TEXAS-OKLAHOMA PASSENGER RAIL STUDY

Service-Level Draft Environmental Impact Statement

Prepared by

Texas Department of Transportation

U.S. Department of Transportation Federal Railroad Administration

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FEDERAL RAILROAD ADMINISTRATION

Texas-Oklahoma Passenger Rail Development Program
Service-Level Draft Environmental Impact Statement

Prepared by
U.S. Department of Transportation
Federal Railroad Administration
and
Texas Department of Transportation
In cooperation with
U.S. Army Corps of Engineers

Pursuant to

National Environmental Policy Act (42 U.S.C. §4332 et seq.), and implementing regulations (40 CFR Parts 1500-1508), 64 FR 28545, 23 CFR §771, 49 U.S.C. §303 (formerly Department of Transportation Act of 1966, Section 4(f); National Historic Preservation Act (16 U.S.C. §470); Clean Air Act as amended (42 U.S.C. §7401 et seq. and 40 CFR Parts 51 and 93); the Endangered Species Act of 1973 (16 U.S.C. §1531-1544); the Clean Water Act (33 U.S.C. §1251-1387; and the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (42 U.S.C. §3601)

FRA will issue a single document that consists of the Final Environmental Impact Statement and Record of Decision pursuant to Pub. L. 112-141, 126 Stat. 405, Section 1319(b) unless FRA determines statutory criteria or practicability considerations preclude issuance of such a combined document.

6/29/2016
Date of Approval

Sarah E. Feinberg, Administrator
Federal Railroad Administration

6/29/2016
Date of Approval

TxDOT

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This service-level draft environmental impact statement (EIS) evaluates passenger rail service development alternatives for the 850-mile north-south corridor roughly paralleling Interstate 35 (IH-35) through Oklahoma and Texas, extending from Oklahoma City, Oklahoma, to the south Texas cities of Laredo, Corpus Christi, and Brownsville. Specifically, the corridor is organized into three sections: Oklahoma City to Dallas and Fort Worth, Dallas and Fort Worth to San Antonio, and San Antonio extending to south Texas. A No Build Alternative and passenger rail improvement alternatives are evaluated. The build alternatives would provide a combination of conventional, higher-speed, and high-speed passenger rail service to meet future intercity travel demand, improve rail facilities, reduce journey times, and improve connections with regional public transit services.

Comments on this service-level draft EIS should be received by August 28, 2016, and should be sent to Mr. Mark Werner at the above address.

Executive Summary

The Texas Department of Transportation (TxDOT), along with the Federal Railroad Administration (FRA), is preparing this environmental impact statement (EIS) to evaluate intercity passenger rail service alternatives for the Texas-Oklahoma Passenger Rail Program (Program), extending from Oklahoma City[1] to the Texas-Mexico border. Preparation of this service-level EIS is one of two primary objectives of the Texas-Oklahoma Passenger Rail Study (Study). In addition to this EIS, the Study includes preparation of a service development plan for the corridor to guide further development and capital investment in passenger rail improvements identified in the EIS Record of Decision. The Oklahoma Department of Transportation (ODOT) is a partnering state agency for the Study and the EIS.

This EIS evaluates a reasonable range of corridor alternatives and passenger rail service types and will recommend a preferred alternative within the EIS study corridor, location of train service termini, and type of service. A No Build Alternative and multiple build alternatives are evaluated. The build alternatives include infrastructure improvements in existing or prior rail corridors, the development of one or more new rail corridors, or a combination of both.

ES.1 Program Overview

The Program could provide new and upgraded intercity passenger rail service along an 850-mile corridor extending approximately from Oklahoma City to south Texas.

The Program corridor runs north-south and roughly parallels Interstate Highway (IH)-35, with the northern point in Edmond, Oklahoma (northern end of the Oklahoma City portion of the corridor), and the southern end of the corridor in south Texas, potentially in Corpus Christi, Brownsville, Laredo, or the Rio Grande Valley (Figure ES-1). The corridor was divided into three geographic sections to address travel markets both within each segment and among all three; they are:

- Northern Section: Oklahoma City to Dallas and Fort Worth
- Central Section: Dallas and Fort Worth to San Antonio
- Southern Section: San Antonio to south Texas (Corpus Christi, Brownsville, Laredo, and the Rio Grande Valley) with the option to extend to Monterrey, Mexico

FRA and TxDOT will use a tiered process, as provided for in the Code of Federal Regulations (CFR) (40 CFR 1508.28), to conduct the environmental review of the Study. This service-level EIS addresses broad corridor issues and alternatives. A preliminary alignment was developed to represent each alternative, based on conceptual engineering that considered, and avoided obvious physical or environmental constraints. These alignments were not refined to optimize performance,

[1] Edmond, Oklahoma, was selected as the northern point of the Northern Section alternatives based on preliminary ridership forecasts and early stakeholder input obtained during the alternatives analysis process. While Edmond is used in the EIS analysis as the actual northern terminus, Oklahoma City is the city name used in the overall descriptions.

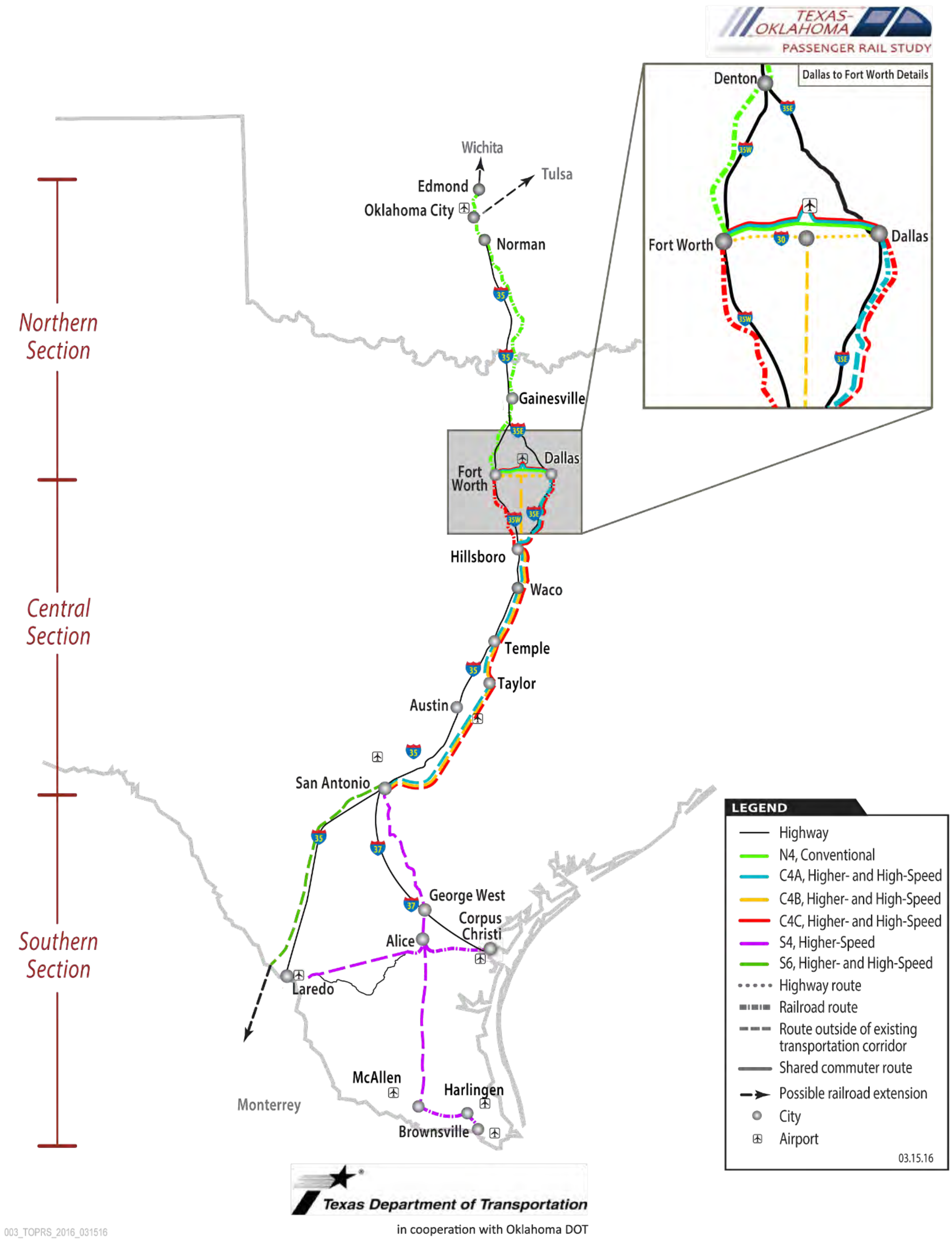

Figure ES-1: Build Alternatives

reduce cost, avoid specific properties or individual environmental resources, or for any other such considerations. If an alternative is selected at the service level for further development, the above considerations would be assessed in subsequent project-level National Environmental Policy Act (NEPA) evaluations that will analyze site-specific projects based on the service-level analyses.

If a build alternative is selected at the conclusion of this service-level EIS, project-level NEPA analysis will be conducted prior to implementation of the Program elements within the selected alternative and, where appropriate, will incorporate by reference the data and evaluations included in this service-level EIS. Subsequent NEPA analysis will concentrate on the issues specific to the component of the alternative selected and analyze the environmental consequences and measures necessary to avoid, minimize, or mitigate potential environmental effects of the component projects.

ES.2 Program History and Prior Planning Activities

High-speed passenger rail has been under consideration in Texas since the late 1980s. In the 1990s, a private consortium was awarded a franchise to design, build, and operate high-speed rail in the state. Although the consortium's study of demand appeared to support the development of high-speed rail, lack of funding and other obstacles prevented that project from moving forward. Since then, other proposals for high-speed rail in Texas have been submitted to FRA, with each proposal showing revenues that exceed operating expenses but requiring funding to build. In 2000, FRA designated the South Central Corridor, including the area between San Antonio and Dallas and Fort Worth, as a future high-speed rail corridor. In 2010, TxDOT received a grant from FRA to study passenger rail in that corridor.

In cooperation with TxDOT and the Federal Highway Administration, the Texas A&M Transportation Institute (TTI) completed a study in 2010 evaluating the potential for development of an intercity rail and express bus system in Texas. The TTI study examined long-distance intercity and interregional corridors to determine which corridors are most likely to need additional intercity travel capacity in the coming decades. The results of the study indicated a critical need for efficient travel scenarios for both freight and passenger demand. The study developed a preliminary concept plan with potential costs and benefits for intercity transportation corridors that would be served by an intercity rail/express bus system and would not preclude a future rail system capable of operating at higher speeds (TTI 2010).

ES.3 Purpose and Need

The purpose and need statement for the Program identifies two levels of discussion. The first level addresses the overall purpose and need for the entire 850-mile Program corridor from Oklahoma City to south Texas (Figure ES-1). The second level addresses the purpose and need specific to each of the three geographic sections that compose the Program corridor.

ES.3.1 Overall Program

The purpose of the Program is to enhance intercity mobility by providing new or enhanced passenger rail service as a transportation alternative that is competitive with automobile, bus, and air travel. The objectives of the overall Program are to:

- Provide high-quality intercity rail service that will offer competitive travel times, schedule reliability, and traveler comfort.
- Encourage more efficient and environmentally sensitive modes of intercity travel.
- Provide an equitable and affordable intercity travel alternative.
- Enhance interconnectivity between intercity rail services, regional transit services, and major regional airports.
- Enhance environmental sustainability by facilitating regional land use and transit-oriented development plans within the Program corridor.
- Enhance interregional access to employment, entertainment, recreation, health, and shopping opportunities within the Program corridor.
- Coordinate and avoid conflicts with freight rail operations and facilities.
- Be a cost-efficient investment where the projected train service revenue meets or exceeds the following percentages of operation and maintenance costs:
  - Conventional rail (speeds up to 90 miles per hour [mph]) = 50 percent
  - Higher-speed rail (speeds up to 125 mph) = 75 percent
  - High-speed rail (speeds up to 220 to 250 mph) = 100 percent

The need for the Program is to meet current and future mobility needs in the Program corridor, including the following:

- Population and economic growth will increase travel demand, generate additional roadway and aviation congestion, and reduce automobile, aviation, and transit reliability, thereby requiring regional mobility alternatives.
- Limited intercity passenger rail service and capacity and lack of interregional connectivity restrict both mobility and economic development.
- Declining air quality resulting from increased travel demand and congestion requires more environmentally sustainable modes of travel.
- Growth in truck and rail freight has negative effects on the safety of the transportation system.

ES.3.2 Northern Section: Oklahoma City to Dallas and Fort Worth

The purpose of the Program in the Northern Section is to provide efficient and reliable intercity passenger rail service along the corridor from Oklahoma City to Dallas and Fort Worth that is competitive with other travel options.

Population and economic growth in the Northern Section are projected to increase intercity passenger travel demand beyond what the existing highway, intercity passenger rail, and air travel systems in the Northern Section can accommodate. Specific needs for the Northern Section include the following:

- Increasing population density and changes in demographic profile require alternatives in regional mobility.
- Existing constrained passenger rail service that competes with freight for rail line capacity is affected by delays and makes it difficult to attract business or short-travel riders.
- Inefficient connections with other modes of travel reduce the attractiveness of passenger rail as an intercity travel alternative.
- Local governments require regional support to improve interregional connectivity.

ES.3.3 Central Section: Dallas and Fort Worth to San Antonio

The purpose of the Program in the Central Section is to provide efficient and reliable intercity passenger rail service along the corridor from Dallas and Fort Worth to San Antonio that is competitive with other travel options.

Multiple transportation, land use, socioeconomic, and environmental considerations drive the need for the Program in the Central Section, including the following:

- Changing transportation demand of an increasing transit-dependent population requires an alternative mode.
- Inefficient and infrequent rail service limits ridership.
- Increasing congestion and unreliable travel times on both the existing highway and rail services require an alternative interregional service.
- Poor and declining air quality requires more sustainable modes of travel.

ES.3.4 Southern Section: San Antonio to South Texas

The purpose of the Program in the Southern Section is to provide efficient and reliable intercity passenger rail service from San Antonio to south Texas that is competitive with other mode options.

Population and economic growth in the Southern Section will increase intercity passenger travel demand beyond what the existing highway and air travel systems can accommodate. Air service options available in the Southern Section are limited. Specific needs for the Southern Section include the following:

- Regional and cross-border travel is constrained by uncompetitive trip times, poor reliability, and low levels of passenger convenience.
- Poor and declining air quality requires more sustainable modes of travel.

ES.4 Alternatives Considered

The service-level EIS analyzes the No Build Alternative and 10 build alternatives in the three geographic sections (see Figure ES-1). The build alternatives consist of both a “route,” which refers to the specific corridor that a potential alignment follows, and a “service type,” which refers to the speed or category of rail transportation (conventional rail, higher-speed rail, or high-speed rail). The alternatives carried forward for analysis in the EIS, including their geographic sections, routes, and service types, are listed in Table ES-1 and described in the following sections.

Table ES-1: Alternatives Carried Forward for Analysis

Route	Service Type[a]
No Build Alternative	
Northern Section	
N4A	CONV
Central Section	
C4A	HrSR
	HSR
C4B	HrSR
	HSR
C4C	HrSR
	HSR
Southern Section	
S4	HrSR
S6	HrSR
	HSR

[a] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail (see Section ES.4.1, below for a description of service types)

ES.4.1 Service Types

The three service types (conventional rail, higher-speed rail, and high-speed rail) considered in this EIS are described below.

ES.4.1.1 Conventional Rail Service

Conventional rail service typically includes diesel-powered, steel-wheeled trains operating on steel tracks. Roadway crossings may be grade-separated depending on the type of roadway and amount of traffic, and rail rights-of-way may be fenced. Conventional rail service in Oklahoma and Texas are shared-use corridors, meaning that the passenger rail service operates on a freight rail line owned by a “host” railroad, such as BNSF Railway or UPRR. Conventional rail would typically operate at top speeds of up to 79 to 90 mph. This service type would primarily use existing railroad rights-of-way and existing railroad track; in some cases, modifications such as double-tracking could be constructed within the existing right-of-way to accommodate additional trains.

ES.4.1.2 Higher-Speed Rail Service

Higher-speed rail is similar to conventional rail in several respects. In many cases, higher-speed rail trains can run on the same steel tracks that support conventional rail service, but higher speeds can require improvements such as upgrading wooden ties to concrete ties and grade separating roadway crossings. Higher-speed service can use diesel-powered, steel-wheeled trains operating on steel tracks that are shared with freight trains or it can operate on dedicated passenger tracks. This service type can be an electrified rail system powered by overhead catenary lines, but for the purposes of this EIS, higher-speed rail trains are assumed to be diesel-powered. Higher-speed rail would be operated at top speeds of up to 110 to 125 mph.

Where proposed within an existing railroad right-of-way, higher-speed rail would share right-of-way with the existing host railroad, but would construct separate tracks for the passenger service. Because of its maximum speed and because train frequency would be similar to conventional rail, higher-speed rail could operate on a single track with passing locations and would not require double-tracking. Where higher-speed rail is proposed outside an existing transportation corridor, the new alignment would be designed with curves and other features that could accommodate high-speed rail service, if warranted by ridership and economically feasible, in the future. For the purposes of this EIS, unlike high-speed rail, the design would not include electrification and would include a mixture of single and double track, and some at-grade crossings would remain. In some short segments in dense urban areas, existing track shared with freight may be used by new passenger rail, operated at reduced speeds. Newly constructed track would be dedicated exclusively to passenger rail service.

ES.4.1.3 High-Speed Rail Service

High-speed rail service uses electric trains powered by an overhead power supply system. Train sets are steel wheel on steel rail, but are designed to operate at high speeds with an aerodynamic shape and specialized suspension and braking systems. High-speed rail would operate at top speeds of up to 220 to 250 mph.

The entire right-of-way would be enclosed and fully grade-separated. The alignment would be electrified and double-tracked and would be dedicated entirely to passenger rail service. Freight trains and other non-high-speed rail systems would be prohibited from using the high-speed rail tracks. This service type could only reach its maximum speeds outside existing transportation corridors because existing railroad alignments are not compatible with the speeds required, and they do not have the required space for separation of freight and high-speed rail. In areas where this service type is within existing transportation corridors, it would operate at lower speeds.

ES.4.2 Alternative Descriptions

The No Build Alternative and the 10 build alternatives are shown on Figure ES-1. The build alternatives have been developed to a level of detail appropriate for a service-level analysis; preliminary alignments represent potential corridors where rail improvements could be implemented but do not specify the precise location of the track alignment. The preliminary alignments are based on conceptual engineering that considers and avoids obvious physical or environmental constraints. These alignments have not been refined to optimize performance, reduce cost, or avoid specific properties or individual environmental resources. If an alternative is selected at the service level for further development, the above considerations would be assessed at the project level.

A 500-foot-wide EIS Study Area has been identified along the route of each build alternative, providing an envelope that could accommodate areas for associated effects, including roadway shifts, grade separations, construction activities, and affiliated features such as stations and parking, traction-power substations, power lines, and maintenance-of-way facilities.

Alternatives in the Northern, Central, and Southern sections could be built as individual, stand-alone projects or in combination with alternatives in another section. In addition, more than one alternative in the Central Section and Southern Section could be built in the future because the alternatives provide different service types for independent destinations. Details on connecting the alternatives would be determined during project-level studies.

The route alignments are described in terms of nearby transportation corridors and cities. For example, potential alignments are described as “following” railway corridors, which could mean that they are sharing existing tracks, are located within an existing right-of-way, or are generally adjacent to existing tracks depending on the service type.

The Southern Section alternatives include a potential extension to Monterrey, Mexico. For Alternative S6, an extension from Laredo to Monterrey could follow an alignment that has been studied by Mexico, and is therefore considered feasible. The EIS evaluates alignment corridors only within the United States; however, the potential extension to Monterrey has been included for ridership analysis purposes for Alternative S6, and FRA and TxDOT have initiated coordination with the Mexican government about the potential extension.

ES.4.2.1 No Build Alternative

The No Build Alternative would not fulfill the Program’s purpose and need, but is carried forward as a baseline alternative against which the build alternatives are compared. The No Build Alternative would consist of the existing transportation network, including roadway, passenger rail, and air travel in the Study Vicinity, as well as maintenance and planned improvements to these systems. The sections below describe existing and planned roadway, passenger rail, and air travel in the Study Vicinity. Information was collected from current regional transportation plans within the Study Vicinity, as well as web sites describing services such as train schedules. These improvements and their analysis at this service-level stage would require project-specific assessment. Conducting project assessments at this stage of the program development process would be speculative; however, the evaluation and assessment of potential environmental effects from a cumulative perspective has been conducted and is included in the introduction to Chapter 3, Affected Environment and Environmental Consequences.

ES.4.2.2 Northern Section: Oklahoma City to Dallas and Fort Worth

Due to feasibility based on initial ridership and cost information, one route alternative with one service type was considered feasible in the Northern Section: Alternative N4A with conventional rail.

ES.4.2.2.1 Alternative N4A Conventional

Alternative N4A would begin in Edmond, Oklahoma, and follow the BNSF rail alignment south to Oklahoma City. The alternative would continue south along the BNSF rail alignment to Norman, Oklahoma; through Metro Junction, near Denton, Texas; and on to Fort Worth (as does the existing Amtrak Heartland Flyer). From Fort Worth, the alternative would continue east to Dallas following the Trinity Railway Express (TRE) tracks. From Edmond to Dallas, the route would be approximately 260 miles long. Because existing freight traffic would not preclude passenger service along this section of track, the route would provide passenger rail service on the existing BNSF track, with potential improvements within the existing BNSF right-of-way.

Alternative N4A would provide several improvements over the existing Heartland Flyer service. Alternative N4A would increase the number of daily round trips along this route (the Heartland Flyer currently offers one round trip per day), and the N4A route would extend from Fort Worth to Dallas without requiring a transfer (the Heartland Flyer service currently terminates in Fort Worth). In addition, Alternative N4A would provide improvements to existing station facilities, and new train equipment with more onboard amenities, including business class available for a premium price.

Alternative N4A assumes diesel-locomotive hauled equipment running three to six daily round trips. Two or three of the round trips would operate on an accelerated schedule, making roughly seven stops, with remaining “local” trains making as many as 12 stops.

ES.4.2.3 Central Section: Dallas and Fort Worth to San Antonio

Three route alternatives, each with higher-speed and high-speed rail options, were evaluated in the Central Section: Alternatives C4A, C4B, and C4C.

The Central Section alternatives would provide several improvements over the existing Texas Eagle service in this corridor. All of the alternatives would increase the number of daily round trips along this route (the Texas Eagle currently offers one round trip per day), The high-speed rail alternatives would provide much faster service between Dallas and Fort Worth and Antonio—2 hours versus 8 hours for the Texas Eagle Service. In addition, the Central Section alternatives would provide improvements to existing station facilities, and new train equipment.

ES.4.2.3.1 Alternative C4A Higher-Speed and High-Speed Rail

Alternative C4A would begin in Fort Worth and follow the TRE tracks east to Dallas. From Dallas, it would follow the BNSF alignment south toward Waxahachie where it would enter a new alignment outside existing highway and rail corridors to accommodate maximum operating speeds. Though outside existing transportation corridors, the southern portion of Alternative C4A would generally follow the BNSF alignment for about 250 miles, extending south from Waxahachie through Hillsboro, Waco, Temple, Taylor, and Austin to San Antonio.

Alternative C4A Higher-Speed Rail assumes new diesel-locomotive hauled equipment running six to 12 daily round trips. Express trains would likely make seven stops with local trains making 12 stops.

Alternative C4A High-Speed Rail assumes electric-powered, high-speed rail service running 12 to 20 daily round trips. Express trains would likely make six stops, while local trains would make up to nine stops.

ES.4.2.3.2 Alternative C4B Higher-Speed and High-Speed Rail

Alternative C4B would serve both Fort Worth and Dallas, with trains following a new elevated high-speed rail alignment over IH-30. In Arlington (between Dallas and Fort Worth), the alternative would turn south to Hillsboro on an alignment outside existing transportation corridors. The alternative would then follow the same high-speed rail alignment as Alternative C4A from Hillsboro to San Antonio.

Alternative C4B Higher-Speed Rail assumes new diesel-locomotive hauled equipment running six to 12 daily round trips. Express trains would likely make seven stops, and local trains would make up to 12 stops.

Alternative C4B High-Speed Rail assumes electric-powered, high-speed service running 12 to 20 daily round trips. Express trains would likely make six stops, and local trains would make up to eight stops.

ES.4.2.3.3 Alternative C4C Higher-Speed and High-Speed Rail

Alternative C4C would follow the same potential alignment as Alternative C4A from Fort Worth east to Dallas and south to San Antonio, but would include a link from Hillsboro directly to Fort Worth parallel to the UPRR alignment. Service on the Alternative C4C route would operate in a clockwise direction, running from Hillsboro to Fort Worth, to Dallas, back to Hillsboro, and south to San Antonio in order to serve Fort Worth directly (while also being compatible with the general service for C4A alternatives).

Alternative C4C Higher-Speed Rail assumes new diesel-locomotive hauled equipment running six to 12 daily round trips. Express trains would likely make seven stops, and local trains would make up to 12 stops.

Alternative C4C High-Speed Rail assumes electric-powered high-speed service running 12 to 20 daily round trips. Express trains would likely make six stops, while local trains would make up to nine stops.

ES.4.2.4 *Southern Section: San Antonio to South Texas*

Two route alternatives were evaluated in the Southern Section: Alternative S4, with higher-speed rail, and Alternative S6, with higher-speed and high-speed rail options.

ES.4.2.4.1 Alternative S4 Higher-Speed Rail

Alternative S4 would begin in San Antonio and travel southeast along the UPRR alignment to George West, where it would continue outside existing transportation corridors to Alice. At Alice, the alternative would divide into three legs at a stop. The first leg would travel west along the Kansas City Southern (KCS) Railway to San Diego, Texas; it would then travel outside existing transportation corridors to east of Laredo in an alignment that would allow higher speeds and rejoin the KCS Railway to enter the highly developed Laredo area. The second leg would travel south along abandoned railroad tracks to McAllen and east to Harlingen and Brownsville. The third leg would travel east along the KCS Railway to Corpus Christi.

Alternative S4 Higher-Speed Rail assumes new diesel-locomotive hauled equipment running four to six daily round trips. Depending on corridor demand model forecasts, the primary service may be designated as Laredo-Alice-San Antonio and Corpus Christie-Alice-San Antonio, with a connecting feeder from Brownsville, Harlingen, and McAllen.

ES.4.2.4.2 Alternative S6 Higher-Speed and High-Speed Rail

Alternative S6 would begin in San Antonio and travel south on a new alignment outside existing transportation corridors to a station near the Laredo-Columbia Solidarity Bridge, which crosses the Rio Grande north of Laredo. The alternative would then cross on a new railway bridge to join a new rail line being constructed in Mexico, which would continue to Monterrey. This study only examines the physical effects of the U.S. component of this new line, but it does consider the ridership effect of such a connection.

Alternative S6 Higher-Speed Rail assumes new diesel-locomotive hauled equipment running four to six daily round trips between San Antonio and Laredo, which would be the only U.S. stops for the alternative. If an extension from Laredo to

Monterrey were added, the frequency of trips to Monterrey is assumed to be the same as those from San Antonio to Laredo.

Alternative S6 High-Speed Rail assumes electric-powered, high-speed service running eight to 12 daily round trips between San Antonio and Laredo. If an extension from Laredo to Monterrey were added, the frequency of trips to Monterrey is assumed to be the same as those from San Antonio to Laredo.

ES.4.3 Preferred Alternative

Recommended preferred alternatives have been identified based on differentiating metrics for each of the geographic sections in the Study. Metrics that differentiate between alternatives are based on the overall Study purpose and need, as well as the purpose and need for each geographic section (see Chapter 1, Purpose and Need; see Chapter 2, Alternatives, for additional information on the analysis and selection of the preferred alternatives). Preferred alternatives are recommended for each geographic section separately because the Study does not analyze alternatives that extend between Oklahoma City and Laredo/Brownsville, but rather to the endpoint cities of each geographic section (Northern, Central, and Southern). In addition, more than one alternative in the Central Section or Southern Section could be built in the future to provide different service options or serve different cities. Recommendation of these preferred alternatives does not preclude connectivity between geographic sections of the Study, but it does not assume connectivity either. Details about how preferred alternatives might connect would be analyzed during project-level analysis after completion of the service-level EIS.

The recommended preferred alternatives for each geographic section are as follows:

- Northern Section
  - N4A Conventional
- Central Section
  - C4A High-Speed Rail
  - C4B High-Speed Rail
  - C4C High-Speed Rail
- Southern Section
  - S4 Higher-Speed Rail
  - S6 Higher-Speed Rail or High-Speed Rail, but only with a connection to Monterrey, Mexico

ES.4.4 Station Cities

This service-level EIS does not evaluate specific station locations, and no conclusion about the exact location of stations will be made as part of the service-level EIS process. However, based on ridership data and transit connectivity information developed as part of this EIS, and based on stakeholder input, the cities in which stations would most likely be located have been assumed.

The size and design of stations would be appropriate for the service type and the route of the alternative. Cities that could have stations are listed in Table ES-2.

Table ES-2: Cities with Potential Stations

Oklahoma	
Edmond	Pauls Valley
Oklahoma City	Ardmore
Norman	
Texas	
Gainesville	Austin
Fort Worth	San Antonio
Arlington	Alice
Dallas	Corpus Christi
Waxahachie	Harlingen
Waco	McAllen
Temple (also serving Killeen)	Brownsville
Taylor	Laredo

ES.5 Summary of Effects

This section summarizes the potential effects of implementation of the build alternatives based on the analysis of the social, economic, and environmental resources documented in Chapter 3. The No Build Alternative does not meet the Program's purpose and need, but is carried forward as a baseline alternative against which the build alternatives are compared. The potential effects, and differences in effects among alternatives, are described in each resource section and are summarized in Tables ES-3 through ES-5 for the Northern, Central, and Southern sections, respectively. Station locations have not yet been selected, but general considerations regarding station effects are discussed when applicable.

The potential for effects and comparison of effects among alternatives are based on the presence of resources within the 500-foot-wide EIS Study Area for each alternative. The 500-foot EIS Study Area contains more land than the ultimate Program would require, which allows for avoidance of key resources and flexibility in future project-level design. The EIS Study Area also provides space for associated effects, such as roadway modifications, grade separations, construction activities, and maintenance-of-way facilities. The identification of resources within the EIS Study Area allows for a comparison of effects among alternatives and provides information about key resources that may need to be considered during project-level design. It does not represent the actual impacts that would occur from implementation of a future project (project-level impacts would be anticipated to be less).

Table ES-3: Summary of Resource Effects in the Northern Section

Resource	N4A Conventional
Air Quality	Negligible (adverse) short-term (construction) and negligible (benefit) long-term regional (operation) effects.
Water Quality	*Surface waters:* Waterbodies crossed by the EIS Study Area would experience negligible effects based on the use of existing railway infrastructure and corridors, and through project design and implementation of BMPs. *Runoff:* Negligible effect due to low amount of impervious surfaces and implementation of structural stormwater management practices and construction BMPs. *Erosion:* Moderate effect due to the acreage of erosive soils crossed which would be minimized with use of construction BMPs. *Groundwater:* Negligible effect as a result of no Sole Source Aquifer recharge area crossings, low acreage of unconfined aquifer crossings, and implementation of BMPs.
Noise and Vibration	Noise and vibration-sensitive land uses are present in the EIS Study Area and would be subject to moderate effects. *Noise*[a] Category 2 receivers: 15,395 acres Category 3 receivers: 245 facilities *Vibration* Category 1 receivers: 1 land use Category 2 receivers: 11,247 acres Category 3 receivers: 24 facilities
Solid Waste Disposal	Negligible effects to landfills.
Natural Ecological Systems and Wildlife	85 acres of wildlife corridors and assemblages. 10% of EIS Study Area composed of higher ecological value land coverage. Alignment would not likely be fenced, making wildlife movement vulnerable to increased risk for strikes from additional rail traffic. Moderate effects on wildlife corridors and communities associated with operation. All other effects would be negligible.
Wetlands	Wetlands and other waterbodies are present in the EIS Study Area and would experience negligible effects. *Waterbodies*: 537 waterbodies; 103 acres; 317,365 linear feet. *Wetlands*: 271 wetlands; 363 acres.
Threatened and Endangered Species	*Sensitive plant species:* Negligible effects since there are no occurrences of sensitive plant species. *Wildlife species:* 5 federally listed and 1 other sensitive wildlife species. Negligible effects during construction and moderate effects during operation. *Critical Habitat:* 34 acres of Arkansas River shiner critical habitat. Negligible effects.

Resource	N4A Conventional
Flood Hazards and Floodplain Management	Floodplains and floodways are present in the EIS Study Area and would experience negligible effects. *Floodplains*: 2,005 acres *Floodways*: 410 acres
Coastal Zone Management	N/A, there are no coastal zone management areas.
Energy	Negligible adverse effects during construction and negligible beneficial effects during operation. Annual energy savings: 114,000 MBTUs
Utilities[b]	361 utility crossings. Negligible effects.
Geologic Resources[c]	Geologic risks could be avoided or minimized by meeting building standards. Moderate effects from geologic hazards. No change in access to, or reduction of, high-value minerals. Negligible effects on mineral resources.
Aesthetics and Visual Quality	49 miles of the alignment near sensitive viewers. 46 miles would have negligible effects, 1 mile, would have moderate effects, and 2 miles would have substantial effects. The overall effect would be negligible.
Land Use and Prime Farmland	*Land use*: High land use compatibility. Negligible effects. *Prime Farmland*: 6,140 acres of prime farmland. Low potential prime farmland conversion and bisection. Negligible effects.
Environmental Justice and Socioeconomics	*Socioeconomics*: Negligible effects. *Environmental Justice*: Negligible effects.
Public Health	Negligible (adverse) effects relating to air quality during construction. Negligible (benefit) long-term effects relating to air quality during operation. Negligible effects relating to groundwater and hazardous materials.
Public Safety and Hazardous Materials	*Public Safety*: Would improve crossing safety but would continue to have collision risk associated with crossings. Negligible effects. *Hazardous Materials*: 8 sites. Negligible effects.
Recreational Areas and Opportunities[d]	Negligible effects from construction activities and property acquisition. 56 recreational resources.
Historic Resources[d]	Moderate effects from acquisition or rehabilitation, restoration, or expansion of existing railroad-related historic resources. 35 known NRHP-listed, NRHP-eligible, or potentially NRHP-eligible historic resources.
Archaeological Resources[d]	Moderate effects from demolition or disturbance of resources. 1 NRHP-eligible site and 14 undetermined eligible archaeological sites.
Section 4(f)/Section 6(f)	65 Section 4(f) properties and 3 Section 6(f) properties in the EIA Study Area. The alternative may avoid Section 4(f) resources by remaining inside existing rail or transportation right-of-way.

Resource	N4A Conventional
Travel Demand and Transportation	*Effects on Transit Providers*: 50 and 44 percent of bus and air passengers would be diverted to rail, respectively. This would have substantial (negative) effects on both bus and air service providers. *Change in VMT*: Negligible (beneficial) effects. 0.6% reduction in VMT. Potential secondary beneficial effect (reduced congestion) to bus service providers.

[a] Category 1 noise- and vibration-sensitive land uses are those that are set aside for serenity and quiet such as outdoor amphitheaters. Category 2 noise- and vibration-sensitive land uses include residences and hotels. Category 3 land uses include churches, schools, recreation areas, and similar land use activities with which noise and vibration could interfere.

[b.] The most intense effect for each alternative is presented in the table; however, alternatives may include additional less intense effects depending on urban or rural locations, density of utilities, and if existing or new track would be constructed.

[c] The most intense effect for each alternative is presented in the table. However, alternatives may include additional, less intense effects depending on specific geologic hazards.

[d] The most intense effect for each alternative is presented in the table. However, alternatives may include additional less intense effects depending on urban, suburban, or rural locations.

BMP = best management practice

MBTU = million British thermal units

N/A = not applicable

NRHP = National Register of Historic Places

VMT = vehicle miles traveled

Table ES-4: Summary of Resource Effects in the Central Section by Alternative

<table>
<tr><th>Resource</th><th>C4A HrSR</th><th>C4A HSR</th><th>C4B HrSR</th><th>C4B HSR</th><th>C4C HrSR</th><th>C4C HSR</th></tr>
<tr><td>Air Quality</td><td colspan="2">Substantial (adverse) short-term (construction) effects and substantial (benefit) long-term regional (operation) effects.</td><td>Substantial (adverse) short-term (construction) effects and moderate (benefit) long-term regional (operation) effects.</td><td>Moderate (adverse) short-term (construction) effects and substantial (benefit) long-term regional (operation) effects.</td><td colspan="2">Substantial (adverse) short-term (construction) effects and substantial (benefit) long-term regional (operation) effects.</td></tr>
<tr><td>Water Quality</td><td colspan="2">Surface waters: More waterbodies than C4B, fewer than C4C (700 features; 24,187 linear feet of listed Section 303(d) impaired waters). Moderate effects due to the acreage and linear feet crossed.

Runoff: Negligible effect due to low amount of impervious surfaces and implementation of structural stormwater management practices and construction BMPs.

Erosion: Less erosive soils crossed than C4B and C4C (101 crossed). More acreage than C4B and less than C4C (1,424 acres). Moderate effect due to the acreage of erosive soils crossed which would be minimized with use of construction BMPs.

Groundwater: More aquifers crossed than C4B and less than C4C (25,775 acres crossed). Negligible effect as a</td><td colspan="2">Surface waters: Fewer waterbodies than C4A and C4B (650 features; 18,870 linear feet of listed Section 303(d) impaired waters). Moderate effects due to the acreage and linear feet crossed.

Runoff: Negligible effect due to low amount of impervious surfaces and implementation of structural stormwater management practices and construction BMPs.

Erosion: More erosive soils crossed than C4A and less crossed than C4C (116 crossed). Less acreage than C4A and C4C (1,395 acres). Moderate effect due to the acreage of erosive soils crossed which would be minimized with use of construction BMPs.

Groundwater: Less aquifers crossed than C4A and C4C (23,160 acres).</td><td colspan="2">Surface waters: More waterbodies than C4A and C4B (850 features; 23,084 linear feet of listed Section 303(d) impaired waters). Moderate effects due to the acreage and linear feet crossed.

Runoff: Negligible effect due to low amount of impervious surfaces and implementation of structural stormwater management practices and construction BMPs.

Erosion: More erosive soils crossed (123 crossed) and more acreage (1,706 acres) than C4A and C4B. Moderate effect due to the acreage of erosive soils crossed which would be minimized with use of construction BMPs.

Groundwater: More aquifers crossed than C4A and C4B (31,900 acres). Negligible effect as a result</td></tr>
</table>

Resource	C4A HrSR	C4A HSR	C4B HrSR	C4B HSR	C4C HrSR	C4C HSR
	result of no Sole Source aquifer recharge area crossings, low acreage of unconfined aquifer crossings, and implementation of stormwater treatment measures and BMPs.		Negligible effect as a result of no Sole Source aquifer recharge area crossings, low acreage of unconfined aquifer crossings and implementation of stormwater treatment measures and BMPs.		of no Sole Source aquifer recharge area crossings, low acreage of unconfined aquifer crossings and implementation of stormwater treatment measures and BMPs.	
Noise and Vibration	Higher amount of noise- and vibration-sensitive land uses than C4B, but lower amount than C4C. C4A HSR effects more receivers than C4A HrSR, however, both would have moderate effects.		Lowest amount of noise- and vibration-sensitive land uses. C4B HSR effects more receivers than C4B HrSR, however, both would have negligible effects.		Highest amount of noise- and vibration-sensitive land uses. C4C HSR effects more receivers than C4C HrSR; however, both would have moderate effects.	
	Noise[a] Category 2 receivers: 7,937 acres Category 3 receivers: 100 facilities *Vibration* Category 2 receivers: 8,686 acres Category 3 receivers: 32 facilities	*Noise* [a] Category 2 receivers: 19,466 acres Category 3 receivers: 227 facilities *Vibration* Category 2 receivers: 11,919 acres Category 3 receivers: 39 facilities	*Noise* [a] Category 2 receivers: 6,560 acres Category 3 receivers: 81 facilities *Vibration* Category 2 receivers: 6,917 acres Category 3 receivers: 26 facilities	*Noise* [a] Category 2 receivers: 15,549 acres Category 3 receivers: 179 facilities *Vibration* Category 2 receivers: 9,566 acres Category 3 receivers: 35 facilities	*Noise* [a] Category 2 receivers: 9,284 acres Category 3 receivers: 110 facilities *Vibration* Category 2 receivers: 9,019 acres Category 3 receivers: 37 facilities	*Noise* [a] Category 2 receivers: 22,799 acres Category 3 receivers: 256 facilities *Vibration* Category 2 receivers: 12,387 acres Category 3 receivers: 44 facilities
Solid Waste Disposal	Landfills present in the counties affected by the EIS Study Area would experience negligible effects.					
Natural Ecological Systems and Wildlife	62% non-developed land covers. 107 acres of wildlife corridors and assemblages.		64% non-developed land covers. 66 acres of wildlife corridors and assemblages.		62% non-developed land covers. 107 acres of wildlife corridors and assemblages.	

Resource	C4A HrSR	C4A HSR	C4B HrSR	C4B HSR	C4C HrSR	C4C HSR
	628 acres of sensitive plant communities. 18% of EIS Study Area composed of higher ecological value land coverage. Substantial effects during construction and moderate effects during operation on non-developed lands, wildlife corridors and assemblages, and areas of high ecological importance. Higher overall potential for effects to wildlife corridors and communities from HSR than HrSR because HSR noise and vibration would travel farther than that generated by HrSR.		628 acres of sensitive plant communities. 18% of EIS Study Area composed of higher ecological value land coverage. Substantial effects during construction and moderate effects during operation on non-developed lands, wildlife corridors and assemblages, and areas of high ecological importance. Higher overall potential for effects to wildlife corridors and communities from HSR than HrSR because HSR noise and vibration would travel farther than that generated by HrSR.		628 acres of sensitive plant communities. 15% of EIS Study Area composed of higher ecological value land coverage. Substantial effects during construction and moderate effects during operation on non-developed lands, wildlife corridors and assemblages, and areas of high ecological importance. Higher overall potential for effects to wildlife corridors and communities from HSR than HrSR because HSR noise and vibration would travel farther than that generated by HrSR.	
Wetlands	More waterbodies and wetlands than C4B, but fewer than C4C. Moderate effects. *Waterbodies*: 700 waterbodies; 153 acres; 316,909 linear feet. *Wetlands*: 349 wetlands; 312 acres.		Fewest waterbodies and wetlands. Moderate effects. *Waterbodies*: 650 waterbodies; 99 acres; 293,669 linear feet. *Wetlands*: 309 wetlands; 181 acres.		Most waterbodies and wetlands. Moderate effects. *Waterbodies*: 850 waterbodies; 164 acres; 400,363 linear feet. *Wetlands*: 391 wetlands; 345 acres.	
Threatened and Endangered Species	No occurrences of sensitive plant species. Negligible effect. 1 federally listed and 1 other sensitive wildlife species. Substantial effect for construction and moderate effect for operation. No critical habitat. Negligible effect.		No occurrences of sensitive plant species. Negligible effect. 1 federally listed and 1 other sensitive wildlife species. Substantial effect for construction and moderate effect for operation. No critical habitat. Negligible effect.		No occurrences of sensitive plant species. Negligible effect. 1 federally listed and 1 other sensitive wildlife species. Substantial effect for construction and moderate effect for operation. No critical habitat. Negligible effect.	

Resource	C4A HrSR	C4A HSR	C4B HrSR	C4B HSR	C4C HrSR	C4C HSR
Flood Hazards and Floodplain Management	More floodplains and floodways than C4B, but fewer than C4C. Negligible effects. *Floodplains*: 2,212 acres *Floodways*: 815 acres		Fewest floodplains and floodways. Negligible effects. *Floodplains*: 2,193 acres *Floodways*: 582 acres		Most floodplains and floodways. Negligible effects. *Floodplains*: 2,691 acres *Floodways*: 961 acres	
Coastal Zone Management	N/A; there are no coastal zone management areas.					
Energy	Moderate adverse effects during construction, and moderate beneficial effects during operation. Annual energy savings: 668,832 MBTUs	Substantial adverse effects during construction, and substantial beneficial effects during operation. Annual energy savings: 1,812,892 MBTUs	Moderate adverse effects during construction, and moderate beneficial effects during operation. Annual energy savings: Not estimated.	Substantial adverse effects during construction, and substantial beneficial effects during operation. Annual energy savings: 2,264,999 MBTUs	Moderate adverse effects during construction, and moderate beneficial effects during operation. Annual energy savings: Not estimated.	Substantial adverse effects during construction, and substantial beneficial effects during operation. Annual energy savings: 1,413,391 MBTUs
Utilities[b]	424 utility crossings. Moderate effect.	424 utility crossings. Substantial effect.	315 utility crossings. Substantial effect.	315 utility crossings. Substantial effect.	744 utility crossings. Substantial effect.	744 utility crossings. Substantial effect.
Geologic Resources[c]	Geologic risks could be avoided or minimized by meeting building standards. Moderate effects from geologic hazards. None of the alternatives would affect access or availability of high-value minerals. Negligible effects on mineral resources.					
Aesthetics and Visual Quality	47 miles of the alignment near sensitive viewers. C4A HSR would affect more sensitive viewers than C4A HrSR.		49 miles of the alignment near sensitive viewers. C4B HSR would affect more sensitive viewers than C4B HrSR.		62 miles of the alignment near sensitive viewers. C4C HSR would affect more sensitive viewers than C4C HrSR.	

Resource	C4A HrSR	C4A HSR	C4B HrSR	C4B HSR	C4C HrSR	C4C HSR
	C4A HSR: 0 miles would have negligible effects, 36 miles would have moderate effects, and 11 miles would have substantial effects. Overall, the effect of C4A HSR would be substantial. C4A HrSR: 36 miles would have negligible effects, 10 miles would have moderate effects, and 1 mile would have substantial effects. Overall, the effect of C4A HrSR would be moderate.		C4B HSR: 0 miles would have negligible effects, 36 miles would have moderate effects, and 13 miles would have substantial effects. Overall, the effect of C4B HSR would be substantial. C4B HrSR: 36 miles would have negligible effects, 11 miles would have moderate effects, and 2 miles would have substantial effects. Overall, the effect of C4B HrSR would be moderate.		C4C HSR: 0 miles would have negligible effects, 51 miles would have moderate effects, and 11 miles would have substantial effects. Overall, the effect of C4C HSR would be substantial. C4C HrSR: 51 miles would have negligible effects, 10 miles would have moderate effects, and 1 mile would have substantial effects. Overall, the effect of C4C HrSR would be moderate.	
Land Use and Prime Farmland	*Land use compatibility*: Medium land use compatibility. Moderate effects. *Prime farmland*: 10,440 acres. Moderate effects.	*Land use compatibility*: Medium land use compatibility. Moderate effects. *Prime farmland*: acres. 10,440 Moderate effects.	*Land use Compatibility*: Low land use compatibility. Moderate effects. *Prime farmland*: 10,217 acres. Substantial effects.	*Land use Compatibility*: Low land use compatibility. Moderate effects. *Prime farmland*: 10,217 acres. Substantial effects.	*Land use Compatibility*: Medium land use compatibility. Substantial effects. *Prime farmland*: 12,435 acres. Substantial effects.	*Land use Compatibility*: Medium land use compatibility. Substantial effects. *Prime farmland*: 12,435 acres. Substantial effects.
Environmental Justice and Socioeconomics	*Environmental Justice*: Moderate effects. *Socioeconomics*: Moderate effects.					
Public Health	Moderate (adverse) effects during construction related to air quality. Negligible (benefit) long-term effects relating to air quality during operation. Negligible effects relating to groundwater and hazardous materials.					
Public Safety and Hazardous Materials	*Public Safety:* Would improve crossing safety over No Build Alternative. C4A HrSR would have more at-grade crossings and		*Public Safety:* Would improve crossing safety over No Build Alternative. C4B HrSR would have the fewest at-grade crossings		*Public Safety:* Would improve crossing safety over No Build Alternative. C4C HrSR would have the most at-grade	

Resource	C4A HrSR	C4A HSR	C4B HrSR	C4B HSR	C4C HrSR	C4C HSR
	collision risk than C4B HrSR, but fewer at-grade crossings and less collision risk than C4C HrSR. However, effects would be negligible through implementation of project design features and mitigation measures, such as following safety design standards for track and roadway design.		and least collision risk of the HrSR alternatives. Effects would be negligible through implementation of project design features and mitigation measures, such as following safety design standards for track and roadway design.		crossings and collision risk of the HrSR alternatives. However, effects would be negligible through implementation of project design features and mitigation measures, such as following safety design standards for track and roadway design.	
	HSR alternatives would have no at-grade crossings and no associated collision risk. Negligible effects.					
	Hazardous Materials: More sites (9) than C4B, but fewer than C4C. Negligible effects for C4A HrSR and moderate effects for C4A HSR.		*Hazardous Materials:* Fewest sites (8). Moderate effects.		*Hazardous Materials:* Most sites (12). Negligible effects for C4C HrSR and moderate effects for C4C HSR.	
Recreational Areas and Opportunities[d]	More recreational resources than C4B, but fewer than C4C. Substantial effects from construction activities and property acquisition. 57 recreational resources: 28 in urban, 17 in suburban, 12 in rural areas.		Fewest recreational resources. Substantial effects from construction activities and property acquisition. 51 recreational resources: 28 in urban, 15 in suburban, 8 in rural areas.		Most recreational resources. Moderate effects for C4C HrSR and substantial effects for C4C HSR from construction activities and property acquisition. 62 recreational resources: 33 in urban, 17 in suburban, 12 in rural areas.	
Historic Resources[d]	More known NRHP-listed, NRHP-eligible, or potentially NRHP-eligible historic resources than C4B, but fewer than C4C. Substantial effects from acquisition or rehabilitation, restoration, or expansion of existing railroad-related historic resources. 45 known NRHP-listed, NRHP-eligible, or potentially NRHP-eligible historic resources.		Fewest known NRHP-listed, NRHP-eligible, or potentially NRHP-eligible historic resources. Substantial effects from acquisition or rehabilitation, restoration, or expansion of existing railroad-related historic resources. 38 known NRHP-listed, NRHP-eligible, or potentially NRHP-eligible historic resources.		Most known NRHP-listed, NRHP-eligible, or potentially NRHP-eligible historic resources. Substantial effects from acquisition or rehabilitation, restoration, or expansion of existing railroad-related historic resources. 52 known NRHP-listed, NRHP-eligible, or potentially NRHP-eligible historic resources.	

Resource	C4A HrSR	C4A HSR	C4B HrSR	C4B HSR	C4C HrSR	C4C HSR
Archaeological Resources[d]	More identified sites than C4B, but fewer than C4C. Moderate (C4A HrSR) to substantial (C4A HSR) effects from disturbance or demolition of resources. 1 NRHP-eligible site and 25 undetermined eligible archaeological sites.		Fewest identified sites. Moderate (C4B HrSR) to substantial (C4B HSR) effects from disturbance or demolition of resources. 2 NRHP-eligible sites and 18 undetermined eligible archaeological sites.		Most identified sites. Moderate (C4C HrSR) to substantial (C4C HSR) effects from disturbance or demolition of resources. 1 NRHP-eligible site and 26 undetermined eligible archaeological sites.	
Section 4(f)/ Section 6(f)	64 Section 4(f) properties and 3 Section 6(f) properties in the EIS Study Area. All of the Central Section alternatives are likely to result in a potential use of Section 4(f) resources. Design refinements to avoid specific Section 4(f) properties and/or to minimize harm will be addressed at the project level.					
Travel Demand and Transportation	Effects on Transit Providers: 14% and 38% of bus and air passengers would be diverted to rail. Resulting in moderate and substantial effects on bus and air service providers, respectively. Change in VMT: Moderate (beneficial) effects. 3.1% reduction in VMT. Potential secondary beneficial effect (reduced congestion) to	Effects on Transit Providers: 22% and 68% of bus and air passengers would be diverted to rail. Resulting in moderate and substantial effects on bus and air service providers, respectively. Change in VMT: Substantial (beneficial) effects. 8.6% reduction in VMT. Potential secondary beneficial effect (reduced congestion) to bus	Travel demand modeling not conducted[e]	Effects on Transit Providers: 23% and 70% of bus and air passengers would be diverted to rail. Resulting in moderate and substantial effects on bus and air service providers, respectively. Change in VMT: Substantial (beneficial) effects. 9% reduction in VMT. Potential secondary beneficial effect (reduced congestion) to	Travel demand modeling not conducted[e]	Effects on Transit Providers: 21% and 62% of bus and air passengers would be diverted to rail. Resulting in moderate and substantial effects on bus and air service providers, respectively. Change in VMT: Substantial (beneficial) effects. 7.2% reduction in VMT. Potential

Resource	C4A HrSR	C4A HSR	C4B HrSR	C4B HSR	C4C HrSR	C4C HSR
	bus service providers. For air carriers the potential benefits may include the opportunity to shift from short-haul to longer-haul flight operations, which may include more reliable scheduling and increased revenue.	service providers. For air carriers the potential benefits may include the opportunity to shift from short-haul to longer-haul flight operations, which may include more reliable scheduling and increased revenue.		bus service providers. For air carriers the potential benefits may include the opportunity to shift from short-haul to longer-haul flight operations, which may include more reliable scheduling and increased revenue.		secondary beneficial effect (reduced congestion) to bus service providers. For air carriers the potential benefits may include the opportunity to shift from short-haul to longer-haul flight operations, which may include more reliable scheduling and increased revenue.

[a] Category 2 noise- and vibration-sensitive land uses include residences and hotels. Category 3 land uses include churches, schools, recreation areas, and similar land use activities with which noise and vibration could interfere.

[b] The most intense effect for each alternative is presented in the table; however, alternatives may include additional less intense effects depending on urban or rural locations, density of utilities, and if existing or new track would be constructed.

[c] The most intense effect for each alternative is presented in the table. However, alternatives may include additional, less intense effects depending on specific geologic hazards.

[d] The most intense effect for each alternative is presented in the table. However, some alternatives may include additional less intense effects depending on urban, suburban, or rural locations.

[e] For this service-level analysis, the travel demand modeling for Alternatives C4B and C4C Higher-Speed Rail was not conducted to the same level of detail, but instead relied upon a proportional relationship based on full travel demand modeling conducted for the C4A High-Speed Rail and C4A Higher-Speed Rail alternatives. Refer to Section 3.20, Travel Demand and Transportation.

Table ES-5: Summary of Resource Effects in the Southern Section by Alternative

<table>
<tr><th rowspan="2">Resource</th><th colspan="3">Alternative</th></tr>
<tr><th>S4 HrSR</th><th>S6 HrSR</th><th>S6 HSR</th></tr>
<tr><td>Air Quality</td><td>Substantial (adverse) short-term (construction) and long-term regional (operation) effects.</td><td>Moderate (adverse) short-term (construction) effects and long-term regional (operation) effects.</td><td>Substantial (adverse) short-term (construction) effects and negligible (benefit) long-term regional (operation) effects.</td></tr>
<tr><td>Water Quality</td><td>Surface waters: More waterbodies than S6 (443 features; 13,928 linear feet of listed Section 303(d) impaired waters). Moderate effects due to the acreage and linear feet crossed.

Runoff: Negligible due to amount of impervious surfaces and structural stormwater management practices and construction BMPs.

Erosion: More erosive soils crossed (22 crossed) but less acreage (678 acres) than S6. Negligible effect due to the acreage of erosive soils crossed which would be minimized with use of construction BMPs.

Groundwater: More aquifers crossed (27,610 acres) than S6. Negligible effect as a result of no Sole Source aquifer recharge area crossings, acreage of unconfined aquifer crossings and implementation of stormwater treatment measures and BMPs.</td><td colspan="2">Surface waters: Fewer waterbodies than S4 (255 features; 2,921 linear feet of listed Section 303(d) impaired waters). Moderate effects due to the acreage and linear feet crossed.

Runoff: Negligible due to amount of impervious surfaces and structural stormwater management practices and construction BMPs.

Erosion: Less erosive soils crossed (4 crossed) but more acreage (691 acres) than S4. Negligible effect due to the acreage of erosive soils crossed which would be minimized with use of construction BMPs.

Groundwater: Less aquifers crossed (12,450 acres) than S4. Negligible effect as a result of no Sole Source aquifer recharge area crossings, acreage of unconfined aquifer crossings and implementation of stormwater treatment measures and BMPs.</td></tr>
</table>

Resource	Alternative		
	S4 HrSR	S6 HrSR	S6 HSR
Noise and Vibration	Highest amount of noise- and vibration-sensitive land uses. Moderate effects.	Lowest amount of noise- and vibration-sensitive land uses. S6 HSR effects more receivers than S6 HrSR, however, both would have negligible effects.	
	Noise[a]*:* Category 2 receivers: 8,753 acres Category 3 receivers: 62 facilities *Vibration:* Category 2 receivers: 2,181 acres Category 3 receivers: 17 facilities	*Noise* [a]*:* Category 2 receivers: 687 acres Category 3 receivers: 1 facility *Vibration:* Category 2 receivers: 172 acres Category 3 receivers: 0 facilities	*Noise* [a]*:* Category 2 receivers: 1,586 acres Category 3 receivers: 3 facilities *Vibration:* Category 2 receivers: 240 acres Category 3 receivers: 0 facilities
Solid Waste Disposal	Landfills present in the counties affected by the EIS Study Area would experience negligible effects.		
Natural Ecological Systems and Wildlife	68% non-developed land covers. Moderate effect. No wildlife corridors or assemblages. Negligible effect. 15% of EIS Study Area composed of higher ecological value land coverage. Substantial effects during construction and moderate effects during operation.	92% non-developed land covers. Substantial effects during construction and moderate effects during operation. No wildlife corridors or assemblages or sensitive plant communities. Negligible to moderate effects. There is higher potential for effects from HSR than HrSR because HSR noise and vibration would travel farther than that generated by HrSR. 21% of EIS Study Area composed of higher ecological value land coverage. Substantial effects.	
Wetlands	Most waterbodies and wetlands. Moderate effects. Waterbodies: 443 waterbodies; 74 acres; 247,448 linear feet. Wetlands: 189 wetlands; 142 acres.	Fewest water bodies and wetlands. Moderate effects. Waterbodies: 255 waterbodies; 29 acres; 120,488 linear feet. Wetlands: 83 wetlands; 57 acres.	

Resource	Alternative		
	S4 HrSR	S6 HrSR	S6 HSR
Threatened and Endangered Species	5 federally listed and 13 other sensitive plant species. Substantial effects during construction and negligible effects during operation. 2 federally listed and 11 other sensitive wildlife species. Substantial effects during construction and moderate effects during operation. No critical habitat. Negligible effects.	No occurrences of sensitive plant species. Negligible effects. 1 sensitive wildlife species. Negligible effects during construction and moderate effects during operation. No critical habitat. Negligible effects.	
Flood Hazards and Floodplain Management	Cannot compare against S6 because of data constraints. Negligible effects. Floodplains: 3,011 acres Floodways: 4 acres	National Flood Hazard Layer data missing for much of EIS Study Area. Negligible effects. Floodplains: 453 acres, based on limited data Floodways: 12 acres, based on limited data	
Coastal Zone Management	10 miles of alignment in Nueces County Coastal Management Zone. Negligible effects.	N/A, there are no coastal zone management areas.	
Energy	Moderate adverse effects during construction and moderate beneficial effects during operation. Annual energy savings: 229,024 MBTUs	Moderate adverse effects during construction and moderate beneficial effects during operation. Annual energy savings: 295,143 MBTUs	Substantial adverse effects during construction and substantial beneficial effects during operation. Annual energy savings: 398,507 MBTUs
Utilities[b]	847 utility crossings. Moderate effect.	84 utility crossings. Moderate effect.	84 utility crossings. Moderate effect.
Geologic Resources[c]	Geologic risks could be avoided and minimized by meeting building standards. Moderate effects from geologic hazards. None of the alternatives would affect access or availability of high-value minerals. Negligible effects on mineral resources.		
Aesthetics and Visual Quality	50 miles of the alignment near sensitive viewers. 36 miles would have negligible effects, 6 miles would have moderate effects,	18 miles of the alignment near sensitive viewers. S6 HSR would affect more sensitive viewers than S6 HrSR. S6 HSR: 0 miles would have negligible effects, 0 miles would have moderate effects, and 18 miles would have substantial effects. Overall, the effect of S6 HSR would be substantial. S6	

Resource	Alternative		
	S4 HrSR	S6 HrSR	S6 HSR
	and 8 miles would have substantial effects. Overall, the effect would be moderate.	HrSR: 0 miles would have negligible effects, 16 miles would have moderate effects, and 2 miles would have substantial effects. Overall, the effect of S6 HrSR would be moderate.	
Land Use and Prime Farmlands	*Land use*: Low land use compatibility. Moderate effects. *Prime farmland*: 11,814 acres. Substantial effects.	*Land use*: Low land use compatibility. Substantial effects. *Prime farmland*: 4,810 acres. Substantial effects.	
Environmental Justice and Socioeconomics	*Environmental Justice*: Substantial effects. *Socioeconomics*: Moderate effects.		
Public Health	Moderate (adverse) effects during construction related to air quality. Moderate (adverse) long-term regional effects during operation associated with diesel trains and vehicle idling near high concentrations of sensitive populations. Negligible effects relating to groundwater and hazardous materials.	Moderate (adverse) effects during construction related to air quality. Negligible (adverse) long-term regional effects during operation. Negligible effects relating to groundwater and hazardous materials.	Moderate (adverse) effects during construction related to air quality. Negligible (benefit) long-term regional effects during operation. Negligible effects relating to groundwater and hazardous materials.
Public Safety and Hazardous Materials	*Public Safety:* Would improve crossing safety over No Build Alternative. Would have most at-grade crossings and collision risk. However, effects would be negligible through implementation of project design features and mitigation measures, such as following safety design standards for track and roadway design.	*Public Safety:* Would improve crossing safety over No Build Alternative. Would have fewer at-grade crossings and less collision risk than S4 HrSR, but more than S6 HSR. However, effects would be negligible through implementation of project design features and mitigation measures, such as following safety design standards for track and roadway design.	*Public Safety:* Would improve crossing safety over No Build Alternative. Would have no at-grade crossings and no collision risk. Negligible effects.
	Hazardous Materials: 4 sites. Negligible effects.	*Hazardous Materials:* 0 sites. Negligible effects.	

Resource	Alternative		
	S4 HrSR	S6 HrSR	S6 HSR
Recreational Areas and Opportunities[d]	Highest number of recreational resources, but effects reduced because of greater use of existing rail right-of-way. Moderate effects from construction activity and property acquisition. 54 recreational resources: 38 in urban, 4 in suburban, 12 in rural areas.	Fewest number of recreational resources. Negligible effects from construction activity and property acquisition. 3 recreational resources: 1 in urban, 0 in suburban, 2 in rural areas.	
Historic Resources[d]	Most known NRHP-listed, NRHP-eligible, or potentially NRHP-eligible historic resources. Moderate effects from acquisition or rehabilitation, restoration, or expansion of existing railroad-related historic resources. 36 known NRHP-listed, NRHP-eligible, or potentially NRHP-eligible historic resources.	No known NRHP-listed, NRHP-eligible, or potentially NRHP-eligible historic resources. Negligible effects.	
Archaeological Resources[d]	Most identified sites. Potential for moderate effects. 1 NRHP-eligible site and 20 undetermined eligible archaeological sites.	Potential for moderate effects. 0 NRHP-eligible sites and 7 undetermined eligible archaeological sites.	Potential for substantial effects. 0 NRHP-eligible sites and 7 undetermined eligible archaeological sites.
Section 4(f)/ Section 6(f)	62 Section 4(f) properties and 2 Section 6(f) properties in the S4 HrSR Study Area. 1 Section 4(f) property and 0 Section 6(f) properties in the S6 HrSR and HSR Study areas. Southern Section alternatives may avoid Section 4(f) resources by remaining inside existing rail or transportation right-of-way or by implementing variations of the evaluated alternatives at the project-level that would traverse areas where no Section 4(f) resources have been identified.		
Travel Demand and Transportation	Effects on Transit Providers: 23% and 64% of bus and air passengers would be diverted to rail. Resulting in moderate and substantial effects on	Effects on Transit Providers: 9% of bus passengers would be diverted to rail, resulting in moderate effects on bus	Effects on Transit Providers: 15% of bus passengers would be diverted to rail, resulting in moderate effects on bus

Resource	Alternative		
	S4 HrSR	**S6 HrSR**	**S6 HSR**
	bus and air service providers, respectively. *Change in VMT*: Negligible (beneficial) effects. 0.2% reduction in VMT. Potential secondary beneficial effect (reduced congestion) to bus service providers. For air carriers the potential benefits may include the opportunity to shift from short-haul to longer-haul flight operations, which may include more reliable scheduling and increased revenue.	service providers. No effect on air carriers. *Change in VMT*: Negligible (beneficial) effects. 0.4% reduction in VMT. Potential secondary beneficial effect (reduced congestion) to bus service providers.	service providers. No effect on air carriers. *Change in VMT*: Negligible (beneficial) effects. 0.9% reduction in VMT. Potential secondary beneficial effect (reduced congestion) to bus service providers.

[a] Category 2 noise- and vibration-sensitive land uses include residences and hotels. Category 3 land uses include churches, schools, recreation areas, and similar land use activities with which noise and vibration could interfere.

[b] The most intense effect for each alternative is presented in the table; however, alternatives may include additional less intense effects depending on urban or rural locations, density of utilities, and if existing or new track would be constructed.

[c] The most intense effect for each alternative is presented in the table. However, alternatives may include additional, less intense effects depending on specific geologic hazards.

[d] The most intense effect for each alternative is presented in the table. However, some alternatives may include additional less intense effects depending on urban, suburban, or rural locations.

ES.6 Summary of Mitigation

In a service-level analysis, the description of effects and their severity is not detailed enough to formulate specific mitigation measures. Therefore, each resource analysis in Chapter 3 includes a list of mitigation strategies that would be considered and further developed at the project-level EIS phase. Mitigation strategies include conceptual avoidance and minimization measures for the next phase of design, suggestions for programmatic agreements, and descriptions of options for replacing or re-establishing the affected resources.

ES.7 Next Steps

The public review and comment period on the service-level Draft EIS will provide agencies and members of the public the opportunity to review the document, attend public hearings, and provide comments to inform decision-making. As reflected in Chapter 2, Section 2.2, the Draft EIS has identified the preferred alternative by geographic section and provided a summary explanation regarding the basis for the selection. A Final EIS will summarize the basic content of the Draft EIS, list changes to the Draft EIS that occurred as a result of agency and public input, and respond to substantive environmental comments received on the Draft EIS.

FRA will issue a single Final EIS and Record of Decision document pursuant to Pub. L. 112-141, 126 Stat. 405, Section 1319(b), unless FRA determines statutory criteria or practicability considerations preclude issuance of a combined document pursuant to Section 1319. Both the Draft and Final EIS are full-disclosure documents that provide descriptions of the proposed action, the affected environment, alternatives considered, and the expected beneficial or adverse environmental effects. Future project-level analyses will develop detailed design alternatives and quantify impacts for individual project decisions and implementation.

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List of Acronyms

°F	degrees Fahrenheit
AADT	average annual daily traffic
ACOG	Association of Central Oklahoma Governments
ADA	Americans with Disabilities Act
APE	Area of Potential Effect
AREMA	American Railway Engineering and Maintenance-of-Way Association
BEA	U.S. Bureau of Economic Analysis
BMP	best management practice
BTEX	benzene, toluene, ethylbenzene, and xylenes
Btu	British thermal unit
CAA	Clean Air Act
CAMPO	Capital Area Metropolitan Planning Organization
Capital Metro	Capital Metropolitan Transportation Authority
CEQ	Council on Environmental Quality
CERCLIS	Comprehensive Emergency Response Compensation and Liabilities Information System
CFR	Code of Federal Regulations
CH2M	CH2M HILL
CMZ	coastal management zone
CO	carbon monoxide
CO_2	carbon dioxide
COG	Council of Governments
CONV	conventional rail
CWA	Clean Water Act
CZMP	coastal zone management program
DAL	Dallas Love Field Airport
DART	Dallas Area Rapid Transit
dB	decibel
dBA	decibel A-weighted

DFW	Dallas/Fort Worth International Airport
DHHS	U.S. Department of Health and Human Services
diesel PM	diesel particulate matter plus diesel exhaust organic gases
DUS	Dallas Union Station
EIA	U.S. Energy Information Administration
EIS	environmental impact statement
ENV	Environmental Affairs Division
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FM	Farm-to-Market Road
FR	Federal Register
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GDP	gross domestic product
GHG	greenhouse gas
GIS	geographic information system
GLO	General Land Office
HCMPO	Hidalgo County Metropolitan Planning Organization
HOU	William P. Hobby Airport
HOV	high-occupancy vehicle
HrSR	higher-speed rail
HSR	high-speed rail
IAH	Houston George Bush Intercontinental Airport
IH	Interstate Highway
ITC	Intermodal Transportation Center
KCS	Kansas City Southern
KOP	key observation point

kV	kilovolt
L&WCF	Land and Water Conservation Fund
LEP	limited English proficiency
Leq(h)	hourly equivalent sound level
LUST	leaking underground storage tank
MBTA	Migratory Bird Treaty Act
MBtu	million British thermal units
MOA	Memorandum of Agreement
mph	miles per hour
MPO	metropolitan planning organization
MRLC	Multi-Resolution Land Characteristic Consortium
MT	metric ton
MTP	Metropolitan Transportation Plan
NAAQS	National Ambient Air Quality Standards
NCTCOG	North Central Texas Council of Governments
NEPA	National Environmental Policy Act
NHD	National Hydrographic Dataset
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NLD	National Levee Database
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory

NWSR	National Wild and Scenic River
O_3	ozone
OAS	Oklahoma Archeological Survey
ODEQ	Oklahoma Department of Environmental Quality
ODOT	Oklahoma Department of Transportation
ODWC	Oklahoma Department of Wildlife Conservation
OKC	Will Rogers World Airport
OWRB	Oklahoma Water Resources Board
PAH	polycyclic aromatic hydrocarbon
PB	Parsons Brinckerhoff
PM	particulate matter
PM_{10}	particulate matter 10 micrometers in diameter or less
$PM_{2.5}$	particulate matter 2.5 micrometers in diameter or less
PRIIA	Passenger Rail Investment and Improvement Act
Program	Texas-Oklahoma Passenger Rail Program
PUC	Public Utility Commission
RCRA	Resource Conservation and Recovery Act
REAP	Regional Ecological Assessment Protocol
RWQCB	Regional Water Quality Control Board
SAL	State Antiquities Landmark
SAT	San Antonio International Airport
SH	State Highway
SHPO	State Historic Preservation Officer
SIP	state implementation plan
SO_2	sulfur dioxide
SP	Stated Preference
SSURGO	Soil Survey Geographic Database
Study	Texas-Oklahoma Passenger Rail Study
SVOC	semivolatile organic compound
SWRCB	State Water Resources Control Board

TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TCMP	Texas Coastal Management Program
TCP	traditional cultural property
THC	Texas Historical Commission
The T	Fort Worth Transportation Authority
TMP	Traffic Management Plan
TPH	total petroleum hydrocarbon
TPWD	Texas Parks and Wildlife Department
TRE	Trinity Railway Express
TTI	Texas A&M Transportation Institute
TWDB	Texas Water Development Board
TxDOT	Texas Department of Transportation
TXNDD	Texas Natural Diversity Database
U.S.C.	U.S. Code
UDP	Unanticipated Discovery Plan
US	U.S. Highway
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
V/C	volume to capacity (ratio)
VCP	Voluntary Cleanup Program
VIA	VIA Metropolitan Transit
VMT	vehicle miles traveled
VOC	volatile organic compound
WSRA	Wild and Scenic Rivers Act

1.0 Purpose and Need

The Texas Department of Transportation (TxDOT), along with the Federal Railroad Administration (FRA), is preparing this service-level environmental impact statement (EIS) to evaluate intercity passenger rail service alternatives for the Texas-Oklahoma Passenger Rail Program (Program). Preparation of this EIS is one of two primary objectives of the Texas-Oklahoma Passenger Rail Study (Study). In addition to this EIS, the Study includes preparation of a service development plan for the corridor to guide further development and capital investment in passenger rail improvements identified in the EIS Record of Decision. The Oklahoma Department of Transportation (ODOT) is a partnering state agency for the Study and the EIS.

This service-level EIS evaluates a reasonable range of corridor alternatives and passenger rail service types and will recommend a preferred corridor, location of train service termini, and type of service. A No Build Alternative and multiple build alternatives are evaluated. The build alternatives include infrastructure improvements in existing or prior rail corridors, the development of one or more new rail corridors, or a combination of both.

This chapter describes the need for a transportation program that addresses the inadequacies of existing passenger rail service and other modes of transportation to meet current and future mobility needs in the EIS Study Area. The EIS Study Area includes the passenger rail improvement alternatives that were developed within the Program corridor to meet the EIS purpose and need. Issues addressed in the EIS Study Area include increased travel demand, congestion, air quality, restricted mobility and economic development, and safety. This chapter also describes how improved intercity transportation, provided by enhanced passenger rail service, would meet future intercity travel demand, improve rail facilities, reduce travel times, and improve connections with regional public transit services.

1.1 Introduction

The Program would provide enhanced passenger rail service along an 850-mile corridor extending approximately from Oklahoma City to south Texas (Corpus Christi, Brownsville, Laredo, and the Rio Grande Valley, including McAllen, Harlingen, and Brownsville, and surrounding communities along the Rio Grande River).

The Program corridor runs north-south and roughly parallels Interstate Highway 35 (IH-35), with the northern point in Edmond, Oklahoma (the northern end of the Oklahoma City portion of the corridor), and the southern end in south Texas, potentially in Corpus Christi, Brownsville, Laredo, or the Rio Grande Valley (Figure 1-1). Although Edmond was selected as the northern point based on preliminary ridership forecasts and early stakeholder input, Oklahoma City is the city name used in general descriptions of the corridor because of its larger size and name recognition. The corridor analysis addresses the interrelationships of the key regional markets within the Program corridor EIS in the following three geographic sections:

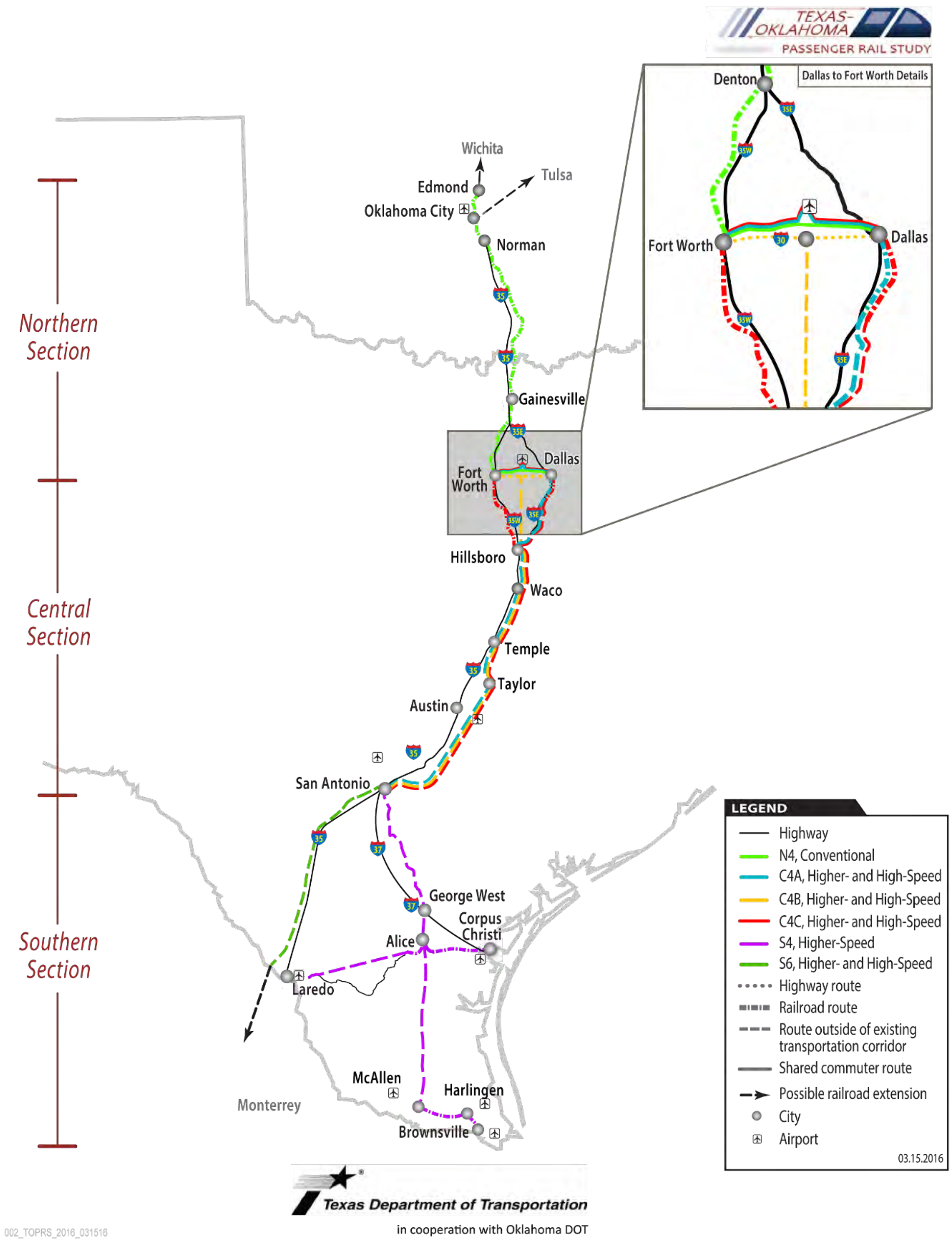

Figure 1-1: Geographic Sections and Alternatives

- Northern Section: Edmond, Oklahoma, to Dallas and Fort Worth, Texas
- Central Section: Dallas and Fort Worth to San Antonio
- Southern Section: San Antonio to south Texas (Corpus Christi, Brownsville, Laredo, and the Rio Grande Valley) with the option to extend to Monterrey, Mexico

FRA and TxDOT will use a tiered process, as provided for in 40 Code of Federal Regulations (CFR) 1508.28, to conduct the environmental review of the Study. This service-level EIS addresses broad corridor issues and alternatives. Subsequent project-level National Environmental Policy Act (NEPA) evaluations will analyze site-specific projects based on the service-level evaluations. This service-level EIS addresses the following:

- Confirm the purpose and need for the proposed action.
- Confirm the EIS Study Area appropriate to assess reasonable alternatives.
- Identify a comprehensive set of goals and objectives for the corridor in conjunction with stakeholders. These goals and objectives will be crafted to allow comprehensive evaluation of study alternatives necessary to achieve the goals, including train operations, vehicles, and infrastructure.
- Develop alternative evaluation criteria based on purpose and need, goals, and objectives.
- Identify the range of reasonable alternatives to be considered, consistent with the current and planned use of the corridor and the existing services within and adjacent to the EIS Study Area.
- Identify the general corridor alignment(s) and right-of-way requirements for the build alternatives.
- Identify, at the corridor planning level, the infrastructure and equipment investment requirements for the build alternatives.
- Evaluate the No Build Alternative as the baseline for comparison with the build alternatives. The No Build Alternative represents other transportation modes, such as auto, air travel, intercity bus, and existing rail, and the physical characteristics and capacities as they exist at the time of the service-level EIS, with planned and funded improvements that will be in place at the time rail improvements would become operational.
- Evaluate and describe, at the corridor planning level, the potential environmental consequences (benefits and adverse impacts on the human and natural environment) associated with the build alternatives.
- Establish the timing and sequencing and future NEPA processes for component projects to implement the proposed action.
- Identify preferred alternatives for corridor route alignment within each of the three geographic sections.

