the modeled paths flows in a southwestern direction before turning 180 degrees to flow northeasterly beneath US 281. Most recharge to the flow paths is primarily regional, occurring in the EARZ west of the project corridor. The permeable sections of the aquifer in the flow paths to Comal Springs, although faulted, are juxtaposed in a manner that promotes the flow of groundwater in the project corridor from the center of Bexar County through southern Comal County. The groundwater then encounters a transverse fault northeast of New Braunfels that forms a barrier to groundwater flow and is forced up along the Comal Springs fault and through the overlying gravels to form a majority of the springs and seeps in the Comal Springs complex. Water level and spring hydrographs at wells in northern Bexar County, southern Comal County, and Comal Springs provide evidence of patterns indicating a common flowpath for groundwater flowing past the wells and discharging at Comal Springs (Otero 2007).

Recent dye tracing studies have been conducted under the direction of the EAA (Johnson et al. 2010) and provide good evidence for flowpaths and time of travel in the aquifer. These studies took place near Panther Springs Creek and US 281 (**Figure 3-34**) and are directly applicable to evaluation of sensitivity of the EARZ in the area near the proposed US 281 project corridor. Four phases of tracing, using non-toxic fluorescent dyes, were performed through injection sites in six caves and at an additional site that is a soil covered inter-stream location with no visible karst features. Water was sampled for the detection of the dyes in 32 public and private wells located in the general vicinity of Panther Springs Creek near Loop 1604 and US 281.

The path that the dyes took from injection point to receptor crossed under Loop 1604 near Blanco Road, which is approximately 2.5 miles west of US 281. The potential straight-line flow velocities measured from the testing ranged from a low of 43 feet per day to a high of 17,400 feet per day. The large discrepancies in velocities can be attributed to whether a monitored well is located in the vicinity of a karst conduit or flowpath that might directly channel the dye to a particular location. Reduced concentration of dye in the vadose zone due to natural absorption by clay particles at injection sites may also cause discrepancies in velocities. The hydrologic conditions before, during, and after dye injections potentially impact both groundwater velocity and direction of groundwater flow. Several mapped faults are located between injection and the monitored receptor wells. The results from the traces indicate that these faults did not interfere or redirect the flowpath between receptor and injection locations. The apparent flow direction was perpendicular to the faults and generally parallel to the surface direction along the surface drainage. Additionally, some of the injections were in caves predominantly in the upper Glen Rose (location of a portion of the Trinity Aquifer) and were detected downstream and upsection (higher stratigraphic position) in wells completed into the Edwards Aquifer, indicating that groundwater flows between underlying Trinity and overlying Edwards aquifers. See **Appendix J2** for discussion of stratigraphy of Edwards and Trinity aquifers. The location of one dye injection was in an inter-stream location and was slowly flushed with water over a two-month period in an area with no observable karst features. The dye was detected in two wells, which demonstrated the potential vulnerability of the Recharge Zone even in areas that are not known to have mapped caves or other karst features.

Figure 3-34: Modeled and dye traced groundwater flowpaths in the area near US 281 up to Comal Springs



Source: (USGS) Otero, 2007. Johnson et al., 2010. TCEQ Edwards Aquifer Zones, Zara Environmental, 2010.

Groundwater Quantity

Central Texas is in a semi-arid environment with average annual rainfall of about 30 to 35 inches per year. Evaporation of 75 to 90 inches per year removes much of this water prior to recharging the aquifers. Many of the rainfall events occur as thermal convection thunderstorms that can produce excessive amounts of precipitation in short periods of time. Some of this water makes its way into the aquifers; usually through concentrated areas along creeks and rivers in outcrop areas of the Recharge Zone. In order to maintain a healthy, sustainable aquifer, discharge to springs, wells, and other aquifers must not exceed recharge. When discharge exceeds recharge, water levels drop in the aquifer, impacting spring and well flows as well as habitat for aquifer and spring-dependent species. Recharge is controlled by the amount of precipitation available in any given year, which is widely variable in Central Texas. Multi-year droughts are routine, as are intervening years of record-breaking high rainfall. Recharge is also controlled by the amount of water available to the Recharge Zone, which can be impacted by irrigation draws on surface waters and by impermeable cover. Recharge is also affected by the amount of evapotranspiration (ET) that occurs in given settings, although the variation in ET from different plant communities pales in comparison to the variation in discharge from pumping.

As water demand increases during dry periods, aquifer discharge (i.e. pumping) increases while recharge does not. During drought, demand increases even more sharply and stresses aquifer resources. As discharge exceeds recharge, aquifer levels decline. This leads to decreased springflows, desiccation of springs and spring runs, and dry water wells. Decreased spring flows and water levels across the region point to a decline in groundwater resources (Ashworth 1983; Brune 1981; Davidson 2008; Mace et al 2000). A 2011 USGS publication observed that annual discharge by wells more than tripled between 1939 and 2000 in the San Antonio region, noting that "…increased pumping has affected springflow at some springs over time, but no long-term declines in groundwater levels have been observed" (USGS 2011b).

In the Trinity Aquifer, simulations indicate that the area near Cibolo Creek in northern Bexar, southern Kendall and western Comal counties is very susceptible to water level declines due to the combination of drought and pumping withdrawals (Mace et al 2000). This report projects that the Trinity Aquifer in this area could be largely depleted by 2030. Additional development and pumping withdrawals will have a negative impact on water quantity in this area. The report also projects less severe but still significant water level declines in much of the rest of the Trinity Aquifer, particularly in Hays, Blanco, Travis, southeastern Kerr, and eastern Bandera counties.

Water levels of the Edwards Aquifer and associated flows of Comal Springs, San Marcos Springs, and other major and minor natural discharge points, are affected by the rate of water entering the aquifer (recharge) and the rate of water exiting the aquifer (discharge). Recharge into the Edwards Aquifer occurs from water entering the Recharge Zone from streams, natural catchments, recharge features, localized runoff, upland recharge from precipitation events, and potential cross-formational flow from the Trinity Aquifer. Seasonal rainfall over the region ultimately controls the rate of recharge.

Estimates of the average annual recharge of the Edwards Aquifer vary according to changes in weather cycles and resulting precipitation over the Recharge Zone. Maclay (1995) cites an average annual recharge of 635,000 acre-feet. However, Klemt et al. (1979) indicate an average annual recharge of approximately 651,000 acre-feet. Data from the EAA's *2012 Hydrogeologic Data Report* indicate an average annual recharge of 566,900 acre-feet for the period of record 1934-2012 (Tremallo et al., 2013). The lowest annual recharge (43,700 acre-feet) occurred during 1956 at the peak of the drought of record, and the highest recharge (2,486,000 acre-feet) occurred in 1992, with 2012 estimated recharge of 313,500 acre-feet. Streams losing flow as they cross the Edwards outcrop account for approximately half of the recharge to the aquifer and approximately half of recharge is contributed by direct precipitation and localized runoff within the Recharge Zone (LBG-Guyton Associates 2005; EAA 2009b). Rates of infiltration of water carried by the streams across the Recharge Zone have been estimated by the US Army Corps of Engineers (USACE) in 1965 to range from 500 to greater than 1,000 cubic feet per second (cfs).

Discharge occurs from withdrawal of water from wells and from natural springs and seeps. An unknown smaller quantity is discharged to the saline water zone (Maclay 1995). Discharge is greatly affected by water demand and rate of pumping. If recharge is high, the aquifer can sustain higher levels of pumping, while maintaining higher levels of springflows. However, if there is low seasonal recharge followed by reduced rainfall and by high rates of pumping, then aquifer levels decline with resulting decreased spring discharge.

Springs are major natural discharge points for aquifers and have been the focal point for establishing cities such as Del Rio, Brackettville, Uvalde, San Antonio, New Braunfels and San Marcos by providing their initial water supply. The areas near many of these springs in Central Texas have been inhabited by man for thousands of years and the springs have been utilized as a water resource.

Some of the major springs in the Edwards Aquifer from west to east include San Antonio and San Pedro in Bexar County; Comal and Hueco in Comal County; San Marcos in Hays County; and Barton Springs in Travis County. Major springs in the Trinity Aquifer in the region include Jacob's Well and Dead Man's Hole in Hays County; Spring Creek Cave, Cave Without a Name, and Alzafar Springs in Kendall County; Honey Creek Cave in Comal County; and Cold Springs in Uvalde County. The four springs in closest proximity to the US 281 project corridor are San Antonio, San Pedro, Hueco and Comal. The environment near the springs provides habitat for several endangered and threatened species. Additionally, the baseflow from the springs provide a significant portion of the water available to downstream interests along the regions river basins.

Total discharge from springs accounts for the majority (54.9 percent) of water exiting the Edwards Aquifer and averages about 383,200 acre-feet/year for the period of record 1934-2012 (Tremallo et al., 2013). Discharge from springs is relatively higher during years with higher rainfall.

Comal Springs, which is the largest spring in Texas and less than 20 miles from the US 281 project corridor, is within the flowpaths of waters that recharge the Edwards Aquifer near the US 281 project corridor. San Marcos Springs receives most of its recharge locally and from the Confined Zone to the southwest Hays and Comal counties and likely does not receive a significant amount of flow from the Bexar County region (Johnson et al., 2012; Johnson and Schindel, 2008). Hueco Springs in Comal County recharges from western Comal and northern Bexar counties, and may receive some flow from water recharging near the project corridor.

Because of flowpaths and specific recharge areas that feed some springs, long-term impact or contamination from an extremely large spill in the US 281 project corridor could affect water quality at the springs. The springs west of Bexar County would not be impacted because the flowpaths in the Edwards Aquifer generally move eastward. The springs located east of the US 281 project corridor have some potential for degradation if spills or leaks occurred along the highway. The remote distance that water would travel in the aquifer from the US 281 project corridor would limit the impact to San Marcos Springs. Hueco Springs in Comal County recharges from western Comal and northern Bexar Counties, and could be impacted if a contamination event occurred.

Contaminants such as polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs) have been detected in karst springs of the Edwards Aquifer, originating from either discrete spills or as non-point source contamination due to run-off from urbanized areas. Any level of contaminants from potential spills, construction, or cumulative operation could degrade the overall quality of the spring water. Of all the springs in the Edwards Aquifer, Comal Springs has the highest potential for impact and water-quality degradation resulting from any activities in northern Bexar County.

Decreased spring discharge and/or degradation of water quality, including anthropogenic contamination, can adversely affect the health of federally-listed endangered or threatened species (See **Section 3.16 Threatened and Endangered Species**) that depend on adequate minimum flows at the Comal and San Marcos Springs for survival.

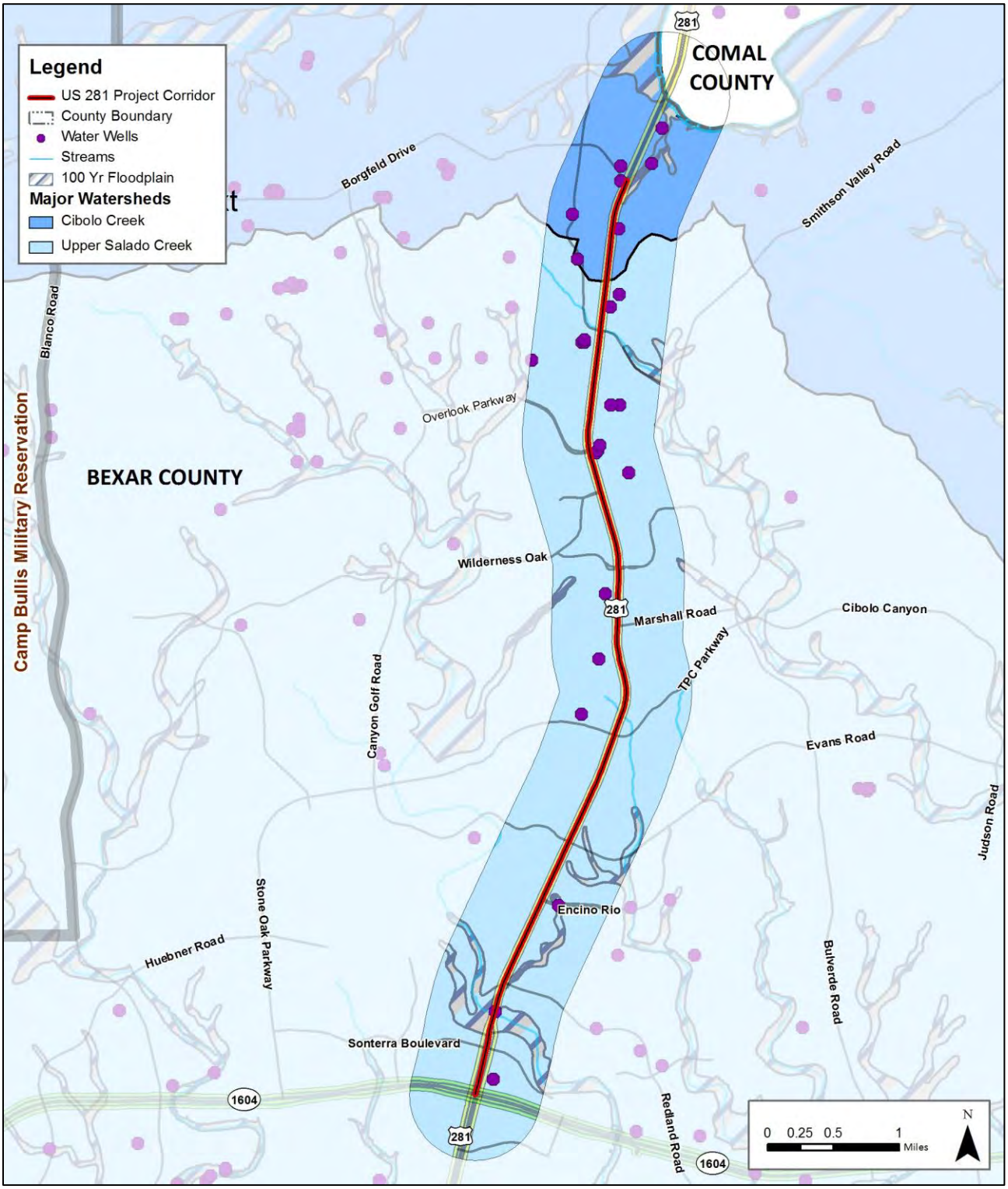
In addition to natural springs and seeps, wells are the other source of discharge from the Edwards Aquifer. Wells are the principal source of water for agricultural, municipal, and industrial uses in the region. Total discharge from wells averages 314,600 acre-feet/year (45.1 percent) for the period of record 1934-2012 (Tremallo et al., 2013). The ratio of discharge from wells and springs generally increases during droughts as spring flow rates diminish. In 1956, wells contributed 82 percent of the discharge compared to 18 percent for springs. During 2012, a drought year, wells comprised 56 percent and springs 44 percent of the Edwards Aquifer annual discharges (Tremallo et al., 2013).

Historically, wells were drilled into the Edwards Aquifer to supplement the water originally available from springs. Wells are now the principal source of water for agricultural, municipal, and industrial uses in the region. Public supply is the highest use category and is centered on the major metropolitan areas. Irrigation use is second and is predominantly located in western Uvalde and Medina counties. Well records and published groundwater reports from the Texas Water Development Board (TWDB) were reviewed to provide information on water-supply wells within a one-mile radius of the project study area. The well records were obtained from the TWDB Ground Water Database (GWDB), which is the most comprehensive and accurate listing of water wells available. However, the database only includes wells, which have been reported to the TCEQ and the TWDB and does not include all water-supply wells in the State of Texas.

The results of the water-supply well review identify a total of 36 water-supply wells located within a one-half mile buffer around the US 281 project corridor (**Figure 3-35**). Twenty-nine of the water-supply wells are public; one of which is a monitoring well. The total depths range from 260 to 960 feet below ground surface. Seven of the water-supply wells are private. The total depths range from 350 to 580 feet below ground surface.

Well discharge has generally increased over the period of record to a point beginning in 1968 and running through 1989 where annual discharge consistently exceeded the average annual recharge (Maclay 1995). Pumping peaked in 1989 at an estimated level of 542,000 acre-feet. Since 1980, as a result of increased pumping, there has been greater fluctuation of springflow with increased the time required for recovery, even during a period that recorded the two highest levels of aquifer recharge (1992 and 1987).

1 Figure 3-35: Water supply wells



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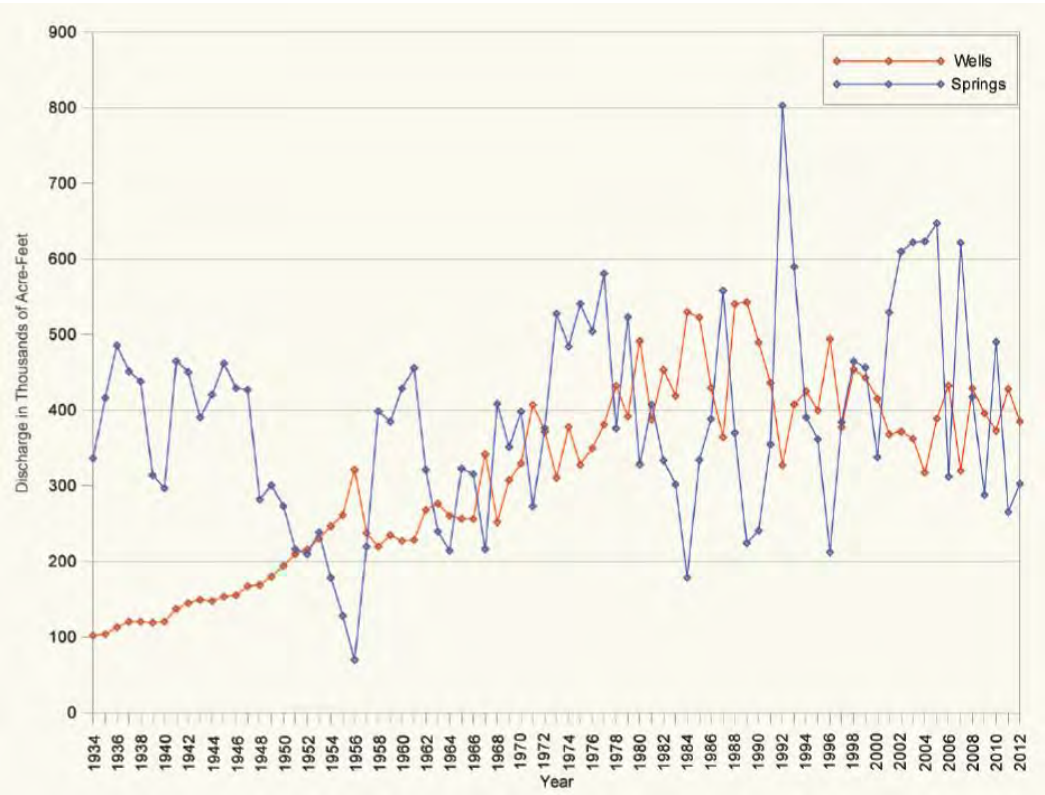
3 Source: TWDB, TNRIS, US 281 EIS Team, July 2011.

In the Edwards Aquifer, the amount of groundwater discharged as springflow has historically been greater than the amount discharged through wells. However, over the period 2008-2012, well discharges have exceeded spring discharges in four of the five years. In 2012, well discharges were 384,685 acre-feet per year, while spring discharges were 302,348 acre-feet per year. The 2012 annual mean flow values for both Comal and San Marcos Springs were below the period-of-record mean discharge (EAA 2013, 28).

Figure 3-36: Groundwater pumping compared with springflow from the Edwards Aquifer, 1934-2012 (measured in thousands of acre-feet)



Source: Hydrologic Data Report for 2012 (EAA 2013)

Average annual withdrawal from wells over the period of record 1934-2012 was 314,600 acre-feet (45 percent), in comparison to 383,200 acre-feet (55.4 percent) from springflow discharges. During droughts, the proportion of well discharge to spring discharge changes considerably. The historical comparison shown in **Figure 3-36** indicates that well withdrawals tend to spike during severe drought years while spring discharge plummets. This spring-to-well discharge relationship during droughts is probably associated with two factors: (1) there is increased demand for well water for human and agricultural uses during severe droughts, when surface water sources are diminished and (2) during severe droughts, when the ground water table is lowered as a result of reduced recharge, the additional well pumping may cause further lowering of the water table and thus contribute to reduced springflow. While droughts and associated springflow fluctuations are natural phenomena, the effects can be exacerbated by well pumping. During 1956 at the height of the drought of record, when the total annual discharge from the aquifer was approximately 392,000 acre-feet, wells accounted for 82 percent of the discharge in comparison to 18 percent for springs. During the 1984 drought there was a total discharge of 711,000 acre-feet, with well withdrawal accounting for 74 percent and spring discharge accounting for 26 percent. Similarly, during the 1996 drought well withdrawal accounted for 70 percent and springs 30 percent of the total annual discharge of 707,000 acre-feet.

During the drought year of 2008, wells contributed 51 percent of the total discharge, while spring discharge comprised 49 percent (EAA 2009b). When well withdrawals are classified by type of use, total aquifer discharge for 2012 was distributed as follows: 45 percent spring discharges, 37.5 percent municipal use, 13.2

percent irrigation use, 3.3 percent industrial/commercial use, and two percent domestic/livestock use (EAA 2013, 35).

Well discharge has generally increased over the period of record, and pumping peaked in 1989 at an estimated level of 542,000 acre-feet. From 1968 through 2008, annual withdrawals from wells have consistently exceeded 300,000 acre-feet, and the total discharge from the aquifer (wells plus springs) has exceeded the estimated average annual recharge (Maclay 1995). Since 1980, as a result of increased pumping, there has been greater fluctuation of springflow with increased time required for recovery, even during a period that recorded the two highest levels of aquifer recharge (1992 and 1987).

Because pumping can greatly affect the discharge of two of the aquifer's largest springs, Comal Springs and San Marcos Springs, and adversely affect their respective ecosystems, the EAA established mandatory staged pumping reductions during critical drought periods to protect aquifer levels and associated springflow discharge. The triggers for each of the critical period reduction stages are based on aquifer levels and volume of springflow discharge. During severe drought conditions, required critical period reductions can be as high as 40 percent and are intended to protect the spring ecosystems that support seven endangered species: the Texas blind salamander (*Eurycea rathbuni*), fountain darter (*Etheostoma fonticola*), San Marcos gambusia (*Gambusia georgei*), Texas wild-rice (*Zizania texana*), Comal Springs riffle beetle (*Heterelmis comalensis*), Comal Springs dryopid beetle (*Stygoparnus comalensis*), Peck's cave amphipod (*Stygobromus pecki*); and one threatened species, the San Marcos salamander (*Eurycea nana*).

Recent studies conducted by the Edwards Aquifer Recovery Implementation Program (EARIP 2012) indicate that in order to sustain the spring ecosystems during the most extreme droughts, regional pumping would need to be curtailed by 85 percent to assure required minimum flows (long-term average flow, six-month average flow, and one-month average flow) at Comal and San Marcos Springs.

The Trinity Aquifer has historically been a source of groundwater for agricultural and residential use. Development over the aquifer has resulted in declining well production in many locations and resulting water shortages during drought conditions.

Groundwater Quality

Karst aquifers are by nature extremely vulnerable to contamination. Soils in karst areas tend to be thin and patchy. When eroded, they are slow to recover. Thus, the filtration of diffuse recharge afforded by soils is, at best, low and is only decreased by human activity. Recharge in karst systems commonly occurs as point recharge into specific karst features, bypassing what little filtration would otherwise be afforded by the soil zone. Furthermore, a karst flow system is formed by convergent flowpaths that combine to form efficient flow networks. Rapid transportation through integrated flow networks leads to lower residence times, minimizing the opportunity for the die-off of pathogens or the degradation of hazardous chemicals. These efficient flow networks can cover large areas, allowing contaminants to travel long distances very quickly, endangering distant water supplies before problems are identified (Ford and Williams 2007). Monitoring of contaminant plumes is very difficult due to the nature of karst flow systems, where traditional placement of up- and down-gradient monitoring wells are likely to miss the conduits through which the contaminants are flowing (Benson and La Fountain 1984).

Both the Edwards and Trinity aquifers have secondary porosity developed by the dissolution of limestone that allows water to enter and travel through the limestone matrix. This porosity can be structurally controlled with features such as fractures and faults or stratigraphically controlled by the originally deposited layers in the limestone. The openings in the rock might be karst-related features such as caves, sinkholes, or other dissolution formed voids that have enhanced both structural and stratigraphical related porosity and permeability of the aquifer.

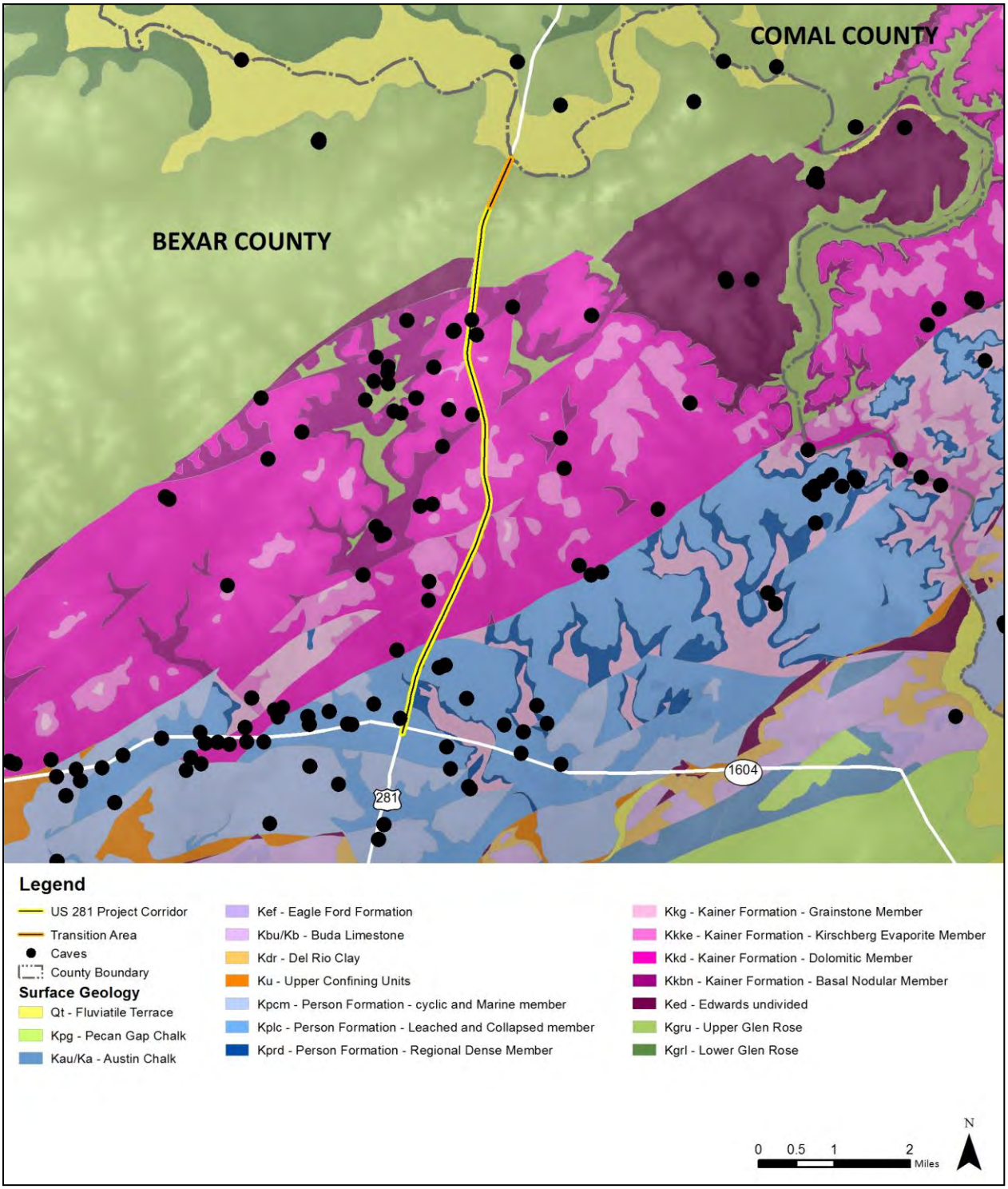
Areas with extensive secondary porosity are believed to be most sensitive to recharge and potential contamination, which can ultimately impact the quality of groundwater in the aquifer. However, water can enter the aquifer almost anywhere along the limestone outcrop where there are no apparent conduits to the subsurface even if the area has not been previously mapped with karst or other hydrologically sensitive features. Notable recharge features in the Edwards Aquifer include: recharge along streambeds (Cibolo Creek and Helotes Creek in Bexar County), recharge in surface water impoundments (with the exception of Canyon Lake and the Guadalupe River that are cut down below the level of the aquifer) that create high hydraulic gradients (Medina Lake in Medina County), discrete recharge through a network of caves, solution cavities, and sinkholes, and diffuse upland recharge through areas.

Karst features are highly susceptible to rapid point contamination and fast travel times. There are thousands to tens of thousands of recharge features into the Edwards and Trinity aquifers. Within northern Bexar County, there have been more than 1,400 karst features identified, and many near highway US 281 (**Figure 3-37**). Information regarding significant recharge features of the Edwards and Trinity aquifers are gathered from TCEQ geologic assessment records, published papers, database of the Texas Speleological Survey, common knowledge, and professional experience.

In Bexar County, significant caves include: Backhole, Banzai Mud Dauber Cave, Bet-Ya-Can't-Find-It Cave, Bear Cave, Blanco Road Cave, Boneyard Pit, Bullis Hole, Camp Bullis Bad Air Cave, Camp Bullis Bat Cave, Camp Bullis Cave No. 1, Camp Bullis Cave No. 3, Cave of the Creek, Cave of the Woods, Cibohole, Corkscrew Cave, Dead Deer Cave, Eagles Nest Cave, Elm Springs Cave, Elm Water Hole Cave, 50 Bucket Cave, Fair Hole (Bexar, Comal and Kendall counties), Genesis Cave, George's Hole, Grosser's Sink, Hill's and Dale's Pit, Hold Me Back Cave, Hornet's Last Laugh Cave, Hunting Headquarters Cave, Jabba's Giant Sink, MARS Shaft, MARS Pit, Poison Ivy Pit, 17' Pit, Poor Boy Baculum Cave, Root Canal Cave, SARA Site 4 Cave, Shavano Park Cave, Stealth Cave, Summerglen Cave, Twin Sinks Cave, and Wedge Cave. Numerous caves and karst features are found within one mile of the proposed project corridor and several within the direct impact area.

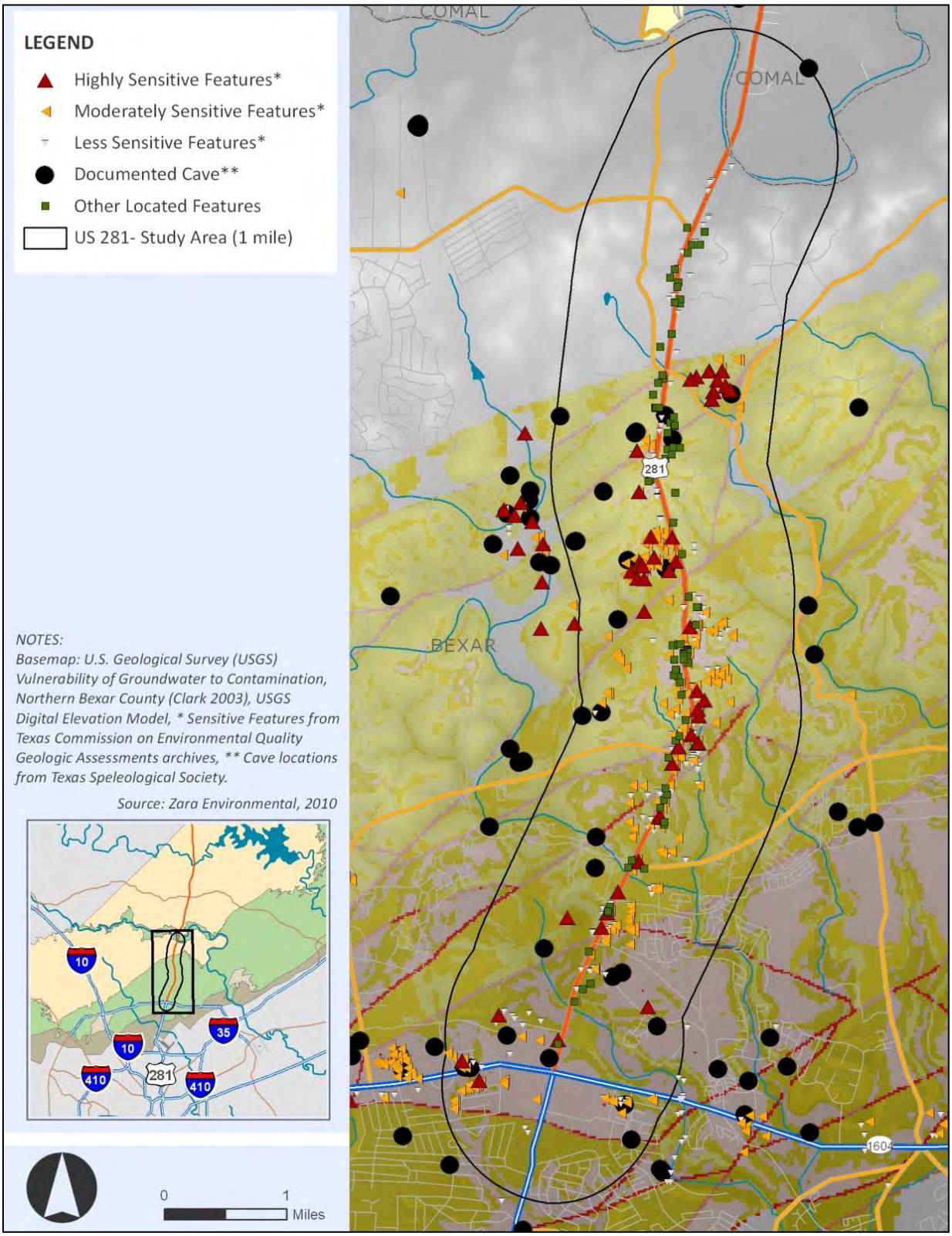
The portions of the outcrop area that exhibit more porosity and permeability are inherently more vulnerable to receiving contamination. **Figure 3-38** illustrates where known caves and karst features exist and whether they are over vulnerable groundwater regions. However, all voids that can receive potential recharge into the ground are not always observable and at a mapable scale. The outcrop of the Edwards Aquifer and the nearby upgradient Contributing Zone can be susceptible and vulnerable to potential contamination. As previously described, the Edwards Aquifer has been divided into aquifer subdivisions with differing lithologic characteristics. The two units with the most inherent porosity and permeability are the collapsed and leached members in the Person Formation and in zones that are less resistant to weathering in the Kirschberg member of the Kainer Formation (Hauwert 2009, **Appendix J2**). In addition to the stratigraphic units, areas that have been faulted and broken structurally have additional fractures that have greatly added to the porosity and permeability of the limestone. Karst features that result in caves, sinkholes and collapsed features also add greatly to the sensitivity of an area.

Figure 3-37: Karst features in the area surrounding the US 281 project corridor



Source: USGS Geologic Map of the Edwards Aquifer Recharge Zone (Blome et al., 2005), TNRIS 1:250, 000 Geologic Atlas of Texas, USGS 1:24,000 National Hydrography dataset; July 2011.

Figure 3-38: The U S 281 study area with locations of known caves and karst features overlain on groundwater vulnerability map from Clark (2000)



Source: Clark, 2003. Zara Environmental, 2010.

The groundwater of the Edwards Aquifer is generally known to be of high quality, typically fresh, but hard with an average dissolved solid concentration of less than 500 mg/l (TWC 1992). Increased human development throughout the region has resulted in increased quantities of pollutants in the environment and increased the potential to adversely affect surface water and groundwater quality. Cooperative efforts between the EAA, USGS, and TWDB have resulted in a systematic program of water quality monitoring. Each year the EAA measures the quality of water in the aquifer by sampling surface and groundwater throughout the Edwards Aquifer region. In 2012, 95 wells, 12 surface water sites, and 5 major spring groups with 82 individual springs were sampled (Tremallo et al., 2013). Sample collection sites are typically selected to provide representative samples of the Recharge Zone, shallow and deep Artesian Zone, springs, and surface streams that flow across the Recharge Zone as well as areas with historical detection of anthropogenic compounds.

The 2012 well sampling data did not indicate widespread contamination in the aquifer (Tremallo et al., 2013). However, VOCs, such as chloroform and tetracholorethene (PCE) were the most commonly detected compounds, with no samples in excess of regulatory standards for drinking water. Herbicides and pesticides were detected in five wells with all results below regulatory standards. Nitrates were detected in eight wells above 5 milligrams per liter [mg/L], but below the regulatory standard of 10 mg/L. The metal thallium was detected above the regulatory limit in four wells. Samples collected at springs also detected VOCs at San Marcos Springs below regulatory standards. Pesticide and herbicide compounds were detected in 15 samples in Hueco, Comal, and San Marcos springs all at extremely low levels. Thallium and iron were both detected above regulatory limits at Comal Springs (Tremallo et al., 2013).