If a build alternative is selected at the conclusion of this service-level EIS process, project-level assessment(s) will address component projects to be implemented within the selected alternative and, where appropriate, will incorporate by reference the data and evaluations included in this service-level EIS. Subsequent evaluations will concentrate on the issues specific to the component of the alternative selected and analyze the environmental consequences and measures necessary to avoid, minimize, or mitigate potential environmental impacts of the component projects.

1.2 Background

The 850-mile EIS Study Area corridor extends from Edmond, Oklahoma, located just north of Oklahoma City, through Dallas, Fort Worth, Austin, and San Antonio to south Texas, including Laredo, Corpus Christi, and Brownsville. The IH-35 corridor extends from Duluth, Minnesota, to Laredo, and is a congressionally identified Corridor of National Significance. IH-35 is one of the fastest growing corridors in the United States (Parsons Brinckerhoff [PB] and ODOT 2010). It extends through six of the largest urban areas and nine of the 50 largest cities in the United States. International truck traffic demand, intercity truck traffic demand, and passenger travel demand compete for highway capacity, creating substantial congestion inside the urban areas through which IH-35 runs. Average speeds along IH-35 from Dallas and Fort Worth to San Antonio are projected to drop from 55 to 15 miles per hour (mph) by 2035 (Texas A&M Transportation Institute [TTI] 2010).

Transportation plans for Texas and Oklahoma have identified substantial population growth and population aging within the Program corridor. Texas's population is expected to increase by 39 percent from 2010 to 2035. The population of the Texas Triangle (the region of Texas bounded by Dallas, Houston, and San Antonio) has increased rapidly over the last several decades, with growth rates as high as 27 percent in some areas (TxDOT 2010a). Texas is the second-most populous state in the United States, with most of the state's population centered in the eastern half, along and east of the IH-35 corridor. Oklahoma City's population is expected to increase by 25 percent from 2000 to 2035, with intensified population densities in the metropolitan area (PB and ODOT 2010). Populations within the Program corridor are aging, with the population of people over 65 years old expected to increase from about 13 percent to nearly 20 percent by 2030 in Oklahoma and from 10 percent to more than 17 percent in Texas. The aging population is expected to rely more on public transportation modes such as intercity rail. Long-range transportation plans in Texas and Oklahoma have identified the need to improve passenger rail services to meet the future demand created by the aging population.

Existing passenger rail service includes intercity service on the Heartland Flyer (Oklahoma City to Fort Worth), Texas Eagle (Fort Worth to San Antonio), and Sunset Limited (Los Angeles to New Orleans through San Antonio) operated by Amtrak and regional/commuter rail service on the Trinity Railway Express (TRE) (Dallas to Fort Worth) and Capital MetroRail (Austin) operated by Texas operators. Intercity passenger rail between Oklahoma City and San Antonio provides service to cities and communities along the IH-35 corridor. This EIS evaluates alternatives to provide enhanced passenger rail service to meet future intercity travel demand and to improve rail facilities, reduce travel times, and improve connections with regional public transit services. These improvements are needed to address the increasing congestion on highways and rail services along the IH-35 corridor.

1.2.1 Program Corridor Description

Although a common need exists for increased passenger rail service across the Program corridor, the corridor has been divided into three geographic sections where the passenger rail needs and opportunities, while interdependent, are distinct. Each section is evaluated separately and as part of the overall rail corridor in this EIS.

The Northern Section has intercity passenger rail service (Heartland Flyer) with one train in each direction per day, where annual ridership has increased by as much as 10 percent within the last 3 years. Without this train, more than 60 percent of train passengers would have taken automobiles and up to 29 percent of passengers would not have traveled (ODOT 2012). This passenger rail service is constrained by operation on a busy freight railroad line, resulting in delays and inconvenient layovers for connecting with other rail or transit services in Fort Worth. Rail improvement planning in this section has identified the need for enhanced railroad facilities and better coordination with other connecting passenger rail services to increase the attractiveness of rail as a travel option. Additional needs in the Northern Section include direct connection to the City of Dallas and the Dallas/Fort Worth International Airport (DFW), improved train control systems to increase train speed and allow safe operation of the increased numbers of freight and passenger trains within the rail corridor, and additional roadway/railroad grade separations to enhance safety where rail and roadways cross.

The Central Section has intercity passenger rail service provided by the Texas Eagle, the southernmost portion of daily Amtrak service between Chicago and San Antonio. From Fort Worth, daily connections with the Heartland Flyer provide intercity rail service north to Oklahoma City. From San Antonio, connections with the Sunset Limited operate three times per week east to New Orleans and west to Los Angeles. Approximately 23 percent of Amtrak trips ending in Texas originate within the state.

The Central Section is characterized by the highest level of intercity travel demand in Texas. This is, in part, a result of its linking three of the four largest metropolitan areas within the state, all of which are projected to grow in the future. The Central Section, through the IH-35 corridor, is characterized by substantially higher automobile and truck volumes than any other intercity corridor in the state. These volumes are projected to increase steadily through 2035, by which time traffic volumes are projected to reduce freeway speeds to as low as 15 mph, causing substantial delays. Air travel between the Central Section termini (Dallas and Fort Worth to San Antonio) is characterized by higher passenger volumes than any other intrastate connection. With the exception of the connection from Dallas and Fort Worth to Houston, air travel demand from Dallas and Fort Worth to San Antonio is more than twice the demand of any other intrastate intercity connection. Enhanced passenger rail service in the Central Section would assist in meeting the strong demand for intercity travel in this highly populated corridor, thereby reducing current and projected automobile and truck volumes.

The Southern Section does not have passenger rail service. Instead, Amtrak provides passenger service south of San Antonio by motor coach. Brownsville and Laredo have heavy commercial truck traffic on the highways and heavy freight traffic along freight railroad lines. The increasing congestion in these border cities affects the economic viability of the region. Other intercity public transportation, including transportation to other destinations in the United States and Mexico, is provided by motor coaches operated by Mexican and U.S. operators. Travel options are needed to address future passenger travel demand in this area and reduce roadway congestion caused by the passenger buses and commercial truck traffic. Rail service in this section would provide an efficient, safe, equitable, and affordable option to highway, bus, or air travel. In the Southern Section, cross-border travel demand to Mexican destinations such as Monterrey, a major business hub, results in strong potential passenger rail demand.

1.2.2 History

High-speed passenger rail has been under consideration in Texas since the late 1980s. In the 1990s, a private consortium was awarded a franchise to design, build, and operate high-speed rail in the state. Although demand appeared to support the development of high-speed rail, lack of funding and other obstacles prevented the project from moving forward. Since then, other proposals for high-speed rail in Texas have been submitted to FRA, with each proposal showing revenues that exceed operating expenses but requiring funding to build. In 2000, FRA designated the South Central Corridor, including the area between San Antonio and Dallas and Fort Worth, as a future high-speed rail corridor. In 2010, TxDOT received a grant from FRA to study passenger rail in that corridor.

1.2.3 Related Planning Activities

In cooperation with TxDOT and the Federal Highway Administration, TTI studied the potential for development of an intercity rail and express bus system in Texas. The TTI study examined long distance intercity and interregional corridors to determine which corridors are most likely to need additional intercity travel capacity in the coming decades. TTI examined specific corridor characteristics for 18 intercity corridors and ranked the corridors to identify those needing more intercity transit capacity in the future. TTI based its analysis of corridors on several factors, including the following:

- Current and future population and demographic projections along 18 intercity corridors in the state.
- Projected future intercity travel demand based on forecasts by the Texas State Demographer and other state agencies.
- Current transportation network capacity and routes for intercity highway, bus, air, and rail travel.

The TTI study was completed in 2010, and the final report was published in May 2010. This report indicated that there is a critical need to provide efficient travel scenarios for both freight and passenger demand. Expanding the existing roadway network would be difficult because of the surrounding development within the major urban areas. Options for highway loops built around the areas to accommodate traffic would lengthen the distance to travel through those areas. The TTI study developed a preliminary concept plan with potential costs and benefits for the intercity transportation corridors. The intercity transportation corridors within the state would be served by an intercity rail/express bus system and not preclude an enhanced passenger rail system to meet the travel demand identified in existing highway and rail corridors. Local and regional development of improved bus, light rail, and commuter rail systems would continue within the major urban areas of the state to transport travelers from stations potentially served by a statewide transit system.

Potential enhancements to transportation systems and their sustainability include the planning and implementation of land uses that reduce total travel trips or the need for private vehicle trips. Metropolitan areas within the Program corridor are incorporating transit and passenger rail into their plans for intermodal facilities, which support transit-oriented development (Association of Central Oklahoma Governments [ACOG] 2011). Transit-oriented development provides a variety of land uses close to transit and rail stations. The higher density of commercial and residential uses increases transit access, encourages ridership, and promotes interregional connectivity with other economic centers. Transit-oriented development reduces the area needed for parking and increases the proximity and density of mixed uses. In other national centers, passenger rail service has spawned development near rail stations that combines residential, commercial, and job centers, which reduces the need for private vehicles. For example, the Fort Worth Intermodal Transportation Center (ITC) connects intercity rail with the TRE, operated by Dallas Area Rapid Transit (DART) and the Fort Worth Transportation Authority, and with regional public transit service. Examples under development include a planned intermodal transit hub in Oklahoma City and a transit center in San Antonio that previously had passenger rail service. The Program should evaluate other opportunities for reducing trips and the need for private vehicles, enhancing transit facilities and potential locations for transit-oriented development.

1.3 Overall Program – Purpose and Need

This purpose and need statement for the Program identifies two levels of discussion. The first level addresses the overall purpose and need for the entire 850-mile Program corridor from Oklahoma City to south Texas (Figure 1-1). The second level addresses the purpose and need specific to each of the three geographic sections that compose the Program corridor.

1.3.1 Overall Program – Purpose

The purpose of the Program is to enhance intercity mobility by providing enhanced passenger rail service as a transportation alternative that is competitive with automobile, bus, and/or air travel. The objectives of the overall Program are the following:

- Provide high-quality intercity rail service that will offer competitive travel times, schedule reliability, and traveler comfort.
- Encourage more efficient and environmentally sensitive modes of intercity travel.
- Provide an equitable and affordable intercity travel alternative.
- Enhance interconnectivity between intercity rail services, regional transit services, and major regional airports.
- Enhance environmental sustainability by facilitating regional land use and transit-oriented development plans within the Program corridor.
- Enhance interregional access to employment, entertainment, recreation, health, and shopping opportunities within the Program corridor.
- Coordinate and avoid conflicts with freight rail operations and facilities.
- Be a cost-efficient investment where the projected train service revenue meets or exceeds the following percentages[1] of operations and maintenance costs:
  - Conventional rail (speeds up to 90 mph) = 50 percent
  - Higher-speed rail (speeds up to 125 mph) = 75 percent
  - High-speed rail (speeds up to 220 to 250 mph) = 100 percent

1.3.2 Overall Program – Need

The need for the Program arises from the inadequacies of existing passenger rail service and other modes of transportation to meet current and future mobility needs in the EIS Program corridor, which are the following:

- Population and economic growth will increase travel demand, generate additional roadway and aviation congestion, and reduce automobile, aviation, and transit reliability, thereby requiring regional mobility alternatives.
- Limited intercity passenger rail service and capacity and lack of interregional connectivity restrict both mobility and economic development.
- Declining air quality resulting from increased travel demand and congestion requires more environmentally sustainable modes of travel.
- Growth in truck and rail freight has negative effects on the safety of the transportation system.

[1] For this EIS, cost efficiency is defined as the estimated percentage of operating cost (including operations and maintenance of the service) that could be recovered through service revenue such as passenger fares. The higher the percentage, the greater the cost efficiency. Capital costs such as the cost of rail construction and purchase of train sets is not included the evaluation of cost efficiency. The three different cost-efficiency thresholds reflect the expectation that higher-speed rail, and to an even greater extent, high-speed rail, is capable of higher rates of cost recovery (higher cost efficiency) compared with conventional rail service.

The following sections discuss the considerations that drive the need for the overall Program.

1.3.2.1 Population and economic growth will increase travel demand, generate additional roadway and aviation congestion, and reduce automobile, aviation, and transit reliability, thereby requiring regional mobility alternatives.

Demographics are changing transportation demand in the Program corridor. Statewide transportation plans for Texas and Oklahoma have identified substantial population growth and an increasingly higher percentage of older people within the Program corridor. The population in the Texas Triangle has increased rapidly over the past several decades, with growth rates as high as 27 percent in some areas. The population in Texas is expected to increase even more rapidly, by 39 percent from 2010 to 2035, with 92 percent of the population growth between 2010 and 2030 in metropolitan areas (TxDOT 2010a). Texas is the second-most populous state in the United States. Most of the state's population resides in the eastern half, along and east of the IH-35 corridor. Similarly, the population in Oklahoma City is expected to increase by 25 percent between 2000 and 2035, with intensified population densities in the metropolitan area (PB and ODOT 2010). Population forecasts anticipate that the population of people over 65 years old will increase from about 13 percent to nearly 20 percent by 2030 in Oklahoma (PB and ODOT 2010) and from 10 percent to more than 17 percent in Texas (TxDOT 2010a). Generally, an aging population relies more on public transportation modes such as intercity rail as a safer means of accessibility, and as the population ages, this segment of demand is expected to increase (PB and ODOT 2010; TxDOT 2010b). The change in demographics is likely to increase the demand for options to the automobile for intercity travel.

Economic growth in Texas has outpaced national economic output. Forecasts predict that economic growth in Texas will more than double between 2010 and 2035, with the manufacturing and information sectors expected to have the highest growth rates. In addition, Texas freight volumes are expected to increase overall by about 82 percent between 2008 and 2035. In this timeframe, rail and rail/truck volume (a combination of freight in rail cars and truck trailers shipped by rail) will increase by 91 percent and truck volume will increase by 77 percent (TxDOT 2010a).

Over time, the economy of Oklahoma has evolved, transitioning from natural resources and agriculture to the manufacturing and services sectors, with additional stability provided by a large military presence. The Oklahoma economy is expected to grow at a moderate pace, and, led by the services sector, will continue to diversify. Freight volume in Oklahoma is expected to increase at a moderate pace from 2010 to 2020, at a rate of 1.7 percent per year, and then to 2035 at about 1.5 percent per year (PB and ODOT 2010).

The growth in freight volume in both Texas and Oklahoma will add congestion to the already stressed highway and freight rail systems. The increase in regional traffic volumes will also increase travel time congestion. For persons traveling between major economic centers, the cost associated with increased travel time will increase.

The Program corridor experiences heavy congestion on the region's highway system. The public highway and commercial aviation systems have served the intercity travel needs of the residents of Texas and Oklahoma. The combined growth of the population and economy add intercity transportation demand that will worsen travel conditions.

Transportation investments are needed to reduce travel delay and improve the competitiveness of and access to economic markets. The IH-35 corridor is a congressionally identified Corridor of National Significance and is one of the fastest-growing regions in both population and economic expansion in the United States (PB and ODOT 2010). It extends through six of the largest urban areas and nine of the 50 largest cities in the United States. International truck traffic demand, intercity truck traffic demand, and passenger travel demand compete for highway capacity, creating substantial congestion inside and between the urban areas through which IH-35 runs (TTI 2010). In Oklahoma, long-range planning identified the need for expansion of IH-35 to six lanes south of Oklahoma City, but has not identified funding for this capacity enhancement (PB and ODOT 2010). From Dallas and Fort Worth to San Antonio, traffic levels on IH-35 are higher than on any comparable corridor in Texas, with the exception of the Dallas and Fort Worth to Houston Interstate Highway 45 (IH-45) corridor. Truck traffic on IH-35 is the highest of any highway corridor in Texas. These high traffic volumes will increase through 2035. Projections for the Central Section of the Program corridor show average speeds along IH-35 will drop from 55 to 15 mph by 2035 (TTI 2010). South of San Antonio, both truck traffic and intercity bus traffic contribute to highway congestion, with truck traffic expected to increase by 175 percent and 125 percent on IH-35 and Interstate Highway 37 (IH-37), respectively, between 2002 and 2035 (TTI 2010). In south Texas, motor coach service across the Mexico border from Laredo and north into Texas creates localized congestion in the urban areas and at the border crossings. The extensive truck and motor coach congestion increases travel times and inefficient intercity travel for passengers unable or unwilling to travel by private passenger vehicles or by air.

Table 1-1 shows the 2002 and 2035 forecast average annual daily traffic (AADT) volumes, volume-to-capacity (V/C) ratios, and average speeds for the major highway corridors in the Central and Southern sections (TTI 2010).

The AADT and V/C ratios projected for the highway corridors between the city pairs show that demand will increase far beyond recent historical trends to expand highway capacity. The V/C ratios are projected to be at or over 1.0, which means that, on average, traffic volumes will be at or above the available highway capacity, which will decrease average travel speeds and increase average travel times and delays. These changes will affect automobile travelers and bus carrier services. The busiest intercity travel corridor in the Program corridor, Dallas and Fort Worth to San Antonio, is projected to have a V/C ratio of 1.90 by 2035 — almost double the corridor average capacity.

Table 1-1: 2002 and 2035 Forecast Traffic Data and Projections by City Pair

Geographic Section of Corridor	City Pair	2002			2035		
		AADT	V/C Ratio	Average Speed	AADT	V/C Ratio	Average Speed
Central	Dallas and Fort Worth to San Antonio	71,952	0.80	55 mph	178,452	1.90	15 mph
Southern	San Antonio to Brownsville (via Corpus Christi)	22,391	0.46	58 mph	49,173	1.00	45 mph
Southern	San Antonio to Brownsville (via Laredo)	23,783	0.44	53 mph	60,529	1.05	37 mph
Source: TTI (2010).							

Additionally, Texas and Oklahoma state transportation plans identify a substantial number of commercial air passengers traveling to or from the major metropolitan areas within the Program corridor (TxDOT 2010b; PB and ODOT 2010; TTI 2010), as shown in Table 1-2. Although many passengers travel by air between cities in the Program corridor, market changes in the air travel industry have changed air carrier schedules and eliminated service at some airports as airlines opt for longer haul flights that create higher revenue (Holloway 2003; TTI 2010). City pairs within the Program corridor that have lost air carrier service since 2007 include Austin-Midland and Corpus Christi-Dallas Love Field, while air carrier service between Brownsville and DFW was added (TTI 2010). Austin-Corpus Christi also lost air carrier service in the same timeframe, but as of 2013, it does have limited air carrier service. As the air travel industry evolves, air carriers may consider additional reductions in intercity services to reduce costs associated with rising aviation fuel prices. In addition, the aviation system is vulnerable to disruption caused by adverse weather locally or in other parts of the country, creating reliability issues.

Because airports are not located near commercial centers, passengers require additional connections upon arrival. For example, both DFW and San Antonio International Airport (SAT) have identified a need for direct connection with passenger rail (DFW 2009), and the Will Rogers World Airport in Oklahoma City has identified the need for direct connectivity with regional transit systems. Providing intermodal connectivity is a stated objective of airport host cities, and with air service emphasizing long-distance flights, efficient intercity travel options for air passengers would enhance accessibility options. There is a need to coordinate intermodal service to expand accessibility options.

Table 1-2: 2011 and 2040 Airport Data and Projections by Major Airports in the EIS Program Corridor

Airport	2011 Actual (thousands)	2040 Forecast (thousands)	Compound Annual Growth Rate[a] 2011-2040
Enplanements			
Waco (ACT)	60	132	2.76%
Austin (AUS)	4,410	9,130	2.54%
Brownsville (BRO)	84	151	2.04%
Corpus Christi (CRP)	328	445	1.06%
Dallas-Love Field (DAL)	3,842	6,483	1.82%
Dallas/Fort Worth (DFW)	27,464	49,421	2.05%
Harlingen (HRL)	362	676	2.18%
Killeen (GRK)	189	176	-0.25%
Laredo (LRD)	106	219	2.53%
McAllen (MFE)	335	626	2.18%
Oklahoma City (OKC)	1,721	2,911	1.83%
San Antonio (SAT)	3,968	7,651	2.29%
Operations			
Waco (ACT)	32	43	1.02%
Austin (AUS)	180	275	1.47%
Brownsville (BRO)	41	42	0.08%
Corpus Christi (CRP)	103	87	-0.58%
Dallas-Love Field (DAL)	178	293	1.73%
Dallas/Fort Worth (DFW)	650	1077	1.76%
Harlingen (HRL)	52	58	0.38%
Killeen (GRK)	13	12	-0.28%
Laredo (LRD)	68	125	2.12%
McAllen (MFE)	65	66	0.05%
Oklahoma City (OKC)	128	145	0.43%
San Antonio (SAT)	179	300	1.80%

[a] Compound annual growth rate represents the average annual rate of demand increase across the time span where individual year demand growth would be higher or lower than the average annual.

Source: Federal Aviation Administration (2014).

The viability of travel alternatives and options needs to be evaluated to provide efficient access and mobility between major population and economic centers, increase safety, reduce overall travel time, and increase convenience and comfort for travelers.

1.3.2.2 Limited intercity passenger rail service and capacity and lack of interregional connectivity restrict both mobility and economic development.

Passenger rail options exist in the Northern and Central sections of the Program corridor; however, the constrained capacity and availability of rail lines limit operations. Intercity passenger rail in the Program corridor operates predominantly on host Class I railroads[2] that are privately owned and primarily in the business of high-volume freight movement, such as UPRR and BNSF Railway. Competing needs for track usage creates operational problems that can delay passenger rail service within the Program corridor.

Figure 1-2: Passenger Rail Routes in the Program Corridor

Amtrak provides intercity passenger rail service on the Heartland Flyer, Texas Eagle, and Sunset Limited lines, as shown on Figure 1-2. There is no passenger rail service in Texas south of San Antonio. Intercity ground-based passenger service south of San Antonio is provided primarily by motor coaches operated by private bus operators, with destinations in Mexico and the United States. The limited travel options and the congestion in Texas along the border with Mexico and ports prolong international trips and affect this region's economic connectivity with other areas of the state.

Although currently the demand on the transportation system is high and increasing, intercity and regional travel options are limited. Intercity passenger rail service could be an effective option for travel in the Program corridor. For example, the Heartland Flyer diverted 39,000 vehicle trips in

[2] Class I railroads are the largest railroad operators in the United States, with annual operating revenues of at least $250 million.

2009, with a reduction of 7.9 million vehicle-miles traveled (ODOT 2012). Two primary factors limit passenger ridership: (1) long travel times with frequent delays, and (2) lack of interregional connectivity.

The first factor limiting passenger ridership involves the robust freight rail business with the host Class I railroads. To avoid affecting current operation or future growth of freight rail, options to expand the intercity passenger rail service on the existing infrastructure are limited. Because of the limited intercity rail service schedules, passengers can have long layovers at rail stations before boarding other intercity rail services or connecting with regional rail or transit services. In addition, the intercity passenger trains are subject to delays, most of which (85 percent for Heartland Flyer and 71 percent for Texas Eagle) result from delays associated with the host railroad (ODOT 2012; TxDOT 2010a). These delays increase travel times, affect schedule reliability, and affect the ability of passengers to connect with other services. Faster, more reliable passenger rail service is needed to enhance its attractiveness as an intercity travel option. Evaluating options for improved passenger rail service and preparing a service development plan are two of the short-term objectives of the *Texas Rail Plan* (TxDOT 2010a).

The second factor limiting ridership on passenger rail lines is the lack of interregional connectivity with high-speed transit service between communities and destinations. The limited service schedules of the three intercity passenger rail lines — Heartland Flyer, Texas Eagle, and Sunset Limited — result in substantial layovers and delays for passengers transferring from one service to another and limited connectivity to other modes due to infrequent service. These rail lines also do not link all of the vital economic centers within the Program corridor or provide intermodal connections with other local rail lines or commercial airports. This lack of connectivity limits the attraction of passenger rail as an intercity travel option.

1.3.2.3 Declining air quality resulting from increased travel demand and congestion requires more environmentally sustainable modes of travel.

The counties in the Dallas and Fort Worth area do not meet the federal air quality standard for ozone, which is a byproduct of internal combustion engines (U.S. Environmental Protection Agency [EPA] 2016). High vehicle volumes and the resulting congestion on IH-35 is a major contributor to this condition. As discussed above, traffic congestion on IH-35 is projected to worsen. In south Texas, the Corpus Christi area currently meets air quality standards, but is near the limits of compliance, and Laredo has concerns with dust emissions from extensive traffic movement, including heavy vehicles (Texas Commission on Environmental Quality [TCEQ] 2007). Although Austin and San Antonio are in attainment, they have taken early action and implemented rules to reduce ozone precursors because they are close to the nonattainment threshold. Traffic congestion associated with the increased travel demand may increase localized vehicle emissions because of the reduced speed and increased idling time of the vehicles. Environmentally sustainable travel options will relieve traffic congestion and reduce vehicle emissions, which is beneficial to the local and regional air quality.

In addition, greenhouse gases (GHGs), such as carbon dioxide emitted by the combustion of fossil fuels, increase global average temperatures, which changes the climate and melts land-based ice, causing sea levels to rise. Climate change affects local weather, changing temperatures, wind patterns, precipitation, and the intensity and frequency of storms. More energy-efficient travel and reduced fuel consumption would reduce GHG emissions.

Nationwide fuel use data show that rail is the most fuel-efficient mode of land-based freight movement and is more fuel-efficient than truck movement (TxDOT 2010a). Between 1980 and 2009, the fuel efficiency of freight rail increased by 104 percent, and further efficiencies are being made as a result of improvements in equipment and rail yard operations (TxDOT 2010a). According to Amtrak, rail travel is more energy-efficient than either air travel or automobiles, using almost 20 percent less fuel than domestic airline travel and 30 percent less fuel than automobile travel on a per-passenger-mile basis. Improvements in passenger rail technology, including the use of modern train equipment and new service that avoids delays, would further reduce fuel consumption of passenger trains (Amtrak 2013). Along with the improvement in fuel consumption, expanding passenger rail options would reduce GHG emissions (TxDOT 2010a). Rail (combined freight and passenger rail) contributes just 2.7 percent of transportation-related GHG emissions, and efforts are under way to improve rail fuel economy and reduce GHG emissions in the Program corridor, such as projects to reduce rail bottlenecks (TxDOT 2010a).

1.3.2.4 Growth in truck and rail freight has negative effects on the safety of the transportation system.

As discussed in Section 1.3.1, Overall Program – Purpose, economic growth will continue to create higher volumes of heavy truck movement on IH-35. Large trucks have been involved in an increasing number of fatal crashes in all categories — large-truck occupants, occupants of other vehicles, and non-occupants (USDOT, National Highway Traffic Safety Administration 2012a). With increasing heavy truck traffic, options are needed for intercity passengers traveling within this corridor that would reduce on-road vehicle accidents. For safety reasons, passenger rail should be evaluated as an intercity travel option to traveling on highways shared with heavy trucks.

The top rail safety priority in Texas is to enhance safety for all transportation system users, including improvements in safety (such as fewer injuries and fatalities) and at rail grade crossings (TxDOT 2010a). Texas has the most rail miles and the most grade crossings of any state in the United States. Although Texas has ranked highest nationally in number of grade-crossing accidents and fatalities, the accident rate has steadily decreased over the last decade. Texas has provided grade-separated crossings or safe crossings where grade separations are not possible. The state's plan addresses crossings that have been identified as safety concerns. The approach includes implementing improvements to crossing surfaces, highway median barriers, grade-crossing signals, and pedestrian crossings; installing reflector systems; consolidating grade crossings; and addressing trespasser issues (TxDOT 2010a). The *2010-2035 Statewide Oklahoma Long Range Transportation Plan* also identified a lack of grade separation for passenger rail routes, the safest operational environment, which is a deficiency found with most passenger rail routes (PB and ODOT 2010).

For those corridors where passenger trains would operate in a shared right-of-way with freight services, many of the grade separations would consist of highway overpasses/underpasses, which produce a collateral safety benefit for freight because a potentially dangerous highway grade crossing for both the new passenger trains and adjacent freight lines would be removed. Furthermore, given the well-recognized and documented higher level of safety for passengers traveling on intercity or high-speed rail versus riding or driving in automobiles, every passenger-mile diverted from automobile to rail would be approximately 20 times safer or less likely to incur a fatality (National Association of Railroad Passengers 2001).

1.4 Northern Section – Purpose and Need

1.4.1 Northern Section – Purpose

The purpose of the Program in the Northern Section is to provide efficient and reliable intercity passenger rail service along the Northern Section of the Program corridor that is competitive with other travel options. The specific objectives are the following:

- Provide faster and more frequent intercity connections between central Oklahoma and communities in southern Oklahoma and the state of Texas, specifically the Dallas and Fort Worth region in north Texas. These potential improvements in speed and frequency would also apply to local transit connections in the Dallas-Fort Worth Metroplex, as well as a connection to the national intercity rail network.
- Enhance opportunities for rail service that is connected with current and planned intercity passenger rail and air passenger services, such as linking with DFW.
- Reduce delays and bottlenecks to create competitive rail service travel times compared with other modes of intercity travel, including private vehicles, buses, and air carriers.
- Provide intercity passenger rail service that supports the transit-oriented development objectives of the *Intermodal Transportation Hub Master Plan for Central Oklahoma* (ACOG 2011).
- Protect the carrying capacity of freight rail.
- Provide mode alternatives that help meet the region's air quality attainment goals.

1.4.2 Northern Section – Need

Population and economic growth in the Northern Section are projected to increase intercity passenger travel demand beyond that which can be accommodated by the existing highway, intercity passenger rail, and air travel systems in the Northern Section. Specific needs for the Northern Section are the following:

- Increasing population density and changes in demographic profile require alternatives in regional mobility.
- Existing constrained passenger rail service that competes with freight for rail line capacity is impacted by delays and makes it difficult to attract business or short-travel riders.
- Inefficient connections with other modes of travel reduce the attractiveness of passenger rail as an intercity travel alternative.
- Local governments require regional support to improve interregional connectivity.

The following sections discuss the specific considerations that drive the need for the Program in the Northern Section.

1.4.2.1 Increasing population density and changes in demographic profile require alternatives in regional mobility.

Changing demographics and economic growth will affect transportation demand in the Oklahoma region. The population of Oklahoma is expected to increase to 4.3 million people by 2035, a 25 percent increase from 2000, with intensified population densities in the metropolitan areas (PB and ODOT 2010). Land use planning in the state encourages higher-density development and infill development within urbanized areas. Oklahoma City already has significant peak-hour highway congestion along IH-35. The growing population and increased densities in the metropolitan regions will increase congestion if alternative intermodal access is not provided. In addition, the overall population age is expected to rise, with the population over 65 years old increasing from 13 percent in 2000 to almost 20 percent in 2030 (PB and ODOT 2010). Elderly individuals historically have a higher rate of transit ridership than any other age group (TxDOT 2010b). With the aging population increasing, the available transit options cannot meet the demand on public transportation.

Although the drop in natural resource prices in the 1980s and the national economic downturn in 2009 affected the economy of Oklahoma, the negative impact was contained by stability in the state's housing market. Oklahoma remains one of the nation's largest producers of livestock and wheat, but new economic drivers include manufacturing, healthcare, and finance service sectors. Oklahoma anticipates moderate but steady economic growth of 2.5 percent through 2038 (PB and ODOT 2010).

1.4.2.2 Existing constrained passenger rail service that competes with freight for rail line capacity is impacted by delays and makes it difficult to attract business or short-travel riders.

Passenger rail service is limited between Oklahoma City and Dallas and Fort Worth. The Heartland Flyer, operated by Amtrak, provides intercity passenger rail between Oklahoma City and Fort Worth, generally following IH-35. The Heartland Flyer operates one round-trip per day and stops in Oklahoma City, Norman, Purcell, Pauls Valley, and Ardmore, Oklahoma, and in Gainesville and Fort

Worth, Texas. In past years, demand for passenger rail in the Northern Section has increased. The Heartland Flyer carried 81,000 riders in 2010, an 11 percent increase over 2009, and ridership continued to increase in 2011. According to the *Texas Rail Plan*, about 58 percent of rail passengers were diverted from vehicle trips (39,000 vehicle trips in 2009). While passenger satisfaction has scored higher than other state-sponsored or short-distance Amtrak trains (95 out of 100 versus scores in the 80s for other trains), speed, reliability, and frequency of operation need to be addressed. The current travel time from Oklahoma City to Fort Worth averages 4.25 hours, about 45 minutes longer than the same trip by private vehicle. A 15-month study of delay times between March 2011 and May 2012 showed that the average total delay time per month was 2,405 minutes (ODOT 2012). Eight to five (8 to 5) percent of these delays were caused by the host railroad, BNSF, because freight demand uses most of the capacity available on the rail corridor (TxDOT 2010a). These delays and limited trip frequency make it difficult to attract business or short-trip travelers because commuting from Oklahoma City to Dallas and Fort Worth in the same day is difficult. In addition to travel time reductions and increases in train frequency, improved reliability is needed to increase the attractiveness of rail travel.

As noted above, the Heartland Flyer operates one round-trip per day from Oklahoma City to Fort Worth (departing Oklahoma City at 8:25 am and arriving in Fort Worth at 12:39 pm and departing Fort Worth at 5:25 pm and arriving in Oklahoma City at 9:39 pm). The service schedule only allows brief day trips for traveling from Oklahoma to Texas. Except for a short trip confined to an afternoon in Texas, any visit of longer duration or planned for a different time of day requires at least a 1-night stay to provide a full day in the Dallas and Fort Worth area. In the other direction, a 2-night stay is required in Oklahoma.

1.4.2.3 Inefficient connections with other modes of travel reduce the attractiveness of passenger rail as an intercity travel alternative.

The current passenger rail service is not competitive with other modes of travel. Because the Heartland Flyer terminates at Fort Worth on the BNSF line, there is no direct rail connection to Dallas. There is also no direct rail connection with DFW to transfer travel mode from rail to air carrier. Travel to Dallas requires a connection with the TRE commuter rail service or other regional transit, as noted above. Because the Heartland Flyer and TRE schedules are not coordinated at Fort Worth, a rider must wait more than 1 hour to continue to Dallas or DFW. Coordinating the commuter rail schedule with the Heartland Flyer would improve service to the Dallas market.

Limitations in the intercity rail service and poor coordination among carriers, particularly with one intercity train per day, create delays and inefficient connections. There is a 1.5-hour wait between Heartland Flyer and Texas Eagle connections in either direction, and there is a 5-hour layover in Fort Worth between the southbound arriving and northbound departing Heartland Flyer[3]. An earlier

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[3] The schedule for the Heartland Flyer can be found at http://heartlandflyer.com/schedule/, and the schedule for the Texas Eagle can be found at http://www.texaseagle.com/cgi-bin/via.pl?id=21,22,421,422.

departure from Fort Worth would reduce the wait, but would limit the ability to remain in Fort Worth without an overnight stay. Leisure travelers to Fort Worth account for a much higher percentage of riders than those who connect with the Texas Eagle, so an earlier departure might discourage day trippers. TRE does not coordinate its schedule with the Heartland Flyer, so there can be a long delay for passengers traveling to DFW (ODOT 2012).

The *Oklahoma Long Range Transportation Plan* (PB and ODOT 2010) identified the lack of local intermodal connections at the Heartland Flyer station in Oklahoma City. A collaboration of agencies in central Oklahoma has planned for an intermodal transit hub that includes passenger rail service (including high-speed rail), local transit service, and adjacent transit-oriented development. The plan focuses on the Santa Fe Station, which is the current location of the Heartland Flyer service. The *Oklahoma Long Range Transportation Plan* identified the following passenger rail weaknesses related to inefficient connections:

- Rail congestion with Class I railroads causes passenger rail delays.
- Regional, rural, high-speed, and Amtrak services are operating or being pursued, but there is a lack of coordination between these efforts.
- Heartland Flyer connection times with the Texas Eagle are long, with a scheduled 1.5-hour delay in either direction, which discourages passenger rail use.
- A single round-trip per day for the Heartland Flyer discourages use.

1.4.2.4 Local governments require regional support to improve interregional connectivity.

As outlined in the *Oklahoma Long Range Transportation Plan*, to meet environmental and sustainability goals, the urbanized areas are planning for increased sustainability in development and transportation. A collaboration of agencies in central Oklahoma has planned for an intermodal transit hub that would include passenger rail service (including high-speed rail), local transit service, and adjacent transit-oriented development (ACOG 2011). Intermodal connectivity and transit-oriented development require collective actions from multiple levels of transportation planning, and these plans need to be considered for any enhanced passenger rail that would serve Oklahoma. The *Oklahoma Long Range Transportation Plan* rail weaknesses described above require regional transportation agency coordination and support to improve interregional connectivity.

1.5 Central Section – Purpose and Need

1.5.1 Central Section – Purpose

The purpose of the Program in the Central Section is to provide efficient and reliable intercity passenger rail service along the corridor from Dallas and Fort Worth to San Antonio that is competitive with other travel options. Specific objectives include the following:

- Provide efficient intercity rail service to DFW, as a more environmentally sustainable option to commuter flights, and provide regional connectivity for long-distance passengers upon arrival and departure.
- Provide connecting service to major regional air carrier services such as Austin-Bergstrom International Airport (AUS) and DFW, where passenger rail becomes the regional leg of a long-distance domestic or international journey.
- Provide a viable transportation option compared to continued expansion of IH-35.
- Avoid conflicts with freight rail operations and congested track areas.
- Provide direct, intercity rail service between Dallas and Fort Worth.
- Provide opportunities for interconnected service with other planned intercity passenger rail services (such as the proposed high-speed rail from Dallas to Houston).
- Provide intermodal connections with transit in served urban areas.
- Protect the carrying capacity of freight rail.

1.5.2 Central Section – Need

Multiple transportation, land use, socioeconomic, and environmental considerations drive the need for the Program in the Central Section, including the following:

- Changing transportation demand of an increasing transit-dependent population requires an alternative mode.
- Inefficient and infrequent rail service limits ridership.
- Increasing congestion and unreliable travel times on both the existing highway and rail services require an alternative interregional service.
- Poor and declining air quality requires more sustainable modes of travel.

The following sections discuss the specific considerations that drive the need for the Program in the Central Section.

1.5.2.1 Changing transportation demand of an increasing transit-dependent population requires an alternative mode.

The Central Section of the Program corridor connects three of the four largest metropolitan areas in Texas, extending 247 miles from Dallas and Fort Worth to San Antonio, through Austin, the state capitol. The Central Section's growing and increasing transit-dependent population is changing travel demands. The U.S. Census Bureau (2011) lists populations of 1,981,967 for Dallas and Fort Worth; 1,359,758 for San Antonio; and 820,611 for Austin. With the exception of the Dallas and Fort Worth to Houston corridor, which had a 2000 population of 9,983,833, the Central Section had the highest 2000 population, at 8,667,241 (TTI 2010). The population along the Central Section corridor is projected to increase by 2.15 percent per year through 2040 (TTI 2010), which increases the highway congestion and travel demand, as described in Section 1.5.2.3. In addition, increasingly congested highways, particularly during peak travel hours, and air travel delays associated with lengthy lines for security checks and adverse weather conditions make other travel modes more attractive.

Changing demographics and land use patterns create a need for travel options. Development in Texas is concentrated along its intercity corridors. Compared to other intercity corridors in Texas, the Central Section has the highest elderly and student populations, both of which are dependent on transit. By 2040, the Central Section is projected to have the highest percentage (18.6 percent) of persons over 65 years old and the greatest number (3,908,853) of elderly persons (TTI 2010). As their ability to safely drive automobiles decreases, the elderly will seek alternatives (PB and ODOT 2010). One option is intercity bus service, which is primarily provided by Greyhound, with additional services provided by Megabus, offering four trips per day along the IH-35 corridor and serving Dallas, Grand Prairie, Austin, and San Antonio. Passenger rail can provide another travel option.

1.5.2.2 Inefficient and infrequent rail service limits ridership.

Linking three of the four largest metropolitan areas in Texas, the Central Section has the highest level of intercity travel demand in the state. Therefore, the Central Section has substantially higher automobile and truck volumes than any other intercity corridor in the state, primarily concentrated on IH-35. These volumes are projected to increase steadily through 2035, increasing congestion (TTI 2010).

Intercity passenger rail service is limited between the urban centers in the Central Section. The Texas Eagle is the only passenger rail service in this part of the Program corridor, providing the southernmost portion of daily Amtrak service between Chicago and San Antonio and traveling from Fort Worth to San Antonio through Temple and Austin. In Fort Worth, there is a connection with the Heartland Flyer with one train in each direction to Oklahoma City. In San Antonio, there is a connection with the Sunset Limited running three days per week in each direction between Los Angeles and New Orleans, with seven stops in Texas. Most passenger train travelers are not engaged in intercity service within Texas; only 23 percent of Amtrak rail trips ending in Texas originate within the state. As an option to intercity passenger rail and to supplement limited passenger rail service, Greyhound Lines and Amtrak Thruway motor coach provide intercity travel services. With limited passenger train service and delays, vehicle travel is faster and more efficient than intercity passenger rail (TTI 2010).

In contrast to rail ridership, air travel between the Central Section termini (Dallas and Fort Worth to San Antonio) is characterized by the highest passenger volumes of any other intrastate air service connection. With the exception of the Dallas and Fort Worth to Houston connection (about 3 million passengers in 2008), air travel demand from Dallas and Fort Worth to San Antonio is more than twice the demand of any other Texas intrastate air travel connection. However, air passengers do not arrive or depart from the point of final destination; they require another mode to get to the airport and their destination. Regional planning agencies, including the North Central Texas Council of Governments, have identified as a priority connecting communities to airports that provide long-haul flights and provide a modal option to short-haul flights (TTI 2010). Table 1-3 shows segment-level air service for 2012 in the Central Section.

As noted by Amtrak, passenger rail service is more fuel-efficient and environmentally sustainable than air and automobile travel (Amtrak 2013). However, limitations in intercity passenger rail service in the Central Section may discourage passengers from changing to a passenger rail travel option. While commuter rail systems provide service in several metropolitan areas in the Central Section, they do not provide interregional connections. Planning for a regional passenger rail service between Austin and San Antonio has been underway for over 10 years by the Lone Star Rail District, but that proposed service remains in the planning phase as it addresses the need for access to the existing freight rail line and evaluates options for design and construction funding. Commuter rail systems include the TRE, operated by DART and the Fort Worth Transportation Authority; the A-Train north of Dallas, operated by the Denton County Transportation Authority; and MetroRail, operated by the Capital Metropolitan Transportation Authority in Austin. A light rail system also operates in Dallas; a light rail service had been planned in Austin but funding for that proposed service was not supported in a November 2014 bond measure. Intermodal connections between intercity passenger rail and these regional systems are not coordinated and are not efficient for travelers (TxDOT 2010a). Although inefficient and infrequent rail service limits patronage, high volumes of air passengers prove there is demand for interregional connectivity, which would be enhanced by intermodal connections.

Table 1-3: Segment-Level Air Service Summary for Program Corridor – 2012 Actual

Airport Pair	Annual Passengers	Annual Seats	Annual Scheduled Departures
DFW-ACT	88,644	135,458	2,780
DFW-AUS	1,178,168	1,375,156	9,812
DFW-GRK	187,134	300,167	6,131
DFW-LRD	75,387	115,039	2,539
DFW-MFE	111,396	172,411	1,283
DFW-OKC	542,303	654,928	4,727
DFW-SAT	1,146,608	1,320,858	7,326
DAL-AUS	727,298	993,924	7,326
DAL-OKC	257,822	415,849	3,044
DAL-SAT	807,168	1,109,772	8,260
AUS-HRL	56,455	89,124	656
BRO-DFW	40,012	62,752	1,310
CRP-DFW	183,711	238,268	5,023
HRL-SAT	84,534	186,284	1,152

Airport Pair	Annual Passengers	Annual Seats	Annual Scheduled Departures
ACT = Waco Regional Airport AUS = Austin-Bergstrom International Airport BRO = Brownsville/South Padre Island International Airport CRP = Corpus Christi International Airport DAL = Dallas Love Field GRK = Killeen-Fort Hood Regional Airport		HRL = Valley International Airport LRD = Laredo International Airport MFE = McAllen International Airport OKC = Will Rogers World Airport SAT = San Antonio International Airport	
Source: USDOT, Bureau of Transportation Statistics (2012b).			

1.5.2.3 Increasing congestion and unreliable travel times on both the existing highway and rail services require an alternative interregional service.

The Central Section closely parallels the IH-35 corridor connecting Dallas and Fort Worth, Austin, and San Antonio. In 2006, traffic levels in this corridor, at 66,939 vehicles per day, were higher than on any comparable corridor in Texas, with the exception of the Dallas and Fort Worth to Houston corridor (TTI 2010). By 2035, traffic volume on the Central Section of IH-35 will reach 178,452 vehicles per day, representing an average increase of almost 3.5 percent per year (TTI 2010). This projected traffic volume is nearly double the rated roadway capacity and will create extensive travel delays, with peak-hour travel speeds reduced to as low as 15 mph without additional capacity improvements. As stated in Section 1.3.2.1, congestion and intensity of freight movement affect traveler and business connectivity. Automobile and bus transportation are vulnerable to delays caused by congestion, and these delays increase costs for business and travelers.

There is also congestion in the rail corridors serving the Central Section. In the Fort Worth area, a centrally located rail intersection poses a rail congestion and safety challenge. At Tower 55, 11 major North American freight and passenger rail routes converge in a single intersection where two north-south lines cross an east-west line. This major crossing is close to the Fort Worth ITC, and as a result, passenger trains serving the transportation center are delayed by freight train traffic transiting through the crossing. Congestion along the north-south corridor is anticipated to increase over the next 20 years. One hundred trains per day use this intersection, which is operating above 90 percent capacity, making it one of the most congested rail intersections in the United States. Options have been suggested to address this key crossing, and a third north-south line was completed in 2014 as a short-term solution; however, no long-term solution to Tower 55 has moved forward. Increasing congestion on both the highway and rail lines requires an alternative interregional service.

1.5.2.4 Poor and declining air quality requires more sustainable modes of travel.

As discussed in Section 1.3.2.3, the counties surrounding the northern portion of the Central Section do not meet the federal air quality standard for ozone. The high vehicle volumes and resulting congestion on IH-35 could further increase localized ozone concentrations by emitting ozone precursors (nitrogen oxide and volatile organic compounds). Traffic congestion in the Central Section is projected to increase considerably because this section not only connects the other regions of Texas, but also the larger IH-35 corridor across the central United States. Improving air quality with more sustainable travel options, described in Section 1.3.2.3, is beneficial to local and regional air quality and is urgent for the Central Section with ozone concentrations that exceed the National Ambient Air Quality Standards.

1.6 Southern Section – Purpose and Need

1.6.1 Southern Section – Purpose

The purpose of the Program in the Southern Section is to provide efficient and reliable intercity passenger rail service from San Antonio to south Texas that is competitive with other mode options. Specific objectives include the following:

- Provide an equitable and affordable intercity travel alternative.
- Meet future intercity travel demand along the IH-35, IH-37, and U.S. Highway 281 (US-281) corridors.
- Provide opportunity for efficient international cross-border travel.
- Coordinate with and do not negatively affect freight rail operations or facilities.
- Meet the region’s air quality attainment goals.

In addition, there is a desire to have an option to extend passenger rail service to Monterrey, Mexico, based upon previous passenger rail operation and upon the interest and support expressed for this option during the EIS scoping period.

1.6.2 Southern Section – Need

Population and economic growth in the Southern Section will increase intercity passenger travel demand beyond that which can be accommodated by the existing highway and air travel systems. Air service options available in the Southern Section are limited. Specific needs for the Southern Section include the following:

- Regional and cross-border travel is constrained by uncompetitive trip times, poor reliability, and low levels of passenger convenience.
- Poor and declining air quality requires more sustainable modes of travel.

The following sections discuss the specific considerations that drive the need for the Program in the Southern Section.

1.6.2.1 Regional and cross-border travel is constrained by uncompetitive trip times, poor reliability, and low levels of passenger convenience.

In the Southern Section, travel issues include capacity limitations, lack of passenger rail, and high cost and limited connectivity associated with air travel.

1.6.2.1.1 Travel demand and capacity limitations

Between 2000 and 2010, the Brownsville area added more than 70,000 residents — an overall growth rate of 21.2 percent and a compound annual growth rate of 1.94 percent (Texas Department of State Health Services 2010). These growth rates are slightly higher than the Texas average. The population in Corpus Christi and surrounding areas, including Nueces and San Patricio Counties, increased by 14.1 percent between 2000 and 2010 with more than 54,000 additional residents (Corpus Christi Metropolitan Planning Organization 2009). The population in the Laredo area has more than doubled since 1970 and is expected to increase at an annual rate of 2.7 percent. Population growth increases the highway congestion and travel demand described in Section 1.3.2.3.

Commercial truck traffic is heavy on highways and freight traffic is heavy on freight railroad lines in the border areas of Brownsville and Laredo. Between San Antonio and Brownsville (via Corpus Christi), average daily vehicle and truck traffic is expected to increase by approximately 120 percent and 125 percent, respectively, from 2002 to 2035. Average speed is expected to decrease from 58 to 45 mph between 2002 and 2035 (Table 1-1). Between San Antonio and Brownsville (via Laredo), average daily vehicle and truck traffic is expected to increase by approximately 153 percent and 175 percent, respectively, from 2002 to 2035. Average speed is expected to decrease from 53 to 37 mph between 2002 and 2035 (Table 1-1) (TTI 2010). Longer delays occur as travelers compete with freight traffic crossing the Texas-Mexico border and using the transportation network near the border.

Both sides of the Texas-Mexico border depend on continued growth of freight movement. Brownsville and Laredo are along an industrialized international border, which increases truck and freight movement on the highway and freight rail system. There is increasing freight movement demand from oil and gas industry operations, resulting in increasing numbers of trucks hauling hazardous materials. Truck and freight movement creates competing demands with vehicle travel along the roadways. Intercity passenger rail service in the Southern Section corridor would provide a reliable travel option to avoid increasingly congested highways associated with the industrialized international border.

1.6.2.1.2 Lack of intercity passenger rail service and travel demand

Passenger rail service is not currently available in the Southern Section. Although bus and air transportation options are available, there is no reliable linkage between the industrial development areas in south Texas and the other economic centers to meet increasing traveler demand. Greyhound, other bus operators, and Amtrak provide motor coach service from San

Antonio to the southern border region. Mexico-based bus companies, some of which are subsidiaries of U.S. companies, provide intercity motor coach service between and through many Texas cities along their routes. Key points of U.S. entry from Mexico in the Program corridor include Laredo and Brownsville.

Multiple, robust freight rail lines serve the border areas in the Southern Section, operating on the following three Class I railroads: UPRR, BNSF, and Kansas City Southern. At Brownsville and Laredo, freight rail service extends into Mexico. Future passenger rail service using these railroad lines would need to preserve the freight rail service and allow for future growth in freight rail (TxDOT 2010a).

Private bus operators provide cross-border travel. However, these services are vulnerable to congested roadways and have long border wait times as buses queue to cross the border daily. These bus services can be delayed because of increased truck movement, and they need to stop frequently, which affects passenger convenience. Greyhound is the primary carrier along the Program corridor, and its subsidiary Valley Transit operates most of the service in the Southern Section. Valley Transit/Greyhound operates 15 trips per day in each direction over the Dallas/Fort Worth/San Antonio/Laredo route and nine trips in each direction between San Antonio and southern Texas. The Valley Transit/Greyhound Service connects the Lower Rio Grande Valley to Houston, San Antonio, and Laredo. In addition, the Valley Transit/Greyhound lines provide direct intercity bus services from Corpus Christi to Houston, San Antonio, and Laredo.

The Central Section and the Laredo portion of the Southern Section have an estimated average of 2,900 to 4,200 daily bus passenger trips (1,450 to 2,100 in each direction), and approximately 1,900 to 2,600 of those daily passenger trips are within the Program corridor (Goldberg 2013). The remaining 1,100 to 1,600 trips have an origin or destination outside the Program corridor (predominantly in Mexico).

Several Hispanic intercity bus companies provide service in Texas, especially along the Laredo-Dallas corridor. Turimex Internacional, Omnibus Express, Tornado, El Expreso, and El Conejo are the primary Hispanic carriers operating in Texas cities. Private buses provide intercity connections from Laredo and Brownsville to San Antonio and areas farther north (as far as Chicago). In some cases, these bus companies have developed station hubs in Texas. Existing station hubs in the Program corridor include San Antonio, Laredo, and Brownsville.

More than 80 percent of bus operations in the Southern Section continue beyond San Antonio to the Mexican border. Many of these buses cross the border and provide service to Mexico. Approximately 50 percent of the passengers along these routes are making a cross-border trip. Intercity bus traffic in the Southern Section corridor could be diverted to passenger rail.

The Brownsville/Corpus Christi/McAllen portion of the Southern Section has less intercity bus service than the Laredo portion. Greyhound, El Expreso, and Tornado provide nearly 20 round-trips per day between this region and Houston, while Valley Transit/Greyhound and El Expreso provide only 10 round-trips per day to San Antonio and locations along the IH-35 corridor. This portion of the Southern Section generates 540 to 700 passenger trips per day (250 to 350 in each direction) to San Antonio.

Greyhound provides intercity bus services from Laredo to San Antonio, where passengers can connect with passenger rail services, specifically with the daily Texas Eagle and Sunset Limited trains, which operate three times per week. Other intercity bus services from Laredo are provided by Greyhound/Valley Transit and Americanos USA to Austin, Dallas, and Houston.

1.6.2.1.3 Airport access and connectivity

Commercial airports in the Southern Section are in Laredo, Corpus Christi, McAllen, Harlingen, and Brownsville. Regional airlines provide most of the commercial air operations for these airports (other than SAT), including service to other destinations in Texas. Enplanements at these airports are expected to increase from 2010 through 2025, and none of these airports is expected to exceed capacity. Only SAT has a planned capacity enhancement project, to be implemented by 2025; none of the other airports requires such a project (TTI 2010). While capacity is not an issue, an efficient and safe intercity travel option is needed for travelers who cannot afford or choose not to use commercial air service. In addition, access to and from these airports requires additional transportation modes.

1.6.2.2 Air quality concerns require more sustainable modes of travel.

The Corpus Christi area is in air quality attainment, but historically was close to exceeding federal air quality standards (TCEQ 2007; EPA 2016). The area is considered an urban airshed, in which air emissions from sources interact to influence the level of ambient air pollution in the community. There is a concentration of mobile and point sources of air emissions, including power plants, chemical plants, military facilities, petroleum refineries, and on-road and off-road vehicles.

Laredo is in an air quality attainment area; however, airborne particulate matter caused by dry climate, frequent winds, unpaved streets, diesel trucks, and traffic congestion are becoming a concern in the Laredo metropolitan area. Increasing truck and vehicle traffic can affect the spread of particulate matter. As noted in Section 1.3.2.4, the Southern Section needs to improve air quality, which supports investigating a more sustainable travel option such as intercity passenger rail.

2.0 Alternatives

This chapter describes the alternatives evaluated in this service-level environmental impact statement (EIS) for the Texas-Oklahoma Passenger Rail Study (Study). Section 2.1 describes the alternatives development and screening process. Sections 2.2 and 2.3 describe the No Build Alternative and build alternative routes and service types.[1] Section 2.4 discusses costs and funding for future implementation of the Texas-Oklahoma Passenger Rail Program (Program). Section 2.5 describes those alternatives considered during the screening process, but eliminated from further consideration.

2.1 Alternatives Development and Screening Process

This section describes the process used to develop and evaluate alternatives for passenger rail within the Study Vicinity.[2] The alternatives screening process included the following steps: collecting stakeholder input; developing a range of initial route alternatives; performing an Initial Feasibility Screening of the route alternatives; and performing a structured route alternatives analysis to identify alternatives to be evaluated further.

Stakeholder input was collected during the Study scoping process. Public scoping meetings and individual meetings with key stakeholder groups (including local jurisdictions, local transportation planning groups, and railroads) were held in March and April 2013. Key components of this scoping effort are described in Appendix A, *Texas-Oklahoma Passenger Rail Program Scoping Report* (Texas Department of Transportation [TxDOT] 2013a). General issues identified through public and stakeholder comments included reducing impacts on farmland and natural resources, integrating new passenger rail with existing or planned transportation and transit, and identifying potential station locations. After the scoping process, a range of initial route alternatives and three service types (conventional rail, higher-speed rail, and high-speed rail) that could provide additional or new passenger rail service between Oklahoma City[3] and south Texas were developed. Route alternatives followed the existing railroad network or the existing interstate highway network when possible, and followed new alignment corridors when necessary to accommodate higher operating speeds. An Initial Feasibility Screening assessed the route alternatives for fatal flaws, such as

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[1] In this service-level EIS, "route alternative" refers to the specific route or corridor that a potential alignment follows (for example, the C4A route alternative), and "service type" refers to the speed or category of rail transportation (i.e., conventional rail, higher-speed rail, high-speed rail), while "alternative" refers specifically to a route alternative inclusive of a service type (e.g., Alternative C4A Higher-Speed Rail and Alternative C4A High-Speed Rail).

[2] For descriptions of *EIS Study Area* and *Study Vicinity*, see Chapter 3.0, Affected Environment and Environmental Consequences.

[3] Edmond, Oklahoma, was selected as the northern point of the Northern Section alternatives based on preliminary ridership forecasts and early stakeholder input obtained during the alternatives analysis process. While Edmond is used in the EIS analysis as the actual northern terminus, Oklahoma City is the city name used in the overall descriptions.

inability of route corridors to accommodate necessary design speeds or conflicts with freight rail. This screening process is described in detail in Appendix B, *Initial Development of Alternatives Technical Memorandum* (CH2M 2013). The potentially feasible route alternatives identified in the initial screening were carried forward for a route alternatives analysis.

The route alternatives analysis compared route alternatives and service-type options in three geographic sections (Northern, Central, and Southern) against evaluation criteria that focused on access, cost, operations, infrastructure, and environmental impact. Route alternatives that did not perform well against the evaluation criteria were eliminated from further consideration. The route alternatives analysis, and subsequent stakeholder input, resulted in a set of route alternatives carried forward for further evaluation. The sections below provide more detail about the Initial Feasibility Screening and the route alternatives analysis.

2.1.1 Initial Feasibility Screening

As part of the Initial Feasibility Screening, route alternatives with service types were developed for three geographic areas: the Northern Section (Oklahoma City to Dallas and Fort Worth), Central Section (Dallas and Fort Worth to San Antonio), and Southern Section (San Antonio to South Texas). In addition, Metroplex alternatives were developed to connect Dallas and Fort Worth. The route alternatives were based on the alignments of existing transportation networks with corridors potentially suitable for passenger rail operations (the existing railroad network and the existing interstate highway network), or were located on new alignments outside existing transportation corridors. In subsequent steps of the alternative selection process, additional route alternatives were added as a result of stakeholder input, including for example, additional high-speed rail alternatives between Dallas and Fort Worth.

The range of route alternatives considered in the Initial Feasibility Screening, with their respective service types for each geographic section, are listed in Table 2-1.

Table 2-1: Route Alternatives Considered in the Initial Feasibility Screening

Geographical Section	Endpoints	Initial Route Alternative	Service Types[a]
Northern	Oklahoma City to Dallas and Fort Worth	N1	HrSR, HSR
		N2	HrSR, HSR
		N3	CONV
		N4	CONV, HrSR
Central	Dallas and Fort Worth to San Antonio	C1	CONV, HrSR
		C2	HrSR, HSR
		C3	CONV
Southern	San Antonio to South Texas	S1	CONV
		S2	CONV, HrSR
		S3	CONV

Geographical Section	Endpoints	Initial Route Alternative	Service Types[a]
		S4	HrSR, HSR
		S5	CONV, HrSR
Metroplex	Dallas and Fort Worth	M1	CONV, HrSR
		M2	HrSR, HSR
		M3	CONV, HrSR
[a] CONV = conventional rail (up to 79 to 90 miles per hour [mph]); HrSR = higher-speed rail (up to 110 to 125 mph); HSR = high-speed rail (up to 220 to 250 mph).			

These routes were initially screened to determine overall feasibility by considering two sources of information. The first source of information was the *Oklahoma City to South Texas Infrastructure Analysis* (TxDOT 2013b). That report evaluated the possibility of operating high-speed or higher-speed rail in the rights-of-way of interstate highways within the Study Vicinity. The findings of that report established that interstate highways are designed with curve radii too small for high- or higher-speed rail operation, that railroad vertical clearance needs are often higher than highway clearances at existing overpasses, and that many operational limitations of both highways and railroads make shared rights-of-way problematic for all but short stretches of a new rail alignment. The second source was information provided by the Class 1 railroads (owners of the existing major operating rail lines in the EIS Study Area) regarding the level of existing and potential future freight rail traffic and how that freight traffic might affect the feasibility of adding or expanding passenger rail service on these rail lines.

Figure 2-1 shows the route alternatives considered in the Initial Feasibility Screening. Some route alternatives include alignment options, which are identified separately on the figure (e.g., Alternatives N4A and B, or S4A, B, and C).

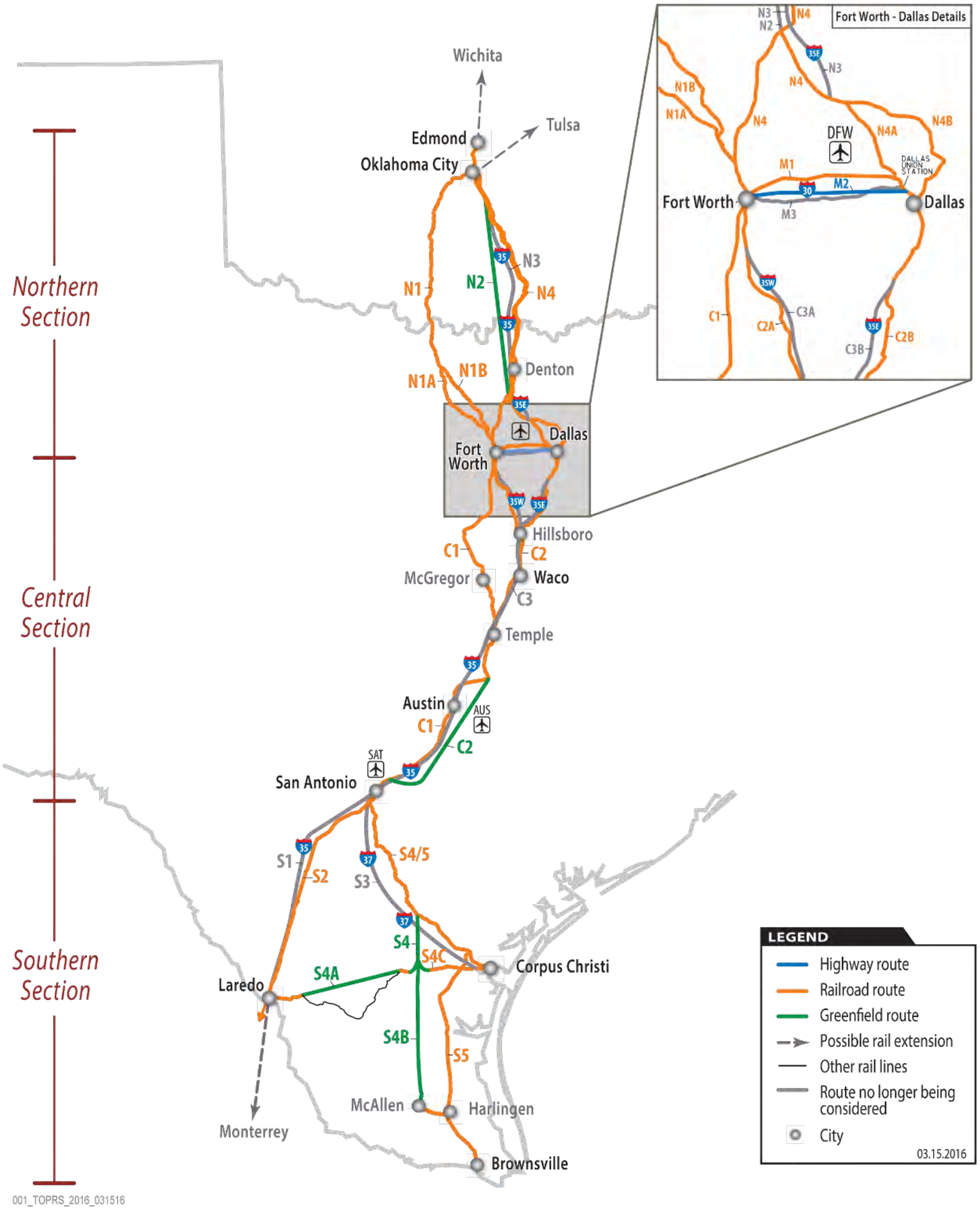

Figure 2-1: Screened Initial Route Alternatives

Route alternatives were eliminated from further consideration for two reasons. Some were eliminated because they would use a railroad right-of-way where the addition of passenger rail traffic would be infeasible due to existing and potential future freight traffic volume. Others were eliminated because they use a shared highway right-of-way for most of their length, which would be infeasible because, as noted above, the highway designs would not be compatible with passenger train operation. Additionally, these highway corridors are constrained by existing dense development and, therefore, locating the routes adjacent to the highways would also not be feasible. For these reasons, the following route alternatives were eliminated:

- N3 (uses Interstate Highway [IH]-35 corridor)
- C3 (uses IH-35 corridor)
- S1 (uses IH-35 corridor)
- S3 (uses IH-37 corridor)
- M3 (uses railroad right-of-way)

One of the highway alignment alternatives considered at this screening level (high-speed rail over IH-30 between Dallas and Fort Worth) was retained because the North Central Texas Council of Governments has reserved space on the highway for an elevated high-speed railway alignment (CH2M 2012) and requested that it be included in the EIS.

2.1.2 Route Alternatives Analysis

The alternatives carried forward for the route alternatives analysis are shown on Figure 2-2. These alternatives include both those carried forward from the Initial Feasibility Screening, as well as the following three route alternatives that were added based on stakeholder input:

- C4A. This route alternative would be similar to Alternative C2B, but would use corridors outside existing transportation networks to allow high-speed rail beginning north of Hillsboro and continuing to San Antonio. This alternative was added based on stakeholder interest in expanded use of high-speed rail and reduced journey times in one of the most heavily traveled portions of the corridor.
- C4B. This route alternative would extend south from Arlington between Fort Worth and Dallas to Hillsboro, then would follow the same alignment as Alternative C4A. This alternative was added in response to stakeholder interest in an option providing direct, high-speed service from the Arlington area to points south without having to go to Dallas or Fort Worth first.
- S6. This route alternative would extend from San Antonio to the Laredo-Colombia Solidarity Bridge northwest of Laredo in a corridor outside existing transportation networks to allow high-speed rail. It was added as a result of stakeholder meetings in Laredo.

In addition, to streamline the route alternatives analysis, the Metroplex alternatives were incorporated into Northern Section and Central Section route alternatives. For example, Alternative N4A was combined with Alternative M2 so that Alternative N4A would extend from Edmond, Oklahoma (just north of Oklahoma City) to Fort Worth and then Dallas.

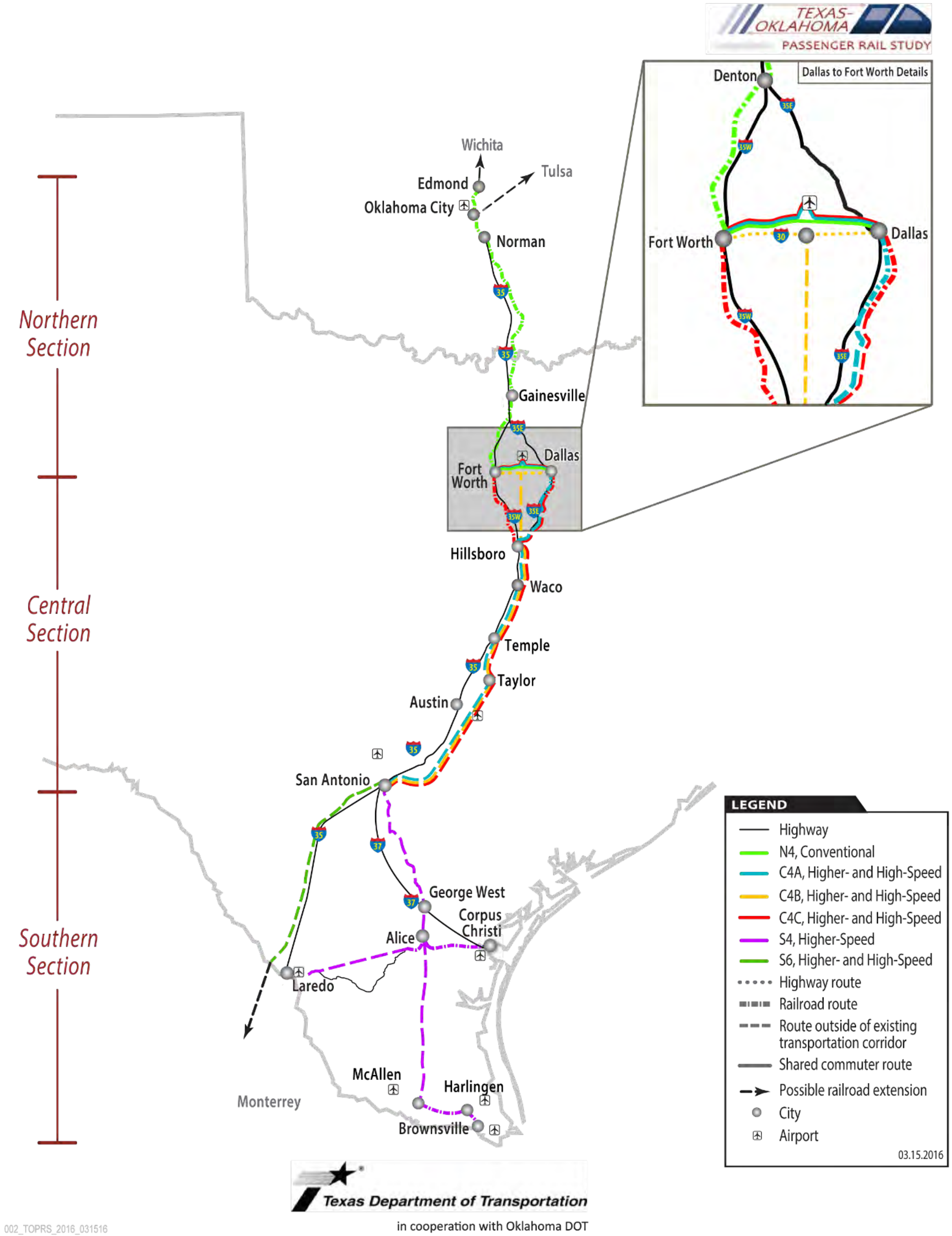

Figure 2-2: Route Alternatives Carried Forward into the Route Alternatives Analysis

To evaluate and compare the route alternatives, screening criteria were established to determine how well the route alternatives would fulfill the Program's purpose and need and meet local and regional goals, the level of stakeholder support, and the potential for environmental impacts. The criteria were grouped into the following four categories: alternative attributes, operational criteria, infrastructure criteria, and environmental criteria. The criteria and the measure used to evaluate each are listed in Table 2-2.

Table 2-2: Route Alternatives Analysis Screening Criteria

Criterion No.	Criterion	Measure
ALTERNATIVE ATTRIBUTES		
1a	Access to stations	Total population of cities served by stations
1b	Access to stations with endpoint cities removed	Total population of cities served by stations with endpoint cities removed
2	Ridership for each alternative	Ridership (annual trips)
3	Length of route	Length of route in miles
4	Cost to construct alternative	Total capital cost for alternative ($)
OPERATIONAL CRITERIA		
5	Revenue/operating cost ratio	Revenue/operating cost (%)
6	Reduce travel times	Time reduction versus automobile
7	Enhance mode share on rail	Rail mode share (%)
INFRASTRUCTURE CRITERIA		
8	Capital cost per passenger-mile	Capital cost per passenger-mile ($)
9	Minimize right-of-way/real estate impacts	Acres of non-transportation right-of-way within EIS Study Area
10	Provide additional improvements to national railroad network	Professional judgment (value of improvements and risk reduction evaluation)
ENVIRONMENTAL CRITERIA[a]		
Minimize Impacts on Natural Resources		
11a	Wetlands	Acres within EIS Study Area
11b	Critical habitat	Acres within EIS Study Area
Minimize Impacts on Cultural/Recreational Resources		
12a	National and State Historic Places	Number of historic sites

Criterion No.	Criterion	Measure
12b	River and stream crossings	Number of river and stream crossings (proxy for likelihood of finding cultural resources along alternative because archaeological resources are often found along waterways)
12c	Parks and open space	Acres within EIS Study Area
Minimize Impacts on Social Resources		
13a	Prime farmland	Acres within EIS Study Area
13b	Sensitive receptors	Number of schools, places of worship, and hospitals within study area
13c	Environmental justice	Number of census blocks with % minority greater than state
[a] In the route alternatives analysis, the EIS Study Area for environmental impacts was a 500-foot-wide area along each alternative, unless the alternative used existing infrastructure.		

Route alternatives screening was based on the measures and methodology established for each criterion (for detailed methodologies and results tables, see Appendix C, *Texas-Oklahoma Passenger Rail Study Route Alternatives Analysis* [TxDOT 2014a]). Alternatives were eliminated that did not meet a criterion threshold or that ranked considerably lower than other alternatives within the same geographic section. Table 2-3 lists the alternatives and indicates whether each was recommended to be dismissed or carried forward for further evaluation.

Table 2-3: Route Alternatives Analysis Recommendations

Route Alternative[a]	Service Type[b]	Routes Alternative Analysis Recommendation
N1A	CONV and HrSR	Dismiss
N1B	CONV and HrSR	Dismiss
N2	HrSR and HSR	Dismiss
N4A	CONV	Carry Forward
	HrSR	Dismiss
N4B	CONV and HrSR	Dismiss
N4C	CONV and HrSR	Dismiss
C1	CONV and HrSR	Dismiss
C2A	CONV and HrSR	Dismiss

Route Alternative[a]	Service Type[b]	Routes Alternative Analysis Recommendation
C2B	CONV	Carry Forward
	HrSR	Dismiss
C4A	HrSR and HSR	Carry Forward
C4B	HrSR and HSR	Carry Forward
S2	CONV and HRSR	Dismiss
S4	HrSR	Carry Forward
	HSR	Dismiss
S5	CONV	Carry Forward
	HrSR	Dismiss
S6	HrSR	Carry Forward
	HSR	Carry Forward

[a] N = Northern Section, C = Central Section, S = Southern Section.

[b] CONV = conventional rail (up to 79 to 90 mph); HrSR = higher-speed rail (up to 110 to 125 mph); HSR = high-speed rail (up to 220 to 250 mph).

The rationale for carrying alternatives forward is described below, and the rationale for dismissing route alternatives is included in Section 2.5, Alternatives Considered but Eliminated from Future Consideration.

- **Alternative N4A (Conventional).** This alternative would include most of the same rail line that has been upgraded by TxDOT and Oklahoma Department of Transportation as part of an ongoing passenger rail improvement program and, therefore, would represent a good use of resources that can be further built-upon. Although Alternative N4A would not meet the revenue-to-operating-cost threshold, it would have the lowest capital cost per passenger-mile of the Northern Section route alternatives.
- **Alternative C2B (Conventional).** This alternative would have the lowest capital cost of the Central Section alternatives and among the highest revenue-to-operating-cost ratios. It would also avoid crossing the congested Tower 55 rail intersection in Fort Worth.
- **Alternative C4A** and **Alternative C4B (Higher-Speed Rail and High-Speed Rail).** These alternatives would have the highest revenue-to-operating-cost ratio and the biggest travel time savings compared to automobile travel. In addition, these alternatives would be comparable to other alternatives in the Central Section in terms of potential environmental impacts.

- **Alternative S4 (Higher-Speed Rail).** Although this alternative would have the greatest potential impact on parks and open space, it is the longest alternative, by a factor of 2 or 3, to serve the population centers that contribute to operational performance. So although the environmental criterion value would be highest for this alternative, this condition could be avoided with project-level refinement of the route and would not be expected to be a fatal flaw.
- **Alternative S5 (Conventional)** and **Alternative S6 (Higher-Speed Rail and High-Speed Rail**). These alternatives would allow extension to Monterrey, Mexico. Without that extension, these alternatives would not be recommended to be carried forward because they would not meet the revenue-to-operating-cost ratio threshold. Alternative S5 would have the highest revenue-to-operating-cost ratio and the lowest capital cost per passenger-mile for the Southern Section alternatives.

After the route alternatives analysis, input from stakeholders eliminated two additional alternatives and added one alternative. Alternatives C2B Conventional and S5 Conventional were eliminated because of potential conflicts with existing freight rail service. Alternative C4C Higher-Speed and High-Speed Rail was added as a result of input from stakeholders in Fort Worth. This alternative would be identical to Alternative C4A but would connect Hillsboro to Fort Worth, which would allow direct service to Fort Worth. With these changes, the following alternatives have been carried forward for further evaluation:

- **Northern Section:** Alternative N4A with conventional rail
- **Central Section:** Alternatives C4A, C4B, and C4C with higher-speed rail and high-speed rail
- **Southern Section:** Alternative S4 with higher-speed rail and Alternative S6 with higher-speed rail and high-speed rail

These alternatives are shown on Figure 2-3 and are described in Section 2.3, Build Alternatives.

2.2 No Build Alternative

The No Build Alternative would not fulfill the Program's purpose and need, but is carried forward as a baseline alternative against which the build alternatives are compared. The No Build Alternative would consist of the existing transportation network, including roadway, passenger rail, and air travel in the Study Vicinity, as well as maintenance and planned improvements to these systems. The sections below describe existing and planned roadway, passenger rail, and air travel in the Study Vicinity. Information was collected from current regional transportation plans within the Study Vicinity, as well as web sites describing services such as train schedules. These improvements and their evaluation at this service-level stage would require project-specific assessment. Conducting project assessments at this stage of the program development process would be speculative; however, the evaluation and assessment of potential environmental effects from a cumulative perspective has been conducted and is included in Chapter 3.0, Affected Environment and Environmental Consequences.

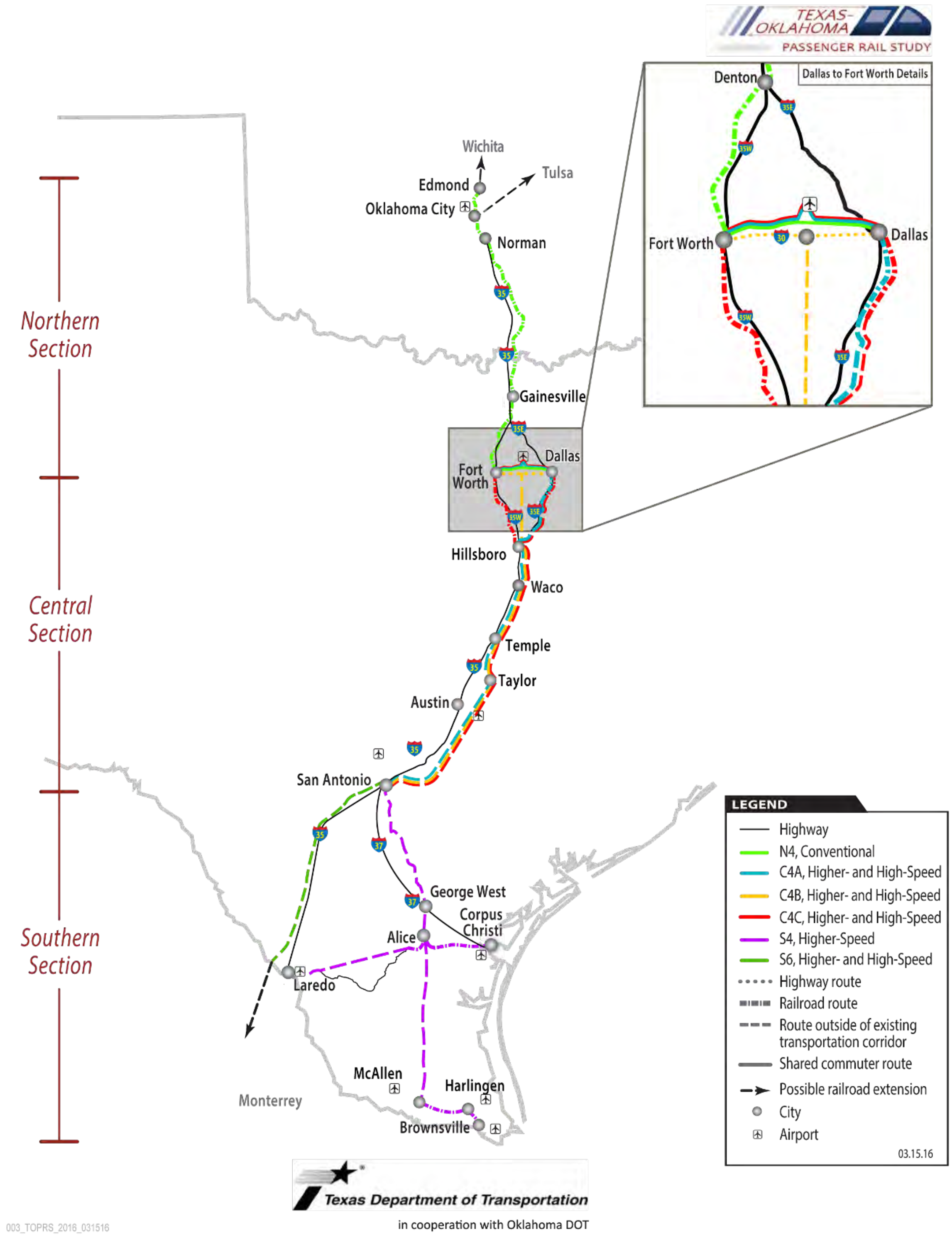

Figure 2-3: Alternatives Carried Forward for Further Evaluation in This EIS

2.2.1 Planned Roadway Projects

Planned roadway improvement projects within the EIS Study Vicinity were compiled using transportation planning documents developed by regional metropolitan planning organizations (MPOs) in the Study Vicinity. The projects are listed by type and MPO in Table 2-4.