Vulnerability modeling of groundwater contamination in the Edwards Aquifer in northern Bexar County was performed by Clark (2000), in which a numerical weighting system was applied to rate several factors that represented the potential for contamination by recharging water. This model predicts the susceptibility of groundwater to contamination depending on the location and compound effects of numerous hydrologic factors that impact the hydrogeology, including (1) Edwards Aquifer hydrostratigraphic subdivisions, (2) locations of faults, (3) locations of some caves and sinkholes, (4) topographic slope, and (5) soils. Caves, faults, fractures and other karst features act to provide direct passageways for water to enter the aquifer. The lack of soils and topography can also reduce the potential for filtration prior to entering the aquifer. Much of the project corridor is in zones that are susceptible to groundwater contamination and there are many sensitive karst features within the project corridor that may rapidly transmit runoff into the aquifer.

Environmental Consequences

No-Build Alternative

Groundwater Quantity

The No-Build Alternative would not alter the amount of water that is recharged into or discharges out of the Edwards or Trinity aquifers. As such, the No-Build Alternative would not impact groundwater quantity.

Groundwater Quality

The US 281 project corridor has unpaved and informal shoulders along the entire corridor from Loop 1604 to Borgfeld Drive and does not have a storm water drainage system that meets current Edwards Aquifer Rules with the exception of the facilities recently constructed as part of the US 281 Super Street project. As such, the US 281 project corridor would remain susceptible to contaminants, such as metals and organic compounds, entering recharge features with the No-Build Alternative.

Build Alternatives

Construction and operation of a Build Alternative has a number of potential environmental impacts related to groundwater quality and quantity in the project corridor and the region. These possible impacts include decreased recharge and water supply contamination associated with increased levels of suspended sediment,

dissolved metals, VOCs, PAHs, and other toxic materials resulting from increased anthropogenic disturbance and activity (Barrett et al., 1995). Infiltration of any of these contaminants into the groundwater system is enhanced in the particular hydrogeologic setting of northern Bexar County, which is karstic in nature and vulnerable to contaminants. Karst aquifers are well documented to rapidly transmit surface water into the subsurface through systems of enhanced permeability channels that include solution-enlarged fractures or joints, faults, solution cavities, solution sinkholes, collapse sinkholes, caves, or combinations of these features. Karst features identified during the geologic assessment were reviewed for the Preferred Expressway Alternative (**Table 3-39**). Special consideration is required to protect the karst features and groundwater resources from urban development, including that related to the proposed US 281 Corridor Project.

Table 3-39: Recharge and Discharge Features Impacted by the Preferred Expressway Alternative

Feature	Features Impacted within the Proposed ROW
Sensitive Karst Feature[1]	24
Non-Sensitive Karst Feature[2]	28
Fault	9
Well	3
Spring	1
Total per area	65

Source: Zara 2011
1: Geologic assessment score of 40 or greater, indicating potential to recharge groundwater directly to the Edwards Aquifer (Appendix J1)
2: Geologic assessment score of 40 or less, indicating less potential to be a recharge feature (Appendix J1)
*: These features were not excavated due to lack of ROE, so their potential for recharge is not fully known.

Groundwater Quantity

Groundwater quantity impacts can occur for two reasons: 1) changing the amount of water that is discharged from the aquifer (e.g. wells and springs); or 2) changing the amount or rate of aquifer recharge (e.g. karst features and faults).

The acquisition of ROW for the Preferred Expressway Alternative would impact three wells (two of which are used for water supply and one for monitoring purposes) and one spring. These features would likely be capped and would no longer function as discharge features.

As indicated in **Table 3-39**, sensitive karst features are those with potential to recharge groundwater directly to the Edwards Aquifer; whereas, non-sensitive karst features have less potential to be recharge features. The Preferred Expressway Alternative would impact 24 sensitive karst features, 28 non-sensitive karst features and 9 faults. The closure of these recharge features could decrease the recharge entering the Edwards and Trinity aquifers in the project corridor. Decreased recharge could lead to lower aquifer levels and decreased springflows down gradient. However, the direct impacts to recharge would be minor when compared to the estimated yearly recharge to the San Antonio Segment of the Edwards Aquifer, which is estimated to be 697,500 acre-feet for the period of record 1934-2012 (Tremallo et al., 2013). The Preferred Expressway Alternative ROW is 0.02 percent (457 acres) of the 3,600 square miles comprising this segment of the aquifer.

Recharge to the aquifer can be affected by increased impervious cover. The Preferred Expressway Alternative would add a total of 118 acres of impervious cover, of which 105 acres would be over the Recharge Zone and 13 acres would be over the Contributing Zone. The storm water generated from the Preferred Expressway Alternative would be treated through bioretention and then released over time (after any single event, the water would be retained for a minimum of 12 hours and released over a 48-hour period) to recharge back into the aquifer. BMPs would be utilized to treat and then release stormwater runoff such that recharge would still occur. Some BMPs, such as vegetative filter strips, grassy swales, water quality ponds, and bioretention allow

for recharge by slowing runoff velocities, thereby increasing infiltration, in addition to removing TSS and other pollutants from runoff. During large storm events, in which much more runoff is produced than is recharged to the aquifer during high-flow periods (Slade, Dorsey, and Stewart, 1986), the retention of stormwater runoff and gradual release from water quality ponds may allow for greater recharge to the Edwards Aquifer. The proposed water quality BMPs for the US 281 Corridor Project would capture storm water runoff; this stored runoff would slowly be released to receiving waters following peak flows and would allow more runoff to recharge the Edwards Aquifer (Slade, Dorsey, and Stewart, 1986).

The Build Alternatives would result in temporary impacts to groundwater quantity during construction as changes in vegetation coverage, soil compaction, and soil roughness (a measure of how easily water will flow over ground) all change infiltration rates and flow dynamics. A decrease in soil roughness and an increase in soil compaction are common on construction sites where heavy machinery travels over the same areas repeatedly. Increased soil compaction leads to decreased infiltration and, therefore, increased volumes of stormwater runoff. Use of temporary BMPs, such as silt fences, inlet protection barriers, hay bales, and seeding or sodding of excavated soils during construction would minimize impacts to groundwater quantity. The temporary BMPs will be documented in the SW3P and followed throughout construction phases to minimize sediment-laden stormwater discharge.

Groundwater Quality

There are several ways that contaminants get introduced into the groundwater system in urbanized areas. Cumulative build-up of metals and organic compounds along heavily used highways is the most persistent source of pollutants (Van Metre et al. 2000). Large spills from storage tanks resulting from vehicle accidents are listed as direct threats to water quality in the Edwards Aquifer (Johnson et al. 2009). Gasoline and diesel fuels are the most common hazardous materials carried along the project corridor. An accidental release of a large quantity of hazardous material to a sensitive recharge feature is a low-probability event; however, it has the potential to adversely impact the major regional groundwater source. PAH compounds and heavy metal elements are harmful hydrophobic contaminants shown to accumulate with vehicle traffic on highways, and become associated with sediment particles. Storm events wash the contaminated particles into surface streams (Van Metre et al. 2003; Mahler et al. 2006), and in the specific setting of the Edwards Aquifer, can be rapidly transmitted directly into the groundwater system. This could allow for a build-up of PAHs in the aquifer that could present long-term adverse effects on drinking water supplies and eventually make it to springs through direct transfer or re-suspension (Massei et al. 2003). Contaminants such as PAHs and VOCs have been detected in karst springs of the Edwards Aquifer, originating from either discrete spills or as non-point source contamination due to run-off from urbanized areas. Any level of contaminants from potential spills, construction, or cumulative operation could degrade the overall quality of the spring water.

These contaminants are normally conveyed by runoff from the roadway primarily during the “first flush”, or the first inch of rain. The first flush carries with it concentrations of pollutants that have accumulated during periods of dry weather between storms, and is strongly correlated with amounts and types of land use within a drainage area (Van Metre et al. 2003). TCEQ Edwards Aquifer Rules (Chapter 213) require the construction and maintenance of permanent water quality controls to remove suspended solids from runoff after construction, and for the life of the roadway. These water quality controls include filter strips, sand filters, and extended detention basins. The implementation of these engineered water quality control structures, or BMPs are put in place to help offset potential impacts through short-term retention or filtration prior to discharging to streams. By utilizing suitable BMPs for filtering storm water, the potential for groundwater quality degradation may be reduced, but not eliminated. Without strict adherence of efficient BMPs, highway construction and operation has been shown to have a large negative impact on water quality, including groundwater in karst zones (Barrett et al. 1995; Donaldson 2004). Other water quality mitigation practices include: defining extent of contamination plumes, predicting groundwater flow paths, building and maintaining effective monitoring networks, and treating contaminated water. Under the Preferred Expressway Alternative the entire corridor from Loop 1604 to Borgfeld Drive will have a storm water

drainage system that complies with the Edwards Aquifer Rules. Information on the proposed BMPs, TSS calculations and compliance with the Edwards Aquifer Rules can be found in **Appendix K3.** Permanent BMPs will be documented in the WPAP.

Both the modeled and traced flowpaths in northern Bexar County have significant implications to construction and operation of the proposed US 281 Corridor Project. The tracer results indicate that contaminants introduced through discrete karst features and even open ground potentially reach water supply wells at extremely rapid rates. Modeled flowpaths indicate that water entering the aquifer in northern Bexar County flows to Comal Springs, which provides habitat to endangered species. The springs west of Bexar County would not be impacted because the flowpaths in the Edwards Aquifer generally move eastward. The springs located east of the US 281 project corridor, particularly Comal Springs, have potential for degradation due to spills, leaks and contaminated runoff. San Marcos Springs receives most of its water from an area in western Comal County and into Hays County and would likely be minimally impacted from US 281 activities. The long distance that water would travel in the aquifer from the US 281 project corridor would also limit the impact to San Marcos Springs as contaminants would degrade and lessen over the longer flowpaths and residence time in the aquifer. Hueco Springs in Comal County recharges from western Comal and northern Bexar counties, and could be impacted if a major contamination event occurred. Several of these springs are the sole habitat for several federally-listed endangered species (see **Appendix I4**).

Any water wells or hydrologic features in the local one-mile area may experience a more rapid and more intense response to any contamination issues along the US 281 project corridor. Any karst feature near the proposed ROW could become immediately contaminated if a spill were to occur or if proper storm water BMPs are not installed and maintained. Any well or spring downstream of groundwater flow routes from the US 281 project corridor could receive pollutants from the highway. The regional area may experience water quality degradation that is then transmitted in a more dilute manner through the flow paths in the Edwards Aquifer towards the major spring discharge points.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative is being considered for non-toll/managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same and storm water management improvements are proposed for all lane options; therefore the impacts to groundwater would not change based on funding options.

Conclusion and Proposed Mitigation Measures

The Build Alternatives have the potential to impact groundwater quantity by impacting both recharge and discharge features. The Edwards Aquifer Rules state that, to the extent practicable, BMPs must maintain flow to naturally occurring sensitive recharge features and that the permanent sealing of, or diversion of, flow from a naturally occurring sensitive feature that accepts recharge to the Edwards Aquifer as a permanent pollution abatement measure should be avoided. The proposed water quality BMPs for the Preferred Expressway Alternative would slow runoff velocities, thereby increasing the potential for recharge, in addition to removing TSS and other pollutants from runoff. The temporary BMPs for the US 281 Corridor Project would capture storm water runoff; this stored runoff would slowly be released to receiving waters following peak flows and would allow more runoff to recharge the Edwards Aquifer.

Construction activities associated with the Build Alternatives could change infiltration rates and flow dynamics resulting from impacts to vegetation coverage, soil compaction, and changes in soil roughness. The use of temporary BMPs, such as silt fences, inlet protection barriers, hay bales, and seeding or sodding of excavated soils during construction would minimize impacts to groundwater quantity. The temporary BMPs will be documented in the SW3P and followed throughout construction phases to minimize sediment-laden stormwater discharge.

The Build Alternatives have the potential to impact groundwater quality due to recharging roadway runoff or accidental spills from storage tanks on vehicles, petroleum fuels, and hazardous materials. The potential for groundwater contamination is increased due to the numerous karst features surrounding the US 281 project corridor. Karst features can act as a conduit for rapid transmission of contaminants into the Edwards Aquifer. The inclusion of hazardous material traps will be evaluated in final design.

The greatest possibility for groundwater impacts during the construction would occur if voids connected to the aquifer or containing groundwater are intersected during the down cutting of bedrock or during other subsurface disturbing activities. When voids are encountered, 30 TAC 213.5(f)(2) requires that construction in the vicinity of the void cease. A geologist would evaluate the void and, if necessary for structural concerns, work with the design engineer to develop a void mitigation plan. The void mitigation plan must be certified by the geologist, submitted to the TCEQ, and approved prior to the implementation of mitigation, and before continuing construction in the vicinity of the void. In addition, a section 10(A)(1)(a) permitted scientist would inspect the site as soon as possible in order to evaluate potential karst species habitat. If habitat for federally-listed endangered karst invertebrates is encountered, there may be an effect on those species (see **Section 3.16 Threatened and Endangered Species)**. Measures would be taken to ensure that there is project-wide awareness and education about the need to report void discoveries and implement protection measures.

If a Build Alternative is selected in the ROD, an Edwards Aquifer Water Pollution and Abatement Plan (WPAP) will be prepared before construction. Independent from the TCEQ's process for reviewing WPAPs, TxDOT will submit a copy of the WPAP to the EPA's Sole Source Aquifer Program personnel for review. The project will not be approved for federal funding unless the EPA determines that the project will not adversely affect the quality of the underlying groundwater (TCEQ 2010d).

Under the guidance of the Edwards Aquifer Protection Program, groundwater quality mitigation practices include defining the extent of contamination plumes, predicting groundwater flow paths, building and maintaining effective monitoring networks, and treating contaminated water. Treatments may include vegetative filter strips, sand filters, and bioretention. The implementation of these engineered water-quality control structures, or BMPs are put in place to help offset potential impacts through short-term retention or filtration prior to discharging to streams. The US 281 project corridor has unpaved and informal shoulders along the entire project corridor and does not have a storm water drainage system that meets current Edwards Aquifer Rules except at the newly constructed US 281 Super Street. As such, the US 281 project corridor would remain susceptible to contaminants.

The design plans for the Build Alternatives call for the installation of storm water BMPs that would capture and treat the first flush, according to TCEQ guidelines, such as bioretention ponds and vegetative filter strips. The regulations require the removal of 80 percent of the TSS in storm water runoff resulting from the incremental increase in impervious cover from the project. Typically, for a project of this scale, this standard is met by placing water quality treatment, or TSS removal, BMPs sporadically throughout the project at concentrated sites to minimize the number of BMPs necessary to reduce the pollutant load released offsite to 80 percent removal overall. In a typical project, there can be gaps within the corridor without water quality treatment BMPs. The US 281 Corridor Project would meet the 80 percent TSS removal threshold by removing 80 percent of the TSS at each storm water outfall. Unlike the typical project, the US 281 Corridor Project would provide consistent levels of TSS removal throughout the whole corridor. The No-Build Alternative would maintain the current condition on the US 281 project corridor, which does not include any storm water BMPs for treating TSS and other contaminants, with the exception of the facilities constructed as part of the recent Super Street project.

Although the proposed water quality BMP's would be sized to capture at least 80 percent of the TSS generated from the incremental increase in impervious cover; all runoff from the site would be routed through the proposed BMP's, from both the existing and proposed impervious cover. Roadway runoff would flow across the vegetated filter strips before being released from the site. The bioretention ponds would

collect runoff from their respective drainage basins and slowly release it. According the Edwards Aquifer Rules, the bioretention ponds were sized to capture the runoff for a storm of a specific duration and intensity (design storm). Most storms are significantly smaller than the design storm; when these smaller storms occur the proposed BMP's would treat their entire drainage basin effectively, for both the existing and proposed impervious cover. For the design storm and larger storms the BMP's would work to capture at least 80 percent of the TSS from the proposed impervious cover. More information can be found in **Appendix K3**.

The Preferred Expressway Alternative includes TCEQ-approved storm water BMPs which would likely result in improved runoff water quality. Improvements in highway runoff water quality could result in improved groundwater quality because highway runoff is not currently treated before entering streams or karst features that may recharge the Edwards Aquifer. The effective use of BMPs would result in an improvement in the quality of surface water and groundwater associated with the US 281 project corridor.

3.10 FLOODPLAINS

3.10.1 Methodology

The assessment methodology is based on the requirements provided in EO 11988 Floodplain Management, FHPM 6-7-3-2, *Location and Hydraulic Design of Encroachments on Floodplains*, and U.S. Department of Transportation 5650.2 Floodplain Management and Protection. FHPM 6-7-3-2 essentially references 23 CFR § 650 Subpart A, *Location and Hydraulic Design of Encroachments on Floodplains*.

This analysis was completed using the Flood Insurance Rate Maps published by the Federal Emergency Management Agency (FEMA) for Bexar County. The locations of the 100-year floodplain within the area of the Build Alternatives were determined. Floodplain impacts were assessed by analyzing the amount of additional impermeable surface area and number of linear feet of 100-year floodplain crossings that could result from the Build Alternatives.

A hydraulic study was conducted to locate and size culverts and bridges at stream crossings and to document that encroachments on floodplains are the only practicable alternative (see **Appendix K4).**

3.10.2 Affected Environment

The US 281 project corridor is located within FEMA Flood Map panel numbers 48029C0130E, 48029C0140E and 48029C0277E and crosses two areas within the 100-year floodplain (Zone A) in the southern and northern extents. The southern extent includes the floodplain of Mud Creek and the northern extent includes the floodplain of Upper Cibolo Creek, with the majority of floodplain acreage located near the southern extent. The floodplains are shown in **Figure 3-35**.

3.10.3 Environmental Consequences

No-Build Alternative

The No-Build Alternative would result in no new encroachment on the 100-year floodplain, and therefore would have no direct or indirect impacts. However, growth in the area would continue, as would potential indirect impacts to the floodplain resulting from that growth and development. Potential floodplain impacts would be regulated by floodplain policy.

Build Alternatives

Executive Order 11988, *Floodplain Management*, requires that federal agencies avoid activities that directly or indirectly result in the development of a floodplain area. Roadways are impermeable surfaces that deflect, rather than absorb or store water; thus, the presence of floodplains in the vicinity of roadway facilities is an important construction consideration. Building a new roadway, or expanding an existing facility, increases the potential for flooding impacts due to the addition of impermeable surface area. Additionally, roadway construction could alter the extent of the 100-year floodplain by acting as a levee or barrier to the natural ebb and flow of storm waters. The proposed facility would increase runoff rates due to the increase in impervious cover (pavement) surface area. However, the increase would be mitigated by using drainage facilities that would be designed and constructed in compliance with guidelines of the effected cities and flood control districts. Both of the Build Alternatives would be designed such that potential flooding would be avoided or minimized through mitigation measures (i.e., crossing streams and tributaries at locations that would minimize impacts to floodplains). **Table 3-40** provides estimates of floodplain impacts for the Build Alternatives and the Preferred Expressway Alternative.

Table 3-40: Floodplains by Alternative ROW Footprint

Floodplain	No-Build Alternative (acres)	Elevated Expressway Alternative (acres)	Preferred Expressway Alternative (acres)
Unnamed Tributaries to Mud Creek	13.7	14.2	13.7
Mud Creek	6.6	6.6	6.6
Unnamed Tributary to West Elm Creek	0.0	0.3	0.0
Unnamed Tributary to Cibolo Creek	3.1	4.5	3.1
Borgfeld Creek	0.5	0.5	0.5
Cibolo Creek	2.2	2.2	2.2
Total	26.1	28.3	26.1

Source: FEMA, US 281 EIS Team, March 2014
Note: Acreage and length obtained from data provided in FEMA maps covering study area in Bexar County, TX

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative is being considered for non-toll/managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same; therefore the impacts to floodplains would not change based on funding options.

3.10.4 Conclusion and Proposed Mitigation Measures

Any fill placed into the floodplain will be mitigated with floodplain storage adjacent to the roadway (detention facilities). These detention facilities will offset increases in flows as well as add additional floodplain storage to the watershed, which will restore and preserve the natural and beneficial floodplain values.

The design of the Preferred Expressway Alternative will not increase the base flood elevation to a level which would violate applicable floodplain regulations and ordinances. The hydraulic design for this project is in accordance with current TxDOT and FHWA policies and standards. The US 281 Corridor Project would permit the conveyance of the 100 year flood, inundation of the roadway being acceptable, without causing substantial damage to the roadway or other property. Bexar County participates in the National Flood Insurance Program.

During the design phase, potential impacts to floodplains will be identified and drainage structures designed to accommodate anticipated high flows such that upstream and downstream areas are not adversely impacted. The US 281 Corridor Project will be designed in compliance with appropriate local, state, and federal standards to ensure that floodplain encroachment does not increase the risk of flooding to adjacent properties. Adverse impacts will be mitigated through measures such as implementation of BMPs during construction and development of detention facilities to offset anticipated increased flows.

3.11 WILD AND SCENIC RIVERS

The *Wild and Scenic Rivers Act* was enacted into law on October 2, 1968. Section 1(b) of the Act expresses Congressional policy, stating that certain rivers of the Nation that, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values shall be preserved in free-flowing condition, and that their immediate environments shall be protected for the benefit and enjoyment of present and future generations (National Park Service 2014). No river or river segments listed in the Nationwide Rivers Inventory are located within the US 281 project corridor.

3.12 COASTAL ZONE MANAGEMENT AND COASTAL BARRIERS

The *Coastal Zone Management Act* (CZMA) of 1972, as amended in 1996, provides for the preservation, protection, development, and where feasible, restoration and enhancement of the nation's coastal zone resources. In Texas, the General Land Office (GLO) is designated as the lead agency that coordinates the development and implementation of the *Texas Coastal Management Plan* (TCMP). The Coastal Coordination Council (CCC) administers the coastal management program and is in charge of adopting uniform goals and policies to guide decision making by all entities regulating or managing natural resource use within the Texas coastal area.

The boundary of the Texas Coastal Management Zone (CMZ) was delineated in accordance with the requirements of the federal CZMA, federal program development and approval regulations, and the *Texas Coastal Coordination Act*. Requirements dictate that a state's coastal zone boundaries include four elements: inland boundary, seaward boundary, interstate boundaries, and federal land excluded from the boundary. Neither of the Build Alternatives traverses the Texas CMZ; therefore, no formal coordination with the GLO would be required.

The *Coastal Barrier Resource Act* was passed in 1982 to address potential impacts to coastal barriers caused by development. The US 281 project corridor is not mapped as part of the nation's coastal barrier resources system; therefore, neither of the Build Alternatives would impact coastal barrier resources.

3.13 WATERS OF THE U.S. INCLUDING WETLANDS

3.13.1 Methodology

A survey was conducted of the waters of the U.S. including wetlands that occur in the US 281 project corridor using published U.S. Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI) maps, aerial photographs, and U.S. Geological Survey (USGS) topographic maps. This information was used in a field reconnaissance to preliminarily verify the presence of wetland areas within the existing and proposed ROW for the Build Alternatives.

Wetland delineations were performed in March 2014 within the existing and proposed ROW where ROE was granted. The delineations included a preliminary jurisdictional determination and potential impacts assessment; and were conducted in accordance with the U.S. Army Corps of Engineers (USACE) 1987 Wetlands Delineation Manual.

Final wetland determinations would be decided by the USACE and other resources agencies during the Section 404 permitting process, as necessary. Permitting and mitigation requirements would be determined as needed.

3.13.2 Affected Environment

According to the NWI maps, two major subclasses of wetlands occur within the areas traversed by the Build Alternatives: Palustrine Unconsolidated Shore (PUS) and riverine.

Wetland Types

Palustrine Unconsolidated Shore
PUS systems are nontidal and less than 6.6 feet in depth, with 75 percent cover of stones, boulders or bedrock and less than 30 percent cover of vegetation. These wetlands are found adjacent to unconsolidated bottoms, are regularly and/or irregularly flooded (Cowardin et al. 1979). These types of wetlands are characterized by erosion and deposition by waves and currents, which produce a number of landforms such as beaches, bars and flats and typically lack vegetation except for pioneering plants that become established during brief periods when growing conditions are favorable.

Riverine
A riverine wetland is contained in natural or artificial channels. A low gradient and slow water velocity characterize this riverine wetland with no tidal influence (Cowardin et al. 1979). The substrate consists mainly of mud and sand. Very little vegetation is found within this wetland.

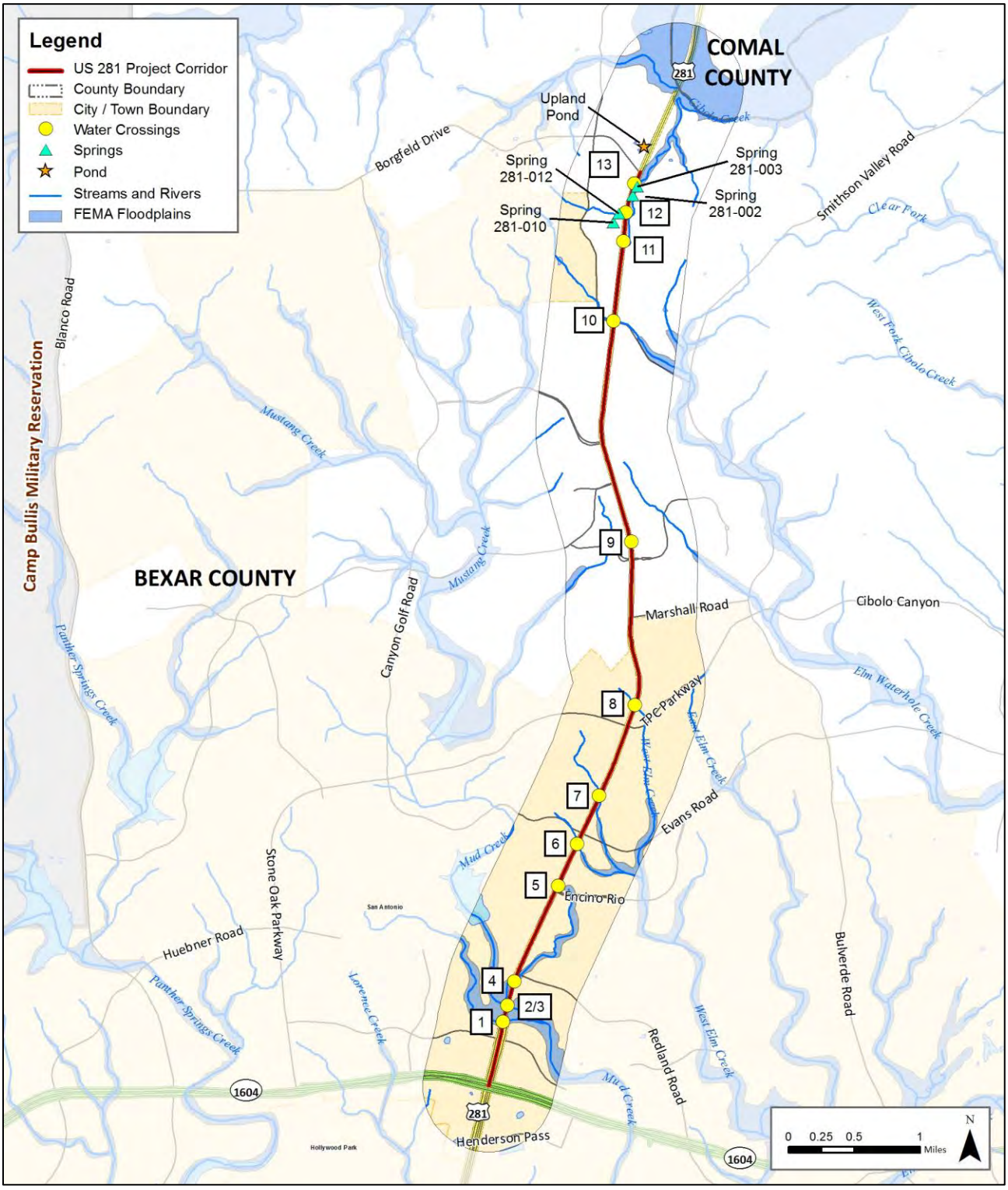
Wetland Functions and Values
Wetland functions and values are included in Sections 401 and 404 of the CWA. Wetland function is a physical or chemical process or activity. A function is related to the wetland's position in the watershed, the overall hydrological cycle, and its ecological integrity. There are 14 functions that are generally recognized: ecological integrity, habitat, environmental education, recreation, food chain support, nutrient cycling, flood control/conveyance, flood flow alteration, ground water recharge, shoreline stabilization and erosion control, quality of life, sediment/toxicant/pathogen retention, nutrient removal/retention/transformation, and historic/archeological significance.

A wetland value is the social benefit that is derived from one or more functions and the physical characteristics associated with a wetland. The value of a particular wetland function, or combination of functions, is based on human judgment of the worth, merit, or importance attributed to those functions. Examples of values are recreation, educational/scientific, uniqueness/heritage, and visual quality/aesthetics.

There are 44 recognized methods for measuring functions and values. During the Section 404 permitting process these functions and values of wetlands that may be impacted by the US 281 Corridor Project would be determined jointly with USACE and the resource agencies.

According to the USGS 7.5 Minute Topographic Map Quadrangles (Bulverde, Camp Bullis, Castle Hills and Longhorn, TX quads), and field reconnaissance, the US 281 project corridor contains a total of thirteen water crossings. Major streams and their tributaries that flow throughout the project area include Mud Creek, West Elm Creek, Elm Waterhole Creek, and tributaries of Cibolo Creek. Several more road drainages were observed in the area. Four ephemeral springs and an upland pond were identified during field work. These features are shown in **Figure 3-39.**

Figure 3-39: Surface waters that cross the US 281 project corridor



Source: FEMA, 2010, USGS, 2010, US 281 EIS Team, March 2014.

Field reconnaissance verified the presence of an observable ordinary high water mark (OHWM) for each of the water crossings listed in **Table 3-41.** Any of these potential waters of the U. S. that are determined by the USACE to be jurisdictional waters of the U. S. would be subject to permitting requirements under Section 404 of the CWA.

Table 3-41: Direct Impacts to Waters of the U.S.

Crossing	Type	Short-term Construction and Permanent Impacts			Anticipated Section 404 Permit	PCN Required	Stream Class	Stream Name
		Preferred Expressway Alternative	Elevated Expressway Alternative	No-Build				
1	None	0	0	0	N/A	N/A	Ephemeral	Tributary to Mud Creek
2	Culvert	0.33	0.33	0	NWP 14	Yes	Ephemeral	Mud Creek
3	Culvert	0.05	0.05	0	NWP 14	No	Ephemeral	Tributary to Mud Creek
4	Culvert	0.06	0.06	0	NWP 14	No	Ephemeral	Tributary to Mud Creek
5	Culvert	0.16	0.21	0	NWP 14	Yes	Ephemeral	Tributary to Mud Creek
6	Culvert	0.35	0.35	0	NWP 14	Yes	Ephemeral	Tributary to West Elm Creek
7	Culvert	0.19	0.19	0	NWP 14	Yes	Ephemeral	Tributary to West Elm Creek
8	Culvert	0.09	0.09	0	NWP 14	No	Ephemeral	West Elm Creek
9	Culvert	0.07	0.07	0	NWP 14	No	Ephemeral	Tributary to Elm Waterhole Creek
10	Culvert	0.09	0.09	0	NWP 14	No	Ephemeral	Elm Waterhole Creek
11	None	0	0	0	N/A	N/A	Ephemeral	Tributary to Cibolo Creek
12	Culvert	0.11	0.22	0	NWP 14	Yes	Ephemeral	Tributary to Cibolo Creek
13	None	0	0	0	N/A	N/A	Ephemeral	Tributary to Cibolo Creek
Total		1.50	1.66	0				

Source: US 281 EIS Team, March 2014.

3.13.3 Environmental Consequences

No-Build Alternative

With implementation of the No-Build Alternative, there would be no impact to waters of the U.S. including wetlands.

Build Alternatives

The wetland delineation resulted in the identification of 13 stream crossings and 1 off-channel pond. The 13 water crossings show a connection to waters of the U.S. as defined by the USACE. All 13 crossings are considered to be jurisdictional (see **Figure 3-39**). Several more road drainages were observed in the area, but do not appear to be jurisdictional.

The off-channel pond noted on the NWI maps is a temporarily flooded-impounded wetland (shown as Upland Pond in **Figure 3-39**). This type of wetland typically serves an agricultural use such as ponds for livestock watering or similar functions. This pond does not appear to serve as an agricultural use and is degraded. This is an upland pond with no connection to waters of the U.S., as defined by the USACE. This is a non-jurisdictional pond.

Activities involving the discharge of degraded or fill material below the plane of ordinary high water of waters of the U.S., including wetlands, are subject to Section 404 of the CWA and Section 401 water quality certification. Potential impacts are described below:

The Elevated Expressway Alternative would permanently impact ten of the thirteen crossings. This impact would comprise 1.66 acres of waters of the U.S. being affected (see **Table 3-41)**. The greatest impacts occur at crossings 2, 5, 6, 7, and 12. All 10 crossings currently have box culverts.

The Preferred Expressway Alternative would result in permanent impacts to ten of the thirteen crossings of waters of the U.S., which compromises 1.5 acres of waters of the U.S. The greatest impacts occur at crossings 2, 6, and 7 (see **Table 3-41**). All ten crossings currently have box culverts which would be replaced with new box culverts, some relocated, and extended to include the entire length of the proposed ROW. ROE was not granted on all properties with the potential for waters of the U.S. within the Preferred Expressway Alternative ROW. All impacts to waters of the U.S. would be permitted under a Nationwide Permit (NWP) 14 and a pre-construction notification (PCN) would be required for crossings 2, 5, 6, 7 and 12.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative is being considered for non-toll/managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore the impacts to waters of the U.S. including wetlands would not change based on funding options.

3.13.4 Conclusion and Proposed Mitigation Measures

Executive Order 11990, *Protection of Wetlands,* established a national policy to avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

Based on a preliminary jurisdictional determination and potential impact assessment the Preferred Expressway Alternative would impact 1.5 acres of waters of the U.S. Final determinations would be decided by the USACE during the Section 404 permitting process during final design. This final wetland delineation would be used to calculate impacts to waters of the U.S., including wetlands, associated with the US 281 Corridor Project. Once the extent of impacts has been finalized, alternative mitigation scenarios for compensation of these impacts would be identified and evaluated. Mitigation alternatives may include any or all of the following: wetland/habitat restoration, enhancement, creation, and/or preservation. Preference would be given to potential mitigation within the San Antonio River Basin. Natural resource agencies would be involved in decisions regarding appropriate mitigation ratios, wetland type/function, location and size. A compensatory mitigation plan would be prepared, as necessary, and submitted to the USACE as part of a Section 404 permit application.

Activities to minimize the impacts to habitats from highway construction include: minimizing devegetation of the construction area wherever safety allows, decreasing the amount of fill placement, and implementation of BMPs, including an erosion and sedimentation control plan. Specific impact minimization to wetland areas may include; the use of retention basins and revegetated swales to minimize runoff, sedimentation, turbidity, leaching of soil nutrients and chemicals from petroleum products, pavement and waste material; and alleviating flow alterations due to structures which may change established wetland drainage or flooding patterns.

Some degree of impact is often unavoidable, regardless of the care applied during the planning, design and construction of a highway. Therefore, plans for compensatory mitigation may need to be developed to reconstruct the features or habitat that may be impacted, even after practicable minimization has been achieved. Both of the Build Alternatives would traverse 13 mapped water crossings and impact waters of the U.S. including potential wetlands. It should be noted that alternative evaluations involving avoidance and minimization of wetland impacts where possible have been, and would continue to be, an essential part of the NEPA process and engineering design of the US 281 Corridor Project.

3.14 VEGETATION

With the exception of certain vegetation communities that afford habitat for species listed under the Endangered Species Act (ESA), impacts to vegetation communities are generally not regulated under federal or state law. However, there are guidance documents that govern how impacts to vegetation communities are to be documented and mitigated in the interagency agreement between the Texas Parks and Wildlife Department (TPWD) and TxDOT as outlined in the MOU signed in 1998 and the MOA signed in 2001.[1]

The MOU between TxDOT and TPWD specifies the information pertaining to vegetation communities that must be included in environmental documents. The MOU further specifies that TxDOT and TPWD would consult on any non-regulatory mitigation that is deemed appropriate. Any mitigation, regulatory or non-regulatory, would be coordinated with TPWD and the USFWS in accordance with the MOU and other laws. The MOU specifies the habitats that would be given consideration for non-regulatory mitigation.

The 2001 MOA outlines the finalization of the 1998 MOU between TxDOT and TPWD concerning habitat descriptions and mitigation for impacts to habitat. In addition, the MOA defines unusual vegetation and special habitat features and further describes compensatory mitigation in accordance with Provisions (4)(A)(ii) of the MOU.