Table 2-4: Overview of Roadway Projects within the Study Vicinity by Project Type

MPO/County	New Road	New Toll	New HOV	Widen	Total
Association of Central Oklahoma Governments	2			18	20
Capital Area MPO	26	16		63	105
Corpus Christi MPO		3		9	12
Harlingen-San Benito MPO				1	1
Hidalgo County MPO	1	2		37	40
Killeen-Temple MPO	4			7	11
North Central Texas COG	2	62	29	77	170
San Antonio-Bexar County MPO	3	11		7	21
Sherman-Denison MPO				7	7
Waco MPO	1			11	12
Webb County	1			1	2
Total	40	94	29	238	401

HOV = high-occupancy vehicle

Within the Study Vicinity, 49 projects are planned to increase the capacity along IH-35 by 2035. Table 2-5 summarizes IH-35 improvements under development according to the planned completion date, and Table 2-6 tallies the number of projects by type of improvement.

Table 2-5: Summary of Roadway Projects along IH-35 within the Study Vicinity by Project Year

MPO	2010	2020	2030	2035	Total
Association of Central Oklahoma Governments		3	2		5
Killeen-Temple MPO	1	2			3
North Central Texas COG		7	28	1	36
San Antonio-Bexar County MPO		3			3
Waco MPO		1			1
Total	1	16	30	1	48

Table 2-6: Summary of Roadway Projects along IH-35 within the Study Vicinity by Project Type

MPO/County	Widen	New Toll	New HOV	Total
Association of Central Oklahoma Governments			5	5
Killeen-Temple MPO			3	3
North Central Texas COG	12	10	14	36
San Antonio-Bexar County MPO	3			3
Waco MPO			1	1
Webb County	1		1	2
Total	16	10	23	49

2.2.2 Planned Passenger Rail Service

Passenger rail service in the Study Vicinity includes two Amtrak routes and a network of commuter rail service in major metropolitan areas. The Amtrak routes within the Study Vicinity are the Heartland Flyer from Oklahoma City to Fort Worth and the Texas Eagle, which extends from Los Angeles to Chicago, with stops in San Antonio, San Marcos, Austin, Taylor, Temple, McGregor, Cleburne, Fort Worth, and Dallas. The Heartland Flyer is a conventional rail service running one train per day in each direction between Oklahoma City and Fort Worth. Studies have been performed to consider a second daily round-trip for the Heartland Flyer, but no committed plans have been made. The Texas Eagle is a conventional rail service running one train per day in each direction between Chicago and San Antonio, with service from Chicago to Los Angeles on Sunday, Tuesday, and Friday. There are currently no plans to increase service on the Texas Eagle.

Passenger rail service in the Study Vicinity also includes regional and commuter rail in the Dallas, Fort Worth, Austin, and San Antonio areas. Additional future planned passenger rail service was identified using transportation plans of MPOs within the Study Vicinity. Currently, although other MPOs (such as ACOG) are considering future passenger rail, additional passenger rail service (including improvements to existing service and new routes) has only been formally planned in the Dallas, Fort Worth, Austin, and San Antonio areas.

Improved service is planned for two existing commuter rail lines in the Study Vicinity. In the Dallas and Fort Worth area, the Trinity Railway Express (TRE) plans to increase the speed and frequency of service as demand and budget allow. The METRO Red Line in the Austin area plans to increase frequency of service and extend hours of operation. In addition, several new passenger rail lines are planned. In some cases, improvement and expansion of commuter rail may depend on availability of funding, which could include bonds or other sources that require approval through a ballot measure. These new lines range from expanding existing commuter rail service, such as the Dallas Area Rapid Transit, to the new regional high-speed rail service from Dallas to Houston, the Texas Central Railway. Planned rail lines are listed in Table 2-7 and are shown on Figures 2-4 and 2-5.

Table 2-7: Planned Passenger Rail Routes in the Study Vicinity

Route Name	Type of Service (Mode)[a]	Year of Introduction
Dallas and Fort Worth Area		
Cotton Belt Line	Commuter rail	2025
TEX Rail	Commuter rail	2020
Cleburne Line	Commuter rail	2030
Frisco Line	Commuter rail	2030
McKinney Line	Regional rail	2030
Mansfield Line	Commuter rail	2035
Midlothian Line	Commuter or light rail	2035
Scyene Line	Light rail	2035
Speedway Line	Commuter rail	2035
East/West Line	Commuter rail	2035
Waxahachie Line	Commuter rail	2030
Dallas – Houston Area		
Texas Central	High-speed rail	2021
Austin Area		
Elgin Rail	Diesel light rail	2030
Austin and San Antonio Area		
Lone Star	Regional rail	2030[b]

[a] Commuter rail is defined as passenger service between urbanized areas and outlying areas.
Diesel light rail is defined as a light rail system using diesel-powered trains.
High-speed rail is defined as electric rail service operating speeds as high as 220 to 250 mph.
Light rail is defined as urban street-car type passenger rail service.
Regional rail is defined as passenger rail service connecting two urban areas.
[b] Lone Star commuter rail between Austin and San Antonio is a plan and is not included in any of the MPO transportation plans.

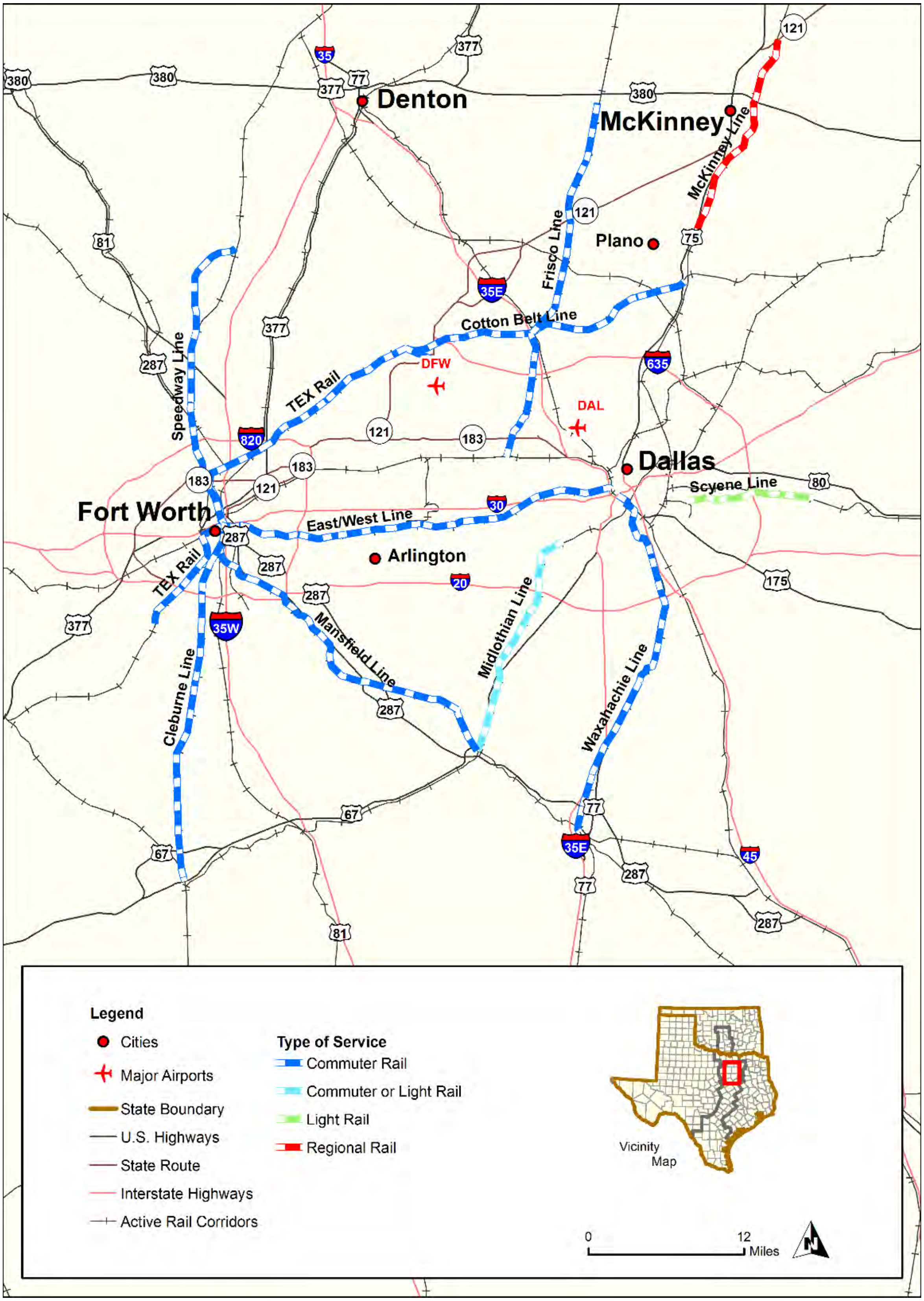

Figure 2-4: Existing or Planned Passenger Rail in the Dallas and Fort Worth Area

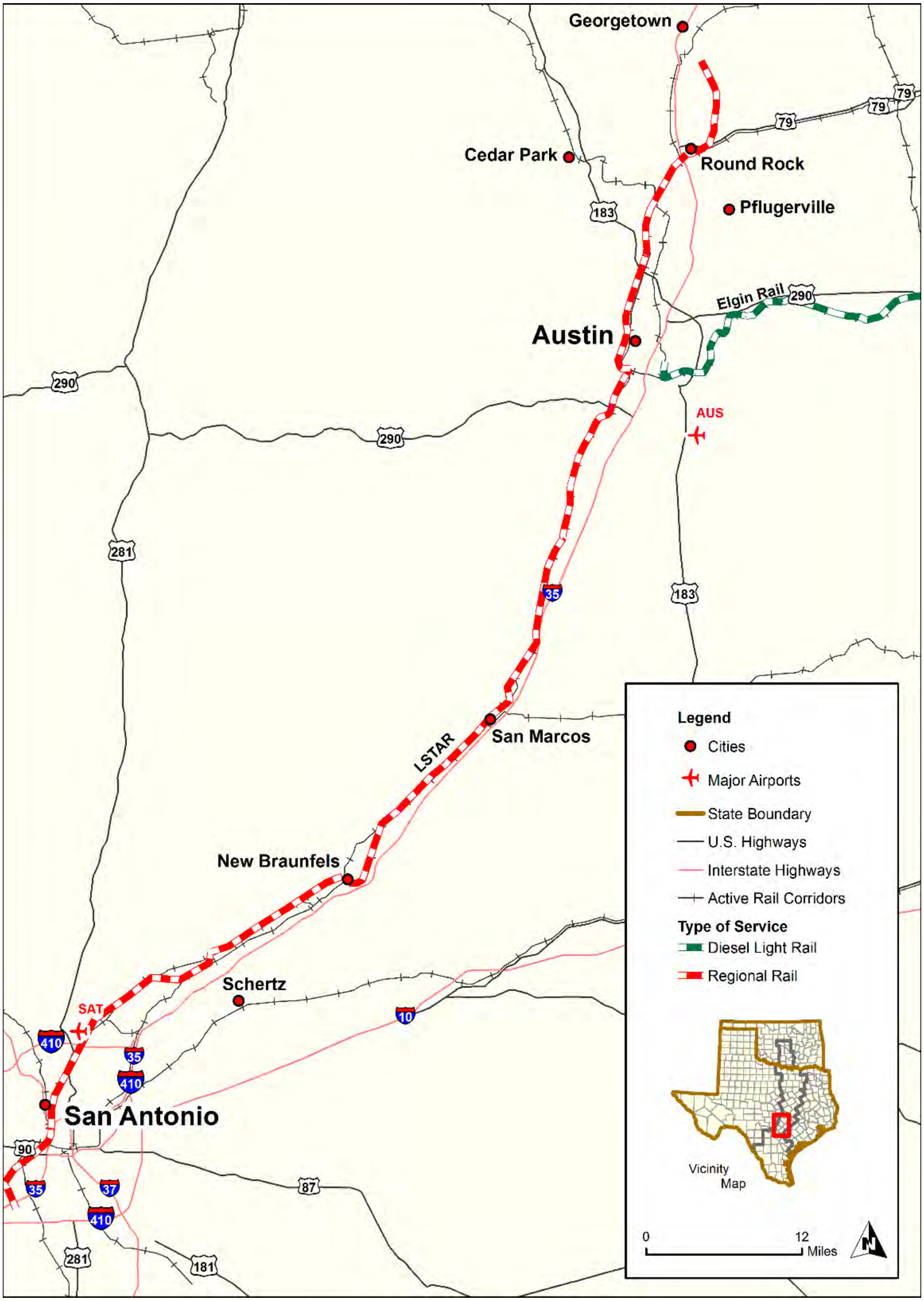

Figure 2-5: Existing or Planned Passenger Rail in the Austin and San Antonio Areas

2.2.3 Planned Airport Projects

The Federal Aviation Administration (FAA) recently assessed future airport capacity needs, identifying airports and metropolitan areas with the greatest need for additional capacity (FAA 2007). The FAA study examined U.S. airports in the years 2007, 2015, and 2025. No Texas airports showed a capacity improvement need for 2007. One airport in the Study Vicinity, San Antonio International, showed a need for additional capacity in 2015 and 2025 if planned improvements do not occur. According to the San Antonio International Airport Master Plan (San Antonio Airport System 2010), capacity-building improvements planned by 2030 include extending one existing terminal and building one new terminal.

2.3 Build Alternatives

The alternatives carried forward for further evaluation are listed in Table 2-8, and shown on Figure 2-3. The three service types are described in Section 2.3.1, Service Type Descriptions, and the route alternatives are described in Section 2.3.2, Route Alternative Descriptions.

Table 2-8: Alternatives Carried Forward for Further Evaluation

Route Alternative	Service Type
Northern Section	
N4A	CONV
Central Section	
C4A	HrSR
	HSR
C4B	HrSR
	HSR
C4C	HrSR
	HSR
Southern Section	
S4	HrSR
S6	HrSR
	HSR

2.3.1 Service Type Descriptions

The three service types (conventional rail, higher-speed rail, and high-speed rail) considered in this EIS are described below.

2.3.1.1 Conventional Rail Service

Conventional rail service typically includes diesel-powered, steel-wheeled trains operating on steel tracks. Roadway crossings may be grade separated depending on the type of roadway and amount of traffic, and rail rights-of-way may or may not be fenced. Conventional rail service in Oklahoma and Texas are shared-use corridors, meaning that the passenger rail service operates on a freight rail line owned by a “host” railroad, such as BNSF or UPRR. Amenities on conventional rail trains may include dining cars, sleeping cars, and other services, such as wireless internet. The Amtrak Texas Eagle is an example of conventional rail.

Conventional rail would typically be operated at speeds of 79 to 90 mph and would mostly use existing railroad rights-of-way. For conventional rail, existing railroad track may be used, or in some cases, modifications such as double-tracking (adding a track parallel to an existing track or adding a siding to pull trains to the side for passing trains) could be constructed within the existing right-of-way to accommodate additional trains.

Texas Eagle Conventional Rail at McGregor Texas
Photo credit: Brian Hausknecht

In general, stops for conventional rail service would typically be between 15 and 60 miles apart, and on average three to six trains per day would run in each direction, with a maximum of 12 trains per day.

2.3.1.2 Higher-Speed Rail Service

Higher-speed rail is similar to conventional rail in several respects. In many cases, higher-speed rail trains can run on the same steel tracks that support conventional rail service, but higher speeds can require improvements such as upgrading wooden ties to concrete ties and grade-separating roadway crossings. Higher-speed service can use diesel-powered, steel-wheeled trains operating on steel tracks that are shared with freight trains, or it can operate on dedicated passenger tracks or be an electrified rail system powered by overhead catenary lines. For the purposes of this EIS, higher-speed trains are assumed to be diesel-powered. Amenities offered on higher-speed rail trains are similar to conventional rail. The British First Great Western, operating in southern England, is an example of higher-speed rail.

British First Great Western Higher Speed Rail
Photo credit: Bruce Horowitz

Higher-speed rail would be operated at speeds up to 110 to 125 mph. Where proposed within an existing railroad right-of-way, a shared right-of-way with separate tracks for freight and passenger services would be constructed. Because of its maximum speed and because train frequency would be similar to conventional rail, higher-speed rail could operate on a single track with passing locations and would not require double-tracking. Where higher-speed rail is proposed outside an existing transportation corridor, the new alignment would be designed with curves and other features that could accommodate high-speed rail service if warranted by ridership and economically feasible in the future. For the purposes of this EIS, unlike high-speed rail, the design would not include electrification and would include a mixture of single and double track, and some at-grade crossings would remain. In some short segments in dense urban areas, existing track shared with freight may be used by new passenger rail operated at reduced speeds. Newly constructed track would be dedicated exclusively to passenger rail service.

In general, stops for higher-speed rail service would typically be between 30 and 90 miles apart, and on average four to eight trains per day would run in each direction, with a maximum of 12 trains per day.

2.3.1.3 High-Speed Rail Service

High-speed rail service includes electric trains powered by an overhead power supply system. Train sets are steel wheel on steel rail, but are designed to operate at high speeds with an aerodynamic shape and specialized suspension and braking systems. The Shinkansen in Japan, the TGV in France and the Chinese High-Speed Rail are examples of high-speed rail service. The Dallas to Houston High-Speed Rail Project proposed by Texas Central High-Speed Railway, LLC and the California High-Speed Rail Program are other examples of high-speed rail service.

High-Speed Rail at Shanghai Station, China
Photo Credit: Brian Hausknecht

High-speed rail would be operated at speeds up to 220 to 250 mph. The entire right-of-way would be enclosed and fully grade-separated. The alignment would be electrified and double-tracked and would be dedicated entirely to passenger rail service. Freight trains and other non-high-speed rail systems would be prohibited from using the high-speed rail tracks. This service type could only reach its maximum speeds of 220 to 250 mph outside existing transportation corridors because existing railroad alignments are not compatible with the speeds required and they do not have the required room for separation of freight and high-speed rail. In areas where this service type is within existing transportation corridors or within constrained right-of-way that may impede the design, it would operate at lower speeds.

In general, stops for high-speed rail service would typically be between 50 and 100 miles apart, and on average 12 to 24 trains per day would run in each direction.

2.3.2 Alternative Descriptions

The alternatives evaluated in this EIS, shown on Figure 2-3, have been developed to a level of detail appropriate for a service-level analysis: the route alternatives represent a potential corridor where rail improvements could be implemented, but do not specify the precise location of the track alignment. Route alternatives in the Northern, Central, and Southern sections could be built as individual, stand-alone projects or in combination with alignments in another section. In addition, more than one alternative in the Central or Southern sections could be built in the future because the alternatives provide service options for different destinations. Details on connecting the alternatives would be determined during project-level studies.

Potential alignments are described below in terms of nearby transportation corridors and cities. For example, potential alignments are described as "following" railway corridors, which could mean that they are sharing existing tracks, are located within an existing right-of-way, or are generally adjacent to existing tracks depending on the service type.

The Southern Section alternatives include a potential extension to Monterrey, Mexico. For Alternative S6, an extension from Laredo to Monterrey could follow an alignment that has been studied by Mexico, and is therefore considered feasible. This EIS evaluates alignment corridors only within the United States; however, the potential extension to Monterrey has been included for ridership analysis purposes for Alternative S6, and the Federal Railroad Administration and TxDOT have initiated coordination with the Mexican government about the potential extension.

2.3.2.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Due to feasibility based on initial ridership and cost information, only one route alternative and service type was considered feasible in the Northern Section: Alternative N4A with conventional rail.

2.3.2.1.1 Alternative N4A Conventional

Alternative N4A would begin in Edmond and follow the BNSF rail alignment south to Oklahoma City. The alternative would continue south along the BNSF rail alignment to Norman, Oklahoma; through Metro Junction, near Denton, Texas; and on to Fort Worth (as does the Heartland Flyer). From Fort Worth, the alternative would continue to Dallas following the TRE tracks. From Edmond, Oklahoma, to Dallas, the route would be approximately 260 miles long. Because existing freight traffic would not preclude passenger service along this section of track, the route would provide passenger rail service on the existing BNSF track, with potential improvements within the existing BNSF right-of-way.

Alternative N4A would provide several improvements over the existing Heartland Flyer service. Alternative N4A would increase the number of daily round trips along this route (the Heartland Flyer currently offers one round trip per day), and the N4A route would extend from Fort Worth to Dallas without requiring a transfer (the Heartland Flyer service currently terminates in Fort Worth). In addition, Alternative N4A would provide improvements to existing station facilities, and new train equipment with more onboard amenities, including business class available for a premium price.

Alternative N4A assumes diesel-locomotive hauled equipment running three to six daily round trips. Two or three of the round trips would operate on an accelerated schedule, making roughly seven stops, with remaining "local" trains making as many as 12 stops.

2.3.2.2 Central Section: Dallas and Fort Worth to San Antonio

Three route alternatives, each with higher-speed and high-speed rail were evaluated in the Central Section: Alternatives C4A, C4B, and C4C.

The Central Section alternatives would provide several improvements over the existing Texas Eagle service in this corridor. All of the alternatives would increase the number of daily round trips along this route (the Texas Eagle currently offers one round trip per day). The high-speed rail alternatives would provide much faster service between Dallas and Fort Worth and Austin and San Antonio—2 hours versus 8 hours for the Texas Eagle Service. In addition, the Central Section alternatives would provide improvements to existing station facilities, and new train equipment.

2.3.2.2.1 Alternative C4A Higher-Speed and High-Speed Rail

Alternative C4A would begin in Fort Worth and follow the TRE tracks east to Dallas. From Dallas, it would follow the BNSF alignment south toward Waxahachie where it would enter a new alignment outside existing highway and rail corridors to accommodate maximum operating speeds. Though outside existing transportation corridors, the southern portion of Alternative C4A would generally follow the BNSF alignment for about 250 miles, extending south from Waxahachie through Hillsboro, Waco, Temple, Taylor, and Austin to San Antonio.

Alternative C4A Higher-Speed Rail assumes new diesel-locomotive hauled equipment running six to 12 daily round trips. Express trains would likely make seven stops with local trains making 12 stops.

Alternative C4A High-Speed Rail assumes electric-powered, high-speed rail service running 12 to 20 daily round trips. Express trains would likely make six stops, while local trains would make up to nine stops.

2.3.2.2.2 Alternative C4B Higher-Speed and High-Speed Rail

Alternative C4B would serve both Fort Worth and Dallas, with trains following a new elevated high-speed alignment over IH-30. In Arlington (between Dallas and Fort Worth), the alternative would turn south to Hillsboro on an alignment outside existing transportation corridors. The alternative would then follow the same high-speed alignment as Alternative C4A from Hillsboro to San Antonio.

Alternative C4B Higher-Speed Rail assumes new diesel-locomotive hauled equipment running six to 12 daily round trips. Express trains would likely make seven stops, and local trains would make up to 12 stops.

Alternative C4B High-Speed Rail assumes electric-powered, high-speed service running 12 to 20 daily round trips. Express trains would likely make six stops, and local trains would make up to eight stops.

2.3.2.2.3 Alternative C4C Higher-Speed and High Speed Rail

Alternative C4C would follow the same potential alignment as Alternative C4A from Fort Worth east to Dallas and south to San Antonio, but would include a link from Hillsboro directly to Fort Worth parallel to the UPRR alignment. Service on the Alternative C4C route would operate in a clockwise direction, running from Hillsboro to Fort Worth, east to Dallas, back to Hillsboro, and south to San Antonio in order to serve Fort Worth directly (while also being compatible with the general service for the C4A alternatives).

Alternative C4C Higher-Speed Rail assumes new diesel-locomotive hauled equipment running six to 12 daily round trips. Express trains would likely make seven stops, and local trains would make up to 12 stops.

Alternative C4C High-Speed Rail assumes electric-powered high-speed service running 12 to 20 daily round trips. Express trains would likely make six stops, while local trains would make up to nine stops.

2.3.2.3 Southern Section: San Antonio to South Texas

Two route alternatives were evaluated in the Southern Section: Alternative S4, with higher-speed rail, and Alternative S6, with higher-speed rail or high-speed rail and a future extension to Monterrey.

2.3.2.3.1 Alternative S4 Higher-Speed Rail

Alternative S4 would begin in San Antonio and continue southeast along the UPRR alignment to George West, where it would continue outside existing transportation corridors to Alice. At Alice, the alternative would divide into three legs at a stop. The first leg would travel west along the Kansas City Southern (KCS) Railway to San Diego, Texas; then it would travel outside existing transportation corridors to just east of Laredo in an alignment that would allow higher speeds and rejoin the KCS Railway to enter the more highly developed Laredo area. The second leg would travel south along abandoned railroad tracks to McAllen and east to Harlingen and Brownsville. The third leg would travel east along the KCS Railway to Corpus Christi.

Alternative S4 Higher-Speed Rail assumes new diesel-locomotive hauled equipment running four to six daily round trips. Depending on corridor demand model forecasts, the primary service may be designated as Laredo-Alice-San Antonio and Corpus Christi-Alice-San Antonio, with a connecting feeder from Brownsville, Harlingen, and McAllen.

2.3.2.3.2 Alternative S6 Higher-Speed and High-Speed Rail

Alternative S6 would begin in San Antonio and travel south on a new alignment outside existing transportation corridors to a station near the Laredo-Columbia Solidarity Bridge, which crosses the Rio Grande north of Laredo. The alternative would then cross on a new railway bridge to join a new rail line being constructed in Mexico, which would continue to Monterrey. This study only examines the physical effects of the U.S. component of this new line, but it does consider the ridership impact of such a connection.

Alternative S6 Higher-Speed Rail assumes new diesel-locomotive hauled equipment running four to six daily round trips between San Antonio and Laredo, which would be the only U.S. stops for the alternative. If an extension from Laredo to Monterrey were added, the frequency of trips to Monterrey is assumed to be the same as those from San Antonio to Laredo.

Alternative S6 High-Speed Rail assumes electric-powered, high-speed service running eight to 12 daily round trips between San Antonio and Laredo. If an extension from Laredo to Monterrey were added, the frequency of trips to Monterrey is assumed to be the same as those from San Antonio to Laredo.

2.3.3 Preferred Alternative

Recommended preferred alternatives have been identified based on differentiating metrics for each of the geographic sections in the Program. Metrics that differentiate between alternatives are based on the Program purpose and need, as well as the purpose and need for each geographic section (see Chapter 1, Purpose and Need). Preferred alternatives are recommended for each geographic section separately because the Program does not analyze alternatives that extend between Oklahoma City and Laredo/Brownsville, but rather to the endpoint cities of each geographic section (Northern, Central, and Southern). In addition, more than one alternative in the Central or Southern sections could be built in the future to provide different service options or serve different cities. Recommendation of these preferred alternatives does not preclude connectivity between geographic sections of the Program, but it does not assume connectivity either. Details about how preferred alternatives might connect would be analyzed during project-level analysis after completion of the service-level EIS.

2.3.3.1 Northern Section: Oklahoma to Dallas and Fort Worth

Due to feasibility based on initial ridership and cost information, only one route alternative and service type is considered feasible in the Northern Section, Alternative N4A Conventional Rail. During operation, this alternative would have similar environmental effects as the No Build Alternative except for a beneficial effect on passenger transportation because of the proposed incremental system and service improvements. Temporary impacts during construction would be slightly more than the No Build Alternative. However, the No Build Alternative would not meet the purpose and need for the Northern Section and there is a build alternative that is feasible and would meet the purpose and need; therefore, the No Build Alternative is not recommended as a preferred alternative. Alternative N4A Conventional Rail is the recommended preferred alternative for the Northern Section.

2.3.3.2 Central Section: Dallas and Fort Worth to San Antonio

In the Central Section, four key metrics were identified using studies completed for the Texas-Oklahoma Passenger Rail Study (TxDOT 2016a, 2016b, 2016c) that could be used to differentiate between alternatives:

- Break-even or profitability[4]: revenue to operating cost ratio, or the ability for an alternative to pay for itself.
- Capital cost investment[5]: cost to construct an alternative.
- User (train rider) and Non-user Societal Benefits[6]:
  - Safety – former highway users switching by choice to train (measured by passenger miles traveled diverted from automobile to train); reduction in fatal and non-fatal accidents.
  - Value-of-time – former highway users (and users of other modes, like bus or sometimes air) switching by choice to rail (measured by estimated mode-specific number of hours saved); less time traveling from ultimate trip origin to ultimate trip destination.
  - Cars off the road – reduction in automobile usage.
- Environmental effects: the conclusions on effects for resources analyzed as part of the Study Area EIS do not identify important differences between alternatives in the Central Section for this service-level evaluation (see Chapter 3, Affected Environment and Environmental Consequences). However, there are differences in quantitative measures that can be used to support a general ranking of the alternatives, in conjunction with the other differentiating metrics.

Based on these differentiating metrics, the recommended preferred alternatives for the Central Section are Alternatives C4A High-Speed Rail, C4B High-Speed Rail, and C4C High-Speed Rail. Alternatives C4A High-Speed Rail and C4B High-Speed Rail are recommended for two primary reasons. First, the revenue to operating cost ratio of these two alternatives suggests profitability, which in turn would support private investment in construction of the project. Second, the capital cost of the C4A and C4B routes would be the lowest among the Central Section alternatives.

In addition, while conclusions on effects for environmental resources (discussed in Chapter 3, Affected Environment and Environmental Consequences) do not differ greatly between the Central Section alternatives, impacts of Alternatives C4A and C4B would likely be quantitatively the lowest of the Central Section alternatives because they are the shortest routes (they do not include the additional leg between Hillsboro and Fort Worth). Both Alternatives C4A High-Speed Rail and C4B High-Speed Rail are recommended as preferred alternatives because a differentiation cannot be made between the two routes at the service-level analysis phase. Alternatives C4A and C4B with the Higher-Speed Rail service level, however, are not recommended as preferred alternatives

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[4] Based on analysis completed as part of the *Texas-Oklahoma Passenger Rail Study EIS-Phase Business and Financial Plan* (TxDOT 2016c).

[5] Based on analysis competed as part of the *Texas-Oklahoma Passenger Rail Study EIS-Phase Capital Investment Plan* (TxDOT 2016a).

[6] Based on analysis competed as part of the *Texas-Oklahoma Passenger Rail Study EIS-Phase Public Benefits Assessment* (TxDOT 2016b).

because their potential profitability (as implied by the revenue to operating cost ratio) does not likely support privately-funded construction of the higher-speed rail service level for these routes.

Alternative C4C Higher-Speed Rail is not recommended as a preferred alternative for three key reasons: a lack of potential profitability (similar to Alternatives C4A and C4B Higher-Speed), operating conflicts at the rail intersection known as “Tower 55” located south of Fort Worth, and failure to support the Program Purpose and Need by not providing local transportation benefits. Operational conflicts at Tower 55 would occur because Alternative C4C Higher-Speed Rail trains would cross the Tower 55 rail intersection at grade a minimum of 14 times per day, which would not be compatible with freight operations in one of the most heavily used rail “intersections” in the United States. In addition, Alternative C4C Higher-Speed Rail would provide little local area transportation benefit in the Dallas-Fort Worth Metroplex because the highly constrained Tower 55 area would limit operation to clockwise-only service in the Fort Worth-Dallas-Hillsboro loop. Passengers returning from Dallas to Fort Worth would have to travel through Hillsboro where they wound have to change trains for their return trip to Fort Worth. In contrast, Alternatives C4A and C4B would provide symmetrical two-way transportation in the corridor. Because of this lack of local transportation benefits, these two alternatives would not support the Program Purpose and Need (see Chapter 1, Purpose and Need).

Though Alternative C4C High-Speed Rail shares some of the disadvantages of Alternative C4C Higher-Speed Rail, strong local stakeholder support for this alternative supports the Program Purpose and Need. Therefore, Alternative C4C High-Speed Rail is recommended as a preferred alternative. There are two ways in which Alternative C4C High-Speed Rail performs better than Alternative C4C Higher-Speed. First, Alternative C4C High-Speed Rail would avoid crossing the Tower 55 rail intersection at grade by tunneling under or bridging over it. This could cause Alternative C4C High-Speed Rail to be more expensive in terms of capital costs than other Central Section alternatives, but it would be feasible to construct and operate. Also, though Alternative C4C High-Speed Rail shares the same low level of local transportation benefits in the Dallas-Fort Worth Metroplex as Alternative C4C Higher-Speed Rail, it would generate effectively the same level of intercity ridership and revenue as the other Central Section alternatives.

The No Build Alternative would not meet the Purpose and Need for the Central Section and because there are build alternatives that are feasible and would meet the Purpose and Need, the No Build Alternative is not recommended as a preferred alternative.

2.3.3.3 Southern Section: San Antonio to South Texas

In the Southern Section, Alternative S4 Higher-Speed Rail is recommended as a preferred alternative because this alternative provides public benefits that include meeting more local transportation need than any other alternative, which supports the Southern Section purpose and need. While potential environmental effects are quantitatively greater for this alternative than the other Southern Section alternatives, because it is a longer route, the overall effects conclusions for this alternative are the same or less than the other Southern Section alternatives.

Alternative S6 Higher-Speed Rail and Alternative S6 High-Speed Rail are recommended as preferred alternatives, but only if the alternatives include a connection to Monterrey, Mexico. This is because three-fourths of potential ridership on this route would occur only with the connection to Monterrey. The higher-speed versus high-speed service levels for this route cannot be further analyzed without more information about the Monterrey connection. For example, electric-powered high-speed rail would be more compatible with the recommended preferred alternatives in the Central Section, which are both high-speed alternatives; however, if higher-speed rail is more compatible with the infrastructure in Mexico, it could be preferred.

The No Build Alternative would not meet the purpose and need for the Southern Section. Because there are build alternatives that are feasible and would meet the purpose and need, the No Build Alternative is not recommended as a preferred alternative.

2.3.3.4 Conclusion for the Preferred Alternative

In conclusion, the recommended preferred alternatives for the Texas-Oklahoma Passenger Rail Study for each geographic section are as follows:

- Northern Section
  - N4A Conventional
- Central Section
  - C4A High-Speed Rail
  - C4B High-Speed Rail
  - C4C High-Speed Rail
- Southern Section
  - S4 Higher-Speed Rail
  - S6 Higher-Speed Rail or High-Speed Rail, but only with a connection to Monterrey, Mexico

2.3.4 Station Cities

This EIS did not evaluate specific station locations, and no conclusion about the exact location of stations will be made as part of this service-level EIS. However, based on ridership data and transit connectivity information developed as part of the alternatives analysis (see Appendix D; TxDOT 2014b) for this EIS, the cities in which stations could potentially be located have been determined. In some cities, based on stakeholder input, station locations have been assumed for the purpose of this EIS, but a final decision on exact station locations will not be made as part of this EIS. The size and design of stations would be appropriate for the service type of the associated route alternative. Cities that could have stations are listed in Table 2-9.

Table 2-9: Cities with Potential Stations

Oklahoma	
Edmond	Pauls Valley
Oklahoma City	Ardmore
Norman	
Texas	
Gainesville	Austin
Fort Worth	San Antonio
Arlington	Alice
Dallas	Corpus Christi
Waxahachie	Harlingen
Waco	McAllen
Temple (also serving Killeen)	Brownsville
Taylor	Laredo

2.4 Costs and Funding

As part of the alternatives analysis (see Appendix D; TxDOT 2014b), conceptual costs per mile for the alternatives were estimated based on standard infrastructure costing categories. As reflected in the preferred alternative discussion, a more detailed conceptual-level estimate for capital infrastructure costs, rolling stock fleet, operations and maintenance costs, fuel and utility costs, and a capital replacement budget for long-life items has been utilized in the evaluation and selection process. These estimates were developed in conjunction with the Service Development Plan, which includes more refined service plans, potential schedules, train set requirements, and other related information.

Appropriate funding sources for the expected infrastructure investment and next steps will be identified. Funding sources could include opportunities for grants, loans, private investment, public-private partnership, or joint development efforts by multiple agencies or governments. These options will be evaluated in the service development plan after the preferred alternative for the service-level EIS has been selected.

2.5 Alternatives Considered but Eliminated from Further Consideration

Based on the route alternatives analysis, as well as subsequent stakeholder input, certain alternatives were recommended to be eliminated from further consideration (see Appendix D, TxDOT 2014b). These alternatives and a summary of the rationale for eliminating them are discussed below.

2.5.1 Northern Section

- **Alternative N1 (Conventional Rail and Higher-Speed Rail).** The revenue-to-operating-cost ratio for this alternative (including Alternatives N1A and N1B) would not meet the required threshold for conventional service (50 percent cost recovery) or higher-speed service (75 percent cost recovery). The anticipated ridership and population access to the proposed station would be lower than the other Northern Section alternatives. The significant investment in infrastructure required for this alternative would not produce a commensurate increase in ridership. The environmental benefits of this route would be similar to other higher-ranked alternatives, which provided no compelling reason to further study of this alternative.
- **Alternative N2 (Higher-Speed Rail and High-Speed Rail).** The revenue-to-operating-cost ratio for this alternative would not meet the required threshold for higher-speed service (75 percent cost recovery) or high-speed service (100 percent cost recovery). This alternative would have the highest potential impact on non-transportation right-of-way, affecting a large number of farm properties, and potential environmental effects would be similar to Alternative N4A, which ranked higher in terms of operational criteria. The significant investment in infrastructure required for this alternative would not produce a commensurate increase in ridership.
- **Alternative N4A (Higher-Speed Rail).** This alternative would have a capital cost per passenger-mile six times the cost of other alternatives, and the alternative would provide a lower revenue-to-operating-cost ratio than the conventional rail option, indicating that the market for riders is saturated at the conventional rail service type and that higher-speed rail would not attract additional riders.
- **Alternative N4B (Conventional and Higher-Speed Rail)**. This alternative would have a much higher capital cost per passenger-mile than similar alternatives (N4A and N4C). In addition, this alternative would enter the TRE tracks at a location that would make handling the additional trains difficult and would require reversing the trains in Dallas Union Station, which would not be required by other alternatives.
- **Alternative N4C (Conventional and Higher-Speed Rail).** This alternative would have the greatest potential for environmental impacts, including the greatest potential impacts on wetlands and parks and open space. It would traverse a long looping arc through suburban Dallas, creating grade-crossing issues and potential delays at a KCS yard along the route.

2.5.2 Central Section

- **Alternative C1 (Conventional and Higher-Speed Rail).** This alternative would have the least benefit in terms of travel time, the lowest potential ridership, the lowest revenue-to-operating-cost ratio, the highest cost per passenger-mile, and the potential for significant environmental impacts.

- **Alternative C2A (Conventional).** This alternative would be comparable to Alternative C2B in operating performance and environmental issues, but would require trains to cross the congested Tower 55 rail intersection in Fort Worth. Obtaining consistent operating slots for passenger rail would be unlikely for this crossing, which would severely limit service options.
- **Alternative C2A and Alternative C2B (Higher-Speed Rail).** These alternatives would have significantly higher costs per passenger-mile, but the same revenue-to-operating-cost ratio when compared to the Alternative C4 Higher-Speed Rail option. In addition, there would be significant capital cost risk in coordinating a joint right-of-way with UPRR.
- **Alternative C2B (Conventional Rail).** Subsequent to the route alternatives analysis, input from stakeholders resulted in eliminating Alternative C2B (Conventional Rail) because of potential conflicts with existing freight rail service.

2.5.3 Southern Section

- **Alternative S2 (Conventional Rail and Higher-Speed Rail).** This alternative would have the lowest revenue-to-operating-cost-ratio of all the conventional and higher-speed rail alternatives. In addition, its cost per passenger-mile would be three times higher than any of the other alternatives.
- **Alternative S4 (High-Speed Rail).** This alterative would have significantly higher capital cost per passenger-mile and a lower revenue-to-operating-cost ratio than the higher-speed rail option, indicating that the market for riders is saturated at the higher-speed rail service type and that high-speed rail would not attract additional riders.
- **Alternative S5 (Higher-Speed Rail).** This alterative would have a significantly higher capital cost per passenger-mile with a similar revenue-to-operating-cost ratio compared to the conventional rail option. The S4 Higher-Speed Rail option is one-fourth the cost per passenger-mile of the S5 Higher-Speed Rail option, indicating that there would be no advantage in pursuing this alternative. In addition, this alternative would have the highest area of potential wetland effects.
- **Alternative S5 (Conventional Rail).** Subsequent to the route alternatives analysis, input from stakeholders resulted in eliminating Alternative S5 (Conventional Rail) because of potential conflicts with existing freight rail service.

3.0 Affected Environment and Environmental Consequences

This chapter addresses existing environmental conditions and provides an analysis of potential effects of the intercity passenger rail service alternatives for the Texas-Oklahoma Passenger Rail Study (Study), as required for a National Environmental Policy Act (NEPA) service-level environmental impact statement (EIS). A service-level analysis only evaluates a preliminary alignment to represent each EIS alternative, based on conceptual engineering that considered and avoided obvious physical or environmental constraints. The service-level analysis reviews generalized effects for a large swath within which the project area may occur and reports both the potentially adverse and beneficial effects without knowing the exact footprint of the alignment. These alignments are not refined to optimize performance, reduce cost, avoid specific properties or individual environmental resources, or for any other such considerations. If an alternative is selected at the service level for further development, the above considerations would be assessed at the project level. The project-level analysis will determine specific project *impacts* while the service-level analysis analyzes and describes the general *effects* by alternative. The service-level analysis includes best management practices (BMPs), design features, and mitigation strategies that address effects on a broad, service-level scale. The subsequent project-level analysis would include, but not be limited to, these BMPs, design features, and mitigation strategies.

A broad corridor of study with a width of 500 feet has been identified along each route (EIS Study Area). Unless described differently in the resource sections, the EIS Study Area[1] is the area, for each environmental resource being analyzed, in which potentially affected environmental resources in proximity to each alternative are identified. This EIS Study Area provides an envelope that could accommodate areas for associated effects, such as necessary roadway shifts, grade separations, construction activities, and affiliated features, such as stations and parking, traction-power substations, power lines, and maintenance-of-way facilities, as described in Chapter 2, Alternatives. Data for potentially affected counties were obtained from the Texas Department of Transportation (TxDOT). The area for which the data were collected is identified as the "Study Vicinity." Typically, county-wide data were collected for counties partially or completely within the EIS Study Area.

As discussed in Chapter 2, the route alternatives were based on the alignments of existing transportation networks (i.e., the existing railroad network and the existing interstate highway network) with corridors potentially suitable for passenger rail operations,[2] or they were located on new alignments outside existing transportation corridors. Potential alignments described as "following" railway corridors share existing tracks, are located within an existing right-of-way, or are generally adjacent to existing tracks, depending on the service type. Alternatives that are outside of the existing transportation corridor could have greater indirect effects than those located in the

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[1] Some environmental resource issues, such as transportation, air quality, and noise and vibration, use broader study areas to determine impacts and are described in the respective sections for those resources.

[2] The term "operations" includes maintenance of passenger rail facilities.

existing transportation corridor; for example, alternatives outside existing corridors could divide neighborhoods or wildlife communities by creating potential new barriers (e.g., to existing roadways or wildlife habitat or crossings).

NEPA requires the consideration of potential environmental impacts in the evaluation of any proposed federal agency action. General NEPA procedures are set forth in the Council on Environmental Quality Regulations (40 Code of Federal Regulations [CFR] 1500-1508). This chapter organizes the affected environment and environmental consequences discussions into environmental resource issues according to the Federal Railroad Administration (FRA)'s *Procedures for Considering Environmental Impacts*, as set forth in 64 Federal Register 29545, May 26, 1999 (Environmental Procedures), which includes the evaluation of the following environmental resource disciplines:

- Air Quality
- Water Quality
- Noise and Vibration
- Solid Waste Disposal
- Natural Ecological Systems and Wildlife
- Wetlands
- Threatened and Endangered Species
- Flood Hazards and Floodplain Management
- Coastal Zone Management
- Energy
- Utilities
- Geologic Resources
- Aesthetics and Design Quality Impacts
- Land Use and Prime Farmland
- Environmental Justice, Socioeconomic Environment, and Elderly and Handicapped
- Public Safety and Hazardous Materials
- Recreational Areas and Opportunities
- Historic, Architectural, and Non-archaeological Cultural Resources
- Archaeological Sites
- Travel Demand and Transportation
- Public Health

In this chapter, each resource analysis contains the following sections, which are described below:

1. Laws, Regulations, and Orders
2. Methodology
3. Affected Environment
4. Environmental Consequences
5. Avoidance, Minimization, and Mitigation Strategies
6. Subsequent Analysis

The **Laws, Regulations, and Orders** section lists and briefly describes the federal, state, and local laws, regulations, and orders applicable to the resource discussion. If one of these levels of regulation (federal, state, and local) is not listed, then there are no laws, regulations, or orders of that type that apply to the environmental resource being discussed.

The **Methodology** section provides readers with the process used to gather data and to assess and evaluate potential effects. The methodology section lists resource-specific impact types for both construction and operations phases of the Program, as well as the implications of conventional, higher-speed, and high-speed rail technology, if applicable, to the analysis.

The **Affected Environment** section provides the existing context for each environmental resource and its basis for analysis of potential impacts. This section describes the presence of the resource and the existing environment in the EIS Study Area based on the most recent publicly available data or on data collected during field reviews in 2013 and 2014. Existing conditions are described either broadly for all Study alternatives within the Northern, Central, and Southern sections or, when available, for the EIS Study Area for each alternative, including the No Build and build alternatives. For certain environmental resource areas, such as travel demand and transportation, land use, and air quality, adopted and programmed land use plans, projected growth, and infrastructure improvements can be quantified and used as the basis of comparison for the build alternatives. For these resources, the future 2035 condition is described for the No Build Alternative.

As described in Chapter 2, Section 2.3.1, Service Type Descriptions, there are three passenger rail service-types proposed for the Program: 1) conventional rail (which has a higher frequency of trips compared with the other service types), 2) higher-speed rail (reaching speeds of up to 110 to 125 miles per hour [mph]), and 3) high-speed rail (speeds up to 220 to 250 mph). The analyses describe whether impacts would differ among rail service types. Several alternatives share the same EIS Study Area but are still described separately because there are differences among conventional, higher-speed, and high-speed technology that affect the analysis.

The recommended preferred alternatives are identified in Chapter 2, Section 2.3.3, based on differentiating metrics for each of the geographic sections in the Study. Metrics that differentiate between alternatives are related to the overall Study purpose and need, as well as the purpose and need for each geographic section (see Chapter 1, Purpose and Need). The recommended preferred alternatives for the Study for each geographic section are as follows:

- Northern Section
  - N4A Conventional
- Central Section
  - C4A High-Speed Rail
  - C4B High-Speed Rail
  - C4C High-Speed Rail
- Southern Section
  - S4 Higher-Speed Rail
  - S6 Higher-Speed Rail or High-Speed Rail, but only with a connection to Monterrey, Mexico

As reflected in Chapter 2, Section 2.2, the No Build Alternative would not fulfill the Program's purpose and need; however, the No Build Alternative is used as a baseline alternative against which the build alternatives are compared. The No Build Alternative consists of the existing transportation network, including roadway, passenger rail, and air travel, as well as planned improvements to these systems. These improvements and their evaluation at this service-level stage would require project-specific assessment. Conducting project assessments at this stage of the program development process would be speculative; however, the evaluation and assessment of potential environmental effects from a cumulative perspective has been conducted and is included in Chapter 5, Cumulative Impacts. In addition to presenting the No Build Alternative, this chapter discusses the Northern, Central, and Southern sections and the 10 alternatives in the following order, generally proceeding geographically from north to south:

- **Northern Section:** Oklahoma City to Dallas and Fort Worth
  - Alternative N4A Conventional
- **Central Section:** Dallas and Fort Worth to San Antonio
  - Alternative C4A Higher-Speed Rail
  - Alternative C4A High-Speed Rail
  - Alternative C4B Higher-Speed Rail
  - Alternative C4B High-Speed Rail
  - Alternative C4C Higher-Speed Rail
  - Alternative C4C High-Speed Rail
- **Southern Section:** San Antonio to South Texas (U.S./Mexico border)
  - Alternative S4 Higher-Speed Rail
  - Alternative S6 Higher-Speed Rail
  - Alternative S6 High-Speed Rail

The **Environmental Consequences** section presents quantitative and qualitative differences in effects among alternatives. The discussion of different effect types describes how the analysis incorporates regulatory requirements and standard implementation of specific BMPs.

This section does not provide a summary of effects for the entire route between Oklahoma City and Laredo/Brownsville. More than one alternative in the Central Section or Southern Section could be built in the future to provide different service options or serve different cities. Details about how alternatives might connect would be analyzed during project-level analysis after completion of this service-level EIS. This service-level analysis does not preclude connectivity, but it does not assume connectivity either. The analysis provides quantitative information about the presence of resources within the EIS Study Area for each alternative and compares it against the No Build Alternative and other build alternatives in the same geographic region. The discussion of effects also provides qualitative differences in permanent, temporary, and direct and indirect effects that are associated with the service-type (conventional, higher-speed, high-speed rail) relative to the environmental context (**Affected Environment**). However, because the 500-foot EIS Study Area does not represent the actual footprint of operation or construction phases, the analysis is primarily comparative, based on the presence of the resource within the EIS Study Area and the likelihood of effects as appropriate for this service-level analysis.

The potential effects of the build alternatives for each geographic section (Northern, Central, and Southern) are described and then categorized by the potential severity of the effect. For this service-level analysis, severity of effects is described using the terms negligible, moderate, or substantial, which are defined for each resources in the subsequent sections.

The **Avoidance, Minimization, and Mitigation Strategies** section presents BMPs, design features, and mitigation strategies for each resource evaluation on a broad service-level scale. Each resource evaluation includes a list of mitigation strategies that would be further developed during project-level analysis. Strategies listed in this section include conceptual avoidance and minimization measures for the next phase of design, suggestions for programmatic agreements, and descriptions of a range of options for replacing or re-establishing the affected resources.

The **Subsequent Analysis** section identifies whether further analysis is needed and recommends next steps for each environmental issue area as the Program advances into more detailed analysis of the selected alternative.

3.1 Air Quality

This section describes the air quality effects related to the No Build Alternative and build alternatives. Preliminary avoidance, minimization, and mitigation strategies and further analyses needed in the project-level National Environmental Policy Act (NEPA) analysis are identified at the end of the section. The introduction to Chapter 3 describes the environmental impact statement (EIS) Study Area and use of terms such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.1.1 Laws, Regulations, and Orders

Applicable legislation, regulations, and orders pertaining to air quality are described below. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.1.1.1 Federal

Clean Air Act and National Ambient Air Quality Standards

The Clean Air Act (CAA) and CAA Amendments of 1990 established the National Ambient Air Quality Standards (NAAQS) for specific criteria pollutants in 40 Code of Federal Regulations (CFR) Part 50 to protect public health and welfare. The primary standards are intended to protect the public health with an adequate margin of safety. The secondary standards are intended to protect the nation's welfare and account for air-pollutant effects on soil, water, visibility, vegetation, and other aspects of the general welfare. NAAQS sets standard for the following major air pollutants. These pollutants, known as criteria pollutants, are carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone, particulate matter 10 micrometers in diameter or less (PM_{10}), particulate matter 2.5 micrometers in diameter or less ($PM_{2.5}$), and lead (U.S. Environmental Protection Agency [EPA] 2016a). The NAAQS are shown in Table 3.1-1. The Oklahoma Department of Environmental Quality (ODEQ) and the Texas Commission on Environmental Quality (TCEQ) have adopted the NAAQS as their state standards (ODEQ 2013a; TCEQ 2014a).

The criteria pollutants of concern for transportation-related sources such as the Texas-Oklahoma Passenger Rail Program (Program) include PM_{10} and $PM_{2.5}$ due to diesel locomotive emissions (referred to as diesel particulates), CO and NO_x due to roadway vehicle emissions, and ozone. Ozone is formed in the atmosphere through photochemical reactions between precursor gases including volatile organic compounds (VOCs) and nitrogen oxides (NO_x). Sources of VOCs and NO_x include emissions from internal combustion engines such as those associated with roadway vehicles and diesel locomotives. Diesel and gasoline combustion result in similar levels of VOCs and carbon dioxide (CO_2) on a gallon-per-gallon comparison. Diesel combustion has slightly higher emission rates of NO_x than gasoline; however, the difference in NO_x emissions rates on a gallon-per-gallon basis between gasoline and diesel is not substantial (California Air Resources Board 2013).

Table 3.1-1. Ambient Air Quality Standards

Pollutant	Primary / Secondary	Concertation Averaging Time	NAAQS	Threshold
Carbon Monoxide (CO)	Primary	8-hour	9 ppm	Not to be exceeded more than once per year
		1-hour	35 ppm	
Lead	Primary and Secondary	Rolling 3-month average[a]	0.15 µg/m³	Not to be exceeded
Nitrogen Dioxide (NO_2)	Primary	1-hour[b]	100 ppb	98th percentile, averaged over 3 years
	Primary and Secondary	Annual[c]	53 ppb	Annual mean
Ozone (O_3)	Primary and Secondary	8-hour (2015 Standard)[d]	0.070 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particulate Matter ($PM_{2.5}$)	Primary	Annual	12 µg/m³	Weighted annual mean, averaged over 3 years
	Secondary	Annual	15 µg/m³	Annual mean, averaged over 3 years
	Primary and Secondary	24-hour	35 µg/m³	98th percentile, averaged over 3 years
Particulate Matter (PM_{10})	Primary and Secondary	24-hour	150 µg/m³	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)	Primary	1-hour	75 ppb[e]	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Pollutant	Primary / Secondary	Concertation Averaging Time	NAAQS	Threshold

[a] Final rule signed October 15, 2008. The 1978 lead standard (1.5 μg/m³ as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
[b] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb.
[c] The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.
[d] Final rule signed October 26, 2015.
[e] Final rule signed June 2, 2010. The 1971 annual and 24-hour SO_2 standards were revoked in that same rulemaking. However, these standards remain in effect until 1 year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.
μg/m³ = micrograms per cubic meter
ppb = parts per billion
ppm = parts per million
Source: EPA (2016a).

The CAA requires EPA to classify areas in the country as attainment or nonattainment, with respect to each criteria pollutant, depending on whether the areas meet the applicable NAAQS. Areas classified as "attainment areas" comply with the applicable NAAQS. Areas once classified as nonattainment that have since demonstrated attainment of the NAAQS are classified as "maintenance areas." Maintenance areas are required to implement the EPA-approved maintenance plan to maintain the standard under NAAQS. Areas not in compliance with the NAAQS are classified as "nonattainment areas." The CAA requires each state to produce and regularly update a state implementation plan (SIP) for each criteria pollutant that violates the applicable NAAQS. SIP is an enforceable plan developed at the state level that serves as a tool to avoid and minimize emissions of pollutants to achieve compliance with the NAAQS.

General Conformity

The EPA Final Conformity Rule implements Section 176(c) of the CAA, as amended in 42 United States Code 7506(c). This rule was originally published in the Federal Register on November 30, 1993, and took effect on January 31, 1994. In March 2010, EPA revised the Final Conformity Rule and published it in the Federal Register in April 2010. EPA's conformity rule requires federal agencies to ensure that any federal action resulting in emissions of any nonattainment or maintenance criteria pollutants conforms with the approved or promulgated state or federal implementation plans for attaining or maintaining the NAAQS. Specifically, this means ensuring that the federal action will not (1) cause a new violation of NAAQS, (2) increase the frequency or severity of existing violations of NAAQS, or (3) delay the timely attainment of NAAQS interim or other attainment milestones.

NEPA

Signed into law on January 1, 1970, NEPA requires federal agencies to assess the environmental effects of their proposed actions prior to making decisions. In 1978, the Council on Environmental Quality (CEQ) issued regulations (40 CFR Parts 1500-1508) to implement NEPA. These regulations are binding on all federal agencies. The regulations address the procedural provisions of NEPA and the administration of the NEPA process, including the preparation of environmental assessments and EIS documents to assess the likelihood of impacts from alternative courses of action.

Air Toxics

In addition to the criteria pollutants, EPA also regulates air toxic emissions. Controlling air toxic emissions became a national priority with the passage of the CAA Amendments of 1990, whereby Congress mandated that EPA regulates 188 air toxics, also known as hazardous air pollutants. EPA has assessed this expansive list in its 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 its Integrated Risk Information System (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 its 1999 National Air Toxics Assessment (http://www.epa.gov/ttn/atw/nata1999/); these compounds are acrolein, benzene, 1,3-butidiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While EPA has regulations to limit the emissions of air toxics, there are currently no federal or state ambient air quality concentration standards for air toxics.

Greenhouse Gases

In addition to regulating criteria pollutants, in accordance with the CAA Section 202(a) and the Final Endangerment and Cause or Contribute Findings, greenhouse gas (GHG) pollutants are also regulated at the federal level (EPA 2014). CEQ released revised draft guidance on the consideration of GHG in NEPA documents for all federal actions on December 18, 2014. The revised guidance established a reference point of 25,000 metric tons of CO_2-e emissions on an annual basis, below which a quantitative GHG emissions analysis is not warranted (CEQ 2014). The draft CEQ guidance is still under review, and currently there is not a quantitative federal threshold to address GHG emissions and the impacts on climate change at the project level.

Since the U.S. Supreme Court in 2007 clarified that CO_2 is an “air pollutant” subject to regulation under the CAA, EPA embarked on developing requirements and standards for GHG emissions from mobile and stationary sources under the CAA. However, currently there are no NAAQS or *de minimis* thresholds in place for GHG. The following summarizes the main GHG regulatory initiatives recently undertaken by EPA in the transportation sector:

- EPA and the National Highway Traffic Safety Administration are taking steps to enable the production of a new generation of clean vehicles, through the reduction of GHG emissions and improved fuel use. Together, the enacted and proposed standards are expected to save more than 6 billion barrels of oil through 2025 and reduce more than 3,100 million metric tons (MT) of CO_2 emissions (EPA 2016b).
- EPA is responsible for developing and implementing regulations to ensure that transportation fuel sold in the United States contains a minimum volume of renewable fuel. By 2022, the Renewable Fuel Standard Program, which was created under the Energy Policy Act of 2005, anticipates reducing GHG emissions by 138 million MT, equivalent to the annual emissions of 27 million passenger vehicles (EPA 2016b).

GHGs are air emissions that are addressed on a regional or national level. Although no ambient air quality standards have been established for GHGs, the federal government has established a goal of reducing GHG emissions from transportation-related activities. The goal will be attained by implementing the following four strategies:

1. Use low carbon fuels including ethanol, biodiesel, natural gas, liquefied petroleum gas, synthetic fuels, hydrogen, and electricity.
2. Increase vehicle fuel efficiency by developing and bringing to market advanced engine and transmission designs, lighter-weight materials, improved vehicle aerodynamics, and reduced rolling resistance, which would result in lower fuel use (U.S. Department of Transportation 2010).
3. Improve transportation system efficiency through traffic management and bottleneck relief, as well as by lowering speed limits on national highways.
4. Reduce carbon-intensive transit activity by implementing transportation pricing strategies, a few examples being a fee per vehicle-mile traveled (VMT) of about 5 cents per mile, an increase in the motor fuel tax of about $1.00 per gallon, or pay-as-you-drive insurance. Also, significant expansion of urban transit services, in conjunction with land use changes and pedestrian and bicycle improvements, would be included (U.S. Department of Transportation 2010).

To date, no national standards have been established regarding GHGs, nor has EPA established criteria or thresholds for ambient GHG emissions pursuant to its authority to establish motor vehicle emission standards for CO_2 under the CAA. However, there is considerable scientific literature addressing the sources of GHG emissions and their effects on climate, including reports from the Intergovernmental Panel on Climate Change, the National Academy of Sciences, EPA, and other federal agencies. Given their characteristic rapid dispersion into the global atmosphere, GHGs are different from other air pollutants evaluated in federal environmental reviews because the effects are not localized or regional. From a quantitative perspective and in terms of both absolute numbers and types, global climate change is the cumulative result of numerous and varied natural and anthropogenic emissions sources (Texas Department of Transportation 2015).

3.1.1.2 State

Air quality is regulated in Oklahoma at the state level by ODEQ as specified by the Oklahoma Administrative Code Title 252 Chapter 100 (ODEQ 2013a). Oklahoma has a Regional Haze Implementation Plan consistent with federal Prevention of Significant Deterioration regulations to protect the state's one Class 1 area, the Wichita Mountains, which is located 60 to 90 miles west of the EIS Study Area (ODEQ 2013b). Oklahoma does not have any areas that are classified as nonattainment or maintenance areas according to the NAAQS.

Although all regions of Oklahoma are in attainment or unclassified with the NAAQS, the Association of Central Oklahoma Governments (ACOG) participated in the EPA 8-Hour Ozone Flex program to implement voluntary reduction measures to control ground level ozone formation and set a 5-year plan in place for Central Oklahoma in June 2008 (40 CFR Part 81 Subpart C Section 107). Activities associated with the 5-year plan concluded in June 2013. In 2012, ACOG registered with EPA for participation in the EPA's Ozone Advance Program, where participants have agreed to take proactive steps toward improving air quality. EPA will assist these areas to help identify, evaluate, select, and implement measures and programs tailored to their needs (ACOG 2012). Programs that are being implemented as a part of ACOG's advance voluntary program are the Oklahoma City metro area's Compressed Natural Gas and Alternative Fuels Programs (EPA 2013). Oklahoma currently has two SIP revisions pending submission to EPA in regards to the NAAQS 2008 primary and secondary 8-hour ozone standards and the 2010 primary SO_2 standard (ODEQ 2014).

Air quality is regulated in Texas at the state level by under Texas Administrative Code Title 30 Part 1 Chapters 101 through 122 (TCEQ 2013a). Texas has developed a SIP to manage emissions on a state-wide and regional basis. Revisions to the SIP incorporate changes in regulations and attainment status of regions. The most recent state-wide revision was the Regional Haze update, which was approved by EPA in March 2014. Texas has also adopted SIP revisions for the Dallas and Fort Worth area, which predominantly target stationary sources in the region and the Austin-Round Rock, San Antonio, and Corpus Christi area ozone planning activities (TCEQ 2014a).

3.1.2 Methodology

The methodology for analysis adheres to the regulatory review requirements which are outlined in the section above. The general approach was to determine the existing ambient air quality conditions using data collected by national ambient air quality stations, evaluate the potential change in air emission under the Program and across the proposed alternatives relative to the No Build Alternative, and evaluate the changes relative to the existing conditions.

3.1.2.1 Types of Impacts Evaluated

Potential regional and/or localized air quality impacts were evaluated for the following general categories:

- Short-term Construction Effects: Construction effects on air quality are generally short term and are due to the emissions from construction equipment, fugitive dust from ground-level disturbances, on-site materials processing and handling such as concrete plants, and vehicle emissions from increases in local traffic congestion. The potential construction impacts on air quality are evaluated based on the intensity of the construction activities and duration of the construction of the Program and corresponding alternatives. The longer the construction period and the more non-road construction equipment used (such as cranes, bulldozers, heavy duty trucks, and concrete batch plants), the greater the potential for construction effects on air quality.
- Long-term Regional Effects: Long-term regional effects on air quality were evaluated based on both the direct and indirect emissions from operation of the Program. Ridership data from the Federal Railroad Administration's CONNECT model were used to determine the ridership and mode share information. Detailed emission evaluations are in Appendix A of the *Air Quality Technical Study* (see Appendix E of this Draft EIS). Long-term regional effects were evaluated based on emissions from the following sources.
  - On-Road Vehicle Emissions: The Program would reduce passenger VMT and subsequently reduce vehicle emission in the region due to people switching from driving to riding the trains. Regional vehicle emissions were evaluated based on the VMTs within the EIS Study Area and the vehicles emission factors from EPA's Motor Vehicle Emission Simulator model.
  - Diesel Locomotive Emissions: Railroad activity releases emissions, primarily from fuel combustion during diesel-powered train operations. Emissions from diesel locomotives were calculated using *Emission Factors for Locomotives* (EPA 2009) and the train schedules developed in the *Transportation Technical Study* (see Appendix L of this Draft EIS).
  - Airplane Emissions: The Program could potentially change emissions from airplanes when passengers select traveling by trains instead of airplanes. The number of airplanes per day in each region was obtained from the travel demand model. The Federal Aviation Administration's Emissions and Dispersion Modeling System estimates the emissions generated from a specified number of landing and take-off cycles and was used to estimate airplane emissions. Emissions from airport ground support equipment were also included in this evaluation.
  - Power Generation Emissions: Electrical train operation requires additional power to be generated by power plants. While these emissions would not be located directly adjacent to the railway, they are accounted as indirect emissions from the Program in the regional emissions evaluations. The power demands due to propulsion of the electrical trains were calculated based on average engine size and the associated electrical demand. Indirect emissions from power demand of the stations and other supporting facilities are expected to be minimal in comparison to the emissions from other Program emission sources; therefore, these emissions are not included in this service-level analysis.

   - Localized Vehicle Emissions: Localized vehicle emissions would occur if a large amount of diesel vehicles or equipment congregate at a single location because substantial emissions of criteria pollutants or air toxics from mobile or stationary sources would accumulate. Localized emissions effects were evaluated qualitatively in this analysis, because detailed localized impacts evaluation of CO, PM, or air toxics requires project-specific information that is not currently available.

- GHG Effects: GHG emissions from the Program would be due to fossil fuel combustion of vehicles, diesel trains, airplanes, and power plants that provides electricity to meet the Program's power demand. Potential change in GHG emissions from implementation of the Program were calculated for the same sources and categories as identified above for long-term regional effects.

3.1.2.2 Intensity of Effects Criteria

The air quality effects are characterized as negligible, moderate, or substantial as compared to the No Build Alternative.

A *substantial* effect on air quality would have some or all of the following characteristics:

- Short-Term Construction Effects: Construction emissions would be determined to have substantial adverse short-term effects if construction activities would generate air emissions in a quantity and location that would have the potential to cause or contribute to an exceedance of an ambient air quality standard or generate fugitive dust or other pollutants to a level that would be a nuisance. There are no beneficial short-term effects from construction for air quality.
- Long-Term Regional Operational Effects:
   - Regional Adverse Effects: Regional adverse effects would be substantial if the net increase in emissions of criteria pollutants is greater than 100 tons per year between the No Build Alternative and the build alternatives.
   - Regional Beneficial Effects: Substantial beneficial effects on air quality are based on a noticeable reduction in air emissions due to the Program. Although a substantial reduction may not directly result in a change of attainment status for a region, it would cause or contribute to an overall measureable and continued improvement to the air quality in the region. The improvement could be due to a reduction of criteria pollutants, air toxics, or GHG emissions. A regional beneficial effect on GHG emissions would occur if the Program is consistent with federal, state, or local GHG reduction strategies.
- Localized Adverse Effects: A localized adverse effect would occur if the Program would cause a localized air emissions increase with the potential to cause violation of the NAAQS; cause or contribute to a substantial air toxic emission increase that exposes sensitive populations to a high level of air toxic concentrations; or result in a stationary source that could not be permitted by the local regulatory agency due to a local increase in air emissions. For this service-level analysis, there is insufficient project-specific data available to make a determination regarding

potential for substantial local effects. Therefore, where an alternative would have a higher potential for localized vehicle emissions of CO, PM, or air toxics, a detailed project-level localized effects analysis is recommended.

- GHG Effects: Substantial regional adverse effects would occur when the Program or the Program design are inconsistent with federal, state, and local emission reduction goals. A regional beneficial effect would occur if the Program is consistent with the federal, state, or local GHG-reduction goals.
- A *moderate* effect would be noticeable, but overall the emissions and effects would be less than a substantial effect. Specifically, the effects would be moderate if the net increase in emissions from operations of criteria pollutants is less than 100 tons per year between the No Build Alternative and the build alternatives. A proportional reduction in short-term construction-related emissions and fugitive dust would result in a moderate effort.
- A *negligible* effect is one that would result in similar or limited emissions compared to the No Build Alternative and would result in no noticeable change. Construction emissions would be determined to have negligible short-term effects if construction activities generate air emissions in a quantity and location that would not have the potential to cause or contribute to any exceedance of an ambient air quality standard and would also not generate fugitive dust or other pollutants to a level that would be a nuisance.

3.1.2.3 General Conformity

For project areas located in nonattainment and maintenance areas under NAAQS, the project would be subject to the general conformity rule and required to demonstrate compliance with the conformity requirements. The EPA Final Conformity Rule requires that total direct and indirect emissions of nonattainment and maintenance criteria pollutants, including ozone precursors (VOC and NO_x), be considered in determining conformity. If a federal action meets *de minimis* requirements established in 40 CFR 93.153(b), detailed conformity analyses are not required.

General conformity applicability analysis (e.g., to demonstrate that project emissions would be less than the general conformity *de minimis* levels) would be conducted at the project level for each project that is located in Dallas-Fort Worth nonattainment or maintenance areas. Further conformity determination will be required if the emissions exceed the *de minimis* levels for the nonattainment or maintenance pollutants.

3.1.3 Affected Environment

3.1.3.1 Overview

The EIS Study Area for air quality is composed of the regional air basins that the Program corridor would go through. Air quality in nearby air basins could also be affected by changes in travel patterns, VMT, and regional pollutant transport resulting from the alternatives, but likely at a much lower level than in the Program corridor. For this service level analysis, potential effects on air quality are evaluated only for the air basins (i.e., regions) that physically contain the alternatives.

Table 3.1-2 summarizes the general climate, existing air quality, attainment status, and major emission sources for each of the regions in the EIS Study Area. Of all these regions, only the Dallas-Fort Worth area is designated as nonattainment for ozone and lead 2008 standard, and in maintenance for lead 1978 standard. The Dallas-Fort Worth area is in attainment or unclassified for all other pollutants. Other regions of the study area are in attainment or unclassified for all pollutants. Specific details about the air quality plans and activities and the ambient air quality conditions of each region are included in the sections below.

Table 3.1-2. General Climate and Existing Air Quality Conditions

Study Segment	Air Basin (Region)	Counties and Main Cities	Attainment/ nonattainment [a]	Weather / Topography	Main Sources of Air Emissions
Northern Section: Oklahoma City to Dallas-and Fort Worth	Central Oklahoma Intrastate Air Quality Control Region Northern Texas	Oklahoma City; Garvin, Murray, Carter, and Love Counties Cooke County	Oklahoma: Attainment for all criteria pollutants Attainment	Frequent winds, long hot summers and shorter milder winters; [b,c] mostly flat with rolling hills	Power plants, industrial, and mobile sources [j]
Central Section: Dallas and-Fort Worth to San Antonio	Dallas-Fort Worth – Arlington Basin	Dallas, Fort Worth, Arlington; Denton, Tarrant, Dallas, Johnson, Ellis, and Collins Counties	Dallas-Fort Worth-Arlington Area: Nonattainment 8-hour ozone Collins County: Nonattainment, lead (2008 standard), Maintenance (1978 standard) Attainment/unclassified for other criteria pollutants	Humid subtropical climate with hot summers; continental climate with generally mild winters; [d] rolling hills	Power plants, industrial, and mobile sources (on-road and off-road) [i]
	Austin-Round Rock	Austin, San Antonio; Hill, McLennan, Falls Bell, Williamson, Travis, and Caldwell Counties	Attainment: Unclassified for all criteria pollutants	Humid subtropical climate with hot summers and relatively mild winters but with sudden cold fronts; [e] elevations range from 400 feet to 1,000 feet above sea level	Power plants, industrial, and mobile sources [i]

Study Segment	Air Basin (Region)	Counties and Main Cities	Attainment/ nonattainment [a]	Weather / Topography	Main Sources of Air Emissions
Southern Section: San Antonio to South Texas	San Antonio	Guadalupe and Bexar Counties	Attainment/ unclassified for all criteria pollutants	Humid subtropical climate with hot summers and relatively mild winters; elevation ranges from 550 to 1,000 feet above sea level [f]	In rural areas, agricultural dust and soil disturbances; In other areas: power plants, industrial, and mobile sources (on-road and off-road) [i]
	Southern Texas	Laredo / Along the Texas-Mexico border; sparsely populated.[g]	Attainment/ unclassified for all criteria pollutants	Semi-arid region results in lower precipitation than other Gulf Coast regions; low, rolling hills.	In rural areas Agricultural dust and soil disturbances; In other areas Power plants, industrial, and mobile sources (on-road and off-road) [i]
		Corpus Christi in the Rio Grande Valley Region	Attainment/ unclassified	Subtropical climate [h]	

[a] EPA (2016c).
[b] Oklahoma Climatological Survey (2014).
[c] U.S. Census (2013); Oklahoma Climatological Survey (2014).
[d] National Climatic Data Center (2014); National Oceanic and Atmospheric Administration (NOAA) (2014a).
[e] U.S. Census (2013); NOAA (2014b).
[f] National Climatic Data Center (2014); NOAA (2014c).
[g] U.S. Census (2013).
[h] National Climatic Data Center (2014).
[i] TCEQ (2014a).
[j] ODEQ (2013b).

GHG emissions are not limited to regional boundaries but are global. GHG emissions from transportation have been growing steadily in recent decades. In 2014, GHG emissions from transportation accounted for about 26 percent of total GHG emissions in the United States, making it the second largest contributor of U.S. GHG emissions after the electricity sector. GHG emissions from transportation have increased by 17 percent since 1990 (EPA 2016b). The majority of transportation sector GHG emissions result from fossil fuel combustion. CO_2 is the largest component of these GHG emissions.

3.1.3.2 Northern Section: Oklahoma City to Dallas and Fort Worth

While all of Oklahoma is in attainment or unclassified for all criteria pollutants under NAAQS, ACOG has been proactive in its planning to reduce mobile source emissions—cars and trucks—which account for approximately 60 percent of the region's pollution, and is currently implementing plans to increase participation in public fleet conversions, the use of public transportation, and ride-sharing programs. Also, ACOG is participating in EPAs 8-hour Ozone Flex Program to implement voluntary reduction measures to control ground-level ozone formation (ACOG 2012; EPA 2008).

Oklahoma's Interstate Transport SIP for an Assessment of Oklahoma's Impact on Downwind Nonattainment for the National Ambient 8-hour Ozone and $PM_{2.5}$ Air Quality Standards was partially approved by EPA in 2012, with a revision submitted in 2013 pending EPA approval. The SIP demonstrates that Oklahoma does not have a significant impact on ozone or $PM_{2.5}$ nonattainment for any other state, and does not interfere with maintenance of the NAAQS in any other state (ODEQ 2013b).

In Texas, the counties in the Dallas and Fort Worth area, including Denton, Tarrant, Dallas, Johnson, and Ellis are designated as moderate nonattainment areas for the 2008 8-hour ozone standard and serious nonattainment areas for the 1997 8-hour ozone standard. To show progress towards attainment of the 1997 8-hour ozone standard, on July 2, 2014, TCEQ adopted the Attainment Demonstration SIP Revision that includes the Dallas and Fort Worth area, a Reasonable Further Progress SIP Revision, and revisions to Texas Administrative Code Title 30 Chapter 115 into the Texas SIP. EPA approval of these revisions is pending (TCEQ 2014b).

Starting at the northern border of Denton County, this area is in a nonattainment area for ozone. Consequently, activities in this region are subject to the TCEQ 2014 Five-Year Regional Haze State Implementation Plan Revision (TCEQ 2014c) and emissions of ozone precursors, NO_x and VOC, are more tightly regulated. TCEQ adopted the 2014 Five-Year Regional Haze SIP Revision on February 26, 2014, which implements further reductions in the NO_X emissions caps for electricity-generating units that went into place in 2015 and continues with clean diesel and motor vehicle programs as the primary method to address the 1997 8-hour ozone standard.

A portion of Collin County is a nonattainment area for the 2008 lead standard and a maintenance area for the 1978 lead standard (TCEQ 2013b).

As required by general conformity, because the alignment passes through an ozone nonattainment area, the Program must be consistent with the SIP and not create a local violation of an air quality standard. A detailed conformity demonstration would be performed at the project level for alternatives located within the nonattainment or maintenance areas.

3.1.3.3 Central Section: Dallas and Fort Worth to San Antonio

Areas designated as attainment or unclassifiable/attainment for the 8-hour ozone standard, as published on April 30, 2004 (69 Federal Register 23858) are eligible to participate in EPA's 8-Hour Ozone Flex Program. The program is implemented through a voluntary intergovernmental agreement (Memorandum of Agreement [MOA]) among EPA, TCEQ, and the local communities. The proposed alignment travels through Austin, which is a participant in the MOA (EPA 2008). The Austin-Round Rock 8-Hour Ozone Flex MOA commits the Austin-Round Rock area to continuing the implementation of the Early Action Compact SIP and voluntary emission reduction measures. The MOA also includes applying for Texas Emission Reduction Plan grants, when available; Transportation Emission Reduction Measures; regional rideshare program; inviting five or more additional cities to join the area's Clean Air Coalition and becoming signatories to the MOA; implementing a watch/warning ozone alert system for the area; implementing AirCheck Texas local initiative projects with Low Income Repair Assistance Program funds; and road paving projects.

From the Austin-Round Rock air basin, the proposed alignment travels along Interstate Highway 35 into the San Antonio air basin, traversing Guadalupe and Bexar counties, which are in the San Antonio air basin. The San Antonio air basin was designated as attainment for the 1997 8-hour ozone standard by EPA on April 2, 2008 (Federal Register, Vol. 73, No. 64, pages 17897 to 17901). There are no further SIP requirements for the existing standard as long as the area continues to be in monitor attainment for the standard.

In the region south of the Dallas-Fort Worth air basin to the Austin-Round Rock air basin, and between the Austin-Round Rock air basin and San Antonio air basin area, sources including agricultural dust and soil disturbances are major contributors to air pollution. In the Austin-Round Rock air basin and San Antonio air basin, the predominant contributors to air pollution are point sources, including power plants and industrial facilities, and mobile emissions combined (both road and non-road) (TCEQ 2014a).

3.1.3.4 Southern Section: San Antonio to South Texas

The areas in the Southern Section are in attainment or unclassified for all criteria pollutants under NAAQS. The areas in the southwestern portion of Texas have historically lower ambient background concentrations of air pollutants than those found in more developed counties. The Corpus Christi area manages ozone precursors in accordance with the Ozone Flex Plan (TCEQ 2007).

Corpus Christi was designated as attainment by EPA for the 1997 8-hour ozone NAAQS. A 5-year agreement was signed in 2007 for Nueces and San Patricio counties to participate in the Ozone Flex Program for the 8-hour ozone standard, which encourages 8-hour ozone attainment areas nationwide to reduce ozone emissions to continue to meet the NAAQS for ozone (EPA 2008; TCEQ 2014a).

In the rural regions, outside the San Antonio air basin and Corpus Christi air basin, the predominant contributors to air pollution are area sources including agricultural dust and soil disturbances. In the San Antonio air basin and Corpus Christi air basin, the predominant contributors to air pollution are point sources, including power plants and industrial facilities, and mobile emissions combined (both on-road and off-road) (TCEQ 2014a).

3.1.4 Environmental Consequences

3.1.4.1 Overview

This sections discusses the air quality effects due to the implementation of the Program. Impacts were evaluated for the short-term construction emissions, long-term regional operational emissions, localized impacts of vehicle emissions of CO, PM, and air toxics, and GHG emissions. Determinations of level of impacts are based on the impact criteria presented in Section 3.1.2.2.

In general, alternatives located in a nonattainment or maintenance area would have a greater potential for effects on air quality due to the already degraded state of air quality. Additionally, alternatives that have higher concentrations of air pollutants located near areas of higher population have the potential to expose more people to air pollutions. Each type of service (conventional rail, higher-speed rail, and high-speed rail) has general characteristics that would have similar effects regardless of alternative. Construction effects were evaluated not on the type of service, but based on the potential size and scale of construction. The operational effects by type of service are summarized, and the long-term regional effects are similar for all alternatives evaluated unless otherwise noted.

3.1.4.1.1 Short-Term Construction Effects

The Program would involve construction of the rails and other facilities, such as stations and maintenance yards, that support the operation of the rail system. These construction activities can result in short-term increases in dust and equipment-related emissions in and around the construction site. Exhaust emissions during construction would be generated by fuel combustion in motor vehicles and construction equipment, and particulate emissions would result from soil disturbance, earthwork, and other construction activities. Construction vehicle activity and disruption of normal traffic flow may result in increased motor vehicle emissions within certain areas.

Construction of the build alternatives would have the potential to cause temporary air quality impacts, and the extent of the impact would vary slightly based on alternative. In general, the degree of adverse construction effects is proportional to length of new rail proposed to be constructed, number of grade separations, number and size of new facilities, relationship of the alignment to populated areas, and the duration of construction at each site. The more non-road construction equipment used; the greater the potential for construction effects on air quality. Therefore, the alternatives with shorter alignments, smaller right-of-way footprints, and/or using existing infrastructure and alignments would result in fewer effects on air quality from construction. Construction sites located farther from populated areas would have less potential to cause air toxic effects on sensitive populations. Additionally, within the EIS Study Area, the Dallas and Fort Worth area is classified as a nonattainment area for ozone. Therefore, construction activities in the Dallas and Fort Worth area would have a greater potential effect on air quality than other regions due to the higher ambient background of ozone and ozone precursors.

Regardless of the differences in alternative service types (i.e., higher-speed, high-speed, or conventional), potential air quality impacts from each construction project would be short-term, occurring at a location only while construction work is in progress. Construction activities will comply with applicable federal, state, and local regulations and best management practices will be implemented to minimize emissions.

3.1.4.1.2 Long-Term Regional Operational Effects

Operation of the build alternatives would generally result in a long-term net benefit to air quality by reducing emissions of criteria pollutants, air toxics, and GHG. There are several factors which would contribute to the extent to which the operation of the alternative has a long-term effect on air quality. These include the locomotive power source (diesel versus electric), operation of the stations and other supporting facilities, the forecasted ridership of the rail system, and the subsequent vehicle and airplane emission change due to the shift of travel mode.

Alternatives that use electric-powered trains (high-speed rail) would result in much lower direct effects on air quality due to a decrease in overall fuel consumption compared to alternatives that use diesel locomotives (conventional rail and higher-speed rail). Electric-powered trains would have lower regional emissions, fewer local incidences of increased pollutant concentrations due to train idling, and fewer potential health effects from diesel PM.

While electric-powered trains would result in indirect emissions from power plants, these indirect emissions would be at much lower levels compared to the diesel locomotive emissions. About 50 percent of electric power production for Texas and Oklahoma is from coal, with the remainder of production from the combustion of natural gas and renewable sources, which generate fewer emissions than the combustion of diesel (U.S. Energy Information Administration 2014).

Alternatives with higher ridership would have the potential to shift more passengers from driving to riding the trains, thus decreasing the regional VMT and associated vehicle emissions. In addition, longer route segments would provide access to more locations and would likely have a greater reduction in regional VMT. Since the high-speed rail service type is projected to have greater ridership than higher-speed rail for the same alignment, it would result in a greater reduction of air emissions in the region due to the combined effects of using electric-powered trains and higher ridership. Therefore, compared to higher-speed rail, the high-speed rail service types for the same alignment have a larger reduction in regional air pollutant emissions and a greater net benefit to air quality.

Long-term regional effects of the build alternatives were evaluated based on the total direct and indirect emissions associated with Program operation, as discussed in Sections 3.1.2.1 and 3.1.2.2. Long-term operational emissions from trains, regional VMT changes, airplanes, and power generation are calculated for each Program alternative, except C4B Higher-Speed Rail and C4C Higher-Speed Rail. The traffic demand modelling for C4B Higher-Speed Rail and C4C Higher-Speed Rail was not performed at the same levels as other alternatives, therefore, emissions of these two alternatives were not quantified. Total emissions of each alternative are summarized in Table 3.1-3.

Detailed discussion of long-term regional effects of the No Build Alternative and the build alternatives are discussed in Section 3.1.4.2 and Sections 3.1.4.3 through 3.1.4.5, respectively.

Table 3.1-3. Summary of Operational Regional Air Quality Emissions

Evaluation Years	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2
N4A Conventional: Emissions Tons per year							
2013	256	7,271	2,257	11	66	45	619,797
2035 No Build	20	2,857	256	4	59	15	569,972
2035 Project Alternative	20	2,841	255	4	59	15	566,919
C4A HSR: Emissions Tons per year							
2013	261	7,096	2,312	12	67	45	647,748
2035 No Build	44	4,126	1,051	8	90	29	990,694
2035 Build Alternative	23	3,104	133	5	70	15	880,246
C4A HrSR- Diesel: Emissions Tons per year							
2013	234	7,294	1,578	12	47	25	620,683
2035 No Build	40	4,028	827	7	88	27	938,132
2035 Build Alternative	29	3,543	357	6	79	19	771,182
C4B HSR: Emissions Tons per year							
2013	226	7,014	1,529	12	46	24	597,632
2035 No Build	41	4,042	938	7	88	28	957,194
2035 Build Alternative	22	3,090	132	5	69	15	901,358
C4C HSR: Emissions Tons per year							
2013	225	6,972	1,521	12	46	24	594,172
2035 No Build	44	4,112	1,050	8	89	29	987,791
2035 Build Alternative	23	3,137	134	5	70	15	936,978
S4 HrSR - Diesel: Emissions Tons per year							
2013	485	16,236	2,521	24	75	31	1,226,662
2035 No Build	83	12,945	442	16	261	57	2,408,974
2035 Build Alternative	86	13,049	599	17	262	60	2,449,934
S6 HrSR - Diesel: Emissions Tons per year							
2013	97	3,232	516	5	16	7	246,172
2035 No Build	8	1,307	47	2	27	6	246,083
2035 Build Alternative	9	1,296	102	2	26	6	253,037
S6 HSR: Emissions Tons per year							
2013	97	3,232	516	5	16	7	246,172
2035 No Build	8	1,307	47	2	27	6	246,083
2035 Build Alternative	8	1,230	45	2	25	6	343,919

Evaluation Years	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2
There was no projected change in air traffic or bus travel from 2013 to 2025 due to the build alternatives. The Northern and Central sections have existing rail travel that was assumed to grow similar to alternatives and that is diesel fueled, based on the existing infrastructure. The Southern Section does not have rail except for that associated with the build alternatives. Traffic data provided by Steer Davies Gleave, March 1, 2016, version 2252703 – TOPRS Phase 3. HrSR = higher-speed rail; HSR = high-speed rail							

3.1.4.1.3 Localized Impacts

It is anticipated that the build alternatives would reduce overall traffic congestion in the region by removing passenger vehicles from roadways. Because localized CO and PM emissions tend to occur at locations with a large number of vehicles idling, such as at congested intersections, the program would be beneficial to reduce localized vehicle emissions by relieving traffic congestions.

While the conventional and potentially higher-speed service types could add new at-grade rail crossings that would increase localized vehicle emissions at those isolated locations, other service types, such as high-speed rail, would have grade-separated crossing and, therefore, would not increase localized vehicle emissions at these crossings. Traffic congestions and localized impacts of CO and PM may also occur near large rail stations on routes that passengers use to travel to and from the stations.

Localized air toxic emissions from Program operation would have the potential to expose nearby population to air toxics such as diesel PM. Potential localized air toxic emissions associated Program operation would be mostly from diesel locomotives idling. However, localized air toxic emissions from diesel train travel are expected to be limited due to the low number of diesel locomotives that would idle at particular locations. Localized air toxic effects would be higher in urban or populated areas due to the exposure of sensitive receptors. Alternatives and facilities located mostly in rural areas, such as those in the Southern Section, would likely have lower potential to cause localized air toxic exposure then alternatives in the Central Section, where there are more densely populated areas.

Electric trains idling would not emit air pollutants to increase local concentrations of pollutants near the alignment, nor would they increase the exposure of sensitive populations to toxic pollutants. Therefore, the high-speed rail alternatives would result in fewer local effects on air quality and air toxic exposure than the alternatives that would use diesel trains.

Increased travel speeds associated with the high-speed rail service type would have the potential to generate more fugitive dust compared to operation of the higher-speed rail service type. This would be minimized through the design and materials of the track as well as the grade separation requirement.

As discussed above, the Program would be beneficial in reducing localized effects in some cases and would have adverse effects in other cases. Final conclusions of localized effects would depend on design details and information on affected locations and the corresponding traffic data that are not available as part of this service-level evaluation. Therefore, localized effects of the Program would be evaluated at the project level when specific information becomes available and are not discussed further in this EIS.

3.1.4.1.4 General Conformity

For alignments that are located in the Dallas and Fort Worth area that is designated as nonattainment for ozone, the Program would be subject to conformity requirements. A general conformity determination would be required during project-level analysis if construction and operation emissions would exceed the general conformity *de minimis* levels. Because project-level information is not currently available, analysis related to general conformity will be performed during project-level analysis, and a conclusion is not made in this service-level analysis.

The following sections outline the potential effects of the short-term construction effects and the long-term regional operation effects on air quality of the proposed build alternatives relative to the No Build Alternative.

3.1.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline to evaluate the air quality effects of the build alternatives. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program. Existing air quality, compared to air quality in 2035 without the Program, would be affected by two key factors: regional growth and air quality regulatory actions. Regional growth, such as increased residential development and density, along with additional industry, results in more and greater sources of air emissions. These increases in air emissions are offset by transportation projects which generally reduce traffic congestion, thus minimizing local effects for emission hot spots, as well as vehicle regulatory programs that control the level of emissions from on-road and non-road vehicles.

Due to the Texas Motor Vehicle Fuel Programs, the Texas Emission Reduction Plan, and the Vehicle Inspection and Maintenance Program, it is expected that pollutant burdens for VOC, CO, NO_x, and PM will continue to decrease from the current conditions to 2035 (TCEQ 2014d). The fuel programs such as the Texas Low Emission Diesel Fuel Program initially implemented in 2005 will continue to reduce emissions in the region (TCEQ 2014e). Reduction from the Texas Emission Reduction Plan and the Vehicle Inspection and Maintenance Program will continue due to the phasing of implementation dates (TCEQ 2014d). Additionally, under the No Build Alternative, several roadway and mass transit projects, as discussed in Chapter 2, Alternatives, are designed to alleviate congestion through the entire region. The effect of the federal mobile vehicle emission reduction programs are included in Motor Vehicle Emission Simulator emission factors and reflected in the 2035 alternative emissions. Regional program reductions would further reduce the future emission for all alternatives.

The No Build Alternative would not require construction and operation of any component of the Program.

3.1.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.1.4.3.1 Alternative N4A Conventional Rail

Construction

Alternative N4A would primarily use existing rail infrastructure and would require minimal construction activities to implement. Due to the limited construction emissions associated with these minimal construction activities, short-term effects on air quality would be negligible for Alternative N4A.

Operation

Relative to the No Build Alternative, Alternative N4A would slightly decrease the amount of travel by personal vehicles, which are typically gasoline-fueled. Therefore, Alternative N4A would result in slightly lower regional emissions from personal vehicles compared to the No Build Alternative. Alternative N4A would use Tier 4 or similar diesel locomotive engines. As shown in Table 3.1-3, there would be a negligible reduction (less than 1 percent) in CO, NO_x, and CO_2 pollutants relative to the No Build Alternative. Because regional criteria pollutants and GHG emissions from Alternative N4A would be similar or slightly lower relative to the No Build Alternative, the overall benefit in regional air quality would be negligible

3.1.4.4 Central Section: Dallas and Fort Worth to San Antonio

All Central Section alternatives would result in construction period air quality impacts, but each build alternative would result in long-term VMT reductions and resultant air quality benefits.

3.1.4.4.1 Alternative C4A Higher–Speed Rail

Construction

Construction of Alternative C4A Higher-Speed Rail would be a major infrastructure project and would occur in an area that is currently designated as nonattainment for ozone. It is anticipated that the construction of C4A Higher-Speed Rail would generate substantial short-term regional air quality emissions.

Operation

Operation of the alternative would reduce criteria pollutants and GHG emissions compared to No Build Alternative, as shown in Table 3.1-3. Emissions of criteria pollutants with this alternative would be reduced by 10 to 57 percent compared to No Build Alternative, with NO_x having the greatest reduction, attributed mostly to the reduced travel time of the higher-speed rail service types and their resulting reduced fuel usage.

GHG emissions are generated from the combustion of fossil fuels. As shown in Table 3.1-3, the regional reduction in emissions would be approximately 167,000 tons per year, or 18 percent, for CO_2 compared to the No Build Alternative. Emission reductions of GHG are mainly due to the reduced travel time and resulting reduced fuel usage.

Because the air pollution emissions would be greatly reduced, C4A Higher-Speed Rail would have substantial regional benefits.

3.1.4.4.2 Alternative C4A High-Speed Rail

Construction

Alternative C4A High Speed Rail would result in higher short-term construction emissions compared the higher-speed rail service type because it would require more grade-separated segments, a larger construction footprint, and more mobilization effort due to the high-speed rail track and station design requirements. The scale of construction would likely result in a substantial effect on regional air quality.

Operation

Operation of Alternative C4A High-Speed Rail would have greater regional beneficial impacts on air quality due to the higher ridership (reducing reliance on vehicles) and use of electric trains. As shown in Table 3.1-3, emissions of criteria pollutants would be reduced by 25 to 87 percent compared to No Build Alternative, with NO_x having the highest reduction, attributed mostly to the use electric-powered trains.

The regional reduction in emissions would be approximately 110,000 tons per year, or 11 percent, for CO_2 compared to the No Build Alternative, mostly due to the use of electric-powered trains and the passenger vehicle emission reduction when people switch from driving to riding the trains.

Because the air pollution emissions would be greatly reduced, Alternative C4A High-Speed Rail would have substantial long-term regional benefits.

3.1.4.4.3 Alternative C4B Higher-Speed Rail

Construction

Similar to Alternative C4A Higher-Speed Rail, construction of Alternative C4B Higher-Speed Rail would also represent a major infrastructure project in an area that is currently designated as nonattainment for ozone. However, as the shortest rail alignment with the smallest right-of-way, Alternative C4B Higher-Speed Rail is expected to result in fewer short-term effects on air quality from construction than C4A Higher-Speed Rail would. There is a potential for substantial short-term effects on air quality.

Operation

For this service-level analysis, the travel demand modeling for Alternative C4B Higher-Speed Rail was not conducted to the same level of detail as it was for Alternative C4A Higher-Speed Rail, but instead relied upon a proportional relationship based on full travel demand modeling conducted for the C4A High-Speed Rail and C4A Higher-Speed Rail alternatives. This appropriate level of detail applied for Alternative C4B Higher-Speed Rail is supported by a linear proportional adjustment in ridership and demand, which is based on the relationship between the C4A High-Speed Rail and

C4A Higher-Speed Rail alternatives, thereby producing reasonably accurate estimates for Alternative C4B Higher-Speed Rail.

The higher-speed rail service type would use diesel train during operation. However, the overall emissions of each criteria pollutant and GHG are expected to decrease compared to the No Build Alternative, similar to C4A Higher-Speed Rail but at a reduced level due to the shorter alignment and relatively fewer vehicles being removed from road. The air pollution emissions would be reduced, similar to Alternative C4A Higher-Speed Rail; the corresponding reductions, taking into account the shorter alignment, would have moderate regional benefits.

3.1.4.4.4 Alternative C4B High-Speed Rail

Construction

Alternative C4B High-Speed Rail would have design of rail tracks, facilities, and grade-separated crossings similar to Alternative C4A High-Speed Rail but would have a shorter rail alignment and smaller right-of-way. Air quality effects from construction of Alternative C4B High-Speed Rail would likely be fewer than those associated with Alternative C4A High-Speed Rail. Alternative C4B High-Speed Rail would likely have short-term moderate effects on air quality.

Operation

Alternative C4B High-Speed Rail would have a shorter alignment than Alternative C4A High-Speed Rail and as a result VMT reductions would be smaller. Operation of Alternative C4B High-Speed Rail would result in similar but slightly fewer benefits than Alternative C4A High-Speed Rail, as compared to the No Build Alternative. As shown in Table 3.1-3, emissions of criteria pollutants would be reduced by 22 to 86 percent compared to No Build Alternative, with NO_x having the highest reduction, attributed mostly to the use electric-powered trains. The regional reduction in CO_2 emissions would be approximately 56,000 tons per year, or 18 percent, compared to the No Build Alternative.

Because the air pollution emissions would be greatly reduced, Alternative C4A High-Speed Rail would have substantial long-term regional benefits.

3.1.4.4.5 Alternative C4C Higher-Speed Rail

Construction

Air quality effects from construction of Alternative C4C Higher-Speed Rail would be similar to but greater than those identified for Alternative C4A Higher-Speed Rail due to the longer alignment for the C4C alternative. Alternative C4C Higher-Speed Rail would likely have substantial short-term effects on air quality.

Operation

For this service-level analysis, the travel demand modeling for Alternative C4C Higher-Speed Rail was not conducted to the same level of detail as for C4A Higher-Speed Rail, but instead relied upon a proportional relationship based on full travel demand modeling conducted for the C4A High-Speed Rail and C4A Higher-Speed Rail alternatives. This appropriate level of detail applied for Alternative C4C Higher-Speed Rail is supported by a linear proportional adjustment in ridership and demand, which is based on the relationship between the C4A High-Speed Rail and C4A Higher-Speed Rail alternatives, thereby producing reasonably accurate estimates for Alternative C4C Higher-Speed Rail.

Air quality effects from operation of Alternative C4C Higher-Speed Rail would be similar to those discussed for C4A Higher-Speed Rail. Similar to Alternative C4A Higher-Speed Rail, but with a slightly increased level due to the longer alignment and more vehicles removed from the road, the air pollution emissions would be reduced; the corresponding reductions, taking into account the longer alignment, would have substantial regional benefits.

3.1.4.4.6 Alternative C4C High-Speed Rail

Construction

Construction emissions of Alternative C4C High-Speed Rail would be higher than those related to Alternative C4C Higher-Speed Rail due to the construction of grade-separated crossing. Alternative C4C High-Speed Rail would likely have substantial short-term effects on air quality.

Operation

Operation of the Alternative C4C High-Speed Rail would result in similar but slightly fewer benefits than Alternative C4A High-Speed Rail, as compared to the No Build Alternative. As shown in Table 3.1-3, emissions of criteria pollutants would be reduced by 21 to 87 percent compared to No Build Alternative, with NO_x having the highest reduction, attributed mostly to the use electric-powered trains. The regional reduction in CO_2 emissions would be approximately 51,000 tons per year, or 5 percent, compared to the No Build Alternative.

Because the air pollution emissions would be greatly reduced, Alternative C4C High-Speed Rail would have substantial long-term regional benefits.

3.1.4.5 Southern Section: San Antonio to South Texas

3.1.4.5.1 Alternative S4 Higher-Speed Rail

Construction

Construction of Alternative S4 Higher-Speed Rail would be a major infrastructure project. While the area is in attainment for ozone there is active management of ozone precursors in accordance with the Ozone Flex Plan. Alternative S4 Higher-Speed Rail would be located in a mostly rural area and the station capacity is expected to be less than half that of the stations associated with the Central Section alternatives. However, there is minimal existing rail infrastructure in the Southern Section, as shown in Section 3.20, Transportation, which indicates there would be no existing or future passenger rail service in the area without the Program. Therefore, the major infrastructure construction required for this alternative would result in a substantial short-term effect on air quality.

Operation

The regional emissions associated with Alternative S4 Higher-Speed Rail, compared to the No Build Alternative, are included in Table 3.1.3. Alternative S4 Higher-Speed Rail is expected to have an increase in criteria pollutants and GHG emissions compared to the No Build Alternative. This is because, although there would be a reduction in personnel VMT, the traffic modeling evaluation projected no change in bus or air miles traveled, and there is no future rail travel included in the No Build Alternative. Therefore, while Alternative S4 Higher-Speed Rail would provide additional modes of transport in the region, the use of diesel-powered trains would increase emissions compared to the No Build Alternative for all pollutants evaluated. For NO_x and CO, the increase is estimated to be approximately 157 and 104 tons per year, respectively. The CO_2 emissions increase would be approximately 41,000 tons per year, or 2 percent, compared to the No Build Alternative. The increase in other pollutants would be negligible.

Because the emission increases associated with Alternative S4 Higher-Speed Rail would be greater than 100 tons per year for CO and NO_x, it would have substantial regional adverse effects during operation.

3.1.4.5.2 Alternative S6 Higher-Speed Rail

Construction

The alignment length of Alternative S6 Higher-Speed Rail is approximately one third the length of the S4 Higher-Speed Rail and S6 High-Speed Rail alternative alignments. Therefore, Alternative S6 Higher-Speed Rail would have lower construction emissions than S4 Higher-Speed Rail and S6 High-Speed Rail. Construction of Alternative S6 Higher-Speed Rail would likely result in moderate effects on air quality.

Operation

While Alternative S4 Higher-Speed Rail has a much longer alignment than S6 Higher-Speed Rail and is projected to have a lower level of ridership than Alternative S6 Higher-Speed Rail, there would be a proportionally greater reduction in regional VMT with Alternative S6 Higher-Speed Rail compared to S4 Higher-Speed Rail. As shown in Table 3.1-3, Alternative S6 Higher-Speed Rail would have a negligible reduction in emissions of PM and CO compared to the No Build Alternative. NO_x would increase by approximately 55 tons per year, and GHG would increase by 7,000 tons per year. Increases of NO_x and GHG emissions are mostly due to the use of diesel-powered trains for Alternative S6 Higher-Speed Rail and the extremely low baseline emissions of the No Build Alternative. Because the alternative would cause criteria pollution emissions less than 100 tons per year, it would have moderate adverse effect on air quality during operation.

3.1.4.5.3 Alternative S6 High-Speed Rail

Construction

Construction of Alternative S6 High-Speed Rail would have potential for higher short-term air quality effects than Alternative S6 Higher-Speed Rail due to the increased construction footprint and elevated structures required. Construction of Alternative S6 High-Speed Rail would likely result in short-term substantial effects on air quality.

Operation

Operation of the Alternative S6 High-Speed Rail would have greater beneficial effects than Alternative S6 Higher-Speed Rail due to the use of electric-powered trains. Although the high-speed rail service type would result in increases in emissions from power production, the associated indirect increase in emissions from power generation would be lower than emissions associated with diesel locomotives in Alternative S6 Higher-Speed Rail. These criteria and GHG emissions would not be local and would be distributed throughout the state's existing power supply sources, which are required to operate within their permit limits. The permits are issued on the basis that operation of the power plants will not result in an exceedance of an ambient air quality standard.

The reduction in regional emissions associated with Alternative S6 High-Speed Rail would be negligible to moderate, or less than 7 percent, compared to No Build Alternative, for the pollutants evaluated except for CO_2. There would be an increase in CO_2 emissions due to the indirection emissions from power generation. Although there is projected to be an increase in GHG emissions for this alternative, it is primarily due to the addition of a transportation mode that did not previously exist in the region. Alternative S6 High-Speed Rail would be consistent with long-term federal and state goals to reduce the reliance on fossil fuels for new transportation alternatives because it would use electricity rather than direct combustion of diesel.

Due to the minimal emission reduction of criteria pollutant, Alternative S6 High-Speed Rail would have negligible long-term regional benefits.

3.1.4.6 Summary of Potential Effects

Table 3.1-4 presents the short- and long-term regional effects on air quality from the construction and operation of the build alternatives. As discussed in Section 3.1.2.3, general conformity applicability analysis would be performed during project-level analysis when project construction and operational information are available to quantify the emissions. A conformity demonstration will be performed if the project's emissions exceed general conformity *de minimis* levels. Localized impacts of CO, PM, and air toxics during operation would be performed during project-level analysis when project-specific information is available and would be only for alternative operations that are determined to have the potential to increase localized emissions substantially.

Table 3.1-4. Potential Effects on Air Quality

Alternative	Short-Term Effects	Long-Term Regional Effects
Northern Section		
N4A	Negligible (adverse)	Negligible (benefit)
Central Section		
C4A HrSR	Substantial (adverse)	Substantial (benefit)
C4A HSR	Substantial (adverse)	Substantial (benefit)
C4B HrSR	Substantial (adverse)	Moderate (benefit)
C4B HSR	Moderate (adverse)	Substantial (benefit)
C4C HrSR	Substantial (adverse)	Substantial (benefit)
C4C HSR	Substantial (adverse)	Substantial (benefit)
Southern Section		
S4 HrSR	Substantial (adverse)	Substantial (adverse)
S6 HrSR	Moderate (adverse)	Moderate (adverse)
S6 HSR	Substantial (adverse)	Negligible (benefit)

3.1.5 Avoidance, Minimization, and Mitigation Strategies

3.1.5.1 Construction Phase

Temporary, short-term emissions increases associated with construction activities, and potential localized air pollution increases associated with traffic near proposed stations would be substantially reduced by the application of mitigation strategies and design practices. Potential emission reduction measures include but are not limited to:

- Use of low-emissions vehicles during construction, and use of newer and well-maintained equipment.
- Effects from concrete and asphalt batch plants would be limited by placing these facilities farther from sensitive populations, such as schools, hospitals, and residences, to the extent possible.
- Potential fugitive dust effects would be mitigated through best management practices such as water sprays during demolition; wetting, paving, or landscaping exposed earth areas; covering dust-producing materials during transport; limiting dust-producing construction activities during high wind conditions; and providing street sweeping and tire washes for trucks leaving the site.
- Traffic congestion emissions can be reduced using site-specific traffic management plans; temporary signage and other traffic controls; designated staging areas, worker parking lots (with shuttle bus service if necessary), and truck routes; and prohibition of construction vehicle travel during peak traffic periods.

Localized air pollutant increases associated with traffic near construction sites would be addressed by mitigation strategies discussed in Section 3.20, Transportation, as well as by implementing enhanced accessibility and signal design practices.

3.1.5.2 Operation Phase

Avoidance and minimization of effects at the project-level would be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies would be implemented. Strategies for managing emissions from diesel trains could addressed by using Tier 4 locomotive engines and implementing additional measures to reduce diesel locomotive idling times. Locating the tracks, stations, and other supporting facilities away from populated areas and sensitive receptors would minimize and reduce the potential exposure to air toxics from diesel combustion.

3.1.6 Subsequent Analysis

3.1.6.1 Construction and Operation Emissions

A detailed quantification of construction emissions based on the proposed segment and station construction will be conducted during project-level analysis. Project operation analysis will include emissions from operating the trains and stations of the alternatives and will include regional changes in emissions due to mode change. Based on the refined segment options, a detailed evaluation of the potential changes in VMT for all modes affected, including personal vehicles, airplanes, buses, and conventional train, will be included in subsequent analysis. The evaluation will also include the quantification of both direct and indirect air emissions during operation.

3.1.6.2 Localized Impacts

Localized impacts of CO, PM, and air toxics during operation will be performed during project-level analysis when project-specific information is available and will only be for alternative operations that are determined to have potential to increase localized emissions substantially. If a quantitative modeling analysis is triggered, air dispersion modeling of CO or PM will be conducted for locations that would have the potential to cause an exceedance of NAAQS, even with mitigation.

3.1.6.3 General Conformity

For alternatives located in the Dallas and Fort Worth area that is designated as nonattainment or maintenance for ozone, construction and operation emission evaluations will be performed and compared to the general conformity *de minimis* levels to demonstrate compliance with general conformity requirements. A general conformity evaluation is not required for projects located in attainment areas.

3.1.6.4 Greenhouse Gases and Climate Change

GHG emissions and the associated climate change impacts due to project emissions will be analyzed for the alternatives. GHG emissions from project operation in the study area will be quantified. In addition, a qualitative discussion of project adaptation to the effects of climate change will be included in the project-level analysis.

3.2 Water Quality

This section describes water resources within the environmental impact statement (EIS) Study Area and assesses potential effects on these resources by the build alternatives. The analysis of water resources includes surface waters (waters deemed impaired under Section 303[d] of the Clean Water Act [CWA], and rivers designated under the Wild and Scenic Rivers Act), erosion, and groundwater (hydrologic unit sub-basins). The introduction to Chapter 3 describes the EIS Study Area and use of terms, such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.2.1 Laws, Regulations, and Orders

Applicable federal, state, and local legislation, regulations, and orders pertaining to water quality within the EIS Study Area are listed and described below. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.2.1.1 Federal

- **CWA.** Restores and maintains the chemical, physical, and biological integrity of the nation's waters through prevention and elimination of pollution. It is applicable to any discharge of a pollutant into waters of the U.S. Key sections of the CWA include the following:
  - <u>Section 401 (33 United States Code [U.S.C.] § 1341 and 40 Code of Federal Regulations [CFR] 121).</u> Section 401 of the CWA requires a water quality certification from the State Water Resources Control Board or Regional Water Quality Control Boards when a project involves the placement of dredged or fill material into waters of the U.S.
  - <u>Section 402 (33 U.S.C. § 1342 and 40 CFR 122)</u>. Establishes a permitting system for the discharge of any pollutant (except dredge or fill material) into waters of the U.S. A National Pollutant Discharge Elimination System (NPDES) permit is required for point discharges of pollutants to surface waters. A point source is a discernible, confined, and discrete conveyance, such as a pipe, ditch, or channel.
  - <u>Section 404 (33 U.S.C. § 1344, 33 CFR 323, and 40 CFR 230).</u> Establishes a permit program administered by the U.S. Army Corps of Engineers, which regulates the discharge of dredged or fill material into waters of the U.S. (including wetlands). Section 404(b)(1) guidelines allow the discharge of dredged or fill material into the aquatic system only if there is no practicable alternative that would have less adverse impacts.
- **Wild and Scenic Rivers Act (WSRA) of 1968, as Amended (16 U.S.C. § 1271–1287).** Preserves and protects wild and scenic rivers and immediate environments for the benefit of present and future generations. The WSRA is applicable to all projects that affect designated wild, scenic, and recreational rivers and their immediate environments and rivers under study for inclusion in the National Wild and Scenic Rivers (NWSR) System. The WSRA prohibits federal agencies from undertaking activities that would adversely affect the values for which the river was designated. The WSRA is administered by a variety of state and federal agencies. Designated river segments flowing through federally managed lands are administered by the land-managing agency (e.g.,

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U.S. Forest Service, Bureau of Land Management, or the National Park Service). River segments flowing through private lands are administered by the state in conjunction with local government agencies. On projects that affect designated rivers or their immediate environments (Designated Waters), consultation will occur through the National Environmental Policy Act (NEPA) process between the state lead agency and the land-managing agencies.

The following three categories of rivers are protected by the WSRA:

1. Designated Rivers – Rivers designated as an NWSR, and their tributaries, are protected under Section 7(a) of the WSRA.
2. Study Rivers – Potential additions to the NWSR System are protected under Section 7(a) of the WSRA.
3. National Rivers Inventory – Rivers believed to possess one or more "outstandingly remarkable" natural or cultural values with more than local or regional significance are protected under Section 5 (d) of the WSRA.

Entire rivers or river segments may be protected. An environmental review of potential impacts on protected rivers is initiated when projects occur within 1 mile of an NWSR, within 20 miles upstream of an NWSR, within 10 miles downstream of an NWSR, or are located on a tributary in close proximity to an NWSR. Projects within these thresholds are required to consult with the federal agency having jurisdiction over the NWSR.

- **Safe Drinking Water Act of 1974, as Amended (42 U.S.C. § 300[f]).** Protects public health and welfare through safe drinking water. The Safe Drinking Water Act is applicable to public drinking water systems and reservoirs (including rest area facilities). It is also applicable to actions that may have a significant impact on an aquifer or wellhead protection area that is the sole or principal drinking water source. The Safe Drinking Water Act requires coordination with the U.S. Environmental Protection Agency when an area designated as a principal or Sole Source Aquifer may be affected by a proposed project.
- **Flood Disaster Protection Act (42 U.S.C. § 4001–4128; U.S. Department of Transportation Order 5650.2).** Identifies flood-prone areas and provides insurance. The Flood Disaster Protection Act requires purchase of insurance for buildings in special flood-hazard areas. The Flood Disaster Protection Act is applicable to any federally assisted acquisition or construction project in an area identified as having special flood hazards. Projects should avoid construction in, or develop a design consistent with, Federal Emergency Management Agency flood hazard areas.

3.2.1.2 State

- **1955 Oklahoma Water Pollution Control Act.** The 1955 Oklahoma Water Pollution Control Act declared that it is the public policy of the state "to conserve the waters of the state and to protect, maintain and improve the quality thereof for public water supplies, for the propagation of wildlife, fish and aquatic life and for domestic, agricultural, industrial, recreational and other legitimate beneficial uses." The Oklahoma Water Pollution Control Act made it unlawful to pollute state waters. It was further forbidden for any person to carry out certain activities that cause the discharge of waste into waters, or could lead to a related reduction in water quality without first securing a permit from the Oklahoma Water Resources Board.

Subsequent changes in roles and responsibilities regarding administration of the 1955 Oklahoma Water Pollution Act have transferred various water quality and related programs and functions of several agencies to the Oklahoma Department of Environmental Quality. As a result, one permit issued under NPDES would apply to federal and state regulations.

- **Texas Commission on Environmental Quality (TCEQ), Civil Law from Title 28 of Third Partida; Water Code §11.096: Obstruction of Navigable Streams**. No person may obstruct the navigation of any stream that can be navigated by steamboats, keelboats, or flatboats by cutting and felling trees or by building on or across the stream a dike, milldam, bridge, or other obstruction. Under Section 11.096, TCEQ shall be notified prior to projects that construct bridges, dams, or places obstructions in streams that are determined to be navigable in fact.

  Trice v. State, 712 S.W.2d 842 (Tex.App. Waco 1986, writ ref'd n.r.e.) addressed who is allowed to bridge Texas streams under the laws then in effect. The court noted (at p. 847): "The State, through legislative action, has also authorized certain entities to erect bridges over the navigable waters within its boundaries (citing statutes pertaining to counties, municipalities, railroads, and toll road corporations). However, except for tidal waters, the State has not authorized an individual to construct a bridge over its navigable waters. Furthermore, the State has not created an agency or designated any public official to regulate bridge construction over its navigable waters. Under a change in the law in 1993, the Commissioner of the General Land Office was granted limited permitting power to allow private road crossings over public streams. See Natural Resources Code §51.291 (quoted in section on OBSTRUCTIONS)" (Texas Parks and Wildlife Department 2004).

- **TCEQ: Edwards Aquifer Protection Program.** Before building on the recharge, transition, or contributing zones of the Edwards Aquifer, an Edwards Aquifer Protection Plan must be reviewed and approved by the TCEQ Edwards Aquifer Protection Program. Once a plan is approved, the site is monitored for compliance throughout construction and operation. The Edward Aquifer Protection Plan should outline the best management practices (BMPs) that will be implemented and maintained — both during and after construction activities — to prevent contaminants found in stormwater from reaching the Edwards Aquifer.

- All projects must be consistent with the state Nonpoint Source Pollution Management Program (Section 319).

3.2.1.3 Local

- **County Agencies.** The current alternatives cross up to 7 county jurisdictions within Oklahoma and 29 county jurisdictions in Texas. Potential exists for each county to regulate construction activities within the county as it pertains to water quality or water conservation. Divisions of county public works departments or county districts that focus on land development, protection of natural resources, flood control, water conservation, or construction stormwater could require permits. These may include floodplain protection, grading, waterway crossing, construction stormwater, building, or encroachment permits. County permit requirements and regulations would need to be investigated, meetings held with each county, and a permitting strategy developed for each county that would address conditions and permits consistent with county programs.

- **Individual Cities.** Under the CWA (and regulations promulgated pursuant to the CWA), communities with a population greater than 100,000 are required to apply for a municipal permit under the NPDES program. In some cases, individual cities join with counties, water districts, and flood control districts to apply for joint permits. Cities that are joint permittees with counties are required to implement programs to verify that city-permitted projects adhere to conditions of NPDES permits; this may include programs to confirm that BMPs and other stormwater quality protection measures are incorporated into grading and building permits, and that regulatory and site inspection programs are developed. Individual water quality protection measures, including BMPs, are developed at the county level, making the counties and cities jointly responsible for confirming compliance.

3.2.2 Methodology

The methodology employed for the water quality and hydrology effect evaluation consisted of a combination of qualitative and quantitative assessments. A qualitative assessment was used for general comparisons of the alternatives when discussing issues, such as sedimentation and groundwater resources, which required a more detailed approach than warranted for this EIS. The qualitative general conclusions support the relative change in effects among the alternatives. The effects assessment and conclusions are focused on surface water, runoff, erosion, and groundwater and are detailed in Section 3.2.4, Environmental Consequences. Effects related to runoff were strictly qualitative while those for groundwater included a combination of both qualitative and quantitative assessments. Effects related to surface water and erosion were quantitative. All quantitative assessments were based on the number of features (e.g., 303[d] waters and erosive soils) potentially crossed and the size of the features. The quantitative conclusions were determined based on a comparison of the magnitude of potential effects. The No Build Alternative is the primary basis of comparison.

The effects as a result of the route alternatives are characterized as negligible, moderate, or substantial compared to the No Build Alternative. A threshold or value for which an effect is determined to be negligible, moderate, or substantial is not feasible or appropriate for this service-level analysis. A threshold would not provide an accurate means of comparison as the alternatives have varying lengths both between and within the geographical sections (Northern, Central, and Southern). Additionally, alternatives within any given geographical section cannot be compared with those in other sections as the Program will require that alternatives be selected from each of the three sections. Effects determinations considered the service-type and route construction requirements (e.g., use of existing tracks), as well as minimization, avoidance, and mitigation strategies. These terms are defined as follows:

- Negligible intensity effects from construction and operation of an alternative are those that would have a slight change in water quality and surface water and groundwater hydrology, but are very close to the existing conditions.
- Moderate intensity effects from construction and operation of an alternative are those with a noticeable change in water quality and surface water and groundwater hydrology, but would not have an adverse residual effect on water resources, such as streams, rivers, lakes, and reservoirs.
- Substantial intensity effects from construction and operation of an alternative are those that would have a noticeable change in water quality and surface water and groundwater hydrology, and would be highly likely to have an adverse residual effect on water resources, such as streams, rivers, lakes, and reservoirs.

Additional potential impacts on hydrology and water quality could include increased or decreased runoff and stormwater discharge caused by changes in the area of paved surfaces, increased or decreased contribution of automotive-based nonpoint source contamination, and impacts on areas of groundwater discharge or infiltration.

For the quantitative assessment, readily available information, such as stream locations, effects on areas with existing water quality problems and soil information, is used to assess the magnitude of potential effect. Water resources within the vicinity of the EIS Study Area are also discussed to provide context for the effect evaluations. To evaluate the quantitative effects on water quality caused by the alternatives, the following activities were conducted:

- The acreage of lakes and the linear feet of rivers and streams within the EIS Study Area were determined. For the purpose of this analysis, surface waters are defined as lakes, rivers, and streams identified using U.S. Geological Survey (USGS) 1:24,000 scale Digital Line Graphs. Surface water linear feet were calculated as the flow-path length of rivers and streams within the EIS Study Area. Lake surface areas represent the impoundment at maximum capacity.
- The locations of surface waters designated by the Wild and Scenic Rivers Act (Public Law 90-542; 16 U.S.C. § 1271 et seq.), which includes specific designated river segments (Designated Rivers), Study Rivers, and National Rivers Inventory segments within the EIS Study Area, were determined.
- The locations of impaired waters, which are defined as waters on the CWA Section 303(d) list (USGS 2014), within the EIS Study Area were determined.
- The locations of potential erodible conditions were identified as those areas with a combination of erodible soils and high slopes, evaluated as the product of *kfact* (an erodibility factor that is adjusted for the effect of rock fragments) and *slopeh* (the maximum value for the range of slope of a soil component within a map unit). The Soil Survey Geographic (SSURGO) database includes an Erosion Hazard of Forest Roads and Trails – Dominant Component category that is calculated using erodibility factor (kfact), slope (slopeh), and content of rock fragments for each individual soil map unit (Natural Resources Conservation Service 2014). For the purpose of this

analysis, susceptibility of soils to erosion is evaluated based the Erosion Hazard of Forest Roads and Trails – Dominant Component index.

3.2.3 Affected Environment

3.2.3.1 Overview

The EIS Study Area alternatives are spread across a broad geographic area characterized as generally low-elevation basins and valleys associated with the rolling terrain in the Great Plains and the Coastal Plains in the most southern extent of the alternatives. These areas are either developed or vegetated, with open grasslands, agricultural land, shrub land, or forests. The climate is characterized as generally semi-arid to humid subtropical to modified subtropical conditions with mild winters and hot summers. Precipitation regimes include periods of hot summer drought and winter rain. Winter rain occurs as a result of low-pressure depressions that are associated with Pacific and Arctic fronts (University of Oklahoma 2014; Texas Climate Data 2014). Annual average precipitation decreases southward along the EIS Study Area and ranges from 48 inches near Oklahoma City, Oklahoma, to 20 inches in Laredo, Texas (U.S. Climate Data 2014).

3.2.3.2 Northern Section: Oklahoma City to Dallas and Fort Worth

3.2.3.2.1 Surface Waters

Surface waters and associated channels are sensitive resource areas that provide the following functions:

- Convey floodwaters that may enhance adjacent flooding or may attenuate downstream flooding risks by storing floodwater
- Provide important native species habitat and support wetland and riparian habitats
- Provide direct pathways of nutrients and contamination to downstream ecological or human resources
- Provide locations for groundwater recharge and discharge

For the purpose of this document, surface waters including lakes, rivers, and streams are identified by using USGS 1:24,000 scale Digital Line Graphs. Blue-line streams and bodies of water on the Digital Line Graphs are generally under jurisdiction of the U.S. Army Corps of Engineers. Most surface waters within the Northern Section EIS Study Area are associated with significant drainage channels and riparian areas. These include improved flood control drainage channels, intermittent river and stream channels, perennial river and stream channels, ponds, lakes, and reservoirs. Table 3.2-1 identifies surface water classifications crossed within the Northern Section EIS Study Area. Figure 3.2-1 shows surface waters within the vicinity of the Northern Section EIS Study Area.

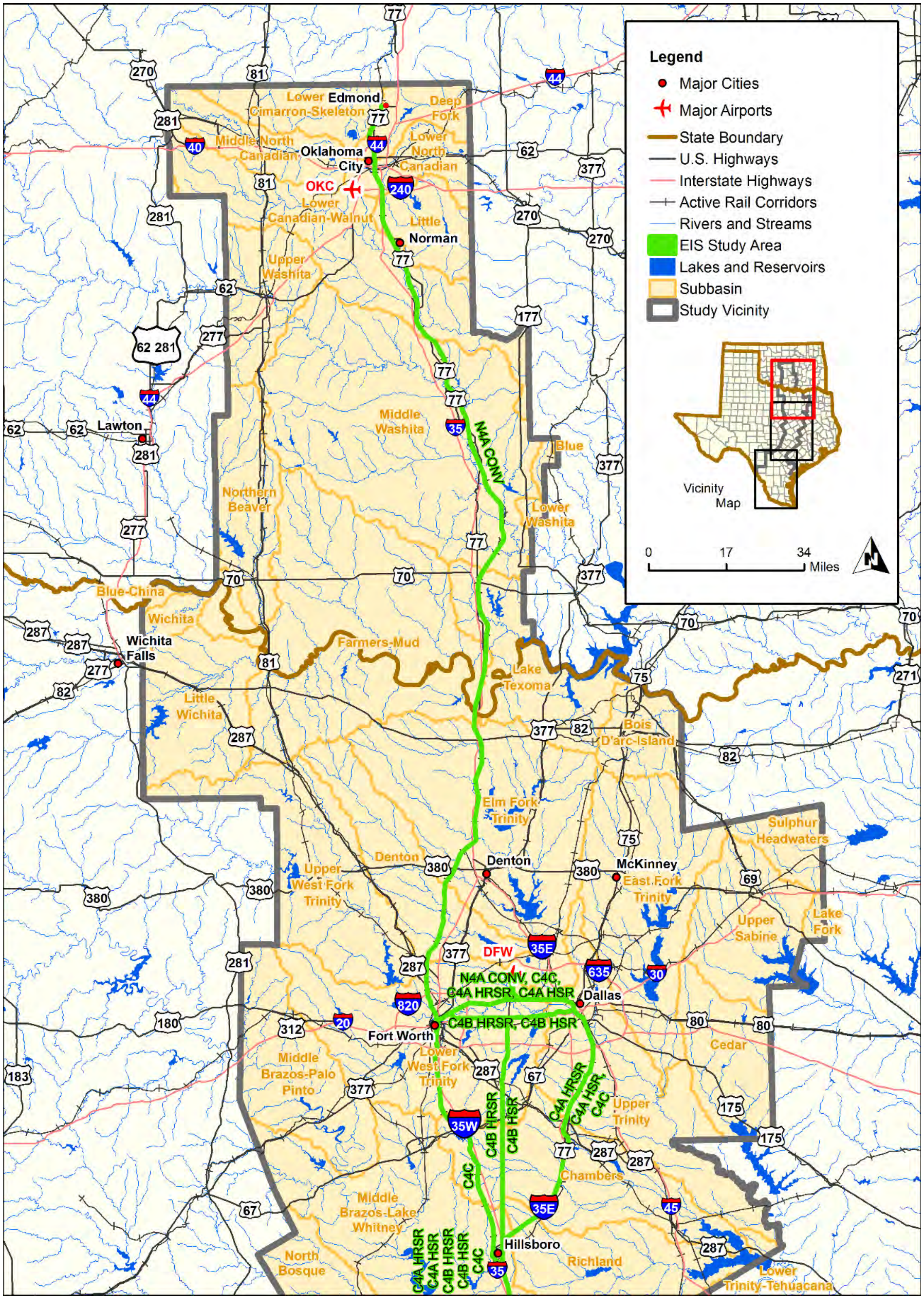

Figure 3.2-1: Surface Waters and Hydrologic Unit Sub-basins within the Vicinity of the Northern Section EIS Study Area

Table 3.2-1: Surface Waters Crossed within the Northern Section EIS Study Area

Water Body Classification	Number Crossed
Alternative N4A CONV[a]	
Perennial Stream	43
Intermittent Stream	300
Open Water – Lake/Pond	163
Open Water – Reservoir	31
Approximate Total	**537**

[a] CONV = conventional rail
Source: USGS (2014).

Hydrologic Units

The Northern Section EIS Study Area crosses Oklahoma and Texas and includes 13 hydrologic unit sub-basins. Each unit generally consists of individual watersheds or subwatersheds and in some cases contains more than one watershed. Table 3.2-2 identifies the hydrologic unit sub-basins by state crossed within the Northern Section EIS Study Area. Figure 3.2-1 shows the boundaries of the hydrologic unit sub-basins within the vicinity of the Northern Section EIS Study Area.

Table 3.2-2: Hydrologic Unit Sub-basins Crossed within the Northern Section EIS Study Area

Hydrologic Unit	State	Hydrologic Unit	State
Deep Fork	Oklahoma	Lake Texoma	Oklahoma and Texas
Farmers-Mud	Oklahoma	Denton	Texas
Little	Oklahoma	Elm Fork Trinity	Texas
Lower Canadian-Walnut	Oklahoma	Little	Texas
Lower Cimarron-Skeleton	Oklahoma	Lower West Fork Trinity	Texas
Lower North Canadian	Oklahoma	Upper Trinity	Texas
Middle Washita	Oklahoma		

Source: USGS (2014).

Designated Waters

The majority of the Northern Section EIS Study Area is within Oklahoma. No surface waters designated as National Wild and Scenic Rivers or Study Rivers within the National Wild and Scenic Rivers System occur within Oklahoma. However, eight rivers and river segments included in the National Rivers Inventory occur within Oklahoma. The only National Rivers Inventory river or river segment within the Northern Section EIS Study Area is a 20-mile segment of the Washita River, in Carter and Murray counties (National Park Service 2014). This segment of the Washita River is listed in the National Rivers Inventory for the outstanding, remarkable values it possesses, including scenery, recreation, geology, fish populations, and fish and wildlife habitat. This segment of the river is within the migration route of the federal endangered whooping crane and contains important fish and wildlife habitat. It has been identified as a potential State Scenic River passing through the Arbuckle Mountains, with numerous observable geologic processes. Recreational activities on the river include floating, camping, and fishing (National Park Service 2014). No National Rivers Inventory river segments are located within the Texas portion of the Northern Study Area.

Listed Section 303(d) Impaired Waters

Section 303(d) of the CWA (33 U.S.C. § 1250, et seq., at 1313[d]) requires states to identify waters that do not meet water quality standards after applying certain required technology-based effluent limits ("impaired" bodies of water). States are required to compile this information in a list and submit the list to the U.S. Environmental Protection Agency for review and approval. This list is known as the Section 303(d) list of impaired waters. As part of this listing process, states are required to prioritize waters and watersheds for future development of total maximum daily loads. The Oklahoma Department of Environmental Quality and TCEQ have the responsibility to monitor and assess water quality, to prepare the Section 303(d) list, and subsequently to develop total maximum daily loads in Oklahoma and Texas, respectively. The most recent Section 303(d) list for Oklahoma was approved in 2013 and contains 4,203 bodies of water, many listed as being impaired for multiple pollutants. The most recent Section 303(d) list for Texas was approved in 2013 and contains 1,214 bodies of water under evaluation; of those, 568 were impaired. The 303(d) list can identify areas where there already is a significant degradation of water quality, providing an indication of where additional contaminants resulting from the Program and alternatives potentially would have the most effect.

Table 3.2-3 identifies the total number of perennial and intermittent streams and the Section 303(d) waters crossed within the Northern Section EIS Study Area. Figure 3.2-2 shows 303(d) waters crossed within the Northern Section EIS Study Area, based on a review of the Texas and Oklahoma 303(d) lists.

Table 3.2-3: Surface Waters Classified as Impaired Crossed within the Northern Section EIS Study Area

Water Body Classification	Number Crossed
Alternative N4A	
Total Perennial and Intermittent Streams	343
Impaired Streams	14
Percent of Impaired Streams	***4.0%***
Source: USGS (2014).	

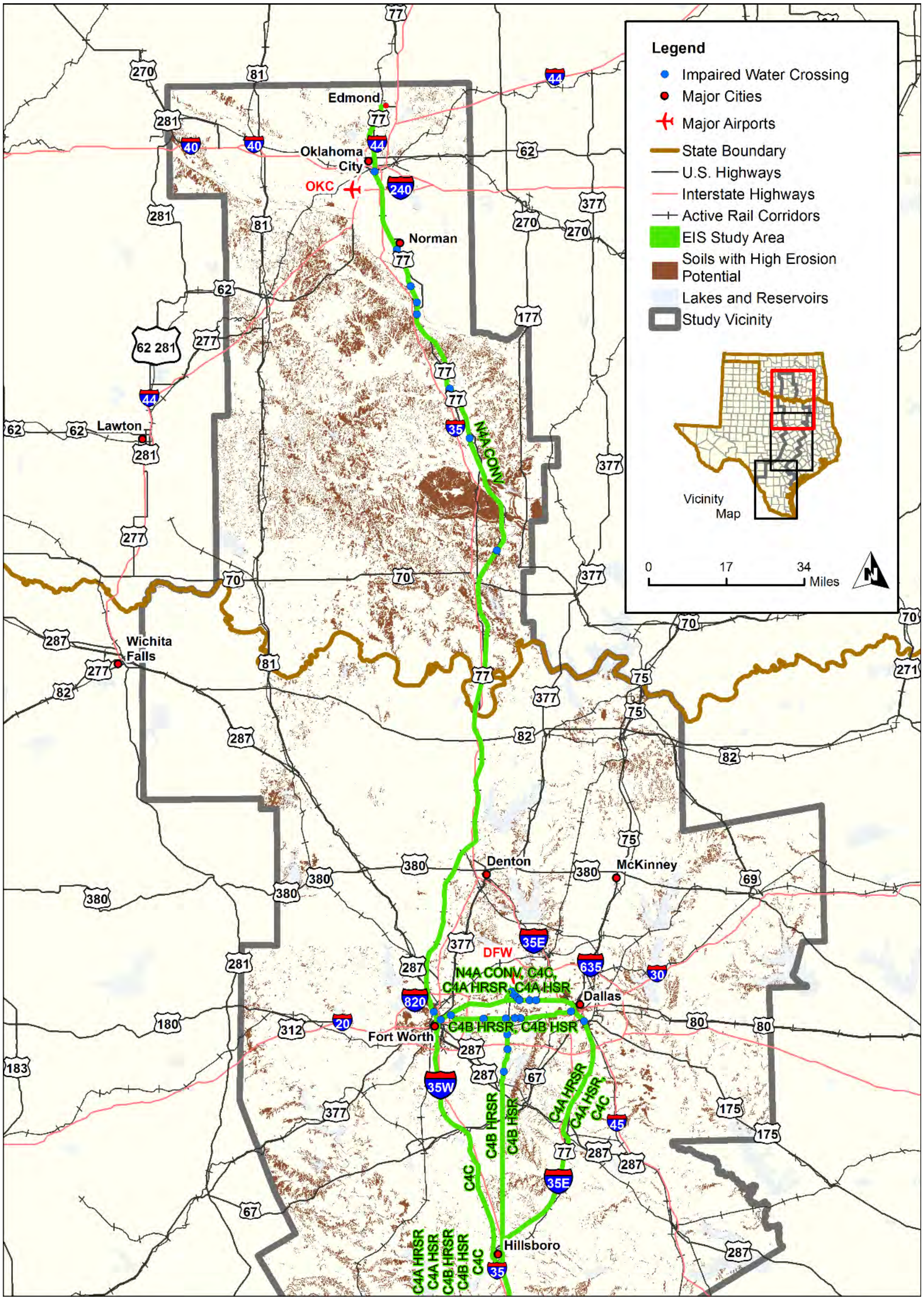

Figure 3.2-2: Impaired Water Crossings and Soils with High Erosion Potential within the Vicinity of the Northern Section EIS Study Area

3.2.3.2.2 Erosion

Table 3.2-4 summarizes SSURGO soil types crossed within the Northern Section EIS Study Area. Figure 3.2-2 shows areas within the vicinity of the Northern Section EIS Study Area with severe and very severe soil erosion potential.

Table 3.2-4: Erodible Soils Crossed within the Northern Section EIS Study Area

Erosion Hazard Classification	Number Crossed
Alternative N4A	
Not Rated	31
Slight	651
Moderate	420
Severe	77
Very Severe	20
Approximate Total	**1,199**
Source: SSURGO (2014).	

3.2.3.2.3 Groundwater

Groundwater is a significant resource for fresh water throughout the EIS Study Area in Texas and Oklahoma; it is a major source of potable and irrigation water in the region. Eleven major and six minor groundwater aquifers occur within the EIS Study Area. Aquifers in Oklahoma contain an estimated 320 million acre-feet of fresh water, of which about half is considered recoverable for use. The aquifers supply more than 60 percent of the water used in the state, particularly where less surface water is available. Six aquifers in Oklahoma are in bedrock and six are in Quaternary-age alluvium and terrace deposits. Bedrock aquifers typically consist of sandstone, sand, limestone, dolomite, gypsum, or fractured novaculite and chert (Section 3.12, Geology). The aquifers range in thickness from 100 feet to several thousand feet. The depth to fresh water typically ranges from several feet to more than 1,000 feet. Alluvium and terrace aquifers typically consist of unconsolidated sand, silt, clay, and gravel deposited by rivers and streams. The thickness of these aquifers ranges from 10 to 100 feet (Oklahoma Historical Society 2014). Major aquifers in the Northern Section include Garber-Wellington, Canadian River, Washita River, Antlers, Red River, Arbuckle-Simpson, North Canadian River, and Trinity aquifers. The entire area of the Arbuckle-Simpson aquifer is considered a recharge area. These aquifers include alluvial terrace (unconfined) and bedrock types (confined). Minor aquifers crossed include the Pennsylvanian and Woodbine aquifers (both confined and unconfined) (University of Texas 2004).

Aquifers crossed within the Northern Section EIS Study Area are listed in Table 3.2-5. Major and minor aquifers within the vicinity of the EIS Study Area are shown on Figures 3.2-3 and 3.2-4, respectively. The only aquifer system within the Northern Section designated as a Sole Source

Aquifer by the U.S. Environmental Protection Agency is the eastern portion of the Arbuckle-Simpson Aquifer.

The Arbuckle-Simpson aquifer underlies approximately 500 square miles in southern Oklahoma and is the principle water source for 39,000 people within the region. The aquifer is a source for several rivers including the Blue River and Delaware Creek, which are tributaries of the Washita River, and nearly 100 springs including Byrds Mill Spring, which is the primary drinking water source for the city of Ada (Oklahoma Historical Society 2014). The entire aerial extent of the aquifer is considered a recharge area (Oklahoma Geologic Society 1983).

Table 3.2-5: Aquifers Crossed within the Northern Section EIS Study Area

Aquifer Name	Type
Oklahoma – Major Aquifers	
Garber-Wellington	Confined
Canadian River	Unconfined
Washita River	Unconfined
Antlers	Confined
Red River	Unconfined
Arbuckle-Simpson[a]	Confined
North Canadian River	Unconfined
Texas – Major Aquifers	
Trinity	Confined
Oklahoma – Minor Aquifers	
Pennsylvanian	Unconfined
Texas – Minor Aquifers	
Woodbine	Confined, unconfined
[a] Designated Sole Source Aquifer	
Source: Texas Water Development Board (2014a).	

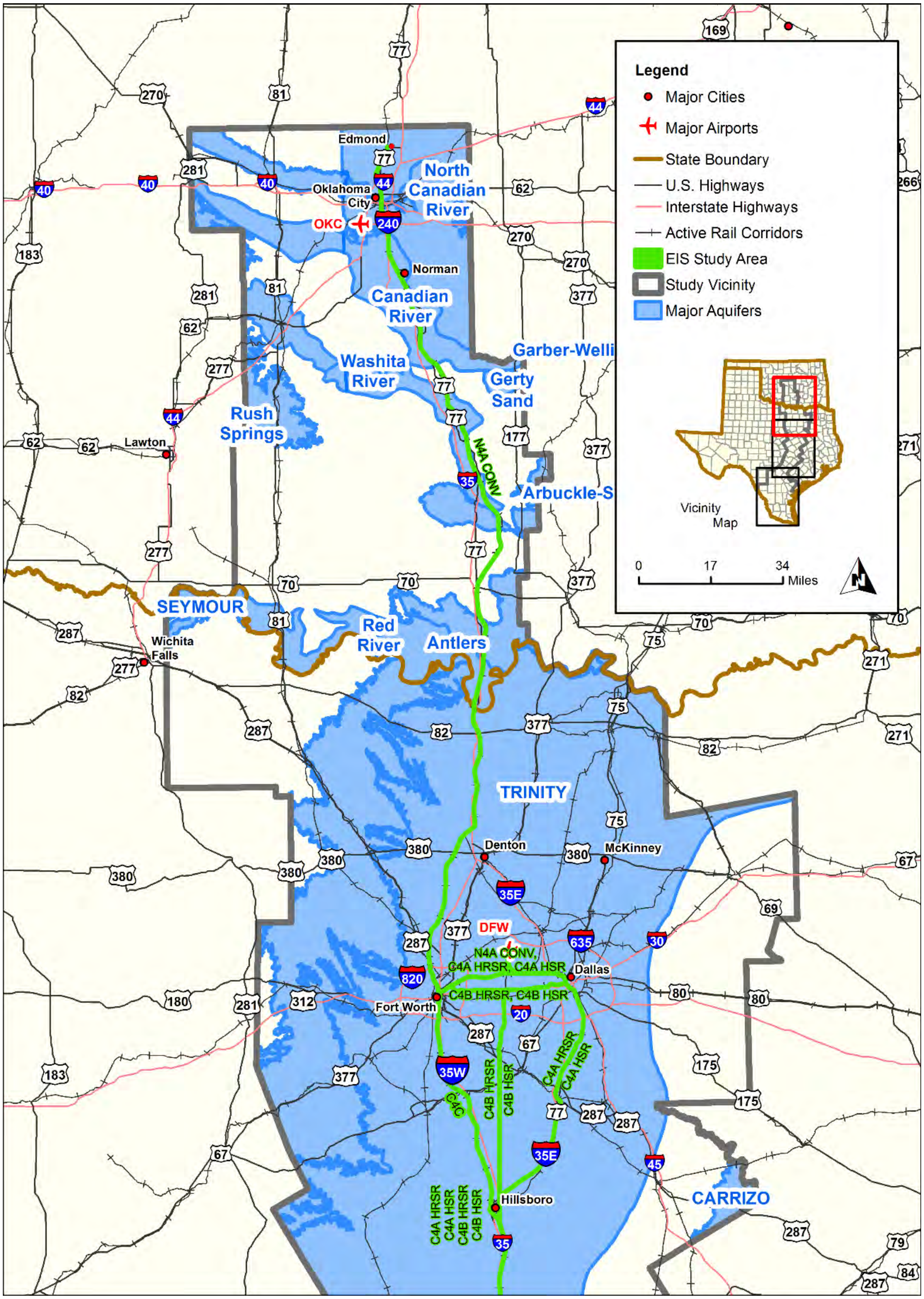

Figure 3.2-3: Major Aquifers within the Vicinity of the Northern Section EIS Study Area

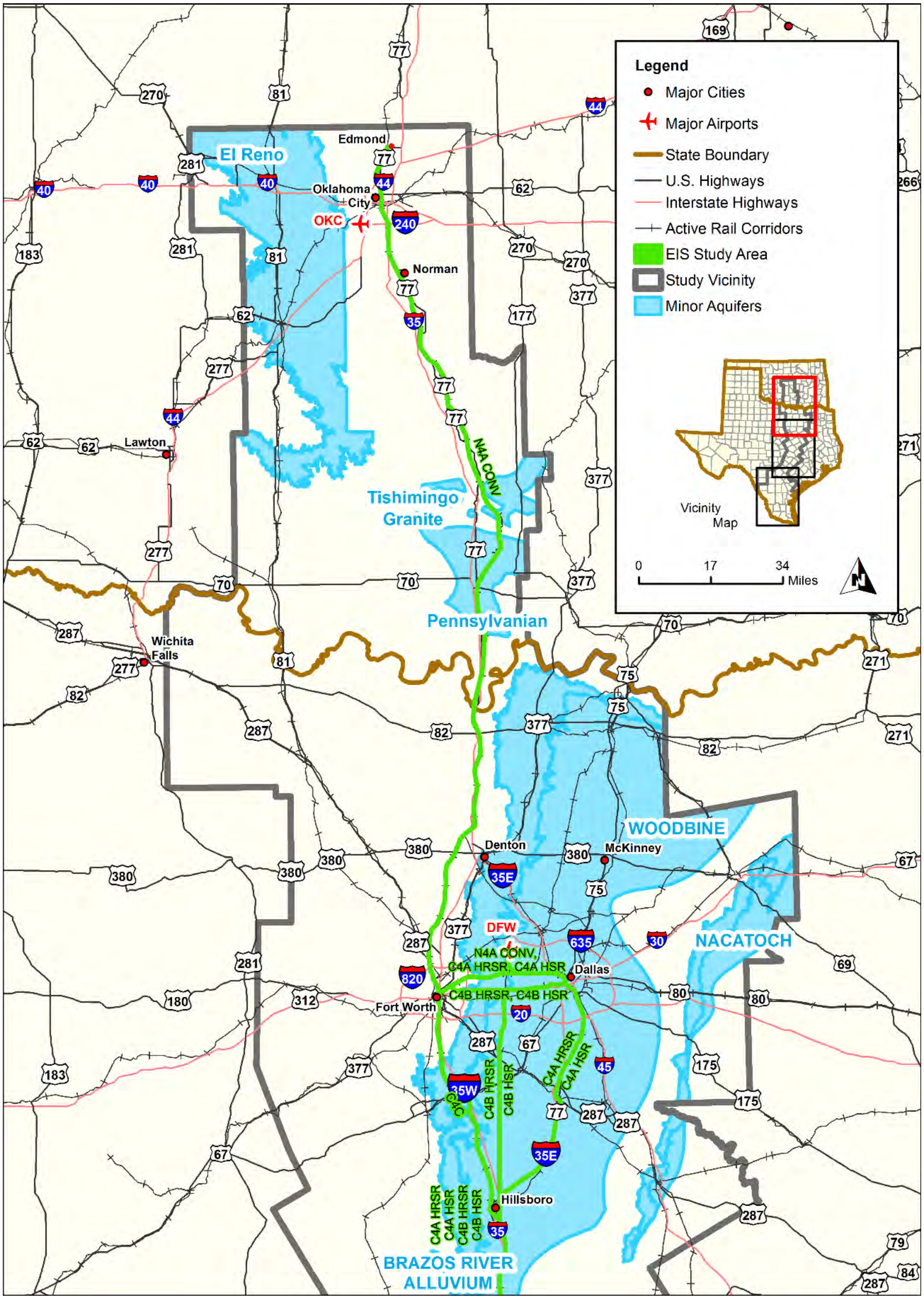

Figure 3.2-4: Minor Aquifers within the Vicinity of the Northern Section EIS Study Area

3.2.3.3 Central Section: Dallas and Fort Worth to San Antonio

3.2.3.3.1 Surface Waters

Most surface waters within the Central Section EIS Study Area are similar to the Northern Section and are associated with significant drainage channels and riparian areas. These include improved flood control drainage channels, intermittent river and stream channels, perennial river and stream channels, ponds, lakes, and reservoirs. Table 3.2-6 identifies surface waters crossed within the Central Section EIS Study Area. Figure 3.2-5 shows surface waters within the vicinity of the Central Section EIS Study Area.

Table 3.2-6: Surface Waters Crossed within the Central Section EIS Study Area

Water Body Classification	Number Crossed
Alternative C4A HrSR and C4A HSR[a]	
Perennial Stream	75
Intermittent Stream	362
Open Water – Lake/Pond	246
Open Water – Reservoir	17
Approximate Total	**700**
Alternative C4B HrSR and C4B HSR	
Perennial Stream	42
Intermittent Stream	374
Open Water – Lake/Pond	222
Open Water – Reservoir	12
Approximate Total	**650**
Alternative C4C HrSR and C4C HSR	
Perennial Stream	82
Intermittent Stream	459
Open Water – Lake/Pond	291
Open Water – Reservoir	18
Approximate Total	**850**

[a] HrSR = higher-speed rail; HSR = high-speed rail

Source: USGS (2014).

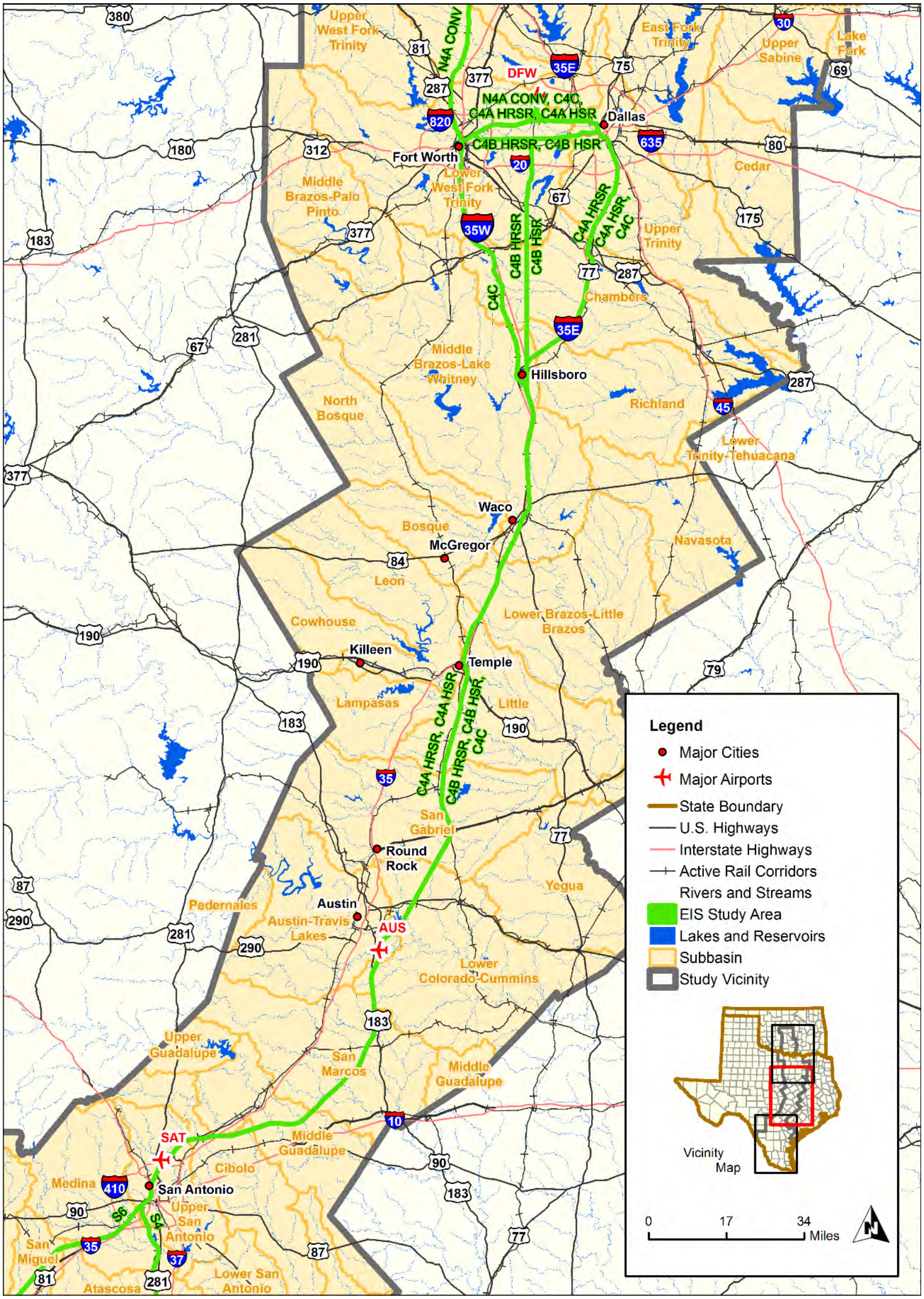

Figure 3.2-5: Surface Waters and Hydrologic Unit Sub-basins within the Vicinity of the Central Section EIS Study Area

Hydrologic Units

The Central Section EIS Study Area is entirely within Texas and consists of 16 hydrologic unit sub-basins. Each unit generally consists of individual watersheds or subwatersheds, and in some cases contains more than one watershed. Table 3.2-7 identifies the hydrologic unit sub-basins crossed within the Central Section EIS Study Area. Figure 3.2-5 shows the boundaries of the hydrologic unit sub-basins within the vicinity of the Central Section EIS Study Area.

Table 3.2-7: Hydrologic Unit Sub-basins Crossed within the Central Section EIS Study Area

Hydrologic Unit	State	Hydrologic Unit	State
Austin-Travis Lakes	Texas	Lower West Fork Trinity	Texas
Chambers	Texas	Middle Brazos-Lake Whitney	Texas
Cibolo	Texas	Middle Guadalupe	Texas
Elm Fork Trinity	Texas	Richland	Texas
Leon	Texas	San Gabriel	Texas
Little	Texas	San Marcos	Texas
Lower Brazos-Little Brazos	Texas	Upper San Antonio	Texas
Lower Colorado-Cummins	Texas	Upper Trinity	Texas
Source: USGS (2014).			

Designated Waters

There are no designated surface waters in the EIS Study Area for the Central Section alternatives.

Listed Section 303(d) Impaired Waters

Table 3.2-8 identifies the total number of perennial and intermittent streams and the Section 303(d) waters classified as impaired crossed within the Central Section EIS Study Area. Figure 3.2-6 shows listed 303(d) waters crossed within Central Section EIS Study Area, based on a review of the Texas 303(d) list.

Table 3.2-8: Surface Waters Classified as Impaired Crossed within the Central Section EIS Study Area

Water Body Classification	Number Crossed
Alternative C4A HrSR and C4A HSR	
Total Perennial and Intermittent Streams	437
Impaired Streams	17
Percent of Impaired Streams	*3.9%*
Alternative C4B HrSR and C4B HSR	
Total Perennial and Intermittent Streams	416
Impaired Streams	21
Percent of Impaired Streams	*5.0%*
Alternative C4C HrSR and C4C HSR	
Total Perennial and Intermittent Streams	541
Impaired Streams	18
Percent of Impaired Streams	3.3%
Source: USGS (2014).	

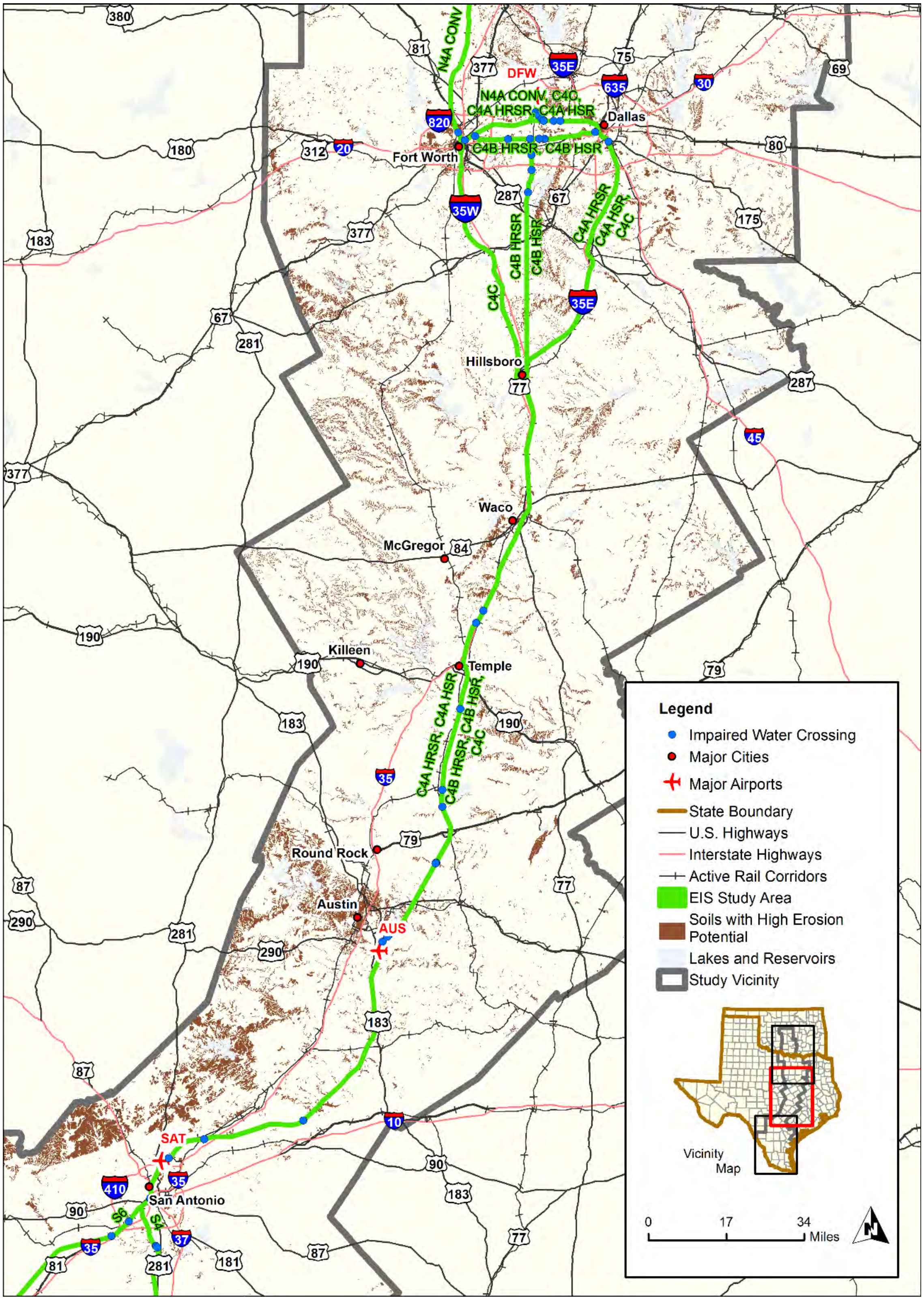

Figure 3.2-6: Impaired Waters Crossed and Soils with High Erosion Potential within the Vicinity of the Central Section EIS Study Area

3.2.3.3.2 Erosion

Table 3.2-9 summarizes SSURGO soil types crossed within the Central Section EIS Study Area. Figure 3.2-6 shows areas within the vicinity of the Central Section EIS Study Area with severe and very severe soil erosion potential.

Table 3.2-9: Erodible Soils Crossed within the Central Section EIS Study Area

Erosion Hazard Classification	Number Crossed
Alternative C4A HrSR and C4A HSR	
Not Rated	29
Slight	874
Moderate	439
Severe	68
Very Severe	33
Approximate Total	**1,443**
Alternative C4B HrSR and C4B HSR	
Not Rated	32
Slight	836
Moderate	428
Severe	85
Very Severe	31
Approximate Total	**1,412**
Alternative C4C HrSR and C4C HSR	
Not Rated	33
Slight	1,044
Moderate	531
Severe	82
Very Severe	41
Approximate Total	**1,731**
Source: SSURGO (2014).	

3.2.3.3.3 Groundwater

Aquifers in Texas provide about 60 percent of the 16.1 million acre-feet of water used within the state. There are 9 major and 21 minor aquifers recognized and monitored for water quality in Texas (Texas Water Development Board 2014b). The aquifers include alluvial aquifers in sediments deposited by rivers and streams in the Cenozoic, coastal aquifers composed of layers of sand, gravel, and clay deposited in the Cenozoic, and bedrock aquifers in Cretaceous rocks, such as sandstone and limestone, found across the middle of the state (see Section 3.12, Geology). Typically, the alluvial and coastal aquifers are shallow and intensively used for irrigation. The bedrock aquifers can be as deep as 3,000 feet and may have complex connections to adjacent aquifers via caves and fractures (University of Texas 2004).

The Edwards Aquifer is the only designated Sole Source Aquifer in Texas. The aquifer underlies approximately 3,600 square miles within Kinney, Uvalde, Medina, Bexar, Comal, and Hays counties. The aquifer has three primary zones: the contributing zone, the recharge zone, and the artesian zone. The contributing zone collects rainfall as source water for the aquifer and occurs north of the other zones on the Edwards Plateau. The aquifer is considered one of the most prolific artesian aquifers in the world and provides water to approximately 2 million people (San Antonio Water System 2014). The recharge area (unconfined) for the aquifer underlies approximately 1,250 square miles and follows the Balcones Fault escarpment from Bracketville through San Antonio and north to Austin (TCEQ 2014). Across much of the aquifer, the recharge and artesian zones (confined) are interspersed, except on the western end where the artesian areas extend approximately 10 to 20 miles south and on the eastern end where the artesian areas extend only a few miles to the south (San Antonio Water System 2014). Major springs produced by the Edwards Aquifer include San Pedro, San Antonio, Comal, San Marcos, and Hueco Springs (Edwards Aquifer Website 2014).