3.14.1 Methodology

The analysis of the vegetation communities surrounding the US 281 project corridor began through the examination of the following information/data sources:

- aerial images
- USGS topographic maps
- USFWS National Wetland Inventory maps
- USDA soil survey maps
- TPWD Natural Diversity Database

These resources were used to determine the vegetation study area and to create maps to be used for field surveys. The vegetation study area was defined as the existing and proposed ROW for both Build

[1] Although a new TxDOT-TPWD MOU became effective on September 1, 2013, coordination with TPWD for the US 281 EIS was initiated prior to September 1, 2013; therefore, coordination was completed under the procedures of the pre-existing MOU as outlined in the MOU signed in 1998 and the MOA signed in 2001. The Preferred Expressway Alternative has been evaluated under the requirements of the new 2013 MOU.

Alternatives. These maps and field surveys were used to characterize vegetation within the existing ROW and in adjacent areas, when readily visible.

The following field surveys were completed in the Spring of 2010, Spring of 2012, and the Spring of 2014 and the vegetation was described per the TxDOT-TPWD MOA:

- dominant species for each vegetation stratum;
- height of trees, if present;
- diameter at breast height (dbh) of trees, if present;
- acreage of each vegetation community present; and
- percent canopy cover of trees.

Per the TxDOT-TPWD MOU:
Unusual vegetation features may include:

1) unmaintained vegetation;
2) trees or shrubs along the fenceline;
3) riparian vegetation;
4) trees that are unusually larger than other trees in the area; and
5) unusual stands or islands (isolated) of vegetation.

Special habitat features include the following:

1) bottomland hardwoods;
2) caves;
3) cliffs and bluffs;
4) native prairies;
5) ponds;
6) seeps or springs;
7) snags; and
8) waterbodies and existing bridges with known or easily observed bird or bat colonies.

3.14.2 Affected Environment

The US 281 Corridor Project is located in the Edwards Plateau ecological region of Texas. According to the TPWD's *Vegetation Types of Texas* (1984), the corridor is situated within the Live Oak-Ashe Juniper Parks (46 percent), Live Oak-Mesquite-Ashe Juniper Parks (45 percent), and Live Oak-Ashe Juniper Woods (9 percent) regions of Texas. Commonly associated plants of the Live Oak-Ashe Juniper Parks and Live Oak-Mesquite-Ashe Juniper Parks include Texas oak (*Quercus buckleyi*), Ashe juniper (*Juniperus ashei*), cedar elm (*Ulmus crassifolia*), shin oak (*Quercus buckleyi*), netleaf hackberry (*Celtis retculata*), flameleaf sumac (*Rhus lanceolat*a), Texas persimmon (*Diospyros texana*), agarito (*Berberis trifoliata*), Texas pricklypear (*Opuntia lindheimeri*), Texas kidneywood (*Eysenhardtia texana*), greenbrier (*Smilax bona-nox*), Texas wintergrass (*Stipa leucotricha*), little bluestem (*Schizachyrium scoparium*), curly mesquite (*Hilaria belangeri*), Texas grama (*Bouteloua rigidiseta*), Halls panicum (*Panicum hallii*), purple threeawn (*Aristida purpurea*), hairy tridens (*Tridens pilosum*), cedar sedge (*Carex planostachys*), two-leaved senna (*Cassia roemeriana*), mat euphorbia (*Euphorbia serpens*), and rabbit tobacco (*Evax prolifera*). Commonly associated plants of the Live Oak-Ashe Juniper Woods vegetation type include many of the species listed above in addition to escarpment black cherry (*Prunus serotina*), twistleaf yucca (*Yucca rupicola*), and elbow-bush (*Forestier pubescens*).

A field survey of general areas along the US 281 project corridor in 2010 and 2012 indicated an ongoing conversion from native vegetation towards urban and residential development.

Developed Areas (includes maintained vegetation)

Residential/urban vegetation communities within the vegetation study area are primarily rocky with some native vegetation. It is heavily disturbed by residential/urban development. Vegetation within these areas tends to include Roosevelt weed (*Baccharis neglecta*), giant ragweed (*Ambrosia trifida*), annual sunflower (*Helianthus annuus*), Johnsongrass (*Sorghum halepense*) and ornamental landscaping plants. This component is approximately 54 percent of the vegetation study area.

Live Oak-Ashe Juniper Parks (wooded and unmaintained non-wooded areas)

The majority of the undeveloped or unmaintained portion of the vegetation study area is characterized as Live Oak-Ashe Juniper segmented woodlands. The dominant woody species include plateau live oak (*Quercus fusiformis*) and Ashe juniper (*Juniperus ashei*), with much lesser amounts of Texas oak (*Q. buckleyi*), sugar hackberry (*Celtis laevigata*), Texas ash (*Fraximus texensis*), cedar elm (*Ulmus crassifolia*), escarpment black cherry (*Prunus serotina* var. eximius), and Texas walnut (*Juglans microcarpa* var. *microcarpa*). The understory of these areas are generally well developed with Ashe juniper limbs, vines, various shrubs including the Texas persimmon (*Diospyros texana*), shunkbush sumac (*Rhus aromatic*), agarito (*Berberis trifoliate*), mountain laurel (*Sophora secundiflora*), prickly pear (*Opuntia* spp.) flameleaf sumac (*Rhus copallium*), elbow bush (*Fortetiera pubescens*), greenbrier (*Smilax bona-nox*), and grape (*Vitis* spp.). The average canopy coverage in these areas range from 50 to 90 percent and the height range was estimated to be 15 to 25 feet. The dbh ranged from 8 to 24 inches and an estimated average dbh of 15 inches. This component is approximately 46 percent of the vegetation study area.

Texas Natural Diversity Database Observations

TPWD's Texas Natural Diversity Database (TxNDD) is a database of observations of rare, threatened and endangered species and communities throughout the state. The TxNDD identified several vegetative species that occur or have historically occurred in Bexar County. The TxNDD was searched July 1, 2011 and updated February 13, 2014, for Element of Occurrence Records (EORs) to determine if any reports of species have occurred within a 10-mile radius of the US 281 biological study area. The biological study area is defined as 500 feet beyond the proposed ROW for both Build Alternatives. More information on the results of the TxNDD search can be found in **Section 3.16 Threatened and Endangered Species**.

Several rare vegetative series and plant species have been documented within 10 miles of the US 281 biological study area, but well beyond the US 281 vegetation study area. An occurrence of the plateau live oak/curly mesquite (*Quercus fusiformes/Hilaria belangeri*) series was recorded within the US 281 biological study area in 1992. Two occurrences of the federal candidate species, the bracted twistflower (*Streptanthus bracteatus*) were recorded two and seven miles west of the US 281 biological study area around Camp Bullis and in Eisenhower Park, which is adjacent to and immediately south of Camp Bullis. Additionally, an occurrence of the rare Texas mock-orange (*Philadelphus texensis*) has been recorded as close as seven miles northwest of the US 281 biological study area near the Comal County line. Lastly, the rare bald cypress/sycamore (*Taxodium distichum/Platanus occidentalis*) vegetative series was noted approximately nine miles northwest in Guadalupe River State Park and the rare plateau live oak/little bluestem (*Quercus fusiformes/Schizachyrium scoparium*) series has been recorded approximately 10 miles in the nearby Honey Creek Wildlife Management Area. None of these species were identified during on-site habitat assessments in 2010 and 2012 of the US 281 biological study area.

TxDOT-TPWD MOU

According to the MOU, there are unusual vegetation and special habitat features within the US 281 project corridor.

Unmaintained vegetation (approximately 125 acres) exists adjacent to the US 281 project corridor and along a utility corridor. This vegetation is the same as other adjacent vegetation within the area and is not considered to be of special importance.

The US 281 project corridor only contains limited fence line vegetation (approximately one acre) with the following dominant species: netleaf hackberry (*Celtis reticulata*), sugarberry (*Celtis laevigata*), live oak (*Quercus virginiana*), Ashe juniper (J*uniperus ashei*), cedar elm (*Ulmus crassifolia*), honey mesquite (*Prosopis glandulosa*), baccharis (*Baccharis texana*), and huisache (*Acacia smallii*). These species range from 8 to 24 inches in dbh and an average dbh of 15 inches, and an estimated height range from 10 to 40 feet. Vines located on fence lines were dominated by greenbrier (*Smilax rotundifolia*). Herbaceous vegetation near fence lines was dominated by bluegrass (*Bothriochloa spp.*), broomweed (*Amphiachyris dracunculoides*), little bluestem (*Schizachyrium scoparium*), prickly pear (*Opuntia* spp.), dewberry (*Rubus riograndis*) and maintained turf grasses.

Riparian vegetation (approximately 0.6 acre) can be found near Mud Creek. Dominant tree species include live oak and cedar elm with a dbh range from 8 to 24 inches and an average dbh of 15 inches, and a height range from 18 to 40 feet. Canopy cover is approximately 40 percent.

Trees that are unusually larger than other trees in the area and isolated vegetation were not found during the field surveys.

The vegetation study area is a karst landscape. In this type of terrain, limestone bedrock is dissolved by mildly acidic rain and groundwater to create caves and sinkholes. A number of caves and karst features are known to occur within the US 281 project corridor. The number of features varies within the existing and proposed ROW for either of the Build Alternatives (see **Section 3.16 Threatened and Endangered Species**). Cut areas are located along the US 281 project corridor in sections that were blasted and excavated to make room for the roadway. These cuts are into limestone and act as shelter and habitat for vegetation and wildlife species.

One rock bottom pond surrounded by emergent grass vegetation was noted on the west side of US 281, approximately 0.2 mile north of Borgfeld Drive. This man-made pond is located above a road cut and is approximately 0.1 acre in size. It is surrounded by Ashe juniper, live oak, Linheimer muhly (*Muhlenbergia lindheimeri*) and white tridens (*Tridens albescens*).

Four springs were identified during karst feature surveys (Zara 2010). One of the springs is located within the existing ROW (#281-002), one is located within the proposed ROW (#281-003) of both Build Alternatives and the other two springs are located outside of the proposed ROW (#281-010 and #281-012). The two springs located within the vegetation study area are located on the east side of US 281, approximately 0.15 mile south of Borgfeld Drive. The other two springs are located outside the study area and are approximately 300-450 feet west of the existing US 281 ROW and 0.4 mile north of Trinity Park. A field survey was conducted in 2010 at the spring (#281-002) located within the existing US 281 ROW. It appeared to emerge from a mud bank and be highly degraded. Right-of-entry (ROE) was not granted to conduct field surveys at the other three springs. More information about these springs can be found in **Appendix I2** and **Appendix J1**.

Two snags were noted on the east side of US 281 across from Summerglen Way. Both of these were live oak trees.

Thirteen drainage crossings were identified within the vegetation study area including Mud Creek and four of its tributaries, West Elm Creek and two of its tributaries, Elm Waterhole Creek and one of its tributaries, and three tributaries of Cibolo Creek. Most drainage crossings within the US 281 project corridor have been segmented by the development of adjacent commercial and residential properties. Water runoff is carried

through a series of concrete box culverts under the developments, across the ROW and then into other concrete box culverts. Only Mud Creek appears to remain relatively undisturbed. More information on these crossings can be found in **Section 3.9.1 Surface Water.**

Two barn swallow (*Hirundo rustica*) nests were noted under the Sonterra Boulevard overpass.

Bottomland hardwoods, native prairies, and bat colonies under bridges were not found during field surveys in 2010 and 2012.

3.14.3 Environmental Consequences

No-Build Alternative

The No-Build Alternative would not involve any impacts to any vegetation types within the vegetation study area, would not involve any impacts requiring compliance with beneficial landscape practices, and would not involve any impacts requiring compliance with EO 13112, regarding invasive species.

Build Alternatives

The primary impact to vegetation would be removal of existing vegetation due to site preparation and construction of the proposed US 281 Corridor Project. **Table 3-42** contains estimates of the vegetation areas in the existing ROW and proposed ROW.

Table 3-42: Vegetation in Acres per Alternative

Area	Acres within ROW per Alternative		
	No-Build	Elevated Expressway Alternative	Preferred Expressway Alternative
Wooded	35	80	68
Unmaintained (non-wooded)	90	111	104
Developed (including maintained non-wooded vegetation)	145	170	167
Total ROW	378	478	447
Total Vegetation Cover	270	361	339

Source: US 281 EIS Team, Field reconnaissance and GIS analysis, March 2014

Live Oak-Ashe Juniper Park and Live-Oak-Mesquite Ashe-Juniper Park are the dominant vegetation communities within the vegetation study area; these are also the communities that would be impacted most by the Build Alternatives. The Preferred Expressway Alternative would impact approximately 68 acres of wooded area, 104 acres of unmaintained vegetation (non-wooded), and 167 acres of maintained vegetation (primarily ROW that is mowed on a regular basis and residential/commercial landscaping); and the Elevated Expressway Alternative would impact approximately 80 acres of wooded area, 111 acres of unmaintained vegetation and 170 acres of maintained vegetation.

The removal of approximately one acre of fence line vegetation would be necessary for either Build Alternative during construction in areas where new ROW would be acquired.

Riparian areas would only be removed where necessary within the existing and proposed ROW. Impacts to riparian habitat would be approximately 0.6 acre for either Build Alternative located at stream crossings located on Mud Creek. More information on impacts to stream crossing is included in **Section 3.13 Waters of the U.S. including Wetlands**.

Karst features would be impacted by either of the Build Alternatives. The Preferred Expressway Alternative would impact 57 features and the Elevated Expressway Alternative would impact 54 features. More information on these features is included in **Section 3.16 Threatened and Endangered Species** and **Appendix I2.**

Expansion of road cuts would be necessary in the Preferred Expressway Alternative, but not in the Elevated Expressway Alternative because the existing US 281 lanes would remain in place.

The approximately 0.1 acre man-made pond will likely be removed by either of the Build Alternatives.

Two springs (#281-002 and #281-003) would be impacted by either of the Build Alternatives. They would be potentially impacted by alteration of the local hydrogeology or covering the spring orifice. More information about the karst feature survey where these springs were located can be found in the **Appendix I2** and **Appendix J1.**

Both of the snags would be removed by either of the Build Alternatives.

Impacts to water crossings would be necessary due to roadway expansion and improvements to drainage structures. The Build Alternatives have the potential to permanently impact ten water crossings. More information on impacts to stream crossing is included in **Section 3.13 Waters of the U.S. Including Wetlands**.

In accordance with the *Migratory Bird Treaty Act* (MBTA) of 1918, the two barn swallow nests located at US 281/Sonterra Boulevard would not be disturbed during construction of either of the Build Alternatives. The overpass at Sonterra Boulevard would not be affected by the US 281 improvements.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative is being considered for non-toll/managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for both alternatives are the same, therefore the impacts to vegetation would not change based on funding options.

3.14.4 Conclusion and Proposed Mitigation Measures

The vegetation communities occurring within and adjacent to the proposed ROW for each of the Build Alternatives would be directly impacted by construction related activities.

Both Build Alternatives would have generally similar impacts to vegetation. For safety reasons there is typically a clear zone boundary between the edge of the pavement and the ROW line, where vegetation is removed. While it is not known at this time what width the clear zone will be, every effort would be made to preserve trees between the boundary of the clear zone and the ROW line where it neither compromises safety nor substantially interferes with the construction of the US 281 Corridor Project. Also, after construction is complete, similar tree and groundcover species from the surrounding area would be used to revegetate disturbed areas outside the clear zone.

In accordance with Provision (4)(A)(ii) of the TxDOT-TPWD MOU and the MOA, the following habitats were given consideration for non-regulatory mitigation during project planning:

- habitat for federal candidate species if mitigation would assist in the prevention of the listing of the species
- rare vegetation series (S1, S2, or S3) that also locally provide habitat for a state listed species
- all vegetation communities listed as S1 or S2, regardless of whether the series in question provide habitat for state listed species

- bottomland hardwoods, native prairies and riparian sites
- any other habitat feature considered to be locally important

None of the vegetation communities along the US 281 project corridor provide habitat for federal candidate species. In addition, according to *Plant Communities of Texas (Series Level)* (Texas Natural Heritage Program 1993), none of the plant communities in the vegetation study area listed as S1, S2, or S3. Bottomland hardwoods and native prairies were not found during field surveys in May 2012. The vegetation habitats in the vegetation study area are relatively common for South-central Texas.

Riparian areas would only be removed where necessary within the existing and proposed ROW. In order to avoid and/or minimize riparian impacts, contractors, where practicable, would remove trees by cutting at or slightly above ground level to allow roots to remain intact to prevent erosion and maintain bank stability. In addition to stabilizing banks, leaving roots increases the probability that the area would revegetate naturally with existing species following construction.

Beneficial Landscape Practices

The Executive Memorandum dated April 29, 1994, on Beneficial Landscaping Practices was published in the August 10, 1995 *Federal Register*. It requires that all agencies 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 will (1) use regionally native plants for landscaping; (2) design, use, or promote construction practices that minimize adverse effects on natural habitat; (3) seek 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. Seeding and replanting would be completed according to TxDOT specifications and in compliance with the Executive Memorandum on Beneficial Landscaping.

Invasive Species

Executive Order 13112 on Invasive Species requires that federal agencies identify actions that can affect the disposition or introduction of invasive species, monitor known populations of invasive species, and restore areas that have been affected by such species. Seeding and replanting would be completed according to TxDOT specifications and in compliance with EO 13112.

3.15 WILDLIFE

This section describes the existing conditions concerning wildlife habitats in Bexar County and the US 281 biological study area and discusses the potential consequences to wildlife habitats resulting from the US 281 Corridor Project. The US 281 biological study area is defined as the existing ROW of the US 281 project corridor and 500-feet beyond the proposed ROW for the Build Alternatives.

3.15.1 Methodology

Site-specific wildlife habitats in the US 281 biological study area were assessed by reviewing aerial photography and topographic and soil survey maps, and by conducting field investigations.

3.15.2 Affected Environment

Terrestrial

Native wildlife populations of Bexar County have been largely displaced by land fragmentation from commercial and residential development and land clearing for agricultural purposes. Bexar County exhibits a variety of upland, wetland, and fragmented bottomland vegetative habitats that may support numerous species of terrestrial wildlife (mammals, birds, reptiles, and amphibians). The diversity of species has been

negatively impacted by years of extensive conversion of natural habitat to urban development, consisting of residential and commercial properties. Mammals most likely to occur in the region include the Virginia opossum (*Didelphis virginiana*), nine-banded armadillo (*Dasypus novemcinctus mexicanus*), raccoon (*Procyon lotor*), eastern cottontail (*Sylvilagus floridanus*), striped skunk (*Mephitis mephitis*), white-tailed deer (*Odocoileus virginianus*), eastern mole (*Scalopus aquaticus*), eastern gray squirrel (*Sciurus carolinensis*), eastern flying squirrel (*Glaucomys volans*), Baird's pocket gopher (*Geomys breviceps*), and several species of bats, rats, and mice. The white-tailed deer (*Odocoileus virginianus*), cottontail (*Sylvilagus floridanus*), and grey fox (*Urocyon cinereoargentus*) were observed during on-site habitat observations. A diversity of birds is likely to occur, both migratory and non-migratory, either nesting within areas of suitable habitat or temporarily using areas of suitable habitat for forage during their migration. The most common avian species observed during on-site habitat assessments included Carolina Chickadee (*Poecile carolinensis*), Black-crested Titmouse (*Baeolophus bicolor*), Carolina Wren (*Thryothorus ludovicianus*), Bewick's Wren (*Thryomanes bewickii*), Northern Mockingbird (*Mimus polyglottus*), Rufous-crowned Sparrow (*Aimophila ruficeps*), Northern Cardinal (*Cardinalis cardinalis*), Brown-headed Cowbird (*Molothrus ater*), and Lesser Goldfinch (*Carduelis psaltria*). Reptiles and amphibians indigenous to the area include several species of snakes, frogs and toads, and turtles. The Rio Grande leopard frog (*Rana berlandieri*) and the American bullfrog (*Rana catesbeiana*) tadpoles were observed during on-site habitat assessments. Reptiles and amphibians are relatively rare within developed tracts, in open grasslands without cover, and in areas recently disturbed by human contact. Common domesticated mammals found within the more urbanized segments include cats (*Felis domesticus*), dogs (*Canis familiaris*), cattle (*Bos taurus*), and horses (*Equus equine*).

The terms of the MBTA of 1918 apply to the US 281 Corridor Project. The MBTA prohibits all negative impacts to birds, young, eggs, or occupied nests in part or whole for all birds on the migratory birds list, except as authorized by federal permit. Avoidance and mitigation measures proposed for migratory birds are described in **Section 3.16.5 Threatened and Endangered Species**.

Karst

The US 281 biological study area is a karst landscape. In this type of terrain, limestone bedrock is dissolved by mildly acidic rain and groundwater to create caves and sinkholes. The US 281 biological study area has seen significant development in recent years, particularly in the form of increased impervious cover due to commercial infrastructure and residential developments. This impervious cover tends to reduce water and nutrient input into cave passages and mesocavernous voids, which in turn has the potential to negatively impact habitat and species within them. In karst areas, water enters the subsurface not only at obvious cave entrances and seemingly plugged sinkholes, but also generally across the landscape. This general recharge occurs at the soil/bedrock interface via the semi-dissolved upper layer of limestone known as epikarst. These epikarstic portals lead into the mesocavernous zone and also introduce nutrients such as organic debris, roots, and micro-fauna. The existing impervious cover along the US 281 project corridor inhibits these processes by diverting water from natural paths of flow.

Some cave entrances are known to have been destroyed along the US 281 project corridor. These include Tiny Town Sink, which was covered during widening of US 281 in the early 1970's (Veni 1988), and Voight Cave No. 1, which is in an area now covered by retail development. Other caves were impacted when they were opened up as a result of development activities, such as Power Pole Hole. This feature was intersected while drilling the foundation for a utility pole in 2007, at a depth of one meter. This void may actually have had a natural opening in the past that was covered either by shoulder grading activities, or by sewer line installation along the US 281 project corridor. At some time during these activities, a large quantity of fill was dumped into it, primarily recycled asphalt. In addition, this cave is penetrated by small core holes into which copper ground rods for two power poles were inserted. A black tar-like material, possibly creosote, has dripped down into the cave through these holes. Both asphalt and creosote are potentially harmful to the cave ecosystem. The possibility exists that other caves in the US 281 project corridor were destroyed in the past, but for which there are no records. Prior to the establishment of required assessments for recharge

features (by the TCEQ) and endangered karst invertebrates (by the USFWS), there were no regulatory requirements to record or preserve caves. Cave entrances allow surface species such as bats, porcupines, and cave crickets to enter the subsurface and thereby introduce energy in the form of waste and corpses. Organic debris such as leaf litter is also washed into cave entrances by flood waters. The input of organic debris and moisture are crucial to subterranean ecosystems.

Several large quarries are adjacent to the US 281 project corridor and have likely resulted in the destruction of caves, given the observed density of cave entrances and karst features in the surrounding area, and considering the depth to which these quarries have cut into the bedrock. Quarry Bat Cave is located in a quarry wall northwest of the intersection of US 281 and Sonterra Boulevard. It was initially reported by a helicopter pilot who witnessed bats flying out of it. It is not known if this cave still exists, or if it has been removed through continued quarrying. Cave-dwelling bat species nationwide have been severely impacted by a disease known as white-nose syndrome (WNS). Millions of bats have been killed in recent years by this disease in the northeastern US, resulting in catastrophic population declines, and may lead to local or widespread extinctions. In May 2010, the USFWS reported that WNS had reached Oklahoma, and a July 2013 report from the Arkansas Game and Fish Commission indicates that it was detected in that state in February 2012 (AGFC 2013). It could soon spread to Texas, which makes any potentially adverse impacts to bat caves an immediate concern.

A number of caves, verified karst features, and potential karst features (those not yet fully investigated) are known to occur within the ROW of the US 281 project corridor. The number of features varies within the existing and the proposed ROW for each of the Build Alternatives. Beyond these known features, it is likely that additional features would be revealed during construction of either of the Build Alternatives.

Aquatic

The region does not support an extensive surface aquatic ecosystem, thereby limiting the potential to support diverse aquatic biota. In addition, a majority of the stream crossings within the project area are typically dry and only carry water after rain events, further limiting the potential for a diverse aquatic ecosystem. Development of areas adjacent to the crossings has segmented those channels, further limiting the potential for diversity. Neither tidal influence nor cold water fishery conditions exist under normal circumstances along the US 281 project corridor. Therefore, the project is not subject to the Magnuson-Stevens Fishery Conservation and Management Act and would not impact Essential Fish Habitat as defined by 16 USC 1802. At this time, plans for the US 281 Corridor Project would not involve impounding, diverting or deepening; however, if these plans change, coordination would be conducted with USFWS and TPWD accordingly.

3.15.3 Environmental Consequences

No-Build Alternative

The No-Build Alternative would not result in impacts to any wildlife within the US 281 biological study area. However, other developments, including local roads, may further develop this area sometime in the future which could impact wildlife and their habitat.

The No-Build Alternative would have few effects on karst habitat beyond those already existing. Potential effects resulting from the No-Build Alternative include water runoff contamination from vehicles slowed or stopped by traffic congestion. Outdated, insufficient, or non-existent storm water runoff mitigation infrastructure on the current US 281 project corridor would not be improved under this alternative.

Build Alternatives

Construction of the US 281 Corridor Project would directly impact those animals that reside within the biological study area. As with the vegetation communities, wildlife communities are impacted by the

permanent loss of habitat. In addition to direct construction-related mortality or injury, wildlife populations often suffer impacts associated with displacement into adjacent habitats, which often are already at carrying capacity for that species.

Considering potential impacts to wildlife, the primary concerns are impacts caused by disturbance and fragmentation of habitat, specifically to oak-Ashe juniper parks and endangered or threatened species habitat (karst features and golden-cheeked warbler [GCWA] habitat). These areas would change to roadway material and grassland (in unpaved portions of the ROW), and terrestrial wildlife would be displaced into an ever-decreasing habitat block as development continues to grow. These small, vegetated areas are becoming increasingly valuable to wildlife due to the continuing urban development within and surrounding the US 281 vegetation study area. **Table 3-43** shows the acreage of wooded ROW by Build Alternative that may be used by wildlife as habitat.

Table 3-43: Acreage of Wooded Areas in ROW

Alternative	Wooded Areas in ROW (in acres)
No-Build	35
Elevated Expressway	80
Preferred Expressway	68

Source: US 281 EIS Team, March 2014.

Potential impacts to karst habitat include additional impervious cover, exposure of karst voids in new road cut areas, and elimination of habitat due to bedrock removal. **Table 3-45** in **Section 3.16.3** shows the number of karst features that could be impacted by the Build Alternatives.

There are three types of impacts to aquatic habitats resulting from construction and use of the US 281 Corridor Project: physical alteration, sedimentation and water quality degradation due to increased vehicular traffic and non-point source runoff or point source toxic spills draining into the waterways.

Physical alteration can occur when a waterway is crossed or by the installation of a culvert. Typical short-term construction impacts are associated with excess turbidity and siltation. High levels of turbidity can clog the gills of fish and reduce their ability to extract oxygen from the water, as well as prevent some species that feed on plankton from feeding. High turbidity could also affect those fish species that feed on prey by limiting food supplies and impeding on their ability to locate prey. However, high turbidity is either tolerated by many species or the fish move away and return when acceptable levels are restored. While fish normally recover quickly from such stresses, such circumstances during spawning season may reduce reproductive success.

More typically, sedimentation can bury food supplies of benthic feeders. This is of limited concern in streams with mud or silt bottoms. If the degree of siltation is minimal, the benthic species often survive. In addition, many benthic species living in mud bottoms are very opportunistic and recolonization of such habitats is often quite rapid (Waters 1995).

Oil and grease are typically the petroleum products that are washed into a stream from a roadway. Such chemicals accumulate on the road during dry periods and are rinsed off when it rains. However, the most lethal fraction of petroleum products is the volatile compounds, which rapidly evaporate. Therefore, these volatiles are rarely washed into a stream. Since flows are generally high after a rain, the oil and grease are often diluted and washed away before there can be any impacts to the local aquatic life.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative is

being considered for non-toll/managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same; therefore, the impacts to wildlife would not change based on funding options.

3.15.4 Conclusion and Proposed Mitigation Measures

Construction of the US 281 Corridor Project would result in the loss of wildlife habitat. Wildlife inhabiting urban and residential communities would be temporarily displaced, but likely would assimilate into the surrounding developed areas. Thus, no major long-term effects to wildlife in the urban and residential areas are expected.

In the event that migratory birds are encountered on-site during construction, every effort would be made to avoid harm of protected birds, active nests, eggs, and/or young. The contractor would remove any old migratory bird nests between September 1 and February 28 from any structure where work will be done. In addition, the contractor would be prepared to prevent migratory birds from building nests between March 1 and August 31.

Primary measures to mitigate temporary adverse channel impacts include minimizing the area to be disturbed, replanting the areas cleared, and optimizing stream diversions to include low flow augmentation of intermittent streams. Permanent water quality management BMPs would also be implemented including vegetative filter strips and biorentention.

3.16 THREATENED AND ENDANGERED SPECIES

The USFWS has legislative authority to list and monitor the status of species whose populations are considered to be imperiled. This federal legislative authority for the protection of vulnerable species is derived from the *Endangered Species Act* (ESA) of 1973, and its subsequent amendments. Regulations supporting this Act are codified and regularly updated in Sections 17.11 and 17.12 of Title 50 of the Code of Federal Regulations. Petitions for federal protection of species receive an initial review and if the USFWS finds that listing may be warranted, the species undergoes a thorough status review. After the status review is complete, vulnerable species that qualify for listing are either listed as threatened (T) or endangered (E) or categorized as candidates. Candidate species have been deferred from listing while the USFWS works on listing proposals for other species they determine are at greater risk. The vulnerability decision is based upon many factors affecting the species within its range and is always linked to the best current scientific data available to the USFWS. Fish and wildlife species listed as endangered or threatened by the USFWS are provided full protection. This protection includes a prohibition on direct "take" of the listed species in addition to indirect "take" such as destruction of habitat. As defined by the ESA, take means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." ESA does permit the incidental take of endangered species for certain activities through prescribed measures to mitigate or minimize harm. Federal prohibition of take of listed plants is limited to federal lands; however, federal law federalizes state law prohibitions on the taking of plants. The ESA and accompanying regulations provide the necessary authority and incentive for the individual states to establish their own regulatory vehicle for the management and protection of threatened and endangered species.

The TPWD oversees endangered resources through the Wildlife Division's Wildlife Diversity Program. This program is responsible for maintaining county occurrence records for state and federal endangered and threatened species and maintaining the TxNDD. This database provides site specific information and other species status tracking information on listed or rare animal and plant species, including unique or declining vegetation communities of concern. State endangered species have limited regulatory protection. While these species cannot be taken, collected, held, or possessed without a permit, their habitat is afforded no

regulatory protection, except on tracts managed by state, federal, or private interests for conservation purposes.

3.16.1 Methodology

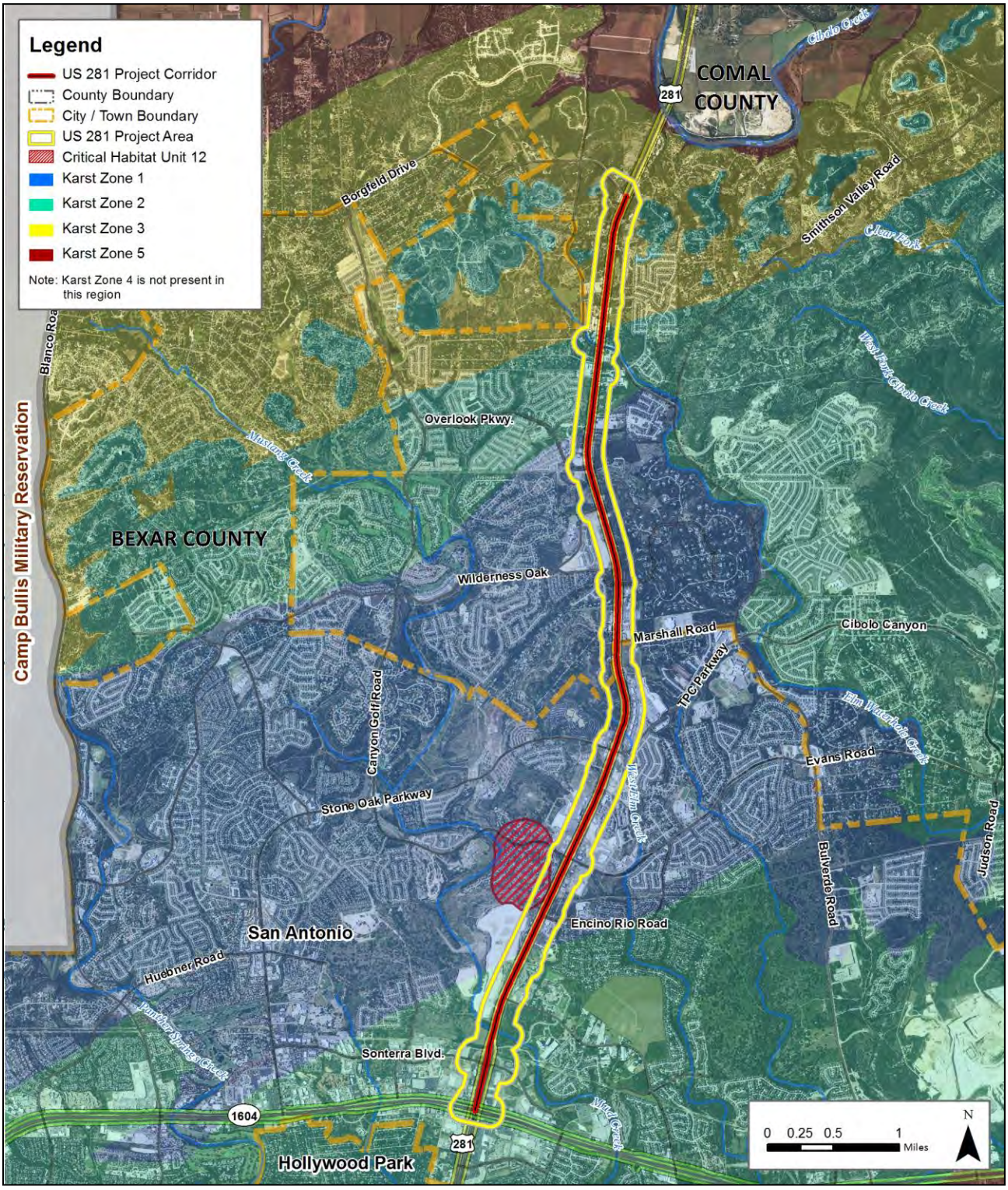
To determine the potential for federally-listed, state-listed, and other rare species to occur along the US 281 project corridor and be affected by the US 281 Corridor Project, background reviews and field investigations were conducted. To focus these efforts the US 281 biological study area was defined as the existing ROW of the US 281 project corridor and 500-feet beyond the proposed ROW for the Build Alternatives. The US 281 biological study area is depicted in **Figure 3-40**. Background reviews included the following:

1. Reviewed the USFWS and TPWD list of threatened and endangered species for Bexar County.
2. Reviewed the TPWD's TxNDD for all previously recorded occurrences of threatened and endangered species in the project vicinity.
3. Conducted a literature review to identify habitat requirements, current distribution, and status of each listed species.
4. Reviewed the US 281 biological study area relative to vegetation communities, soil associations, topography, and aerial photography.
5. Conducted meetings with USFWS Ecological Services in January 2010, September 2010, March 2011 and September 2014 to discuss the US 281 Corridor Project and its potential effects on federally-listed threatened and endangered species.

After review of available background information, project biologists conducted on-site habitat assessments within the US 281 biological study area for all federally-listed, state-listed, and other listed rare species in Bexar County. In addition, presence-absence surveys were conducted using USFWS protocols for the federally listed Madla's Cave meshweaver (*Cicurina madla*), the ground beetle (*Rhadine exilis*), the ground beetle (*Rhadine infernalis*), and golden-cheeked warbler (*Setophaga chrysoparia*). The karst invertebrate survey was conducted in 2010 and the avian survey was conducted in 2009, 2010, and 2014. Although there is no USFWS survey protocol for *Eurycea* or the rare spring-associated invertebrate species, the springs within the US 281 biological study area were surveyed in 2010 for the two state-listed salamanders (*Eurycea latitans complex* and *Eurycea tridentifera*) and the rare Texas salamander (*Eurycea neotenes*) and spring-associated invertebrate species where access was available, using scientifically acceptable standard methods for spring surveys. A presence-absence or biological survey was used to determine whether or not a species was present in an area that provides suitable habitat. These surveys were completed in all potential habitat areas where ROE was granted.

Methods for the avian surveys followed the most recent *USFWS Section 10(a)(1)(A) Scientific Permit Requirements for Conducting Presence/Absence Surveys for Endangered Golden-cheeked Warblers*, (2006). Methods used for karst surveys followed the USFWS protocol outlined in *USFWS Section (10)(a)(1)(A) Scientific Permit Requirements for Conducting Presence/Absence Surveys for Endangered Karst Invertebrates in Central Texas* (2006) and *Geologic Controls on Cave Development and the Distribution of Endemic Cave Fauna in San Antonio, Texas Region*, (Veni 1994).

Figure 3-40: US 281 biological study area



Source: USFWS, 2006, US 281 EIS Team, February 2014.