The Trinity and Edwards aquifers are confined major aquifers within the Central Section (Table 3.2-10 and Figure 3.2-7). Minor aquifers that underlie the Central Section EIS Study Area include the Woodbine (confined and unconfined) and Brazos River aquifers (see Table 3.2-10 and Figure 3.2-8).

Table 3.2-10: Aquifers Crossed within the Central Section EIS Study Area

Aquifer Name	Type
Texas – Major Aquifers	
Trinity	Confined
Edwards[a]	Confined
Texas – Minor Aquifers	
Woodbine	Unconfined
Woodbine	Confined
Brazos River Alluvium	Unconfined

[a] Designated Sole Source Aquifer

Source: Texas Water Development Board (2014a).

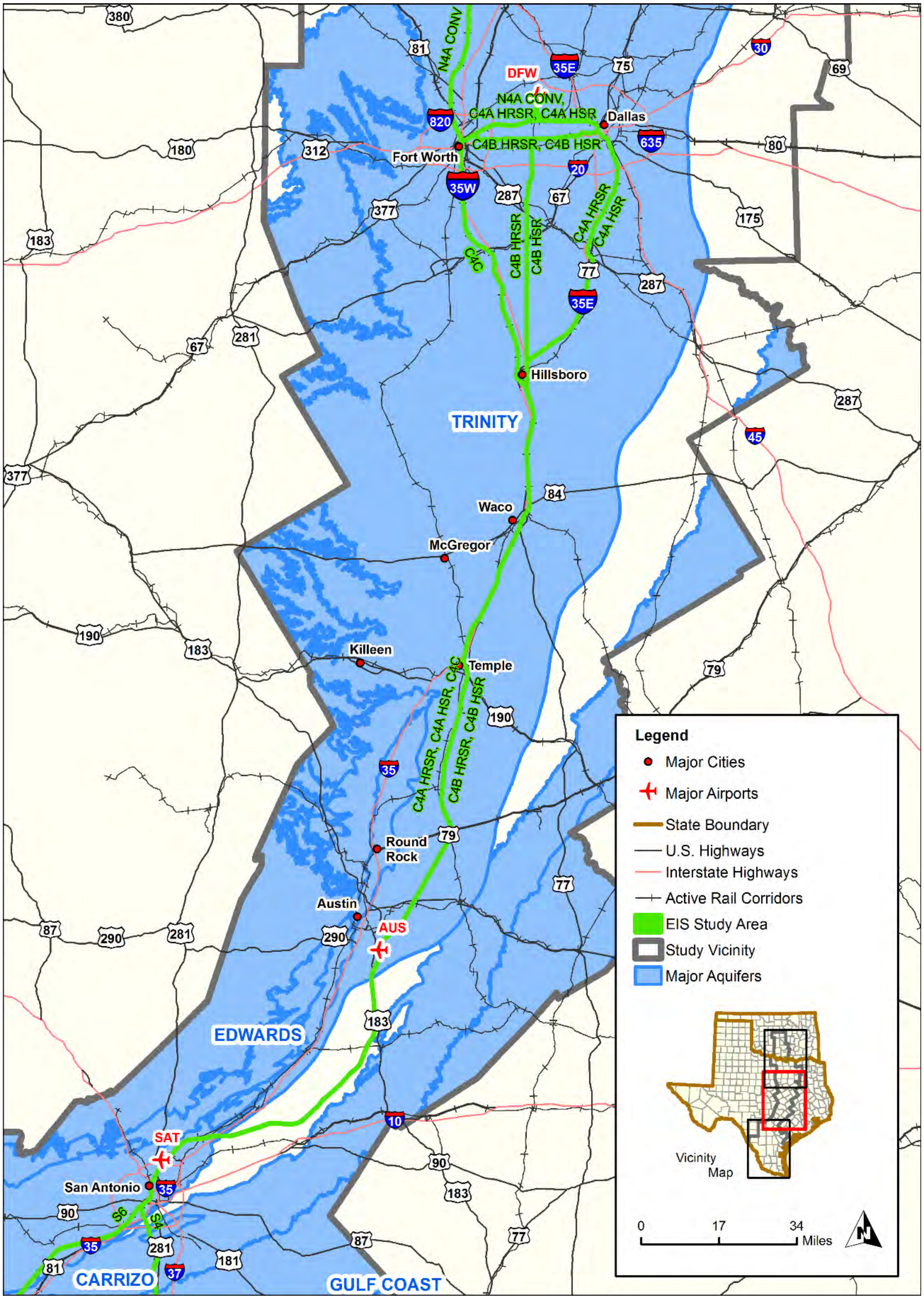

Figure 3.2-7: Major Aquifers within the Vicinity of the Central Section EIS Study Area

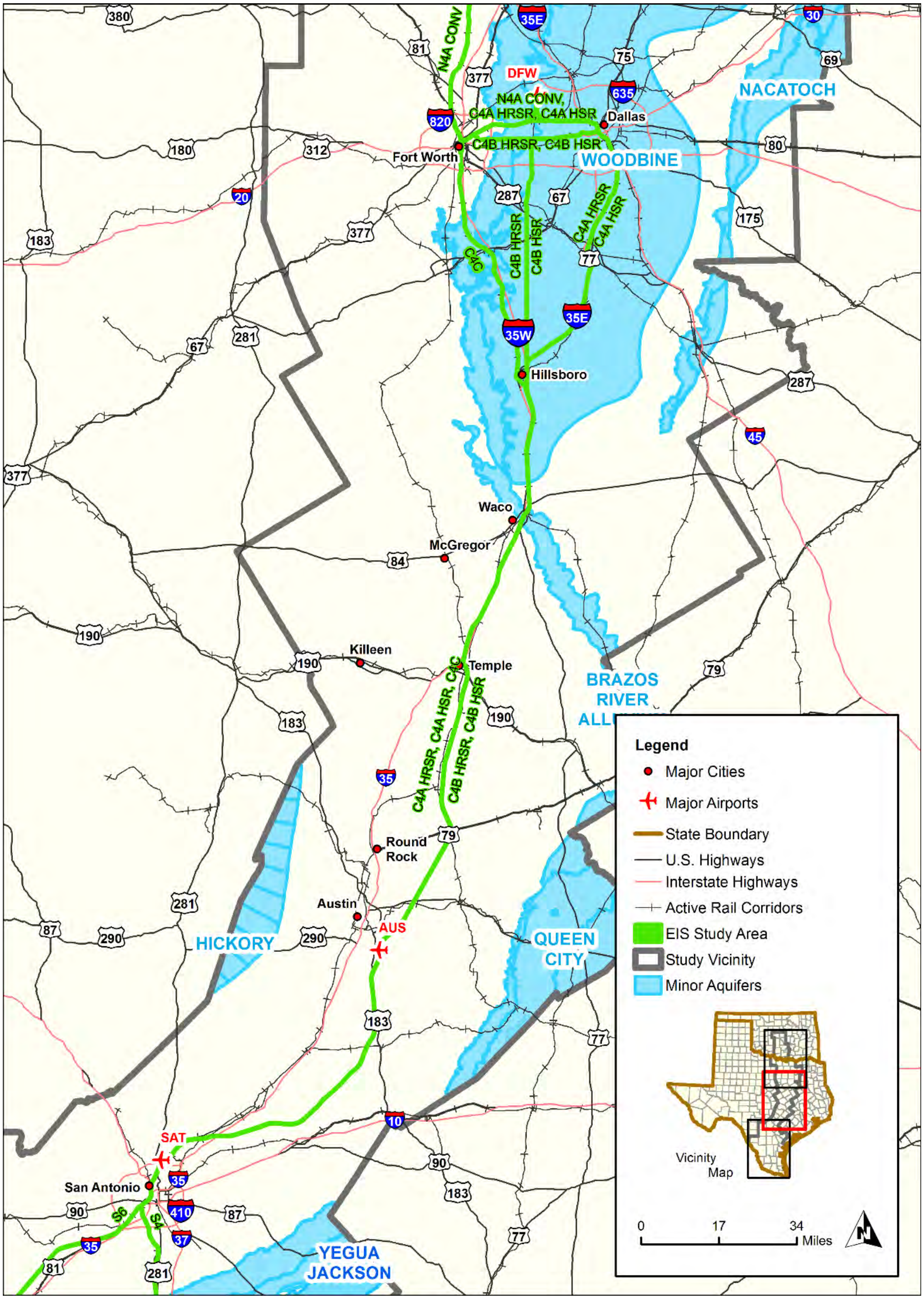

Figure 3.2-8: Minor Aquifers within the Vicinity of the Central Section EIS Study Area

3.2.3.4 Southern Section: San Antonio to South Texas

3.2.3.4.1 Surface Waters

The majority of surface waters within the Southern Section EIS Study Area are similar to the surface waters described for the Northern and Central sections. They are associated with significant drainage channels and riparian areas, or they are within coastal areas. These include improved flood control drainage channels, intermittent river and stream channels, perennial river and stream channels, ponds, lakes, reservoirs, coastal estuarine lagoons, and intertidal sloughs. Table 3.2-11 identifies surface waters crossed within the Southern Section EIS Study Area. Figure 3.2-9 shows surface waters within the vicinity of the Southern Section EIS Study Area.

Table 3.2-11: Surface Waters Crossed within the Southern Section EIS Study Area

Water Body Classification	Number Crossed
Alternative S4 HrSR	
Perennial Stream	4
Intermittent Stream	310
Open Water – Lake/Pond	113
Open Water – Reservoir	16
Approximate Total	**443**
Alternative S6 HrSR and S6 HSR	
Perennial Stream	2
Intermittent Stream	196
Open Water – Lake/Pond	53
Open Water – Reservoir	4
Approximate Total	**255**
Source: USGS (2014).	

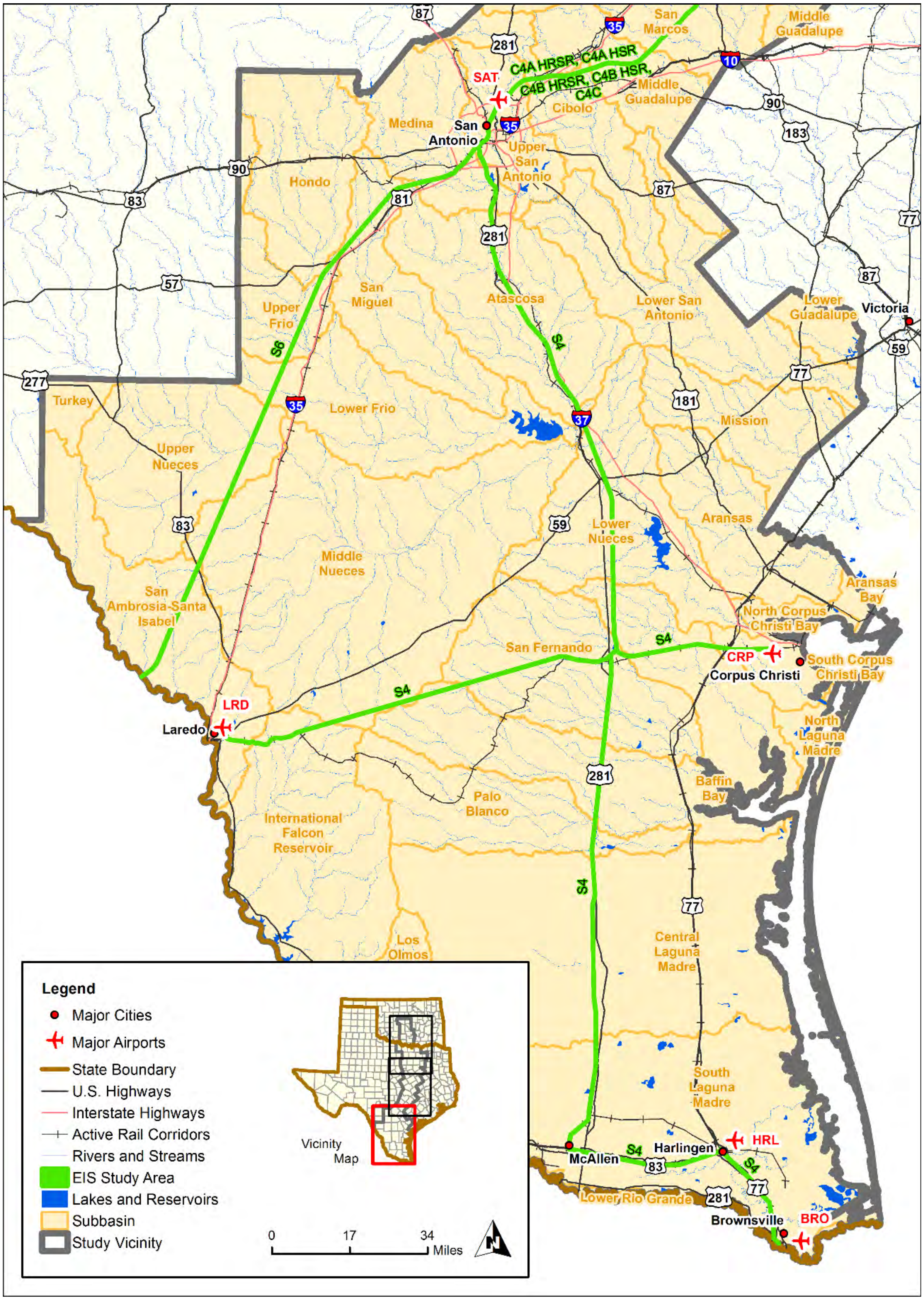

Figure 3.2-9: Surface Waters and Hydrologic Unit Sub-basins within the Vicinity of the Southern Section EIS Study Area

Hydrologic Units

The Southern Section EIS Study Area is entirely within Texas and consists of 18 hydrologic unit sub-basins. Two of the sub-basins extend into Mexico. Each unit generally consists of individual watersheds or subwatersheds, and in some cases contains more than one watershed. Table 3.2-12 identifies the hydrologic unit sub-basins crossed within the Southern Section EIS Study Area. Figure 3.2-9 shows the boundaries of the hydrologic unit sub-basins within the vicinity of the Southern Section EIS Study Area.

Table 3.2-12: Hydrologic Unit Sub-basins Crossed within the Southern Section EIS Study Area

Hydrologic Unit	State	Hydrologic Unit	State
Atascosa	Texas	San Fernando	Texas
Baffin Bay	Texas	San Miguel	Texas
Central Laguna Madre	Texas	South Corpus Christi Bay	Texas
Hondo	Texas	South Laguna Madre	Texas
Lower Frio	Texas	Upper Frio	Texas
Lower Nueces	Texas	Upper Nueces	Texas
Medina	Texas	Upper San Antonio	Texas
Middle Nueces	Texas	International Falcon Reservoir	Texas
Palo Blanco	Texas	San Ambrosia-Santa Isabel	Texas

Source: USGS (2014).

Designated Waters

There are no designated surface waters in the EIS Study Area for the Southern Section alternatives.

Listed Section 303(d) Impaired Waters

Table 3.2-13 identifies the total number of perennial and intermittent streams and the Section 303(d) impaired waters crossed within the Southern Section EIS Study Area. Figure 3.2-10 shows listed 303(d) waters crossed within Southern Section EIS Study Area, based on a review of the Texas 303(d) list.

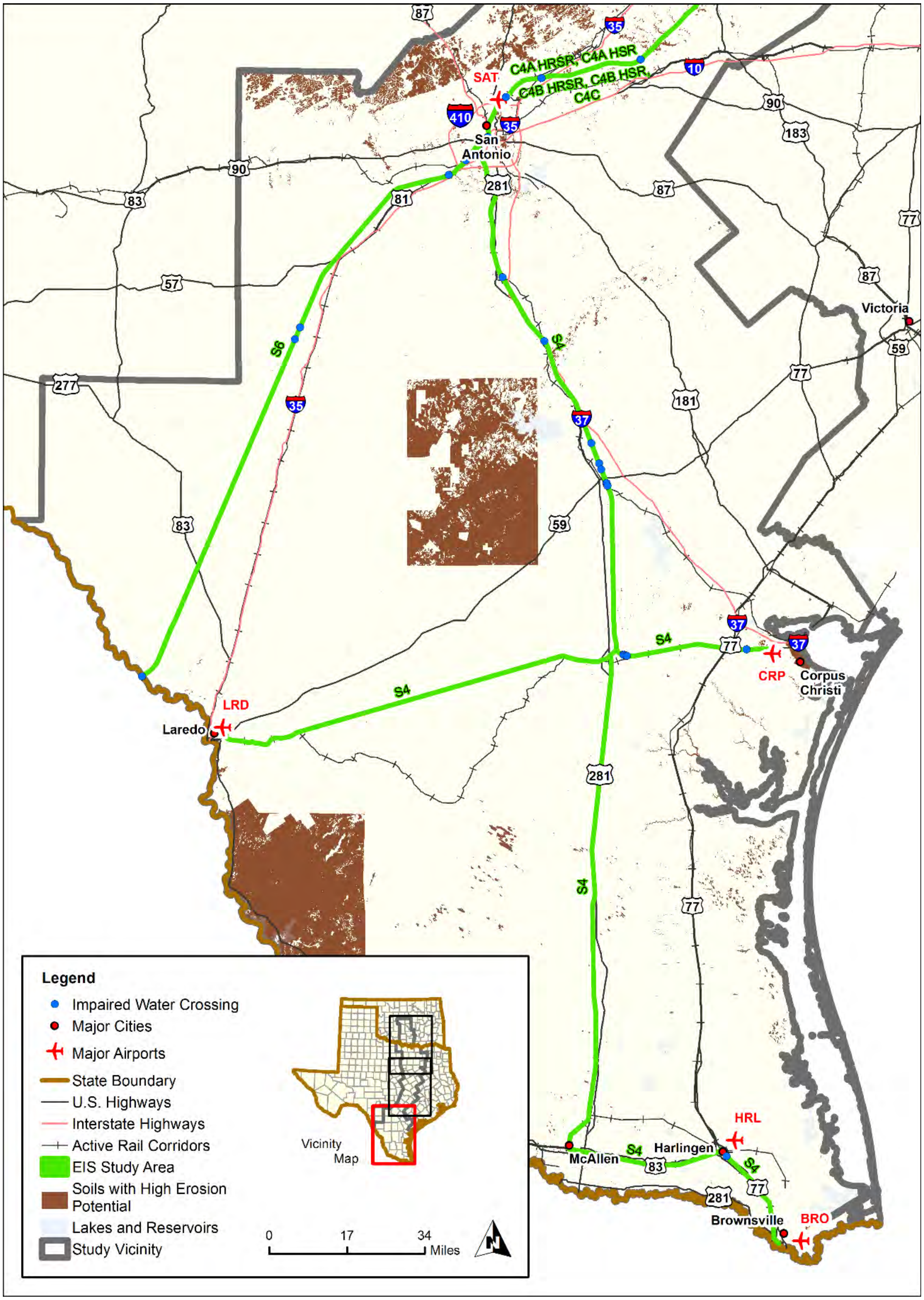

Figure 3.2-10: Impaired Waters Crossed and Soils with High Erosion Potential within the Vicinity of the Southern Section EIS Study Area

Table 3.2-13: Surface Waters Classified as Impaired Crossed within the Southern Section EIS Study Area

Water Body Classification	Number Crossed
Alternative S4 HrSR	
Total Perennial and Intermittent Streams	314
Impaired Streams	7
Percent of Impaired Streams	***2.2%***
Alternative S6 HrSR and S6 HSR	
Total Perennial and Intermittent Streams	198
Impaired Streams	5
Percent of Impaired Streams	***2.5%***
Source: USGS (2014).	

3.2.3.4.2 Erosion

Table 3.2-14 summarizes SSURGO soil types crossed within the Southern Section EIS Study Area. Figure 3.2-10 shows areas within the vicinity of the Southern Section EIS Study Area with severe and very severe soil erosion potential. Soil erosion data for the area within the vicinity of the Southern Section EIS Study Area are limited; the available data were used for tabular summaries and graphical depictions.

Table 3.2-14: Erodible Soils Crossed within the Southern Section EIS Study Area

Erosion Hazard Classification	Number Crossed[a]
Alternative S4	
Not Rated	29
Slight	1,102
Moderate	190
Severe	3
Very Severe	19
Approximate Total	**1,340**
Alternative S6	
Not Rated	5
Slight	349
Moderate	81

Erosion Hazard Classification	Number Crossed[a]
Severe	0
Very Severe	4
Approximate Total	**439**

[a] Availability of soil erosion data within the vicinity of the Southern Section EIS Study Area is limited.
Source: SSURGO (2014).

3.2.3.4.3 Groundwater

The Southern Section EIS Study Area crosses over four major aquifers that include unconfined areas of the Gulf Coast, unconfined and confined areas of the Carrizo, confined areas of the Trinity, and confined areas of the Edwards aquifers (Table 3.2-15 and Figure 3.2-11). Three minor aquifers underlie alternatives within the Southern Section EIS study Area including unconfined areas of the Yegua Jackson, unconfined and confined areas of the Sparta, and unconfined and confined areas of the Queen City aquifers (Table 3.2-15 and Figure 3.2-12).

Table 3.2-15: Aquifers Crossed within the Southern Section EIS Study Area

Aquifer Name	Type
Texas – Major Aquifers	
Gulf Coast	Unconfined
Carrizo	Confined, unconfined, not defined
Trinity	Confined
Edwards[a]	Confined
Texas – Minor Aquifers	
Yegua Jackson	Unconfined
Sparta	Confined, unconfined
Queen City	Confined, unconfined

[a] Designated Sole Source Aquifer
Source: Texas Water Development Board (2014a).

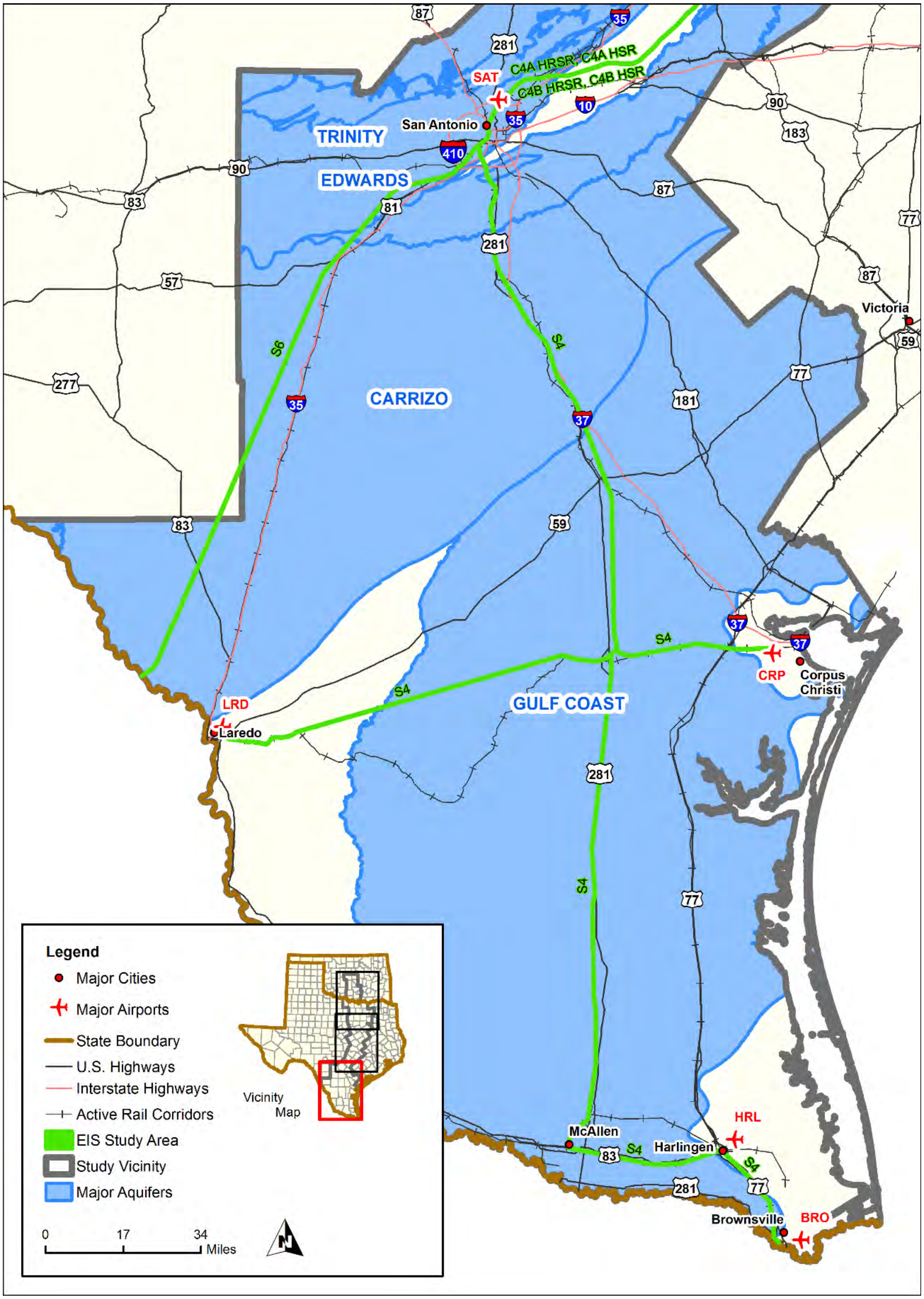

Figure 3.2-11: Major Aquifers within the Vicinity of the Southern Section EIS Study Area

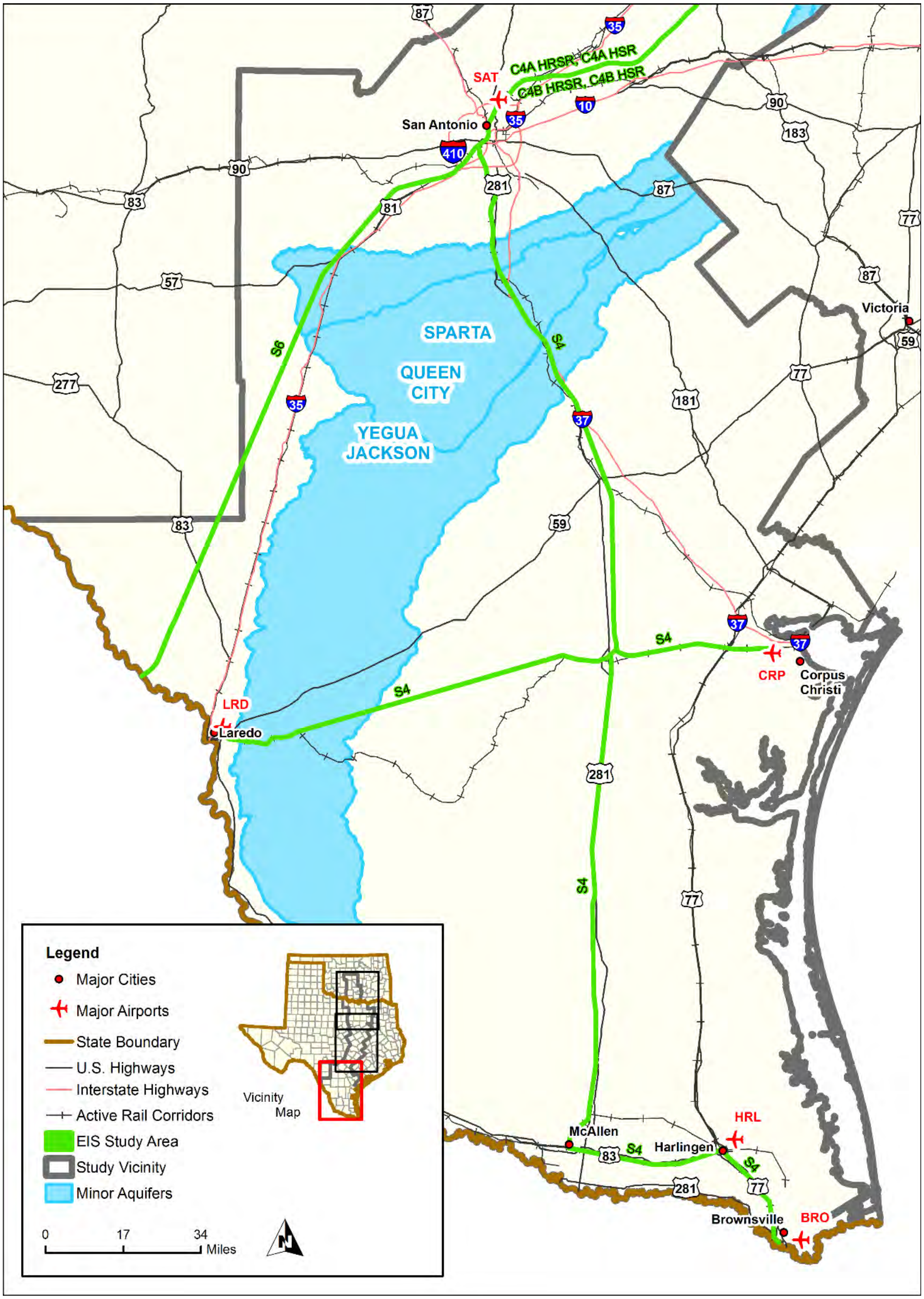

Figure 3.2-12: Minor Aquifers within the Vicinity of the Southern Section EIS Study Area

3.2.4 Environmental Consequences

3.2.4.1 Overview

Effects for the alternatives and associated infrastructure can be broadly classified as construction effects and operational effects (including maintenance). Construction-related effects are typically short-term effects. Construction activities such as the use of construction equipment, site access, and site grading could potentially result in increased erosion and sedimentation entering surface waters. Construction activities could result in construction materials such as tar, oil, grease, and solvents being released into surface waters. In some locations, temporary dewatering of surface waters and/or surficial groundwater would be necessary for excavations or the construction of pier foundations. These construction activities would potentially lower the water quality and availability for drinking, recreation, and wildlife use. During construction activities, effects would be minimized by implementing BMPs (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies).

Potential effects from the operation of the Program would be mostly long-term effects, including expansion of impervious surfaces, placement of fill material, and the reduction of groundwater infiltration in aquifer recharge areas. Effects on surface waters and floodplains (Section 3.8, Flood Hazards and Floodplain Management) would occur if these resources are displaced, redirected, or altered (e.g., confining the watercourse with bridge structures and culverts). These effects would occur for the Program, and depending on the alternative, changes to the nearby infrastructure may be necessary to accommodate grade separations and roadway realignments, which could also affect water bodies. Additional operational effects on designated surface waters and groundwater could be short-term but recurring. These include potential releases of grease, tar, oil, solvents, or metals to water bodies from the operations and maintenance of trains and guideway. During operation activities, effects would primarily be minimized by implementing required stormwater management regulations and BMPs (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies).

Because this is a service-level EIS, details regarding the alignment, the structures, and station locations are not known. Therefore, as described in Section 3.2.2, Methodology, the surface waters, runoff, erodible soils, and groundwater aquifers within the EIS Study Area for each alternative provides an indication of the potential effects on water quality and hydrology for the construction and operational phases of the Program. There are no substantial differences regarding surface waters or groundwater for high-speed or higher-speed rail technologies, and station locations would not influence the effect descriptions in this service-level EIS. A detailed assessment of these features will be performed as part of the project-level EIS.

3.2.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this Service Level evaluation, and would not meet the purpose and need of the Program, and therefore the No Build Alternative would not affect water quality and hydrology. The No Build Alternative assumes that city and county stormwater systems are in place and that standards are met.

3.2.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.2.4.3.1 Surface Waters

Table 3.2-16 identifies potential effects on surface waters (lakes, rivers, and streams) within the Northern Section EIS Study Area. This includes the acreage of surface waters (lakes and ponds) and linear feet (rivers and streams) crossed within the EIS Study Area. While a relatively high number of potential crossings of surface waters are possible with Alternative N4A Conventional, overall effects would be negligible as defined in Section 3.2.2, Methodology, when compared to the No Build Alternative because the N4A Alternative would use existing railway infrastructure and corridors. Additionally, project design and BMPs would reduce water quality and hydrology related impacts related to surface waters.

Table 3.2-16: Surface Waters, Listed Impaired Waters, and Designated Waters Crossed within the Northern Section – Alternative N4A Conventional

Water Body Classification	Number Crossed	Linear Feet	Acres
Alternative N4A CONV			
Streams and Rivers	343	317,365	-
Lakes and Reservoirs	194	-	103
303(d) Waters	14	15,368	-
Designated Waters	1	-	-
Source: USGS (2014).			

Listed Section 303(d) Impaired Waters

Table 3.2-16 identifies potential effects on Section 303(d) waters for the Northern Section EIS Study Area. Alternative N4A could involve the construction of improvements, including new river crossings or sidings, in the vicinity of 303(d) impaired water bodies. Overall effects on 303(d) waters from Alternative N4A Conventional would be negligible because of the relatively low magnitude (number and length) of 303(d) impaired water bodies crossed within the EIS Study Area. Additionally, the alternative would use existing railway infrastructure and corridors. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies.

Designated Waters

Alternative N4A Conventional would operate completely within the existing BNSF right-of-way from Edmond, Oklahoma, to Fort Worth, Texas, and completely within the Trinity Railway Express right-of-way from Fort Worth to the Northern Section terminus at Dallas Union Station. Where feasible, existing railroad track would be used. Modifications within the existing BNSF and Trinity Railway Express rights-of-way, such as double-tracking, would accommodate additional trains in areas where shared track is not feasible. Alternative N4A Conventional would potentially include improvements to the existing crossings of the Washita River, a National Rivers Inventory river, and may also include up to 20 new river crossings, depending on the improvements proposed and their proximity to the river. The types and construction of the spans will be defined for project-level NEPA documentation. Effects from improvements to existing or new crossings of rivers may include long-term effects such as clearing of the riparian buffer, grading, and fill. These effects could potentially alter the Washita River, resulting in increased nutrient and sediment inputs and changes in channel flow characteristics and water temperature. However, the effects would likely be localized in the area of new crossings over the river, and would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies. The potential discharge of construction-related materials into the river would be negligible because effects would be minimized during the design process and BMPs would be implemented during construction. While a relatively high number of potential crossings of a National Rivers Inventory river (Washita River) are possible with Alternative N4A Conventional, overall effects would be negligible because the alternative would use existing railway infrastructure and corridors. Additionally, project design and BMPs would reduce water quality and hydrology related impacts related to designated waters.

No surface waters designated as National Wild and Scenic Rivers, Study Rivers, or National Rivers Inventory occur within the Texas portion of the EIS Study Area for Alternative N4A Conventional.

3.2.4.3.2 Runoff

With construction of Alternative N4A Conventional, additional impervious surface associated with the stations would be constructed. Most rail construction would use permeable material; therefore, Alternative N4A Conventional would not be expected to contribute significantly to runoff. In many cases, the improvements would occur in existing urbanized areas, resulting in the addition of less impervious surface than the suburban and rural areas. However, where segments or facilities are constructed in undeveloped areas, increased runoff would result. The quantity of increased runoff has not been determined but, if substantial, could result in increased surface flows downstream and potentially greater flooding risk (Section 3.8, Flood Hazards and Floodplain Management). This potential increase may be offset because of reduced automobile use and a correlating reduction in impervious surfaces associated with parking lots and roadways throughout the region, potentially resulting in a net beneficial effect on runoff. To further reduce the potential for an adverse effect on runoff from Alternative N4A Conventional, facility designs would include measures to reduce impervious surfaces or provide on-site retention and treatment. Increases in runoff from the construction of new impervious surfaces would be reduced through the implementation of structural stormwater management practices and construction BMPs (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). The project-level NEPA process would evaluate the effects on runoff from impervious surfaces associated with the project design, assess potential effects on existing stormwater structures, and propose specific measures to address those potential effects. Therefore, overall potential increases in runoff from Alternative N4A Conventional would be negligible with avoidance and minimization measures.

3.2.4.3.3 Erosion

Table 3.2-17 lists the acreage of potentially erodible areas crossed within the Northern Section EIS Study Area. This table shows areas of potential effects on surface water quality. Because the erodible index is slope sensitive, only areas that exceed slope thresholds (slope steepness at which a given soil will begin to erode) within the indicated acreage meet criteria for erodible areas. Overall potential increases in erosion from Alternative N4A Conventional would be moderate because of the acreage of erosive soils crossed. The construction of new stations would potentially increase erosion and sedimentation of surface waters during construction. However, these effects would likely be mitigated by implementing BMPs during construction to prevent erosion (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Operation of new stations would not likely increase localized erosion of sediments into surface waters.

Table 3.2-17: Areas with High Erosion Potential Crossed within the Northern Section – Alternative N4A Conventional

Erosion Classification	Number Crossed	Acres
Alternative N4A CONV		
Severe	77	800
Very Severe	20	505
Approximate Total	**97**	**1,305**
Source: SSURGO (2014).		

3.2.4.3.4 Groundwater

The EIS Study Area for Alternative N4A Conventional crosses eight major aquifers systems in Oklahoma and Texas (Table 3.2-18). The largest major aquifer crossed is the Trinity Aquifer, which is primarily confined. The Arbuckle-Simpson Aquifer also underlies the EIS Study Area. Effects from construction and operational activities would most likely affect unconfined and Sole Source Aquifer systems because they have a direct connection to the ground surface and are the primary source of water for adjacent populations. Long-term effects may include groundwater contamination caused by rainfall runoff from created impervious surfaces and spills of construction materials, such as hydraulic fluid, fuel, paint, and solvents. The effects on groundwater resources from Alternative N4A Conventional would be negligible because the stormwater treatment measures and BMPs that would be implemented during construction and operation would reduce the potential for contaminants associated with impervious surfaces and spills to affect groundwater (refer to Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies).

Table 3.2-18: Aquifers Crossed within the Northern Section – Alternative N4A Conventional

Aquifer Name	Type	Alternative N4A CONV (acres)
Alternative N4A CONV		
Oklahoma – Major Aquifers		
Garber-Wellington	Confined	2,540
Canadian River	Unconfined	2,080
Washita River	Unconfined	1,940
Antlers	Confined	1,305
Red River	Unconfined	700
Arbuckle-Simpson[a]	Confined	165
North Canadian River	Unconfined	145
Texas – Major Aquifers		
Trinity	Confined	6,435
Approximate Total		**15,310**
Oklahoma – Minor Aquifers		
Pennsylvanian	Unconfined	1,760
Texas – Minor Aquifers		
Woodbine	Confined	955
Woodbine	Unconfined	385
Approximate Total		**3,100**

[a] Designated Sole Source Aquifer

Source: Texas Water Development Board (2014a).

3.2.4.4 Central Section: Dallas and Fort Worth to San Antonio

3.2.4.4.1 Alternative C4A Higher-Speed Rail

Surface Waters

Table 3.2-19 identifies potential effects on surface waters (lakes, rivers, and streams) within the EIS Study Area for Alternative C4A Higher-Speed Rail. This includes acreage of surface waters (lakes and ponds) and linear feet (rivers and streams) crossed within the EIS Study Area. Potential effects on surface waters within the EIS Study Area are greater than Alternative C4B (both service types) and less than Alternative C4C (both service types), but overall are similar in magnitude. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies. Compared to the No Build Alternative, potential effects on surface waters from Alternative C4A Higher-Speed Rail would be moderate.

Table 3.2-19: Surface Waters, Listed Impaired Waters, and Designated Waters Crossed within the Central Section – Alternative C4A Higher-Speed Rail and C4A High-Speed Rail

Water Body Classification	Number Crossed	Linear Feet	Acres
Alternative C4A HrSR and C4A HSR			
Streams and Rivers	437	316,909	-
Lakes and Reservoirs	263	-	153
303(d) Waters	17	24,187	-
Designated Waters	0	-	-
Source: USGS (2014).			

Listed Section 303(d) Impaired Waters

Table 3.2-20 identifies potential effects on the linear feet of Section 303(d) waters within the EIS Study Area for Alternative C4A Higher-Speed Rail. This alternative has the greatest potential effects on 303(d) waters followed by Alternative C4C (both service types) and Alternative C4B (both service types), but overall, the magnitude of the effects is similar. Potential effects on 303(d) waters from Alternative C4A Higher-Speed Rail would be negligible because of the low magnitude of linear feet of surface waters crossed within the EIS Study Area. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies.

Designated Waters

Table 3.2-20 identifies potential effects on the linear feet and acreages of surface waters within the EIS Study Area for Alternative C4A Higher-Speed Rail. There are no designated waters in the EIS Study Area for the Central Section. Therefore, no effects on designated waters are anticipated from any of the Central Section alternatives.

Runoff

Under Alternative C4A Higher-Speed Rail, additional impervious surface associated with the stations would be constructed. Most rail construction would use permeable material; therefore, the alignments would not be expected to contribute significantly to runoff. In many cases, the improvements would occur in existing urbanized areas, resulting in the addition of less impervious surface than the suburban and rural areas. However, where segments or facilities are constructed in undeveloped areas, increased runoff would result. The amount of increased runoff has not been determined, but, if substantial, would result in increased surface flows downstream and potentially greater flooding risk (Section 3.8, Flood Hazards and Floodplain Management). This potential increase may be offset because of reduced automobile use and a correlating reduction in impervious surfaces associated with parking lots and roadways throughout the region, potentially resulting in a net beneficial effect to runoff. To further reduce the potential for adverse effects on runoff from Alternative C4A Higher-Speed Rail, facility designs would include measures to reduce impervious surfaces or provide on-site retention and treatment. Increases in runoff from the construction of new impervious surfaces would be reduced through the implementation of structural stormwater management practices and construction BMPs (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). The project-level NEPA process would evaluate the effects on runoff from impervious surfaces associated with the project design, assess potential effects on existing stormwater structures, and propose specific measures to address those potential effects. Therefore, overall potential increases in runoff from Alternative C4A Higher-Speed Rail would be negligible through implementation of avoidance and minimization measures.

Erosion

Table 3.2-20 lists the acreage of potentially erodible areas within the EIS Study Area for Alternative C4A Higher-Speed Rail, which represents areas of potential effects on surface waters. Because the erosive index is slope sensitive, only areas that exceed slope thresholds within the indicated acreage meet criteria for erodible areas. Potential effects on water quality from erodible soils crossed (number and acres) within Alternative C4A Higher-Speed Rail are similar to Alternative C4B (both service types) and less than Alternative C4C (both service types). Overall potential effects from crossing erodible soils would be similar in magnitude among the Central Section alternatives (both service types). The potential effects from increases in erosion from Alternative C4A Higher-Speed Rail would be moderate. Construction of the alternative corridor and stations would potentially increase erosion and sedimentation in surface waters during construction. However, some of these effects would likely be reduced by implementing BMPs during construction to prevent erosion (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Operation of the alternative and stations would not likely increase localized erosion of sediments into surface waters.

Table 3.2-20: Areas with High Erosion Potential Crossed within the Central Section – Alternative C4A Higher-Speed Rail and C4A High-Speed Rail

Erosion Classification	Number Crossed	Acres
Alternative C4A HrSR and C4A HSR		
Severe	68	573
Very Severe	33	851
Approximate Total	**101**	**1,424**
Source: SSURGO (2014).		

Groundwater

Alternative C4A Higher-Speed Rail crosses over Trinity and Edwards confined major aquifers (Table 3.2-21). Minor aquifers that underlie this alternative include the Woodbine aquifer (confined and unconfined) and Brazos River aquifer (unconfined). Alternative C4A Higher-Speed Rail overlays the Edwards Aquifer, which is designated as a Sole Source Aquifer. Effects on Sole Source Aquifers would be negligible because Alternative C4A Higher-Speed Rail does not cross recharge areas where groundwater would be more susceptible to surface disturbances and potential effects from construction activities. Potential effects on groundwater resources (total acres of all aquifer types crossed) from Alternative C4A Higher-Speed Rail is greater than Alternative C4B (both service types) and less than Alternative C4C (both service types). Effects from construction- and operation-related activities would potentially affect unconfined aquifers because they have a direct connection to the ground surface. Long-term effects on unconfined aquifers may include groundwater contamination caused by rainfall runoff from created impervious surfaces, and spills of construction materials such as hydraulic fluid, fuel, paint, and solvents. The effects on groundwater resources from Alternative C4A Higher-Speed Rail would be negligible because of the stormwater treatment measures and BMPs that would be implemented during construction and operation (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies).

Table 3.2-21: Aquifers Crossed within the Central Section – Alternative C4A Higher-Speed Rail and C4A High-Speed Rail

Aquifer Name	Type	Acres
Texas – Major Aquifers		
Trinity	Confined	16,770
Edwards[a]	Confined	1,540
Approximate Total		**18,310**

Aquifer Name	Type	Acres
Texas – Minor Aquifers		
Woodbine	Unconfined	6,830
Woodbine	Confined	465
Brazos River Alluvium	Unconfined	170
Approximate Total		**7,465**
[a] Designated Sole Source Aquifer Source: Texas Water Development Board (2014a).		

3.2.4.4.2 Alternative C4A High-Speed Rail

Surface Waters

Table 3.2-19 identifies potential effects on surface waters (lakes, rivers, and streams) within the EIS Study Area for Alternative C4A High-Speed Rail. Alternative C4A High-Speed Rail would have the same effects on surface waters as the higher-speed rail option because both service types would follow the same route. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies. Compared to the No Build Alternative, potential effects on surface waters from Alternative C4A High-Speed Rail would be moderate.

Designated Waters

Table 3.2-19 identifies potential effects on the linear feet of designated waters within the EIS Study Area for Alternative C4A High-Speed Rail. Alternative C4A High-Speed Rail would have the same effects on surface waters as the higher-speed rail option because both service types would follow the same route. There are no designated waters in the EIS Study Area for the Central Section. Therefore, no effects on designated waters are anticipated from any of the Central Section alternatives.

Listed Section 303(d) Impaired Waters

Table 3.2-19 identifies potential effects on the linear feet of Section 303(d) waters within the EIS Study Area for Alternative C4A High-Speed Rail. Alternative C4A High-Speed Rail would have the same effects on surface waters as the higher-speed rail option because both service types would follow the same route. Potential effects on 303(d) waters from Alternative C4A Higher-Speed Rail would be negligible because of the low magnitude of linear feet of surface waters crossed within the EIS Study Area. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies.

Runoff

Alternative C4A High-Speed Rail would have the same effects on surface waters from runoff as the higher-speed rail option because both service types would follow the same route. BMPs used during construction and operation of Alternative C4A High-Speed Rail would be the same as the higher-speed rail option and would provide the same minimization functions in regards to runoff (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Overall potential increases in runoff from Alternative C4A High-Speed Rail would be negligible with avoidance and minimization measures.

Erosion

Table 3.2-20 lists the acreage of potentially erodible areas within the EIS Study Area for Alternative C4A High-Speed Rail. Alternative C4A High-Speed Rail would have the same effects on surface waters from erosion as the higher-speed rail option because both service types would follow the same route. BMPs used during construction and operation of Alternative C4A High-Speed Rail would be the same as the higher-speed rail option and would provide the same minimization functions in regards to erosion (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Overall potential increases in erosion from Alternative C4A High-Speed Rail would be moderate.

Groundwater

Table 3.2-21 lists the acreage and types of aquifers crossed by Alternative C4A High-Speed Rail. Potential effects on these groundwater resources would be the same effects as the higher-speed rail option because both service types would follow the same route. BMPs used during construction and operation of Alternative C4A High-Speed Rail would be the same as the higher-speed rail option and would provide the same mitigation functions in regards to potential effects on groundwater resources (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Overall potential effects on groundwater from Alternative C4A High-Speed Rail would be negligible through implementation of avoidance and minimization measures.

3.2.4.4.3 Alternative C4B Higher-Speed Rail

Surface Waters

Table 3.2-22 identifies potential effects on surface waters (lakes, rivers, and streams) within the EIS Study Area for Alternative C4B Higher-Speed Rail. This includes acreage of surface waters (lakes and ponds) and linear feet (rivers and streams) crossed within the EIS Study Area. Relative effects comparisons among the Central Section alternatives (both service types) were previously presented. Potential effects on surface waters from Alternative C4B Higher-Speed Rail would be moderate because of the total linear feet and acreage of surface waters crossed.

Table 3.2-22: Surface Waters, Listed Impaired Waters, and Designated Waters Crossed within the Central Section – Alternative C4B Higher-Speed Rail and C4B High-Speed Rail

Water Body Classification	Number Crossed	Linear Feet	Acres
Alternative C4B HrSR and C4B HSR			
Streams and Rivers	416	293,669	-
Lakes and Reservoirs	234	-	99
303(d) Waters	21	18,870	-
Designated Waters	0	-	-
Source: USGS (2014).			

Listed Section 303(d) Impaired Waters

Table 3.2-22 identifies potential effects on the linear feet of Section 303(d) waters within the EIS Study Area for Alternative C4B Higher-Speed Rail. Relative effects comparisons among the Central Section alternatives (both service types) were previously presented. Potential effects on 303(d) waters from Alternative C4B Higher-Speed Rail would be negligible because of the low magnitude of linear feet of surface waters crossed within the EIS Study Area. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies.

Designated Waters

Table 3.2-22 identifies potential effects on the linear feet of designated waters within the EIS Study Area for Alternative C4B Higher-Speed Rail. There are no designated waters in the EIS Study Area for the Central Section. Therefore, no effects on designated waters are anticipated from any of the Central Section alternatives.

Runoff

Under Alternative C4B Higher-Speed Rail, additional impervious surface associated with the stations would be constructed. The alternative's rail construction measures are the same as the other Central Section alternatives (both service types) and have been previously discussed in regards to increases in runoff. The amount of increased runoff has not been determined. Offsets from these potential increases have also been previously discussed and would be the same for Alternative C4B Higher-Speed Rail. The use of construction and operational BMPs would also be the same for each of the Central Section alternatives (both service types). The project-level NEPA process would evaluate the effects on runoff from impervious surfaces associated with the project design, assess potential effects on existing stormwater structures, and propose specific measures to address those potential effects. Overall potential increases in runoff from Alternative C4B Higher-Speed Rail would be negligible through implementation of avoidance and minimization measures (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies).

Erosion

Table 3.2-23 lists the acreage of potentially erodible areas within the EIS Study Area for Alternative C4B Higher-Speed Rail, which represents areas of potential effects on surface waters. Relative effects comparisons among the Central Section alternatives (both service types) were previously presented. Overall potential increases in erosion from Alternative C4B Higher-Speed Rail would be moderate. Construction of the alternative corridor and stations would potentially increase erosion and sedimentation in surface waters during construction. However, some of these effects would likely be reduced by implementing BMPs during construction to prevent erosion (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Operation of the alternative and stations would not likely increase localized erosion of sediments into surface waters.

Table 3.2-23: Areas with High Erosion Potential Crossed within the Central Section – Alternative C4B Higher-Speed Rail and C4B High-Speed Rail

Erosion Classification	Number Crossed	Acres
Alternative C4B HrSR and C4B HSR		
Severe	85	828
Very Severe	31	567
Approximate Total	**116**	**1,395**
Source: SSURGO (2014).		

Groundwater

Alternative C4B Higher-Speed Rail crosses over the same major and minor aquifers as the other Central Section alternatives (Table 3.2-24). Relative effects comparisons among the Central Section alternatives (both service types) were previously presented. Effects on Sole Source Aquifers would be negligible because Alternative C4B Higher-Speed Rail does not cross recharge areas. Effects on groundwater resources from Alternative C4B Higher-Speed Rail would be negligible because of the stormwater treatment measures and BMPs that would be implemented during construction and operation (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Types of potential effects and mitigation BMPs used during construction and operation of Alternative C4B Higher-Speed Rail would be the same as the other Central Section alternatives. Short- and long-term effects on groundwater resources caused by construction and operation activities would be negligible through implementation of avoidance and minimization measures.

Table 3.2-24: Aquifers Crossed within the Central Section – Alternative C4B Higher-Speed Rail and C4B High-Speed Rail

Aquifer Name	Type	Acres
Texas – Major Aquifers		
Trinity	Confined	15,315
Edwards[a]	Confined	1,540
Approximate Total		**16,860**
Texas – Minor Aquifers		
Woodbine	Unconfined	5,540
Woodbine	Confined	590
Brazos River Alluvium	Unconfined	170
Approximate Total		**6,300**

[a] Designated Sole Source Aquifer
Source: Texas Water Development Board (2014a).

3.2.4.4.4 Alternative C4B High-Speed Rail

Surface Waters

Table 3.2-22 identifies potential effects on surface waters (lakes, rivers, and streams) within the EIS Study Area for Alternative C4B High-Speed Rail. Alternative C4B High-Speed Rail would have the same effects on surface waters as the higher-speed rail option because both service types would follow the same route. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies. Potential effects on surface waters from Alternative C4B High-Speed Rail would be moderate because of the total linear feet and acreage of surface waters crossed.

Listed Section 303(d) Impaired Waters

Table 3.2-22 identifies potential effects on the linear feet of Section 303(d) waters within the EIS Study Area for Alternative C4B High-Speed Rail. Alternative C4B High-Speed Rail would have the same effects on surface waters as the higher-speed rail option because both service types would follow the same route. Potential effects on 303(d) waters from Alternative C4B High-Speed Rail would be negligible because of the low magnitude of linear feet of surface waters crossed within the EIS Study Area. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies.

<u>Designated Waters</u>

Table 3.2-22 identifies potential effects on the linear feet of designated waters within the EIS Study Area for Alternative C4B High-Speed Rail. Alternative C4B High-Speed Rail would have the same effects on surface waters as the higher-speed rail option because both service types would follow the same route. There are no designated waters in the EIS Study Area for the Central Section. Therefore, no effects on designated waters are anticipated from any of the Central Section alternatives.

Runoff

Alternative C4B High-Speed Rail would have the same effects on surface waters from runoff as the higher-speed rail option because both service types would follow the same route. BMPs used during construction and operation of Alternative C4B High-Speed Rail would be the same as the higher-speed rail option and would provide the same mitigation functions in regards to runoff (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Potential effects from increases in runoff from Alternative C4B High-Speed Rail would be negligible.

Erosion

Table 3.2-23 lists the acreage of potentially erodible areas within the EIS Study Area for Alternative C4B High-Speed Rail. Alternative C4B High-Speed Rail would have the same effects on surface waters from erosion as the higher-speed rail option because both service types would follow the same route. BMPs used during construction and operation of Alternative C4B High-Speed Rail would be the same as the higher-speed rail option and would provide the same mitigation functions in regards to erosion (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Overall potential increases in erosion from Alternative C4B High-Speed Rail would be moderate with avoidance and minimization measures.

Groundwater

Table 3.2-24 lists the acreage and types of aquifers crossed by Alternative C4B High-Speed Rail. Potential effects on these groundwater resources would be the same effects as the higher-speed rail option because both service types would follow the same route. BMPs used during construction and operation of Alternative C4B High-Speed Rail would be the same as the higher-speed rail option and would provide the same mitigation functions in regards to potential effects on groundwater resources (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Short- and long-term effects on groundwater resources caused by construction and operation activities would be negligible through implementation of avoidance and minimization measures.

3.2.4.4.5 Alternative C4C Higher-Speed Rail

Surface Waters

Table 3.2-25 identifies potential effects on surface waters (lakes, rivers, and streams) within the EIS Study Area for Alternative C4C Higher-Speed Rail. This includes acreage of surface waters (lakes and ponds) and linear feet (rivers and streams) crossed within the EIS Study Area. Relative effects comparisons among the Central Section alternatives (both service types) were previously presented. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies. Potential effects on surface waters from Alternative C4C Higher-Speed Rail would be moderate because of the total linear feet and acreage of surface waters crossed.

Table 3.2-25: Surface Waters, Listed Impaired Waters, and Designated Waters Crossed within the Central Section – Alternative C4C Higher-Speed Rail and C4C High-Speed Rail

Water Body Classification	Number Crossed	Linear Feet	Acres
Alternative C4C HrSR and C4C HSR			
Streams and Rivers	541	400,363	-
Lakes and Reservoirs	309	-	164
303(d) Waters	18	23,084	-
Designated Waters	0	-	-
Source: USGS (2014).			

Listed Section 303(d) Impaired Waters

Table 3.2-25 identifies potential effects on the linear feet of Section 303(d) waters within the EIS Study Area for Alternative C4C Higher-Speed Rail. Relative effects comparisons among the Central Section alternatives (both service types) were previously presented. Potential effects on 303(d) waters from Alternative C4C Higher-Speed Rail would be negligible because of the low magnitude of linear feet of surface waters crossed within the EIS Study Area. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies.

Designated Waters

Table 3.2-25 identifies potential effects on the linear feet of designated waters within the EIS Study Area for Alternative C4C Higher-Speed Rail. There are no designated waters in the EIS Study Area for the Central Section. Therefore, no effects on designated waters are anticipated from any of the Central Section alternatives.

Runoff

Under Alternative C4C Higher-Speed Rail, additional impervious surface associated with the stations would be constructed. The alternative's rail construction measures are the same as the other Central Section alternatives (both service types) and have been previously discussed in regards to increases in runoff. The amount of increased runoff has not been determined. Offsets from these potential increases have also been previously discussed and would be the same for Alternative C4C Higher-Speed Rail. The use of construction and operation BMPs would also be the same for each of the Central Section alternatives (both service types) (refer to Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Potential effects from increases in runoff from Alternative C4C Higher-Speed Rail would be negligible. The project-level NEPA process would evaluate the effects on runoff from impervious surfaces associated with the project design, assess potential effects on existing stormwater structures, and propose specific measures to address those potential effects.

Erosion

Table 3.2-26 lists the acreage of potentially erodible areas within the EIS Study Area for Alternative C4C Higher-Speed Rail, which represents areas of potential effects on surface waters. Relative effects comparisons among the Central Section alternatives (both service types) were previously presented. Overall potential increases in erosion from Alternative C4C Higher-Speed Rail would be moderate. Construction of the alternative corridor and stations would potentially increase erosion and sedimentation in surface waters during construction. However, some of these effects would likely be reduced by implementing BMPs during construction to prevent erosion (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Operation of the alternative and stations would not likely increase localized erosion of sediments into surface waters.

Table 3.2-26: Areas with High Erosion Potential Crossed within the Central Section – Alternative C4C Higher-Speed Rail and C4C High-Speed Rail

Erosion Classification	Number Crossed	Acres
Alternative C4C HrSR and C4C HSR		
Severe	82	654
Very Severe	41	1,052
Approximate Total	**123**	**1,706**
Source: SSURGO (2014).		

Groundwater

Alternative C4C Higher-Speed Rail crosses over the same major and minor aquifers as the other Central Section alternatives (Table 3.2-27). Relative effects comparisons among the Central Section alternatives (both service types) were previously presented. Effects on Sole Source Aquifers would be negligible because Alternative C4C Higher-Speed Rail does not cross recharge areas. Effects on groundwater resources from Alternative C4C Higher-Speed Rail would be negligible because of the stormwater treatment measures and BMPs that would be implemented during construction and operation (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies).

Types of potential effects and mitigation BMPs used during construction and operation of Alternative C4C Higher-Speed Rail would be the same as the other Central Section alternatives. Short- and long-term effects on groundwater resources caused by construction and operation activities would be negligible through implementation of avoidance and minimization measures.

Table 3.2-27: Aquifers Crossed within the Central Section – Alternative C4C Higher-Speed Rail and C4C High-Speed Rail

Aquifer Name	Type	Acres
Texas – Major Aquifers		
Trinity	Confined	20,355
Edwards[a]	Confined	1,540
Approximate Total		**21,895**
Texas – Minor Aquifers		
Woodbine	Unconfined	1,505
Woodbine	Confined	8,390
Brazos River Alluvium	Unconfined	170
Approximate Total		**10,065**

[a] Designated Sole Source Aquifer
Source: Texas Water Development Board (2014a).

3.2.4.4.6 Alternative C4C High-Speed Rail

Surface Waters

Table 3.2-25 identifies potential effects on surface waters (lakes, rivers, and streams) within the EIS Study Area for Alternative C4C High-Speed Rail. Alternative C4C High-Speed Rail would have the same effects on surface waters as the higher-speed rail option because both service types would follow the same route. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies. Potential effects on surface waters from Alternative C4C High-Speed Rail would be moderate because of the total linear feet and acreage of surface waters crossed.

<u>Designated Waters</u>

Table 3.2-25 identifies potential effects on the linear feet of designated waters within the EIS Study Area for Alternative C4C High-Speed Rail. Alternative C4C High-Speed Rail would have the same effects on surface waters as the higher-speed rail option because both service types would follow the same route. There are no designated waters in the EIS Study Area for the Central Section. Therefore, no effects on designated waters are anticipated from any of the Central Section alternatives.

<u>Listed Section 303(d) Impaired Waters</u>

Table 3.2-25 identifies potential effects on the linear feet of Section 303(d) waters within the EIS Study Area for Alternative C4C High-Speed Rail. Alternative C4C High-Speed Rail would have the same effects on surface waters as the higher-speed rail option because both service types would follow the same route. Potential effects on 303(d) waters from Alternative C4C High-Speed Rail would be negligible because of the low magnitude of linear feet of surface waters crossed within the EIS Study Area. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies.

Runoff

Alternative C4C High-Speed Rail would have the same effects on surface waters from runoff as the higher-speed rail option because both service types would follow the same route. BMPs used during construction and operation of Alternative C4C High-Speed Rail would be the same as the higher-speed rail option and would provide the same minimization functions in regards to runoff (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Potential effects from increases in runoff from Alternative C4C High-Speed Rail would be negligible. The project-level NEPA process would evaluate the effects on runoff from impervious surfaces associated with the project design, assess potential effects on existing stormwater structures, and propose specific measures to address those potential effects.

Erosion

Table 3.2-26 lists the acreage of potentially erodible areas within the EIS Study Area for Alternative C4C High-Speed Rail. Alternative C4C High-Speed Rail would have the same effects on surface waters from erosion as the higher-speed rail option because both service types would follow the same route. BMPs used during construction and operation of Alternative C4C High-Speed Rail would be the same as the higher-speed rail option and would provide the same minimization functions in regards to erosion (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Potential effects from increases in erosion from Alternative C4C Higher-Speed Rail would be moderate because of the total linear feet and acreage of surface waters crossed.

Groundwater

Table 3.2-27 lists the acreage and types of aquifers crossed by Alternative C4C High-Speed Rail. Potential effects on these groundwater resources would be the same effects as the higher-speed rail option because both service types would follow the same route. BMPs used during construction and operation of Alternative C4C High-Speed Rail would be the same as the higher-speed rail option and would provide the same minimization functions in regards to potential effects on groundwater resources (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Short- and long-term effects on groundwater resources caused by construction and operation activities would be negligible through implementation of avoidance and minimization measures.

3.2.4.5 Southern Section: San Antonio to South Texas

3.2.4.5.1 Alternative S4 Higher-Speed Rail

Surface Waters

Table 3.2-28 identifies potential effects on surface waters (e.g., lakes, rivers, and streams) within the EIS Study Area for Alternative S4 Higher-Speed Rail. This includes the acreage of surface waters (lakes and ponds) and linear feet (rivers and streams) crossed within the EIS Study Area. Potential effects on surface waters from Alternative S4 Higher-Speed Rail are greater than from Alternative S6 (both service types). Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies. Compared to the No Build Alternative, the potential effects on surface waters from Alternative S4 Higher-Speed Rail would be moderate because the total linear feet and acreage of surface waters crossed.

Table 3.2-28: Surface Waters, Listed Impaired Waters, and Designated Waters Crossed within the Southern Section – Alternative S4 Higher-Speed Rail

Water Body Classification	Number Crossed	Linear Feet	Acres
Alternative S4 HrSR			
Streams and Rivers	314	247,448	-
Lakes and Reservoirs	129	-	74
303(d) Waters	7	13,928	-
Designated Waters	0	-	-
Source: USGS (2014).			

<u>**Listed Section 303(d) Impaired Waters**</u>

Table 3.2-28 identifies potential effects on the linear feet of Section 303(d) waters within the EIS Study Area for Alternative S4 Higher-Speed Rail. Alternative S4 Higher-Speed Rail has greater potential effects on 303(d) waters than Alternative S6 (both service types). Potential effects on 303(d) waters from Alternative S4 Higher-Speed Rail would be negligible because of the low magnitude of linear feet of surface waters crossed within the EIS Study Area. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies.

<u>**Designated Waters**</u>

Table 3.2-28 identifies potential effects on the linear feet of designated waters within the EIS Study Area for Alternative S4 Higher-Speed Rail. There are no designated waters in the EIS Study Area for the Southern Section. Therefore, no effects on designated waters are anticipated from any of the Southern Section alternatives.

Runoff

Under Alternative S4 Higher-Speed Rail, additional impervious surface associated with the stations would be constructed. Most rail construction would use permeable material, so the alignments would not be expected to contribute significantly to runoff. In many cases, the improvements would occur in existing urbanized areas, resulting in no increase in impervious surfaces. However, where segments or facilities are constructed in undeveloped areas, increased runoff would result. The majority of Alternative S4 Higher-Speed Rail would cross undeveloped areas with shallow topographic slopes. Runoff from this route would be anticipated to be localized and less likely to reach sparse surface waters. The amount of increased runoff has not been determined but could result in increased surface flows downstream and potentially greater flooding risk if it did reach surface waters (Section 3.8, Flood Hazards and Floodplain Management). This potential increase may be offset because of reduced automobile use a correlating reduction in impervious surfaces associated with parking lots and roadways throughout the region, potentially resulting in a net beneficial effect to runoff. To further reduce the potential for adverse effects on runoff from Alternative S4 Higher-Speed Rail, facility designs would include measures to reduce impervious surfaces or provide on-site retention. Potential effects from increases in runoff from Alternative S4 Higher-Speed Rail would be negligible because increases in runoff from the construction of new impervious surfaces would be minimized through the implementation of structural stormwater management practices and construction BMPs (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). The project-level NEPA process would evaluate the effects on runoff from impervious surfaces associated with the project design, assess potential effects on existing stormwater structures, and propose specific measures to address those potential effects.

Erosion

Table 3.2-29 lists the acreage of potentially erodible areas within the EIS Study Area for Alternative S4 Higher-Speed Rail, which represents areas of potential effects on surface waters. However, soil erosion data for the Southern Section EIS Study Area are limited; the available data were used for tabular summaries and graphical depictions. Because the erosive index is slope sensitive, only areas that exceed slope thresholds within the indicated acreage meet criteria for erodible areas. Potential effects on water quality from erodible soils crossed (number and acres) within Alternative S4 Higher-Speed Rail would be similar to Alternative S6 (both service types). The potential effects from increases in erosion from Alternative S4 Higher-Speed Rail would be negligible. Construction of the alternative and stations would potentially increase erosion and sedimentation in surface waters during construction. However, some of these effects would likely be minimized by implementing BMPs during construction to prevent erosion (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Operation of the alternative and stations would not likely increase localized erosion of sediments into surface waters.

Table 3.2-29: Areas with High Erosion Potential Crossed within the Southern Section – Alternative S4 Higher-Speed Rail

Erosion Classification	Number Crossed[a]	Acres[a]
Alternative S4 HrSR		
Severe	3	62
Very Severe	19	616
Approximate Total	**22**	**678**

[a] Availability of soil erosion data for the area within the vicinity of the Southern Section EIS Study Area is limited.
Source: SSURGO (2014).

Groundwater

The EIS Study Area for Alternative S4 Higher-Speed Rail crosses four major aquifers (Gulf Coast, Carrizo, Trinity, and Edwards) and three minor aquifers (Yegua Jackson, Sparta, and Queen City). Alternative S4 Higher-Speed Rail crosses a greater areal extent (acres) of aquifers than Alternative S6 (both service types) (Table 3.2-30). Alternative S4 Higher-Speed Rail crosses the Edwards Aquifer, but does not cross the associated recharge zone where groundwater would be more susceptible to surface disturbances and potential effects from construction activities. The EIS Study Area for Alternative S4 Higher-Speed Rail also crosses a greater areal extent of unconfined minor aquifers than Alternative S6 (both service types). Effects from construction- and operation-related activities would most likely affect unconfined aquifers because they have a direct connection to the ground surface.

Effects on Sole Source Aquifers would be negligible because Alternative S4 Higher-Speed Rail does not cross recharge areas. Long-term effects may include groundwater contamination caused by rainfall runoff from created impervious surfaces and spills of construction materials, such as hydraulic fluid, fuel, paint, and solvents. The effects on groundwater resources would be negligible because of stormwater treatment measures and BMPs that would be implemented during construction and operation (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Short- and long-term effects on groundwater resources caused by construction and operation activities would be negligible through implementation of avoidance and minimization measures

Table 3.2-30: Aquifers Crossed within the Southern Section – Alternative S4 Higher-Speed Rail

Aquifer Name	Type	Acres
Texas – Major Aquifers		
Gulf Coast	Unconfined	17,570
Carrizo	Unconfined	130
Carrizo	Not defined	780
Carrizo	Confined	2,950
Trinity	Confined	205
Edwards[a]	Confined	210
Approximate Total		**21,845**
Texas – Minor Aquifers		
Yegua Jackson	Unconfined	3,245
Sparta	Unconfined	110
Sparta	Confined	925
Queen City	Confined	1,105
Queen City	Unconfined	380
Approximate Total		**5,765**

[a] Designated Sole Source Aquifer

Source: Texas Water Development Board (2014a).

3.2.4.5.2 Alternative S6 Higher-Speed Rail

Surface Waters

Table 3.2-31 identifies potential effects on surface waters (lakes, rivers, and streams) within the EIS Study Area for Alternative S6 Higher-Speed Rail. This includes acreage of surface waters (lakes and ponds) and linear feet (rivers and streams) crossed within the EIS Study Area. Relative effect comparisons between the Southern Section alternatives (both service types) were previously presented. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies. Potential effects on surface waters from Alternative S6 Higher-Speed Rail would be moderate because of the total linear feet and acreage of surface waters crossed.

Table 3.2-31: Surface Waters, Listed Impaired Waters, and Designated Waters Crossed within the Southern Section – Alternative S6 Higher-Speed Rail and S6 High-Speed Rail

Water Body Classification	Number Crossed	Linear Feet	Acres
Alternative S6 HrSR and S6 HSR			
Streams and Rivers	198	120,488	-
Lakes and Reservoirs	57	-	29
303(d) Waters	5	2,921	-
Designated Waters	0	-	-
Source: USGS (2014).			

Listed Section 303(d) Impaired Waters

Table 3.2-31 identifies potential effects on the linear feet of Section 303(d) waters within the EIS Study Area for Alternative S6 Higher-Speed Rail. Relative effects comparisons between the Southern Section alternatives (both service types) were previously presented. Potential effects on 303(d) waters from Alternative S6 Higher-Speed Rail would be negligible because of the low magnitude of linear feet of surface waters crossed within the EIS Study Area.

Designated Waters

Table 3.2-31 identifies potential effects on the linear feet of designated waters within the EIS Study Area for Alternative S6 Higher-Speed Rail. There are no designated waters in the EIS Study Area for the Southern Section. Therefore, no effects on designated surface waters are anticipated from any of the Southern Section alternatives.

Runoff

Under Alternative S6 Higher-Speed Rail, additional impervious surface associated with the stations would be constructed. The alternative's rail construction measures are the same as Alternative S4 Higher-Speed Rail and have been previously discussed in regards to increases in runoff. The amount of increased runoff has not been determined. Runoff from Alternative S6 Higher-Speed Rail would likely be less than Alternative S4 Higher-Speed Rail because of the shorter length of Alternative S6 (both service types). Offsets from potential increases have also been previously discussed and would be the same as Alternative S4 Higher-Speed Rail. The use of construction and operational BMPs would also be the same for the Southern Section alternatives (both service types) (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Potential effects from increases in runoff from Alternative S6 Higher-Speed Rail would be negligible because increases in runoff from the construction of new impervious surfaces would be minimized through the implementation of structural stormwater management practices and construction BMPs (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). The project-level NEPA process would evaluate the impacts on runoff from impervious surfaces associated with the project design, assess potential impacts on existing stormwater structures, and propose specific measures to address those potential impacts.

Erosion

Table 3.2-32 lists the acreage of potentially erodible areas within the EIS Study Area for Alternative S6 Higher-Speed Rail, which represents areas of potential effects on surface waters. Relative effects comparisons between the Southern Section alternatives (both service types) were previously presented. Construction of the alternative corridor and stations would potentially increase erosion and sedimentation in surface waters during construction. However, some of these effects would likely be reduced by implementing BMPs during construction to prevent erosion (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Operation of the alternative and stations would not likely increase localized erosion of sediments into surface waters. Therefore, potential effects from increases in erosion from Alternative S6 Higher-Speed Rail would be negligible.

Table 3.2-32: Areas with High Erosion Potential Crossed within the Southern Section – Alternative S6 Higher-Speed Rail and S6 High-Speed Rail

Erosion Classification	Number Crossed[a]	Acres[a]
Alternative S6 HrSR and S6 HSR		
Severe	0	678
Very Severe	4	13
Approximate Total	**4**	**691**

[a] Availability of soil erosion data for the area within the vicinity of the Southern Section EIS Study Area is limited.
Source: SSURGO (2014).

Groundwater

Alternative S6 Higher-Speed Rail crosses over fewer major and minor aquifers than Alternative S4 Higher-Speed Rail (Table 3.2-33). Major aquifers crossed include Carrizo, Trinity, and Edwards. Only the Queen City minor aquifer is crossed by Alternative S6 Higher-Speed Rail. Relative effects comparisons between the Southern Section alternatives (both service types) were previously presented. Effects on Sole Source Aquifers would be negligible because Alternative S6 Higher-Speed Rail does not cross recharge areas. Effects on groundwater resources from Alternative S6 Higher-Speed Rail would be negligible because of the stormwater treatment measures and BMPs that would be implemented during construction and operation (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Types of potential effects and mitigation BMPs used during construction and operation of Alternative S6 Higher-Speed Rail would be the same as Alternative S4 Higher-Speed Rail. Short-term effects on groundwater resources caused by construction and operation activities would be negligible.

Table 3.2-33: Aquifers Crossed within the Southern Section – Alternative S6 Higher-Speed Rail and S6 High-Speed Rail

Aquifer Name	Type	Acres
Texas – Major Aquifers		
Gulf Coast	Unconfined	-
Carrizo	Unconfined	1,645
Carrizo	Not defined	-
Carrizo	Confined	5,595
Trinity	Confined	2,005
Edwards[a]	Confined	2,000
Approximate Total		**11,245**
Texas – Minor Aquifers		
Yegua Jackson	Unconfined	-
Sparta	Unconfined	-
Sparta	Confined	-
Queen City	Confined	-
Queen City	Unconfined	1,205
Approximate Total		**1,205**

[a] Designated Sole Source Aquifer
Source: Texas Water Development Board (2014a).

3.2.4.5.3 Alternative S6 High-Speed Rail

Surface Waters

Table 3.2-31 identifies potential effects on surface waters (lakes, rivers, and streams) within the EIS Study Area for Alternative S6 High-Speed Rail. Alternative S6 High-Speed Rail would have the same effects on surface waters as the higher-speed rail option because both service types would follow the same route. Potential effects would be avoided or minimized through implementation of measures listed in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies. Potential effects on surface waters from Alternative S6 High-Speed Rail would be moderate because of the total linear feet and acreage of surface waters crossed.

Designated Waters

Table 3.2-31 identifies potential effects on the linear feet of designated waters within the EIS Study Area for Alternative S6 High-Speed Rail. Alternative S6 High-Speed Rail would have the same effects on surface waters as the higher-speed rail option because both service types would follow the same route. There are no designated waters in the EIS Study Area for the Southern Section. Therefore, there would be no effects on designated surface waters within the EIS Study Area.

Listed Section 303(d) Impaired Waters

Table 3.2-31 identifies potential effects on the linear feet of Section 303(d) waters within the EIS Study Area for Alternative S6 High-Speed Rail. Alternative S6 High-Speed Rail would have the same effects on surface waters as the higher-speed rail option because both service types would follow the same route. Potential effects on 303(d) waters from Alternative S6 High-Speed Rail would be negligible because of the low magnitude of linear feet of surface waters crossed within the EIS Study Area and through implementation of measures in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies.

Runoff

Alternative S6 High-Speed Rail would have the same effects on surface waters from runoff as the higher-speed rail option because both service types would follow the same route. BMPs used during construction and operation of Alternative S6 High-Speed Rail would be the same as the higher-speed rail option and would provide the same minimization functions in regards to runoff (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Potential effects from increases in runoff from Alternative S6 High-Speed Rail would be negligible through implementation of these measures.

Erosion

Table 3.2-32 lists the acreage of potentially erodible areas within the EIS Study Area for Alternative S6 High-Speed Rail. Alternative S6 High-Speed Rail would have the same effects on surface waters from erosion as the higher-speed rail option because both service types would follow the same route. BMPs used during construction and operation of Alternative S6 High-Speed Rail would be the same as the higher-speed rail option and would provide the same minimization functions in regards to erosion (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Potential effects from increases in erosion from Alternative S6 High-Speed Rail would be negligible because of the total linear feet and acreage of surface waters crossed and through implementation of measures in Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies.

Groundwater

Table 3.2-33 lists the acreage and types of aquifers crossed by Alternative S6 High-Speed Rail. Potential effects on these groundwater resources would be the same effects as the higher-speed rail option because both service types would follow the same route. BMPs used during construction and operation of Alternative S6 High-Speed Rail would be the same as the higher-speed rail option and would provide the same minimization functions in regards to potential effects on groundwater resources (Section 3.2.5, Avoidance, Minimization, and Mitigation Strategies). Short-term and long-term effects on groundwater resources caused by construction and operation activities would be negligible through implementation of measures

3.2.4.6 Summary of Potential Effects

Tables 3.2-34 through 3.2-37 provide a summary of effects and a qualitative assessment (negligible, moderate, or substantial intensity) for each alternative, compared to the No Build Alternative, for surface waters, erosion, runoff, and groundwater, respectively. It is important to note that the acreages listed below are not the actual areas of effect associated with construction and operation of any of the alternatives. The construction of a passenger rail alignment can reasonably occur within a 100-foot-wide corridor, which leaves an extra 400-foot-wide corridor. The purpose of this service-level EIS is to use the EIS Study Area, or "corridor," to determine the types of resources that may be affected, but more importantly, the relative magnitude of potential affects to those resources. It is also important to note that some routes in the Northern, Central, and Southern Sections could be built alone or combined with other section routes; more than one alternative in the Central or Southern Section could be built in the future because the alternatives provide different service options for the independent destinations. Details about how alternatives might connect will be analyzed at the project-level EIS.

Table 3.2-34: Summary of Effects on Surface Waters

Section	Alternative	Context		Potential Intensity of Effects- Surface Waters Crossed	Potential Intensity of Effects- Designated Waters/303(d) Waters (linear feet)
		Number of Surface Waters Crossed	Designated Waters / 303(d) Waters (linear feet)		
No Build Alternative[a]		0	0/0	No effect	No effect
Northern	N4A CONV	537	1/15,368	Negligible	Negligible
Central	C4A HrSR and HSR	700	0/24,187	Moderate	Negligible
	C4B HrSR and HSR	650	0/18,870	Moderate	Negligible
	C4C HrSR and HSR	850	0/23,084	Moderate	Negligible
Southern	S4 HrSR	443	0/13,928	Moderate	Negligible
	S6 HrSR and HSR	255	0/2,921	Moderate	Negligible

[a] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area. However, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

Table 3.2-35: Summary of Effects on Related to Runoff

Section	Alternative	Context: Magnitude of Impervious Surface	Potential Intensity of Effects
No Build Alternative[a]		None	No effect
Northern	N4A CONV	Low	Negligible
Central	C4A HrSR and HSR	Low	Negligible
	C4B HrSR and HSR	Low	Negligible
	C4C HrSR and HSR	Low	Negligible
Southern	S4 HrSR	Low	Negligible
	S6 HrSR and HSR	Low	Negligible

[a] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area. However, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

Table 3.2-36: Summary of Effects Related to Erosion

Section	Alternative	Context		Potential Intensity of Effects
		Highly Erodible Soils Crossed (number)	Highly Erodible Soils Crossed (acres)	
No Build Alternative[a]		0	0	No effect
Northern	N4A CONV	97	1,305	Moderate
Central	C4A HrSR and HSR	101	1,424	Moderate
	C4B HrSR and HSR	116	1,395	Moderate
	C4C HrSR and HSR	123	1,706	Moderate
Southern [a]	S4 HrSR	22	678	Negligible
	S6 HrSR and HSR	4	691	Negligible

[a] Availability of soil erosion data for the area in the vicinity of the Southern Section EIS Study Area is limited.

[a] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area. However, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

Table 3.2-37: Summary of Effects on Groundwater

Section	Alternative	Context: Aquifers Crossed (acres)	Potential Intensity of Effects
No Build Alternative[a]		None	No effect
Northern	N4A CONV	18,410	Negligible
Central	C4A HrSR and HSR	25,775	Negligible
	C4B HrSR and HSR	23,160	Negligible
	C4C HrSR and HSR	31,965	Negligible
Southern	S4 HrSR	27,610	Negligible
	S6 HrSR and HSR	12,450	Negligible

[a] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area. However, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

3.2.5 Avoidance, Minimization, and Mitigation Strategies

For this service-level EIS, the extent of impacts has not been discretely defined. The intensity of a potential effect has been classified as negligible, moderate, or substantial (Table 3.2-25), along with the potential for beneficial effects under select circumstances. The ability to analyze, determine, and mitigate for future project-level impacts should include the incorporation of construction and operational BMPs that would provide structural remedies to potential water quality impacts. Avoidance and minimization of effects will be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies will be implemented. Construction BMPs would include, but not be limited to, the following:

- Erosion:
  - Phasing and construction sequencing
  - Temporary seeding of cleared areas
  - Mulching
  - Erosion control blankets
  - Reinforced matting
- Sedimentation:
  - Hay bales, silt fences, dikes, and baffles
  - Stabilized construction access
  - Controlled temporary stock pile areas
- Runoff:
  - Runoff diversion measures
  - Level spreaders
  - Subsurface drains

Operation BMPs would include the use of wet and dry retention/detention ponds, vegetated swales and conveyance systems, adequate buffers around or adjacent to water resources and systems (e.g., streams, lakes, ponds, stormwater runoff, ground water recharge areas, and erodible soils), and the use of most up-to-date industry standards for addressing water quality (e.g., porous surfacing and pavement).

Applying these efforts as a means of adhering to the federal, state, regional, and local ordinances, policies, and applicable regulatory mechanisms to avoid, minimize, and mitigate potential water quality impacts will be a required implementation strategy for the project-level EIS during the construction and operational stages.

3.2.6 Subsequent Analysis

Once a Preferred Alternative is selected, field investigations or surveys would be conducted to determine the likelihood of water quality impacts within the EIS Study Area. A project-level NEPA study should identify individual stream crossings, evaluate water quality impacts on each stream, and analyze the expected water quality impacts on existing impaired stream segments. The project-level EIS should also focus on stream crossings located or associated with areas of high runoff and soil with high potential for erosion because this could be a significant source of water quality contamination during construction activities. These areas represent the most risk to maintaining state and federal water quality standards and compliance with NPDES construction stormwater permits.

3.3 Noise and Vibration

This section provides a preliminary assessment of the potential effects on noise- and vibration-sensitive receivers, such as residential areas, schools, and parks. Preliminary mitigation strategies and further analysis needed in the project-level National Environmental Policy Act (NEPA) process are identified at the end of this section. The introduction to Chapter 3 describes the environmental impact statement (EIS) Study Area and use of terms such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.3.1 Laws, Regulations, and Orders

Applicable federal and state legislation and regulations pertaining to noise and vibration within the EIS Study Area are listed and described below. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.3.1.1 Federal

- ***High Speed Ground Transportation Noise and Vibration Impact Assessment* (Federal Railroad Administration [FRA] 2012)*.*** This guidance provides procedures for determining the potential noise and vibration effects associated with high-speed ground transportation projects. The guidance includes procedures for assessing noise and vibration effects during the early stages of project development by conducting a preliminary effects screening.

- ***Transit Noise and Vibration Impact Assessment* (Federal Transit Administration [FTA] 2006).** This guidance provides procedures for determining potential noise and vibration effects associated with conventional rail transportation projects (speeds under 100 miles per hour [mph]). This guidance also provides procedures for assessing noise and vibration effects at this preliminary stage, consistent with the FRA guidance.

- **Federal Noise Emission Compliance Regulation.** This regulation (49 Code of Federal Regulations [CFR] Part 210) prescribes compliance requirements for enforcing railroad noise emission standards adopted by the U.S. Environmental Protection Agency (EPA) in 40 CFR Part 201.

3.3.1.2 State

- ***Guidelines for Analysis and Abatement of Roadway Traffic Noise* (Texas Department of Transportation [TxDOT] 2011).** Federal Highway Administration regulations governing highway noise appear in 23 CFR Part 772. The *Guidelines for Analysis and Abatement of Roadway Traffic Noise*, enacted in 2011, implement the federal regulations. Texas does not have separate guidance for rail noise and vibration.

3.3.2 Methodology

This noise and vibration assessment was conducted in accordance with the *High Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012) and FTA's *Transit Noise and Vibration Impact Assessment* (FTA 2006). The FRA manual is used to analyze effects of speeds of

100 miles per hour (mph) and higher; therefore, screening distances for the higher- and high-speed trains will follow guidelines for screening distances set in the FRA manual. The FTA manual is intended for trains traveling under 100 mph, and will be followed in this analysis for conventional rail, which travels up to 90 mph. In the FRA manual, Chapter 4, Initial Noise Evaluation, and Chapter 8, Preliminary Vibration Assessment, specify the analysis that is appropriate for a service-level EIS. In the FTA manual, Chapter 4, Noise Screening Procedure, and Chapter 9, Vibration Screening Procedures, specify the analysis that is appropriate for a service-level EIS. This analysis followed the FRA and FTA noise and vibration initial screening procedure and is based on existing land uses along the alternatives. Generally, impact intensities depend on the existing noise levels, predicted noise level increases, community views, effectiveness of mitigation measures, and cost of mitigating noise to more acceptable levels. These types of impact intensities are not defined at this stage of analysis and would be determined through modeling during project-level analysis.

In this analysis, the intensity of an effect as a result of the route alternatives are characterized as negligible, moderate, or substantial compared with the No Build Alternative. The level of intensity is determined by the number of noise- and vibration-sensitive receivers and land uses within the EIS Study Area and areas of new versus existing rail, and are described as follows:

- Negligible intensity effects occur when there are little to no noise- and vibration-sensitive receivers and land uses within the EIS Study Area that would have the potential to be affected by noise and vibration levels.
- Moderate intensity effects depend on project-specific factors, which include the types and numbers of noise- and vibration-sensitive land uses affected, and also the noise and vibration sensitivity of the properties’ context (e.g., rural vs. urban) that would have the potential to be affected by noise and vibration levels.
- Substantial intensity effects depend on the same project-specific factors as moderate effects, but with a higher number of noise- and vibration-sensitive receivers and land uses that would have the potential to be affected by noise and vibration levels.

The data used to conduct this analysis were geographic information system (GIS)-based, and include the following:

- Land use categories and zoning (particularly residential, commercial, and institutional)
- Business districts (where available)
- Tax assessor data for improvement values
- Parks, schools, hospitals, and community noise-sensitive receivers (e.g., museums, religious institutions, and recreational areas)
- Texas-Oklahoma Passenger Rail Study alternatives

The existing noise environments were initially evaluated by conducting an inventory of existing noise-sensitive land uses in the EIS Study Area, using Google Earth (Google Earth 2015) to identify noise-sensitive receivers (i.e., by identifying land uses and existing railroads and highways). For higher-speed and high-speed trains, land uses were organized based on the categories identified in the *High Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012) and are shown in Table 3.3-1. For conventional rail, noise-sensitive land uses are not divided into separate categories; instead, the screening distances depend on the characteristic of the land use and unobstructed areas (rural) versus intervening buildings (suburban/urban).

Table 3.3-1: Land Use Categories and Metrics for Higher-Speed and High-Speed Train Noise Effect Criteria

Land Use Category	Noise Metric (dBA)[b]	Description of Land Use Category
1	Outdoor $L_{eq}(h)$[a]	Tracts of land where quiet is an essential element in their intended purpose. This category includes land set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as national historic landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq}(h)$[a]	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches, where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, and museums can also be considered to be in this category. Certain historical sites, parks, campgrounds, and recreational facilities are also included.

[a] For the noisiest hour of transit-related activity during hours of noise sensitivity.

[b] dBA = decibels A-weighted; Ldn = day-night sound level; Leq(h) = hourly equivalent sound level

Source: FRA (2012).

Vibration-sensitive land uses are similar to the noise-sensitive land uses for higher-speed and high-speed rail, as defined in Table 3.3-1. Table 3.3-2 provides more detail on the types of land uses included in each of these categories specific to vibration.

The EIS Study Area was identified by using the noise and vibration screening distances defined in the *High Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012) for an initial screening. These guidelines prescribe distances within which an effect may occur between a passenger rail noise and vibration source and existing land uses, and then uses those distances during initial screening to determine how much sensitive land use may be affected by the alternatives. The EIS Study Area for noise analysis varied for each alternative because it is based on the existing land uses according to their estimated existing ambient noise (e.g., quiet suburban/rural or urban/noisy suburban), the type of corridor the alternative is located in (i.e., existing highway, existing railroad, or new alignment), and the proposed speed of the train (i.e., conventional rail, higher-speed rail, or high-speed rail).

Table 3.3-2 also applies to characteristics of conventional rail adapted from Section 8.1.1 of the *Transit Noise and Vibration Impact Assessment (*FTA 2006).

Table 3.3-2: Land Use Categories and Metrics for Conventional, Higher-Speed, and High-Speed Train Vibration Effect Criteria

Land Use Category	Description of Land Use Category
Category 1: High Sensitivity	Locations in which vibration would interfere. This category includes concert halls, vibration-sensitive research and manufacturing, hospitals with vibration-sensitive equipment, and university research operations.
Category 2: Residential	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where sensitivity during the night is assumed to be of utmost importance.
Category 3: Institutional	Institutional land use that includes schools, places of worship, other institutions, and quiet offices that do not use vibration-sensitive equipment but still have the potential for activity interference.
Source: FRA (2012).	

Table 3.3-3, a modified version of Table 8-1 in the *High Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012), shows the screening distances based on the characteristics of the alternatives. All urban/noisy suburban land uses within the EIS Study Area were considered to be unobstructed by intervening buildings, thereby providing a conservative estimate of the amount that noise-sensitive land uses could be affected by train operations. Quiet suburban/rural land uses are already assumed by FRA guidance to be unobstructed by intervening buildings. Regime II screening distances were used for conventional rail and higher-speed rail; Regime III screening distances were used for high-speed rail.

Table 3.3-3: Screening Distances for Noise Assessments for Higher- and High-Speed Rail

Characteristics of Corridor	Existing Noise Environment	Screening Distance for Speed Regime[a] (feet)	
		Regime II	Regime III
Existing Railroad	Urban/noisy suburban	300	700
	Quiet suburban/rural	500	1,200
Existing Highway	Urban/noisy suburban	250	600
	Quiet suburban/rural	400	1,100
New Alignment (no existing railroad or highway)	Urban/noisy suburban	350	700
	Quiet suburban/rural	600	1,300

[a] Regime II = speeds of 100 mph; Regime III = speeds of 180 mph

Table 3.3-4, a modified version of Table 4-1 in the *Transit Noise and Vibration Impact Assessment* (FTA 2006), shows the screening distances for conventional rail. The EIS Study Area for conventional rail varies depending on if the land uses are rural and unobstructed, or urban, with intervening buildings.

Table 3.3-4: Screening Distance for Noise Assessments for Conventional Rail

Type of Project	Screening Distance (feet)	
	Unobstructed	Intervening Buildings
Commuter Rail Mainline	750	375
Commuter Rail — Highway Crossing with Horns and Bells	1,600	1,200

The vibration EIS Study Area varies for each alternative for higher- and high-speed trains, based on the existing land use (e.g., residential and institutional) and the proposed speed of the train.

Table 3.3-5 is a modified version of Table 8-1 in the *High Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012). Table 3.3-5 shows the screening distances for vibration for different train speeds and types of land use. The conventional rail alternative used screening distances for a train speed of less than 100 mph; the higher-speed rail alternatives used screening distances for train speeds between 100 and 200 mph; and the high-speed rail alternatives used screening distances for train speeds between 200 and 300 mph. The vibration EIS Study Area's screening distance is also based on the speed of the train for higher- and high-speed rail.

Table 3.3-5: Screening Distances for Vibration Assessments for Higher- and High-Speed Rail

Land Use	Screening Distance (feet)		
	Train Speed Less than 100 mph	Train Speed 100 to 200 mph	Train Speed 200 to 300 mph
Residential	60	100	140
Institutional	20	70	100

The vibration EIS Study Area varies for the conventional rail based on the land use categories, which are shown in Table 3.3-6. These categories represent the sensitivity of the land use to vibration.

Table 3.3-6: Screening Distances for Vibration Assessment for Conventional Rail

Vibration Category	Description	Example	Critical Distance for Land Use Categories' - Distance from Right-of-Way or Property Line (feet)[a]
Category 1: High Sensitivity	Buildings where vibration would interfere with uses within the building	Concert halls, vibration-sensitive research and manufacturing	600
Category 2: Residential	Residential land uses and buildings where people sleep	Residences (no differentiation between types), hotels	200
Category 3: Institutional	Buildings without vibration-sensitive uses, with uses that have the potential for activity interference	Schools, churches, other institutions and quiet offices	120

[a] The land use categories are defined in Table 3.3-2. Some vibration-sensitive land uses are not included in these categories. Examples of these are concert halls and TV studios which, for the screening procedure, should be evaluated as Category 1, and theaters and auditoriums, which should be evaluated as Category 2.

Residences typically have a frequent outdoor use, such as a porch or patio, and are considered sensitive land uses. Because of the number of residences within the EIS Study Area, instead of quantifying every house, the residential acreage is identified for each section.

3.3.3 Affected Environment

3.3.3.1 Overview

All of the alternatives travel through quiet rural and low-density suburban areas, as well as noisy urban and high-density suburban areas. Category 1 receivers require extreme quiet, are not commonly encountered, and only one Category 1 land use was identified within the EIS Study Area (Route Alternative N4A). Descriptions of the existing environment for each geographic section are provided in the following sections.

3.3.3.2 Northern Section: Oklahoma City to Dallas and Fort Worth

Alternative N4A Conventional Rail would operate completely within the existing BNSF right-of-way from Edmond, Oklahoma, to Fort Worth, Texas, and completely within the Trinity Railway Express (TRE) right-of-way from Fort Worth to Dallas. Between the Oklahoma City and Dallas and Fort Worth metropolitan areas, farmland is the primary land use. Residential land use, with a number of noise- and vibration-sensitive land uses, are scattered throughout this section, as shown in Tables 3.3-7 and 3.3-8. Although farmland generally has low ambient noise and vibration levels, existing freight and passenger train operations within the EIS Study Area contribute to increased noise and vibration because of train movement on the track and the sound of federally mandated warning horns near at-grade crossings. The Northern Section EIS Study Area is close to many airports and airfields, which also contribute to existing elevated noise levels. In the Oklahoma City and Dallas and Fort Worth metropolitan areas, ambient noise levels and vibration are higher because of highway traffic combined with existing freight and passenger train operations along the BNSF and TRE railroad corridors.

Tables 3.3-7 and 3.3-8 summarize the noise- and vibration-sensitive land uses within the screening distances for the Northern Section identified in the *Transit Noise and Vibration Impact Assessment* (FTA 2006).

Table 3.3-7: Noise-Sensitive Land Uses within Screening Distances in the Northern Section

Alternative	Residential Acres within the Screening Distances	Number of Noise-Sensitive Land Uses within the Screening Distances
N4A	15,395	245

Table 3.3-8: Vibration-Sensitive Land Uses within Screening Distances in the Northern Section

Alternative	Category 1: Number of High-Sensitivity Land Uses	Category 2: Residential Land Uses (200-foot Buffer)	Category 3: Number of Institutional Land Uses
N4A	1	11,247 acres	24

3.3.3.3 Central Section: Dallas and Fort Worth to San Antonio

The Central Section EIS Study Area differs by alternative north of Hillsboro, Texas, but is the same for all alternatives south of Hillsboro. Although the alternative alignments differ north of Hillsboro, large portions of the different alternative study areas are located within the Dallas and Fort Worth metropolitan area, where existing ambient noise levels and vibration are high because of existing highway, rail, and air traffic noise.

Between the Dallas and Fort Worth urbanized area and Hillsboro, the routes are located in rural and low-density suburban areas. Route Alternatives C4A and C4C follow Interstate 35 (IH-35) East, IH-35 West, and railroad corridors through much of these rural and low-density suburban land uses north of Hillsboro. Existing highway traffic and freight train operations in these corridors, including freight train warning horn soundings near at-grade crossings, contribute to increased ambient noise levels and vibration in these EIS Study Areas. Route Alternative C4B follows a new alignment outside of existing transportation corridors between Dallas, Fort Worth, and Hillsboro. As a result, exposure to existing ambient noise levels and vibration by sensitive land use types and receivers are lower along Route Alternative C4B than Route Alternatives C4A and C4C.

South of Hillsboro, all Central Section route alternatives would be located on a new alignment outside of existing transportation corridors, characterized by primarily rural and low-density suburban land uses that have low exposure to existing ambient noise levels and vibration. Higher levels of exposure to ambient noise levels occur in urbanized and high-density suburban portions of the EIS Study Area, which comprise the cities of Waco, Temple, Taylor, Austin, and San Antonio. Commercial airports in Austin and San Antonio also contribute to higher noise levels in those locations.

Tables 3.3-9 and 3.3-10 summarize the presence of sensitive land uses within the noise and vibration screening distances for each alternative in the Central Section, identified in the *High Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012).

Table 3.3-9: Noise-Sensitive Land Uses within Screening Distances in the Central Section

Alternative[a]	Category 2: Acreage of Residential Land Use	Category 3: Number of Institutional Noise-Sensitive Receivers
C4A HrSR	7,937	100
C4A HSR	19,466	227
C4B HrSR	6,560	81
C4B HSR	15,549	179
C4C HrSR	9,284	110
C4C HSR	22,799	256

[a] HrSR = Higher-Speed Rail; HSR = High-Speed Rail

Table 3.3-10: Vibration-Sensitive Land Uses within Screening Distances in the Central Section

Alternativea	Category 2: Acreage of Residential Land Use	Category 3: Number of Institutional Noise-Sensitive Receivers
C4A HrSR	8,686	32
C4A HSR	11,919	39
C4B HrSR	6,917	26
C4B HSR	9,566	35
C4C HrSR	9,019	37
C4C HSR	12,387	44
[a] HrSR = Higher-Speed Rail; HSR = High-Speed Rail		

3.3.3.4 Southern Section: San Antonio to South Texas

The Southern Section EIS Study Area differs by alternative. Route Alternative S4 would be located on a new alignment outside of existing transportation corridors for most of its length, including rural and low-density suburban land uses with low exposure to existing ambient noise levels and vibration. Higher levels of exposure to ambient noise levels occur in portions of the EIS Study Area for Alternative S4 in existing rail corridors between Alice and Corpus Christi and between McAllen and Brownsville due to freight train operations and warning horn soundings near at-grade crossings. Adjacent to IH-37, and to a lesser extent U.S. Highway 281 (US-281), existing highway traffic causes the higher noise levels. There are also higher ambient noise level exposures associated with urbanized environments in the Route Alternative S4 EIS Study Area, including San Antonio, Laredo, Alice, Corpus Christi, McAllen, and Brownsville.

Route Alternative S6 would be located on a new alignment outside of existing transportation corridors for its entire length south San Antonio. The route alternative is in an area of rural land uses, with low exposure to existing ambient noise levels and vibration. Higher exposure to ambient noise levels occurs only in the urbanized area of San Antonio, where the alignment would follow an existing railroad corridor. Overall, the existing environment in the Alternative S6 study represents an area that is very quiet. Tables 3.3-11 and 3.3-12 summarize the presence of sensitive land uses within the noise and vibration screening distances for each alternative in the Southern Section, identified in the *High Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012).

Table 3.3-11: Noise-Sensitive Land Uses within Screening Distances in the Southern Section

Alternative[a]	Category 2: Acreage of Residential Land Use	Category 3: Number of Institutional Noise-Sensitive Receivers
S4 HrSR	8,753	62
S6 HrSR	687	1
S6 HSR	1,586	3
[a] HrSR = Higher-Speed Rail; HSR = High-Speed Rail		

Table 3.3-12: Vibration-Sensitive Land Uses within Screening Distances in the Southern Section

Alternative[a]	Category 2 Acreage of Residential Land Use	Category 3 Number of Institutional Noise-Sensitive Receivers
S4 HrSR	2,181	17
S6 HrSR	172	0
S6 HSR	240	0

[a] HrSR = Higher-Speed Rail; HSR = High-Speed Rail

3.3.4 Environmental Consequences

3.3.4.1 Overview

Construction activities would be temporary and are anticipated to occur during normal daytime working hours; however, some construction work may occur at night. Noise from construction activities would add to the noise environment in the EIS Study Area. The *Transit Noise and Vibration Impact Assessment (*FTA 2006) and *High Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012) manuals provide guidelines to assess construction noise impact. Consistent with the manuals, impacts are experienced when the combined noise level of the two noisiest pieces of equipment, assuming they operate at the same time, exceed the following:

- Residential land use: One-hour Leq of 90 dBA during the day and 80 dBA during the night.
- Commercial and industrial land use: One-hour Leq of 100 dBA during the day and night.

The noise level from two equal sources is 3 dB greater than the source pressure level of only one source. It is assumed that the loudest pieces of equipment routinely used for construction of the alternatives would be diesel-powered heavy equipment. Noise levels from diesel-powered equipment range from 80 to 95 dB at a distance of 50 feet. Equipment such as rock drills and pile drivers, which are anticipated to be used less frequently than other pieces of diesel-powered heavy equipment, could generate louder noise levels. However, with the use of dampers noise levels can be reduced. Impact pile drivers with dampers generate sound levels of approximately 95 dBA at a distance of 50 feet. Therefore, if two pile drivers with dampers were operating at the same time, they would generate sound levels of approximately 98 dBA. Since these two pieces of equipment would generate sound levels that exceed the criteria of 90 dBA in the day and 80 dBA in the night, they would result in an impact to residential land uses during both day and night. However, neither commercial nor industrial land uses would experience impacts. Although the potential for noise effects during construction exists where an alternative would be constructed adjacent to sensitive land uses, the temporary nature and adherence to local noise ordinances would likely result in less than moderate effects.

Construction activities may produce elevated vibration levels. There are two types of construction vibration effects to consider during construction: (1) human annoyance and (2) building damage. Human annoyance occurs when construction vibration rises significantly for extended periods.

Fragile buildings, in particular historic structures, are generally more susceptible to damage from ground vibration than newer, less fragile buildings. The potential for moderate or substantial vibration effects during construction increases where an alternative is located adjacent to sensitive land uses.

The potential for noise and vibration effects resulting from the Program would vary based on the speed of the train (the higher the speed, the greater the effect), the sensitivity of the land uses surrounding the train corridor, and the location of the train corridor (whether along an existing transportation route or on a new alignment). The screening distances used in this analysis take into account these variables. As noted in Section 3.3.2, Methodology, sensitive land uses include places where activities performed require low levels of noise or vibration.

During operation, distances within which potential effects may occur are defined based on the operations of a typical high-speed rail system. These distances were developed from detailed noise models that (1) used empirical measurements of noise levels generated by existing steel-wheel-on-steel-rail high-speed trains, (2) used expected maximum operation levels and speeds, and (3) are considered sensitive land uses. The screening distances studied along the alignments are the areas in which there is potential for noise or vibration effects, and are defined in Section 3.3.2, Methodology. In addition to operational noise within the screening distances, the conventional and higher-speed service types would also generate potential noise effects caused by warning horns and bells near at-grade crossings. Because the high-speed rail would be fully grade-separated, it would not need to use warning horns or bells and would, therefore, avoid this type of noise effect.

Station locations have not yet been determined, and station noise effects would need to be analyzed during subsequent project-level analysis. Noise generated by stations includes both trains approaching stations and vehicle traffic traveling to and from stations.

3.3.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect noise and vibration.

3.3.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.3.4.3.1 Alternative N4A Conventional

Within the noise effect screening distances identified for the noise analysis for Alternative N4A Conventional, there would be 15,395 acres of residential land use (Category 2 receivers) and 245 Category 3 noise-sensitive receivers (institutional land uses such as schools, libraries, churches, and cemeteries, which require a quiet environment). Within the vibration effect screening distances identified for the vibration analysis, there would be one high-sensitivity land use (Category 1 receivers), 11,247 acres of residential land use (Category 2 receivers), and 24 Category 3 vibration-sensitive receivers. A moderate intensity effect was determined based on the range of general land use types the N4A alignment travels through and the combined potential effects on those land uses. Much of the alignment is located in rural farmland, with noise- and vibration-sensitive receivers and land uses at sparsely scattered locations. Because there are few sensitive receivers in these rural areas, intensity effects would be very low. However, in addition to these rural land uses, there are also portions of densely developed cities along the N4A alignment that include concentrations of sensitive noise and vibration receivers and land uses, thereby elevating the potential intensity and resulting in a moderate effect.

3.3.4.4 Central Section: Dallas and Fort Worth to San Antonio

In the Central Section, as shown in Tables 3.3-9 and 3.3-10, the C4C Alternatives would have the greatest potential for effects on noise-sensitive and vibration-sensitive land uses because of their longer length; the C4B alternatives (both speed conventions) would have the least potential for effects because of their shorter length. The length of the alternatives within the Central Section is important since the length may introduce an increase in noise levels and greater number of sensitive receivers being exposed to those increases. This distinction is in reference to the potential for an increase in the number of noise impacts based on a longer, and therefore larger, alternative. Regardless of route, the high-speed rail alternatives would have a higher potential for effects on noise-sensitive land uses than the higher-speed rail alternatives because noise generated by high-speed rail travels farther than the noise generated by higher-speed rail. The high-speed rail alternatives would also have a greater potential for vibration effects than the higher-speed rail alternatives, with one exception: Alternative C4B High-Speed Rail would have fewer potential vibration effects on Category C receivers than Alternative C4C Higher-Speed Rail because of the longer length of Alternative C4C.

3.3.4.4.1 Alternative C4A Higher-Speed Rail

Within the noise effect screening distances identified for the noise analysis, there would be 7,937 acres of residential land use (Category 2 receivers) and 100 Category 3 noise-sensitive receivers. Within the vibration effect screening distances identified for the vibration analysis, there would be 8,686 acres of residential land use (Category 2 receivers) and 32 Category 3 vibration-sensitive receivers. Long stretches of the alignment are located on rural land, with noise- and vibration-sensitive receivers and land uses at sparsely scattered locations. The intensity of effects in these areas would be very low. However, throughout the C4A alignment, there are also areas with densely developed cities, which include concentrations of sensitive noise and vibration receivers. These factors, along with the presence of existing highways and railroad corridors, elevate the intensity of effects to a moderate level.

3.3.4.4.2 Alternative C4A High-Speed Rail

Within the noise effect screening distances identified for the noise analysis, there would be 19,466 acres of residential land use (Category 2 receivers) and 227 Category 3 noise-sensitive receivers. Within the vibration effect screening distances identified for the vibration analysis, there would be 11,919 acres of residential land use (Category 2 receivers) and 39 Category 3 vibration-sensitive receivers. As referenced above, the high-speed rail alternatives would have a higher potential for effects on noise- and vibration-sensitive land uses than the higher-speed rail alternatives. Additionally, and similar to Alternative C4A Higher-Speed Rail, Alternative C4A High-Speed Rail includes a range of both rural and densely developed lands, including noise- and vibration-sensitive receivers, along the alignment. Based on these conditions, Alternative C4A High-Speed Rail would result in a moderate intensity effect.

3.3.4.4.3 Alternative C4B Higher-Speed Rail

Within the noise effect screening distances identified for the noise analysis, there would be 6,560 acres of residential land use (Category 2 receivers) and 81 Category 3 noise-sensitive receivers. Within the vibration effect screening distances identified for the vibration analysis, there would be 6,917 acres of residential land use (Category 2 receivers) and 26 Category 3 vibration-sensitive receivers. Long stretches of the alignment are located on rural land, with noise- and vibration-sensitive receivers and land uses at sparsely scattered locations. The intensity of effects in these areas would be very low, and therefore, negligible.

3.3.4.4.4 Alternative C4B High-Speed Rail

Within the noise effect screening distances identified for the noise analysis, there would be 15,549 acres of residential land use (Category 2 receivers) and 179 Category 3 noise-sensitive receivers. Within the vibration effect screening distances identified for the vibration analysis, there would be 9,566 acres of residential land use (Category 2 receivers) and 35 Category 3 vibration-sensitive receivers. As referenced above, the high-speed rail alternatives would have a higher potential for effects on noise- and vibration-sensitive land uses than the higher-speed rail alternatives. Additionally, and similar to Alternative C4B Higher-Speed Rail, Alternative C4B High-Speed Rail is primarily made up of low-density, rural lands, including noise- and vibration-sensitive receivers, along the alignment. Based on these conditions, Alternative C4B High-Speed Rail would result in a negligible intensity effect.

3.3.4.4.5 Alternative C4C Higher-Speed Rail

Within the noise effect screening distances identified for the noise analysis, there would be 9,284 acres of residential land use (Category 2 receivers) and 110 Category 3 noise-sensitive receivers. Within the vibration effect screening distances identified for the vibration analysis, there would be 9,019 acres of residential land use (Category 2 receivers) and 37 Category 3 vibration-sensitive receivers. Long stretches of the alignment are located in rural farmland, with noise- and vibration-sensitive receivers and land uses at sparsely scattered locations. The intensity effects in these areas would be very low. However, throughout the corridor, there are existing highway and railroad corridors, elevating the intensity of effects to a moderate level.

3.3.4.4.6 Alternative C4C High-Speed Rail

Within the noise effect screening distances identified for the noise analysis, there would be 22,799 acres of residential land use (Category 2 receivers) and 256 Category 3 noise-sensitive receivers. Within the vibration effect screening distances identified for the vibration analysis, there would be 12,387 acres of residential land use (Category 2 receivers) and 44 Category 3 vibration-sensitive receivers. As referenced above, the high-speed rail alternatives would have a higher potential for effects on noise- and vibration-sensitive land uses than the higher-speed rail alternatives. Additionally, and similar to Alternative C4C Higher-Speed Rail, Alternative C4C High-Speed Rail is primarily rural, with existing highways and railroad corridors along the alignment. Based on these conditions, Alternative C4C High-Speed Rail would result in a moderate intensity effect.

3.3.4.5 Southern Section: San Antonio to South Texas

Of the Southern Section alternatives, Alternative S4 Higher-Speed Rail would have the greatest potential for effects on noise-sensitive and vibration-sensitive land uses, and Alternative S6 Higher-Speed Rail would have the least potential for effects, as shown in Tables 3.3-11 and 3.3-12.

3.3.4.5.1 Alternative S4 Higher-Speed Rail

Within the noise effect screening distances identified for the noise analysis, there would be 8,753 acres of residential land use (Category 2 receivers) and 62 Category 3 noise-sensitive receivers. Within the vibration effect screening distances identified for the vibration analysis, there would be 2,181 acres of residential land use (Category 2 receivers) and 17 Category 3 vibration-sensitive receivers. Alternative S4 Higher-Speed Rail would have more potential for noise and vibration effects than the other Southern Section alternatives. Long stretches of the alignment are located on low-density, suburban land, with noise- and vibration-sensitive receivers and land uses at sparsely scattered locations. The intensity effects in these areas would be very low. However, throughout the S4 alignment, there are also areas with densely developed cities, which include concentrations of sensitive noise and vibration receivers. These factors, along with the presence of existing highways and railroad corridors, elevate the intensity of effects to a moderate level.

3.3.4.5.2 Alternative S6 Higher-Speed Rail

Within the noise effect screening distances identified for the noise analysis, there would be 687 acres of residential land use (Category 2 receivers) and one Category 3 noise-sensitive receiver. Within the vibration effect screening distances identified for the vibration analysis, there would be 172 acres of residential land use (Category 2 receivers) and no Category 3 vibration-sensitive receivers. Alternative S6 Higher-Speed Rail would have less potential for noise and vibration effects than the other Southern Section alternatives.

Long stretches of the alignment are located on low-density, rural land, with noise- and vibration-sensitive receivers and land uses at sparsely scattered locations. The intensity of effects for this alternative would be negligible.

3.3.4.5.3 Alternative S6 High-Speed Rail

Within the noise effect screening distances identified for the noise analysis, there would be 1,586 acres of residential land use (Category 2 receivers) and three Category 3 noise-sensitive receivers. Within the vibration effect screening distances identified for the vibration analysis, there would be 240 acres of residential land use (Category 2 receivers) and no Category 3 noise-sensitive receivers. Alternative S6 High-Speed Rail would have more potential for noise and vibration effects than Alternative S6 Higher-Speed Rail but less potential than Alternative S4 Higher-Speed Rail.

As referenced above, the high-speed rail alternatives would have a higher potential for effects on noise- and vibration-sensitive land uses than the higher-speed rail alternatives. Additionally, and similar to Alternative S6 Higher-Speed Rail, Alternative S6 High-Speed Rail is made up primarily of rural land, including noise- and vibration-sensitive receivers, along the alignment. Long stretches of the alignment are located on low-density, rural land, with noise- and vibration-sensitive receivers and land uses at sparsely scattered locations. Based on these conditions, Alternative S6 High-Speed Rail would result in negligible intensity effects.

3.3.4.6 Summary of Potential Effects

Longer routes have more potential for effects on noise- and vibration-sensitive land uses than shorter routes because of their greater length. A new alignment would introduce noise and vibration to existing environments that do not currently have noise and vibration from rail infrastructure. However, because new alignments are generally located in rural areas with sparse development, there would be few noise- and vibration- sensitive receptors to experience the effects of increased or newly introduced noise and vibration.

Regardless of route, the high-speed rail alternatives would have greater potential for effects on noise-sensitive land uses than the higher-speed rail alternatives because noise generated by high-speed rail travels farther than the noise generated by higher-speed rail. The high-speed rail alternatives would also have more potential for vibration effects than the higher-speed rail alternatives in most cases. Tables 3.3-13 and 3.3-14 summarize the amount of sensitive land uses within the screening distances for each alternative and the potential effects.

Table 3.3-13: Summary of Noise-Sensitive Land Uses and Potential Effects

Section	Alternative	Context		Potential Intensity of Effects (Negligible, Moderate, or Substantial)
		Category 2 (acres)	Category 3 (No. of facilities)	
No Build Alternative[a]		0	0	Negligible
Northern	N4A CONV	15,395	245	Moderate
Central	C4A HrSR	7,937	100	Moderate
	C4A HSR	19,466	227	Moderate

Section	Alternative	Context		Potential Intensity of Effects (Negligible, Moderate, or Substantial)
		Category 2 (acres)	Category 3 (No. of facilities)	
	C4B HrSR	6,560	81	Negligible
	C4B HSR	15,549	179	Negligible
	C4C HrSR	9,284	110	Moderate
	C4C HSR	22,799	256	Moderate
Southern	S4 HrSR	8,753	62	Moderate
	S6 HrSR	687	1	Negligible
	S6 HSR	1,586	3	Negligible

[a] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

Table 3.3-14: Summary of Vibration-Sensitive Land Uses and Potential Effects

Section	Alternative	Context			Potential Intensity of Effects (Negligible, Moderate, or Substantial)
		Category 1 (Conventional Rail Only)	Category 2 (acres)	Category 3 (No. of facilities)	
No Build Alternative[a]			0	0	Negligible
Northern	N4A CONV	1	11,247	24	Moderate
Central	C4A HrSR	N/A	8,686	32	Moderate
	C4A HSR	N/A	11,919	39	Moderate
	C4B HrSR	N/A	6,917	26	Negligible
	C4B HSR	N/A	9,566	35	Negligible
	C4C HrSR	N/A	9,019	37	Moderate
	C4C HSR	N/A	12,387	44	Moderate
Southern	S4 HrSR	N/A	2,181	17	Moderate
	S6 HrSR	N/A	172	0	Negligible
	S6 HSR	N/A	240	0	Negligible

Section	Alternative	Context			Potential Intensity of Effects (Negligible, Moderate, or Substantial)
		Category 1 (Conventional Rail Only)	Category 2 (acres)	Category 3 (No. of facilities)	

[a] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.
N/A = not available

3.3.5 Avoidance, Minimization, and Mitigation Strategies

At the service level, detailed avoidance, minimization, or mitigation measures are only presented as proposed strategies. Some future rail traffic noise levels within the EIS Study Area have the potential to approach or exceed the noise abatement criteria and would require noise abatement consideration. These strategies will be developed to reduce noise and vibration for affected communities.

Generally, the most practical strategy to avoid or reduce direct noise effects in route corridors would be to locate the alignment far away from noise-sensitive receivers. If effects cannot be avoided or minimized, mitigation strategies would be implemented at the project level. The most practical noise mitigation strategy would be the construction of noise barriers, including sound walls and vegetative buffers. In some areas, topography may reduce the effectiveness of noise barriers (e.g., where receivers are higher than the track).

Measures to avoid and minimize effects on noise would include, but not be limited to, the following:

- Construction of noise barriers
- Alteration of property rights for construction of noise barriers
- Acquisition of undeveloped land for buffer zones
- Noise berms
- Creation of noise buffer areas
- Noise insulation of buildings
- Adjustment of vertical and horizontal alignments

Measures to mitigate noise effects would include, but would not be limited to, the following:

- Evaluate potential operational controls, such as reducing train horn noise in compliance with the Quiet Zone requirements in FRA's whistle ban regulation in the Train Horn Rule (49 CFR 222).
- During construction, require noise control measures to ensure compliance with all federal and local guidelines and noise limits.

Measures to avoid vibration effects may include, but would not be limited to, the use of design features such as thick slabs in tunnels and floating slabs or rail ties. If effects cannot be avoided or minimized, mitigation strategies would be implemented at the project level. Measures to mitigate vibration effects may include, but would not be limited to, the following:

- Select and use equipment and construction techniques that produce the least vibration.
- Use operational controls, such as restricting vibration-inducing activities to locations that have no potentially affected receivers or restricting vibration-inducing activities to less sensitive times of day.
- Use highly resilient rail fasteners which fasten the rail line to the rail tie and reduces vibration.

Future project-specific noise analysis will determine where noise barriers or other techniques would be an effective mitigation strategy.

3.3.6 Subsequent Analysis

A more comprehensive noise and vibration analysis will be performed during project-level studies. Specifically, background noise level data will be collected and the Detailed Noise and Vibration Analysis procedures outlined in the *High Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012) will be used to predict noise and vibration levels specific to each subsequent higher-speed and high-speed project, allowing for site-specific effect evaluations and mitigations. The *Transit Noise and Vibration Impact Assessment* (FTA 2006) procedures will be used to predict noise and vibration levels specific to each conventional speed project. The detailed analysis for both noise and vibration will use more precise methods than the initial assessment procedures performed for this service-level EIS to account for variations in vertical and horizontal geometry, ground absorption, shielding, and equipment used during construction and operations. The added detail will provide more accurate predictions for both noise and ground-borne vibrations, and when necessary, for evaluation of avoidance, minimization, and mitigation measures.

3.4 Solid Waste Disposal

This section identifies solid waste management practices and solid waste management facilities within or serving the environmental impact statement (EIS) Study Area. Potential effects on waste handling and disposal from the alternatives are also assessed in this section. The introduction to Chapter 3 describes the EIS Study Area and use of terms such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.4.1 Laws, Regulations, and Orders

Applicable federal and state laws and regulations pertaining to solid waste disposal within the EIS Study Area are listed and described below. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.4.1.1 Federal

- U.S. Environmental Protection Agency and other Federal Laws and Regulations (including the Toxic Substances Control Act and Hazardous and Solid Wastes Amendments of 1984 as defined in 40 Code of Federal Regulations). Provide rules and requirements related to the regulation of solid wastes.

3.4.1.2 State

- Oklahoma Solid Waste Management Act, 27A Oklahoma Statutes Annotated 2-10-101 to 2-10-1001. Provides rules for the permitting, construction, operation, and closure of solid waste disposal sites.
- Oklahoma Administrative Code 252:515. Provides authority and applicability to the Oklahoma Solid Waste Management Act, applicable to landfills, landfill operations, and solid waste collection and transport.
- Oklahoma Administrative Code 252:515-19-34. Specifies limits on the number of tons that landfills can accept per day (with exceptions).
- Solid Waste Disposal Act, Texas Health and Safety Code 361.001 to 361.912. Outlines the state's policies to safeguard the health, welfare, and physical property of people and to protect the environment by controlling the management of solid waste, including accounting for hazardous waste that is generated.

3.4.2 Methodology

The methodology for this evaluation consists of a combination of qualitative and quantitative assessments. The specific volume of solid waste generated by the alternatives is not known at this service-level EIS. A qualitative assessment was used for general comparisons of the alternatives when discussing solid waste issues or other issues that require a more detailed approach than what is warranted for this document. General conclusions are generated to support the relative change in effects among the alternatives. The No Build Alternative is the primary basis of comparison. The intensity of an effect as a result of the route alternatives, based on a general comparison between them and the No Build Alternative, is characterized as negligible, moderate, or substantial, compared with the No Build Alternative. For solid waste, these terms are defined as follows:

- Negligible intensity effects would result if only limited quantities of solid waste are added to a landfill, which would result in a minor decrease to the remaining capacity (measured in tons) that can be accepted at a solid waste facility.
- Moderate intensity effects are those that would result if quantities of solid waste added to a landfill would result in a moderate decrease to the remaining capacity (measured in tons) that can be accepted at a solid waste facility.
- Substantial intensity effects are those that would result if the remaining capacity (measured in tons) for which the solid waste facility is permitted for is reached.

In addition to the effects listed above, changes to the collection, transport, and disposal of solid waste could occur. The potential for — and the effect of — these changes will be included in project-level assessments.

Direct physical effects on a landfill facility as the result of an alternative located on or near the landfill would be a substantial intensity effect. The presence of landfills within the EIS Study Area is included in the following analysis; however, the alignments have not been finalized for this service-level EIS. Potential direct effects on and from landfills located within the EIS Study Area will be further evaluated during project-level analysis.

For the quantitative assessment, available solid waste information was used to assess the magnitude of the effect. To evaluate the quantitative effects on solid waste from the alternatives, the following activities were conducted:

- Identification and evaluation of the municipalities within the EIS Study Area that either manage their own solid waste collection program or contract with a private enterprise to manage a program for the municipality.
- Identification and evaluation of solid waste facilities, facility acceptance practices, and potential effects on waste handling from alternative routes.
- Identification and evaluation of areas where further analysis would be necessary during the project-level National Environmental Policy Act (NEPA) process.

3.4.3 Affected Environment

The EIS Study Area for solid waste disposal is delineated by the counties intersected by or immediately adjacent to the 850-mile north-south corridor that have landfills which may potentially accept municipal solid waste or construction and demolition debris generated from construction of the alternatives. Within the Northern Section, five counties in Oklahoma and five counties in Texas have landfills that would potentially serve the Program. Within the Central Section, 13 counties in

Texas have landfills that would potentially serve the Program. Within the Southern Section, 12 counties in Texas have landfills that would potentially serve the Program.

Counties in which the EIS Study Area is located collect solid waste using private enterprises, or they operate their own solid waste collection program. These programs have a collection and disposal system typically using household trash cans and commercial dumpsters emptied into carts or trucks that deliver the solid waste to municipal landfills or sorting centers. Based on the type of waste, the waste is taken to a landfill or recycling facility. Solid waste containing asbestos or waste determined to contain nonhazardous industrial waste may only be disposed of at landfills permitted to receive this type of waste (Texas Commission on Environmental Quality [TCEQ] 2013a, 2014).

Fifty-eight landfills, identified in the following sections, would be potentially available within the EIS Study Area to receive solid waste generated from the Program. Additionally, landfills located outside the EIS Study Area have available capacity that could be used for solid waste and construction debris.

3.4.3.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Sixteen landfills were identified within the Northern Section and are listed in Table 3.4-1. No active solid waste landfills were identified within the EIS Study Area of Alternative N4A.

Table 3.4-1: Waste Management Facilities in the Northern Section

County, State	Landfill[a, b]	Landfill Type[c]	2012 Tons[d]	Remaining Tons[e]	Remaining Years (Permitted)[b, e]
Alternative N4A					
Oklahoma County, OK	Oklahoma Landfill	1	549,606	332,770	0.4
Oklahoma County, OK	SE Oklahoma City Landfill	1	499,460	1,216,312	1.2
Oklahoma County, OK	East Oak Sanitary Landfill	1	525,451	3,104,168	4.3
Oklahoma County, OK	NE Landfill	4	190,552	94,964	0.4
Canadian County, OK	OEMA Landfill	1	77,650	298,348	3.51
McClain County, OK	Newcastle Landfill (Pinecrest)	1	94	149,741	1,194
Garvin County, OK	Pauls Valley Landfill	1	47,778	117,205	1.98

County, State	Landfill[a, b]	Landfill Type[c]	2012 Tons[d]	Remaining Tons[e]	Remaining Years (Permitted)[b, e]
Carter County, OK	Southern Oklahoma Regional Disposal Landfill	1	177,451	886,908	4.33
Grayson County, TX	Hillside Landfill	1	62,523	6,079,993	98
Grayson County, TX	TASWA Disposal and Recycling Facility	1	123,973	10,775,291	87
Denton County, TX	DFW Landfill	1	1,181,857	12,333,874	10
Denton County, TX	Camelot Landfill	1	334,866	6,899,000	21
Denton County, TX	City of Denton Landfill	1	166,022	6,411,924	39
Collin County, TX	121 Regional Disposal Facility	1	723,856	76,580,210	106
Hunt County, TX	Republic Maloy Landfill	1	96,622	4,935,598	51
Parker County, TX	IESI Weatherford Landfill	1	174,782	1,875,161	11

[a] Oklahoma Department of Environmental Quality (ODEQ) (2014a).

[b] TCEQ (2013b).

[c] Description of landfill types: Type 1 facilities are for disposal of municipal solid waste. Type 4 facilities accept only brush, construction and debris waste, and other similar waste that will not putrefy.

[d] ODEQ (2014b).

[e] ODEQ (2014c).

3.4.3.2 *Central Section: Dallas and Fort Worth to San Antonio*

Twenty-five landfills were identified within the Central Section and are listed in Table 3.4-2. One active solid waste landfill (Turkey Creek Landfill) was identified within the EIS Study Area of Alternatives C4A, C4B, and C4C. The location of the Turkey Creek Landfill is shown on Figure 3.4-1.

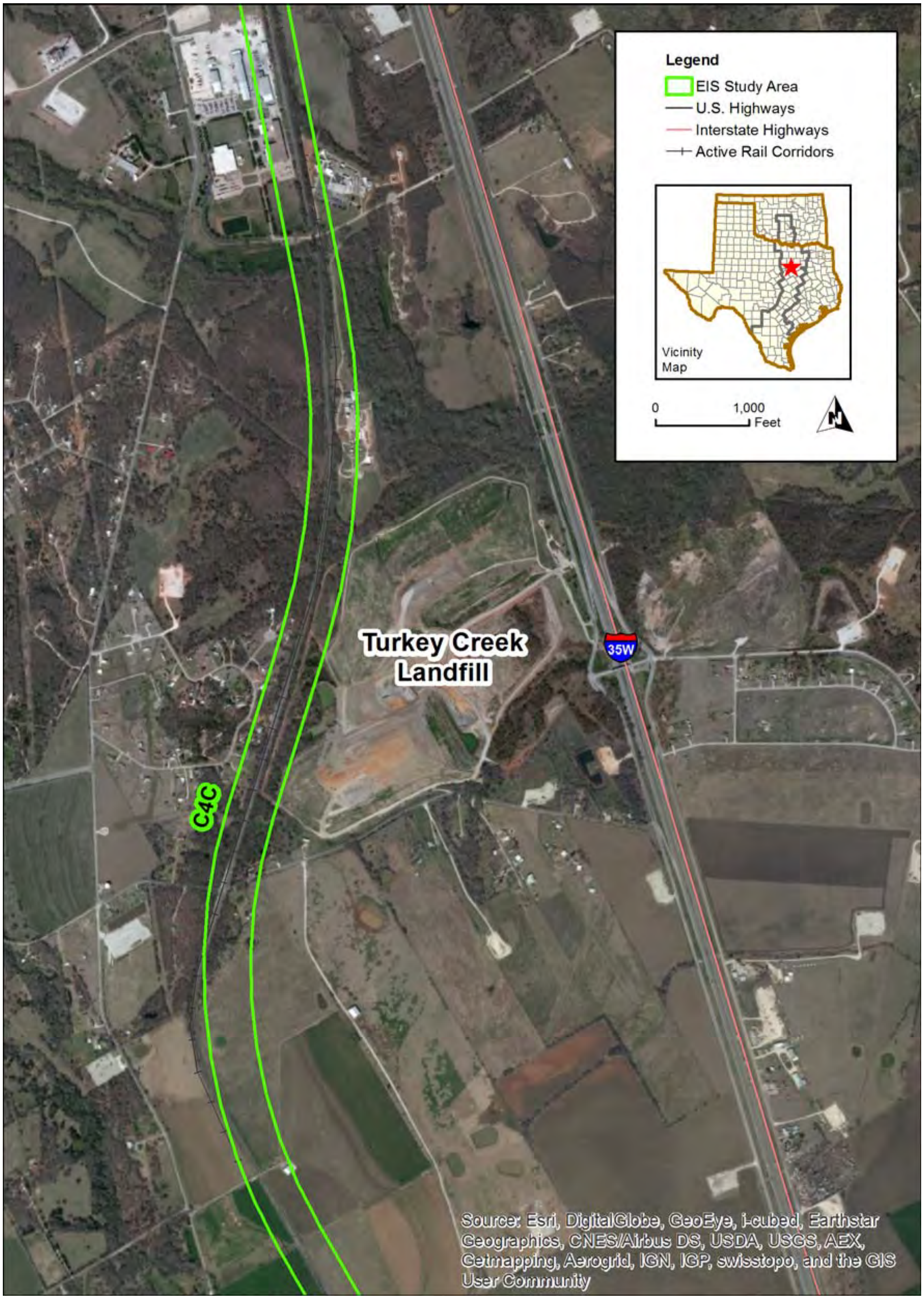

Figure 3.4-1: Turkey Creek Landfill

Three landfills within the EIS Study Area for the Central Section are designated as closed and are therefore not listed in Table 3.4-2: City of Abbott Landfill, City of Austin Landfill, and Guadalupe County Precinct 1 Landfill. These three landfills are discussed in Section 3.16, Public Safety and Hazardous Materials.

Table 3.4-2: Waste Management Facilities in the Central Section

County, State	Landfill[a, b]	Landfill Type[c]	2012 Tons[d]	Remaining Tons[e]	Remaining Years (Permitted)[b, e]
Alternatives C4A, C4B, and C4C					
Tarrant County, TX	Southeast Landfill	1	499,311	12,944	24
Tarrant County, TX	Arlington Landfill	1	811,062	11,101,100	14
Tarrant County, TX	IESI Fort Worth C&D Landfill	4	358,922	3,892,951	11
Dallas County, TX	McCommas Bluff Landfill	1	1,419,508	67,806,589	48
Dallas County, TX	City of Grand Prairie Landfill	1	164,031	11,687,758	50
Dallas County, TX	Hunter Ferrell Landfill	1	164,693	10,758,677	65
Dallas County, TX	City of Garland Charles M Hinton Jr Landfill	1	358,201	18,068,616	51
Johnson County, TX	City of Cleburne Landfill	1	544	12,944	24
Johnson County, TX	Turkey Creek Landfill[f]	1	437,480	7,864,481	18
Ellis County, TX	Skyline Landfill	1	1,056,230	23,684,880	24
Ellis County, TX	CSC Disposal and Landfill	1	11,344	19,231,334	1,695
Ellis County, TX	ECD Landfill	1	60,451	32,499,604	538
Hill County, TX	Itasca Landfill	1	291,734	46,794,663	160
Navaro County, TX	Corsicana Regional Landfill	1	106,226	12,067,259	115

County, State	Landfill[a, b]	Landfill Type[c]	2012 Tons[d]	Remaining Tons[e]	Remaining Years (Permitted)[b, e]
Coryell County, TX	Fort Hood Landfill	1	22,851	1,631,348	34
McLennan County, TX	City of Waco Landfill	1	250,591	3,234,470	13
McLennan County, TX	Lacy Lakeview Recycling & Disposal Facility	1	110,388	1,005,454	8
Bell County, TX	Temple Recycling & Disposal Facility	1	356,652	6,317,245	15
Williamson County, TX	Williamson County Recycling & Disposal Facility	1	249,158	40,588,678	120
Travis County, TX	Austin Community Recycling & Disposal Facility	1	318,721	8,127,194	19
Travis County, TX	BFI Sunset Farms Landfill	1	600,393	5,763,778	4
Travis County, TX	IESI Travis County C&D Landfill	4	139,861	1,720,920	12
Travis County, TX	Texas Disposal Systems Landfill	1	641,120	17,629,696	28
Guadalupe County, TX	Beck Landfill	4	195,418	4,469,776	20
Bexar County, TX	Tessman Road Landfill	1	887,507	53,645,904	65

[a] ODEQ (2014a).
[b] TCEQ (2013b).
[c] Description of landfill types: Type 1 facilities are for disposal of municipal solid waste. Type 4 facilities accept only brush, construction and debris waste, and other similar waste that will not putrefy.
[d] ODEQ (2014b).
[e] ODEQ (2014c).
[f] Turkey Creek Landfill is within 250 feet of the EIS Study Area of Alternatives C4A, C4B, and C4C.

3.4.3.3 Southern Section: San Antonio to South Texas

Seventeen landfills were identified within the EIS Study Area for the Southern Section and are listed in Table 3.4-3. Within the EIS Study Area of Route Alternative S4, the Jim Wells Landfill is designated as closed and is therefore not listed in Table 3.4-3. This landfill is discussed in Section 3.16, Public Safety and Hazardous Materials.

Table 3.4-3: Waste Management Facilities in the Southern Section

County, State	Landfill[a, b]	Landfill Type[c]	2012 Tons[d]	Remaining Tons[e]	Remaining Years (Permitted)[b, e]
Route Alternative S4					
Bexar County, TX	Covel Gardens Landfill	1	1,281,988	76,286,525	88
McMullen County, TX	McMullen County Landfill	1	500	5,250	11
Duval County, TX	Duval County Landfill	4	7,317	19,404	5
Jim Wells County, TX	City of Alice Landfill	1	40,495	642,926	16
Nueces County, TX	El Centro Landfill	1	174,000	9,965,235	57
Nueces County, TX	Cefe Valenzuela Landfill	1	443,424	74,522,109	96
Nueces County, TX	Gulley Hurst	4	7,013	3,870,253	50
Zapata County, TX	San Ygnacio Landfill	1, 4	2,503	157,744	30
Brooks County, TX	Brooks County Landfill	4	253	59,992	29
Kleberg County, TX	City of Kingsville Landfill	1	31,461	1,414,284	48
Star County, TX	City of Roma Landfill	1	4,137	30,969	7
Hidalgo County, TX	Edinburg Regional Sanitary Landfill	1	402,228	4,943,428	11

County, State	Landfill[a, b]	Landfill Type[c]	2012 Tons[d]	Remaining Tons[e]	Remaining Years (Permitted)[b, e]
Hidalgo County, TX	Precinct 3 – Penitas Landfill	1	4,309	47,259	5
Hidalgo County, TX	BFI-Rio Grande Valley Landfill	1	369,980	346,789	1
Hidalgo County, TX	Edinburg Regional Type IV Landfill	4	100,046	5,145,701	35
Cameron County, TX	Brownsville MSW Landfill	1	256,164	17,154,690	40
Route Alternative S6					
Bexar County, TX	Covel Gardens Landfill	1	1,281,988	76,286,525	88
Webb County, TX	City of Laredo Sanitary Landfill	1	334,502	3,602,176	11

[a] ODEQ (2014a).
[b] TCEQ (2013b).
[c] Description of landfill types: Type 1 facilities are for disposal of municipal solid waste. Type 4 facilities accept only brush, construction and debris waste, and other similar waste that will not putrefy.
[d] ODEQ (2014b).
[e] ODEQ (2014c).

3.4.4 Environmental Consequences

3.4.4.1 Overview

Solid waste created during construction and demolition typically consists of asphalt, concrete, and metal rebar associated with roadway removal, culvert removal, and bridge renovations. The landfills that would receive the construction and demolition material from the Program have not been identified. Each landfill has specific permit requirements regarding the acceptance of wastes and construction and demolition material, and quantities of waste accepted each day that may influence the selection of disposal sites.

Effects on solid waste disposal facilities are discussed with the understanding that some alternatives within the Northern, Central, and Southern sections could be built alone or combined with other routes. More than one alternative in the Central or Southern sections could be built in the future because the alternatives provide different service types for different destinations. Details on connecting the alternatives would be determined during the project-level analysis.

Because of the variability in construction possibilities and the lack of detail, this analysis does not provide a summary of effects for the entire route from Oklahoma City to Laredo/Brownsville. Rather, this analysis provides information about each alternative compared with the No Build Alternative and, as appropriate, compared with another alternative for that same section.

The specific locations of proposed stations are not addressed in this service-level EIS. However, based on the cities and communities where construction of stations is being considered programmatically, potential effects on solid waste facilities may be assessed based on whether a station would be in an urbanized, suburban, or rural/unimproved area.

Potential effects on solid waste facilities and solid waste handling from implementation of the alternatives within the Northern, Central, and Southern sections are described below.

3.4.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect solid waste disposal facilities.

3.4.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.4.4.3.1 Alternative N4A Conventional

Alternative N4A Conventional would not substantially affect the landfills within the EIS Study Area because this alternative would implement conventional rail using existing railroad facilities and/or corridors, thereby generating a limited amount of solid waste from construction or demolition activities. Solid waste generated would be limited to construction and demolition debris typically associated with roadway removal, culvert removal, and bridge renovations. The potential for building demolitions would be determined and evaluated during project-level assessments.

Stations in the Northern Section would be constructed in suburban or urban areas. If existing stations require extensive renovation, the amount of solid waste generated would be equivalent to or potentially greater than the solid waste generated from the construction of a new station.

Although the quantity of solid waste generated cannot be determined for this service-level EIS, 16 landfills within the Northern Section have a combined average remaining landfill capacity of 8,255,717 tons and an average combined remaining capacity of 102 years. Therefore, Alternative N4A would have a negligible effect on the landfills within the Northern Section compared with the No Build Alternative.

As discussed in Section 3.16, Public Safety and Hazardous Materials, construction would potentially generate hazardous waste consisting of welding materials, fuel and lubricant containers, paint and solvent containers, unused chemicals, and cement curing products containing strong basic or acidic chemicals. Demolition of older buildings, if required, could also generate hazardous waste, such as asbestos-containing materials, polychlorinated biphenyl-containing oil or equipment, and lead-based paint. The designated contractors for the Program would handle, store, and dispose of hazardous waste in accordance with applicable requirements, including the Resource Conservation and Recovery Act and local and state regulations. Properly licensed transport companies permitted to transport hazardous waste would deliver the waste to an appropriately permitted treatment, storage, disposal, or recycling facility. Generated wastes would be handled and disposed of in accordance with all applicable requirements; therefore, the effect would be negligible. Operations and maintenance of Alternative N4A would generate minor amounts of solid waste from passenger refuse disposal and materials used for maintenance activities. Because these operations and maintenance activities would generate small amounts of waste, effects would be negligible on the landfills within the Northern Section, compared with the No Build Alternative.

3.4.4.4 Central Section: Dallas and Fort Worth to San Antonio

Each alternative in the Central Section has a higher-speed rail and a high-speed rail service type. Compared with conventional rail, higher-speed and high-speed rail both increase the potential for generating solid waste from construction and demolition activities associated with grade-separated crossings, new track next to existing rail, or new track and stations outside existing transportation corridors. Construction- and demolition-generated solid waste can result from clearing of vegetation, removal of existing asphalt and gravel, and demolition of existing structures. In addition, stations in the Central Section would be constructed in suburban or urban areas. If existing stations require extensive renovation, the amount of solid waste generated would be equivalent to or potentially greater than the solid waste generated from the construction of a new station.

3.4.4.4.1 Alternative C4A Higher-Speed Rail

Because of its higher-speed service type, Alternative C4A Higher-Speed Rail has an increased potential for generating solid waste from construction and demolition activities associated with grade-separated crossings, new track next to existing rail, or new track and stations outside existing transportation corridors, compared with conventional rail and the No Build Alternative. The potential for construction to generate hazardous waste would be the same as for Alternative N4A Conventional and the effect would be negligible.

Operations and maintenance of Alternative C4A Higher-Speed Rail would generate solid waste from passenger refuse disposal and materials used for maintenance activities. Because operations and maintenance activities would generate small amounts of waste, effects would be negligible on the landfills within the EIS Study Area compared with the No Build Alternative.

Although the quantity of solid waste generated cannot be determined for this service-level EIS, 25 landfills within the EIS Study Area for the Alternative C4A have a combined average remaining landfill capacity of 16,384,731 tons and an average combined remaining capacity of 127 years. Therefore, Alternative C4A would have a negligible effect on the landfills within the EIS Study Area.

One active solid waste landfill (Turkey Creek Landfill), shown on Figure 3.4-1, was identified within the EIS Study Area for Alternative C4A. Because this a service-level EIS, the alignments have not been finalized; potential impacts on and from this landfill would be further evaluated during project-level analysis.

There are three closed landfills within the EIS Study Area of this alternative: City of Abbott Landfill, City of Austin Landfill, and Guadalupe County Precinct 1 Landfill. Potential effects on these landfills are discussed in Section 3.16, Public Safety and Hazardous Materials.

3.4.4.4.2 Alternative C4A High-Speed Rail

The potential effects on solid waste handling and disposal during construction and operation of Alternative C4A High-Speed Rail would be the same as described in Section 3.4.4.4.1 for Alternative C4A Higher-Speed Rail. Because of its high-speed service type, Alternative C4A High-Speed Rail has an increased potential for generating solid waste from construction and demolition activities associated with grade-separated crossings, new track next to existing rail, or new track and stations outside existing transportation corridors, compared with conventional rail, higher speed rail, and the No Build Alternative. The permitted landfill capacity and operational duration described above would accommodate solid wastes generated from construction and operation of Alternative C4A High-Speed Rail and the effect would be negligible.

3.4.4.4.3 Alternative C4B Higher-Speed Rail

The potential effects on solid waste handling and disposal during construction and operation of Alternative C4B Higher-Speed Rail would be the same as described in Section 3.4.4.4.1 for Alternative C4A Higher-Speed Rail. Because of its higher-speed service type, Alternative C4B Higher-Speed Rail has an increased potential for generating solid waste from construction and demolition activities associated with grade-separated crossings, new track next to existing rail, or new track and stations outside existing transportation corridors, compared with conventional rail and the No Build Alternative. The permitted landfill capacity and operational duration described in Section 3.4.4.4.1 would accommodate solid wastes generated from construction and operation of Alternative C4B Higher-Speed Rail and the effect would be negligible.

3.4.4.4.4 Alternative C4B High-Speed Rail

The potential effects on solid waste handling and disposal during construction and operation of Alternative C4B High-Speed Rail would be the same as described in Section 3.4.4.4.1 for Alternative C4A Higher-Speed Rail. Because of its high-speed service type, Alternative C4B High-Speed Rail has an increased potential for generating solid waste from construction and demolition activities associated with grade-separated crossings, new track next to existing rail, or new track and stations outside existing transportation corridors, compared with conventional rail, higher speed rail, and the No Build Alternative. The permitted landfill capacity and operational duration described above would accommodate solid wastes generated from construction and operation of Alternative C4B High-Speed Rail and the effect would be negligible.

3.4.4.4.5 Alternative C4C Higher-Speed Rail

The potential effects on solid waste handling and disposal during construction and operation of Alternative C4C Higher-Speed Rail would be the same as described in Section 3.4.4.4.1 for Alternative C4A Higher-Speed Rail. Because of its higher-speed service type, Alternative C4C Higher-Speed Rail has an increased potential for generating solid waste from construction and demolition activities associated with grade-separated crossings, new track next to existing rail, or new track and stations outside existing transportation corridors, compared with conventional rail and the No Build Alternative. The permitted landfill capacity and operational duration described in Section 3.4.4.4.1 would accommodate solid wastes generated from construction and operation of Alternative C4C Higher-Speed Rail and the effect would be negligible.

3.4.4.4.6 Alternative C4C High-Speed Rail

The potential effects on solid waste handling and disposal during construction and operation of Alternative C4C High-Speed Rail would be the same as described in Section 3.4.4.4.1 for Alternative C4A Higher-Speed Rail. Because of its high-speed service type, Alternative C4C High-Speed Rail has an increased potential for generating solid waste from construction and demolition activities associated with grade-separated crossings, new track next to existing rail, or new track and stations outside existing transportation corridors, compared with conventional rail, higher speed rail, and the No Build Alternative. The permitted landfill capacity and operational duration described above would accommodate solid wastes generated from construction and operation of Alternative C4C High-Speed Rail and the effect would be negligible.

3.4.4.5 Southern Section: San Antonio to South Texas

The route alternatives in the Southern Section include the S4 route alternative, which is proposed as a higher-speed rail option, and the S6 route alternative, which is proposed as a higher-speed rail and a high-speed rail alternative. Compared with conventional rail, higher-speed and high-speed rail both increase the potential for generating solid waste from construction and demolition activities associated with grade-separated crossings, new track next to existing rail, or new track and stations outside existing transportation corridors. Solid waste created during these activities would be construction and demolition debris, which typically consists of asphalt, concrete, and metal rebar associated with roadway removal, culvert removal, and bridge renovations. In addition, stations in the Southern Section would be constructed in suburban, urban areas, or areas outside of existing transportation corridors. If existing stations require extensive renovation, the amount of solid waste generated would be equivalent to or potentially greater than the solid waste generated from the construction of a new station.

3.4.4.5.1 Alternative S4 Higher-Speed Rail

As described above and because of its higher-speed service type, Alternative S4 Higher-Speed Rail would have an increased potential for generating solid waste from construction and demolition activities compared with conventional rail and the No Build Alternative.

Although the quantity of solid waste generated cannot be determined for this service-level EIS, Sixteen landfills within the EIS Study Area for Alternative S4 have a combined average remaining landfill capacity of 12,163,285 tons and an average combined remaining capacity of 33 years. Therefore, Alternative S4 would have a negligible effect on the landfills within the Southern Section compared with the No Build Alternative.

As discussed previously, the closed Jim Wells Landfill is within the EIS Study Area for Alternative S4 Higher-Speed Rail. Potential effects on this landfill are discussed in Section 3.16, Public Safety and Hazardous Materials.

The potential for construction to generate hazardous waste would be the same as for Alternative N4A.

Operations and maintenance of Alternative S4 Higher-Speed Rail would generate solid waste from passenger refuse disposal and materials used for maintenance activities. Because these operations and maintenance activities would generate small amounts of waste, effects would be negligible on the landfills within the EIS Study Area for Alternative S4.

3.4.4.5.2 Alternative S6 Higher-Speed Rail

The potential effects on solid waste handling and disposal during construction and operation of Alternative S6 Higher-Speed Rail would be the same as described in Section 3.4.4.5.1 for Alternative S4 Higher-Speed Rail. Because of its higher-speed service type, Alternative S6 Higher-Speed Rail has an increased potential for generating solid waste from construction and demolition activities associated with grade-separated crossings, new track next to existing rail, or new track and stations outside existing transportation corridors, compared with conventional rail and the No Build Alternative.

Although the quantity of solid waste generated cannot be determined for this service-level EIS, two landfills within the EIS Study Area for the S6 alternatives have a combined average remaining landfill capacity of 39,944,351 tons and an average combined remaining capacity of 50 years. Therefore, both Alternative S6 Higher-Speed Rail and S6 High-Speed Rail would have a negligible effect on the landfills within the Southern Section compared with the No Build Alternative.

3.4.4.5.3 Alternative S6 High-Speed Rail

The potential effects on solid waste handling and disposal during construction and operation of Alternative S6 High-Speed Rail would be the same as described in Section 3.4.4.5.2 for Alternative S6 Higher-Speed Rail. Because of its high-speed service type, Alternative S6 High-Speed Rail has an increased potential for generating solid waste from construction and demolition activities associated with grade-separated crossings, new track next to existing rail, or new track and stations outside existing transportation corridors, compared with conventional rail, higher-speed rail, and the No Build Alternative. The permitted landfill capacity and operational duration described above would accommodate solid wastes generated from construction and operation of Alternative S6 High-Speed Rail and the effect would be negligible.

3.4.4.6 Summary of Potential Effects

There are 58 landfills potentially available within the EIS Study Area to receive solid waste generated from the alternatives (Tables 3.4-1 through 3.4-3). Because of the larger number of counties intersected by the Central Section EIS Study Area, 25 landfills would be available to potentially accept solid waste in that section. The Northern Section has 16 landfills available to potentially accept solid waste, and the Southern Section has 17 landfills available to potentially accept solid waste. The potential intensity of effects on the 58 landfills are summarized in Table 3.4-4.

Table 3.4-4: Effects on Solid Waste Facilities

Section	Alternative[a]	Potential Landfills Available to Accept Solid Waste within EIS Study Area	Potential Intensity of Effects (Negligible, Moderate, Substantial)
No Build Alternative[b]		58	None
Northern	N4A CONV	16	Negligible
Central[c]	C4A HSR	25	Negligible
	C4A HrSR		Negligible
	C4B HSR		Negligible
	C4B HrSR		Negligible
	C4C HSR		Negligible
	C4C HrSR		Negligible
Southern[d]	S4 HrSR	16	Negligible
	S6 HSR	2	Negligible
	S6 HrSR		Negligible

[a] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

[b] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

[c] The number of landfills within the Central Section does not vary among the alternatives or between service types.

[d] The number of landfills within the Southern Section does not vary between Alternative S6 service types. One landfill in the Southern Section (Covel Gardens Landfill) would potentially be used by both Alternatives S4 and S6, so it is listed twice. However, the total number of landfills in the Southern Section is 17.

During construction, the amount of solid waste generated by Alternative N4A would be limited compared with the other build alternatives because the alternative would use existing rail corridors. Solid waste would be generated from upgrades or repairs to these rails rather than construction of new rails. Comparatively, higher-speed and high-speed rail service types may include construction of grade-separated crossings or new track next to existing rail, requiring the clearing of vegetation, removal of existing asphalt and gravel, and demolition of existing structures. These activities would generate more solid waste and construction debris than conventional rail would.

3.4.5 Avoidance, Minimization, and Mitigation Strategies

The project-level analysis following this service-level EIS would identify impacts on landfills within the EIS Study Area. Although quantifiable impacts on the landfills are not known at the service-level EIS, potential mitigation strategies can be identified that would be used in project-level analysis based on recent rail corridor projects. Avoidance and minimization of effects at the project-level would be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies would be implemented.

When considering mitigation for generation of solid waste from the alternatives, avoidance is the most effective way to minimize effects. In circumstances where the generation of solid waste cannot be avoided, the contractor would divert construction and demolition waste from landfills by reusing or recycling to reduce the amount of solid waste generated. The contractor would either segregate and/or recycle the waste at an appropriately permitted recycling facility or contract with an authorized agent to collect unsegregated waste and recycle at a permitted recycling facility in compliance with federal, state, and local regulations. Reuse and recycling of construction and demolition debris could divert much of these wastes from landfills. The landfills that would receive the construction and demolition material have not been identified. Each landfill has specific permit requirements regarding the acceptance of wastes and construction and demolition material and quantities of waste accepted each day that would influence the selection of disposal sites.

Mitigation strategies related to potential to the active Turkey Creek Landfill identified within the EIS Study Areas of the C4A, C4B, and C4C alternatives would need to be further evaluated during the project-level analysis.

3.4.6 Subsequent Analysis

During project-level assessments, impacts on landfills will be determined based on design, site-specific mapping, and identifying which landfills would potentially receive project-related solid waste or whether any active landfills are within the EIS Study Area. Additional analysis will also be conducted to determine the volume of solid waste generated based upon the selected alternative and service type.

3.5 Natural Ecological Systems and Wildlife

This section describes natural ecological systems, wildlife corridors and assemblages, and sensitive plant communities within the environmental impact statement (EIS) Study Area and assesses potential effects on these resources by the alternatives. The introduction to Chapter 3 describes the EIS Study Area and use of terms, such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.5.1 Laws, Regulations, and Orders

This service-level EIS includes a corridor-level evaluation of reported resources in proximity to the build alternatives, not a detailed evaluation of individual resources and habitats. There are no specific federal or state laws or regulations that apply to natural ecological systems and wildlife, in general. However, there are a number of federal and state legislation and regulations pertaining to threatened and endangered species. Details regarding legal and regulatory requirements pertaining to threatened and endangered species are included in Section 3.7. The potential effects on natural ecological systems and wildlife were analyzed in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code [U.S.C.] § 4321, et seq.), the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), Federal Railroad Administration (FRA) policies and procedures for considering environmental impacts, and the Texas Department of Transportation (TxDOT) *Environmental Manual* (TxDOT 2004). Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.5.2 Methodology

The methodology for this evaluation consists of using existing data to identify natural ecosystem and wildlife resources that could be present within the 500-foot EIS Study Area for each build alternative and evaluating the potential level of effect that each alternative could have if constructed. Build alternatives are compared with other alternatives within the same geographical section, as well as with the No Build Alternative. The intensity of an effect as a result of the build alternatives is characterized as negligible, moderate, or substantial compared with the No Build Alternative. For natural ecological systems and wildlife, these terms are defined as follows:

- Negligible intensity effects from construction and operations of an alternative are those that would have a slight change to natural ecological systems, wildlife corridors and assemblages and sensitive plant communities, and higher ecological importance/value land coverage areas, but are very close to the existing conditions.
- Moderate intensity effects from construction and operation of an alternative would have a noticeable effect on natural ecological systems, wildlife corridors and assemblages and sensitive plant communities, and higher ecological importance/value land coverage areas, but would not have an adverse residual effect on resources.

- Substantial intensity effects would be long-term or permanent, and would have a noticeable, inevitable effect on natural ecological systems, wildlife corridors and assemblages and sensitive plant communities, and higher ecological importance/value land coverage areas within the buffer zone.

Available information, such as land use coverage, wildlife corridors and assemblages, and sensitive plant communities, was used to assess the potential magnitude or intensity of the effects. To evaluate the potential effects on natural ecological systems and wildlife from construction and operation of the alternatives, the following acreages were quantified:

- **Acreage of National Land Cover Database (NLCD) 2011 land cover types.** Potential effects of each build alternative were determined using NLCD 2011 data by comparing acreages of developed land covers (low, medium, and high intensity and open space) with non-developed land covers (crops, forests, wetlands, pasture, etc.) within the EIS Study Area. The NLCD is created through a cooperative project by the Multi-Resolution Land Characteristics (MRLC) Consortium.
- **Acreage of potential wildlife corridors and assemblages and sensitive plant communities.** Potential effects of each build alternative were determined using acreages of wildlife corridors and assemblages and sensitive plant communities within the EIS Study Area.

To determine the locations of ecologically sensitive areas within the EIS Study Area and to analyze the overall potential effects of each build alternative on this resource, the U.S. Environmental Protection Agency (EPA) Regional Ecological Assessment Protocol (REAP) methodology was used. This methodology is a screening-level, rapid assessment tool that uses existing data to assess ecoregions in the five states in EPA Region 6 (Arkansas, Louisiana, New Mexico, Oklahoma, and Texas). Characteristics assessed in REAP include land cover, contiguous size of undeveloped area, vegetation rarity, natural heritage rank, taxonomic richness, rare species richness, regularity of ecosystem boundaries, waterway obstructions (i.e., dams), road density, water quality, and air quality (EPA 2011). REAP assigns an Ecological Importance Rank to each acre within the EIS Study Area. The REAP composite data and the three data layers (diversity, rarity, and sustainability) are designed to assess EPA Region 6 by ecoregion and to identify the optimum ecological areas for protection and mitigation based on ecological theory (no political boundaries or regulatory programs). Higher scores indicate higher ecological importance/value, which are divided into the following five groups: 1 (top 1 percent of scores), 10 (top 10 percent of scores), 25 (top 25 percent of scores), 50 (top 50 percent of scores), and 100 (all the rest of the scores). Higher scores correspond to lower REAP values (1, 10, and 25), which represent the highest ecologically important areas. REAP scores were determined to evaluate the potential quantitative effects on natural ecological systems and wildlife using a similar basis of comparison across the alternatives.

3.5.3 Affected Environment

The Texas-Oklahoma Passenger Rail Program (Program) corridor spans 850 miles, from central Oklahoma to south Texas. Therefore, the alternatives are spread across a broad geographic area with typical weather patterns that include semi-arid, humid subtropical, and modified subtropical conditions. The EIS Study Area generally lies along low-elevation basins and valleys associated with the Great Plains in the north and with the Coastal Plains in the south. Land cover types within the EIS Study Area include developed, vegetated with open grasslands, agricultural, shrubland, and forests.

In general, the climate in the Study Vicinity is characterized by a regime of moderate to hot summer drought and winter rain. Winter rain results from low-pressure depressions associated with Pacific and Arctic fronts (University of Oklahoma 2014; Texas Climate Data 2014). In the Northern Section, annual precipitation averages 48 inches near Oklahoma City to 37 inches near Dallas and Fort Worth. In the Central Section, annual precipitation averages 36 inches in Waco to 34 inches in Austin. In the Southern Section, annual precipitation ranges from 32 inches in San Antonio to 20 inches in Laredo. Precipitation is generally rain except during winter in the Northern Section from Oklahoma to Dallas and Fort Worth where snowfall can occur. The daily high temperature ranges on average from 50 to 94 degrees Fahrenheit (°F) in the Northern Section to 67 to 100°F in the Southern Section; however, temperatures over 100°F are common in summer throughout the entire Study Vicinity (U.S. Climate Data 2014).

The NLCD is used in this analysis to describe general vegetation characteristics throughout the EIS Study Area and to compare areas of developed versus non-developed land covers. The NLCD 2011 land cover types within the EIS Study Area are defined in Table 3.5-1.

Table 3.5-1: National Land Cover Database Land Cover Types

Land Cover Type	Definition
Developed, High Intensity	Highly developed, where people reside or work in high numbers.
Developed, Medium Intensity	Mixture of constructed materials and vegetation. Impervious surfaces account for 50 to 79 percent of the total cover.
Developed, Low Intensity	Mixture of constructed materials and vegetation. Impervious surfaces account for 20 to 49 percent of total cover.
Developed, Open Space	Mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover.
Barren Land	Rock, sand, and clay. Generally, vegetation accounts for less than 15 percent of total cover.
Deciduous Forest	Dominated by trees generally greater than 5 meters tall and greater than 20 percent of total vegetation cover.
Evergreen Forest	Dominated by trees generally greater than 5 meters tall and greater than 20 percent of total vegetation cover.
Mixed Forest	Dominated by trees generally greater than 5 meters tall and greater than 20 percent of total vegetation cover.
Shrub/Scrub	Dominated by shrubs less than 5 meters tall with shrub canopy typically greater than 20 percent of total vegetation.
Grassland/Herbaceous	Dominated by gramanoid or herbaceous vegetation, generally greater than 80 percent of total vegetation.

Land Cover Type	Definition
Pasture/Hay	Grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.
Cultivated Crops	Used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and perennial woody crops, such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation.
Woody Wetlands	Forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover, and the soil or substrate is periodically saturated with or covered with water.
Emergent Herbaceous Wetlands	Perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover, and the soil or substrate is periodically saturated or covered with water.
Open Water	Open water, generally with less than 25 percent cover of vegetation or soil.
Source: Homer et al. (2015).	