3.16.2 Affected Environment

Databases of sensitive species maintained by the USFWS and TPWD identified 28 federally-listed threatened, endangered, or candidate species that may occur or have historically occurred in Bexar County, including 2 plants, 3 mussels, 1 crustacean, 6 arachnids, 5 insects, 2 fish, 2 amphibians, 5 birds, and 2 mammals. Additionally, 30 state listed species (one plant, four mussels, one crustacean, four fishes, four amphibians, four reptiles, nine birds, and three mammals) potentially occur or have historically occurred in Bexar County. The state-listed plant, crustacean, two fishes, two amphibians, four birds, and two of the state listed mammals are also federally listed. The TPWD and USFWS lists differ (see **Appendix I1**) due to differences in the procedures for collecting and disseminating data on recorded occurrences. **Table 3-44** presents the current status and habitat requirements along with potential occurrence within the US 281 biological study area of each of the federally listed threatened, endangered, or candidate species, and the bald eagle, which has been delisted but is still being monitored by the USFWS. **Table 3-44** also includes state listed species and species with no regulatory status that are considered rare in Texas and could occur within Bexar County. A brief account of each federal and state-listed species listed by either agency as potentially occurring in Bexar County is summarized in the **Table 3-44**.

Table 3-44: Federal and State Listed Rare, Threatened and Endangered Species of Bexar County

Species	Federal Status	State Status	Habitat	Habitat Present in Biological Study Area?
Plants				
Big red sage *Salvia pentstemonoides*	----	----	Texas endemic; moist to seasonally wet, steep limestone outcrops on seeps within canyons or along creek banks; occasionally on clayey to silty soils of creek banks and terraces, in partial shade to full sun	Yes
Bracted twistflower *Streptanthus bracteatus*	C	----	Texas endemic; shallow, well-drained gravelly clays and clay loams over limestone in oak juniper woodlands and associated openings, on steep to moderate slopes and in canyon bottoms; several known soils include Tarrant, Brackett, or Speck over Edwards, Glen Rose, and Walnut formations	Yes
Correll's false dragon-head *Physostegia correllii*	----	----	Wet, silty clay loams on streamsides, in creek beds, irrigation channels and roadside drainage ditches; or seepy, mucky, sometimes gravelly soils along riverbanks or small islands in the Rio Grande; or underlain by Austin Chalk limestone along gently flowing spring-fed creek in Central Texas	Yes
Elmendorf's onion *Allium elmendorfii*	----	----	Texas endemic; grassland openings in oak woodlands on deep, loose, well-drained sands; to the north it occurs in post oak-black hickory-live oak woodlands over Queen City and similar Eocene formations; one anomalous specimen found on Llano Uplift in wet pockets of granitic loam	No
Hill Country wild-mercury *Argythamnia aphoroides*	----	----	Texas endemic; mostly in bluestem-grama grasslands associated with plateau live oak woodlands on shallow to moderately deep clays and clay loams over limestone on rolling uplands, also in partial shade of oak-juniper woodlands in gravelly soils on rocky limestone slopes	Yes
Parks' jointweed *Polygonella parksii*	----	----	Texas endemic; mostly found on deep, loose, whitish sand blowouts (unstable, deep, xeric, sandhill barrens) in Post Oak Savanna landscapes over the Carrizo and Sparta formations; also occurs in early successional grasslands, along ROW, and on mechanically disturbed areas	No

Species	Federal Status	State Status	Habitat	Habitat Present in Biological Study Area?
Sandhill woollywhite *Hymenopappus carrizoanus*	----	----	Texas endemic; disturbed or open areas in grasslands and post oak woodlands on deep sands derived from the Carrizo Sand and similar Eocene formations	No
Texas wild-rice* *Zizania texana*	E	E	Perennial, emergent, aquatic grass known only from the upper 2.5 kilometers (km) of the San Marcos River in Hays County	No
Mollusks and Snails				
Creeper (squawfoot) *Strophitus undulatus*	----	----	Small to large streams, prefers gravel or gravel and mud inflowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins	No
False Spike *Quadrula mitchelli*	----	T	Medium to large rivers; substrates varying from mud through mixtures of sand, gravel and cobble; Brazos, Colorado, Guadalupe and Rio Grande (historic) River basins	No
Golden Orb *Quadrula aurea*	C	T	Sand and gravel in some locations and mud at others; intolerant of impoundment in most instances; Guadalupe, San Antonio, and Nueces River basins	No
Mimic cavesnail *Phreatodrobia imitata*	----	----	Subaquatic; only known from two wells penetrating the Edwards Aquifer	No
Texas Fatmucket *Lampsilis bracteata*	C	T	Streams and rivers on sand, mud, and gravel substrates; intolerant of impoundment; broken bedrock and course gravel or sand in moderately flowing water; Colorado and Guadalupe River basins	No
Texas Pimpleback *Quadrula petrina*	C	T	Mud, gravel and sand substrates, generally in areas with slow flow rates; Colorado and Guadalupe River basins	No
Crustaceans				
A cave obligate crustacean *Tethysbaena (=Monodella) texana*	----	----	Subaquatic, subterranean obligate; underground freshwater aquifers; has been collected from caves, springs and artesian wells	Yes
Texanobathynella bowmani	----	----	Subaquatic; underground freshwater aquifers; has been collected from cave streams, springs and wells	Yes
Cascade Cave amphipod *Stygobromus dejectus*	----	----	Subaquatic crustacean; subterranean obligate; has been collected from cave pools	No***
Ezell's cave amphipod *Stygobromus flagellatus*	----	----	subaquatic, subterranean obligate amphipod; has been collected from caves, springs and artesian wells	Yes
Long-legged cave amphipod *Stygobromus longipes*	----	----	Subaquatic crustacean; subterranean obligate; found in subterranean streams	No***
Peck's cave amphipod* *Stygobromus pecki*	E	E	Small, aquatic crustacean; has been collected from two Edwards Aquifer springs in Comal County. There are no known localities in Bexar County.	No***
Allotexiweckelia hirsuta	----	----	Small aquatic crustacean; has been collected from springs and artesian wells	Yes
Parabogidiella americana	----	----	Small aquatic crustacean; has been collected from artesian wells	No
Texas cave shrimp *Palaemonetes antrorum*	----	----	Subaquatic shrimp; has been collected from subterranean streams and pools and from artesian wells	No

Species	Federal Status	State Status	Habitat	Habitat Present in Biological Study Area?
Coahuila isopod *Mexistenasellus coahuila*	----	----	Subaquatic; has been collected from springs and wells south of Loop 410.	Yes
Speocirolana hardeni	----	----	Subaquatic, subterranean obligate; has been collected from springs, caves and artesian wells	Yes
Texiweckeliopsis insolita	----	----	subaquatic, deep subterranean obligate; has only been collected from high flow springs and artesian wells	Yes
Arachnids				
Braken Bat Cave meshweaver *Cicurina venii*	E	----	Small, eyeless, or essentially eyeless spider known only from two caves in the Austin Chalk in the Culebra Anticline KFR.	No
Texella tuburculata	----	----	Small, eyeless, or essentially eyeless harvestman; known only from western Bexar County	Yes
Cokendolpher cave harvestman *Texella cokendolpheri*	E	----	Small, eyeless, or essentially eyeless harvestman; known only from Robber Baron Cave (a cave formed in the Austin Chalk). The currently understood range of this species begins seven miles to the south in an outcrop of the Austin Chalk.	No
Government Canyon Bat Cave meshweaver *Cicurina vespera*	E	----	Small, eyeless, or essentially eyeless spider; known only from Government Canyon Bat Cave.	No
Government Canyon Bat Cave spider *Neoleptoneta microps*	E	----	Small, eyeless or essentially eyeless spider; karst features in north and northwest Bexar County	No
Madla's Cave meshweaver *Cicurina madla*	E	----	Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County	Yes
Cicurina bullis	----	----	Small, eyeless, or essentially eyeless spider; known only from Camp Bullis in the Stone Oak KFR	Yes
Robber Baron Cave meshweaver *Cicurina baronia*	E	----	Small, eyeless, or essentially eyeless spider; known only from Austin Chalk caves in the Alamo Heights KFR	No
Insects				
Comal Springs dryopid beetle* *Stygoparnus comalensis*	E	----	Dryopids usually cling to objects in a stream; dryopids are sometimes found crawling on stream bottoms or along shores; adults may leave the stream and fly about, especially at night	No***
Comal Springs riffle beetle* *Heterelmis comalensis*	E	----	Comal and San Marcos Springs	No***
Ground beetle *Rhadine exilis*	E	----	Small, essentially eyeless ground beetle; karst features in north and northwest Bexar County	Yes
Ground beetle *Rhadine infernalis*	E	----	Small, essentially eyeless ground beetle; karst features in north and northwest Bexar County	Yes
Helotes mold beetle *Batrisodes venyivi*	E	----	Small, eyeless mold beetle; karst features in northwestern Bexar County and northeastern Medina County	No
Manfreda giant-skipper *Stallingsia maculosus*	----	----	Small and stout-bodied; fast erratic flight; skipper larvae usually feed inside a leaf shelter and pupate in a cocoon made of leaves fastened together with silk. The preferred habitat of this plant species is sand, sandy loam, sandy clay, or clay soils; in mesquite scrubland, in both moist and dry sites[1].	No

Species	Federal Status	State Status	Habitat	Habitat Present in Biological Study Area?
Rawson's metalmark *Calephelis rawsoni*	----	----	Moist areas in shaded limestone outcrops in Central Texas, desert scrub or oak woodland in foothills, or along rivers elsewhere; larval hosts are *Eupatorium havanense, E. greggii*	Yes
Fishes				
Fountain darter *Etheostoma fonticola*	E	E	Known only from the San Marcos and Comal Rivers; springs and spring-fed streams in dense beds of aquatic plants.	No***
Guadalupe bass *Micropterus treculii*	----	----	Endemic to perennial streams of the Edwards' Plateau region; introduced in Nueces River system	No
San Marcos gambusia* *Gambusia georgei*	E	E	Extinct; endemic; formerly known from upper San Marcos River; restricted to shallow, quiet, mud-bottomed shoreline areas without dense vegetation in thermally constant main channel	No
Toothless blindcat *Trogloglanis pattersoni*	P	T	Troglobitic; blind catfish endemic to the San Antonio Pool of the Edwards Aquifer	No
Widemouth blindcat *Satan eurystomus*	P	T	Troglobitic; blind catfish endemic to the San Antonio Pool of the Edwards Aquifer	No
Amphibians				
Cascade Caverns salamander *Eurycea latitans complex*	----	T	Endemic; subaquatic; springs and caves in Medina River, Guadalupe River, and Cibolo Creek watersheds within Edwards Aquifer	Yes
Comal blind salamander *Eurycea tridentifera*	P	T	Endemic; semi-troglobitic, found in springs and waters of caves	Yes
San Marcos salamander* *Eurycea nana*	T	T	Headwaters of the San Marcos River downstream to ca. ½ mile past IH-35; water over gravelly substrate characterized by dense mats of algae (*Lyng bya*) and aquatic moss (*Leptodictym riparium*)	No
Texas blind salamander* *Eurycea rathbuni*	E	E	Troglobitic; water-filled subterranean caverns along a six mile stretch of the San Marcos Spring Fault, in the vicinity of San Marcos and four locations in New Braunfels including Comal Springs, Hueco Springs, Mission Bowling Wells, and Panther Canyon Well (Gluesenkamp 2011).	No***
Texas salamander *Eurycea neotenes*	P	----	Endemic; troglobitic; springs, seeps, cave streams, and creek headwaters; often hides under rocks and leaves in water; restricted to Helotes and Leon Creek drainages	Yes
Reptiles				
Spot-tailed earless lizard *Holbrookia lacerata*	----	----	Central and southern Texas and adjacent Mexico; moderately open prairie-brushland; fairly flat areas free of vegetation or other obstructions, including disturbed areas	Yes
Texas garter snake *Thamnophis sirtalis annectens*	----	----	Wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover	Yes

Species	Federal Status	State Status	Habitat	Habitat Present in Biological Study Area?
Texas horned lizard *Phrynosoma cornutum*	----	T	Open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows in soil, enters rodent burrows, or hides under rock when inactive; breeds March-September	Yes
Texas indigo snake *Drymarchon melanurus erebennus*	----	T	Texas south of the Guadalupe River and Balcones Escarpment; thornbush-chaparral woodlands of south Texas, in particular dense riparian corridors; can do well in suburban and irrigated croplands if not molested or indirectly poisoned; requires moist microhabitat, such as rodent burrows for shelter	No
Texas tortoise *Gopherus berlandieri*	----	T	Open brush with a grass understory is preferred; open grass and bare ground are avoided; when inactive occupies shallow depressions at base of bush or cactus, sometimes in underground burrows or under objects; active March-November; breeds April-November	No
Timber/Canebrake rattlesnake *Crotalus horridus*	----	T	Swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto	Yes
Birds				
Bald Eagle *Haliaeetus leucocephalus*	DL/M	T	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	No
Black-capped Vireo *Vireo atricapilla*	E	E	Oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to the ground level for nesting cover; nesting season March-late summer	No
Golden-cheeked Warbler *Setophaga chrysoparia*	E	E	Juniper-oak woodlands; dependent on Ashe juniper for long fine bark strips, only available from mature trees, only a few junipers or nearby cedar brakes are can provide nest material; nesting March-early summer	Yes
Interior Least Tern** *Sterna antillarum athalassos*	E	E	Nests along sand and gravel bars within braided streams, rivers; also known to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc.)	No
Mountain Plover *Charadrius montanus*	P	----	Nests on high plains or shortgrass prairie, on ground in shallow depression; non-breeding habitat includes shortgrass plain and bare, dirt (plowed) fields	No
Peregrine Falcon *Falco peregrinus*	----	T	Occupies a wide range of habitats during migration including urban, concentrations along the coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands	No
Sprague's Pipit** *Anthus spragueii*	C	----	Can be found in Texas during migration and winter. Strongly tied to native upland prairie, can be locally common in costal grasslands, uncommon to rare farther to the west. Sensitive to patch size and avoids edges.	No
Western Burrowing Owl *Athene cunicularia hypugaea*	----	----	Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows	No

Species	Federal Status	State Status	Habitat	Habitat Present in Biological Study Area?
White-faced Ibis *Plegadis chihi*	----	T	Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats	No
Whooping Crane *Grus americana*	E	E	Potential migrant via plains throughout most of the state to coast; winters in coastal marshes in Aransas, Calhoun, and Refugio counties	No
Wood Stork *Mycteria americana*	----	T	Forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes with other wading birds	No
Zone-tailed Hawk *Buteo albonotatus*	----	T	Arid open country, including open deciduous or pine-oak woodland, mesa or mountain country, often near watercourses, and wooded canyons and tree-lined rivers; nests in various habitats and sites ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in mountain regions	No
Mammals				
Black bear *Ursus americanus*	----	T	Bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear, treat all east Texas black bears as federal and state listed Threatened	No
Cave myotis bat *Myotis velifer*	----	----	Colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter	Yes
Ghost-faced bat *Mormoops megalophylla*	----	----	Colonially roosts in cave crevices, abandoned mines, and buildings; insectivorous; breeds late winter-early spring; single offspring born per year	No
Gray wolf** *Canis lupus*	E	E	Extirpated; formerly known throughout the western two-thirds of the state in forests, brushlands, or grasslands	No
Plains spotted skunk *Spilogale putorius interrupta*	----	----	Habitat generalist; open fields, prairies, croplands, fence rows, farmyards, forest edges and woodlands; prefers wooded, brushy areas and tallgrass prairie	Yes
Red wolf** *Canis rufus*	E	E	Extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	No

E – Endangered
T – Threatened
C – Candidate for listing as threatened or endangered
P – Petitioned for federal listing; USFWS has determined the species may warrant listing
DL – Federally De-listed; DM – Federally De-listed, monitoring
"---" – Rare, but with no current regulatory status

*These federally listed species are listed on the USFWS (accessed via website in February 2014) list of species of potential occurrence in Bexar County, but are not considered by TPWD as potentially occurring in this County.
**These federally listed species are listed on the TPWD (accessed via website in February 2014) list of species of potential occurrence in Bexar County, but are not considered by USFWS as potentially occurring in this County.
***These five species, while not known to occur in Bexar County, are further discussed in Chapter 4 and Appendix I4, due to the potential for indirect effects to species dependent on Comal Springs as a result of groundwater pollutant transport via sub-surface flow paths.

Descriptions of Federal and State-Listed Species

The US 281 project corridor traverses an ecologically sensitive area, and extensive field studies have been and continue to be conducted to determine whether threatened or endangered species or their habitats are present. Specifically, endangered avian and karst invertebrate habitat assessments and surveys have been conducted. These surveys are documented in reports included in **Appendix I2** and **Appendix I3**.

Below are brief descriptions of the federally and state listed candidate, threatened and endangered wildlife species with habitat present in the US 281 biological study area.

Plants

Bracted twistflower (Streptanthus bracteata):
The bracted twistflower (*Streptanthus bracteatus*) is a rare annual wildflower endemic to south-central Texas which became a federal candidate for listing in 2011. This species is associated with oak-juniper woodlands and openings on slopes and in canyon bottoms with shallow, well drained gravelly clay and clay loam soils over limestone. Fall and winter rainfalls stimulate seed germination and plants flower in the spring, displaying showy, lavender-purple flowers (NatureServe 2014). Habitat for the bracted twistflower is found within the US 281 project corridor.

Arachnids

Madla's Cave Meshweaver (Cicurina madla):
The federally listed endangered Madla's Cave meshweaver is a pale, eyeless, troglobitic spider first collected on October 4, 1963 by J. Reddell and D. McKenzie (Reddell 1993) and described by Gertsch (1992). This species inhabits caves and mesocavernous voids, including those with sparse organic input. *C. madla* has been confirmed in 22 Bexar County caves in Government Canyon, Helotes, University of Texas San Antonio (UTSA) and Stone Oak karst faunal regions (KFRs), and may occur in two additional caves in the Helotes and Stone Oak KFRs (USFWS 2011b). The eastern limit of the currently understood range for this species is located in the western part of Stone Oak KFR, but there are no known localities within the US 281 biological study area. Presence-absence surveys performed in 2010 within potential habitat in the US 281 biological study area did not result in any observations or collections of this species.

Madla's Cave Meshweaver

Photo: Dr. Jean Krejca

Insects

Ground Beetle (Rhadine exilis):
The federally listed endangered ground beetle, *Rhadine exilis*, is a small, slender-bodied, essentially eyeless, troglobitic ground beetle. It inhabits caves that have natural entrances; it is not known to have been encountered in accidently discovered voids during construction activities. It was first collected in 1959 and described as *Agonum exile* but later assigned to the genus *Rhadine* (Barr 1974). The species is currently confirmed in 51 caves in the Government Canyon, Helotes, UTSA, and Stone Oak KFRs and may occur in two additional caves in the UTSA KFR in Bexar County (USFWS 2011b). The currently understood range of this species overlaps with the US 281 biological study area, but there are no known localities within the US 281 biological study area and presence-absence surveys performed in 2010 within potential habitat did not result in any observations or collections of this species.

Ground Beetle (Rhadine infernalis):
The federally listed endangered ground beetle, *Rhadine infernalis*, is a small, slender-bodied, essentially eyeless, troglobitic ground beetle. It was first collected in 1959 and initially described by Barr and Lawrence (1960) as *Agonum infernale*, but later assigned to the genus *Rhadine* (Barr 1974). USFWS (2011b) documents the species as occurring in 39 caves in the Culebra Anticline, Helotes, UTSA, and Stone Oak KFRs located in Bexar County; recent surveys have encountered this species in two additional caves within the Culebra Anticline KFR. Recently collected specimens were taxonomically verified by James Reddell (2014). The current known range of this species is located west of the US 281 project corridor, and there are no known localities within the US 281 biological study area. Presence-absence surveys performed in 2010 within potential habitat did not result in any observations or collections of this species.

Amphibians

Cascade Caverns Salamander (Eurycea latitans complex) group:
The species group containing the Cascade Caverns salamander and Comal blind salamander, *Eurycea latitans* group, is a member of the Blepsimolge clade. The taxonomic history of *Eurycea latitans* is complicated, and was once regarded as a hybrid swarm between *Eurycea neotenes*, a species with epigean (surface-dwelling, typically found in springs) morphology, and *Eurycea tridentifera* (Comal blind salamander), which exhibited characteristics of subterranean species (Sweet 1984). Chippindale (2000) extended the range of *Eurycea latitans* from the type locality at Cascade Caverns in Kendall County to include spring and cave systems in the Cibolo and Guadalupe drainage basins. Bendik (2006) used mtDNA sequencing data to show that *Eurycea latitans* was conspecific with *Eurycea tridentifera* and belonged in a paraphyletic group which may also include *Eurycea pterophila*. *Eurycea latitans* is on the State of Texas threatened species list. No observations or collections of this species occurred during biological surveys in springs located within the US 281 biological study area in 2010, and there are currently no known localities for this species within the US 281 biological study area.

Comal Blind Salamander (Eurycea tridentifera):
This salamander is a member of the Blepsimolge clade, a group of neotenic salamanders endemic to Central Texas spring outflows and caves containing permanent water. Neotenic is defined as the retention of juvenile characteristics in the adults of a species. This species exhibits the most strongly cave adapted morphology (shovel-nose, lack of pigment, and long, slender appendages) in the Blepsimolge clade (Bendik 2006). Like most other Central Texas *Eurycea*, this species retains external gills and other larval features associated with a strictly aquatic life history, even after it reaches reproductive maturity. This species was originally described from Honey Creek Cave in Comal County (Mitchell and Reddell 1965). The species range was extended to include several caves in the Cibolo Sinkhole Plain in Comal and Bexar Counties (Sweet 1984, Chippindale et al. 2000). Recent genetic work suggests that this species be synonymized with the state listed threatened Cascade Caverns salamander (*Eurycea latitans*) (Bendik 2006). Many taxonomists recognize *Eurycea tridentifera* only as a cave adapted morph of *Eurycea latitans* and not as a distinct species (Andrew Gluesenkamp, pers. comm. 2014). The USFWS has determined that this species may warrant listing as an endangered species (as of December 16, 2009). No observations or collections of this species occurred during biological surveys in springs located within the US 281 biological study area in 2010, and there are currently no known localities for this species within the US 281 biological study area.

Reptiles

Texas Horned Lizard (Phrynosoma cornutum):

The Texas horned lizard is a wide-bodied spiny lizard that inhabits open arid and semiarid regions with sparse vegetation such as prairies, deserts, and foothills with grass, cactus, or scattered brush or shrubby trees. The soil ranges from sandy to rocky and when inactive, individuals burrow into the soil, enter rodent burrows, or hide under rocks. They have also been documented climbing three or more feet up tree trunks to escape moist soil after a rain event. Their diet consists primarily of ants, but they are known to eat other small insects. They lay their eggs from March through July in nests dug in the soil or under rocks and have clutch sizes ranging from 14 to 60 eggs (NatureServe 2009). The Texas horned lizard is considered widespread and relatively common in some areas of the south-central US and northern Mexico; however, declines have been documented in portions of their range, including Central Texas. Threats to the lizard include fire ants, insecticides, habitat loss, and over collecting; however, it is listed as threatened in the State of Texas which prohibits collection although enforcement isn't rigorous. The species seems to be particularly vulnerable to the loss of native harvester ants, which comprise up to 68 percent of their diet. Additionally, mortality from road traffic is also an important local threat in some areas where high road mortality may lead to significant local declines (NatureServe 2009). Habitat for the Texas horned lizard was identified during on-site habitat assessments (2010) in the US 281 biological study area, yet no observations of individuals were made.

Texas Horned Lizard

Photo: U.S. Fish & Wildlife Service

Timber/Canebrake Rattlesnake (Crotalus horridus):

The timber rattlesnake is a venomous snake that can reach almost five feet in length. Its range extends from central New England to northern Florida, and west to eastern Texas, central Oklahoma, eastern Kansas, southeastern Nebraska, southern and eastern Iowa, and southeastern Minnesota. In the southern portion of its range, the snake primarily inhabits hardwood woodlands, riparian areas, swampy areas and floodplains, wet pine woodflats, cane fields, and agricultural fields. Underground crevices are used during winter as a retreat for hibernation. Mating occurs in summer through late September with the young born in the fall (NatureServe 2009). The timber rattlesnake is declining or extirpated in all northeastern states and is state listed as threatened in Texas. The major threats facing the species across its range include loss of habitat, habitat fragmentation, commercial collecting, and direct mortality caused by hunting and vehicles (NatureServe 2009). Habitat for the timber rattlesnake was identified during on-site habitat assessments (2010) within the US 281 biological study area, yet no observations of individuals were made.

Birds

Golden-cheeked Warbler (Setophaga chrysoparia):

The state and federally endangered GCWA is a small insectivorous neotropical and migratory songbird. Males have a black back, throat, upper breast, and crown, white belly, black-streaked sides, white wing bars, and a black line through the eye with large yellow patches both above and below the eye. Females and immatures are duller, with olive upperparts with dark streaks and a yellowish or white chin (NatureServe 2009). This songbird nests only in the mixed juniper-oak woodlands of the Balconian biotic province of Central Texas. This species, which winters in southern Mexico and the Central American countries of Guatemala, Honduras, and Nicaragua, is the only Texas species whose breeding range is entirely confined to the state's boundaries. The known breeding range of the GCWA includes 37 Texas counties on the Lampasas Cut Plain, Edwards Plateau and Llano Uplift regions of the state (USFWS 1992). They breed in woodlands characterized by a mix of ashe juniper and various deciduous trees including Texas oak, plateau live oak, cedar elm, Texas persimmon, hackberry (*Celtis* spp.), evergreen sumac (*Rhus virens*), Texas ash (*Fraxinus*

texensis), redbud (*Cercis canadensis*), and escarpment black cherry (*Prunus serotina*) (USFWS 1992). Ashe juniper is often the dominant woody plant and occurs at all sites occupied by the bird. Females construct nests from ashe juniper bark, which exfoliates in the form of strips, especially in more mature trees (Pulich 1976).

Golden-cheeked Warbler

Photo: U.S. Fish & Wildlife Service

Golden-cheeked warblers return from their winter range to Texas by mid-March each year. Most leave the breeding grounds by the end of July (Pulich 1976). The principal threat to the GCWA (and the reason for the species' emergency listing in 1990) is habitat alteration and fragmentation resulting from urbanization and certain range management practices. The USFWS (1992) shows a 35 percent loss of range-wide available habitat since 1962. Other factors that have been implicated in the decline of this species include low oak regeneration rates, oak wilt disease, nest parasitism by the brown-headed cowbird, and increased urbanization, with resulting brush clearing and habitat loss.

A habitat assessment performed in 2009 identified potential GCWA habitat in the US 281 biological study area. After two years of rigorous effort, no GCWA have been detected; however, habitat losses continue due to current and pending development in the US 281 project corridor. In addition, nesting deterrents for the warbler are prevalent and likely increasing due to urbanization, including typical nest predator and social parasite species such as the great-tailed grackle and brown-headed cowbird. Given the negative survey findings to date and increasing reduction of habitat quality, it is not likely that the GCWA will utilize the US 281 biological study area. The results of the 2009, 2010, and 2014 presence-absence surveys for the GCWA are included in **Appendix I3**.

Critical Habitat

Critical habitat is defined in Section 3(5)(A) of the ESA as "(i) the specific areas within the geographical area occupied by the species . . . on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species . . . upon a determination by the Secretary of Commerce (Secretary) that such areas are essential for the conservation of the species" (see 16 U.S.C. 1532(5)(A)). Section 4(a)(3)(A) of the ESA requires that, to the "extent prudent and determinable", critical habitat be designated concurrently with the listing of a species.

Near the US 281 Corridor Project critical habitat has been designated for karst invertebrates. Critical Habitat Unit (CHU) 12 is characterized as a low quality unit due to heavy urbanization and quarrying within its boundaries. Areas of undisturbed, native vegetation and associated surface wildlife, both of which are considered to be primary constituent elements (PCEs) for karst species habitat, are sparse within CHU 12. The unit boundaries reach the edge of the ROW at one point, and cross into it only to an insignificant degree near Evans Road. Therefore, direct physical disturbance to the CHU and to karst species is not anticipated. Indirect disturbance to the PCEs could include increased noise levels and vibration from construction equipment, which may drive away small mammals. This potential disturbance would mainly have the potential to affect the one area where the CHU touches the US 281 ROW, and the disturbance intensity relative to the overall size of the CHU would be low. No effect on vegetation within the CHU is anticipated. The route of Evans Road to the west of US 281 crosses through CHU 12, and construction activities on US 281 have the potential to result in increased traffic backups. This activity may have the potential to impact surface wildlife. This would be a short duration disturbance, once construction ends and traffic flow is improved on US 281, traffic congestion on Evans Road should also improve. Rebound of small mammal populations from temporary noise level increase is anticipated to be rapid.

Texas Natural Diversity Database Observations

TxNDD is a database of observations of rare, threatened and endangered species and communities throughout the state. The TxNDD identified several species that occur or have historically occurred in Bexar County. The TxNDD was searched July 1, 2011 and updated February 13, 2014 for Element of Occurrence Records (EORs) to determine if any reports of species have occurred within a 10-mile radius of the US 281 biological study area.

According to the TxNDD search, 28 occurrences of the federally endangered GCWA have been recorded within 10 miles of the US 281 biological study area. The closest occurrence was recorded in 2001, approximately 1.4 miles east of the US 281 biological study area between Bulverde Road and the West Fork of Cibolo Creek. This area is part of the Cibolo Canyon property and is covered for impacts to the warbler associated with the construction and operation of a mixed use community under the Cibolo Canyon Master Phase II Environmental Assessment/Habitat Conservation Plan (EA/HCP) and associated 10(a)(1)(B) incidental take permit issued by the USFWS in 2006.

More than half of the TxNDD occurrences for the GCWA were recorded approximately four to nine miles west and northwest of the US 281 project corridor on Camp Bullis Military Reservation. Most of these recordings are from 1990-1992; however, to date, Camp Bullis Military Reservation has been conducting their own surveys for the warbler that the TxNDD dataset does not include. Another occurrence of the warbler was recorded in 2000, approximately 8 miles northwest of the US 281 project corridor in the Guadalupe River State Park. The rest of the GCWA occurrences were recorded between 1990 -2001, and were located 4 to 10 miles west of the US 281 biological study area, south/southwest of Camp Bullis Military Reservation. Potential habitat for the GCWA was identified during field investigations within the US 281 biological study area; however, 3 years (2009, 2010 and 2014) of presence/absence surveys have resulted in negative findings.

The TxNDD search also documented two occurrences of the federally endangered Black-capped Vireo within 10 miles of the US 281 biological study area. Both occurrences were approximately 10 miles west of the US 281 biological study area in Friedrich Park, one occurrence was recorded in 1991 and the other in 1999. No habitat for the Black-capped Vireo was identified during on-site habitat assessments in 2009 and 2010.

Additionally, the TxNDD search revealed occurrences of four federally endangered karst invertebrate species within 10 miles of the US 281 biological study area. The ground beetle, *Rhadine exilis*, has been documented approximately two miles east of the US 281 biological study area. This area has been designated by the USFWS as Critical Habitat for *Rhadine exilis*. This species has also been recorded approximately six miles west of the US 281 biological study area in Camp Bullis Military Reservation along with another endangered ground beetle, *Rhadine infernalis*. Although not captured in the TxNDD data, several other areas within 10 miles of the US 281 biological study area have been designated as Critical Habitat for either *Rhadine exilis* or *Rhadine infernalis*. *Rhadine exilis* has additional Critical Habitat designations approximately 0.15 mile west of the project, south of Evans Road, approximately one mile west along Mustang Creek north of Stone Oak Parkway, and approximately nine miles southwest along Loop 1604 west of I-10. *Rhadine infernalis* has Critical Habitat designated approximately 1.5 miles west along Stone Oak Parkway, north of Loop 1604. Although appropriate habitat for these two ground beetles may be present in the US 281 biological study area, this species was not encountered during biological investigations. In addition to these two ground beetles, the TxNDD revealed an occurrence of the federally endangered Robber Baron Cave meshweaver (*Cicurina baronia*) along with an occurrence of the federally endangered Cokendolpher Cave harvestman (*Texella cokendolpheri*) from Robber Baron Cave, located approximately seven miles south of the US 281 biological study area near the intersection of Loop 410 and US 281. The USFWS designated Critical Habitat for both of these species at this same location. Robber Baron Cave is in the Alamo Heights Karst Fauna Region (KFR), which was delineated based on outcroppings of the Austin Chalk formation. The US 281 biological study area lies in the Stone Oak Karst Fauna Region comprised of Edwards limestone; no outcroppings of Austin Chalk are present in this KFR. Given the distance between the study area and the locality for these two species, and

the geologic divide between the karst fauna regions, the presence of these species in the US 281 biological study area is not expected.

The TxNDD revealed four occurrences of the state listed threatened Comal blind salamander (*Eurycea tridentifera*) and six occurrences of the state listed threatened Cascade Caverns salamander (*Eurycea latitans complex*) within 10 miles of the US 281 biological study area. The closest occurrence of the Comal blind salamander was recorded in 1978 approximately three miles northwest of the US 281 biological study area between Blanco Road and Bulverde Road, south of the Comal County line. The salamander was also recorded approximately four miles northeast of the US 281 biological study area east of Lewis Creek near the intersection of FM 1863 and FM 3159 and nearby, approximately 4 miles northeast of the US 281 biological study area close to Dripping Springs Creek. The sixth TxNDD occurrence of the Comal blind salamander was recorded approximately 9 miles northwest of the US 281 biological study area in the Honey Creek Wildlife Management Area. Three of the six occurrences of the Cascade Caverns salamander were recorded approximately from 3 to 4 miles east of the US 281 biological study area along tributaries to Cibolo Creek. The fourth occurrence was recorded in the Shavano Park area of San Antonio, approximately 6 miles southeast of the US 281 biological study area. The fifth occurrence was recorded approximately 9 miles northwest of the US 281 biological study area in the Honey Creek Wildlife Management Area. The sixth occurrence was recorded approximately ten miles northwest in Guadalupe River State Park. Neither of the two salamanders was detected in the springs within the US 281 biological study area during field investigations conducted in 2010.

Bracken Bat Cave is located on the 697-acre Bracken Bat Cave and Nature Reserve approximately 6 miles east outside of the US 281 biological study area. It contains the largest Mexican free-tailed bat colony known, with estimates of up to 40 million bats arriving every spring. In the TxNDD database, it is listed as last seen in 1985; however it is known to be a long-known and well-studied colony protected and managed by Bat Conservation International. No Mexican free-tails or other bats were observed during on-site habitat assessments conducted in 2010.

Several rare and candidate vegetative series and plant species have also been documented within 10 miles of the US 281 biological study area. An occurrence of the plateau live oak/curly mesquite (*Quercus fusiformes/Hilaria belangeri*) series was recorded within the US 281 biological study area in 1992; however, that series was not located during recent field investigations. The bracted twistflower (*Streptanthus bracteatus*) was recorded from 2 to 10 miles west of the US 281 biological study area around Camp Bullis and approximately six miles west in Eisenhower Park, which is adjacent to and immediately south of Camp Bullis. Additionally, an occurrence of the rare Texas mock-orange (*Philadelphus texensis*) has been recorded as close as 7 miles northwest of the US 281 biological study area near the Comal County line. Lastly, the rare bald cypress/sycamore (*Taxodium distichum/Platanus occidentalis*) vegetative series was noted approximately 9 miles northwest in Guadalupe River State Park and the rare plateau live oak/little bluestem (*Quercus fusiformes/Schizachyrium scoparium*) series has been recorded approximately 9 miles in the nearby Honey Creek Wildlife Management Area. None of these species were identified during on-site habitat assessments of the US 281 biological study area.

3.16.3 Environmental Consequences

This section defines the potential direct impacts to the threatened, endangered and rare species and their habitat that could result from implementation of the US 281 Corridor Project. In order to distinguish between federal regulatory requirements and voluntary measures, this discussion of impacts will use the following terms:

Potential impacts to species not protected under the ESA are described by stating that the US 281 Corridor Project will have “no impact” to the species, “may impact” the species, or “would impact” the species.

Assessment determinations for species under the regulatory protection of the ESA, and that are listed by the USFWS as occurring in Bexar County are described using one of the following: "no effect"; "may affect, is not likely to adversely affect"; or "may affect, is likely to adversely affect." These terms are used in this section using the following definitions:

"No effect" means that there is absolutely no effect, positive or negative, to the species or habitat.

"May affect, is not likely to adversely affect" means that all effects are beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact and would not reach the scale where take would occur. Discountable effects are those extremely unlikely to occur.

"May affect, is likely to adversely affect" means that there is at least one adverse effect. This determination means that effects on species and habitat (1) are not insignificant in size and avoidance of take cannot be guaranteed; and (2) discountable effects are not unlikely to occur.

No-Build Alternative

The No-Build Alternative would not affect any federally or state listed threatened or endangered species with the exception that continued traffic congestion and crashes could potentially result in exacerbated vehicle emission and highway run-off conditions which would negatively affect air and water quality along the US 281 project corridor over time.