Based on the *2011 Environmental Occurrences for Federal and State Listed and Tracked Threatened, Endangered, and Rare Species* spatial dataset (Michael Baker Jr., Inc. 2012), one sensitive terrestrial plant community, Little Bluestem-Indiangrass series (*Schizachyrium scoparium-sorghastrum nutans* series), is located within the EIS Study Area. The Little Bluestem-Indiangrass series plant community is an upland prairie, native tall grassland, climax plant community that contains native grasses and forbs. Much of north-central Texas was historically native prairies or savannahs. Few native prairie sites remain today, although there are extensive grasslands on many private ranches in the northern portion of the Fort Worth Prairie (Texas Parks and Wildlife Department [TPWD] 2014).

Based on the same dataset, one type of animal assemblage, identified as a “rookery,” is located within the EIS Study Area. Rookeries, or breeding grounds of colony-forming species, are important in an ecosystem as they are home to migratory and resident wading birds and shorebirds. No other natural plant communities or other significant features (e.g., bat caves, prairie dog towns) occur within the EIS Study Area.

3.5.3.1 Northern Section: Oklahoma City to Dallas and Fort Worth

3.5.3.1.1 National Land Cover Database – Land Cover

Based on the NLCD, approximately 46 percent (6,947 acres) of the 15,108 acres of the EIS Study Area for Alternative N4A is composed of developed land coverage types (high, medium, and low intensity or open space). The remaining 54 percent (8,161 acres) is composed of non-developed land coverage types, with grasslands composing 30 percent, forest composing 12 percent, cultivated crops composing 6 percent, and pasture composing 5 percent. Less than 1 percent of the EIS Study Area is composed of wetlands and shrubland/scrub. Table 3.5-2 includes the acres of NLCD land cover types within the EIS Study Area for Alternative N4A Conventional, as well as the detailed percentages of total area for each land cover type.

Table 3.5-2: Acres of Potential NLCD Land Cover Types within EIS Study Area – Alternative N4A

Land Cover Type	Alternative N4A	
	Acres of Land Cover Types within EIS Study Area	Percentage of Total EIS Study Area
Developed		
High Intensity	1,249	8%
Medium Intensity	1,625	11%
Low Intensity	2,046	14%
Open Space	2,027	13%
Total Developed[a]	**6,947**	**46%**
Non-developed		
Barren Land (Rock/Sand/Clay)	53	<1%
Cultivated Crops	960	6%
Deciduous Forest	1,748	12%
Emergent Herbaceous Wetlands	8	<1%
Evergreen Forest	15	<1%
Grassland/Herbaceous	4,465	30%
Mixed Forest	0	0%
Open Water	120	1%
Pasture/Hay	783	5%
Shrub/Scrub	2	<1%
Woody Wetlands	7	<1%
Total Non-developed [a]	**8,161**	**54%**

[a] Acreage totals may be slightly different because values were rounded to the nearest whole number.

Source: MRLC (2011).

3.5.3.1.2 Wildlife Corridors and Assemblages and Sensitive Plant Communities

Based on the spatial datasets acquired from TXNDD and Oklahoma Department of Wildlife Conservation (ODWC) (2014) and shown on Figure 3.5-1, approximately 85 acres of animal assemblage area (rookeries) occur within the EIS Study Area for Alternative N4A. No other wildlife corridors and assemblages or sensitive plant communities were identified within the EIS Study Area.

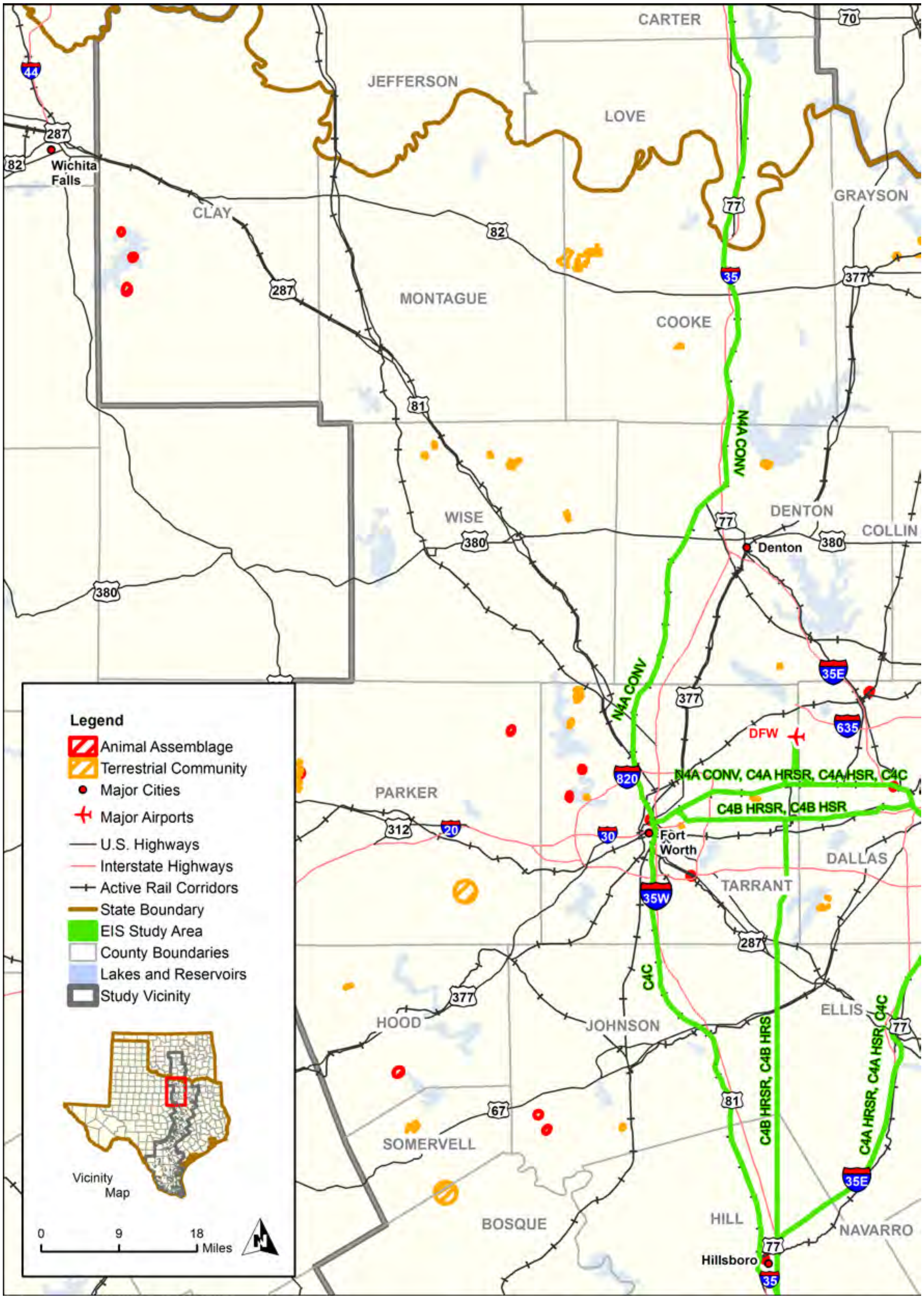

Figure 3.5-1: Wildlife Corridors/Assemblages and Communities – Northern Section Alternative

(Note that wildlife corridors and assemblages are included in figures as Animal Assemblages.)

3.5.3.1.3 REAP Composite Scores

As identified in Table 3.5-3, potentially 10 percent (1,535 acres) of the total land coverage of the EIS Study Area for Alternative N4A is composed of higher ecological importance/value land coverage areas (Ecological Importance Rankings of 1, 10, and 25). As shown on Figures 3.5-2 and 3.5-3, most lands with higher ecological importance are in areas just south of Norman, Oklahoma, near Murray County as the route passes through Love and Grayson counties. All other areas of Alternative N4A Conventional consist predominantly of lower ecological value land types.

Table 3.5-3: Acres of Potential REAP Composite Ranking Land Coverages – Alternative N4A

Ecological Importance Rank	Alternative N4A	
	Acres of Potential REAP Ecological Importance Ranking Types within EIS Study Area	Total Area of EIS Study Area (High Value vs. All Other Land Types)
1	100	10% (1,535 acres)
10	665	
25	770	
50	1,829	90% (13,572 acres)
100	11,743	
Total (acres)[a]	**15,107**	-

[a] Acreage totals may be slightly different because values were rounded to the nearest whole number.

Source: EPA (2011).

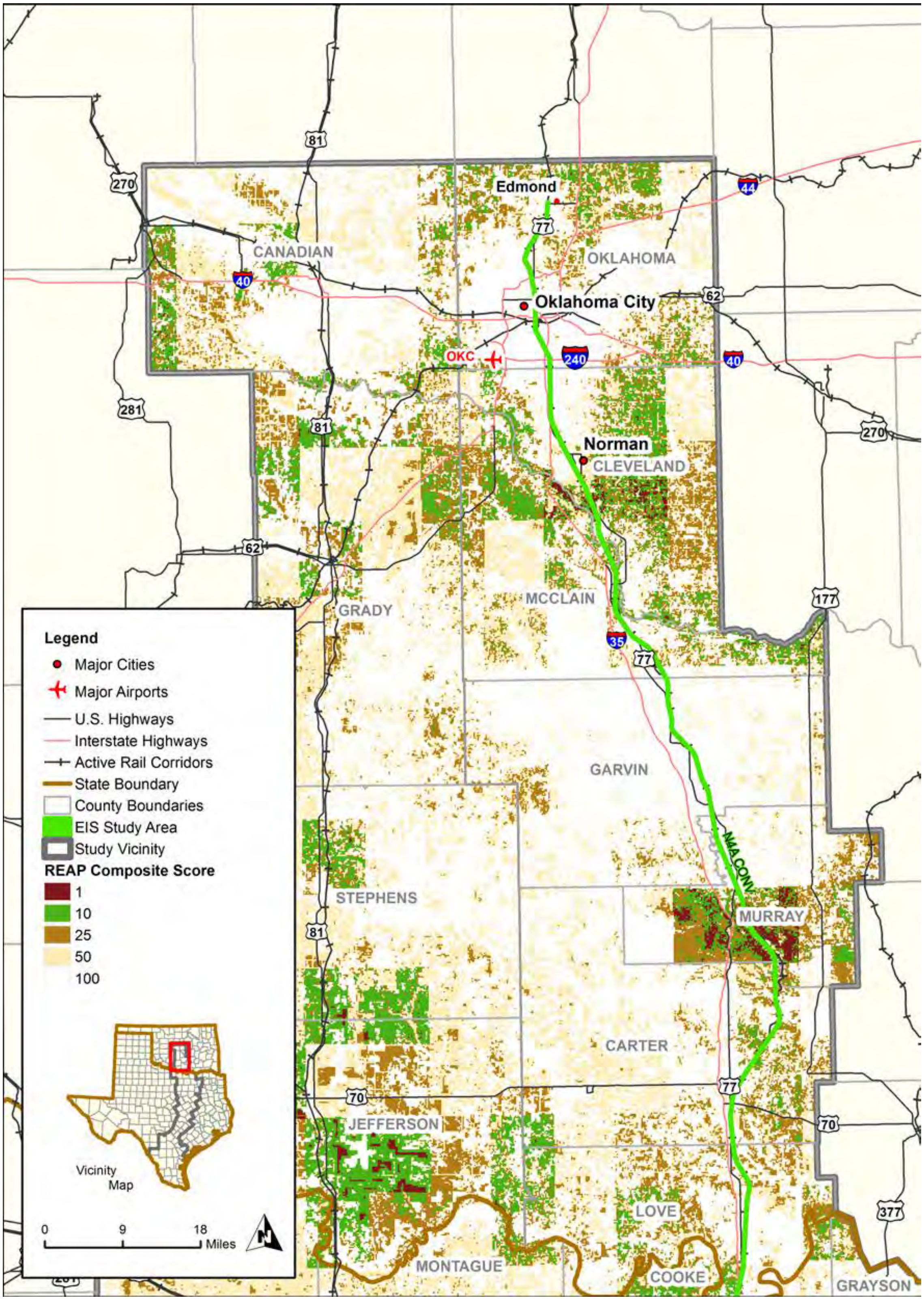

Figure 3.5-2: REAP Composite Scores – Northern Section Alternative

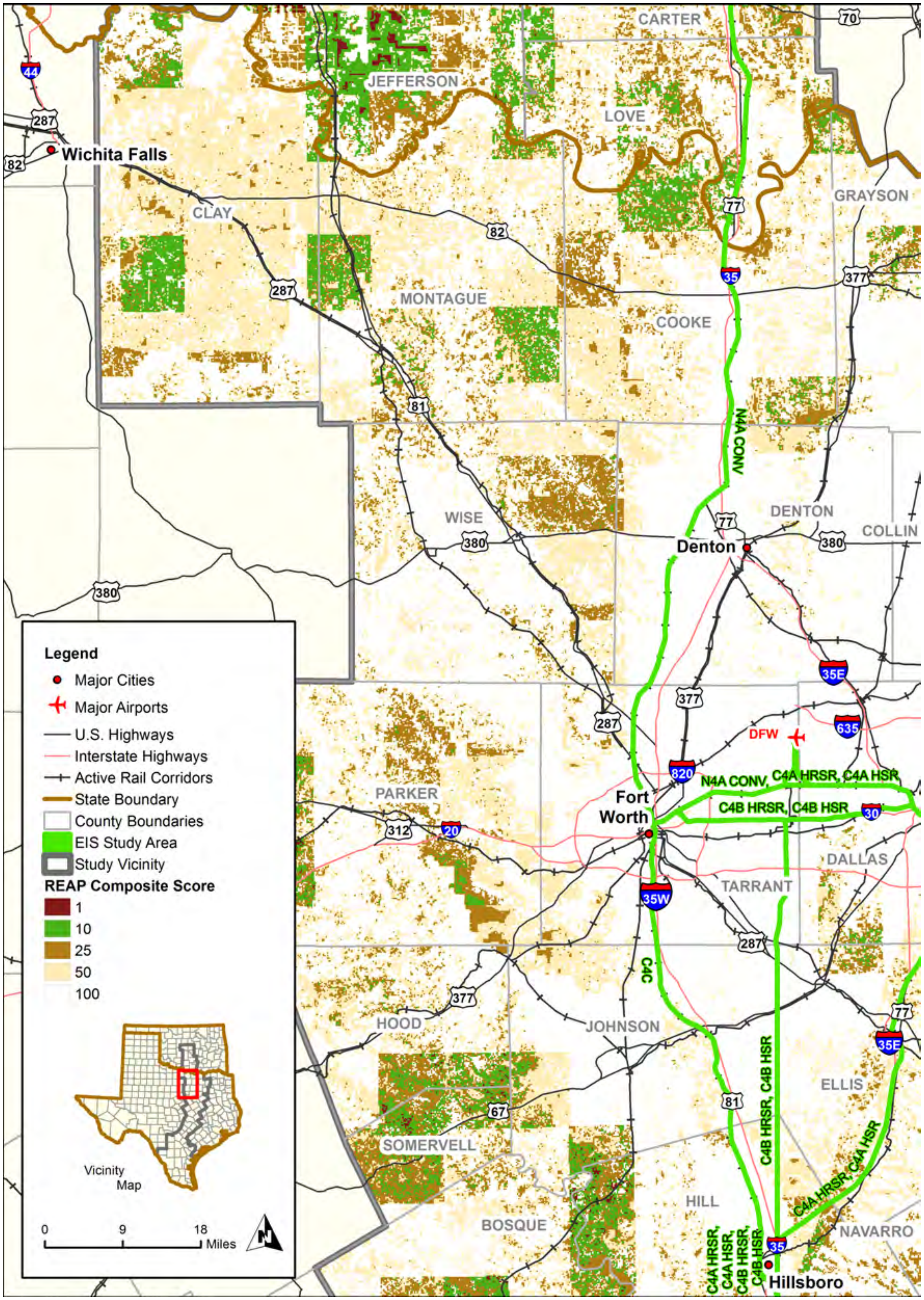

Figure 3.5-3: REAP Composite Scores – Northern Section Alternative

3.5.3.2 Central Section: Dallas and Fort Worth to San Antonio

3.5.3.2.1 National Land Cover Database – Land Cover

Based on NLCD data, approximately 38 percent (7,564 acres) of the 20,129 acres of the EIS Study Area for Alternative C4A is composed of developed land coverage types. The remaining 62 percent (12,565 acres) is composed of non-developed land coverage types, with grasslands composing 21 percent, cultivated crops composing 15 percent, shrub/scrub composing 9 percent, and forest and pasture each composing 7 percent. Wetlands and open water compose about 2 percent and less than 1 percent, respectively. Table 3.5-4 includes the acres of potential land cover types within the EIS Study Area for Alternative C4A, as well as the detailed percentages of total area for each land cover type. The northern extent of Alternative C4A, near Dallas and Fort Worth, would follow the Trinity Railway Express (TRE) between Fort Worth and Dallas, then continue south on the BNSF alignment; however, most of Alternative C4A Higher-Speed Rail, starting at Waxahachie, would follow an alignment outside existing transportation corridors.

Table 3.5-4: Acres of Potential Land Cover Types – Alternative C4A

	Alternative C4A	
Land Cover Type	Acres of Land Cover Types within EIS Study Area	Percentage of Total EIS Study Area
Developed		
High Intensity	1,347	7%
Medium Intensity	1,809	9%
Low Intensity	1,667	8%
Open Space	2,741	14%
Total Developed[a]	**7,564**	**38%**
Non-developed		
Barren Land (Rock/Sand/Clay)	48	<1%
Cultivated Crops	3,013	15%
Deciduous Forest	1,284	6%
Emergent Herbaceous Wetlands	18	<1%
Evergreen Forest	261	1%
Grassland/Herbaceous	4,274	21%
Mixed Forest	63	<1%
Open Water	80	<1%
Pasture/Hay	1,404	7%
Shrub/Scrub	1,720	9%
Woody Wetlands	400	2%
Total Non-developed[a]	**12,565**	**62%**

[a] Acreage totals may be slightly different because values were rounded to the nearest whole number.

Source: MRLC (2011).

Approximately 36 percent (6,642 acres) of the 18,675 acres of the EIS Study Area for Alternative C4B is composed of developed land coverage types. The remaining 63 percent (12,033 acres) is composed of non-developed land coverage types, with grasslands composing 21 percent, cultivated crops composing 17 percent, shrub/scrub and pasture each composing 9 percent, and forest composing 5 percent. Wetlands and open water compose 2 percent and less than 1 percent, respectively. Table 3.5-5 includes the acres of potential land cover types within the EIS Study Area for Alternative C4B, as well as the percentages of total area for each land cover type.

Table 3.5-5: Acres of Potential Land Cover Types – Alternative C4B

Land Cover Type	Alternative C4B	
	Acres of Land Cover Types within EIS Study Area	Percentage of Total EIS Study Area
Developed		
High Intensity	1,318	7%
Medium Intensity	1,810	10%
Low Intensity	1,374	7%
Open Space	2,140	11%
Total Developed[a]	**6,642**	**36%**
Non-developed		
Barren Land (Rock/Sand/Clay)	30	<1%
Cultivated Crops	3,252	17%
Deciduous Forest	812	4%
Emergent Herbaceous Wetlands	10	<1%
Evergreen Forest	237	1%
Grassland/Herbaceous	3,886	21%
Mixed Forest	63	<1%
Open Water	59	<1%
Pasture/Hay	1,602	9%
Shrub/Scrub	1,716	9%
Woody Wetlands	366	2%
Total Non-developed[a]	**12,033**	**63%**

[a] Acreage totals may be slightly different because values were rounded to the nearest whole number.

Source: MRLC (2011).

Approximately 38 percent (9,122 acres) of the 23,713 acres of the EIS Study Area for Alternative C4C is composed of developed land coverage types. The remaining 62 percent (14,591) is composed of grasslands (23 percent), cultivated crops (14 percent), forest (8 percent), shrub/scrub (7 percent), and pasture (6 percent). Wetlands and open water compose 2 percent and less than 1 percent, respectively. Table 3.5-6 includes the acres of potential land cover types within the EIS Study Area for Alternative C4C, as well as the percentages of total area for each land cover type.

The northern extent of Alternative C4C, near Dallas and Fort Worth, would follow the TRE between Fort Worth and Dallas, then continue south on the BNSF alignment; however, the majority of the alternative, starting at Waxahachie, would follow an alignment outside existing transportation corridors.

Table 3.5-6: Acres of Potential Land Cover Types – Alternative C4C

Land Cover Type	Alternative C4C	
	Acres of Land Cover Types within EIS Study Area	Percentage of Total EIS Study Area
Developed		
High Intensity	1,533	6%
Medium Intensity	2,080	9%
Low Intensity	2,108	9%
Open Space	3,401	14%
Total Developed[a]	**9,122**	**38%**
Non-developed		
Barren Land (Rock/Sand/Clay)	60	<1%
Cultivated Crops	3,350	14%
Deciduous Forest	1738	7%
Emergent Herbaceous Wetlands	18	<1%
Evergreen Forest	264	1%
Grassland/Herbaceous	5,415	23%
Mixed Forest	63	<1%
Open Water	84	<1%
Pasture/Hay	1,453	6%
Shrub/Scrub	1,728	7%
Woody Wetlands	418	2%
Total Non-developed[a]	**14,591**	**62%**

[a] Acreage totals may be slightly different because values were rounded to the nearest whole number.

Source: MRLC (2011).

3.5.3.2.2 Wildlife Corridors and Assemblages and Sensitive Plant Communities

Based on the spatial dataset acquired from TXNDD, approximately 107, 66, and 107 acres of rookery animal assemblage occur within the EIS Study Areas for Alternatives C4A, C4B, and C4C, respectively. Approximately 628 acres of Little Bluestem-Indiangrass series terrestrial community occur within the EIS Study Areas. As identified on Figures 3.5-4 and 3.5-5, most animal assemblages and special terrestrial communities identified within the EIS Study Area are located in the portions of the alternative outside existing transportation corridors.

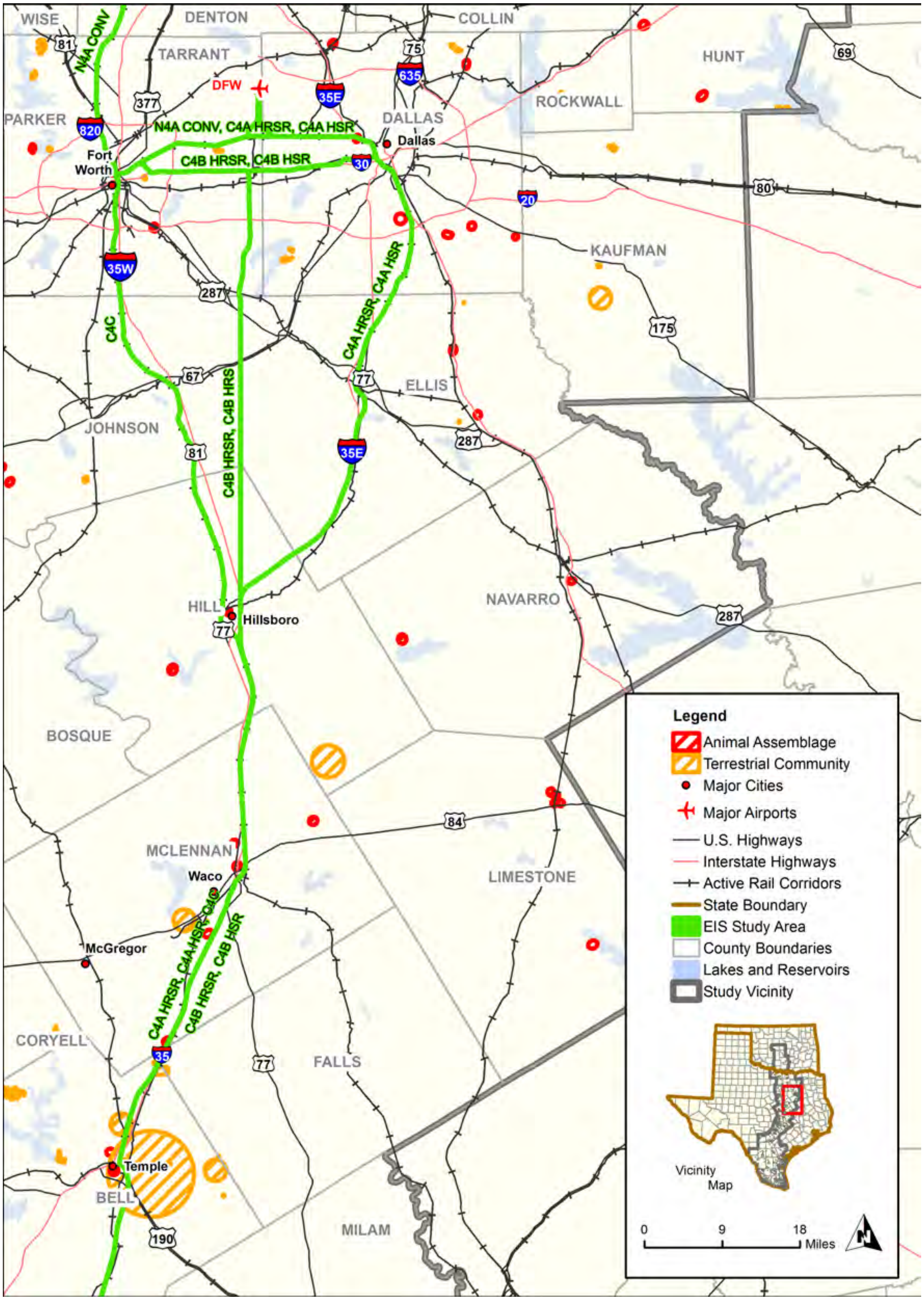

Figure 3.5-4: Wildlife Corridors/Assemblages and Communities – Central Section Alternatives

(Note that wildlife corridors and assemblages are included in figures as Animal Assemblages.)

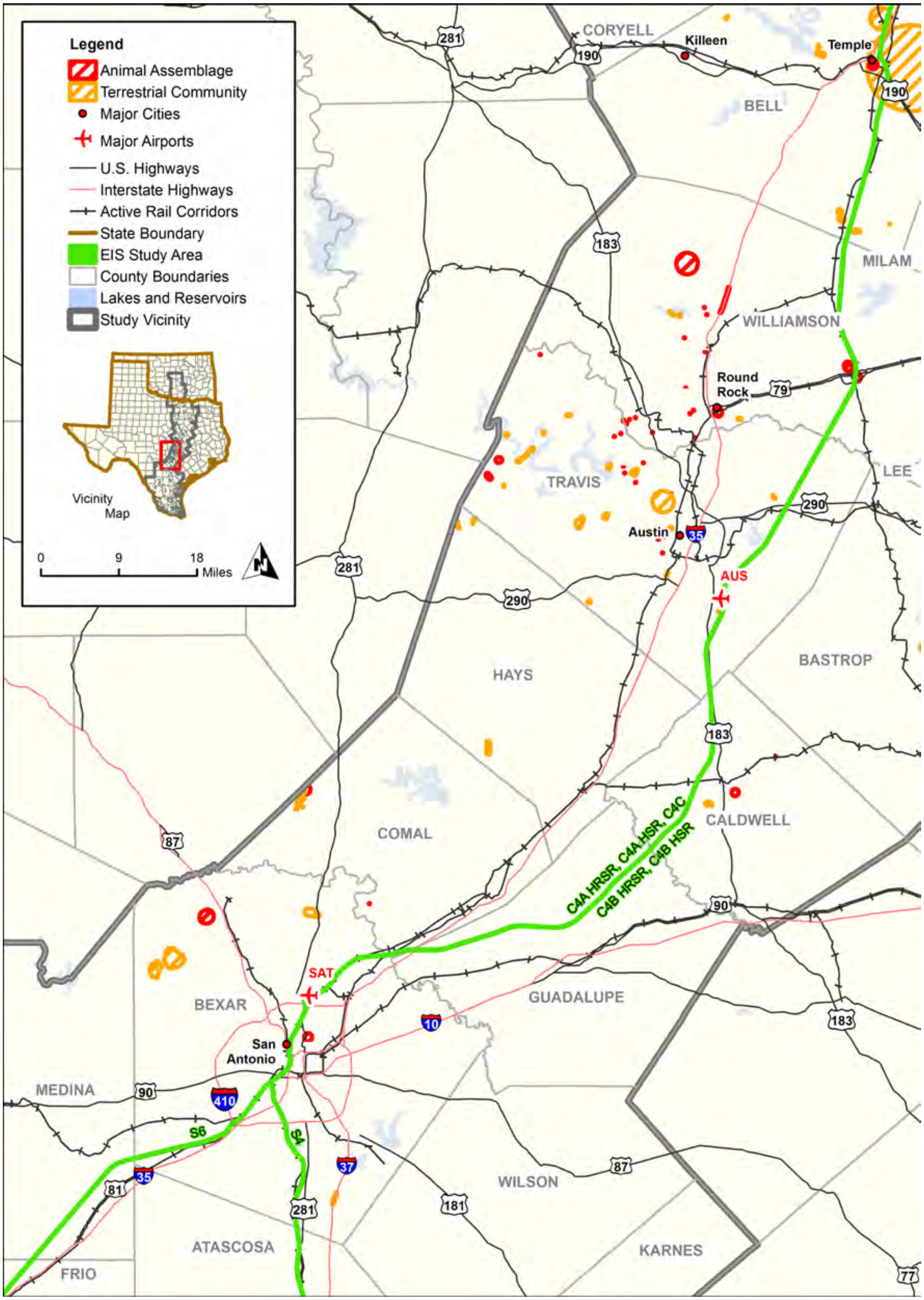

Figure 3.5-5: Wildlife Corridors/Assemblages and Communities – Central Section Alternatives

(Note that wildlife corridors and assemblages are included in figures as Animal Assemblages.)

3.5.3.2.3 REAP Composite Scores

As identified in Table 3.5-7, potentially 18 percent (3,537 acres) of the total acreage of the EIS Study Area for Alternative C4A is composed of higher ecological importance/value land coverage areas (Ecological Importance Rankings of 1, 10, and 25). As shown on Figures 3.5-6 and 3.5-7, the majority of lands with higher ecological importance are in the portions of Alternatives C4A outside existing transportation corridors, in areas just south of McGregor, through Temple, and east of Austin and as the corridor passes through Guadalupe County. Areas of Alternative C4A that consist of predominantly lower ecological value land types are near Dallas and Fort Worth, where the alternative would follow the existing right-of-way of the TRE to Dallas and continue on the BNSF alignment.

Table 3.5-7: Acres of Potential REAP Composite Ranking Land Coverages – Alternative C4A

Ecological Importance Rank	Alternative C4A	
	Acres of Potential REAP Ecological Importance Ranking Types within EIS Study Area	Total Area of EIS Study Area (High Value vs. All Other Land Types)
1	32	18% (3,537 acres)
10	1,884	
25	1,621	
50	3,407	82% (16,591 acres)
100	13,184	
Total (acres)[a]	**20,128**	-

[a] Acreage totals may be slightly different because values were rounded to the nearest whole number.

Source: EPA (2011).

As identified in Table 3.5-8, potentially 18 percent (3,328 acres) of the total acreage of the EIS Study Area for Alternative C4B is composed of higher ecological importance/value land coverage areas (Ecological Importance Rankings of 1, 10, and 25). As shown on Figures 3.5-6 and 3.5-7, the majority of lands with higher ecological importance are in the portions of Alternative C4B outside existing transportation corridors, in areas just south of McGregor, through Temple, and east of Austin and as the corridor passes through Guadalupe County. Areas of Alternative C4B that consist of predominantly lower ecological value land types are near Dallas and Fort Worth, where the alternative would follow a new elevated high-speed rail alignment in the Interstate Highway (IH)-30 median to Arlington.

Table 3.5-8: Acres of Potential REAP Composite Ranking Land Coverages – Alternative C4B

Ecological Importance Rank	Alternative C4B	
	Acres of Potential REAP Ecological Importance Ranking Types within EIS Study Area	Total Area of EIS Study Area (High Value vs. All Other Land Types)
1	32	18% (3,328 acres)
10	1,839	
25	1,457	
50	2,727	82% (15,347 acres)
100	12,621	
Total (acres)[a]	**18,675**	-

[a] Acreage totals may be slightly different because values were rounded to the nearest whole number.

Source: EPA (2011).

As identified in Table 3.5-9, potentially 15 percent (3,556 acres) of the total acreage of the EIS Study Area for Alternative C4C Higher-Speed Rail is composed of higher ecological importance/value land coverage areas (Ecological Importance Rankings of 1, 10, and 25). As shown on Figures 3.5-6 and 3.5-7, the majority of lands with higher ecological importance are in the portions of Alternative C4C outside existing transportation corridors, in areas just south of McGregor, through Temple, and east of Austin and as the corridor passes through Guadalupe County. Areas of Alternative C4C that consist of predominantly lower ecological value land types are near Dallas and Fort Worth, where the alternative would follow a new elevated high-speed alignment in the IH-30 median to Arlington.

Table 3.5-9: Acres of Potential REAP Composite Ranking Land Coverages – Alternative C4C

Ecological Importance Rank	Alternative C4C	
	Acres of Potential REAP Ecological Importance Ranking Types within EIS Study Area	Total Area of EIS Study Area (High Value vs. All Other Land Types)
1	32	15% (3,556 acres)
10	1,884	
25	1,640	
50	3,613	85% (20,158 acres)
100	16,546	
Total (acres)[a]	**23,714**	-

[a] Acreage totals may be slightly different because values were rounded to the nearest whole number.

Source: EPA (2011).

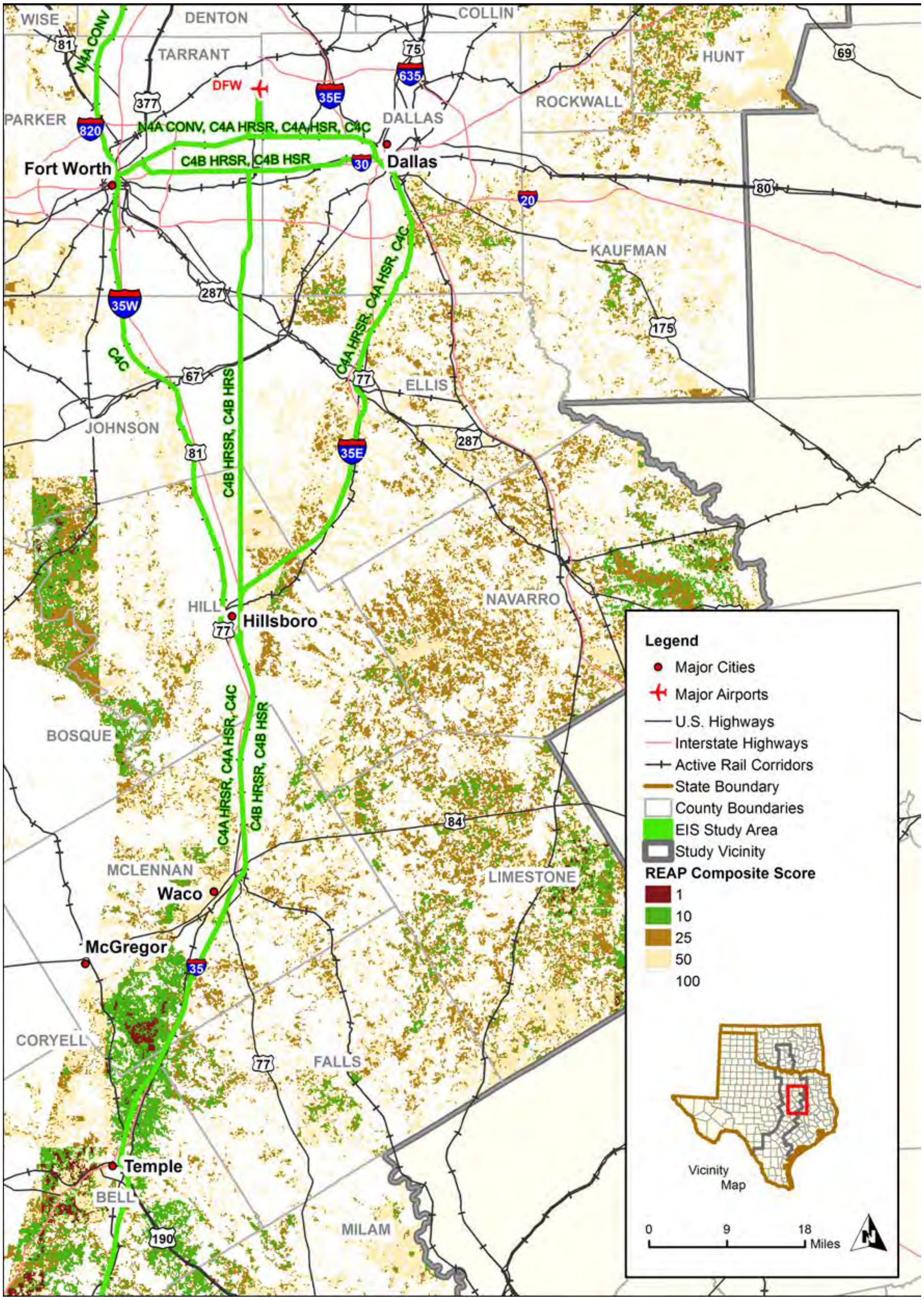

Figure 3.5-6: REAP Composite Scores – Central Section Alternatives

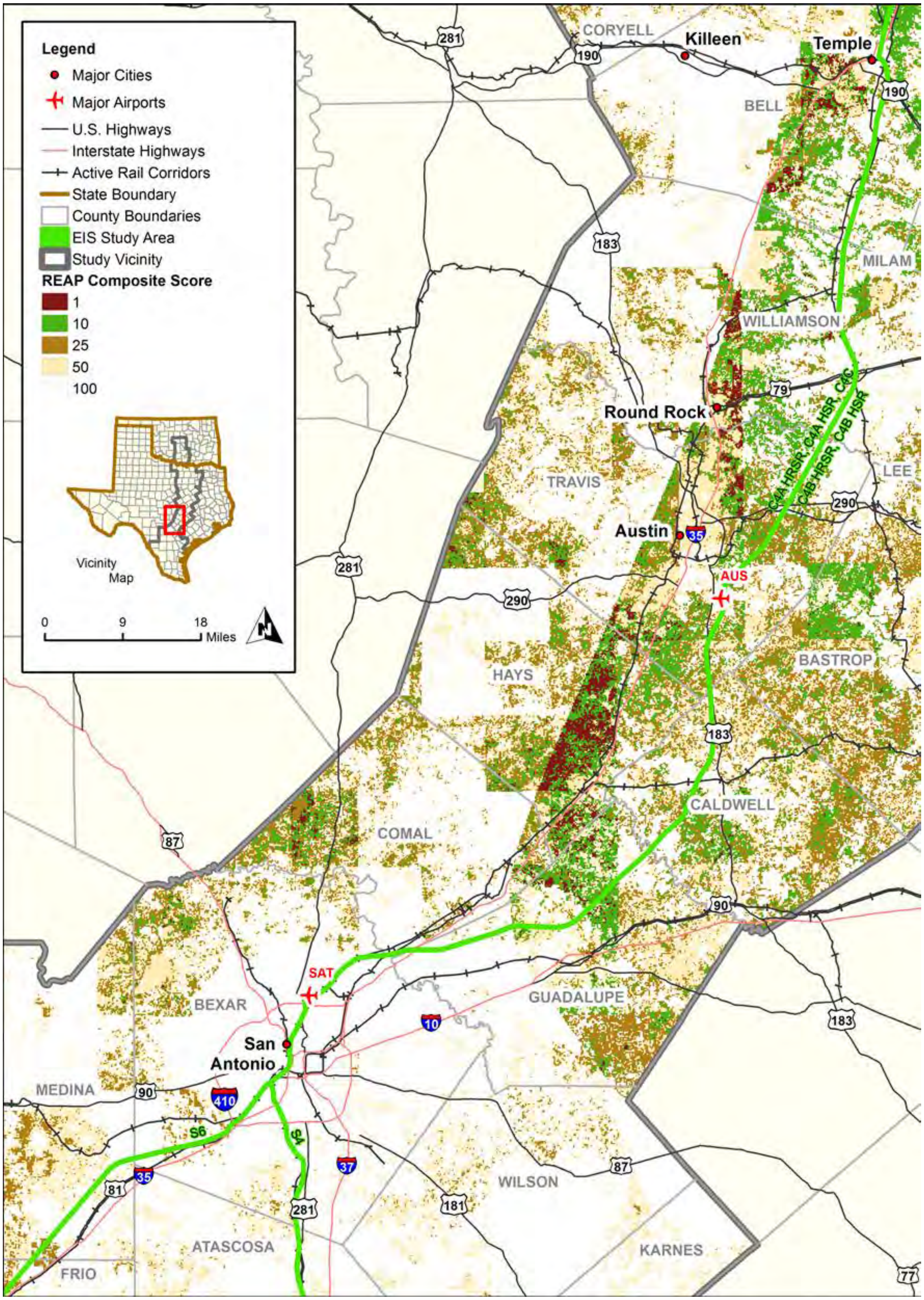

Figure 3.5-7: REAP Composite Scores – Central Section Alternatives

3.5.3.3 Southern Section: San Antonio to South Texas

3.5.3.3.1 National land Cover Database – Land Cover

Based on the NLCD, approximately 32 percent (7,998 acres) of the 25,194 acres of the EIS Study Area for Alternative S4 is composed of developed land coverage types. The remaining 68 percent (17,196) is composed of non-developed land coverage types, with shrub/scrub composing 34 percent, pasture composing 12 percent, grassland and cultivated crops each composing 9 percent. Wetlands compose about 2 percent, and forests compose 1 percent. Table 3.5-10 includes the acres of potential land cover types within the EIS Study Area for Alternative S4, as well as the detailed percentages of total area for each land cover type.

Table 3.5-10: Acres of Potential Land Cover Types within EIS Study Area – Alternative S4

Land Cover Type	Alternative S4	
	Acres of Land Cover Types within EIS Study Area	Percentage of Total EIS Study Area
Developed		
High Intensity	776	3%
Medium Intensity	2,019	8%
Low Intensity	2,888	11%
Open Space	2,315	9%
Total Developed[a]	**7,998**	**32%**
Non-developed		
Barren Land (Rock/Sand/Clay)	260	1%
Cultivated Crops	2,174	9%
Deciduous Forest	340	1%
Emergent Herbaceous Wetlands	64	<1%
Evergreen Forest	41	<1%
Grassland/Herbaceous	2,330	9%
Mixed Forest	24	<1%
Open Water	45	<1%
Pasture/Hay	2,948	12%
Shrub/Scrub	8,574	34%
Woody Wetlands	396	2%
Total Non-developed[a]	**17,196**	**68%**

[a] Acreage totals may be slightly different because values were rounded to the nearest whole number.

Source: MRLC (2011).

Only approximately 8 percent (701 acres) of the 8,666 acres of the EIS Study Area for Alternative S6 is composed of developed land coverage types. The majority of the land coverage of the EIS

Study Area is composed of non-developed land coverage types, consisting of shrub/scrub (44 percent), grasslands (20 percent), cultivated crops (14 percent), pasture (7 percent), wetlands (emergent herbaceous and woody) (3 percent), and forest (deciduous, evergreen, and woody) (3 percent). Table 3.5-11 includes the acres of potential land cover types within the EIS Study Area for Alternative S6, as well as the detailed percentages of total area for each land cover type.

Table 3.5-11: Acres of Potential Land Cover Types within EIS Study Area – Alternative S6

Land Cover Type	Alternative S6	
	Acres of Land Cover Types within EIS Study Area	Land Cover Types within EIS Study Area
Developed		
High Intensity	84	1%
Medium Intensity	97	1%
Low Intensity	202	2%
Open Space	318	4%
Total Developed[a]	**701**	**8%**
Non-developed		
Barren Land (Rock/Sand/Clay)	108	1%
Cultivated Crops	1,177	14%
Deciduous Forest	112	1%
Emergent Herbaceous Wetlands	9	<1%
Evergreen Forest	58	1%
Grassland/Herbaceous	1,729	20%
Mixed Forest	52	1%
Open Water	11	<1%
Pasture/Hay	578	7%
Shrub/Scrub	3,852	44%
Woody Wetlands	279	3%
Total Non-developed[a]	**7,965**	**92%**

[a] Acreage totals may be slightly different because values were rounded to the nearest whole number.

Source: MRLC (2011).

3.5.3.3.2 Wildlife Corridors and Assemblages and Sensitive Plant Communities

Based on the spatial dataset acquired from TXNDD, approximately 678 acres of Little Bluestem-Indiangrass series terrestrial community and no wildlife corridors and assemblages are located within the EIS Study Area for Alternative S4. However, as shown on Figures 3.5-8 through 3.5-11, the large area of this terrestrial community is in Brooks County, in an area that would be constructed on an existing abandoned rail, in areas that were disturbed by prior rail development. No wildlife corridors and assemblages and sensitive plant communities were identified within the EIS Study Area for Alternative S6.

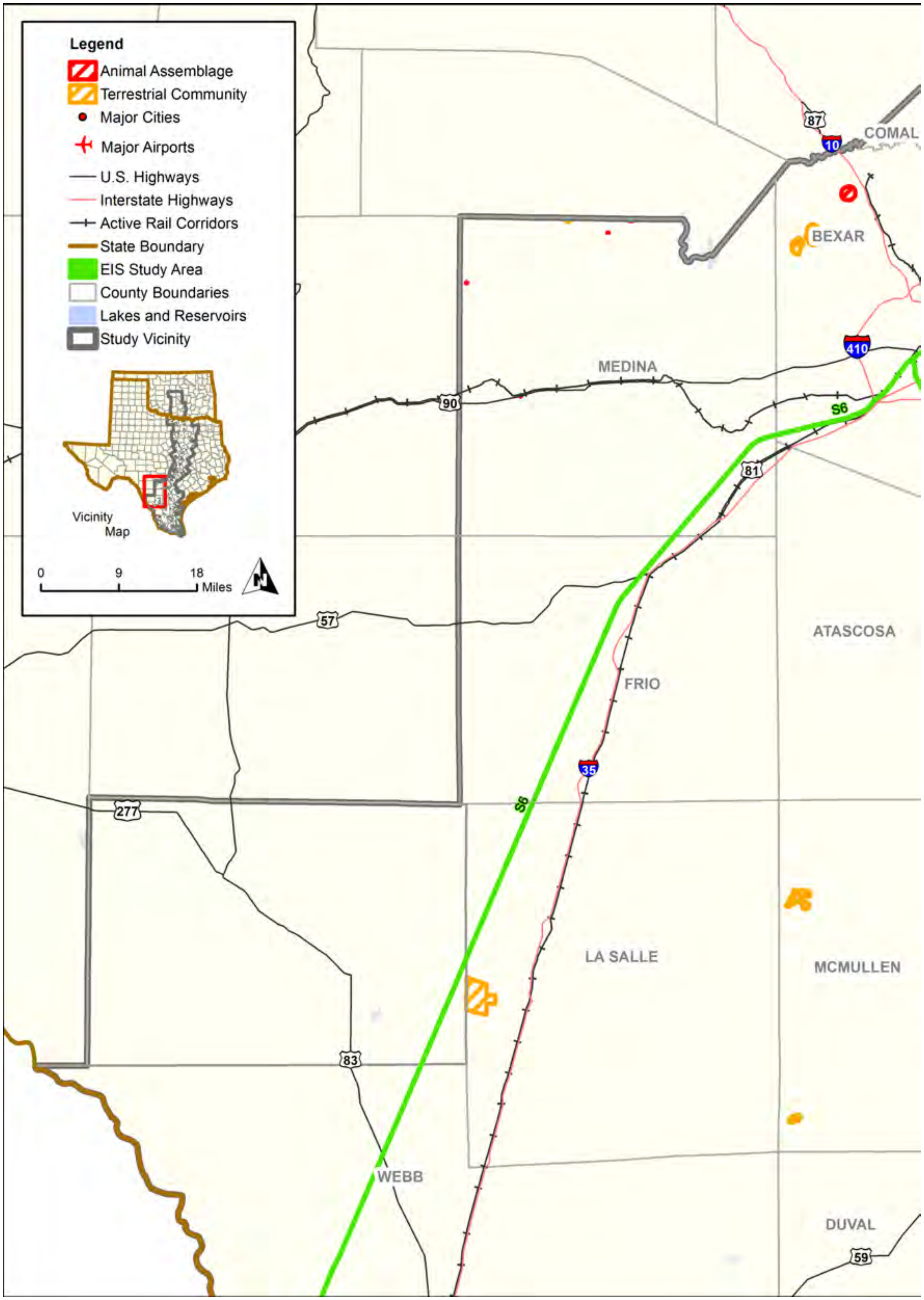

Figure 3.5-8: Wildlife Corridors/Assemblages and Communities – Southern Section Alternatives

(Note that wildlife corridors and assemblages are included in figures as Animal Assemblages.)

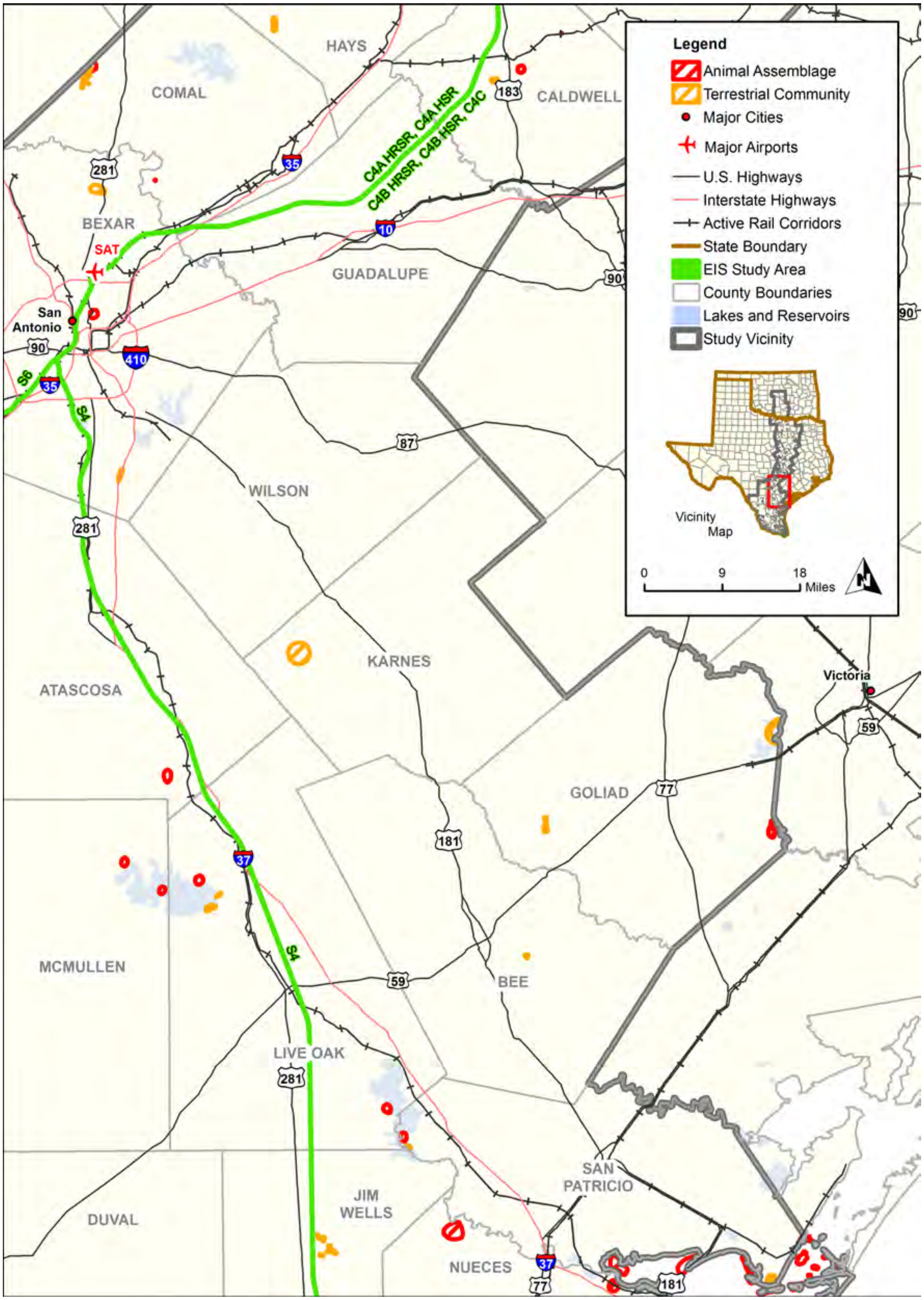

Figure 3.5-9: Wildlife Corridors/Assemblages and Communities – Southern Section Alternatives

(Note that wildlife corridors and assemblages are included in figures as Animal Assemblages.)

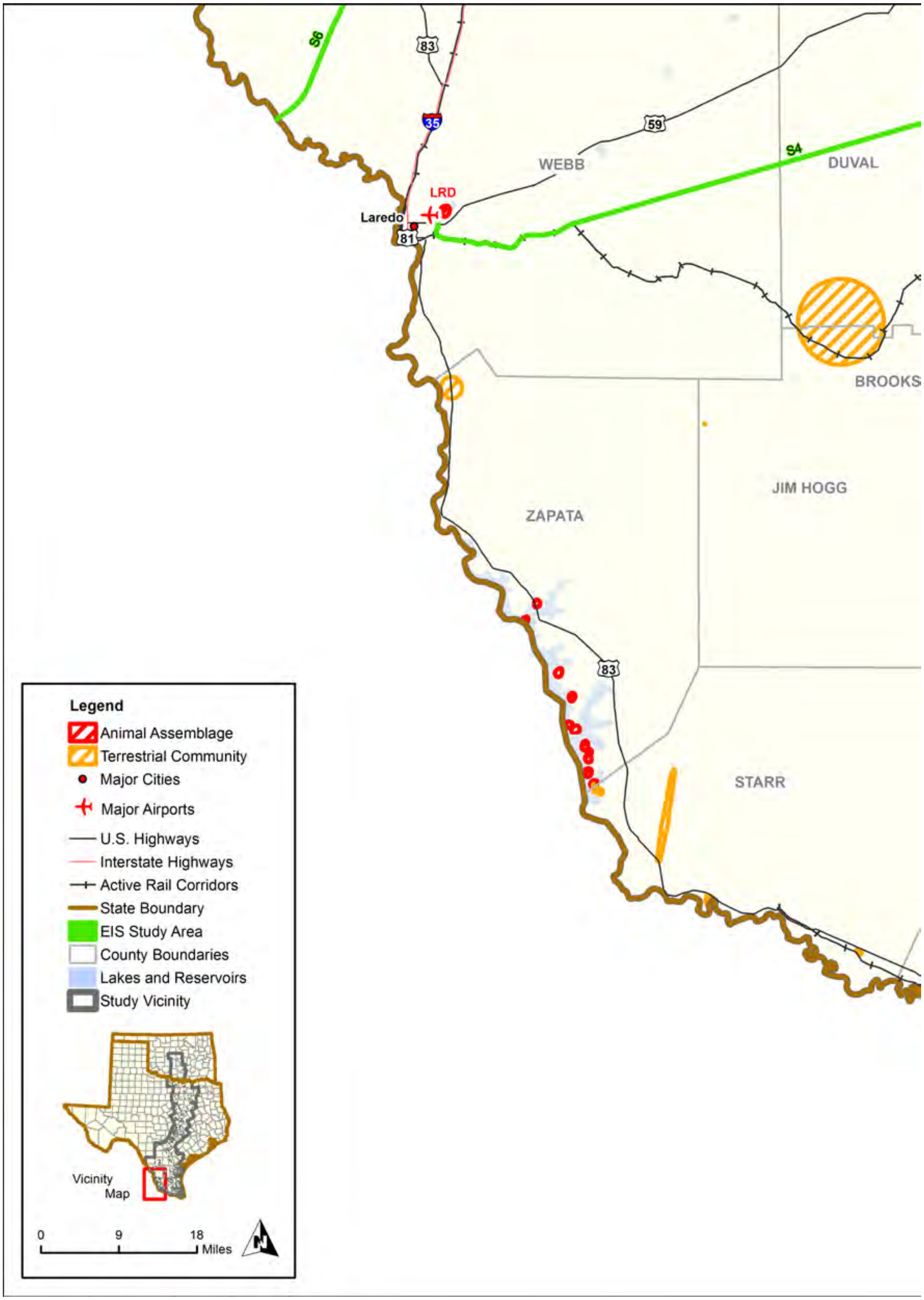

Figure 3.5-10: Wildlife Corridors/Assemblages and Communities – Southern Section Alternatives

(Note that wildlife corridors and assemblages are included in figures as Animal Assemblages.)

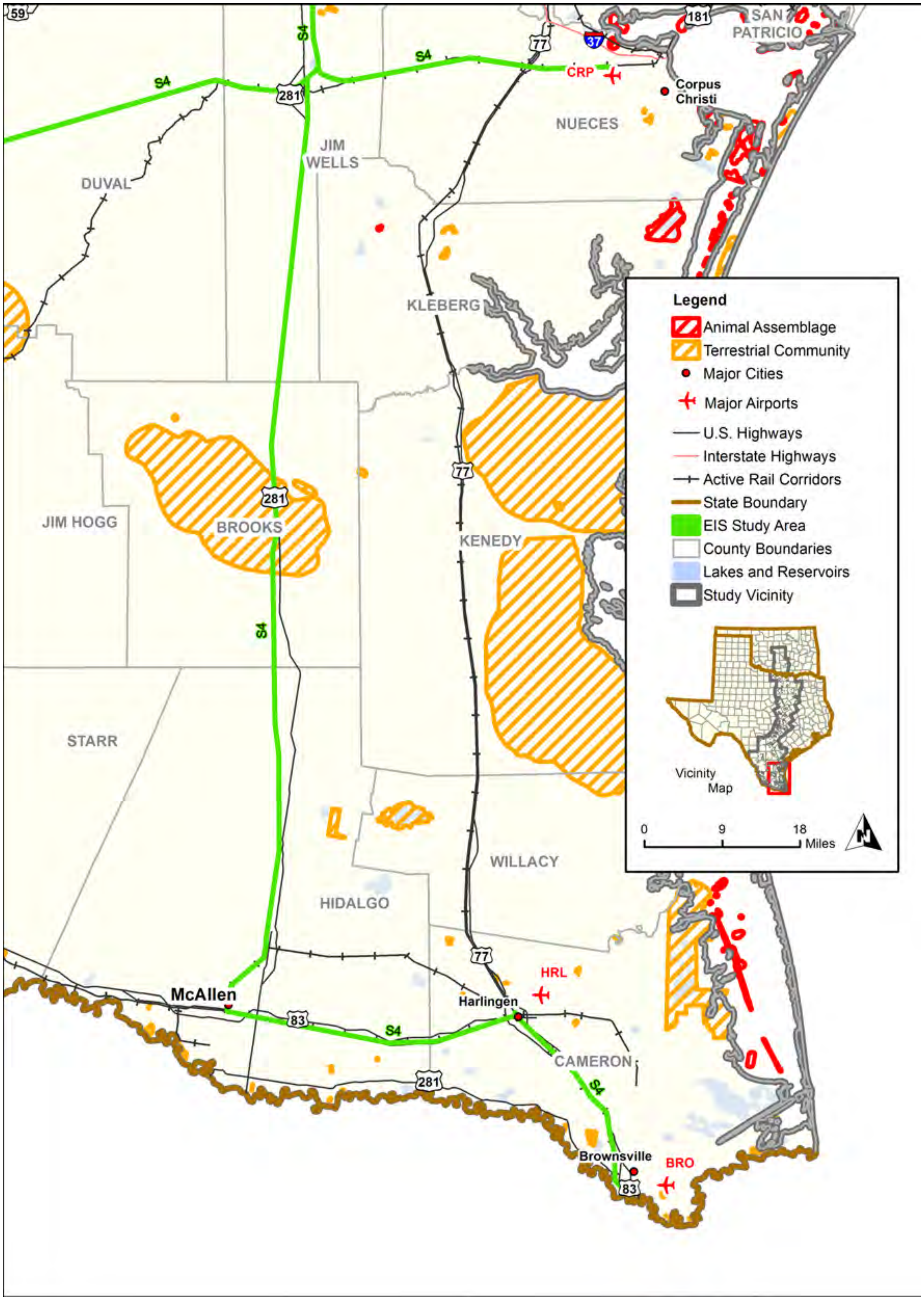

Figure 3.5-11: Wildlife Corridors/Assemblages and Communities – Southern Section Alternatives

(Note that wildlife corridors and assemblages are included in figures as Animal Assemblages.)

3.5.3.3.3 REAP Composite Scores

As identified in Table 3.5-12, potentially 15 percent (3,659 acres) of the total acreage of the EIS Study Area for Alternative S4 is composed of higher ecological importance/value land coverage areas (Ecological Importance Rankings of 1, 10, and 25). As shown on Figures 3.5-12 through 3.5-15, the majority of lands with higher ecological importance for Alternative S4 are near Brooks, Live Oak, Duval, and Webb counties.

Table 3.5-12: Acres of Potential REAP Composite Ranking Land Coverages – Alternative S4

Ecological Importance Rank	Alternative S4	
	Acres of Potential REAP Ecological Importance Ranking Types within EIS Study Area	Total Area of EIS Study Area (High Value vs. All Other Land Types)
1	21	15% (3,659 acres)
10	1,088	
25	2,550	
50	4,589	85% (21,533 acres)
100	16,943	
Total (acres)[a]	**25,192**	-

[a] Acreage totals may be slightly different because values were rounded to the nearest whole number.

Source: EPA (2011).

As identified in Table 3.5-13, potentially 21 percent (1,796 acres) of the total acreage of the EIS Study Area for Alternative S6 Higher-Speed Rail is composed of higher ecological importance/value land coverage areas (Ecological Importance Rankings of 1, 10, and 25). As shown on Figures 3.5-12 through 3.5-15, most lands with higher ecological importance for Alternative S6 Higher-Speed Rail are in areas near Dimmit and Webb counties.

Table 3.5-13: Acres of Potential REAP Composite Ranking Land Coverages – Alternative S6 Higher-Speed Rail

Ecological Importance Rank	Alternative S6 Higher-Speed Rail	
	Acres of Potential REAP Ecological Importance Ranking Types Within EIS Study Area	Total Area of EIS Study Area (High Value vs. All Other Land Types)
1	31	21% (1,796 acres)
10	538	
25	1,227	
50	2,389	79% (6,901 acres)
100	4,469	
Total (acres)[a]	**8,653**	-

[a] Acreage totals may be slightly different because values were rounded to the nearest whole number.

Source: EPA (2011).

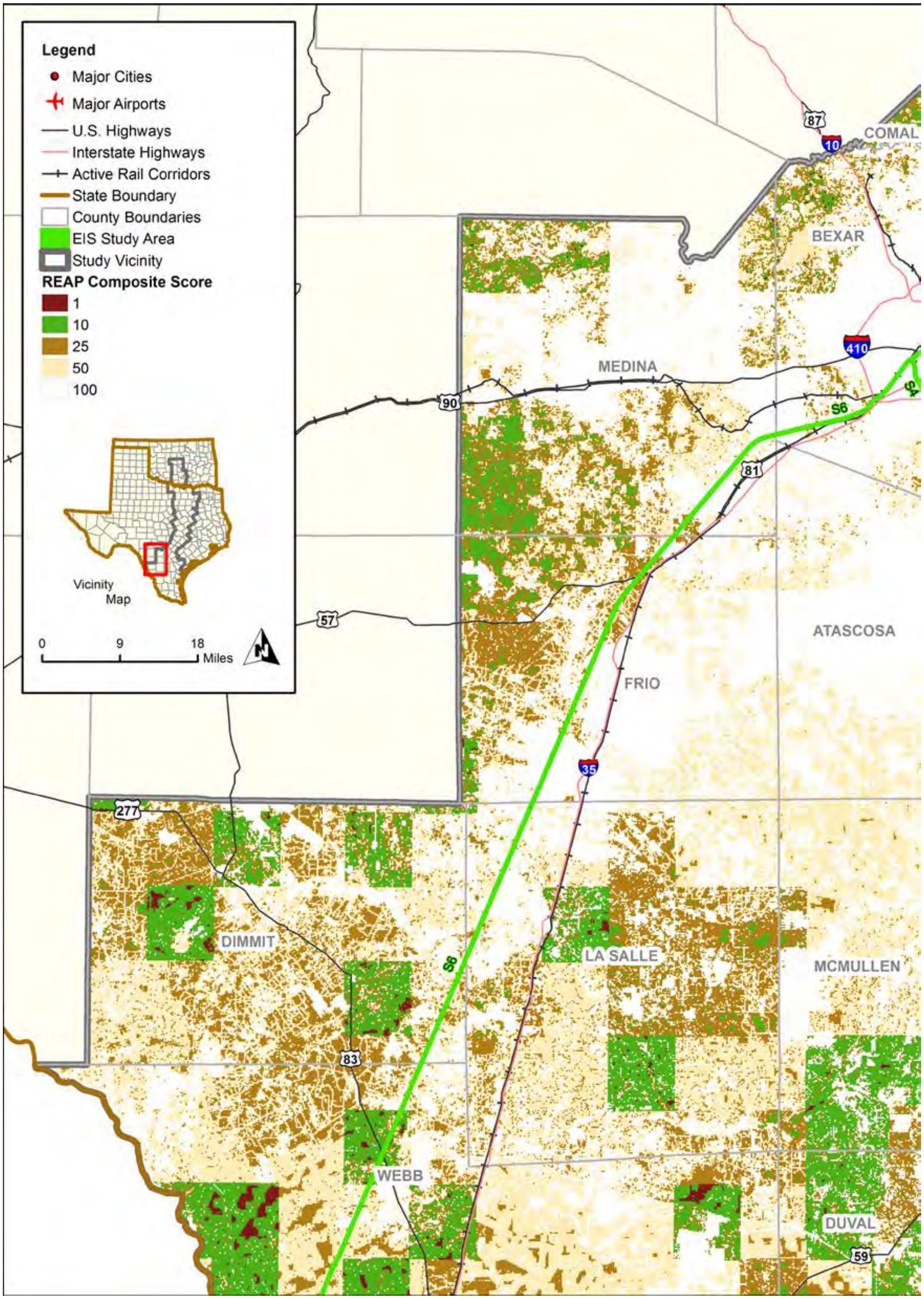

Figure 3.5-12: REAP Composite Scores – Southern Section Alternatives

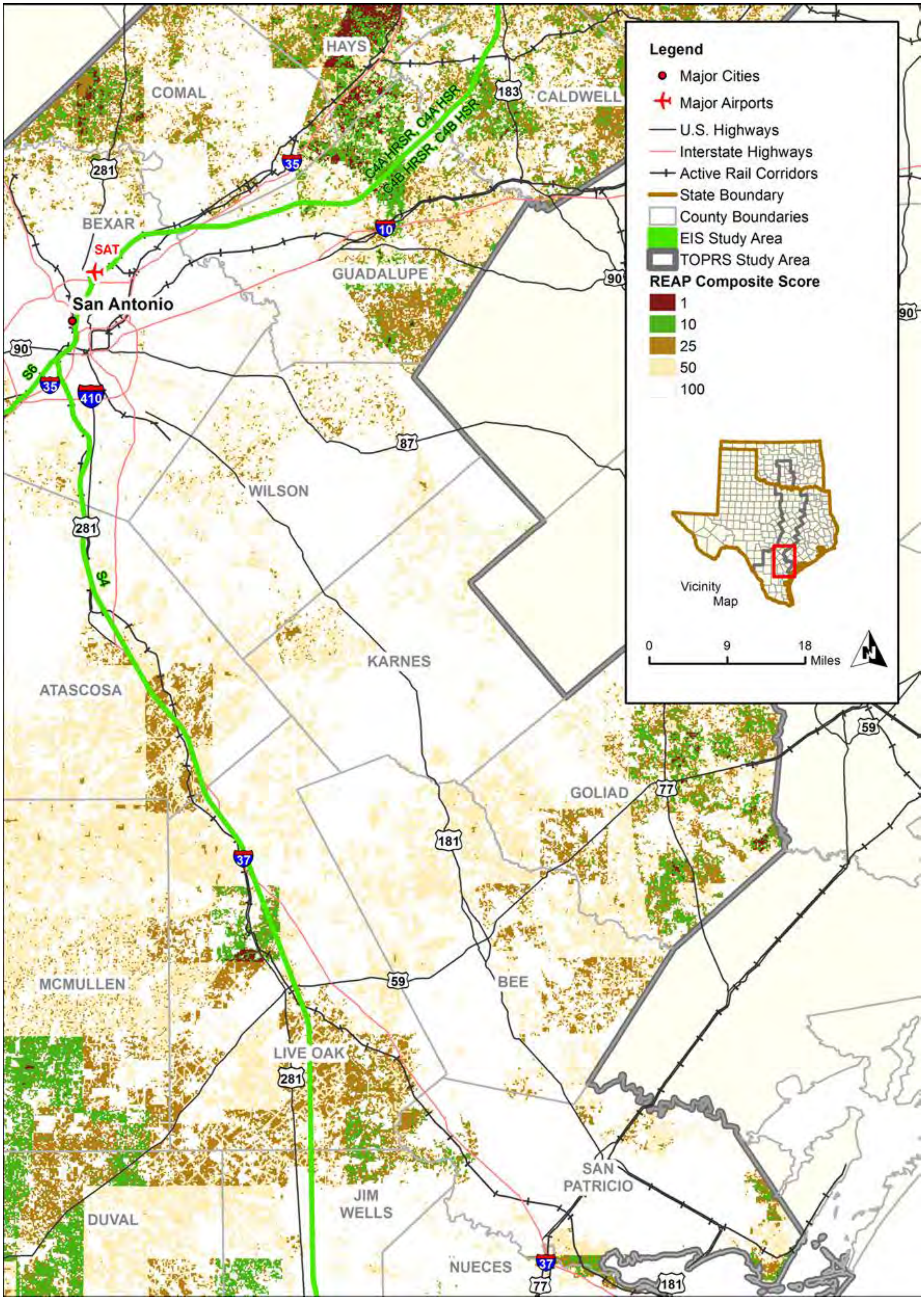

Figure 3.5-13: REAP Composite Scores – Southern Section Alternatives

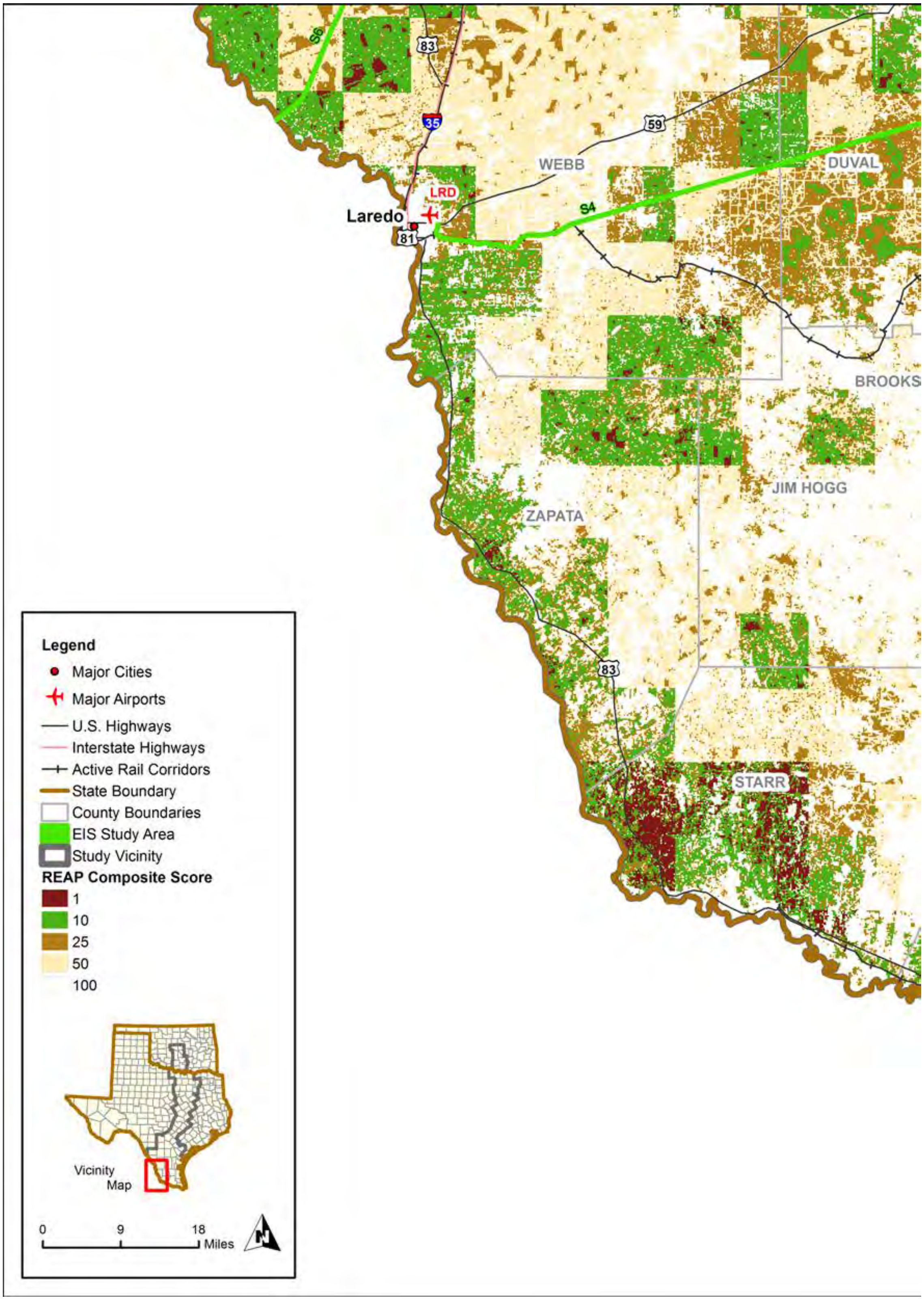

Figure 3.5-14: REAP Composite Scores – Southern Section Alternatives

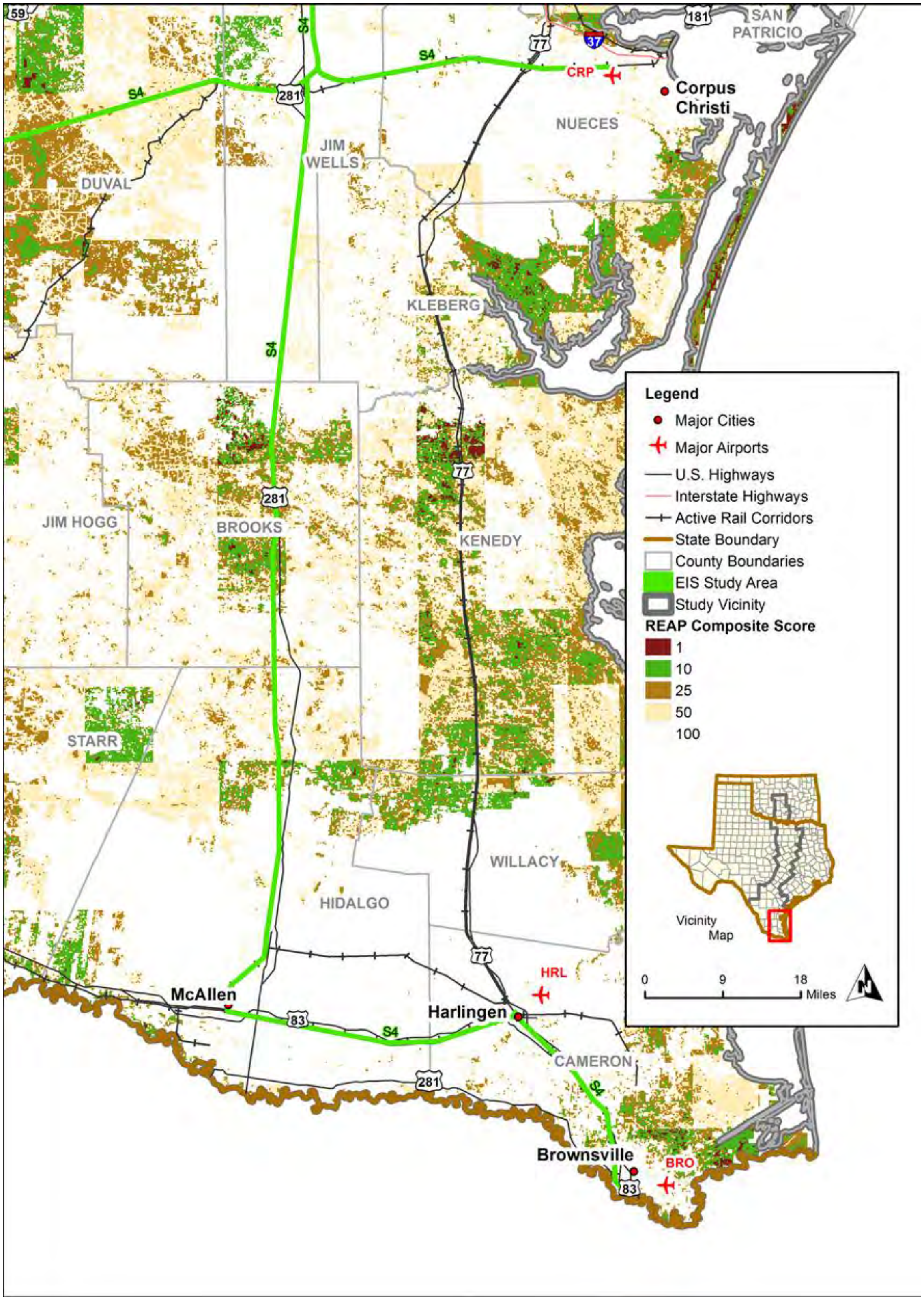

Figure 3.5-15: REAP Composite Scores – Southern Section Alternatives

3.5.4 Environmental Consequences

3.5.4.1 Overview

Effects from the proposed alternatives and associated infrastructure can be broadly classified into construction and operations effects. Long-term or permanent effects and short-term effects on natural ecological systems and wildlife would be anticipated as a result of constructing any of the build alternatives. Long-term or permanent effects on vegetation, including sensitive plant communities, would occur from permanent structures (e.g., track, stations), clearing for construction, staging of equipment, and stockpiling of soil, ballast, or other construction materials. Short-term effects on adjacent habitats and their corresponding wildlife would be caused by noise, vibration, and air pollution from construction equipment and activities. In general, conventional rail would have fewer construction effects on natural because it would follow existing rail alignments, with minimal new right-of-way. Higher-speed and high-speed rail service types would have more effects during construction because some or all of the alignment would be constructed in a new corridor.

Operations effects on wildlife for conventional and higher-speed rail would include making wildlife movement vulnerable to an increased risk of strikes from the additional rail traffic along the routes. High-speed rail would be completely fenced; therefore, the risk of strikes would be lower for this service type. Additionally, construction of new tracks on rail bed elevated above the floodplain could create barriers to wildlife movement. High-speed rail would be fully grade-separated; therefore, more passages for wildlife would likely be included.

3.5.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and the need of the Program. Therefore, the No Build Alternative is anticipated to have the least effect on natural ecosystems and wildlife.

3.5.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.5.4.3.1 Alternative N4A Conventional

National Land Cover Database – Land Cover Type Effects

Alternative N4A Conventional would follow the BNSF rail alignment and the existing TRE tracks. Therefore, this alternative would likely be constructed in areas that were disturbed by prior rail development.

The percentage of total non-developed land covers within the EIS Study Area represents a negligible effect on undeveloped land when compared with the No Build Alternative. Most effects from this alternative would be during construction within existing rights-of-way that were disturbed by prior rail development.

The potential operations effects associated with Alternative N4A Conventional with regard to developed land covers within the EIS Study Area would be considered negligible as the service would operate within existing rights-or-way.