Build Alternatives

Of the species and vegetative series documented by USFWS and TPWD as potentially occurring in the US 281 biological study area, potential habitat for four federally-listed species, one candidate for federal listing and four state-listed species was identified within the US 281 biological study area. Federally-listed species include Madla's Cave meshweaver, two ground beetles (*Rhadine exilis* and *R. infernalis*) and the GCWA. The candidate species is the bracted twistflower and the state-listed species include the Cascade Caverns salamander, Comal blind salamander, Texas horned lizard and the timber/canebrake rattlesnake. In addition to federally and state-listed species, potential habitat for 18 rare but unlisted species was identified within the US 281 biological study area. The following assessment evaluates impacts of the US 281 Corridor Project upon rare, threatened and endangered species, critical habitat and provides an overview of potential species and habitat impacts in the US 281 biological study area in general.

Impacts to Federally-Listed Species

Habitat for one candidate and four federally-listed species was identified within the existing and proposed ROW of both Build Alternatives. These species include the bracted twistflower, Madla's Cave meshweaver, the ground beetles *Rhadine exilis* and *Rhadine infernalis*, and the GCWA.

Plant

Bracted twistflower (Streptanthus bracteata):

Specific surveys for this species have not been conducted; however, it was not observed during avian surveys conducted during the blooming period in potential habitat in 2009–2010. While this species could possibly occur, it is not likely given the disturbed nature of the woodlands along the corridor and the prevalence of herbivores such as the white-tailed deer. Given uncertainty associated with its presence or absence, there is a

potential that the US 281 Corridor Project ***may impact*** this species, but TxDOT has determined that this species would not be adversely affected by the proposed project. Should the species become listed prior to construction, presence-absence surveys would be conducted in appropriate habitat within existing and proposed ROW.

Karst Invertebrates

The USFWS utilizes the Bexar County karst zones as modified from Veni (2003) to predict where listed karst invertebrates are likely to occur. These zones are depicted in the US 281 biological study area in **Figure 3-40**. The probability of detecting listed invertebrate species varies by karst zone. The acreage of each karst zone contained, as well as the total number of karst features that would be impacted as a result of the Build Alternatives are listed in **Table 3-45**. Note that some of the features occur in more than one Build Alternative, and the number indicated does not include wells, faults, or potential karst features that were determined not to have been formed by karst processes. The *Karst Invertebrate Technical Report* (included in **Appendix I2**) details the karst feature investigations and determinations related to each feature.

The karst zones, as defined in USFWS (2006), are:

- Zone 1: Areas known to contain endangered karst invertebrate species.
- Zone 2: Areas having a high probability of containing suitable habitat for endangered karst invertebrate species.
- Zone 3: Areas that probably do not contain endangered karst invertebrate species.
- Zone 4: Areas that require further research but are generally equivalent to Zone 3, although they may include sections that could be classified as Zone 2 or Zone 5 as more information becomes available.
- Zone 5: Areas, both cavernous and non-cavernous, that do not contain endangered karst invertebrate species.

Table 3-45: Bexar County Karst Zone Acreage and the Number of Karst Features Located within the ROW by Alternative

Alternatives	Karst Zone 1		Karst Zone 2		Karst Zone 3		Karst Zone 4		Karst Zone 5		Total # of Features
	acres	features	acres	features	acres	features	acres	features	acres	features	
No-Build	181	36	129	5	71	7	0	0	3	0	48
Elevated Expressway	238	36	149	8	92	10	0	0	3	0	54
Preferred Expressway Alternative	225	37	134	9	85	11	0	0	3	0	57

Source: USFWS 2006 and Zara Environmental 2011.

The entirety of the US 281 biological study area is contained with the Stone Oak KFR, which is known to contain the following federally-listed karst invertebrate species: Madla's Cave meshweaver (*C. madla*) and two ground beetles, *R. exilis* and *R. infernalis.*

Karst feature surveys were conducted within the US 281 biological study area using USFWS survey protocol (USFWS 2006), where landowners granted access. The *Karst Invertebrate Technical Report* is included in **Appendix I2**. Karst feature surveys were performed between December 2009 and November 2010. Researchers recorded 116 features during these surveys, and identified 60 of them that had the potential to contain karst invertebrate habitat. Fifteen features where landowners that had granted access for initial karst feature surveys subsequently did not grant access to their property for excavation of recorded features. The remaining 45 features that had potential to contain karst invertebrate habitat were excavated and re-evaluated for their habitat potential. These re-evaluations led to the identification of 13 caves and karst features that were determined to contain potential habitat and were therefore surveyed for listed karst

invertebrate species. Presence/absence surveys for federally-listed karst invertebrates were conducted in the features between June 14, 2010 and October 10, 2010. Background literature searches provided information on one cave where ROE was not obtained, but where previously conducted fauna surveys did not detect any endangered karst invertebrate species. Three caves that appear to have been covered up by roadways or development are no longer accessible, and no fauna surveys are known from them. Furthermore, only features occurring within the US 281 biological study area are discussed here; features occurring outside the US 281 biological study area are discussed in the indirect and cumulative impacts sections (**Chapter 4 - Indirect Effects** and **Chapter 5 - Cumulative Effects**).

No federally-listed karst invertebrate species were detected during presence-absence surveys in 2010 for the US 281 Corridor Project and none are known to historically occur within the US 281 biological study area. The nearest recorded localities of federally listed karst species in the area are for *Rhadine exilis,* which is known from Ragin' Cajun Cave and Hairy Tooth Cave. These caves lie within Critical Habitat Unit 12 (USFWS 2009, 2012), the edge of which slightly impinges on the US 281 project corridor ROW.

As noted in **Table 3-45,** 57 features within the ROW of the Preferred Expressway Alternative would be removed as a result of construction. All except for three of the 57 features were fully evaluated and no listed karst invertebrates were encountered. The three features (#281-004, #281-009, and #281-099) are considered potential habitat; however, these were not fully evaluated due to having access denied by landowners. Caves and karst features are also known to exist on some of the properties where landowners were unresponsive to requests for or denied access. Conclusions about the status of listed karst invertebrate habitat in those areas cannot be made at this time.

Direct effects to karst invertebrate habitat may occur due to surface disturbances such as vegetation removal. Up to 172 acres of wooded and unmaintained vegetation would be removed by the Preferred Expressway Alternative. The majority of this vegetation is located within karst zone 1 (103 acres), followed by 35 acres in karst zone 2, 33 acres in karst zone 3 and 1 acre in karst zone 5.

Other direct effects to karst invertebrate habitat would occur within and adjacent to the project area due to the placement of impervious cover (bridge decks, roadway surfaces, etc.) and alterations in surface and subsurface drainage that may result in changes to previously stable temperature and moisture regimes in karst habitat. The Preferred Expressway Alternative would add approximately 118 acres of impervious cover.

The US 281 Corridor Project may result in direct impacts to karst invertebrate species due to the disturbance and removal of subsurface habitat by geotechnical borehole drilling, pier drilling, surface milling, grading and excavation. Any of these activities may entirely or partially remove a subsurface void in bedrock that contains habitat for karst invertebrate species. In cases where voids are mostly intact, exposure of subsurface habitat can cause climate alteration such as temperature swings, desiccation, or flooding.

The amount of material that would be excavated in order to construct the Preferred Expressway Alternative was estimated based on the preliminary schematics. An estimated total 997,844 cubic yards of subsurface limestone in karst zones 1, 2 and 3 would be directly impacted by construction activities (see **Appendix I4** for details).

It is anticipated that incidental take of *C. madla*, *R. exilis* and *R. infernalis* may occur as a result of the US 281 Corridor Project. Individuals of these species are difficult to detect unless observed undisturbed in their environment, and occupied karst features in this area are often undetectable until they are exposed from surface or bedrock disturbing activities. Because a precise mechanism for predicting the number of individuals that may actually be taken by the proposed project over time due to habitat loss is not available, potential incidental take is expressed by the extent of karst invertebrate habitat likely to be destroyed or disturbed. TxDOT determined that the US 281 Corridor Project *may affect, and is likely to adversely affect*, the Madla's Cave meshweaver and two ground beetles, *Rhadine exilis* and *Rhadine infernalis,* or their habitat.

TxDOT prepared a Biological Assessment (BA) and requested formal ESA Section 7 consultation with USFWS on January 6, 2015. The BA presents the anticipated impacts of the US 281 Corridor Project on the GCWA, *C. Madla, R. exilis* and *R. infernalis* and proposes conservation measures that would be implemented during project design, during construction, as well as other range-wide conservation measures. The USFWS biological opinion (BO), dated March 11, 2015, concluded that the action, as proposed, is not likely to jeopardize the continued existence of *C. Madla, R. exilis* and *R. infernalis*, nor result in the adverse modification or destruction of designated critical habitat. The incidental take of all *C. Madla, R. exilis* and *R. infernalis* in any karst features underlying the 1,530 acre action area, in the form of harm or harassment, may occur as a result of the US 281 Corridor Project. The USFWS determined that this level of anticipated take is not likely to jeopardize the continued existence of *C. Madla, R. exilis* and *R. infernalis*, and would not result in destruction or adverse modification of designated critical habitat within CHU 12 for *R. exilis*. Several reasonable and prudent measures will be implemented to minimize the impacts. Mitigation measures proposed for the federally-listed karst invertebrates are presented in **Section 3.16.5 Proposed Mitigation Measures** below.

Golden-cheeked Warbler

A brief discussion of the range and life history of the federally endangered GCWA can be found above in **Section 3.16.2 Affected Environment**. A habitat assessment performed in 2009 identified potential GCWA habitat in the US 281 biological study area. Based on the current design of the Preferred Expressway Alternative, approximately 45 acres of GCWA habitat would be cleared within the existing and proposed ROW (**Table 3-46**).

Table 3-46: Impacts to Golden-cheeked Warbler Habitat by Alternative

Alternative	Golden-cheeked Warbler Habitat (acres)
No-Build Alternative	0
Elevated Expressway Alternative	56
Preferred Expressway Alternative	45

Source: Blanton & Associates, Inc., 2009 and Hicks & Company, 2010, Study Team 2014

After three years of presence/absence survey using USFWS protocol (USFWS 2010c), no GCWA have been detected. Habitat losses continue due to current and pending development along the US 281 project corridor. In addition, nesting deterrents for the warbler are prevalent and likely increasing due to urbanization, including effects from typical nest predator and social parasite species such as the Great-tailed Grackle and Brown-headed Cowbird. Given the negative survey findings to date and decline of habitat quality, it is not likely that the GCWA will utilize the US 281 biological study area. Therefore, the US 281 Corridor Project *may affect, but is not likely to adversely affect*, the GCWA. The USFWS concurred with this finding in a letter dated January 7, 2015 (see **Appendix L1**). Indirect and cumulative impacts to the GCWA and/or its habitat are addressed in **Chapter - 4 Indirect Effects** and **Chapter 5 - Cumulative Effects**.

Mitigation measures are proposed for the GCWA in **Section 3.16.5 Proposed Mitigation Measures** and conservation measures are also proposed in the Biological Assessment prepared for the USFWS as a part of the consultation process.

Impacts to Critical Habitat

CHU 12 is characterized as a low quality unit due to heavy urbanization and quarrying within its boundaries. Areas of undisturbed, native vegetation and associated surface wildlife, both of which are considered to be primary constituent elements (PCEs) for karst species habitat, are sparse within CHU 12. The unit boundaries reach the edge of the ROW at one point, and cross into it only to an insignificant degree. Therefore, direct physical disturbance to the CHU and to karst species is not anticipated. Indirect disturbance to the PCEs could include increased noise levels and vibration from construction equipment, which may drive away small mammals. This potential disturbance would mainly have the potential to affect the one area where the CHU touches the US 281 ROW, and the disturbance intensity relative to the overall size of the CHU would be

low. No effect on vegetation within the CHU is anticipated. The route of Evans Road to the west of US 281 crosses through CHU 12, and construction activities on US 281 have the potential to result in increased traffic backups. This activity may have the potential to impact surface wildlife. This would be a short duration disturbance, once construction ends and traffic flow is improved on US 281, traffic congestion on Evans Road should also improve. Rebound of small mammal populations from temporary noise level increase is anticipated to be rapid. The Preferred Expressway Alternative does not propose any additional ROW within or adjacent to CHU 12. More information on potential indirect effects to CHU 12 can be found in the BA (**Appendix I4**).

Impacts to State Listed Species

Habitat for four state listed species, two salamanders and two reptiles, occurs within the US 281 biological study area for the Build Alternatives, including the Preferred Expressway Alternative. The GCWA is state-listed in addition to being federally listed, potential impacts to the GCWA are described under the federal listed species.

The two salamander species include the Cascade Caverns salamander and the Comal blind salamander. Four springs were identified during karst feature surveys (2010), and one of the springs is located within the existing ROW (#281-002), and would be removed as a result of the construction of the Preferred Expressway Alternative. Three other springs (#281-003, #281-010 and #281-012) are located outside of the proposed ROW. All four springs are located between Trinity Park and Borgfeld Drive. Only one of the four springs was surveyed in 2010 for salamanders (#281-002) due to denied access; however, none were found. This spring (#281-002) is less than ideal habitat for these salamander species, which are most often encountered in water filled caves or in clean springs, because it emerged from a mud bank and lacked an open bedrock conduit through which salamanders could pass. Spring (#281-003) is located approximately 13 feet east of the Preferred Expressway Alternative and was observed from across the fence; however, no ROE was granted for that property and investigators were not able to evaluate the condition of the spring. At least one of the springs on private property (#281-012) appears to offer less degraded, more typical habitat for these salamander species; although no salamanders have been encountered during the course of this study. All four springs provide potential habitat, therefore the US 281 Corridor Project may impact the Cascade Caverns salamander and the Comal blind salamander, but is not likely to negatively impact them because the spring (#281-012) that was located on private property that may provide highest quality habitat relative to the others is approximately 93 feet from the proposed ROW of the Preferred Expressway Alternative, and at a higher elevation than the US 281 Corridor Project. More information about the karst feature survey can be found in the **Appendix I2** and **Appendix J1**.

Marginal habitat for the state listed threatened Texas horned lizard and timber/canebrake rattlesnake was identified as potentially occurring within the US 281 biological study area; however, no opportunistic observations of individuals were made during the on-site habitat assessments in 2010. The Texas horned lizard may be found in sparsely vegetated, open, semi-arid areas within the US 281 biological study area and the timber/canebrake rattlesnake could potentially occur in US 281 biological study area floodplains, riparian zones, or abandoned farmland. The US 281 Corridor Project may impact the Texas horned lizard due to habitat loss, increased number of fire ants (often dominant in areas with recent vegetation removal), and/or increased road mortality from higher traffic loads. The US 281 Corridor Project may impact the timber/canebrake rattlesnake through habitat loss, habitat fragmentation, and/or increased road mortality from higher traffic loads.

Although marginal habitat for the Texas horned lizard and timber/canebrake rattlesnake occurs within the US 281 biological study area and individuals could potentially be impacted by the US 281 Corridor Project, it is not likely to negatively impact these species because the habitat is marginal, no individuals were observed in 2010, and the impacted potential habitat is common in the vicinity of the US 281 project corridor.

Mitigation measures are proposed for state listed species in **Section 3.16.5 Proposed Mitigation Measures.**

Impacts to Rare Species (un-listed)

Habitat for 18 rare species (3 plants, 7 crustaceans, 2 arachnids, 1 insect, 1 amphibian, 2 reptiles, and 2 mammals) that are not state or federally listed was identified as potentially occurring within the US 281 biological study area including: big red sage; Correll's false dragon-head; Hill Country wild-mercury; a cave obligate crustacean (*Tethysbaena* (=*Monodella*) *texana*); *Texanobathynella bowmani*; Ezell's cave amphipod; *Allotexiweckelia hirsuta*; Coahuila isopod; *Speocirolana hardeni*; *Texiweckeliopsis insolita; Cicurina bullis; Texella tuburculata*; Rawson's metalmark; Texas salamander; spot-tailed earless lizard; Texas garter snake; cave myotis bat; and Plains spotted skunk. No observations of big red sage, Correll's false dragon-head, Hill Country wild-mercury, Rawson's metalmark, spot-tailed earless lizard, Texas garter snake, cave myotis bat, or the Plains spotted skunk were made during on-site habitat assessments in 2010 within the US 281 biological study area. Therefore, the Preferred Expressway Alternative may impact these species, but with the mitigation measures proposed in **Section 3.16.5 Proposed Mitigation Measures**, it is not likely to negatively impact these species. The spring (281-012) that is most likely to have the potential to provide habitat to the seven crustaceans (cave obligate crustaceans (*Tethysbaena* (=*Monodella*) *texana*) and *Texanobathynella bowmani*, Ezell's cave amphipod, *Allotexiweckelia hirsuta*, Coahuila isopod, the isopod *Speocirolana hardeni* and *Taxiweckeliopsis insolita*) is located on private property where ROE was revoked in 2010, and it was therefore not surveyed for these species. Scientifically acceptable methods for spring surveys would be used for surveying this spring, should access be granted at some point in the future. The US 281 Corridor Project may impact these species, but the spring is located 93 feet from the proposed ROW that would be required for the Preferred Expressway Alternative and at a higher elevation, thus the US 281 Corridor Project is not likely to negatively impact these species.

Two rare arachnids that are not state or federally listed were detected during presence/absence surveys inside caves within the ROW of US 281 Corridor Project Preferred Expressway Alternative. *Cicurina bullis* is an eyeless spider previously known to occur only on Camp Bullis, 4 miles to the northwest. This species was identified from feature 281-080, Power Pole Hole. An eyeless harvestman was detected in feature 281-070, Stafford Cave. The single specimen obtained has tentatively been identified as *Texella tuburcata*, previously known only from a limited number of caves in western Bexar County, but the specimen was in poor condition and could not be positively identified. Nevertheless, it is likely to be considered a rare population even if it turns out to be one of the other four equally rare *Texella* species known from the county.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative is being considered for non-toll/managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same; therefore, the impacts to threatened and endangered species would not change based on funding options for the Preferred Expressway Alternative.

3.16.4 Conclusion

This section summarizes the potential direct impacts to the threatened, endangered and rare species and their habitat that could results from the US 281 Corridor Project.

Table 3-47: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Effect/Impact Determination
Plants			
Big red sage *Salvia pentstemonoides*	----	----	Habitat for the big red sage is found within the US 281 biological study area, yet no specimens were observed during on-site habitat assessments in 2010. The US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Bracted twistflower *Streptanthus bracteatus*	C	----	Habitat for the bracted twistflower is found within the US 281 biological study area, yet no specimens were observed during on-site habitat assessments in 2010. The US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Correll's false dragon-head *Physostegia correllii*	----	----	Habitat for the Correll's false dragon-head is found within the US 281 biological study area, yet no specimens were observed during on-site habitat assessments in 2010. The US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Elmendorf's onion *Allium elmendorfii*	----	----	There are no deep, loose, well-drained sands in the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Hill Country wild-mercury *Argythamnia aphoroides*	----	----	Habitat for the Hill Country wild-mercury is found within the US 281 biological study area, yet no specimens were observed during on-site habitat assessments in 2010. This US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Parks' jointweed *Polygonella parksii*	----	----	There are no sandy areas within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Sandhill woollywhite *Hymenopappus carrizoanus*	----	----	There are no sandy areas within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Texas wild-rice* *Zizania texana*	E	E	This species is only known from the upper 1.6 miles of the San Marcos River in Hays County. The US 281 Corridor Project Preferred Expressway Alternative would have ***no effect*** on this species.
Mollusks and Snails			
(Squawfoot) *Strophitus undulatus*	----	----	There are no perennial streams within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
False spike *Quadrula mitchelli*	----	T	There are no medium to large rivers within the US 281 biological study area, thus the Preferred Expressway Alternative would have ***no impact*** on this species.
Golden Orb *Quadrula aurea*	C	T	There are no perennial streams within the project area within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Mimic cavesnail *Phreatodrobia imitata*	----	----	There are no known artesian wells within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Texas Fatmucket *Lampsilis bracteata*	C	T	The US 281 biological study area falls within the San Antonio River basin and is out of the range for this species, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Texas Pimpleback *Quadrula petrina*	C	T	The US 281 biological study area falls within the San Antonio River basin and is out of the range for this species, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Crustaceans			
A cave obligate crustacean *Tethysbaena (=Monodella) texana*	----	----	One spring located within the US 281 biological study area may provide suitable habitat, thus the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.

Table 3-47: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Effect/Impact Determination
Texanobathynella bowmani	----	----	One spring located within the US 281 biological study area may provide suitable habitat, thus the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Cascade Cave amphipod *Stygobromus dejectus*	----	----	This species is found only in the region of Comal Springs and Hueco Springs in Comal County, thus the US 281 project area is outside the known range of this species. Although the US 281 Corridor Project would have no direct effect on this species, the potential for indirect effects to species dependent on Comal Springs was evaluated. Given the distance of the US 281 Corridor Project from Comal Springs (approximately 20 miles), the fact that this project is a widening of an existing roadway, and the pollutant removal which would be achieved with TCEQ approved storm water BMPs, indirect effects resulting from the US 281 Corridor Project on Comal Springs are not reasonably certain to occur in the future. Therefore, this project would have ***no impact*** on this species.
Ezell's cave amphipod *Stygobromus flagellatus*	----	----	One spring located within the US 281 biological study area may provide suitable habitat, thus the US 281 Corridor Project Preferred Alternative ***may impact*** this species.
Long-legged cave amphipod *Stygobromus longipes*	----	----	This species is found only in the region of Comal Springs and Hueco Springs in Comal County, thus the US 281 project area is outside the known range of this species. Although the US 281 Corridor Project would have no direct effect on this species, the potential for indirect effects to species dependent on Comal Springs was evaluated. Given the distance of the US 281 Corridor Project from Comal Springs (approximately 20 miles), the fact that this project is a widening of an existing roadway, and the pollutant removal which would be achieved with TCEQ approved storm water BMPs, indirect effects resulting from the US 281 Corridor Project on Comal Springs are not reasonably certain to occur in the future. Therefore, this project would have ***no impact*** on this species.
Peck's Cave amphipod *Stygobromus pecki*	E	E	This species is found only in the region of Comal Springs and Hueco Springs in Comal County, thus the US 281 project area is outside the known range of this species. Although the US 281 Corridor Project would have no direct effect on this species, the potential for indirect effects to species dependent on Comal Springs was evaluated. Given the distance of the US 281 Corridor Project from Comal Springs (approximately 20 miles), the fact that this project is a widening of an existing roadway, and the pollutant removal which would be achieved with TCEQ approved storm water BMPs, indirect effects resulting from the US 281 Corridor Project on Comal Springs are not reasonably certain to occur in the future. Therefore, this project would have ***no effect*** on this species.
Allotexiweckelia hirsuta	----	----	One spring located within the US 281 biological study area may provide suitable habitat, thus the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Parabogidiella americana	----	----	There are no known artesian wells within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Texas cave shrimp *Palaemonetes antrorum*	----	----	There are no known artesian wells or water-filled caves within the US 281 biological study area, thus it is anticipated that the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Coahuila isopod *Mexistenasellus coahuila*	----	----	One spring located within the US 281 biological study area may provide habitat, thus the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Speocirolana hardeni	----	----	One spring located within the US 281 biological study area may provide suitable habitat, thus the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Texiweckeliopsis insolita	----	----	One spring located within the US 281 biological study area may provide suitable habitat, thus the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.

Table 3-47: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Effect/Impact Determination
Arachnids			
Braken Bat Cave meshweaver *Cicurina venii*	E	----	While appropriate habitat may be present, the US 281 biological study area is more than 20 miles east of the currently understood distribution of this species. The US 281 Corridor Project Preferred Expressway Alternative is expected to have ***no effect*** on this species.
Cokendolpher cave harvestman *Texella cokendolpheri*	E	----	There are no caves formed in the Austin Chalk occurring within the US 281 biological study area, therefore the US 281 Corridor Project Preferred Expressway Alternative would have ***no effect*** on this species.
Government Canyon Bat Cave meshweaver *Cicurina vespera*	E	----	While appropriate habitat may be present, the US 281 biological study area is approximately 18 miles east of the currently understood distribution of this species. This US 281 Corridor Project Preferred Expressway Alternative is expected to have ***no effect*** on this species.
Government Canyon Bat Cave spider *Neoleptoneta microps*	E	----	While appropriate habitat may be present, the US 281 biological study area is approximately 18 miles east of the currently understood distribution of this species. This US 281 Corridor Project Preferred Expressway Alternative is expected to have ***no effect*** on this species.
Madla's Cave meshweaver *Cicurina madla*	E	----	Although appropriate habitat for this species may be present, this species was not encountered during the 2010 presence-absence surveys and none are historically known to occur in the US 281 biological study area. This US 281 Corridor Project Preferred Expressway Alternative ***may affect, and is likely to adversely affect*** this species.
Robber Baron Cave meshweaver *Cicurina baronia*	E	----	There are no caves formed in the Austin Chalk occurring within the US 281 biological study area; therefore, the US 281 Corridor Project Preferred Expressway Alternative would have ***no effect*** on this species.
Cicurina bullis	----	----	This species was encountered in one cave located within the US 281 biological study area and other karst features may provide suitable habitat, thus the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Texella tuburculata	----	----	This species was encountered in one cave located within the US 281 biological study area and other karst features may provide suitable habitat, thus the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Insects			
Comal Springs dryopid beetle* *Stygoparnus comalensis*	E	----	This species is found only in the region of Comal Springs and Hueco Springs in Comal County, thus the US 281 project area is outside the known range of this species. Although the US 281 Corridor Project would have no direct effect on this species, the potential for indirect effects to species dependent on Comal Springs was evaluated. Given the distance of the US 281 Corridor Project from Comal Springs (approximately 20 miles), the fact that this project is a widening of an existing roadway, and the pollutant removal which would be achieved with TCEQ approved storm water BMPs, indirect effects resulting from the US 281 Corridor Project on Comal Springs are not reasonably certain to occur in the future. Therefore, this project would have ***no effect*** on this species.

Table 3-47: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Effect/Impact Determination
Comal Springs riffle beetle* *Heterelmis comalensis*	E	----	This species is found only in the region of Comal Springs and Hueco Springs in Comal County, thus the US 281 project area is outside the known range of this species. Although the US 281 Corridor Project would have no direct effect on this species, the potential for indirect effects to species dependent on Comal Springs was evaluated. Given the distance of the US 281 Corridor Project from Comal Springs (approximately 20 miles), the fact that this project is a widening of an existing roadway, and the pollutant removal which would be achieved with TCEQ approved storm water BMPs, indirect effects resulting from the US 281 Corridor Project on Comal Springs are not reasonably certain to occur in the future. Therefore, this project would have ***no effect*** on this species.
Ground beetle *Rhadine exilis*	E	----	Although appropriate habitat for this species may be present, this species was not encountered during the 2010 presence-absence surveys and none are historically known to occur in the US 281 biological study area. This US 281 Corridor Project Preferred Expressway Alternative ***may affect, and is likely to adversely affect*** this species.
Ground beetle *Rhadine infernalis*	E	----	Although appropriate habitat for this species may be present, this species was not encountered during the 2010 presence-absence surveys and none are historically known to occur in the US 281 biological study area. This US 281 Corridor Project Preferred Expressway Alternative ***may affect, and is likely to adversely affect*** this species.
Helotes mold beetle *Batrisodes venyivi*	E	----	The US 281 biological study area is outside the known range of this species, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no effect*** on this species.
Manfreda giant-skipper *Stallingsia maculosus*	----	----	There are no mesquite scrublands within the US 281 biological study area and no verified records of this insect since 1980[1], thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** to this species.
Rawson's metalmark *Calephelis rawsoni*	----	----	Moist areas in shaded limestone outcrops are found within the US 281 biological study area, yet no Rawson's metalmarks were observed during on-site habitat assessments. This US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Fishes			
Fountain darter *Etheostoma fonticola*	E	E	This species is found only in the region of Comal Springs and Hueco Springs in Comal County, thus the US 281 project area is outside the known range of this species. Although the US 281 Corridor Project would have no direct effect on this species, the potential for indirect effects to species dependent on Comal Springs was evaluated. Given the distance of the US 281 Corridor Project from Comal Springs (approximately 20 miles), the fact that this project is a widening of an existing roadway, and the pollutant removal which would be achieved with TCEQ approved storm water BMPs, indirect effects resulting from the US 281 Corridor Project on Comal Springs are not reasonably certain to occur in the future. Therefore, this project would have ***no effect*** on this species.
Guadalupe bass *Micropterus treculii*	----	----	No perennial streams are found within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** to this species.
San Marcos gambusia* *Gambusia georgei*	E	E	This species is considered extinct and its previous range is outside of the US 281 biological study area. Thus, the US 281 Corridor Project Preferred Expressway Alternative would have ***no effect*** on the San Marcos gambusia.
Toothless blindcat *Trogloglanis pattersoni*	P	T	The toothless blindcat is known only from wells south of the US 281 biological study area and no artesian wells are located within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** to this species.

Table 3-47: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Effect/Impact Determination
Widemouth blindcat *Satan eurystomus*	P	T	The widemouth blindcat is known only from wells south of the US 281 biological study area and no artesian wells are located within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** to this species.
Amphibians			
Cascade Caverns salamander *Eurycea latitans complex*	----	T	Although this species was not detected in springs during 2010 biological surveys, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Comal blind salamander *Eurycea tridentifera*	P	T	Although this species was not detected in springs during 2010 biological surveys, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
San Marcos salamander* *Eurycea nana*	T	T	The US 281 biological study area is outside the known range of this species, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no effect*** on the San Marcos salamander.
Texas blind salamander* *Eurycea rathbuni*	E	E	This species is found only in the region of Comal Springs and Hueco Springs in Comal County, thus the US 281 project area is outside the known range of this species. Although the US 281 Corridor Project would have no direct effect on this species, the potential for indirect effects to species dependent on Comal Springs was evaluated. Given the distance of the US 281 Corridor Project from Comal Springs (approximately 20 miles), the fact that this project is a widening of an existing roadway, and the pollutant removal which would be achieved with TCEQ approved storm water BMPs, indirect effects resulting from the US 281 Corridor Project on Comal Springs are not reasonably certain to occur in the future. Therefore, this project would have ***no effect*** on this species.
Texas salamander *Eurycea neotenes*	P	----	This species was not detected in springs during 2010 presence-absence surveys within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Reptiles			
Spot-tailed earless lizard *Holbrookia lacerata*	----	----	Although not observed during 2010 on-site habitat assessments, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Texas garter snake *Thamnophis sirtalis annectens*	----	----	Although not observed during 2010 on-site habitat assessments, habitat for this species exists within the US 281 biological study area. Thus, the Preferred Expressway Alternative ***may impact*** this species.
Texas horned lizard *Phrynosoma cornutum*	----	T	Although not observed during 2010 on-site habitat assessments, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Texas indigo snake *Drymarchon melanurus erebennus*	----	T	The range of this species is south of the US 281 biological study area and habitat for this species was not observed during 2010 on-site habitat assessments, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Texas tortoise *Gopherus berlandieri*	----	T	The range of this species is south of the US 281 biological study area and habitat for this species was not observed during 2010 on-site habitat assessments, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** to this species.
Timber/canebrake rattlesnake *Crotalus horridus*	----	T	Although not observed during 2010 on-site habitat assessments, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.

Table 3-47: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Effect/Impact Determination
Birds			
Black-capped Vireo *Vireo atricapilla*	E	E	The appropriate shrub and tree layer with open, grassy spaces required by the Black-capped Vireo does not exist within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no effect*** on this species.
Golden-cheeked Warbler *Setophaga chrysoparia*	E	E	Potential habitat for this species exists within the US 281 biological study area, however, this species was not observed during the 2009 and 2010 presence/absence surveys. Thus, the US 281 Corridor Project Preferred Expressway Alternative ***may affect, but is not likely to adversely affect*** the GCWA.
Interior Least Tern** *Sterna antillarum athalassos*	E	E	No sand or gravel bars within streams or inland beaches, wastewater treatment plants of gravel mines exist within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no effect*** on the Interior Least Tern.
Mountain Plover *Charadrius montanus*	----	----	No nesting habitat, shortgrass plains, or plowed fields exist within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Peregrine Falcon *Falco peregrinus*	----	T	Potential migrant; any use of the US 281 biological study area would be incidental. The US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Sprague's Pipit** *Anthus spragueii*	C		There is no upland prairie or coastal grassland habitat in the US 281 biological study area. The US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Western Burrowing Owl *Athene cunicularia hypugaea*	----	----	The US 281 biological study area contains no open grasslands and is too rocky for this species to burrow. Thus, this US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
White-faced Ibis *Plegadis chihi*	----	T	There are no freshwater marshes, sloughs, or irrigated rice fields in the US 281 biological study area. The Preferred Expressway Alternative would have ***no impact*** on this species.
Whooping Crane *Grus americana*	E	E	Potential migrant; any use of the US 281 biological study area would be incidental. The US 281 Corridor Project Preferred Expressway Alternative would have ***no effect*** on this species.
Wood Stork *Mycteria americana*	----	T	There are no areas of shallow standing water within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Zone-tailed Hawk *Buteo albonotatus*	----	T	The northern limit of the breeding range for this species is southwest of the US 281 biological study area and any use of this area would be considered incidental. It is anticipated that the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Mammals			
Black bear *Ursus americanus*	----	T	No large tracts of inaccessible forested areas exist within the US 281 biological study area, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Cave myotis bat *Myotis velifer*	----	----	Although not observed during 2010 on-site habitat assessments, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Ghost-faced bat *Mormoops megalophylla*	----	----	There are no known caves, abandoned mines or abandoned buildings within the US 281 biological study area that are inhabited by bats, thus the US 281 Corridor Project Preferred Expressway Alternative would have ***no impact*** on this species.
Gray wolf** *Canis lupus*	E	E	This species is considered extirpated from Texas. The US 281 Corridor Project Preferred Expressway Alternative would have ***no effect*** on this species.

Table 3-47: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Effect/Impact Determination
Plains spotted skunk *Spilogale putorius interrupta*	----	----	Although not observed during 2010 on-site habitat assessments, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project Preferred Expressway Alternative ***may impact*** this species.
Red wolf** *Canis rufus*	E	E	This species is considered extirpated from Texas. The US 281 Corridor Project Preferred Expressway Alternative would have ***no effect*** on this species.

E – Endangered, T – Threatened, C – Candidate for listing as threatened or endangered
P – Petitioned for federal listing; USFWS has determined the species may warrant listing
DL – Federally De-listed; DM – Federally De-listed, monitoring, "---" – Rare, but with no current regulatory status
*These federally-listed species are listed on the USFWS list of species of potential occurrence in Bexar County, but are not considered by TPWD as potentially occurring in this County.
**These federally-listed species are listed on the TPWD list of species of potential occurrence in Bexar County, but are not considered by USFWS as potentially occurring in this County.
Note - Potential impacts to species not protected under the ESA are described by stating that the US 281 Corridor Project would have "no impact" to the species, "may impact" the species, or "would impact" the species. Assessment determinations for species under the regulatory protection of the ESA, and that are listed by the USFWS as occurring in Bexar County are described using one of the following: "no effect"; "may affect, is not likely to adversely affect"; or "may affect, is likely to adversely affect."

In summary, based on background reviews, field investigations, and coordination with USFWS, the US 281 Corridor Project "*may affect, but is not likely to adversely affect*" the GCWA, "*may affect, and is likely to adversely affect*" Madla's Cave meshweaver and two ground beetles (*Rhadine exilis* and *R. infernalis*) and "*may impact*" one candidate species, the bracted twistflower. A BA was prepared and submitted to the USFWS on January 6, 2015. In a letter dated January 7, 2015, USFWS concurred with the finding for the GCWA. USFWS issued a BO dated March 11, 2015, which documents the impacts of the proposed project and lists conservation measures that will be taken. It concludes that the US 281 corridor project, as proposed "*is not likely to jeopardize the continued existence of C. madla, R. exilis and R. infernalis, nor result in the adverse modification or destruction of designated critical habitat*." The incidental take of all *C. Madla, R. exilis* and *R. infernalis* in any karst features underlying the 1,530 acre action area, in the form of harm or harassment, may occur as a result of the US 281 Corridor Project. The USFWS determined that this level of anticipated take "*is not likely to jeopardize the continued existence of C. Madla, R. exilis and R. infernalis, and would not result in destruction or adverse modification of designated critical habitat within CHU 12 for R. exilis.*" More information can be found on effects to federally listed species in the Biological Assessment (**Appendix I4**).

In addition to federally-listed and candidate species, the US 281 Corridor Project "may impact" 23 state-listed or rare (un-listed) species. Measures proposed to mitigate for these potential impacts to federally listed, state-listed, and rare species are described below.

3.16.5 Proposed Mitigation Measures

Federal Listed Species

Terrestrial Karst Species

Impacts to *C. madla, R. exilis* and *R. infernalis* would be minimized by restricting construction impacts to the proposed project area. In addition, the following voluntary conservation measures, which have been developed by TxDOT to avoid and minimize impacts to these species, CHU 12 or other federal trust resources, will be implemented. See the BO in **Appendix I4** for more detailed descriptions of each measure. TxDOT will:

- comply with the TCEQ Edwards Aquifer Rules for development within the Contributing and Recharge Zones of the Edwards Aquifer. The proposed project would meet the TSS removal requirement by providing 80 percent TSS removal at each storm water outfall (see **Appendix K3**);

- minimize impacts to CHU 12 and to native vegetation, especially woodland impacts;
- comply with the TCEQ's Texas Pollutant Discharge Elimination System Construction General Permit by preparing a Storm Water Pollution Prevention Plan (SW3P), Water Pollution Abatement Plan (WPAP) and other construction plans;
- require that all construction staging and access areas be located at least 300 feet from any potential listed species habitat unless it has already been surveyed and determined that the habitat is not occupied.
- require contractor to follow the specified procedures if voids are discovered during construction.
- delineate and map the subsurface drainage basins of Hairy Tooth Cave and Ragin' Cajun Cave;
- investigate means to update and enhance protection measures at Genesis Cave;
- work with the City of San Antonio to survey, map and protect the caves in Stone Oak Park (CHU 21);
- partner with resource agencies to create educational and professional development opportunities related to karst habitat and species;
- advance the scientific knowledge of *Cicurina* spiders by conducting biota surveys and genetic testing;
- reassess and revise the boundaries of karst zones as applicable;
- revegetate all disturbed areas in accordance with standard practices; and,
- monitor and report on the voids encountered and surveys conducted during and post construction.

The USFWS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of *C. Madla, R. exilis and R. infernalis.* TxDOT will:

- fully implement the Voluntary Conservation Measures proposed in their BA for this project (see **Appendix I4**).
- provide information and training to all employees and contractors working on the project on the measures proposed to avoid impacts to karst invertebrate and golden-cheeked warbler habitat.
- monitor the take of *C. madla, R. exilis,* and *R. infernalis,* using acreage impacted by the project as a proxy, and provide periodic monitoring reports to the USFWS.

Golden-cheeked Warbler

To avoid/minimize any potential impacts to the GCWA, the following guidelines would be followed during construction:

- Limiting the vegetation removal in wooded areas to outside of the breeding and nesting season, which lasts from March 1 to September 1
- Limiting removal of vegetation to that necessary for constructing the US 281 Corridor Project
- Locating construction staging areas away from potential GCWA habitat

In addition to those items stated above relating specifically to the GCWA, to ensure impacts to other migratory bird species are avoided, typical measures would be in place to comply with the Migratory Bird Treaty Act. As stated above, vegetation clearing would take place outside nesting season to the extent practicable, and if possible, in the year prior to construction and the contractor would be required to remain vigilant for the presence of early nesting species if vegetation clearing occurs in mid-winter. In the event that migratory birds are encountered on-site during construction, every effort would be made to avoid harm of protected birds, active nests, eggs, and/or young. The contractor would remove any old migratory bird nests between September 1 and February 28 from any structure where work would be done. The contractor would be prepared to prevent migratory birds from building nests between March 1 and August 31.

State listed Species

In accordance with TPWD regulations, efforts will be made to avoid direct harm to individuals of state listed species during construction. Specific notes will be inserted into construction plans that indicate the potential presence of these species and instruct the contractors/workers to avoid impacting them. Contractors/workers will be briefed on the species appearance and habitat preferences prior to construction and instructed to cease activities in the vicinity of the protected species, if encountered, for a sufficient amount of time to enable escape or relocation. Specifically for the Texas horned lizard, this will include information on avoiding harvester ant mounds where feasible.

Rare Species (un-listed)

During construction, efforts will be made to avoid direct harm to individuals of rare species; particularly those most vulnerable to earth moving equipment and water quality impacts. Specific notes will be inserted into construction plans that indicate the potential presence of these species and instruct the contractors/workers to avoid impacting them. Contractors/workers will be briefed on the species appearance and habitat preferences prior to construction and instructed to cease activities in the vicinity of the protected species, if encountered, for a sufficient amount of time to enable escape or relocation. To avoid and/or minimize impacts to aquatic species, waterways will be spanned whenever possible and appropriate best management practices put in place. If any waterway must be de-watered, the work site will be isolated to prevent fish from moving into the construction zone and work activities in the channel conducted as quickly as possible to minimize the length of time that flow is modified or interrupted. Prompt and effective erosion control, re-vegetation and restoration of flow lines and grades should further minimize impacts and return the areas to pre-project conditions as soon as possible.

As a proactive mitigation measure a cave gate was installed in the ROW near US 281 and Sonterra Boulevard. This cave was found during the karst survey in 2010. Five subterranean karst invertebrate species were identified during investigations at this cave, including a *Brackenridgia* species (sp.) isopod, a *Cicurina bullis* spider, a *Chinquipellobunus* sp. harvestman, a *Texoreddellia* sp.silverfish, and a *Cambala speobia* millipede. While none of these species are federally or state listed, *Cicurina bullis* is known from only a few localities and is being managed as endangered by the Department of Defense on Camp Bullis. This cave gate was designed to prevent unauthorized entry while maintaining nutrient and moisture flow. Nutrient input from trogloxenes such as cave crickets and small mammals as well as organic debris is an important element of a functioning cave ecosystem. The most reliable way to return the site to the original conditions is to place a gate at-grade over the entrance to the cave.

In order to avoid impacts to the Cave myotis bat, contractors would implement the following measures prior to and during construction: 1) adjacent caves to US 281, would be surveyed by a qualified biologist to determine if bats are present; and 2) if bats are present, appropriate measure would be taken as practicable to ensure that bats are not harmed such as exclusion of bats from the project area, or timing activities to when bats are not present. For maternity colonies, exclusion activities would be timed where practicable to avoid separating lactating females from nursing pups. If features used by bats are removed as a result of construction, artificial roosts would be constructed to replace these features as practicable.

3.17 CULTURAL RESOURCES

Cultural resources are structures, buildings, archeological sites, districts (a collection of related structures, buildings, and/or archeological sites), cemeteries and objects. Both federal and state laws require consideration of cultural resources during project planning. At the federal level, NEPA and Section 106 of the *National Historic Preservation Act* (NHPA) of 1966 (Section 106), among others, apply to transportation projects such as this one. In addition, state laws such as the *Antiquities Code of Texas* apply to this project. Compliance with these laws requires the federal agency to consult with the Texas Historical Commission (THC), State Historic Preservation Officer (SHPO) and federally recognized tribes to determine the project's effects on cultural resources. Review and coordination of the US 281 Corridor Project has followed the procedures for compliance presented in the *First Amended Programmatic Agreement among the FHWA, the Texas Department of Transportation, The Texas State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Implementation of Transportation Undertakings* (PA). Under the PA, TxDOT has consulted with the THC regarding any potential effect that the proposed undertaking may have on eligible cultural resources.

Federally funded transportation projects are also subject to the requirements of Section 4(f) of the U.S. Department of Transportation (USDOT) Act of 1966, which stipulates that the FHWA and other USDOT agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites unless the following conditions apply:

- There is no feasible and prudent alternative to the use of land; and
- The action includes all possible planning to minimize harm to the property resulting from use.

Section 4(f) was set forth in Title 49 United States Code (USC), Section 1653(f). A similar provision was added to Title 23 USC Section 138, which applies only to the Federal-Aid Highway Program.

The EIS relied on cultural resources studies performed in support of the 2007 Environmental Assessment for US 281, under which Section 106 requirements were completed and which covers most of the current Area of Potential Effects (APE), as defined in 36 CFR 800.16(d). The EIS documents the effect of the Build Alternatives on cultural resources as determined by previous coordination with THC. Additionally a detailed desktop review and predictive model was prepared to determine potential for the project to affect resources that could be NRHP-eligible.

Based on the results of the desktop assessment and previous surveys it was determined that there is low potential for Section 4(f) to be triggered by either of the Build Alternatives. Supplemental field surveys for historic and archeological resources were conducted for the Preferred Expressway Alternative. Consultation for historic resources, as defined in 36 CFR 800.2, was conducted following the surveys and presented in this Final EIS. No NRHP-eligible resource was found during these surveys that would be adversely affected by the Preferred Expressway Alternative.

This approach was developed through coordination with FHWA, TxDOT, Alamo RMA, the Peer Technical Review Committee, and all participating and cooperating agencies.

3.17.1 Historic Resources (Non-Archeological)

Methodology

The results from previous non-archeological historic resources investigations and THC coordination were used to evaluate the potential impacts that would result from the Build Alternatives.

TxDOT pre-certified architectural historians conducted a records review of the historic resources APE, 1,300 feet beyond the proposed ROW for Build Alternatives, using historic aerial photographs, maps, previous survey reports and other archival sources to identify the locations of potential historic resources constructed in 1971 or earlier (the 2016 proposed letting date minus 45 years). When the Preferred Alternative was

identified, the APE was refined to 150 feet beyond the proposed ROW for the Preferred Expressway Alternative, referred to as the refined APE.

Affected Environment

Previously Identified Historic Resources

Using the THC's online Texas Historic Sites Atlas, a review was conducted of the National Register of Historic Places (NRHP), State Antiquities Landmarks (SAL) and Recorded Texas Historic Landmarks (RTHL). The review indicated that there are no previously designated properties within the APE (1,300 feet beyond the ROW for the Build Alternatives). There are also no City of San Antonio designated landmarks or Official Texas Historical Markers within the APE.

Previous Historic Resources Surveys and Section 106 Coordination

Historic resources surveys of the US 281 corridor were conducted in 2000, 2004, and 2006, and 2007.

1. The 2000 survey of the US 281 corridor had limits from 0.6 miles north of Loop 1604 to 2.5 miles north of Loop 1604, and found no buildings, structures, or objects within the APE, per correspondence with the THC dated April 14, 2000 (Bell, 2000). The historic cut-off date is not defined in the correspondence but is assumed to be 1950. The SHPO concurred with this finding on April 19, 2000. (The APE was not defined in the correspondence.)
2. The 2004 survey of the US 281 corridor had limits from Stone Oak Parkway to FM 306 in Comal County and identified 136 historic-age resources within an APE that varied from 800 to 1,300 feet beyond the proposed ROW. TxDOT determined that none of the resources were eligible for NRHP listing due to a "lack of architectural significance, severe alterations, and loss of historic integrity" (Jensen 2004). The historic cut-off date is not defined in the correspondence but is assumed to be 1954. The SHPO concurred with TxDOT's findings of eligibility on July 23, 2004.
3. A third historic resources survey was performed in 2006 along the US 281 project corridor from Loop 1604 to Borgfeld Drive (the limits of the current project) to confirm the findings of the previous surveys as they applied to the current project limits. The survey identified 18 properties built before 1965 within a study area extending 500 feet beyond the proposed ROW. TxDOT endorsed the report's recommendation that none of the surveyed resources were eligible for NRHP listing. However, as the report contained no newly identified properties or information, it was not individually coordinated with SHPO.
4. A historic resources survey performed in 2007 along Loop 1604 included US 281 from Loop 1604 to Marshall Road, covering approximately half of the current project area. This survey identified two historic-age resources that were constructed prior to 1965: a residence converted to a business and a highway bridge. Both were determined not eligible for NRHP listing (Jensen, 2007). The SHPO concurred with TxDOT's finding on April 27, 2007.
5. In 2014, a historic resources reconnaissance survey was conducted between Loop 1604 and Borgfeld Drive, which updated the 2006 survey. No NRHP-eligible properties were found within the refined APE (150 feet beyond the proposed ROW).

Environmental Consequences

No-Build Alternative

With the implementation of the No-Build Alternative additional ROW would not be required; therefore, there would be no direct impacts.

Build Alternatives

The results from previous non-archeological historic resources investigation and THC coordination were used to evaluate the potential impacts that could result from the Build Alternatives. The refined APE for non-archeological historic resources for the US 281 Corridor Project is defined as 150 feet beyond the proposed ROW. A historic resources reconnaissance survey was performed to confirm the condition/presence of the previously surveyed resources and whether resources built between 1966 and 1971 are present within the APE of the Preferred Expressway Alternative.

In summary, portions of the currently refined APE (except for a 0.6-mile segment north of Loop 1604 and a 0.3-mile segment south of Stone Oak Parkway) was surveyed between 2000 and 2007; TxDOT coordinated these survey results with the SHPO, who concurred with TxDOT's finding that no NRHP-eligible properties are present. The 2006 survey, which surveyed the current project limits, confirmed the findings of the previous surveys and evaluations. The 2014 survey, which updated the 2006 survey, found no NRHP-eligible properties within the refined APE (150 feet beyond the proposed ROW).

Pursuant to Stipulation VI, Appendix 4 "Undertakings with Potential to Cause Effects" of the First Amended Programmatic Agreement for Transportation Undertakings (PA-TU), between the FHWA, the SHPO, the Advisory Council on Historic Preservation, and TxDOT and the Memorandum of Understanding (MOU), TxDOT Historians determined that no historic properties are present. Therefore, individual project coordination with SHPO is not required.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative is being considered for non-toll/managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore, the impacts to non-archeological historic resources would not change based on funding options.

Conclusion

A 2014 survey of the APE, defined by TxDOT as extending 150 feet beyond the proposed ROW, recorded all buildings, structures, and objects constructed in 1971 or earlier. The survey confirmed that 12 of the properties identified in the 2006 survey are still present within the current APE and have no substantive changes. Six properties included in the 2006 survey are either outside the current APE, were documented as being built after the historic cut-off date, or have been removed. Six new residential and commercial properties were identified, bringing the total to 18. The determinations of eligibility made for the previously recorded properties are still valid: none have attained any distinction since 2006 that would cause them to be eligible for NRHP listing. In addition, the properties recorded for the first time by the 2014 survey are similar to the ones constructed earlier and lack the required associational or intrinsic significance to be eligible for NRHP listing. As such, TxDOT Historians determined that no historic properties are present. A Historic Resources Reconnaissance Survey Report was prepared and is on file at TxDOT.

3.17.2 Archeological Resources

Methodology

As specified in the PA, and the Memorandum of Understanding (MOU) between the TxDOT and the THC, the archeological APE consists of the existing and proposed ROW and any other areas directly impacted by the US 281 Corridor Project. Background research was conducted to determine whether there are any known archeological sites listed in the NRHP, designated as SALs, or any known sites of archeological interest within the APE of the proposed undertaking. Research was conducted at the Texas Archeological Research Laboratory (TARL), the THC, and online at the Texas Historic Sites Atlas. Site files, relevant maps, and NRHP listings were examined. Aerial photographs and Soil Conservation Service survey maps for Bexar

County (Taylor et al. 1991; USDA-NRCS 2012) were also examined to help determine potential for intact buried archeological resources. A summary of this information is presented below.

Affected Environment

Numerous archeological investigations were conducted of the APE including intensive pedestrian survey, reconnaissance survey and archival research. Initial archeological investigations in the APE for the initial project design were conducted in May 2000. A re-evaluation of the APE began June 2005 and because of denied ROE properties, investigations continued sporadically over almost nine years, with surveys conducted in November 2006, August and November 2007, and concluding in February 2014. The February 2014 survey report proposed a project finding of no effect on archeological historic properties and cemeteries and recommended no further archeological investigations for the proposed APE, including those parcels of private property where ROE was denied. The SHPO and THC concurred with these findings and recommendation on February 21, 2014 (see **Appendix L1**).

Section 106 consultation with federally recognized tribes having an interest in the project area was initiated June 17, 2005 by TxDOT on behalf of the FHWA. Additional consultation with interested parties and federally recognized tribes was conducted by Alamo RMA on behalf of the FHWA on August 14, 2009 (see **Appendix L1**). This additional consultation concerned potential project effects within the entirety of the currently proposed APE. None of the responses raised objection to the proposed project.

Previous Archeological Investigations in Northern Bexar County

There have been multiple previous archeological investigations in northern Bexar County. The extent of modern development in this area has resulted in the investigation of a number of prehistoric sites mostly in the past three decades. Often in response to the requirements of federal and state laws, full-scale archeological excavations have been conducted at prehistoric archeological sites in northern Bexar County beyond the US 281 ROW at 41BX52, 41BX126, 41BX228, 41BX300, and at the Walker Ranch National Register Archeological District. In addition, for nearly the last decade, George Veni and Associates (GV&A) in association with Prewitt and Associates Inc. (PAI) have conducted continual hydro-geological, biological, and archeological investigations at Camp Bullis Military Reservation, west of the current project area. These investigations were concluded with the identification of numerous newly recorded archeological sites.

1. A pedestrian archeological survey conducted by PAI was undertaken in 2000 and covered 3,255 acres of the Camp Bullis Military Reservation. The investigations resulted in the identification of 39 new archeological sites, including 28 prehistoric sites, 8 historic sites, and 3 sites with both components. PAI archeologists also revisited and reassessed 26 previously recorded sites.

2. A large aerial survey in the vicinity of the US 281 study area was conducted by the University of Texas at San Antonio (UTSA) in 1977. The survey consisted of 2,000 acres that became the Encino Park subdivision and identified a number of small prehistoric lithic scatters, including sites 41BX90, 41BX91, 41BX99, 41BX121, 41BX749, and 41BX758, recorded near US 281 (McGraw et. al 1977). Over two decades later, in 2000, a subsequent field inspection found that only 41BX90 extended into the US 281 ROW (Houk 2000). Due to the lack of diagnostic artifacts and disturbance of materials, it was not considered eligible for listing in the NRHP. In addition, a partial archeological survey of the proposed 21.3-mile US 281 expansion project from Evans Road to FM 306 in Bexar and Comal counties was conducted by SWCA Environmental Consultants in 2005.

3. In 2001, two other previously recorded sites, 41BX749 and 41BX758 were identified further northward near Elm Creek, in the vicinity of US 281 and Stone Oak Parkway (Young 2001). Neither of these sites was found to extend into the US 281 ROW. Further south along US 281 near the southern terminus of the project area, only one prehistoric archeological site has been previously recorded. Site 41BX777 was found in 1987 near the right bank of Mud Creek adjacent and west of US 281. A surface scatter of lithic debris was observed in a cleared plowed field beyond the ROW. The margin of this site may

have once extended into US 281 ROW, as evidenced by an occasional fragment of burned rock, but shovel testing did not identify any evidence of subsurface deposits. The site was identified so that it could be addressed if future construction expanded beyond the current ROW. The ROW of US 281 in the vicinity of 41BX777 was inspected in 1999 as part of the Sonterra Boulevard/US 281 Overpass project (CSJ: 0253-04-108). No evidence of the site was found within the extensively disturbed ROW.

Archeological Studies for US 281

There have been a number of surveys along the US 281 project corridor in northern Bexar County.

1. The first archeological survey was initiated in December 1984, as improvements to US 281 took place. The 1984 survey likely consisted of visual and windshield inspection and resulted in a report of negative findings (CSJ: 2998-422-019). The US 281 project corridor was revisited in September 1987, with similar results (CSJ: 2998-422-024).

2. In December 1995 intersection improvements along a portion of US 281 were coordinated under Section 106, resulting in a recommendation that no survey was warranted (CSJ: 0253-004-0102).

3. In 1999, an archeological survey was conducted from 0.34 to 0.47 mile north of Loop 1604 in the vicinity of an overpass improvement (CSJ: 0253-04-108), and a year later a portion of US 281 from 0.6 to 2.5 miles north of Loop 1604 was surveyed (CSJ: 0253-04-089) under THC Antiquities Permit No. 2332. One prehistoric archeological scatter of chipped stone, designated 41BX90 was found to extend within the APE of the road expansion project. Due to the lack of chronologically diagnostic material and the extent of modern disturbances, the SHPO concurred on May 19, 2000, that the portion of the site within the ROW was not eligible for listing in the NRHP.

4. In the following year, the proposed widening of the southbound parallel partial access-controlled lanes from Loop 1604 to Henderson Pass (part of a maintenance project) resulted in a recommendation of no historic properties affected with a concurrence from the SHPO on April 23, 2001 (CSJ: 6066-02-001). By 2002, expansion at two additional segments was reviewed: the US 281 expansion projects at Stone Oak Parkway (CSJ: 0253-04-114) and at Borgfeld Drive (CSJ: 0253-04-112). The former received a SHPO concurrence of no effect on March 3, 2002 and the latter, conducted under THC permit No. 2651, received the same on February 12, 2002. The US 281/Stone Oak Parkway project also included a new CSJ number (0253-04-114) that combined a new north terminus at Marshall Road with the Stone Oak Parkway interchange project for combined limits from Loop 1604 to Marshall Road.

5. In early January 2005, TxDOT conducted a reevaluation of a segment of US 281 previously assessed in May 2000 (CSJ: 0253-04-089). This included a small northward extension of the APE approximately 0.25 mile. TxDOT recommended that no historic archeological properties would be affected and received THC concurrence on January 20, 2005. Later, in July 2005, under THC Antiquities Permit No. 3471, TxDOT performed an archeological survey within accessible areas along US 281 from Evans Road to FM 306 in Bexar and Comal counties (CSJs: 0253-04-093, 0253-03-043, 0253-03-057 and 0253-03-058). This survey recorded one non-diagnostic lithic scatter within the existing ROW that was recommended as not eligible for listing in the NRHP. The SHPO agreed with this recommendation in July 2005. However, this survey covered the existing ROW only and did not investigate any areas of proposed new ROW. The SHPO agreed that further Section 106 consultation would be needed for the proposed new ROW, as ROE becomes available. A reevaluation of US 281 at Borgfeld Drive (CSJ: 0253-04-093 and -112) also occurred in November 2005, with no change from the original archeological finding of no effect.

6. Finally, in 2006, TxDOT consultants conducted impact evaluations along US 281 in support of road expansion at several parcels where ROE was available. This impact evaluation consisted of pedestrian inspection only and documented five new archeological sites, 41BX1695-1699, which were

recommended for further survey. Additionally, it documented that two sites, 41BX90 and 41BX121, within the APE of the road expansion did not merit further investigations.

7. In 2014, TxDOT conducted a reconnaissance survey on US 281 from Loop 1604 to the Comal County line. The APE is a setting with low potential to contain intact archeological properties because shallow soils and previous and ongoing development. An approximately 1-acre area was visually inspected at the location of previously recorded sites 41BX749 and 41BX758. No artifacts were collected as no archeological material was observed; therefore, the project will have no effect on archeological historic properties. The SHPO concurred on February 21, 2014.

Archeological Sites Within One Kilometer (0.62 mile) of the APE

Background research documented previously recorded archeological sites within a one kilometer radius of the undertaking, following TxDOT's *Standards of Uniformity for Archeological Background Studies*. The search revealed that there are 36 archeological sites within one kilometer of the APE for the proposed undertaking (in **Table 3-48**). They are all prehistoric sites representing lithic procurement areas or open campsites. Most are on the surface or shallowly buried, and a review of current aerial photography suggests that many have likely been completely destroyed due to recent development. Of the 36 sites recorded, 14 sites were originally recommended for further archeological work at the time of recording. Sites 41BX1695-1699, for instance, were recorded through an impact evaluation of specific project areas along US 281 in 2006 and then recommended for more detailed survey. These sites have not yet been reevaluated. Twelve archeological sites (41BX90, 41BX91, 41BX107, 41BX121, 41BX746, 41BX777, 41BX1620, and 41BX1695-1699) are within the APE. Of these twelve sites, three sites, 41BX1620, 41BX90 and 41BX121, are not considered eligible for listing in the NRHP and no further work is warranted for these sites. The remaining nine sites would require further assessment. Given the high incidence of existing site locales along this corridor, it would be anticipated that unsurveyed portions of the APE could contain similar archeological sites. However, it should be noted that most of the APE falls within an upland setting where surface geology is dominated by shallow soils overlying Edwards and Glen Rose formation limestone bedrock. These are ancient formations typically overlain by very shallow soils. Only the northern terminus of the APE, at Cibolo Creek, contains Holocene Alluvium which may have potential for deeply buried archeological deposits.

Table 3-48: Previously Recorded Archeological Sites

Site Number	Record Date	Site Type and Description	Distance from APE	Eligibility Status
41BX100	1977	Prehistoric open campsite with 6 dart points/preforms collected, utilized and retouched flakes, bifaces, cores, and a quarry blank situated on the E bank of W Elm Creek	1,200 ft from APE	testing recommended
41BX1008	1994	Prehistoric open campsite with fire-cracked rock, debitage, thin biface fragments, and projectile points including Scallorn, Edwards, and 1 Angostura located on low hillside E of tributary to Mud Creek	2,880 ft from APE	site nearly destroyed by looting
41BX101	1977	Prehistoric lithic scatter with cores and retouched and utilized flakes on a sloping terrace on the E bank of W Elm Creek	1,280 ft from APE	no further work recommended
41BX102	1977	Prehistoric lithic scatter including bifaces, point midsection, utilized and retouched flakes, and 1 point on a terrace on the W bank of W Elm Creek	810 ft from APE	no further work recommended
41BX103	1977	Prehistoric lithic scatter with 1 biface and utilized and retouched flakes on a rocky terrace on the E bank of	650 ft from APE	no further work recommended

Table 3-48: Previously Recorded Archeological Sites

Site Number	Record Date	Site Type and Description	Distance from APE	Eligibility Status
		W Elm Creek		
41BX104	1977	Prehistoric lithic scatter including quarry blanks, modified and unmodified flakes, and spokeshaves-may be isolated occurrence; site situated on hilltop E of US 281	1,280 ft from APE	no further work recommended
41BX105	1977	Prehistoric lithic scatter on the slope of an unnamed drainage	790 ft from APE	no further work recommended
41BX106	1977	Prehistoric lithic scatter including 1 point, bifaces, scrapers, cores, and possible burned rock midden situated on flat hilltop E of US 281	660 ft from APE	additional survey recommended
41BX107	1977	Prehistoric lithic procurement site including a biface, scraper, quarry blanks, cores, and retouched flakes on the W sloping ridge of Classen Hill	in APE	2006 survey did not find evidence of this site in ROW and SHPO concurred no further work warranted
41BX108	1977	Prehistoric lithic procurement site at head of small drainage cut through by Marshall Rd	1,350 ft from APE	no further work recommended
41BX109	1977	Prehistoric lithic scatter on E slope near the top of Classen hill	1,200 ft from APE	no further work recommended
41BX121	1977	Prehistoric lithic procurement site with bifaces, cores, large flakes, and a chert outcrop located on the side of a hill and draw of a tributary to W Elm Creek	in APE	not eligible, no further work recommended
41BX122	1977	Prehistoric lithic procurement site with bifaces, preforms, cores, large flakes, scrapers, and an extensive chert outcrop on a sloping hillside E of US 281	1,850 ft from APE	no further work recommended
41BX1620	2005	Prehistoric lithic procurement site located on a high, upland hilltop cut through by the highway	in APE	no further work recommended
41BX1673	2006	Prehistoric lithic scatter including one biface, tested cobbles, cores, and lithic debitage on a terrace on the S bank of Mud Creek	980 ft from APE	no further work recommended
41BX1674	2006	Prehistoric lithic scatter including large flake core, biface thinning flakes, and debitage on a terrace of Mud Creek	1,480 ft from APE	no further work recommended
41BX1675	2006	Prehistoric lithic scatter including cores, tested cobbles, and lithic debitage on a terrace of Mud Creek	1,980 ft from APE	no further work recommended
41BX1695	2006	Prehistoric lithic scatter including a biface and Plainview-like dart point base situated 100 meters W of unnamed drainage to Elm Creek	in APE	not eligible
41BX1696	2006	Prehistoric lithic scatter with Pedernales-like dart point base located 60 meters E of Elm Creek	in APE	not eligible

Table 3-48: Previously Recorded Archeological Sites

Site Number	Record Date	Site Type and Description	Distance from APE	Eligibility Status
41BX1697	2006	Prehistoric lithic scatter located on upland slope W of US 281; artifacts clustered around small karst feature	in APE	reevaluation and survey determined site not eligible
41BX1698	2006	Prehistoric lithic scatter located in clearing W of US 281	in APE	not eligible
41BX1699	2006	Prehistoric lithic scatter with distal fragment of a dart point and natural chert outcropping located in upland setting W of US 281; imported gravels noted	in APE	not eligible
41BX449	1974	Prehistoric lithic scatter with flakes and cores located on a drainage to W Elm Creek	1,300 ft from APE	unknown
41BX746	Mid 1980s	Prehistoric campsite with burned rock midden and projectile points including Corner tang fragments, Nolan, Montell, Pedernales, and Scallorn/Edwards situated on first terrace above tributary to Cibolo Creek	in APE	not eligible
41BX749	1987	Prehistoric open campsite with debitage, Angostura, Pedernales, Montell, and Scallorn points, a mano, and a large burned rock midden situated on a limestone outcrop above a spring fed creek	in APE	not eligible
41BX750	1987	Prehistoric open campsite described as having early to middle archaic dart points; site situated on a hill W of US 281	2,680 ft from APE	no further work recommended
41BX758	1987	Prehistoric open campsite with at least 3 separate burned rock middens situated on the 1st terrace above a spring -feed intermittent creek bed	530 ft from APE	testing recommended
41BX759	1987	Prehistoric open campsite described as having Tortugas and Travis like points; site set on a ridge W of US 281	2,370 ft from APE	additional survey recommended
41BX777	1987	Prehistoric open campsite consisting of a light scatter of lithic debitage located on a terrace of Mud Creek	in APE	SHPO concurred no further work
41BX90	1977	Prehistoric lithic procurement and open campsite consisting of cores, quarry blanks, utilized flakes, unifacial scrapers, bifacial scrapers, and 1 bifacially worked knife along the W ridge of a drainage to W Elm Creek	in APE	not eligible
41BX91	1977	Prehistoric lithic procurement and open campsite with cores, blanks, and heat treated chert located on a drainage of W Elm Creek	in APE	SHPO concurred no further work
41BX92	1977	Prehistoric lithic procurement and open campsite with cores, blanks, scrapers, bifaces, and several point fragments along several drainages of W Elm Creek	990 ft from APE	additional survey recommended
41BX93	1977	Prehistoric lithic scatter with cores, flakes, retouched flakes, unifaces, a blade core, and quarry blanks situated on a flat limestone outcropping E of US 281	3,130 ft from APE	no further work recommended

Table 3-48: Previously Recorded Archeological Sites

Site Number	Record Date	Site Type and Description	Distance from APE	Eligibility Status
41BX94	1977	Prehistoric lithic procurement and open campsite with cores, blanks, scrapers, and bifaces along the W bank of W Elm Creek	3,320 ft from APE	no further work recommended
41BX98	1977	Prehistoric lithic scatter consisting of flakes, scrapers, bifaces, and 2 points set on a terrace on the W bank of W Elm Creek	2,140 ft from APE	testing recommended
41BX99	1977	Prehistoric open campsite with large bifaces, scrapers, drills, dart points/frags., flakes, and cores situated on a slope and hill E of US 281	370 ft from APE	testing recommended

Source: US 281 EIS Team 2011.

Environmental Consequences

No-Build Alternative

With the implementation of the No-Build Alternative additional ROW would not be required; therefore, there would be no direct impacts.

Build Alternatives

The results from previous archeological investigations and THC coordination were used to evaluate the potential impacts that could result from the Build Alternatives.

Based on the background research it is estimated that the following portions of the proposed ROW for the Build Alternatives have been previously surveyed for archeological resources with no further work recommended:

Table 3-49: Previously Surveyed Areas within the APE

Build Alternatives	Previously Surveyed ROW
Elevated Expressway Alternative	67%
Preferred Expressway Alternative	65%

Source: US 281 EIS Team, July 2011.

None of the archeological sites identified within the proposed APE of the US 281 Corridor Project during previous surveys were found to be eligible for the NRHP. Therefore, none of the previous undertakings within the US 281 project corridor were found to have any effects on archeological resources eligible for listing on the NRHP or for designation as SALs.

One site was recommended for further work. Site 41BX749 is located within the proposed ROW for the Preferred Expressway Alternative and the Elevated Expressway Alternative. At the time it was recorded (1977), the site was located more than 200 feet west of US 281. However, since that time the proposed ROW has expanded toward the site, and as currently mapped, it appears to be within both Build Alternatives. It was recorded as a burned rock midden during a survey that took place in 1987. At the time, it was recommended for testing to determine eligibility for the NRHP and as a SAL.

Archeological sites have been recorded in most areas that have been previously surveyed along the US 281 project corridor. Of the recorded archeological sites, all of them are prehistoric. Typically sites are on the surface or shallowly buried, and most appear (from a review of sites forms) to represent lithic procurement areas, open campsites, or kill sites with no interpretable features that would warrant further investigations.

However, one site within the APE and an additional seven sites within one kilometer of the APE have been recommended for further work. Moreover, many of the previously recorded sites within the APE could extend outside the existing ROW of the US 281 project corridor and archeological deposits associated with them have not been evaluated for significance. Based on the review of aerial photographs, previous studies, soils and geology, it can be concluded that potential for prehistoric sites in unsurveyed areas is high. However, these same sources also suggest that sites would likely be shallowly buried or entirely on the surface and would probably reflect lithic procurement areas and temporary campsites with limited features. Artifacts could reflect the Paleo-Indian through Late Prehistoric periods. It would be unlikely that any of these resources would have enough integrity to rise to the level of NHRP-eligibility.

There is limited potential for historic period sites. This portion of the county was very lightly occupied through the middle of the 20th century. If historic sites are identified, they would likely relate to 19th or 20th century ranches.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative is being considered for non-toll/managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore the impacts to archeological resources would not change based on funding options.

Conclusion

In summary, there have been multiple archeological surveys to date throughout the APE and collectively these surveys have documented and evaluated the resources over approximately 65 percent of the APE. For the Preferred Expressway Alternative there are 13 sites—41BX90, 41BX91, 41BX107, 41BX121, 41BX746, 41BX777, 41BX1620, 41BX1695 41BX1696, 41BX1697, 41BX1698, 41BX1699, and 41BX749—within the APE. Twelve of these sites are neither listed in nor considered eligible for listing in the NRHP or as SALs. One site, 41BX749, was recommended for further testing to determine NHRP and/or SAL eligibility; however, in February 2014, TxDOT evaluated unsurveyed portions of the APE and determined that the project would have no effect on any NRHP or SAL-eligible archeological sites. It was determined that archeological studies under Section 106 were complete and the SHPO concurred on February 21, 2014 (see **Appendix L1**). Therefore, there is No Effect on Archeological Historic Properties or SALs.

Compliance with Section 106 of the NHPA also requires FHWA to consult with federally-recognized Native American tribes regarding this undertaking. Consultation with federally recognized tribes with a demonstrated interest in the region was completed following the PA.

3.18 SECTION 4(F) & SECTION 6(F) PROPERTIES

Section 4(f) of the DOT Act of 1966 (Title 49 USC, Section 1653(f) as amended and codified in 49 USC, Section 303 in 1983, states the Secretary of Transportation may approve a transportation program or project requiring use of publicly owned land of a public park, recreation area, wildlife/waterfowl refuge, or land of a historic site of national, state, or local significance (as determined by the officials having jurisdiction over the park, recreation area, refuge or site) only if there is no prudent and feasible alternative to such use and the project includes all planning to minimize harm.

TPWD Code, Title 3, Chapter 26 contains similar language concerning the taking of park and recreational lands. TPWD restricts the use or taking of any public land designated and used as a park (recreation area, scientific area, wildlife refuge, or historic site) unless the department, agency, political subdivision, county, or municipality determines there is no feasible and prudent alternative and that the project/program includes all reasonable planning to minimize harm to the land.

Section 6(f) of the Land and Water Conservation Fund (LWCF) Act requires that any outdoor recreational facilities acquired with the Department of Interior (DOI) financial assistance under the LWCF Act, as allocated by the TPWD, may not be converted to non-recreational use unless approval is granted by the Director of the National Park Service (NPS).

3.18.1 Methodology

Existing public parks, recreational areas, wildlife/waterfowl refuges within one-quarter mile on each side of the US 281 project corridor were identified via field investigations, internet research, project mapping, 2010 aerial photography, and property ownership research. Identified properties were evaluated in the context of surrounding neighborhoods and adjacent properties, ownership and/or jurisdiction, adjacency to the Build Alternatives and associated impacts.

3.18.2 Affected Environment

No public parks, recreational areas, wildlife or waterfowl refuges or historic sites were identified within one-quarter mile of the US 281 project corridor.

3.18.3 Environmental Consequences

No-Build Alternative

With the implementation of the No-Build Alternative additional ROW would not be required; therefore, there would be no direct impacts.

Build Alternatives

As there are no public parks, recreational areas, wildlife or waterfowl refuges, and no historic sites within one-quarter mile of the project corridor, the Build Alternatives, including the Preferred Expressway Alternative, would not have a direct impact.

Based on the results of the desktop assessment and previous surveys it was determined that there is low potential for Section 4(f) to be triggered by the Build Alternatives. Therefore, supplemental field surveys for historic and archeological resources was conducted for the Preferred Expressway Alternative only and documented in the Final EIS. A Public Meeting regarding the Preferred Expressway Alternative occurred after the Draft EIS Public Hearing and prior to circulation of the Final EIS. Consultation for historic resources, as defined in 36 CFR 800.2, was conducted following the surveys and used to refine the Preferred Expressway Alternative which is presented in the Final EIS. No NRHP-eligible resources were found during these surveys that would be adversely affected by the Preferred Expressway Alternative (see **Section 3.17 Cultural Resources** for more information).

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative would include non-toll general purpose lanes and managed lanes. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore the impacts to parkland and recreational areas would not change based on funding options.

3.18.4 Conclusion and Proposed Mitigation Measures

The US 281 Corridor Project is not expected to impact any publicly owned park, recreational area, wildlife or waterfowl refuge or historic site; therefore, a Section 4(f) Statement would not be required. No ROW for the Build Alternatives would be required from any public park or recreational areas within one-quarter mile of the project corridor. No existing parkland and recreation areas identified within one-quarter mile of the US

281 project corridor meet the definition of a Section 6(f) property. As such, no mitigation measures are proposed.

3.19 HAZARDOUS/REGULATED MATERIALS

The Hazardous Materials Assessment was conducted using TxDOT standard search radii (typically 0.25 to 1 mile) for federal and state environmental databases to identify hazardous materials that could be affected by the Build Alternatives.

This section describes hazardous and regulated materials sites that have been identified in regulatory listings adjacent to and in proximity to the US 281 project corridor. It then presents the potential effects to these sites as a result of the Build Alternatives and the No-Build Alternative, and then concludes with proposed mitigation measures that could be taken to prevent potential harm to human health and the environment along the US 281 project corridor.

3.19.1 Methodology

A regulatory database search was performed, in accordance with American Society for Testing and Materials (ASTM) Standards: E 1527-00 *Standard Practice for Environmental Site Assessment*, to identify hazardous and regulated materials along the US 281 project corridor; the search included a review of 34 federal, 23 state, 1 local and 4 tribal regulatory databases. Hazardous and regulated materials sites are defined as having conditions that indicate existing and past releases, or a material threat of release of any hazardous substance or petroleum products into the ground, groundwater, or surface water. Hazardous and regulated material sites were identified within and in proximity to the US 281 project corridor, from Loop 1604 to Borgfeld Drive, by analyzing the database search in GIS. ASTM Standard E 1527-05 was used to establish search radii, or the recommended distance from the US 281 project corridor for each database search, in order to capture the potential harm to human health and the environment as regulated under applicable laws and regulations. A hazardous and regulated materials study area was established based on these search radii which are discussed in more detail in **Table 3-50.** In addition to the regulatory listings of hazardous and regulatory materials sites, a GIS search was conducted to identify the location of public water supply wells that could potentially be affected by the US 281 Corridor Project. A general oil and gas well and pipeline review was also conducted using information provided by the Railroad Commission of Texas (RRC) to determine potential impacts of the US 281 Corridor Project. These database searches were conducted in April of 2014 and serve as an initial screening-type assessment to indicate areas of potential concern for further study or precautionary actions. These limitations should be recognized when consideration is given to the Build Alternatives.

Table 3-50: Federal, State, Local and Tribal Regulatory Listings and Search Radii

Database	Search Radius
Federal Regulatory Listings	
Aerometric Information Retrieval System / Air Facility Subsystem	US 281 Project Corridor
Biennial Reporting System	US 281 Project Corridor
Clandestine Drug Laboratory Locations	US 281 Project Corridor
EPA Docket Data	Existing US 281 ROW
Federal Engineering Institutional Control Sites	US 281 Project Corridor
Emergency Response Notification System	US 281 Project Corridor
Facility Registry System	US 281 Project Corridor
Hazardous Materials Incident Reporting System	US 281 Project Corridor

Table 3-50: Federal, State, Local and Tribal Regulatory Listings and Search Radii

Database	Search Radius
Integrated Compliance Information System	US 281 Project Corridor
Integrated Compliance Information System National Pollutant Discharge Elimination System	US 281 Project Corridor
Land Use Control Information System	US 281 Project Corridor
Material Licensing Tracking System	US 281 Project Corridor
National Pollutant Discharge Elimination System	US 281 Project Corridor
PCB Activity Database System	US 281 Project Corridor
Permit Compliance System	US 281 Project Corridor
RCRA Sites with Controls	US 281 Project Corridor
Cerclis Liens	US 281 Project Corridor
Section Seven Tracking System	US 281 Project Corridor
Toxics Release Inventory	US 281 Project Corridor
Toxic Substance Control Act Inventory	US 281 Project Corridor
No Longer Regulated RCRA Generator Facilities	US 281 Project Corridor and Adjacent Property
Resource Conservation & Recovery Act – Generator Facilities	US 281 Project Corridor and Adjacent Property
Historical Gas Stations	0.25 mile from US 281 Centerline
Brownfields Management System	0.50 mile from US 281 Centerline
Comprehensive Environmental Response, Compensation & Liability Information System	0.50 mile from US 281 Centerline
No Further Remedial Action Planned Sites	0.50 mile from US 281 Centerline
No Longer Regulated RCRA Non-CORRACTS TSD Facilities	0.50 mile from US 281 Centerline
Open Dump Inventory	0.50 mile from US 281 Centerline
Resource Conservation & Recovery Act – Treatment, Storage & Disposal Facilities	0.50 mile from US 281 Centerline
Delisted National Priorities List	1.0 mile from US 281 Centerline
Department of Defense Sites	1.0 mile from US 281 Centerline
Formerly Used Defense Sites	1.0 mile from US 281 Centerline
No Longer Regulated RCRA Corrective Action Facilities	1.0 mile from US 281 Centerline
National Priorities List	1.0 mile from US 281 Centerline
Proposed National Priorities List	1.0 mile from US 281 Centerline
Resource Conservation & Recovery Act – Corrective Action Facilities	1.0 mile from US 281 Centerline
Record of Decision System	1.0 mile from US 281 Centerline
State of Texas Regulatory Listings	
Groundwater Contamination Cases	US 281 Project Corridor
Historic Groundwater Contamination Cases	US 281 Project Corridor
TCEQ Liens	US 281 Project Corridor
Municipal Setting Designations	US 281 Project Corridor
Notice of Violations	US 281 Project Corridor
State Institutional/Engineering Control Sites	US 281 Project Corridor
Spills Listing	US 281 Project Corridor
Tier II Chemical Reporting Program Facilities	US 281 Project Corridor

Table 3-50: Federal, State, Local and Tribal Regulatory Listings and Search Radii

Database	Search Radius
Dry Cleaner Registration Database	0.25 mile from US 281 Centerline
Industrial and Hazardous Waste Sites	0.25 mile from US 281 Centerline
Permitted Industrial Hazardous Waste Sites	0.25 mile from US 281 Centerline
Petroleum Storage Tanks	0.25 mile from US 281 Centerline
Affected Property Assessment Reports	0.50 mile from US 281 Centerline
Brownfields Site Assessments	0.50 mile from US 281 Centerline
Closed & Abandoned Landfill Inventory	0.50 mile from US 281 Centerline
Innocent Owner / Operator Database	0.50 mile from US 281 Centerline
Leaking Petroleum Storage Tanks	0.50 mile from US 281 Centerline
Municipal Solid Waste Landfills	0.50 mile from US 281 Centerline
Railroad Commission VCP and Brownfield Sites	0.50 mile from US 281 Centerline
Radioactive Waste Sites	0.50 mile from US 281 Centerline
Voluntary Cleanup Program Sites	0.50 mile from US 281 Centerline
State Superfund Sites	1.0 mile from US 281 Centerline
Local Regulatory Listing	
Edwards Aquifer Permits	US 281 Project Corridor
Tribal Regulatory Listings	
Underground Storage Tanks on Tribal Lands	0.25 mile from US 281 Centerline
Leaking Underground Storage Tanks on Tribal Lands	0.50 mile from US 281 Centerline
Open Dump Inventory on Tribal Lands	0.50 mile from US 281 Centerline
Indian Reservations	1.0 mile from US 281 Centerline

Source: GeoSearch Radius Report, April 2014.

3.19.2 Affected Environment

The database search identified 35 permitted and non-regulated facilities that currently store, have stored in the past, or have been impacted by hazardous and regulated materials along the US 281 project corridor, as shown in **Table 3-51**. A residential property located at 27890 US 281 was listed for potential groundwater contamination. This property was deemed an Innocent Owner/ Operator as the BTEX and MTBE hazardous material was from a leaking petroleum storage tank located across the ROW at 27755 US 281. Contaminants likely migrated in groundwater, which flows southwest to northeast in the project area. A description of the databases and the detailed results of the search can be found in **Appendix H**.

Table 3-51: Confirmed Hazardous and Regulated Materials Sites

Site ID	Facility Name/Address	Distance from US 281	Hazardous and Regulated Material	Summary of Database Search
1	**Loop 1604 Toll Starter System** Loop 1604 – From west of NW Military to east of Judson Road San Antonio, TX 78258	0.001 mile E	Not Available	This facility is subject to environmental regulations. A site assessment was conducted in 2006 in association with an Edwards Aquifer Permit (EAP) which concluded that using a sand filter is the best management practice for this facility.

Table 3-51: Confirmed Hazardous and Regulated Materials Sites

Site ID	Facility Name/Address	Distance from US 281	Hazardous and Regulated Material	Summary of Database Search
2	**US 281** Along US 281 - From Loop 1604 to Marshall Road.	0.001 mile NE	Not Available	A site assessment was completed in 2006 in association with an EAP which concluded that vegetative filter strips and swales are the best management practice for this facility. A compliance report was later issued for 1 acre of the 174 acre area.
3	**US 281 at Borgfeld Dr.** From north of Bulverde Road to the Bexar/Comal County line.	0.001 mile N	Not Available	A site assessment was completed in 2005 in association with an EAP which concluded that vegetative filter strips and swales are the best management practice for this facility.
4	**US 281 at Loop 1604** From 0.34 mile north of Loop 1604 to 0.47 mile north of Loop 1604.	0.010 mile NE	Not Available	A site assessment was completed in 1999 in association with an EAP; however, no actions or recommendations were provided.
5	**Ram Store 24 Tetco Store 310** **Cowboy Cleaners 6** 27755 US 281 N San Antonio, TX 78260	0.010 mile W	Gasoline – 0 active and 3 removed underground storage tanks Dry Cleaning Chemicals	The Ram Store reported an underground petroleum storage tank leak in 1999 that resulted in groundwater impacts to water supply wells within ¼ mile. Corrective action was taken and the case was closed. The Ram Store also received three minor citations from TCEQ in 2007 for violation of water quality regulations. The Tetco Store 310, a gas station, is listed as having removed 3 underground petroleum tanks from the ground in 2008. And, Cowboy Cleaners 6 is a registered dry cleaning facility with TCEQ.

Table 3-51: Confirmed Hazardous and Regulated Materials Sites

Site ID	Facility Name/Address	Distance from US 281	Hazardous and Regulated Material	Summary of Database Search
6	**The Iron Skillet Carryon** 26715 US 281 N San Antonio, TX 78260	0.010 mile S	Gasoline – 5 active underground storage tanks Diesel - 1 inactive above ground storage tank	Carryon contains 4 active underground petroleum storage tanks which are legally authorized. The Iron Skillet owns 1 legally authorized above ground petroleum storage tank which is not active and 1 active underground storage tank that was reported to have leaked (no date provided) but did not result in groundwater impacts. In 2007 The Iron Skillet received two moderate citations from TCEQ for violations of waste storage regulations. In addition, The Iron Skillet was involved in litigation involving compliance with EPA regulations; however, the details of this case are not disclosed.
7	**Dailey Car Wash** **Jabez Territory Supplies** **Mark William Dailey** 25661 US 281 N San Antonio , TX 78258	0.010 mile SE	Car Wash Chemicals Landscaping Supplies	Dailey Car Wash and Jabez Territory Supplies are listed on the Federal Registry System and therefore subject to environmental regulations. Mark William Dailey, a landscape irrigation system installation business, was given three moderate citations in 2008-09 for violations associated with business practices.
8	**Parrish & Co.** 26995 US 281 N San Antonio , TX 78260	0.010 mile NW	Not Available	Parrish & Co. is listed on the Federal Registry System and therefore subject to environmental regulation. In 2006, this establishment was reported to have spilled an undisclosed material/amount into the Cibolo Creek. After inspection by the Bexar County Fire Marshall's Office the case was closed.
9	**Stonegate Substation (VO)** 25529 US 281 N San Antonio, TX 78258	0.010 mile N	Sulfuric Acid	Stonegate Substation is an electric bulk power transmission and control facility that stores sulfuric acid in its control house. The facility has passed all validation checks.
10	**Ferrell Gas** 26585 US 281 N San Antonio, TX 78260	0.010 mile SE	Liquefied Petroleum Gas	Ferrell Gas is reported to have liquefied petroleum gas on the property. This facility has passed all validation checks.
11	**Winchester Hills** US 281 and Marshall Road. San Antonio, TX 78259	0.010 mile SE	Not Available	Winchester Hills is a residential neighborhood managed by a homeowner's association that is listed on the Federal Registry System and therefore subject to environmental regulations.
12	**US 281 Southbound Frontage Road**	0.020 mile S	Not Available	A site assessment was completed in association with an EAP (no date provided) and no actions or recommendations were

Table 3-51: Confirmed Hazardous and Regulated Materials Sites

Site ID	Facility Name/Address	Distance from US 281	Hazardous and Regulated Material	Summary of Database Search
	From Henderson Pass Road. to Loop 1604			provided.
13	**Ancira Enterprises Ancira Chrysler** 24000 US 281 N San Antonio, TX 78528	0.020 mile SE	Gasoline – 1 active above ground storage tank	Ancira is reported to have gasoline on the property which is stored in an above ground storage tank. This facility has passed all validation checks.
14	**Speedy Stop 31** 22255 US 281 N San Antonio, TX 78258	0.020 mile W	Gasoline – 2 removed underground storage tanks	Speedy Stop had 2 gasoline underground storage tanks on property which were removed in 2005.
15	**David Arkerman (Chevron)** 24341 US 281 N San Antonio, TX 78260	0.020 mile NW	Gasoline – 1 removed underground storage tank	The Chevron station had 1 gasoline underground storage tank on property which was removed in 1987.
16	**Weekley 281 Venture** 26443 US 281 N San Antonio, TX 78260	0.020 mile W	Not Available	Weekley 281 Venture is listed on the Facility Registry System and is therefore subject to environmental regulation.
17	**Five Star Cleaners** 20821 US 281 N San Antonio, TX 78258	0.020 mile S	Dry Cleaning Chemicals	Five Star Cleaners is a registered dry cleaning facility with TCEQ.
18	**Residential Property** 27890 US 281 N San Antonio, TX 78260	0.030 mile SE	BTEX, MTBE	Hazardous and regulated materials have been identified on this residential property that may impact groundwater but which has been traced to a source outside the property. As such, the property owner is not held liable for the contamination.
19	**Bigs 205** 23650 US 281 N San Antonio, TX 78258	0.040 mile SE	Gasoline – 2 active underground storage tanks	Bigs is reported to have 2 legally authorized active underground storage tanks for gasoline.
20	**Speedy Stop 48** 26950 US 281 N San Antonio, TX 78260	0.040 mile SE	Gasoline/Diesel – 3 active underground storage tanks	Speedy Stop is reported to have 3 legally authorized active underground storage tanks, 2 store gasoline and 1 stores diesel.
21	**San Antonio Water System – Oliver Ranch** 26293 US 281 N San Antonio, TX	0.080 mile W	Chlorine	San Antonio Water System stores liquid chlorine on its property. This facility has passed all validation checks.

Table 3-51: Confirmed Hazardous and Regulated Materials Sites

Site ID	Facility Name/Address	Distance from US 281	Hazardous and Regulated Material	Summary of Database Search
	78258			
22	**Five Star Cleaners** 20770 US 281 N, Ste. 107 San Antonio, TX 78258	0.120 mile SE	Dry Cleaning Chemicals	Five Star Cleaners is a registered dry cleaning facility with TCEQ.
23	**Martin Marietta Materials – San Pedro Plant** 19265 US 281 N San Antonio, TX 78258	0.120 mile W	Diesel – 1 active above ground storage tank	Martin Marietta Materials is reported to have 1 legally authorized active above ground storage tank for diesel.
24	**Estates Utility Stonegate** 2363 Estate Gate Dr. San Antonio, TX 78260	0.120 mile W	Chlorine	Estates Utility Stonegate is reported to store chlorine on its property. This facility has passed all validation checks.
25	**Hill Country Dry Cleaners** 18160 US 281 N, Ste. 601 San Antonio, TX 78232	0.120 mile SE	Dry Cleaning Chemicals	Hill Country Dry Cleaners is a registered dry cleaning facility with TCEQ.
26	**Henshaw Brothers Grocery** 26098 US 281 N San Antonio, TX 78258	0.130 mile E	Gasoline – 3 removed underground storage tank	Henshaw Brothers Grocery had 3 gasoline underground storage tanks on property, one of which was reported to have leaked in 1994. The leak was reported to have impacts to the Edwards Aquifer recharge or transition zones. All 3 tanks were removed later that year. Final concurrence was issued and the case is closed.
27	**Wal-Mart Supercenter 1198** 1515 N Loop 1604 E San Antonio, TX 78258	0.160 mile W	Not Available	Wal-Mart has 1 legally authorized active underground storage tank with the capacity of under 1 gallon that stores an undisclosed material.
28	**Contractors Yard** 26254 US 281 N San Antonio, TX 78216	0.170 mile E	Gasoline/Diesel – 4 inactive above ground storage tanks	Contractors Yards has 3 diesel and 1 gasoline storage tank on property which are currently out of use.
29	**San Antonio Water System – Encino Park #2** 19754 US 281 N	0.170 mile SE	Chlorine	San Antonio Water System stores liquid chlorine on its property. This facility has passed all validation checks.

Table 3-51: Confirmed Hazardous and Regulated Materials Sites

Site ID	Facility Name/Address	Distance from US 281	Hazardous and Regulated Material	Summary of Database Search
	San Antonio, TX 78259			
30	**Cowboy Cleaners** 28120 US 281 N San Antonio, TX 78260	0.170 mile NE	Dry Cleaning Chemicals	Cowboy Cleaners is a registered dry cleaning facility with TCEQ.
31	**The Home Depot #6550** 20740 US 281 N San Antonio, TX 78259	0.190 mile SE	Sulfuric Acid, NOs, Aerosols, Gasoline, Mercury, Peroxide, Oxidizers, Compressed Oxygen and Gas, Fertilizer & Pesticides, Paints & Stains, Propane, Bleach, Fluorescent Light Bulbs, Lead Acid Batteries, and Others	Home Depot has been classified as a small quantity generator, non-industrial hazardous waste site. This facility stores Sulfuric Acid for which a validation check has been completed. This facility has been reported to have had a leaking petroleum tank (no date or details provided) which impacted groundwater but had no apparent impacts to receptors.
32	**D&D Machinery Sales** 2420 WR Larson Rd San Antonio, TX 78261	0.220 mile SE	None	D&D Machinery Sales was registered as a small quantity generator of hazardous waste; however, this registration was deactivated as no waste was produced over three consecutive years.
33	**Pilgrim Cleaners 346** 2339 E. Evans Rd., Ste. 112 San Antonio, TX 78259	0.250 mile SE	Dry Cleaning Chemicals	Pilgrim Cleaners is a registered dry cleaning facility with TCEQ.
34	**MCI – SWCOTX** 20855 Stone Oak Pkwy. San Antonio, TX 78258	0.320 mile W	Sulfuric Acid	MCI stores sulfuric acid on its property. This facility has passed all validation checks.
35	**Costco #693** 1201 N Loop 1604 E. San Antonio, TX 78232	0.430 mile W	Sulfuric Acid, Lead Acid Batteries	Costco stores sulfuric acid and lead acid batteries on its property. This facility has passed all validation checks.

Source: GeoSearch Radius Report, April 2014.

Petroleum Storage Tanks Sites and Leaking Storage Tanks

Based on a detailed review, there are 14 sites within the hazardous and regulated materials study area that are reported to have or have had petroleum storage tanks on their property. Eight of the fourteen sites actively use the tanks to store gasoline and diesel fuel. Five of the fourteen sites reported storing petroleum in underground tanks. Four sites have reported leaking tanks in the past, three of which remain actively in use. As there have been four incidents of leaking petroleum tanks within the study area, there is some potential for risk of encountering hazardous and regulated materials along the US 281 project corridor. The

Iron Skillet, at 26715 US 281 N, was reported to have leaked gasoline (no date reported); however, no impacts to groundwater or receptors were documented. Final concurrence was issued for The Iron Skillet leak, the case was closed and the tank is still actively in use. The Ram Store 24, at 27755 US 281 N, was reported to have leaked gasoline in 1999 that resulted in ground water impacts and impacts to water supply wells within one-quarter mile. Final concurrence was issued for The Ram Store leak, the case was closed, and the tank is still in active use. Henshaw Brothers Grocery, at 26098 US 281 N, was reported to have leaked gasoline in 1994 resulting in impact to the Edwards Aquifer recharge or transition zones. Final concurrence was issued for this leak, the case was closed and the tank was removed from the ground. Home Depot, 20740 US 281 N, was reported to have leaked petroleum (no date provided) which resulted in ground water impacts but no apparent threat to receptors. Final concurrence has been issued for the Home Depot leak, the case was closed and the tank remains in active use.

Other Hazardous and Regulated Materials

In addition to sites identified above as storing or having had stored petroleum on their property, 15 sites are reported to store other hazardous and regulated materials in the hazardous and regulated materials study area. Six of these sites are dry cleaning establishments which are currently registered and in compliance with TCEQ regulations. Other regulated materials that exist within the study area include stored chlorine, sulfuric acid, and propane gas; all sites that store these hazardous and regulated materials are in compliance with the Tier II Chemical Reporting Program and have passed all validation checks. The potential risk associated with these sites is low as the database search revealed no reported leaks or violations.

Oil and Gas Well Sites

The RRC website identified no natural gas wells or pipelines within the US 281 project corridor. Based on the review of available information associated with oil and gas wells and pipelines, the potential for impacts resulting from the Build Alternatives is low.

3.19.3 Environmental Consequences

No-Build Alternative

This desktop level of review reveals that the 35 sites identified within the hazardous and regulated materials study area are currently in compliance with environmental regulations and that past violations have been remedied and all cases are closed. As such, it is unlikely that the No-Build Alternative, which does not involve construction or acquisition of ROW, would result in the disturbance of hazardous and regulated materials. Therefore, there likely would be no effect under the No-Build Alternative.

Build Alternatives

The location of each site identified in the database search was compared with the footprints of the Build Alternatives, which includes the proposed roadway and the proposed ROW, to determine if hazardous and regulated material sites could be impacted. The Build Alternatives were then compared to each other based on whether their proposed footprints could affect any portion of the properties identified above. As shown in **Table 3-52**, the Elevated Expressway Alternative has the potential to impact eight properties that currently have or have had in the past, hazardous and regulated materials on site and the Preferred Expressway Alternative has the potential to impact nine properties.

Table 3-52: Properties Impacted by Alternatives and Hazardous and Regulated Material Sites

Alternative	Number of Properties Identified with Hazardous and Regulated Materials that could be Impacted by the US 281 Corridor Project	
No-Build Alternative	0	None
Elevated Expressway Alternative	8	1 - leaking petroleum storage tank (case closed) 1 - hazardous materials spill (case closed) 1 - property with known hazardous material contamination 5 - properties that are regulated for hazardous and regulated materials
Preferred Expressway Alternative	9	2 – leaking petroleum storage tanks (cases closed) 1 – property with notice of violation; operating without permit (case closed) 1 – hazardous materials spill (case closed) 1- innocent owner property with potential groundwater contamination from a leaking petroleum storage tank on property across ROW (case closed) 4 – properties that are regulated for hazardous and regulated materials

Source: US 281 EIS Team, GeoSearch, April 2014.

As shown, the Build Alternatives are generally comparable with the exception that the Preferred Expressway Alternative has the potential to impact two properties that have had leaking petroleum storage tanks on site, as compared to one property for the Elevated Expressway Alternative. If a Build Alternative is identified in the ROD, subsurface investigations will need to be considered within the vicinity of leaking petroleum storage tanks sites to determine if hazardous materials from any of these facilities have adversely affected the subsurface conditions of the areas within the footprint.

Below are some considerations associated with the implementation of a Build Alternative:

- Any bridge or existing roadway pavement demolition could disturb potentially contaminated soils and would require the relocation of existing extensive utilities traversing the US 281 project corridor
- The proposed US 281 Corridor Project may involve excavation at locations where there are existing pipelines, utilities, ROW easements, and/or existing or abandoned railroad crossings, tracks, and ancillary equipment (such as crossties, switches, rail, trim, fasteners) which may require further assessment to evaluate potential releases
- Data on the existence of water wells within the one-half mile of the US 281 project corridor was gathered via a search of Texas Water Development Board records, (See **Section 3.9.2 Water Quality – Groundwater** for detailed discussion).
- No evidence of oil and gas well activities located within the boundaries of the proposed project area was determined based on aerial photography and a database search; however, additional assessment may be required for confirmation of these findings

Any unanticipated hazardous materials and/or petroleum contamination encountered during construction would be handled according to applicable state and federal regulations and TxDOT Standard Specifications and Guidelines for handling emergency discovery of hazardous materials.

If any structures are disturbed during construction activities, an Asbestos Survey and lead-based paint survey would be completed to comply with EPA regulation (40 CFR 61, Subpart M - *National Emissions Standard for Hazardous Air Pollutants*), the *Texas Asbestos Health Protection Rules* (25 TAC 295.31 - .71) and the EPA regulation (40 CFR Part 745 - *EPA Lead; Renovation, Repair, Painting Program*). These regulations require that, prior to any construction, renovation, or demolition, the area where work is to be performed shall be inspected by a properly trained and licensed individual for the presence of asbestos-containing materials and lead-based paint that may be disturbed during the work.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative would include non-toll general purpose lanes and managed lanes. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore, the impacts to hazardous/regulated materials would not change based on funding options.

3.19.4 Conclusion and Proposed Mitigation Measures

This database search should be considered as an initial screening assessment to indicate areas of potential concern for further study or precautionary actions. These limitations should be recognized when consideration is given to the Build Alternatives.

Any unanticipated hazardous materials and/or petroleum contamination encountered during construction would be handled according to applicable federal and state regulation per TxDOT Standard Specifications.

The contractor would take appropriate measures to prevent, minimize, and control the spill of hazardous materials in the construction staging area. The use of construction equipment within sensitive areas would be minimized or eliminated entirely. All construction materials used for this project would be removed as soon as work schedules permit.

3.20 VISUAL AND AESTHETIC QUALITIES

3.20.1 Methodology

This evaluation utilizes the guidance developed by FHWA for the assessment of visual impacts: *Esthetics and Visual Quality Guidance Information* (1986), *Environmental Impact Statement Visual Impact Discussion* (undated), and *Visual Impact Assessment for Highway Projects* (1981).

There are two groups that could potentially be visually and aesthetically impacted by the US 281 Corridor Project: (1) individuals with a view from the road (roadway users), and (2) individuals with a view of the road (roadway viewers). This visual experience of the aesthetic quality of an area depends upon land, waterbody, vegetation and human development patterns.

Evaluating Visual and Aesthetic Change - Roadway Viewers

The existing US 281 project corridor generally follows the contours of the land with many cuts into the landscape. The roadway is visible from many adjacent properties that have an unencumbered view (not blocked by vegetation, terrain and/or other structures or buildings). Both of the Build Alternatives contemplate improvements that would elevate segments of the roadway higher than the existing US 281 roadway. This change would mean that existing roadway viewers could have a more prominent view of the roadway and/or there could be new roadway viewers.

GIS modeling was used to estimate the number of existing and future roadway viewers. A baseline condition was established using the contours of the landscape and the elevation of the existing US 281 roadway. An elevation point was placed every 500 feet along the roadway and a viewshed was mapped in order to estimate where roadway viewers are located. The visual changes were then modeled based on the proposed elevation of the roadway and structure, as contemplated for the Build Alternatives (see **Appendix K1**). An elevation point was mapped along the roadway every 500 feet and at the locations of other proposed elevation changes, such as at overpasses, on and off ramps, and at US 281/Loop 1604 interchange direct connectors for both of the Build Alternatives.

A roadway viewer was counted if a land parcel was within the mapped viewshed. It is assumed that a roadway viewer is located six feet above the ground (such as from a first floor window) and that there are no encumbered views. This is likely to overestimate the number of roadway viewers as there are likely many views of US 281, particularly in residential neighborhoods, that are blocked by vegetation, homes or other structures.

Visual and Aesthetic Change – Design Theme

In an effort to maintain regional identity within the project corridor TxDOT requires that aesthetic treatments for the roadway, structures, drainage, and landscaping elements of the project would be designed to harmonize with the local landscape and architecture. This applies to the materials used, the finish and color applied, lighting, landscaping, and signage in the project corridor. The U.S. 281 project corridor falls within the Hill Country Region identified by TxDOT - San Antonio District's *Urban Design Themes for Bexar and Outlying Counties*. The Hill Country Region is defined as the north and west regions of San Antonio outside of IH 410. This design theme consists of simple materials that translate the historical architecture of Hill Country towns into modern structures of the highway.

Roadway Viewer Response

According to FHWA guidance, a change in viewer exposure is typically assessed by measuring the number of viewers exposed to the change and the position of the viewer. The position of the viewer is described in the guidance as three distinct viewing distances, foreground (0 to 0.25 mile from the roadway), middleground (0.25 to 3 miles from the roadway) and background (greater than 3 miles from the roadway). Roadway viewers located in the foreground are anticipated to have direct exposure to the change and are analyzed here; effects to middleground and background viewers are described in **Chapter 4 – Indirect Effects**.

Visual sensitivity is a relative measure of the degree of concern that a roadway viewer may have in response to the change. Viewer sensitivity is determined by evaluating the type of land use and viewing duration. Different viewer types have different sensitivities. Residential land uses are typically the most sensitive to change because a view of a roadway is generally perceived as negative and residential land uses are occupied day and night. Commercial uses however, are primarily occupied only during working hours and increased visibility of a business is generally perceived as positive.

Evaluating Visual and Aesthetic Change - Roadway Users

Roadway users have a temporary and changing view of the surrounding landscape and land uses as they travel through the US 281 project corridor, as such, they generally have less exposure and sensitivity to the visual and aesthetic conditions compared to roadway viewers. The viewshed models used for roadway viewers were also used to estimate the area likely to be visible from the roadway.

3.20.2 Affected Environment

The US 281 project corridor is located within the Edwards Plateau ecological region of Texas, which is characterized by steep hillsides, pastoral fields and oak and juniper parks and forests. Much of the natural landscape around the US 281 project corridor has been altered by commercial and residential development, especially the southern portion. The southern portion of the US 281 project corridor consists of a viewshed mainly composed of large retail shopping centers, multi-family and single-family residences.

Traveling north from Loop 1604, the roadway user will see the large limestone wall that delineates several acres of a quarry located on the west side of the US 281 project corridor. There are open expanses of cleared lands, devoid of vegetation, which appear to be prepared for development. The tallest structures seen by the roadway user are several water towers, power lines and cell phone towers on both sides of the roadway. As the roadway user passes The Village at Stone Oak, a large retail shopping center in the northeast quadrant of the US 281 and Stone Oak Parkway intersection, the viewshed becomes less dominated by development and includes areas with large tracts of native trees and shrubs interspersed with small businesses (adjacent to the US 281 project corridor) and single-family residences (set back from the US 281 project corridor).

Roadway viewers have a viewshed similar to the roadway user in that it is mainly composed of parking lots, driveways and the current US 281 facility. The roadway viewer sees the highway against a backdrop of homes and businesses. There are currently no sidewalks except for a few signalized cross walks at intersections where the US 281 Super Street was constructed. In the northern portion of the corridor, past Stone Oak Parkway, the viewer will see the highway amongst more natural topography with denser areas of native vegetation.

There are several residential neighborhoods and apartment complexes as well as large lot residential properties located in proximity to the existing US 281 project corridor. Some of the residents in these areas are existing roadway viewers and some could become new roadway viewers as a result of the Build Alternatives. From south to north, the residential neighborhoods include:

- Redland Ridge neighborhood
- The Ravina Apartments
- Encino Park neighborhood
- Big Springs neighborhood
- Villages at Encino Park neighborhood
- Stone Oak neighborhood
- The View at Encino Commons (Apartments)
- Cavalo Creek Estates neighborhood
- Oakridge Heights neighborhood
- Encino Ridge neighborhood
- Evans Ranch neighborhood
- Winchester Hills neighborhood
- The Oaklands neighborhood
- Mountain Lodge neighborhood
- Sendero Ranch neighborhood
- Summerglen neighborhood
- Lookout Canyon neighborhood
- Belterra neighborhood
- Tuscan Oaks neighborhood
- The Estates of Stonegate neighborhood
- Trinity Oaks neighborhood
- Large lot residential properties north of Bulverde Road

Southern US 281 Corridor

Photo: US 281 EIS Team, 2011

Northern US 281 Corridor

Photo: Google, 2012

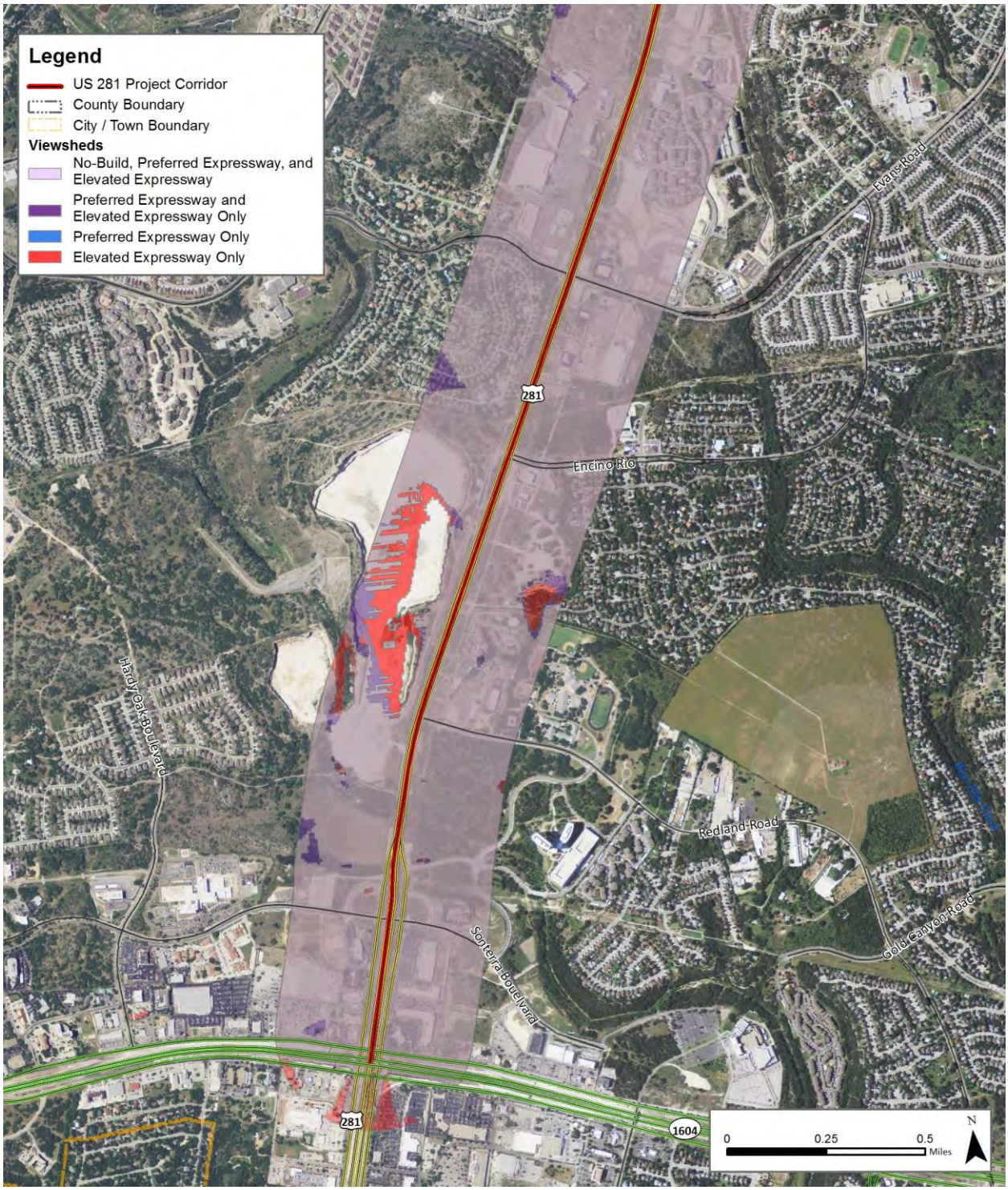
3.20.3 Environmental Consequences

No-Build Alternative

US 281 is currently visible to most of the properties located in the foreground viewshed of the US 281 project corridor (**Figure 3-41a** through **Figure 3-41c**). Approximately 795 residential properties within the existing foreground viewshed.

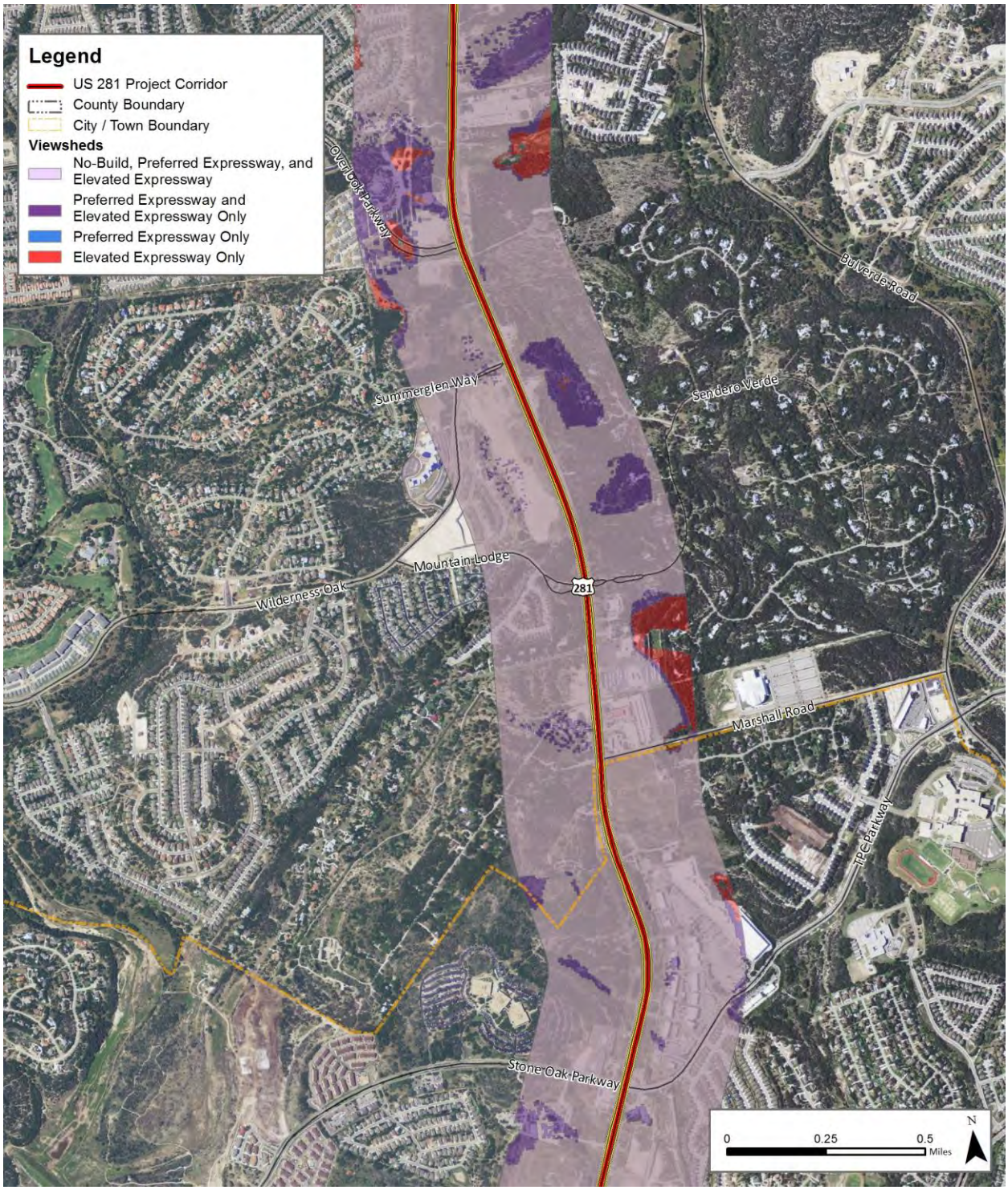
The No-Build Alternative does not propose changes to the US 281 project corridor so would not increase or decrease the exposure for either roadway viewer or roadway user. As such, the No-Build Alternative would have no direct effect on the visual and aesthetic quality of the project corridor.

Figure 3-41a: Foreground viewshed



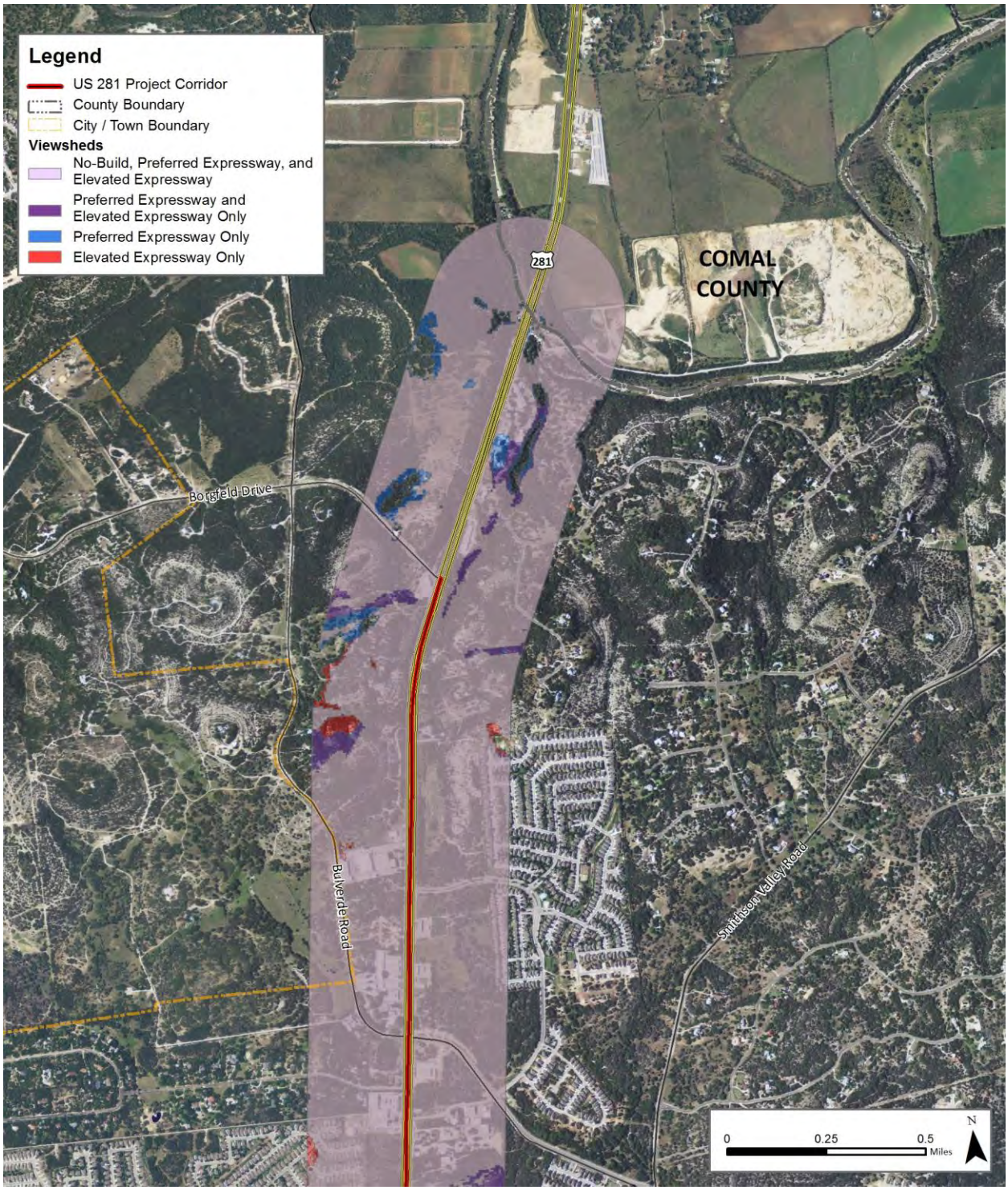
Source: US 281 EIS Team, 2014

Figure 3-41b: Foreground viewshed



Source: US 281 EIS Team, 2014

Figure 3-41c: Foreground viewshed



Source: US 281 EIS Team, 2014

Elevated Expressway Alternative

The proposed elevated structure would traverse the length of the US 281 project corridor at a typical height of 25 feet to 35 feet and could rise to approximately 60 feet where on and off ramps are located. **Figure 3-42** provides a conceptual illustration of the Elevated Expressway Alternative at Evans Road.

Figure 3-42: Foreground viewshed

Source: US 281 EIS Team, 2010

The elevated structure, on and off ramps, and elevated US 281/Loop 1604 interchange direct connectors of the Elevated Expressway Alternative would create a larger foreground viewshed than the No-Build Alternative and the Preferred Expressway Alternative, as shown in **Figure 3-41a** through **Figure 3-41c**.

Approximately 814 residential properties would be within the foreground viewshed of the Elevated Expressway Alternative; this is 31 more than the No-Build Alternative and 12 more than the Preferred Expressway Alterative. It is likely that roadway viewers that have a more prominent or new view of the US 281 project corridor would respond more negatively; particularly residential viewers who are more sensitive to change. Roadway users would have an elevated and more expansive view of the surrounding landscape for a longer period of time traveling on the Elevated Expressway Alternative when compared to the Preferred Expressway Alternative and the No-Build Alternative. The increased exposure for the roadway user would likely be pleasant.

Preferred Expressway Alternative

The Preferred Expressway Alternative could impact the visual and aesthetic quality of the US 281 project corridor for the roadway user and roadway viewer. On an individual scale, visual impacts would occur where the visual resources have a marked change from previous conditions. Marked changes would occur where the cleared open space adjacent to the existing ROW would be converted into frontage roads and landscaping; and where the roadway would be vertically elevated approximately 25 to 35 feet at proposed overpasses (Redland Road, Encino Rio, Evans Road, Stone Oak Parkway, Marshall Road, Wilderness Oak, Overlook Parkway, Bulverde Road and Borgfeld Drive), at the VIA Park and Ride Facility, and at the US 281/Loop 1604 interchange direct connectors.

The construction of the Preferred Expressway Alternative would change the landscape of the US 281 corridor. In an effort to provide a visual representation of that change an artist's rendition of the US 281 corridor was commissioned based on the Preferred Expressway Alternative (**Figure 3-43a** through **Figure 3-43c**). This visualization uses before and after depictions to show what is now in place within the corridor as well as renditions that show the final project design. The visualization is viewable at the US 281 website under the "What's New!" column on the right hand side titled "Draft Preferred Alternative Visualization." The website address is, www.411on281.com

Figure 3-43a: Visualization of US 281 – Looking northbound north of Encino Rio

US 281 EIS Team, 2014, Google Maps, 2014

Figure 3-43b: Visualization of US 281 – Looking southbound north of Stone Oak Parkway

Source: US 281 EIS Team, 2014, Google Maps, 2014

Figure 3-43c: Visualization of US 281 – Looking southbound near the VIA Park and Ride Facility

Source: US 281 EIS Team, 2014, Google Maps, 2014

The elevated overpasses, direct connector to the VIA Park and Ride Facility, and the US 281/Loop 1604 interchange direct connectors would increase the size of the foreground viewshed over the existing condition, thereby increasing the number of residential properties with potential views of US 281 (**Figure 3-41a** through **Figure 3-41c**).

There would be approximately 814 residential properties within the foreground viewshed of the Preferred Expressway Alternative, approximately 19 more residential properties over the No-Build Alternative and 12 less than the Elevated Expressway Alternative. Residential roadway viewers may respond negatively to the change because they would have a more prominent or new view of the structure itself or the lighting, and because this change would be permanent and on-going. The change in viewshed for the roadway user as a result of the Preferred Expressway Alternative may be perceived as positive where the elevated overpasses would offer a new, more expansive view of the surrounding landscape and land uses. These beneficial effects are expected to be negligible because traffic speeds on the corridor are anticipated to increase (see **Section 3.6 Transportation Facilities**) and the exposure time to these new views would be fleeting.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Elevated Expressway Alternative is being considered for non-toll, toll and managed lane funding options and the Preferred Expressway Alternative is would include non-toll general purpose lanes and managed lanes. Visual impacts of tolling would be negligible as tolling equipment would be limited to only a few locations and consist of only minor amount of additional signage and lighting.

3.20.4 Conclusion and Proposed Mitigation Measures

The US 281 project corridor from Loop 1604 to Borgfeld Drive provides a view of commercial and residential development. The northern portion of the corridor is less dominated by development and includes areas with large tracts of native trees and shrubs interspersed with small businesses (adjacent to US 281) and single-family residences (set back from the US 281). Both roadway users and roadway viewers would be impacted by either of the Build Alternatives. The Elevated Expressway Alternative has the highest potential to negatively impact residential roadway viewers and positively impact for roadway users. **Table 3-53** compares the estimated number of residential roadway viewers that could be affected by each alternative.

Table 3-53: Residential Properties within the Foreground Viewshed

Alternative	Number of Residential Properties
No-Build Alternative	795
Elevated Expressway Alternative	826
Preferred Expressway Alternative	814

Source: US 281 EIS Team, 2012

Negative impacts on roadway viewers will be mitigated, where practicable, by landscaping and aesthetic treatments. All lighting for the Build Alternatives will be acceptable fixtures that meet or exceed the COSA City Code – Section 35-339.04 and Bexar County Commissioners Court Regulation No. 12.501.072208 for "full cutoff" criteria (no light output emitted above 90 degrees at any lateral angle around the fixture). The US 281 project corridor falls within the Hill Country Region identified by TxDOT - San Antonio District's *Urban Design Themes for Bexar and Outlying Counties*. The design themes provide guidance on aesthetic form, function, and appearance of new highway elements in Bexar County. Visual aesthetic and landscaping treatments for the US 281 Corridor Project would mirror the Hill Country Region theme, consisting of simple materials that translate the historical architecture of Hill Country towns into modern structures of the highway.

3.21 ENERGY REQUIREMENTS

3.21.1 Methodology

The anticipated impacts related to energy consumption were assessed qualitatively based on the forecasted future traffic operations (see **Section 3.6 Transportation Facilities**), construction activities, and the likely requirements for on-going maintenance.

3.21.2 Affected Environment

The US 281 project corridor has experienced significant growth over the past decade and today is largely developed, with single- and multi- family subdivisions, and commercial and retail businesses line the US 281 project corridor on both sides. The current vehicle fuel consumption is a function of the operational characteristics of the US 281 project corridor. A 2009 study conducted by TxDOT reported that US 281 from Loop 1604 to the Comal County line is the thirty-eighth (out of 100) most congested roadway segment in Texas. According to the study the US 281 corridor experienced over 149,000 annual hours of delay per mile in 2009 and incurred a cost of $25.67 million in lost time and wasted fuel as a result of congestion (TxDOT 2010a). Today, 75 percent of the US 281 corridor is operating at a level of service (LOS) E or F (LOS A being the best traffic condition and F being the worst - see **Section 3.6 Transportation Facilities** for more details).

Energy consumption associated with maintenance activities currently includes energy used to patch and re-surface the roadway and other activities that provide a safe surface for transportation.

3.21.3 Environmental Consequences

No-Build Alternative

By 2035, the average number of vehicles traveling on the US 281 project corridor is anticipated to grow and congestion is expected to worsen if no improvements are made. By 2035, 100 percent of the US 281 project corridor will be operating at a LOS E or F. It is expected that some traffic, that would otherwise use the US 281 project corridor, will use parallel corridors instead, (such as Bulverde Road and Blanco Road) as a result of diminished operational conditions on the US 281 project corridor. Vehicular fuel consumption would continue to increase under the No-Build Alternative as traffic congestion increases.

By 2035 it is likely that the useful life of the existing roadway will expire. As the infrastructure ages and deteriorates, it is expected that the need for on-going maintenance will increase, thus increasing maintenance energy consumption.

Build Alternatives

Both Build Alternatives would improve the LOS on the US 281 project corridor. By 2038 the Preferred Expressway Alternative would offer LOS A and B throughout most of the corridor. The improved operations of the roadway would reduce the annual hours of delay experienced by US 281 project corridor motorists as well as the amount of wasted fuel resulting from congestion.

The fuel consumption for long-term maintenance is expected to be greater for the Build Alternatives when compared to the No-Build Alternative because there would be a greater area of roadway surface to maintain. However, the Build Alternatives would also extend the useful life of the US 281 project corridor, so major maintenance repairs are expected to occur less frequently.

Construction of either of the Build Alternatives would require the short-term consumption of energy including the fuel used by construction vehicles and the energy required to produce construction materials. Some construction activities associated with the Build Alternatives are likely to be intensive (e.g., earthwork, paving) and would expend energy.

3.21.4 Conclusion and Proposed Mitigation Measures

The No-Build Alternative would not consume short-term energy resources associated with construction but would likely require more energy as a result of congestion and the fuel consumption of roadway users, and for on-going maintenance when compared to the Build Alternatives. The Build Alternatives would require short-term, and potentially intensive use of energy resources during construction however, the improvements are likely to reduce long-term consumption of energy.

Several mitigation strategies have been contemplated that could reduce the amount of energy consumed during construction activities:

- Maximize the use of on-site and/or local materials to reduce haulage of materials
- Use repetitive design dimensions to allow for the re-use of forms
- Turn off construction equipment when they are not in use
- Locate construction staging areas and access road to reduce the distances traveled
- Plan construction phasing and detour routes such that they minimize congestion for motorists.

3.22 RELATIONSHIP OF LOCAL SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

An industrial society is highly dependent on transportation. Urbanized development is an integral part of the existing environment. The US 281 Corridor Project would be vital to a much larger transportation system serving the San Antonio area. The proposed project would provide a faster, safer, and more efficient transportation system. It would become a vital component of the overall transportation network in Bexar and Comal counties.

Highways and their construction are classified as long-term productive facilities. The goal in highway construction is to create a facility that fulfills the need for transportation service, is compatible with today's land use, and enhances future development. The long-term objective is to provide the most beneficial means of serving those wishing to use the system with the least amount of money expended for continued maintenance and enhancement. The present land use would possibly experience some degree of change, as these changes would be regulated and controlled to a large degree by the various governmental agencies (local and state) that are responsible for planning and zoning. The facility would enhance accessibility to adjacent sites increasing their value and/or potential for development.

There would be some degree of adverse impacts during construction resulting from the additional noise, dust, and to some extent, mud which is inherent to highway construction despite stringent control measures for temporary erosion and dust prevention. Potential short-term loss of productivity would occur during construction due to congestion delay and temporary access closure. Potential short-term benefits to the local economy are in employment opportunities and increased business with local merchants by the contractor's work force. These benefits would be minor.

3.23 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The implementation of either Build Alternative involves the commitment of natural, physical, human and fiscal resources. Land utilized in the construction of a roadway is considered an irreversible commitment during the period that the land is used as a transportation facility; however, if a greater need arises for the use of the land, or if the roadway facility is no longer needed, the land can be converted to another use. Presently, there are no reasons to consider that such a conversion would ever be necessary or desirable. Considerable amounts of labor, construction material and fuel would be expended as a result of the construction of the US 281 Corridor Project. Additionally, substantial amounts of labor and natural resources would be required in the fabrication and the preparation of the construction materials. Although these materials are generally irretrievable, they are not considered to be in short supply and the use of these materials would not result in an adverse effect upon the continued availability of these resource materials. Any construction would also require a substantial expenditure of local, state, and federal funds, which are not retrievable. All projects that are proposed for federal and/or state funds were 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 fiscal programming of the US 281 Corridor Project. The commitment of these resources is based on the concept that residents in the immediate area, region and state would benefit by the improved quality of the transportation system. These benefits would include, but not be limited to, improved accessibility and safety, savings of time, and a greater availability of quality services. These benefits are anticipated to outweigh the commitment of resources for the construction of the proposed project.

There would be irretrievable and irreversible commitments of land, material and capital used in the construction of either Build Alternative. The No-Build Alternative would involve no irreversible or irretrievable commitment of human and/or natural resources.

3.24 CONSTRUCTION

The US 281 Corridor Project would be constructed in two phases. The first phase would occur between Loop 1604 and Stone Oak Parkway and the second phase would occur between Stone Oak Parkway and Borgfeld Drive. These two phases may overlap slightly and would depend upon when ROW acquisition is complete for the second phase of the project. The following summarizes the temporary impacts that may occur during the construction of the US 281 Corridor Project as well as proposed mitigation measures.

Prior to construction a traffic control plan would be prepared to manage and route traffic safely and efficiently and maintain access to driveways and cross streets. These plans are specific in location and specific to each step of construction activity. Traffic would not be routed on local streets or through neighborhoods. The current flow of traffic on the existing roadway network would be maintained through a traffic control plan and construction scheduling to minimize adverse impacts to the traveling public. Some motorists may seek detours to avoid construction zones and could use local streets through neighborhoods such as Hollywood Park. The development of the traffic control plan will be coordinated with communities that could potentially be affected by temporary traffic diversion during construction. The commitments made in the traffic control plan will be communicated to and implemented by the construction contractor. Traffic control during project construction would be in accordance with Part VI (Traffic Controls for Streets and Highway Construction and Maintenance Operations) of the Texas Manual on Uniform Traffic Control Devices (TMUCD).

In addition to a traffic control plan, construction activities would be scheduled to prevent and minimize traffic interruption. The first step of construction would include the preparation of ROW and the installation of storm water infrastructure. During this time, traffic would remain on the existing roadway with minimal

interruption. The installation of drainage structures and stream bridges would follow, which would occur within the ROW of the existing roadway and may require some modification of traffic flow. The new US 281 main lanes would be built next; these lanes would accommodate through traffic and provide access to local businesses, residences, and cross streets. The new main lanes would provide equal capacity to the existing capacity on US 281 and traffic signals would be timed to prioritize through traffic. The construction of the main lanes would be built such that access to adjacent driveways would be available at all times. Measures such as temporary relocation of a driveway or partial blocking of a driveway may be required to ensure access is provided at all times. When complete, the new main lanes would be used while connector ramps and managed lanes are built.

Traffic that might seek an alternative route to avoid US 281 construction activity would have multiple parallel routes to choose from (e.g. Blanco Road, Bulverde Road, Stone Oak Parkway, etc.), but the additional distance and lower speed limits associated with these detours is not likely to offer an overall travel time savings. Even if some motorists seek detours to the west of US 281 during construction, their route back to US 281 would most likely be via Loop 1604 and the direct connector ramps that connect Loop 1604 to US 281. These ramps provide direct, higher speed access for vehicles moving northbound to westbound and eastbound to southbound at the Loop 1604/US 281 interchange.

In the short-term, there may be an increase in traffic congestion and potential changes in traffic patterns and routes in the vicinity of the project during construction, which could possibly cause temporary delays. The temporary changes to traffic patterns would be communicated in via roadside display signs to alert motorists to the time and day of lane closures. Temporary changes in access would be coordinated with emergency responders (police protection, fire protection, emergency medical service providers and others) and other public service providers prior to construction.

Impacts to existing utilities (water, sewer, electric, natural gas, communication) may be associated with construction. The contractor would contact the appropriate local owner/operators to locate all utility lines within the existing and proposed ROW of the Preferred Expressway Alternative and construction staging areas, and coordinate a work schedule that would avoid and minimize any disruption of the utility service(s) during the construction of the facility.

Temporary construction easements would be negotiated with adjacent property owner to allow for the installation of drainage infrastructure and to ensure proper drainage into these features. Activities that would occur in these easements include vegetation clearing and grading. Once the drainage installation is complete, the land would return to the property owner.

3.25 SOCIAL, ECONOMIC AND ENVIRONMENTAL CONSEQUENCES SUMMARY

A summary of the environmental impacts by section for the Build Alternatives and the Preferred Expressway Alternative is presented in tabular form in **Table 3-54** and a summary of potential mitigation and monitoring options follows in **Table 3-55**. This table provides a concise overview of the difference in cost, impacts, and benefits of the alternatives.

Table 3-54: Summary of Direct Impacts by Alternative

	Alternative and Funding Option				
	Metric or Unit	Preferred Expressway Alternative	Elevated Expressway Alternative		
		Non-Toll / Managed	Non-Toll	Toll	Managed
Additional ROW	Acres	79	99		
Total Cost (millions)	2013-2014 Dollars (Millions)	458.7 to 776.1	614.7	633.1	633.1
Land Use (see Table 3-2)					
Residential (single/multi-family	Acres	1.3	2.0		
Commercial (mixed, office, retail	Acres	18.6	29.0		
Place of Worship	Acres	1.3	1.5		
Forest	Acres	1.3	2.2		
Range Land	Acres	17.0	17.0		
Open Space	Acres	31.8	39.8		
Industrial	Acres	2.2	2.7		
Transportation / Utilities	Acres	5.3	4.9		
Additional ROW Required	Acres	78.8	99.1		
Displacements (see Table 3-19)					
Commercial	# of potential	21	28		
Utilities	# of potential	2	0		
Potential Loss in Tax Revenue (see Table 3-17)					
Total Potential Loss in Tax Revenue	2013 dollars	$431,619	$458,552		
Pedestrian and Bike Facilities					
Planned		Yes	Yes		

Table 3-54: Summary of Direct Impacts by Alternative

	Alternative and Funding Option			
	Metric or Unit	Preferred Expressway Alternative	Elevated Expressway Alternative	
		Non-Toll / Managed	Non-Toll	Toll	Managed
Air Quality				
CO Emission Concentrations (see Table 3-30)				
Stone Oak Parkway				
Estimated Time of Completion	One-Hour CO (ppm)	2.8	2.0	
	One-Hour % NAAQS	8%	6%	
	Eight-Hour CO (ppm)	1.8	1.3	
	Eight-Hour % NAAQS	20%	15%	
Design Year	One-Hour CO (ppm)	2.9	2.1	
	One-Hour % NAAQS	8%	6%	
	Eight-Hour CO (ppm)	1.8	1.3	
	Eight-Hour % NAAQS	20%	15%	
Bulverde Road				
Estimated Time of Completion	One-Hour CO (ppm)	1.9	2.1	
	One-Hour % NAAQS	5%	6%	
	Eight-Hour CO (ppm)	1.2	1.3	
	Eight-Hour % NAAQS	14%	15%	
Design Year	One-Hour CO (ppm)	2.0	2.4	
	One-Hour % NAAQS	6%	7%	
	Eight-Hour CO (ppm)	1.3	1.5	
	Eight-Hour % NAAQS	15%	17%	

Table 3-54: Summary of Direct Impacts by Alternative

	Alternative and Funding Option				
	Metric or Unit	Preferred Expressway Alternative	Elevated Expressway Alternative		
		Non-Toll / Managed	Non-Toll	Toll	Managed
Preliminary Traffic Noise Impacts (see Table 3-35)					
Traffic Noise	Total number of potentially impacted receivers	40	106		
Impervious Cover (see Table 3-38)					
Increased Impervious Surface Area	Acres	118	92		
Waters of the U.S. (Table 3-41)					
Stream Crossings	#	13	13		
Short-term & Permanent Impacts to Stream Crossings	Acres	1.50	1.66		
Vegetation Type (see Table 3-42)					
Wooded	Acres within ROW	68	80		
Unmaintained (non-wooded)	Acres within ROW	104	111		
Developed (including maintained non-wooded vegetation)	Acres within ROW	167	170		
Bexar County Karst Zones (see Table 3-45)					
Zone 1	Acreage of footprint	225	238		
Zone 2	Acreage of footprint	134	149		
Zone 3	Acreage of footprint	85	92		
Zone 4	Acreage of footprint	0	0		
Zone 5	Acreage of footprint	3	3		

Table 3-54: Summary of Direct Impacts by Alternative

	Alternative and Funding Option				
	Metric or Unit	Preferred Expressway Alternative	Elevated Expressway Alternative		
		Non-Toll / Managed	Non-Toll	Toll	Managed
Bexar County Karst Features (see Table 3-45)					
Zone 1	# of Features	37	36		
Zone 2	# of Features	9	8		
Zone 3	# of Features	11	10		
Zone 4	# of Features	0	0		
Zone 5	# of Features	0	0		
Golden-cheeked Warbler (see Table 3-46)					
Habitat	Acres	45	56		
Potential Hazardous/Regulated Materials (see Table 3-52)					
Leaking Petroleum Storage Tanks	#	2	1		
Hazardous Materials Spills	#	1	1		
Properties with Known Hazardous Materials Contamination	#	0	1		
Properties that are Regulated for Hazardous and Regulated Materials	#	4	5		
Properties with Notice of Violation; Operating without a Permit	#	1	0		
Innocent Owner Properties with Potential Groundwater Contamination from a Leaking Petroleum Storage Tank	#	1	0		

Table 3-54: Summary of Direct Impacts by Alternative

	Alternative and Funding Option				
	Metric or Unit	Preferred Expressway Alternative	Elevated Expressway Alternative		
		Non-Toll / Managed	Non-Toll	Toll	Managed
Visual					
Viewshed	Greater impact to roadway user or viewer?	Viewer	Viewer		
Residential Properties within the Foreground Viewshed	#	814	826		

Source: US 281 EIS Team, May 2014.

Table 3-55: Summary of Potential Mitigation and Monitoring Options

Resource	Potential Mitigation and Monitoring Options
Environmental Justice (EJ)	The project would not result in disproportionately high and adverse impacts to low-income or minority populations. On-going measures to ensure full and fair participation in the decision-making process include: • Continue to seek meaningful involvement of low-income and minority communities in the project development. • Publish Spanish language versions of notices in a locally-circulated Spanish language newspaper and include it with notice to affected property owners. • Produce bilingual tolling/managed lanes informational materials for the website and general distribution.
Displacements	Displaced businesses and residences are eligible for assistance per the requirements of the *Uniform Relocation Assistance and Real Property Acquisition Policy Act of 1970, as amended by the Uniform Relocation Act Amendments of 1987*. Assistance may include identification of replacement properties that are: • Comparable in size, amenities, and neighborhood type • Within the financial means of all displaced businesses • Similarly accessible
Right-of-Way (ROW) Impacts	Acquisition of proposed ROW will be conducted in compliance with *Uniform Relocation Assistance and Real Property Acquisition Policy Act of 1970, as amended by the Uniform Relocation Act Amendments of 1987 and* TxDOT's *Right of Way Manual Volume 2 – Right of Way Acquisition*, as revised August 2011.
Pedestrian and Bicycle Facilities	Pedestrian and Bicycle Facilities would be designed in compliance with the Americans with Disabilities Act. Pedestrian and bicycle facilities would be constructed on both east and west sides or the roadway and would include: • 6-foot wide sidewalks • 15-foot wide outer lanes to accommodate bicycles • Crosswalks

Air Quality	• Contractor would schedule construction activities to minimize disruptions to traffic, especially during peak travel periods to minimize emissions
	• Contractor would comply with federal, state, and local regulations concerning the generation of dust from construction activities which may include:
	  o Cover or treat disturbed areas with dust suppressors
	  o Use tarpaulins on loaded trucks
	  o Water dust generating surfaces

Table 3-55: Summary of Potential Mitigation and Monitoring Options

Resource	Potential Mitigation and Monitoring Options
Traffic Noise	A noise barrier is proposed near Big Springs (R4, R5 and R6). The final decision to construct this noise barrier will not be made until after the ROD and during final design, after utility evaluation and after polling of adjacent property owners at a traffic noise workshop. Provisions will be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

Water Quality	• Coordination with TCEQ would be occur to maintain compliance with:
	  ○ Edwards Aquifer Protection Program/Water Pollution Abatement Plan
	  ○ Texas Pollutant Discharge Elimination System permitting requirements
	  ○ Notice of Intent General permitting requirements
	
	Since the project corridor is within five (5) miles upstream of Segment 1908, a 303(d) listed water; coordination with the TCEQ will occur prior to any construction activities in association with the review of the Storm Water Pollution Prevention Plan (SW3P).
	
	• A Storm Water Pollution Prevention Plan would be implemented including strategies such as:
	  ○ Silt fences
	  ○ Inlet protection barriers
	  ○ Hay bales
	  ○ Seeding or re-vegetating excavated soils
	• Low Impact Development strategies would be implemented including:
	  ○ Bioretention
	  ○ Vegetation filter strips

Floodplains	Strategies to minimize impacts to floodplains include: • Provide flood water storage adjacent to the roadway via detention facilities • Design drainage structures to accommodate anticipated high flows to reduce upstream and downstream adverse impacts • Design detention facilities and drainage structures that manage storm water while enhancing water quality
Waters of the U.S. including Wetlands	Impacts to waters of the U.S. will be coordinated with USACE and permitted under NWP 14 and PCN. Strategies to minimize impacts to wetlands and other waters of the US could include: • Implement erosion and sediment control measures during and after construction • Minimize de-vegetation • Decrease the amount of fill placement • Use retention basins and re-vegetated swales • Alleviate flow alterations caused by structures

Table 3-55: Summary of Potential Mitigation and Monitoring Options

Resource	Potential Mitigation and Monitoring Options
Vegetation	Contractors, where practicable, will remove trees by cutting at or slightly above ground level to allow roots to remain intact to prevent erosion and maintain bank stability. In accordance with Executive Memorandum on Beneficial Landscaping Practices, TxDOT will, where cost-effective and to the extent practicable: • use regionally native plants for landscaping; • design, use, or promote construction practices that minimize adverse effects on natural habitat; • seek to prevent pollution by, among other things, reducing fertilizer and pesticide use; • implement water-efficient and runoff reduction practices; and • create demonstration projects employing these practices. In accordance with EO 13112 on Invasive Species TxDOT will identify actions that can affect the disposition or introduction of invasive species, monitor known populations of invasive species, and restore areas that have been affected by such species. Seeding and replanting would be completed according to TxDOT specifications and in compliance with EO 13112 and the Executive Memorandum on Beneficial Landscaping.
Wildlife	To avoid adverse impacts to migratory birds, the contractor could implement measures to prevent migratory birds from building nests in the construction area between March and August and/or could remove any old migratory bird nest between September and February. To avoid adverse impacts to aquatic wildlife, the contractor would minimize the area to be disturbed, replant the areas cleared, and/or optimize stream diversion to include low flow augmentation of intermittent streams.
Threatened & Endangered Species *Karst Species*	Several conservation measures will be taken by TxDOT, as detailed in USFWS' Biological Opinion (see **Appendix I4**). These include measures that are part of the project design, measures that will be taken during construction and other on-going conservation measures that will protect and advance the scientific knowledge of karst habitat and species.
Threatened & Endangered Species *Golden-cheeked warbler*	Strategies to minimize impacts to the GCWA during construction include: • Limit vegetation removed in wooded areas during nesting and breeding season (March to September) • Limit removal of vegetation to that necessary for construction the US 281 Corridor Project • Locate construction staging areas away from known or potential GCWA habitat

Table 3-55: Summary of Potential Mitigation and Monitoring Options

Resource	Potential Mitigation and Monitoring Options
State Listed or Rare (unlisted) Species	Efforts will be made to avoid direct harm to individuals of state-listed or rare species; particularly those most vulnerable to earth moving and de-watering activities. Specific notes will be inserted into the construction plans that indicate the potential presence of these species and instruct the contractor to avoid impacting them. The contractor will be briefed on the species appearance and habitat preferences prior to construction and instructed to cease activities in the vicinity of the protected species, if encountered, for a sufficient amount of time to enable escape or relocation. Specifically for the Texas horned lizard, this will include information on avoiding harvester ant mounds where feasible. If areas must be de-watered, the work site will be isolated to prevent fish and other aquatic species from moving into the construction zone and work activities conducted as quickly as possible to minimize the length of time that flow is modified or interrupted. Prompt and effective erosion control and re-vegetation and restoration of flow lines and grades will be employed to further minimize impacts. The contractor will return temporary work areas to pre-project conditions as soon as practicable. In order to avoid impacts to the Cave myotis bat, contractors would implement the following measures prior to and during construction: 1) adjacent caves to US 281, would be surveyed by a qualified biologist to determine if bats are present; and 2) if bats are present, appropriate measures would be taken as practicable to ensure that bats are not harmed such as exclusion of bats from the project area, or timing activities to when bats are not present. For maternity colonies, exclusion activities would be timed where practicable to avoid separating lactating females from nursing pups. If features used by bats are removed as a result of construction, artificial roosts would be constructed to replace these features as practicable.
Cultural Resources	If unanticipated archeological resources are encountered during construction, work would cease and post-review discovery procedures would be initiated by a certified archeologist.
Potentially Hazardous & Regulated Materials	A Phase I Environmental Assessment in compliance with ASTM Standard E 1507-05 would be conducted during the acquisition of ROW to determine appropriate mitigation requirements. Other mitigation measures may include: • Take appropriate measures to prevent, minimize, and control the spill of hazardous materials in the construction staging area • Minimize or eliminate use of construction equipment within sensitive areas • Remove all construction materials used as soon as work schedules permit • Develop soil and/or groundwater management plans to respond to the discovery of contamination during construction
Visual & Aesthetic Qualities	The US 281 project corridor falls within the Hill Country Region identified by TxDOT – San Antonio District's *Urban Design Themes for Bexar and Outlying Counties.* The design themes provide guidance on aesthetic form, function and appearance of new highway elements in Bexar County. Visual aesthetic and landscaping for the US 281 Corridor Project would mirror the Hill Country Region theme, consisting of simple materials that translate the historical architecture of Hill Country towns into modern structures of the highway. All lighting will be acceptable fixtures that meet or exceed the City of San Antonio City Code – Section 35-339.04 and Bexar County Commissioners Court Regulation No. 12.501.072208 for "full cutoff" criteria (no light output emitted above 90 degrees at any lateral angle around the fixture).

1 Source: US 281 EIS Team, July 2014.

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