3.5.4.3.2 Wildlife Corridors and Assemblages and Sensitive Plant Community Effects

The potential construction effects of Alternative N4A Conventional on wildlife corridors and assemblages or sensitive plant communities would be negligible because this alternative would be constructed within existing rights-of-way that have been disturbed by prior rail development.

Operations effects for Alternative N4A Conventional would be moderate because this alternative would not likely be fenced, making wildlife movement vulnerable to an increased risk for strikes from the additional rail traffic along the route. Such effects would have a noticeable effect on wildlife, but the effects could be reduced by the use of best management practices (BMPs) (see Section 3.5.5, Avoidance, Minimization, and Mitigation Strategies).

REAP Composite Score Effects

Most lands with higher ecological importance are in areas just south of Norman, Oklahoma, near Murray County as the route passes through Love and Grayson counties. All other areas of Alternative N4A Conventional consist predominantly of lower ecological value land types, and in these areas, the alternative would not substantially affect areas of higher ecological importance within the EIS Study Area. The potential effects associated with construction and operation of Alternative N4A Conventional on higher ecological importance/value land coverage types would be negligible, as most effects from this alternative would be during construction within existing rights-of-way that were disturbed by prior rail development

3.5.4.4 Central Section: Dallas and Fort Worth to San Antonio

3.5.4.4.1 Alternative C4A Higher-Speed Rail

National Land Cover Database – Land Cover Type Effects

The northern extent of Alternative C4A Higher-Speed Rail, near Dallas and Fort Worth, would follow the TRE between Fort Worth and Dallas, then continue south on the BNSF alignment; however, most of Alternative C4A Higher-Speed Rail, starting at Waxahachie, would follow an alignment outside existing transportation corridors. Because of the high percentage of total non-developed land cover types within the EIS Study Area, and because most of the alternative would follow an alignment outside existing transportation corridors, the alternative could have a noticeable, inevitable effect on non-developed land within the EIS Study Area. The potential construction effects of Alternative C4A Higher-Speed Rail on non-developed land cover types within the EIS Study

Area would be substantial compared to the No Build Alternative because construction effects on vegetation outside existing transportation corridors are considered long-term or permanent.

The potential operations effects associated with Alternative C4A Higher-Speed Rail with regard to developed land covers within the EIS Study Area would be considered moderate because of disruption of wildlife species from noise and vibration from the additional rail traffic along the route.

Wildlife Corridors and Assemblages and Sensitive Plant Community Effects

The majority of animal assemblages and special terrestrial communities identified within the EIS Study Area are located in the portions of the alternative outside existing transportation corridors. Therefore, the potential construction effects of Alternative C4A Higher-Speed Rail on wildlife corridors, animal assemblages and terrestrial communities would be substantial when compared with the No Build Alternative as construction of the portions of the alternative outside existing transportation corridors would have a noticeable, inevitable effect on these resources within the EIS Study Area.

The potential operations effects for Alternative C4A Higher-Speed Rail would be moderate because this alternative would not likely be fenced, making wildlife movement vulnerable to an increased risk for strikes as a result of the additional rail traffic along the route. Such effects would have a noticeable effect on wildlife, but the effects could be reduced by the use of BMPs (see Section 3.5.5, Avoidance, Minimization, and Mitigation Strategies).

REAP Composite Score Effects

The percentages of the total land coverage of the EIS Study Area composed of higher ecological importance/value land coverage areas for the alternative represent a substantial effect when compared to the No Build Alternative. Construction of the portions of the alternative outside existing transportation corridors would have a noticeable, inevitable effect on lands with higher ecological importance within the EIS Study Area.

The potential operations effects associated with Alternative C4A Higher-Speed Rail with regard to higher ecological importance/value land coverage areas within the EIS Study Area would be considered moderate because of potential disruption of wildlife species from noise and vibration from the additional rail traffic along the route.

3.5.4.4.2 Alternative C4A High-Speed Rail

National Land Cover Database – Land Cover Type Effects

Potential effects on NLCD land cover types would be the same as those discussed for Alternative C4A Higher-Speed Rail, because both service types share the same route. The construction effects would be substantial and the operations effects would be moderate.

Wildlife Corridors and Assemblages and Sensitive Plant Community Effects

Potential construction effects on wildlife corridors and assemblages and sensitive plant communities would be the same as those discussed for Alternative C4A Higher-Speed Rail (substantial) because both service types share the same route. Alternative C4A High-Speed Rail would likely be fully fenced, lessening the likelihood of strikes when compared to the higher-speed rail option. However, Alternative C4A High-Speed Rail would have a higher potential for operations effects overall on wildlife corridors and assemblages within the EIS Study Area than the higher-speed rail option as the noise and vibration generated by high-speed rail would travel farther than the noise generated by higher-speed rail. Overall, the potential operations effects on wildlife corridors and assemblages and sensitive plant communities would be moderate.

REAP Composite Score Effects

The percentage of the total land coverage composed of higher ecological importance/value land coverage area would be the same as Alternative C4A Higher-Speed Rail because both service types share the same route. The construction effects would be substantial and the operations effects would be moderate.

3.5.4.4.3 Alternative C4B Higher-Speed Rail

National Land Cover Database – Land Cover Type Effects

The percentages of total non-developed land covers within the EIS Study Area represent substantial potential effects on non-developed land. The northern extent of Alternative C4B Higher-Speed Rail would follow a new elevated high-speed alignment in the IH-30 median between Fort Worth and Dallas and follow an alignment outside existing transportation corridors starting at Arlington and continuing south to Hillsboro. Construction of the portions of the alternative outside existing transportation corridors would have a noticeable, inevitable effect on non-developed land within the EIS Study Area. The potential construction and operations effects associated with Alternative C4B Higher-Speed Rail with regard to non-developed land covers within the EIS Study Area would be similar to those described for Alternative C4A Higher-Speed Rail because both alternatives share the same route outside existing transportation corridors. The construction effects would be substantial and the operations effects would be moderate.

Wildlife Corridors and Assemblages and Sensitive Plant Community Effects

The animal assemblages and special terrestrial communities identified within the EIS Study Area, for the majority, are in the portions of the alternative outside existing transportation corridors. Therefore, the potential construction effects associated with construction of Alternative C4B Higher-Speed Rail would be substantial and would have a noticeable, inevitable effect on these resources within the EIS Study Area. The effects would be similar to those described for Alternative C4A Higher-Speed Rail because both alternatives share the same route outside existing transportation corridors. Operations effects would have a noticeable and inevitable effect of wildlife, but the effects could be mitigated by the use of BMPs as described for Alternative C4A Higher-Speed Rail, therefore operations effects would be moderate.

REAP Composite Score Effects

The percentages of the total land coverage of the EIS Study Area composed of higher ecological importance/value land coverage areas for the alternative represent a substantial potential effect. Construction of the portions of the alternative outside existing transportation corridors would have a noticeable, inevitable effect on lands with higher ecological importance within the EIS Study Area.

The potential operations effects associated with Alternative C4B Higher-Speed Rail with regard to higher ecological importance/value land coverage areas within the EIS Study Area would be considered moderate because of potential disruption of wildlife species from noise and vibration from the additional rail traffic along the route.

3.5.4.4.4 Alternative C4B High-Speed Rail

National Land Cover Database – Land Cover Type Effects

Potential effects on land cover types would be the same as those discussed for Alternative C4B Higher-Speed Rail, because both service types share the same route. The construction effects would be substantial and the operations effects would be moderate.

Wildlife Corridors and Assemblages and Sensitive Plant Community Effects

Potential construction effects on wildlife corridors and assemblages and sensitive plant communities would be the same as those discussed for Alternative C4B Higher-Speed Rail (substantial), because both service types share the same route. Alternative C4B High-Speed Rail would likely be fully fenced, lessening the likelihood of strikes when compared to the higher-speed rail option. However, Alternative C4B High-Speed Rail would have a higher potential for operations effects on wildlife corridors and assemblages because the noise and vibration generated by high-speed rail would travel farther than the noise generated by higher-speed rail. Overall, the potential operations effects on wildlife corridors and assemblages and sensitive plant communities would be moderate.

REAP Composite Score Effects

The percentage of the total land coverage composed of higher ecological importance/value land coverage area would be the same as Alternative C4B Higher-Speed Rail because both service types share the same route. The construction effects would be substantial and the operations effects would be moderate.

3.5.4.4.5 Alternative C4C Higher-Speed Rail

National Land Cover Database – Land Cover Type Effects

The northern extent of Alternative C4C Higher-Speed Rail, near Dallas and Fort Worth, would follow the TRE between Fort Worth and Dallas, then continue south on the BNSF alignment; however, the majority of the alternative, starting at Waxahachie, would follow an alignment outside existing transportation corridors. Because of the high percentages of total non-developed land covers within the EIS Study Area, and because most of the alternative would follow an alignment outside existing transportation corridors, the alternative could have a noticeable, inevitable effect on non-developed land within the EIS Study Area. The potential construction and operations effects associated with C4C Higher-Speed Rail would be similar to those described for Alternative C4A Higher-Speed Rail, because both alternatives share the same route outside existing transportation corridors. The construction effects would be substantial and the operations effects would be moderate.

Wildlife Corridors and Assemblages and Sensitive Plant Community Effects

The animal assemblages and special terrestrial communities identified within the EIS Study Area are, for the majority, in the portions of the alternative outside existing transportation corridors. Therefore, the potential effects of construction of Alternative C4C Higher-Speed Rail would be substantial because construction of the portions of the alternative outside existing transportation corridors would have a noticeable, inevitable effect on these resources within the EIS Study Area. The potential construction and operations effects associated with C4C Higher-Speed Rail with regard to wildlife corridors and assemblages and sensitive plant communities within the EIS Study Area would be similar to those described for Alternative C4A Higher-Speed Rail because both alternatives share the same route outside existing transportation corridors. Operations effects would have a noticeable and inevitable effect of wildlife, but the effects could be mitigated by the use of BMPs, as described for Alternative C4A Higher-Speed Rail, therefore operations effects would be moderate.

REAP Composite Score Effects

The percentages of the total land coverage of the EIS Study Area composed of higher ecological importance/value land coverage areas for Alternative C4C Higher-Speed Rail represent a substantial potential effect. Construction of the portions of the alternative outside existing transportation corridors would have a noticeable, inevitable effect on lands with higher ecological importance within the EIS Study Area.

The potential operations effects associated with Alternative C4C Higher-Speed Rail with regard to higher ecological importance/value land coverage areas within the EIS Study Area would be considered moderate because of potential disruption of wildlife species from noise and vibration from the additional rail traffic along the route.

3.5.4.4.6 Alternative C4C High-Speed Rail

National Land Cover Database – Land Cover Type Effects

Potential effects on land cover types would be the same as those discussed for Alternative C4C Higher-Speed Rail, because both service types share the same route. The construction effects would be substantial and the operations effects would be moderate.

Wildlife Corridors and Assemblages and Sensitive Plant Community Effects

Potential construction effects on wildlife corridors and assemblages and sensitive plant communities would be the same as those discussed for the Alternative C4C Higher-Speed Rail (substantial), because both service type options share the same route. Alternative C4C High-Speed Rail would likely be fully fenced, reducing the likelihood of strikes when compared to the higher-speed rail option. However, Alternative C4C High-Speed Rail would have a higher potential for operations effects overall on wildlife corridors and assemblages within the EIS Study Area than the higher-speed rail option because the noise and vibration generated by high-speed rail would travel farther than the noise generated by higher-speed rail. Overall, the potential operations effects on wildlife corridors and assemblages and sensitive plant communities would be moderate.

REAP Composite Score Effects

The percentage of the total land coverage composed of higher ecological importance/value land coverage area would be the same as Alternative C4C Higher-Speed Rail because both service types share the same route. The construction effects would be substantial and the operations effects would be moderate.

3.5.4.5 Southern Section: San Antonio to South Texas

3.5.4.5.1 Alternative S4 Higher-Speed Rail

National Land Cover Database – Land Cover Type Effects

Alternative S4 Higher-Speed Rail would have a moderate potential effect on non-developed land. Although portions of Alternative S4 Higher-Speed Rail would be constructed in new alignments outside existing transportation corridors, significant portions of the alternative would likely be constructed within existing routes (e.g., Kansas City Southern Railway and revitalization of abandoned tracks) that have been disturbed by prior rail development, mitigating potential effects on resources.

The potential operations effects associated with Alternative S4 Higher-Speed Rail with regard to developed land covers within the EIS Study Area would be considered moderate as significant portions of the alternative would operate within existing rights-or-way.

Wildlife Corridors and Assemblages and Sensitive Plant Community Effects

The large area of Little Bluestem-Indiangrass terrestrial community within the EIS Study Area for Alternative S4 Higher-Speed Rail is located in Brooks County, in an area that would be constructed on an existing abandoned rail and in areas that were disturbed by prior rail development. The potential effects of construction and operation of Alternative S4 Higher-Speed Rail on wildlife corridors and assemblages or sensitive plant communities would be negligible. This portion of Alternative S4 Higher-Speed Rail would be constructed within existing rights-of-way in the areas of this resource and would not create new effects on sensitive communities.

REAP Composite Score Effects

The portions of Alternative S4 Higher-Speed Rail that cross Brooks and Live Oak counties would be constructed on existing rights-of-way and would have a negligible effect on lands with higher ecological importance within the EIS Study Area. However, construction of the portions of Alternative S4 Higher-Speed Rail outside existing transportation corridors, especially near Duval and Webb counties, would represent a substantial effect. Overall, the construction of Alternative S4 Higher-Speed Rail would have a substantial effect (noticeable, inevitable effect) on lands with higher ecological importance within the EIS Study Area.

The potential operations effects associated with Alternative S4 Higher-Speed Rail with regard to higher ecological importance/value land coverage areas within the EIS Study Area would be considered moderate because of potential disruption of wildlife species from noise and vibration from the additional rail traffic along the route.

3.5.4.5.2 Alternative S6 Higher-Speed Rail

National Land Cover Database – Land Cover Type Effects

Alternative S6 Higher-Speed Rail would have a substantial potential effect on non-developed land within the EIS Study Area because this alternative would follow a new direct high-speed corridor outside existing transportation corridors from San Antonio to a station near the Laredo-Columbia Solidarity Bridge. Construction of this alternative would have a noticeable, inevitable effect on non-developed land within the EIS Study Area. The potential construction effects associated with Alternative S6 Higher-Speed Rail on non-developed land covers within the EIS Study Area would be substantial because construction effects on vegetation outside existing transportation corridors would be long-term or permanent.

The potential operations effects associated with Alternative S6 Higher-Speed Rail on developed land covers within the EIS Study Area would be moderate because of disruption of wildlife species from noise and vibration from the rail traffic along the route. However, the route outside existing transportation corridors could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors. In addition, the majority of effects on non-developed land covers would be during construction of the alternative.

Wildlife Corridors and Assemblages and Sensitive Plant Community Effects

No wildlife corridors and assemblages and sensitive plant communities were identified within the EIS Study Area for Alternative S6 Higher-Speed Rail. Therefore, construction and operation effects on wildlife corridors and assemblages and sensitive plant communities would be negligible.

REAP Composite Score Effects

Alternative S6 Higher-Speed Rail would have a substantial effect on lands with higher ecological importance both during construction and operation because construction of this new alignment outside existing transportation corridors would have a noticeable, inevitable effect on resources.

3.5.4.5.3 Alternative S6 High-Speed Rail

National Land Cover Database – Land Cover Type Effects

Potential effects on land cover types would be the same as those discussed for Alternative S6 Higher-Speed Rail, because both service types share the same route. The construction effects would be substantial and the operations effects would be moderate.

Wildlife Corridors and Assemblages and Sensitive Plant Community Effects

Potential construction effects on wildlife corridors and assemblages and sensitive plant communities would be the same as those discussed for Alternative S6 Higher-Speed Rail because both service types share the same route. Because no wildlife corridors and assemblages and sensitive plant communities were identified within the EIS Study Area, construction and operation effects on wildlife corridors and assemblages and sensitive plant communities would be negligible.

REAP Composite Score Effects

The percentage of the total land coverage composed of higher ecological importance/value land coverage area would be the same as Alternative S6 Higher-Speed Rail and would represent a substantial potential effect during construction and operation, because both service types share the same route.

3.5.4.6 Summary of Potential Effects

The construction and operation of the build alternatives would affect natural ecological systems and wildlife to some degree. Construction of Alternative N4A Conventional would have a negligible effect as the alternative would follow existing rail alignments, with minimal new right-of-way. However, from an operations standpoint, the alternative would not likely be fenced, making wildlife movement vulnerable to an increased risk for strikes from the additional rail traffic that would occur.

The construction of the Central Section build alternatives would have a substantial effect on natural ecological systems and wildlife as most alternatives would be constructed in new rights-of-way, outside of existing transportation corridors, and also bisect known wildlife corridors and assemblages and sensitive plant communities. Operational effects on wildlife for the Central Section higher-speed rail alternatives would be similar to conventional rail service type, as they would not likely be fenced. Conversely, high-speed rail alternatives would be completely fenced and fully grade-separated. Therefore, the risk of strikes would be lower. The high-speed rail alternatives could also be designed with passages for wildlife, further mitigating operational effects. However, the Central Section high-speed rail alternatives would have higher overall potential for effects than the higher-speed rail alternatives, because noise and vibration generated by high-speed rail would travel farther than that generated by higher-speed rail.

The Southern Section build alternatives would have a moderate to substantial effect, with either portions of the alternative constructed outside existing transportation corridors (Alternative S4 Higher-Speed Rail), or, in the case of the S6 alternatives, it would be constructed in a new, direct route, composed of approximately 92 percent non-developed land covers outside existing transportation corridors.

Table 3.5-14 summarizes the qualitative assessment of potential effects (negligible, moderate, or substantial) for the alternatives and also includes measures that could be taken to avoid or reduce the potential effects of the alternatives. Acreages listed below are not the actual areas of effect associated with construction and operation of any of the alternatives. This service-level analysis uses the 500-foot EIS Study Area to determine the types of resources that may be affected and, more importantly, the relative magnitude of resources that may be affected. Some alternatives could be built alone or combined with other section alternatives. In addition, more than one alternative in the Central Section and Southern Section could be built in the future, because the alternatives provide different service type options for the independent destinations. Details about how alternatives might connect, as well as measures to reduce effects, would be analyzed at the project-level EIS phase.

3.5.5 Avoidance, Minimization, and Mitigation Strategies

Avoidance and minimization of project-level effects would be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies would be implemented. Mitigation measures to reduce or eliminate effects on sensitive habitats and species would be coordinated with federal and state agencies. To minimize construction effects and minimize disturbance of terrestrial and aquatic habitats and wildlife, BMPs would be used during construction and operations. BMPs would include but are not limited to the following:

- Construct multiple and varying crossing structures at a wildlife crossing point to provide connectivity for species likely to use a given area.
- Determine and construct the appropriate number, spacing, and location of crossing structures based on species-specific information.
- Monitor structures for obstructions, such as detritus or silt blockages, that impede movement.

- Manage human activity near crossing structures, with use of measures such as fencing and signage.
- Routes outside existing transportation corridors could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors.

Local ordinances would be followed for erosion, sediment, and stormwater controls during construction to minimize potential effects on aquatic resources. For terrestrial habitats that might be temporarily disturbed by construction, pre-construction conditions or better would be restored once construction is complete.

3.5.6 Subsequent Analysis

Once a preferred alternative is selected, field investigations or surveys will be conducted to determine the likelihood of impacts on sensitive habitats within the EIS Study Area and to determine the extent and type of general and sensitive natural ecological systems and wildlife, including formal biological assessments for protected species and consultation with the U.S. Fish and Wildlife Service, TPWD, and ODWC, as needed. The boundaries of sensitive wildlife corridors, sensitive plant communities, or areas identified as having a higher ecological importance/value land coverage will be confirmed to avoid or minimize effects on these areas. Habitat and species assessments will be conducted in accordance with applicable federal and state regulations.

Table 3.5-14: Summary of Effects on Natural Ecological Systems and Wildlife

Alternative[a]	NLCD		Wildlife Corridors and Assemblages and Sensitive Plant Communities		REAP	
	Construction	Operations	Construction	Operations	Construction	Operations
N4A CONV	**Negligible** ▪ 54% non-developed land covers ▪ Alternative would be located within existing transportation corridors, in areas already disturbed by rail development	**Negligible** ▪ Majority of effects would be during construction ▪ Alternative would be located within existing transportation corridors, in areas already disturbed by rail development	**Negligible** ▪ 85 acres of wildlife corridors and assemblages ▪ Alternative would be located within existing transportation corridors, in areas already disturbed by rail development	**Moderate** ▪ Alignment would not likely be fenced, making wildlife movement vulnerable to increased risk for strikes from additional rail traffic ▪ Best management practices could mitigate effects	**Negligible** ▪ 10% of EIS Study Area composed of higher ecological value land coverage ▪ Alternative would be located within existing transportation corridors, in areas already disturbed by rail development	**Negligible** ▪ Majority of effects would be during construction ▪ Alternative would be located within existing transportation corridors, in areas already disturbed by rail development
C4A HrSR	**Substantial** ▪ 62% non-developed land covers ▪ Majority of alternative, starting in Waxahachie, would be located outside existing transportation corridors ▪ Effects on vegetation would be considered long-term or permanent	**Moderate** ▪ Disruption of species from noise and vibration would occur ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Substantial** ▪ 107 acres of wildlife corridors and assemblages ▪ 628 acres of sensitive plant communities ▪ Majority of alternative outside existing transportation corridors ▪ Effects would be considered long-term or permanent	**Moderate** ▪ Disruption of species from noise and vibration would occur ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Substantial** ▪ 18% of EIS Study Area composed of higher ecological value land coverage ▪ Majority of alternative outside existing transportation corridors	**Moderate** ▪ Majority of alternative, starting in Waxahachie, would be located outside existing transportation corridors
C4A HSR	Same as C4A HrSR	Same as C4A HrSR	Same as C4A HrSR	**Moderate** ▪ Would likely be fully fenced, lessening the likelihood of strikes when compared to C4A HrSR ▪ Higher overall potential for effects as noise and vibration generated would travel farther than that generated by HrSR	Same as C4A HrSR	Same as C4A HrSR
C4B HrSR	**Substantial** ▪ 64% non-developed land covers ▪ Majority of alternative outside existing transportation corridors	**Moderate** ▪ Disruption of species from noise and vibration would occur ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Substantial** ▪ 66 acres of wildlife corridors and assemblages ▪ 628 acres of sensitive plant communities ▪ Majority of alternative outside existing transportation corridors	**Moderate** ▪ Disruption of species from noise and vibration would occur ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Substantial** ▪ 18% of EIS Study Area composed of higher ecological value land coverage ▪ Majority of alternative outside existing transportation corridors	**Moderate** ▪ Majority of alternative would be located outside existing transportation corridors
C4B HSR	Same as C4B HrSR	Same as C4B HrSR	Same as C4B HrSR	**Moderate** ▪ Would likely be fully fenced, lessening the likelihood of strikes when compared to C4B HrSR ▪ Higher overall potential for effects as noise and vibration generated would travel farther than that generated by HrSR	Same as C4B HrSR	Same as C4B HrSR

	NLCD		Wildlife Corridors and Assemblages and Sensitive Plant Communities		REAP	
Alternative[a]	Construction	Operations	Construction	Operations	Construction	Operations
C4C HrSR	**Substantial** ▪ 62% non-developed land covers ▪ Majority of alternative outside existing transportation corridors	**Moderate** ▪ Disruption of species from noise and vibration would occur ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Substantial** ▪ 107 acres of wildlife corridors and assemblages ▪ 628 acres of sensitive plant communities ▪ Majority of alternative outside existing transportation corridors	**Moderate** ▪ Disruption of species from noise and vibration would occur ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Substantial** ▪ 15% of EIS Study Area composed of higher ecological value land coverage ▪ Majority of alternative outside existing transportation corridors	**Moderate** ▪ Majority of alternative outside existing transportation corridors
C4C HSR	Same as C4C HrSR	Same as C4C HrSR	Same as C4C HrSR	**Moderate** ▪ Would likely be fully fenced, lessening the likelihood of strikes when compared to C4C HrSR ▪ Higher overall potential for effects as noise and vibration generated would travel farther than that generated by HrSR	Same as C4C HrSR	Same as C4C HrSR
S4 HrSR	**Moderate** ▪ 68% non-developed land covers ▪ Portions of alternative outside existing transportation corridors	**Moderate** ▪ Majority of effects would be during construction ▪ Significant portions of the alternative would be located within existing transportation corridors, in areas already disturbed by rail development	**Negligible** ▪ No wildlife corridors or assemblages within EIS Study Area ▪ 678 acres of sensitive plant communities located in EIS Study Area in portion of alternative within existing transportation corridors	**Negligible** ▪ Majority of effects would be during construction ▪ Alternative would be located within existing transportation corridors, in areas already disturbed by rail development	**Substantial** ▪ 15% of EIS Study Area composed of higher ecological value land coverage ▪ Portions of alternative that consist of higher ecological value land coverage within EIS Study Area located outside existing transportation corridors	**Moderate** ▪ Portions of the alternative outside existing transportation corridors would be located in areas of higher ecological value
S6 HrSR	**Substantial** ▪ 92% non-developed land covers ▪ Alternative would be a new, direct route outside existing transportation corridors	**Moderate** ▪ Disruption of species from noise and vibration would occur ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Negligible** ▪ No wildlife corridors or assemblages or sensitive plant communities within EIS Study Area	**Negligible** ▪ No wildlife corridors or assemblages or sensitive plant communities within EIS Study Area ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Substantial** ▪ 21% of EIS Study Area composed of higher ecological value land coverage ▪ Alternative would be a new, direct route outside existing transportation corridors	**Substantial** ▪ The alternative would be located outside existing transportation corridors ▪ Noticeable and inevitable effect on lands of higher ecological value
S6 HSR	Same as S6 HrSR	Same as S6 HrSR	Same as S6 HrSR	**Moderate** ▪ Would likely be fully fenced, lessening the likelihood of strikes when compared to S6 HrSR ▪ Higher overall potential for effects as noise and vibration generated would travel farther than that generated by HrSR	Same as S6 HrSR	Same as S6 HrSR

[a] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

3.6 Wetlands

This section identifies wetlands within the 500-foot environmental impact study (EIS) Study Area and assesses potential effects on these resources from the alternatives. The introduction to Chapter 3 describes the EIS Study Area and use of terms such as Study Vicinity and transportation corridors, along with the standard organization of each analysis.

Wetlands provide wildlife habitat, but they can be further classified in terms of their level of wildlife/biological habitat and hydrologic and water quality function. Wetlands are defined by soil characteristics, hydrology, and dominance of vegetation adapted to wet environments. The U.S. Army Corps of Engineers (USACE) *Wetlands Delineation Manual* (USACE 1987) defines wetlands as areas that have positive indicators for hydrophytic vegetation, wetland hydrology, and hydric soils, or as:

> "Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (USACE 1987).

This service-level analysis focuses on wetlands and aquatic habitats associated with waters of the U.S. Waters of the U.S. are defined in the Clean Water Act (CWA) and include waters such as those used in interstate or foreign commerce; interstate waters including wetlands; intrastate waters such as lakes, rivers, and streams; impoundments of waters defined as waters of the U.S.; tributaries to the previously listed; and wetlands adjacent to the previously listed. Wetlands fed by or that feed into waters of the U.S. are considered jurisdictional waters and are protected under Section 404 of the CWA. Impacts including discharge of dredged or fill materials to these wetlands and waters of the U.S. require a USACE permit. Waters of the U.S. are also summarized in Section 3.2, Water Quality.

3.6.1 Laws, Regulations, and Orders

Applicable federal and state laws and regulations regarding wetlands in the EIS Study Area are summarized below. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.6.1.1 Federal

- **Executive Order 11990, Protection of Wetlands.** Executive Order 11990, Protection of Wetlands (42 Federal Register [FR] 26961, 3 CFR, 1977 Comp., p. 121), was issued in 1977 by the President of the United States. The Executive Order directs federal agencies under the Executive Branch 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*" (U.S. Environmental Protection Agency [EPA] 2014).

- **U.S. Department of Transportation (USDOT) Order 5660.1A, Preservation of the Nation's Wetlands.** USDOT requires that any mass transportation project that may affect wetlands to complete an analysis of impacts to comply with the "Order on Preservation of the Nation's Wetlands" (5660.1A). The Order states: *"If the analysis shows that the project will have a significant impact on wetlands, an Environmental Impact Statement will usually be required. The environmental analysis should include an assessment of the impacts on wetlands and associated wildlife resulting from both construction and operation of the project. It should also include measures to minimize adverse impacts and avoid, to the fullest extent possible, drainage, filling or other disturbance of wetlands. Alternatives that would avoid new construction in wetlands must be studied. If the preferred alternative requires new construction in wetlands the analysis must demonstrate that there are no practicable alternatives to the use of the wetlands, and all practicable measures to minimize harm have been included"* (USDOT and Federal Transit Administration [FTA] 2014).
- **CWA Section 404 and Rivers and Harbors Act Section 10.** Section 404 of the CWA (33 United States Code [U.S.C.] §1251 et seq.) and Section 10 of the Rivers and Harbors Act (33 U.S.C. §401, et seq.) establish the basic structure for regulating discharges (dredge or fill) into waters of the U.S., including wetlands. The program is jointly administered by USACE and EPA. USACE provides permits and is responsible for the day-to-day administration and permit review. EPA develops and interprets policy, guidance, and environmental criteria used in evaluating CWA permit applications; reviews and comments on CWA permit applications; prohibits, denies, or restricts the use of any defined area as a disposal site for dredge material; and enforces Section 404 provisions. The fundamental goal of the program is that no discharge of dredged or fill material should be permitted if there is a practicable alternative that would be less damaging to waters of the U.S. Permit review and issuance typically involve successive considerations of avoidance, minimization, and compensatory mitigation for unavoidable impacts on waters of the U.S. This sequence is described in Section 404(b)(1) of the CWA (33 U.S.C. §1344[b]) (U.S. Fish and Wildlife Service [USFWS] 2014a).

3.6.1.2 State

- **CWA, Sections 401 and 404 and Harbors Act, Section 10.** Section 401 (33 U.S.C. 1341 and 40 Code of Federal Regulations [CFR] 121) of the CWA requires a Water Quality Certification from the State Water Resources Control Board (SWRCB) or Regional Water Quality Control Board (RWQCB) whenever a project requires a federal license or permit. Certification is also required for projects that require a CWA Section 404 permit or Rivers and Harbors Act Section 10 permit. 401 Water Quality Certifications are administered through the Texas Commission on Environmental Quality (TCEQ) and the Oklahoma Department of Environmental Quality (ODEQ). TCEQ and ODEQ review USACE permit applications for 401 Water Quality Certifications for discharges (dredge or fill) into waters of the U.S. (TCEQ 2014; ODEQ 2014).

3.6.2 Methodology

The methodology for the wetlands evaluation consists of a service-level quantitative assessment, not a detailed evaluation of individual potential wetlands. The quantification compares relative effects among the build alternatives. A detailed evaluation will be completed for the future project-level National Environmental Policy Act (NEPA) analyses and will identify permitting requirements for construction.

Wetlands are categories of waters of the U.S., as defined in the CWA regulations (33 CFR Part 328), and include intrastate lakes, rivers, streams (including intermittent streams), mudflats, sand flats, sloughs, prairie potholes, wet meadows, playa lakes, and natural ponds.

The type and extent of wetlands and deepwater habitats within the EIS Study Area were identified from the National Wetland Inventory (NWI) (http://www.fws.gov/wetlands/Data/Data-Download.html) maintained by USFWS (2014b). Although NWI data provide the location of wetlands, they are derived from aerial photo interpretation with varying limitations due to scale, photo quality, inventory techniques, and other factors. To supplement the NWI data, the National Hydrographic Dataset (NHD) (http://nhd.usgs.gov/data.html) was used to identify waterbodies as an additional indicator of wetlands. Information for these water resources is more comprehensive and complete. Some overlap in the NWI and NHD data is present; however, the overlap is consistent for all alternatives and provides a conservative analysis.
For the purposes of this evaluation, waterbodies and wetlands are often referred to as waters of the U.S. To evaluate the quantitative effects on waters of the U.S. from the Program, the following activities were conducted:

- Analysis of waterbodies using NHD data determined the linear feet of streams and acreage of lakes, ponds, and reservoirs within the EIS Study Area.
    - For this analysis, the NHD data provided the designation of waterbodies in the Northern, Central, and Southern sections of the EIS Study Area as perennial streams, intermittent streams, lakes/ponds, and reservoirs. A perennial stream has flowing water year-round under normal precipitation conditions. The water table is above the streambed for most of the year. Groundwater is the primary water source for streamflow, and runoff from rainfall is a supplemental water source. An intermittent stream has flowing water during certain times of the year under normal precipitation conditions, when groundwater provides water for streamflow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental water source for streamflow.
    - Many ephemeral (transient or seasonal) waterbodies may be considered jurisdictional waters of the U.S. and likely exist within the EIS Study Area. The current NHD does not define ephemeral streams, and remote data for these features are insufficient. For this service-level EIS, ephemeral streams are omitted and will be addressed in follow-up project-specific analysis.

- The number and acreage of wetlands and deepwater habitats within the EIS Study Area were determined using the NWI, which was established by USFWS (2014b). It provides wetland maps and geospatial wetland data to aid in wetland conservation efforts. For this analysis, wetlands are classified according to the USFWS classification system for wetlands and deepwater habitats (Cowardin et al. 1979). A simplification of this classification system was used for this analysis and is described in Table 3.6-1.

Table 3.6-1: USFWS Classification System – Wetlands and Deepwater Habitats within the EIS Study Area

System	Subsystem	Class	Analysis Category
Palustrine Non-tidal wetlands, typically dominated by trees, shrubs, and emergent vegetation. Situated shoreward of lakes, river channels, or estuaries; on river floodplains; in isolated catchments; or on slopes. They may also occur as islands in lakes or rivers.	N/A	UB – Unconsolidated Bottom	Freshwater Pond
	N/A	AB – Aquatic Bed	Freshwater Pond
	N/A	US – Unconsolidated Shore	Freshwater Pond
	N/A	EM – Emergent	Freshwater Emergent Wetland
	N/A	SS – Scrub-Shrub	Freshwater Forested/Scrub Wetland
	N/A	FO – Forested	Freshwater Forested/Scrub Wetland
Riverine Includes wetlands and waterbodies contained within a channel. Typically bounded by the channel bank (including natural and man-made levees) or adjacent palustrine wetlands.	2 – Lower Perennial	UB – Unconsolidated Bottom	Riverine
		US – Unconsolidated Shore	Riverine
	4 – Intermittent	SB – Stream Bed	Riverine
	5 – Unknown Perennial	UB – Unconsolidated Bottom	Riverine
Lacustrine Includes wetlands and waterbodies that have a depressed geomorphic position or a dammed river channel, lack sufficient vegetation, and are generally more than 20 acres. Includes permanently flooded lakes and reservoirs, intermittent lakes, and tidal lakes.	1 – Limnetic	UB – Consolidated Bottom	Lake

N/A = not applicable
Source: Cowardin et al. (1979).

The estimated number and acreage of waterbodies and wetlands were compared for each of the alternatives. The final alignments of the alternatives in the EIS Study Area will not be determined until project-level studies are conducted, and therefore the number and acreages of waterbodies and wetlands within the EIS Study Area provide an estimate of the magnitude of potential effects. The intensity of an effect as a result of the route alternatives are characterized as negligible, moderate, or substantial compared with the No Build Alternative. For wetlands, these terms are defined as follows:

- Negligible intensity effects are those that would have no- or few- effects on waterbodies and wetlands. Negligible intensity effects are very close to the existing conditions.
- Moderate intensity effects would have a noticeable effect on waterbodies and wetlands, but would not have an adverse residual effect.
- Substantial intensity effects would have a noticeable effect on waterbodies and wetlands and would be highly likely to have an adverse residual effect on resources.

3.6.3 Affected Environment

Wetlands compose approximately 2 percent (950,000 acres) of Oklahoma and include bottom-land hardwood forests and swamps; marshes and wet meadows; aquatic-bed wetlands characterized by submersed or floating plants in ponds, lakes, rivers, and sloughs; and sparsely vegetated wetlands such as intermittently flooded playa lakes. Most forested wetlands are in eastern Oklahoma, where precipitation is highest and evaporation is lowest. Riparian wetlands and playa lakes in drier western Oklahoma are especially valuable to wildlife. Nearly two-thirds of Oklahoma's original wetlands have been lost to agricultural conversions, channelization, impoundment, streamflow regulation, and other causes (U.S. Geological Survey [USGS] 1997).

In contrast to Oklahoma, wetlands in Texas are more abundant, estimated at 7.6 million acres (4.4 percent of the state). The most extensive wetlands are the bottom-land hardwood forests and swamps of east Texas; the marshes, swamps, and tidal flats of the coast; and the playa lakes of the High Plains. Wetlands provide flood attenuation, bank stabilization, water quality maintenance, fish and wildlife habitat, and areas for hunting, fishing, and other recreational activities. Commercial fisheries benefit directly from coastal wetlands. About one-half of Texas's original wetlands have been lost to agricultural conversions, overgrazing, urbanization, channelization, water table declines, construction of navigation canals, and other causes (USGS 1997).

The following sections describe potential wetlands associated with waters of the U.S. within the Northern, Central, and Southern sections of the EIS Study Area. The descriptions and maps for waterbodies are provided in Section 3.2, Water Quality.

3.6.3.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Most waterbodies within the Northern Section are characterized by drainage channels and riparian areas including intermittent and perennial streams, ponds, lakes, and reservoirs. The largest wetland areas in the Northern Section are composed of freshwater forested/scrub wetlands, freshwater emergent wetlands, and freshwater ponds. These palustrine wetlands may also include emergent wetlands, marshes, swamps, and wet prairies. The EIS Study Area in the Northern Section also includes ponded areas of shallow permanent or intermittent waterbodies (farm ponds and man-made lakes). Riverine wetlands in the Northern Section include fringe wetlands and deepwater habitats of perennial and intermittent streams and rivers. Tables 3.6-2 and 3.6-3 provide a summary of waters of the U.S. within the Northern Section.

Table 3.6-2: Summary of Waterbodies within the Northern Section

Waterbody Type	Number in EIS Study Area
Alternative N4A	
Perennial Streams	43
Intermittent Streams	300
Lakes/Ponds	163
Reservoirs	31
Total	**537**
Source: USGS (2000-2013).	

Table 3.6-3: Summary of Wetlands and Deepwater Habitats within the Northern Section

Wetland Type	Number in EIS Study Area
Route Alternative N4A	
Lakes	3
Freshwater Ponds	157
Freshwater Emergent Wetlands	36
Freshwater Forested/Scrub Wetlands	54
Riverine	21
Total	**271**
Sources: Cowardin et al. (1979); USFWS (2014a) USFWS (2014b).	

Figure 3.6-1 identifies the NWI wetlands and deepwater habitats within the vicinity of the Northern Section. NHD waterbodies within the vicinity of the Northern Section are identified on Figure 3.2-1 in Section 3.2, Water Quality.

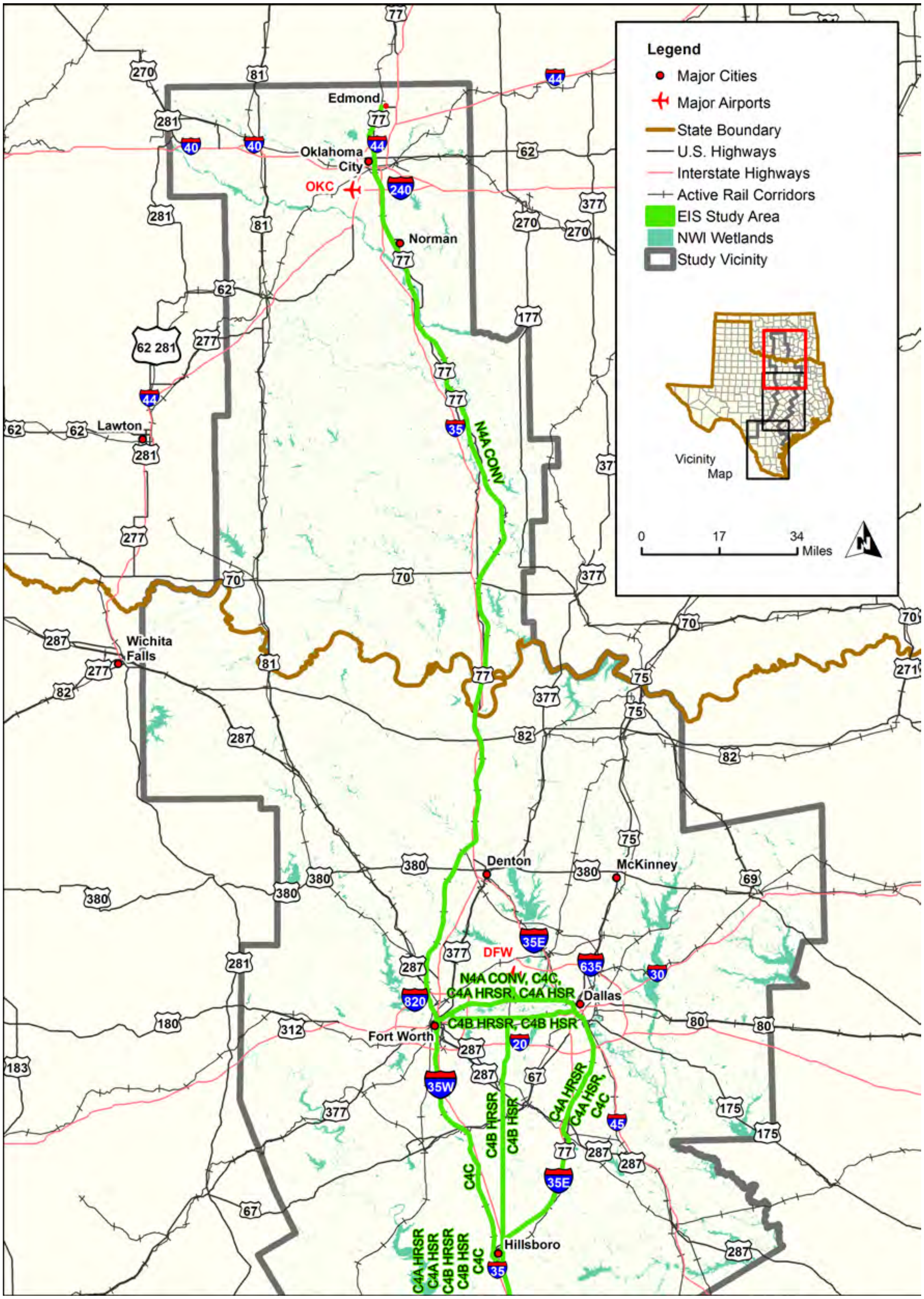

Figure 3.6-1: NWI Wetlands and Deepwater Habitats within the Vicinity of the Northern Section

3.6.3.2 Central Section: Dallas and Fort Worth to San Antonio

Most waters of the U.S. within the Central Section are similar to the Northern Section. Waterbodies are associated with large drainage channels and riparian areas. These include intermittent and perennial streams, ponds, lakes, and reservoirs.

The largest wetland areas in the Central Section are composed of freshwater forested/scrub wetlands, freshwater emergent wetlands, and freshwater ponds. Similar to the Northern Section, in the Central Section, these palustrine wetlands may also include emergent wetlands, marshes, swamps, and wet prairies. The Central Section also includes ponded areas of shallow permanent or intermittent waterbodies (farm ponds and man-made lakes). Riverine wetlands in the Central Section include fringe wetlands and deepwater habitats of perennial and intermittent streams and rivers. Tables 3.6-4 and 3.6-5 provide a summary of waters of the U.S. within the Central Section.

Table 3.6-4: Summary of Waterbodies within the Central Section

Waterbody Type	Number in EIS Study Area
Route Alternative C4A	
Perennial Streams	75
Intermittent Streams	362
Lakes/Ponds	246
Reservoirs	17
Total	**700**
Route Alternative C4B	
Perennial Streams	42
Intermittent Streams	374
Lakes/Ponds	222
Reservoirs	12
Total	**650**
Route Alternative C4C	
Perennial Streams	82
Intermittent Streams	459
Lakes/Ponds	291
Reservoirs	18
Total	**850**
Source: USGS (2000-2013).	

Table 3.6-5: Summary of Wetlands and Deepwater Habitats within the Central Section

Wetland Type	Number in EIS Study Area
Route Alternative C4A	
Lakes	9
Freshwater Ponds	213
Freshwater Emergent Wetlands	28
Freshwater Forested/Scrub Wetlands	47
Riverine	52
Total	**349**
Route Alternative C4B	
Lakes	7
Freshwater Ponds	198
Freshwater Emergent Wetlands	24
Freshwater Forested/Scrub Wetlands	29
Riverine	51
Total	**309**
Route Alternative C4C	
Lakes	11
Freshwater Ponds	245
Freshwater Emergent Wetlands	37
Freshwater Forested/Scrub Wetlands	46
Riverine	52
Total	**391**
Sources: Cowardin et al. (1979); USFWS (2014a); USFWS (2014b).	

Figure 3.6-2 identifies NWI wetlands and deepwater habitats within the vicinity of the Central Section. NHD waterbodies within the vicinity of the Central Section are identified on Figure 3.2-5 in Section 3.2, Water Quality.

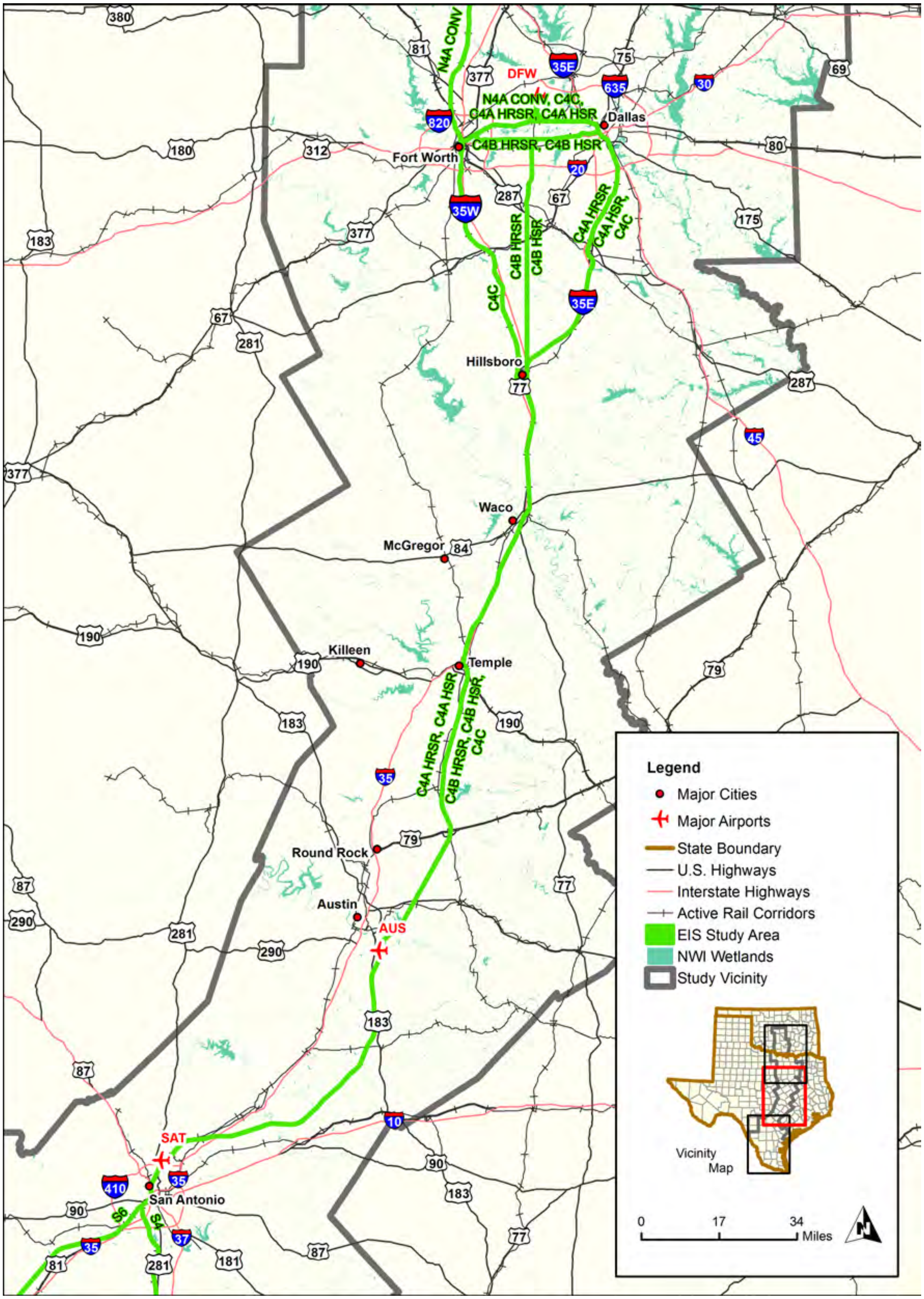

Figure 3.6-2: NWI Wetlands and Deepwater Habitats within the Vicinity of the Central Section

3.6.3.3 Southern Section: San Antonio to South Texas

Most waters of the U.S. within the Southern Section are similar to those within the Northern and Central sections. Waterbodies are associated with drainage channels and riparian areas, or they are within coastal areas. These include drainage channels, intermittent river and stream channels, perennial river and stream channels, ponds, lakes, and reservoirs, coastal estuarine lagoons, and intertidal sloughs.

The largest wetland areas in the Southern Section are composed of freshwater forested/scrub wetlands, freshwater emergent wetlands, and freshwater ponds. Similar to the Northern and Central sections, in the Southern Section, these palustrine wetlands may also include emergent wetlands, marshes, swamps, and wet prairies. The Southern Section also includes ponded areas of shallow permanent or intermittent waterbodies (farm ponds and man-made lakes). Riverine wetlands in the Southern Section include fringe wetlands and deepwater habitats of perennial and intermittent streams and rivers. Tables 3.6-6 and 3.6-7 list waters of the U.S. within the Southern Section.

Table 3.6-6: Summary of Waterbodies within the Southern Section

Waterbody Type	Number in EIS Study Area
Route Alternative S4	
Perennial Streams	4
Intermittent Streams	310
Lakes/Ponds	113
Reservoirs	16
Total	**443**
Route Alternative S6	
Perennial Streams	2
Intermittent Streams	196
Lakes/Ponds	53
Reservoirs	4
Total	**255**
Source: USGS (2000-2013).	

Table 3.6-7: Summary of Wetlands and Deepwater Habitats within the Southern Section

Wetland Type	Number in EIS Study Area
Route Alternative S4	
Lakes	9
Freshwater Ponds	213
Freshwater Emergent Wetlands	28
Freshwater Forested/Scrub Wetlands	47
Riverine	52
Total	**349**
Route Alternative S6	
Lakes	7
Freshwater Ponds	198
Freshwater Emergent Wetlands	24
Freshwater Forested/Scrub Wetlands	29
Riverine	51
Total	**309**
Sources: Cowardin et al. (1979); USFWS (2014a); USFWS (2014b).	

Figure 3.6-3 identifies NWI wetlands and deepwater habitats within the vicinity of the Southern Section. NHD waterbodies in the vicinity of the Southern Section are identified on Figure 3.2-9 in Section 3.2, Water Quality.

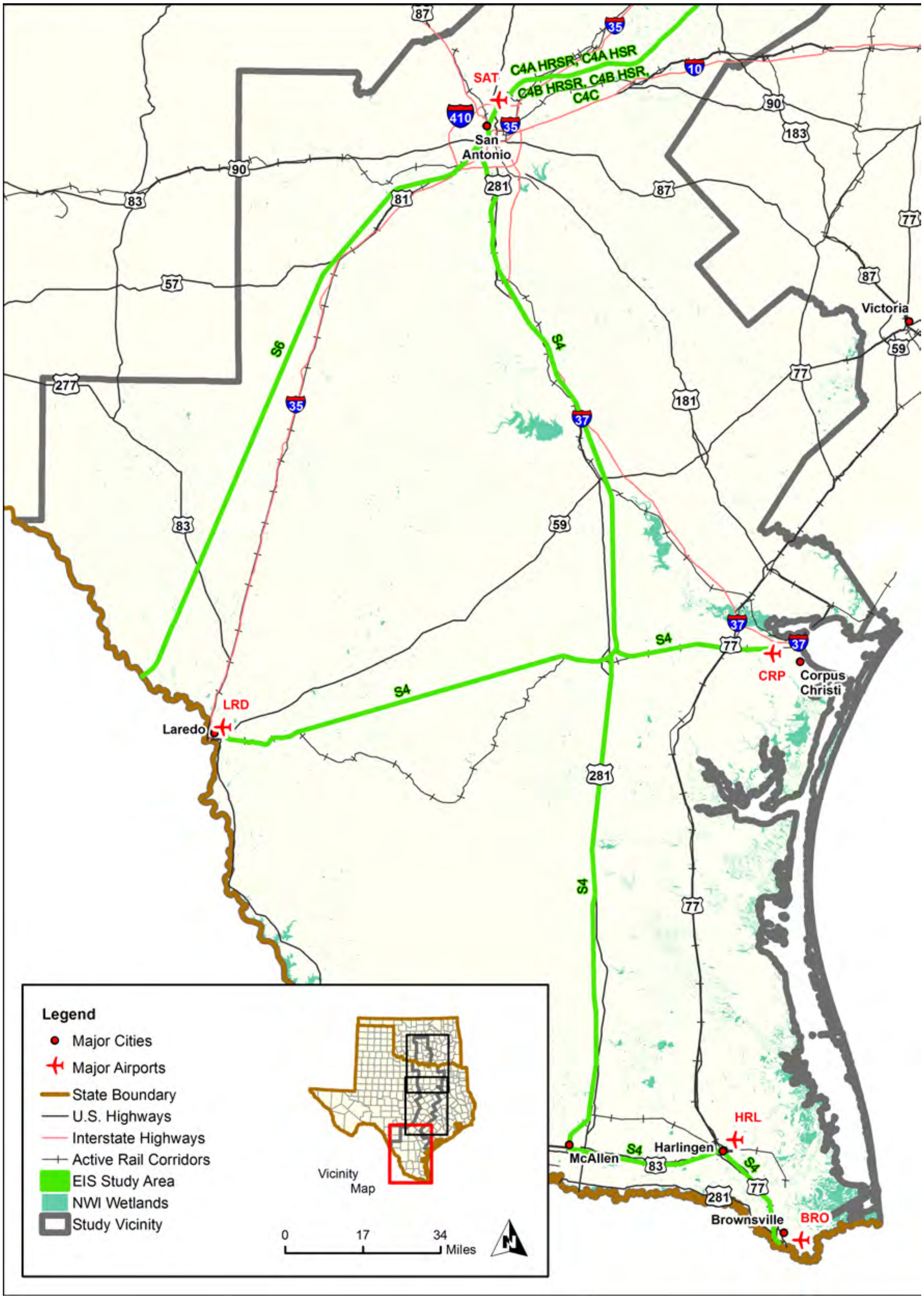

Figure 3.6-3: NWI Wetlands and Deepwater Habitats within the Vicinity of the Southern Section

3.6.4 Environmental Consequences

3.6.4.1 Overview

The Program would cross wetlands and other water resources. Direct and indirect effects could be temporary or permanent.

Most effects on wetlands and other water resources would occur during construction when the ground is disturbed. During construction, all three service types could result in temporary disturbance of wetland areas and functions. Effects could result from vegetation clearing, site grading, and filling for construction access to permanent facilities. These activities could decrease soil permeability, infiltration, water storage capacity, and vegetation regrowth, which may reduce wetland functions. Regulations require that these areas be revegetated and returned to natural conditions following construction. For high-speed rail, temporary effects would include alterations to wetlands beneath the elevated structures.

Additionally, fuel oils, chemicals, or concrete leachate could be spilled during construction. An increase in sediment loading and turbidity from grading and filling activities could contribute sediment-laden runoff into wetlands and degrade water quality. Invasive species could be introduced and spread as a result of disturbance, thus undermining the function of wetland vegetation. After construction is complete, operational effects on waters of the U.S. would be short-term but recurring from maintenance of structures that cross waters of the U.S.

Operation or long-term effects would include the permanent placement of fill of wetlands and wetland buffers for the permanent rail structures and support infrastructure. In addition, permanent effects on wetlands that could persist throughout operation include the following:

- Permanently removing wetland area and function, including wetlands buffer areas.
- Generating runoff from new pollution-generating impervious surfaces (roadway modifications, park-and-ride lots, and maintenance facilities), potentially increasing pollutant loads to wetlands.
- Potentially spilling fuel, oil, or chemical spills at maintenance facilities.

In addition, the high-speed rail could permanently shade wetland areas under elevated structures.

For this service-level analysis, the number and size (linear feet or acreage) of resources that would be affected within the EIS Study Area for each alternative were identified and are referenced in the following sections (Tables 3.6-8 to 3.6-21).

3.6.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation, and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect wetlands or other water resources.

3.6.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.6.4.3.1 Alternative N4A Conventional

Tables 3.6-8 and 3.6-9 list the number and size of waters of the U.S. potentially affected by Alternative N4A Conventional, identifying linear feet (for streams and rivers) and acreage (for lakes and reservoirs, as well as wetlands and deepwater habitats) within the EIS Study Area for Alternative N4A. This alternative would result in negligible effects on waters of the U.S. because it would remain within existing railway infrastructure and right-of-way.

Table 3.6-8: Waterbodies within the Northern Section – Alternative N4A Conventional

Waterbody Type	Number of Features	Acres	Linear Feet
Alternative N4A CONV			
Streams and Rivers	343	N/A	317,365
Lakes and Reservoirs	194	103	N/A
Total	**537**	**103**	**317,365**
Source: USGS (2000-2013).			

Table 3.6-9: Wetlands and Deepwater Habitats within the Northern Section – Alternative N4A Conventional

Wetland Type	Number of Features	Acres
Alternative N4A CONV		
Lakes	3	2
Freshwater Ponds	157	81
Freshwater Emergent Wetlands	36	34
Freshwater Forested/Scrub Wetlands	54	195
Riverine	21	51
Total	**271**	**363**
Sources: Cowardin et al. (1979); USFWS (2014a); USFWS (2014b).		

3.6.4.4 Central Section: Dallas and Fort Worth to San Antonio

Each route alternative in the Central Section has a higher-speed rail and a high-speed rail service type; however, the different service types would not change the levels of effect on waters of the U.S. The variety in the number, acreage, or linear feet of resources that would be affected in the Central

Section is related to the potential alignment of each route alternative. Overall, the C4C alternatives would have greater effects than the C4A alternatives, and the C4B alternatives would have the least effects both on waterbodies and on wetlands and deepwater habitats because each EIS Study Area contains respectively fewer linear feet and acres of waters of the U.S. While the potential alignments and volume of effects of Alternatives C4A, C4B, and C4C would differ, the magnitude of the effects associated with the alternatives in the Central Section would be similar, and all would have effects of moderate intensity compared with the No Build Alternative.

3.6.4.4.1 Alternative C4A Higher-Speed Rail

Tables 3.6-10 and 3.6-11 list the number and size of waters of the U.S. in the EIS Study Area for Alternative C4A Higher-Speed Rail. Compared with the No Build Alternative, potential effects on waters of the U.S. from Alternative C4A Higher-Speed Rail would be moderate based on the total linear feet potentially affected because portions of the alignment would be built outside of existing transportation corridors (or would require new facilities to be built in existing transportation corridors).

3.6.4.4.2 Alternative C4A High-Speed Rail

Tables 3.6-10 and 3.6-11 list the number and size of waters of the U.S. within the EIS Study Area of Alternative C4A High-Speed Rail, which would have the same effects as Alternative C4A Higher-Speed Rail because the both alternatives would follow the same alignment. Potential effects on waters of the U.S. would be moderate.

Although station locations, which are not included in the study, might vary between service types, effects on waters of the U.S. are not anticipated to differ as a result of different types of service along the same alignment except to the extent that high-speed rail may result in a larger area of disturbance than higher-speed rail that may affect wetland features.

Table 3.6-10: Waterbodies within the Central Section – Alternatives C4A Higher-Speed Rail and C4A High-Speed Rail

Waterbody Type	No. of Features	Acreage	Linear Feet
Alternatives C4A HrSR and C4A HSR[a]			
Streams and Rivers	437	N/A	316,909
Lakes and Reservoirs	263	153	N/A
Total	**700**	**153**	**316,909**

[a] HrSR = higher-speed rail; HSR = high-speed rail

Source: USGS (2000-2013).

Table 3.6-11: Wetlands and Deepwater Habitats within the Central Section – Alternatives C4A Higher-Speed Rail and C4A High-Speed Rail

Wetland Type	Number of Features	Acreage
Alternatives C4A HrSR and C4A HSR		
Lakes	9	32
Freshwater Ponds	213	82
Freshwater Emergent Wetlands	28	54
Freshwater Forested/Scrub Wetlands	47	96
Riverine	52	48
Total	**349**	**312**
Sources: Cowardin et al. (1979); USFWS (2014a); USFWS (2014b).		

3.6.4.4.3 Alternative C4B Higher-Speed Rail

Tables 3.6-12 and 3.6-13 provide the potential total effects on waters of the U.S. within the EIS Study Area of Alternative C4B Higher-Speed Rail. Potential effects on waters of the U.S. from Alternative C4B Higher-Speed Rail would be moderate.

3.6.4.4.4 Alternative C4B High-Speed Rail

Tables 3.6-12 and 3.6-13 list the number and size of waters of the U.S. within the EIS Study Area of Alternative C4B High-Speed Rail. Alternative C4B High-Speed Rail would have the same effects on waters of the U.S. as Alternative C4B Higher-Speed Rail because both alternatives would follow the same alignment. Potential effects on waters of the U.S. would be moderate.

Although station locations, which are not included in the study, might vary between alternatives, effects on surface waters are not anticipated to differ as a result of different types of service along the same alignment, except for the potential of the high speed rail to disturb a larger area due to grade separations requirements.

Table 3.6-12: Waterbodies within the Central Section – Alternatives C4B Higher-Speed Rail and C4B High-Speed Rail

Waterbody Type	Number of Features	Acreage	Linear Feet
Alternatives C4B HrSR and C4B HSR			
Streams and Rivers	416	N/A	293,669
Lakes and Reservoirs	234	99	N/A
Total	**650**	**99**	**293,669**
Source: USGS (2000-2013).			

Table 3.6-13: Wetlands and Deepwater Habitats within the Central Section – Alternatives C4B Higher-Speed Rail and C4B High-Speed Rail

Wetland Type	Number of Features	Acreage
Alternatives C4B HrSR and C4B HSR		
Lakes	7	18
Freshwater Ponds	198	68
Freshwater Emergent Wetlands	24	13
Freshwater Forested/Scrub Wetlands	29	32
Riverine	51	50
Total	**309**	**181**
Sources: Cowardin et al. (1979); USFWS (2014a); USFWS (2014b).		

3.6.4.4.5 Alternative C4C Higher-Speed Rail

Tables 3.6-14 and 3.6-15 list the number and size of waters of the U.S. within the EIS Study Area of Alternative C4C Higher-Speed Rail. Potential effects on waters of the U.S. from Alternative C4C Higher-Speed Rail would be moderate.

3.6.4.4.6 Alternative C4C High-Speed Rail

Tables 3.6-14 and 3.6-15 list the number and size of waters of the U.S. within the EIS Study Area of Alternative C4C High-Speed Rail, which would have the same effects on waters of the U.S. as Alternative C4C Higher-Speed Rail because both alternatives would follow the same alignment. Potential effects on waters of the U.S. would be moderate.

Table 3.6-14: Waterbodies within the Central Section – Alternatives C4C Higher-Speed Rail and C4C High-Speed Rail

Waterbody Type	Number of Features	Acreage	Linear Feet
Alternatives C4C HrSR and C4C HSR			
Streams and Rivers	541	N/A	400,363
Lakes and Reservoirs	309	164	N/A
Total	**850**	**164**	**400,363**
Source: USGS (2000-2013).			

Table 3.6-15: Wetlands and Deepwater Habitats within the Central Section – Alternatives C4C Higher-Speed and C4C High-Speed Rail

Wetland Type	Number of Features	Acreage
Alternative C4C HrSR and C4C HSR		
Lakes	11	42
Freshwater Ponds	245	94
Freshwater Emergent Wetlands	37	58
Freshwater Forested/Scrub Wetlands	46	103
Riverine	52	48
Total	**391**	**345**
Sources: Cowardin et al. (1979); USFWS (2014a); USFWS (2014b).		

3.6.4.5 Southern Section: San Antonio to South Texas

Like the alternatives in the Central Section, the number, acreage (lakes and reservoirs, as well as wetlands and deepwater habitats), or linear feet (streams and rivers) of resources that would be affected in the Southern Section is related to the potential alignment and length of the route and not to the service type (in the case of the two S6 alternatives). Compared with the No Build Alternative, the overall potential effects on waters of the U.S. from all the alternatives in the Southern Section would be moderate in intensity; however, the magnitude of the effects associated with Alternative S4 would be greater than those of the two S6 alternatives because the EIS Study Area for Alternative S4 contains more linear feet and acres of waters of the U.S.

3.6.4.5.1 Alternative S4 Higher-Speed Rail

Tables 3.6-16 and 3.6-17 list the number and size of waters of the U.S. potentially affected by Alternative S4 Higher-Speed Rail. Compared with the No Build Alternative, the potential effects on surface waters from Alternative S4 would be moderate.

Table 3.6-16: Waterbodies within the Southern Section – Alternative S4 Higher-Speed Rail

Waterbody Type	Number of Features	Acreage	Linear Feet
Alternative S4 HrSR			
Streams and Rivers	314	N/A	247,448
Lakes and Reservoirs	129	74	N/A
Total	**443**	**74**	**247, 448**
Source: USGS (2000-2013).			

Table 3.6-17: Wetlands and Deepwater Habitats within the Southern Section – Alternative S4 Higher-Speed Rail

Wetland Type	Number of Features	Acreage
Alternative S4 HrSR		
Lakes	5	5
Freshwater Ponds	108	60
Freshwater Emergent Wetlands	17	12
Freshwater Forested/Scrub Wetlands	20	28
Riverine	39	37
Total	**189**	**142**
Sources: Cowardin et al. (1979); USFWS (2014a) USFWS (2014b).		

3.6.4.5.2 Alternative S6 Higher-Speed Rail

Tables 3.6-18 and 3.6-19 list the number and size of waters of the U.S. within the EIS Study Area of Alternative S6 Higher-Speed Rail. Potential effects on waters of the U.S. from Alternative S6 Higher-Speed Rail would be moderate.

3.6.4.5.3 Alternative S6 High-Speed Rail

Tables 3.6-18 and 3.6-19 provide a summary of potential effects on waters of the U.S. within the EIS Study Area of Alternative S6 High-Speed Rail, which would have the same effects on waters of the U.S. as Alternative S6 Higher-Speed Rail because both alternatives would follow the same alignment. Potential effects on waters of the U.S. would be moderate.

Table 3.6-18: Waterbodies within the Southern Section – Alternatives S6 Higher-Speed Rail and S6 High-Speed Rail

Waterbody Type	Number of Features	Acreage	Linear Feet
Alternative S6 HrSR and S6 HSR			
Streams and Rivers	198	N/A	120,488
Lakes and Reservoirs	57	29	N/A
Total	**255**	**29**	**120,488**
Source: USGS (2000-2013).			

Table 3.6-19: Wetlands and Deepwater Habitats within the Southern Section – Alternatives S6 Higher-Speed and S6 High-Speed Rail

Wetland Type	Number of Features Crossed	Acreage
Alternative S6 HrSR and S6 HSR		
Lakes	0	0
Freshwater Ponds	53	27
Freshwater Emergent Wetlands	4	3
Freshwater Forested/Scrub Wetlands	8	6
Riverine	18	21
Total	**83**	**57**
Sources: Cowardin et al. (1979); USFWS (2014a); USFWS (2014b).		

3.6.4.6 Summary of Potential Effects

Tables 3.6-20 and 3.6-21 summarize effects and provide a qualitative assessment (negligible, moderate, or substantial) for each alternative, compared with the No Build Alternative, for waterbodies and for wetlands and deepwater habitats. While the intensity is based on volume of wetlands potentially affected, most wetland effects can be mitigated through wetland replacement or wetland banking. The effects listed are not the actual areas of effect associated with construction and operation of any of the alternatives. This service-level EIS uses the EIS Study Area to determine the types of resources that may be affected, and more importantly, to determine the relative magnitude of potential effects on those resources. Alternatives in the Northern, Central, and Southern sections could be built as individual, standalone projects or in combination with alternatives in another geographic section. More than one alternative in the Central or Southern sections could be built in the future because the alternatives provide service type options for different destinations. Details on connecting the alternatives would be determined during the project-level analysis.

Table 3.6-20: Summary of Effects on Waterbodies

Section	Alternative	Total Number of Waterbodies	Streams and Rivers (linear feet)	Lakes and Reservoirs (acres)	Potential Intensity of Impact
No Build Alternative[a]		0	0	0	None
Northern Section	N4A CONV	537	317,365	103	Negligible
Central Section	C4A HrSR C4A HSR	700	316,909	153	Moderate
	C4B HrSR C4A HSR	650	293,669	99	Moderate
	C4C HrSR C4A HSR	850	400,363	164	Moderate
Southern Section	S4 HrSR	443	247,448	74	Moderate
	S6 HrSR S6 HSR	255	120,488	29	Moderate

[a] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

Table 3.6-21: Summary of Effects on Wetlands and Deepwater Habitats

Section	Alternative	Total Number of Wetlands	Lakes (acres)	Freshwater Ponds (acres)	Freshwater Emergent Wetlands (acres)	Freshwater Forested/Scrub Wetlands (acres)	Riverine (acres)	Total of Wetlands and Deepwater Habitats (acres)	Potential Intensity of Impact
No Build Alternative[a]		0	0	0	0	0	0	0	None
Northern Section	N4A CONV	271	2	81	34	195	51	363	Negligible
Central Section	C4A HrSR C4A HSR	349	32	82	54	96	48	312	Moderate
	C4B HrSR C4A HSR	309	18	68	13	32	50	181	Moderate
	C4C HrSR C4A HSR	391	42	94	58	103	48	345	Moderate
Southern Section	S4 HrSR	189	5	60	12	28	37	142	Moderate
	S6 HrSR S6 HSR	83	0	27	3	6	21	57	Moderate

[a] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

3.6.5 Avoidance, Minimization, and Mitigation Strategies

The environmental planning and review process typically involves successive considerations of avoidance, minimization, and compensatory mitigation with regard to waters of the U.S., as required under the CWA. Measures to avoid, minimize, and provide compensatory mitigation for unavoidable impacts follow USACE rules and guidance, with the goal of no net loss of wetland functions and values. Avoidance, minimization, and mitigation strategies would be considered in evaluating waters of the U.S. impacts. Avoidance and minimization of effects will be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies will be implemented.

Measures implemented to avoid waters of the U.S. impacts may include the following:

- Route selection and route adjustments
- Temporary work space siting during design iterations
- Demarcation of wetlands outside the construction corridor as “no work zones”

Measures implemented to minimize waters of the U.S. impacts may include the following:

- Co-location of the proposed Program alternative with previously disturbed construction areas
- Construction methods that limit temporary workspace through waters of the U.S.
- Topsoil segregation and replacement in temporarily excavated wetlands
- Expedited construction in and around wetlands
- Storage of fuel, lubricant, and hazardous material or location of equipment refueling areas outside waters of the U.S. boundaries
- Right-of-way inspections during and after construction
- Repair of erosion control or restoration features as necessary until permanent re-vegetation is successful
- Restoration of waters of the U.S. to the original contours and flow regimes to the extent practical
- Promotion of natural re-vegetation through the available topsoil seed bank

Where impacts on waters of the U.S. are unavoidable, compensatory mitigation would be required. The approach to compensatory mitigation follows the 2008 EPA and USACE Wetland Compensatory Mitigation Rules (33 CFR Parts 325 and 332, 40 CFR Part 230) emphasizing a watershed-level approach to compensation. Previous EPA and USACE guidance favored mitigation close to the location of impacts, but the March 2008 Wetland Compensatory Mitigation Rule lists the following hierarchy of mitigation preferences: (1) mitigation banks; (2) in-lieu fee programs; and, if the first two options are not practicable (3) permittee-responsible mitigation. Consultation with USACE will determine whether one or a combination of the three mitigation strategies would be appropriate.

3.6.6 Subsequent Analysis

Subsequent analysis will include waters of the U.S. permitting and mitigation strategies, which are discussed below.

3.6.6.1 Waters of the U.S. Permitting

The lead agency with the broadest level of jurisdiction over the waters of the U.S. permitting process is USACE. USACE regulates the discharges of dredge and fill materials into waters of the U.S. under Section 404 of the CWA (33 U.S.C. §§ 1251 – 1376). Placing structures in or under navigable waters is regulated under Section 10 of the Rivers and Harbors Act (33 U.S.C. §403), which is also administered by USACE. Permit authorizations under Section 404 and Section 10 are typically combined into a single permit application.

Before a USACE permit application is submitted, a waters of the U.S. delineation and habitat assessment will be conducted along the Program corridor to identify and map the boundaries of waters of the U.S. and to characterize existing habitat. Features will be mapped using submeter accurate global positioning system (GPS) receivers and will be photo-documented.

The results from the waters of the U.S. delineation will be submitted to USACE for an approved or preliminary jurisdictional determination. USACE would review the jurisdictional determination application and provide a ruling on jurisdictional waters within the Program corridor.

After engineering alignment and facility plans are finalized, a waters of the U.S. impact analysis will be conducted to determine the level of permitting requirements for unavoidable impacts on waters of the U.S. Depending on the impacts on waters of the U.S., the project would require a Nationwide Permit or an Individual Permit, both of which are summarized below:

- Nationwide Permit – The USACE Nationwide Permit authorizes activities that have “minimal individual and cumulative adverse environmental effects” (USACE 2014a). Each of the 49 Nationwide Permits contains specific permit requirements and waters of the U.S. impact threshold limits. A Pre-Construction Notification may be required depending on waters of the U.S. impacts. Nationwide Permits are valid for 5 years and would be subject to regional, state, and USACE district conditions.
- Individual Permit – The USACE Individual Permit is used for significant impacts on waters of the U.S. The process involves pre-application meetings with USACE, stakeholders (federal, state, and local agencies), and the interested public as appropriate. Upon receipt of an application, USACE prepares a public notice (if required), evaluates impacts, considers stakeholders and public comments, recommends changes, and delegates drafting of appropriate documentation in support of permit decision (USACE 2014b).

3.7 Threatened and Endangered Species

This section describes threatened and endangered species within the 500-foot Environmental Impact Statement (EIS) Study Area and assesses potential effects on these resources by the alternatives. The introduction to Chapter 3 describes the EIS Study Area and use of terms such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.7.1 Regulatory Environment

Applicable federal and state legislation and regulations pertaining to threatened and endangered species within the EIS Study Area are described below. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.7.1.1 Federal

- **Endangered Species Act (ESA) of 1973 (16 United States Code [U.S.C.] § 1531-1544 and 42 U.S.C. § 4321, et seq.).** The ESA protects and recovers imperiled species and the ecosystems upon which they depend. The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) administer the ESA. USFWS is responsible for terrestrial and freshwater organisms, and NMFS is responsible for marine wildlife, including whales, and anadromous fish, such as salmon. Under the ESA, species may be listed as either endangered or threatened. An endangered species means a species is in danger of extinction throughout all or a significant portion of its range. A threatened species means a species is likely to become endangered within the foreseeable future. Species of plants and animals, except pest insects, are eligible for listing if they meet the criteria for endangered or threatened classification. The ESA and amendments provide guidance for conserving federally listed species and the ecosystems upon which they depend. Relevant sections within the ESA are summarized below:
  - <u>Section 4 of the ESA (Listing, Critical Habitat and Recovery).</u> Section 4 of the ESA (16 U.S.C. § 1533) includes the procedures for listing a species and requires species to be listed as endangered or threatened solely on the basis of their biological status and threats to their existence. When evaluating a species for listing, USFWS considers the following five factors: (1) damage to, or destruction of, a species' habitat; (2) overuse of the species for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing protection; and (5) other natural or manmade factors that affect the continued existence of the species. When one or more of these factors endanger the survival of a species, USFWS takes action to protect it. Section 4 also requires USFWS and NMFS to designate critical habitat for species listed under the ESA. Critical habitat is defined as follows:
    - Specific areas within the geographical area occupied by the species at the time of listing if those areas contain physical or biological features essential to conservation and if those features require special management considerations or protection.

- Specific areas outside the geographical area occupied by the species if those areas are essential for conservation.

In addition, Section 4 directs USFWS and NMFS to develop and implement recovery plans for threatened and endangered species, unless such a plan would not promote conservation of the species.

- Section 7 of the ESA (Interagency Consultation and Biological Assessments). Section 7 of the ESA (16 U.S.C. § 1536) requires federal agencies to consult with USFWS or NMFS, as appropriate, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of threatened or endangered fish, wildlife, or plant species or result in the destruction or adverse modification of designated critical habitat for any such species. Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features.
- Section 9 of the ESA (Prohibited Acts), and its implementing regulations. Section 9 of the ESA (16 U.S.C. § 1538) prohibits the "taking" of any fish or wildlife species listed under the ESA as endangered or threatened, unless otherwise authorized by federal regulations. "Take" includes the destruction of a listed species' habitat. "Take" also refers to activities that could harm a listed species (e.g., harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct). Section 9 also prohibits specified activities with respect to endangered and threatened plants.
- Section 10 of the ESA (Permitting and Conservation Plans). Section 10 of the ESA (16 U.S.C. § 1539) provides a process by which nonfederal entities may obtain an Incidental Take Permit from USFWS or NMFS for otherwise lawful activities that might incidentally result in take of endangered or threatened species, subject to specific conditions. Take refers to activities that could harm a listed species (e.g., harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct).

- **USFWS Coordination Act of 1934 (16 U.S.C. § 661-667, et seq.).** This Act applies to any federal project where a body of water is impounded, diverted, deepened, or otherwise modified. It provides the basic authority for USFWS involvement in evaluating impacts on fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other project features. It also requires federal agencies that construct, license, or permit water resource development projects to first consult with USFWS (and the NMFS in some instances) and state fish and wildlife agencies regarding the impacts on fish and wildlife resources and measures to mitigate these impacts. Consultation with USFWS, Texas Parks and Wildlife Department (TPWD), and Oklahoma Department of Wildlife Conservation (ODWC) would occur at the project level.

- **Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. § 703-712).** The MBTA protects selected species of birds that cross international boundaries (i.e., species that occur in more than one country at some point during their life cycle). The law prohibits the take of such species, including the removal of nests, eggs, and feathers. The MBTA makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird, except under the terms of a valid permit issued pursuant to federal regulations.
- **Bald and Golden Eagle Protection Act (16 U.S.C. § 668-668d, 50 CFR 22).** This Act prohibits the destruction of bald and golden eagles and their occupied and unoccupied nests. It also makes it illegal to take, transport, or possess eagles or use these species in commerce.
- **Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. §§ 1801-1884).** The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) is the primary law governing marine fisheries management in U.S. federal waters. First passed in 1976, the Magnuson-Stevens Act fosters long-term biological and economic sustainability of our nation's marine fisheries out to 200 nautical miles from shore.

3.7.1.2 State

- **State of Oklahoma Statute Title 29.** This statute gives the state the authority to list a wildlife species as threatened or endangered within Oklahoma, although it might not be classified as threatened or endangered federally through the ESA. An endangered species refers to any wildlife species or subspecies in the wild or in captivity whose prospects of survival and reproduction are in immediate jeopardy. It includes those species listed as endangered by the federal government and any species or subspecies identified as threatened by Oklahoma statute or Commission resolution, as outlined in Oklahoma Statute Title 29. Four wildlife species are listed as state-threatened or state-endangered in Oklahoma.

  State of Oklahoma Statute Title 29 also prohibits possession, hunting, chasing, harassing, capture, shooting at, wounding or killing, taking or attempting to take, trapping or attempting to trap any endangered or threatened species or subspecies without specific written permission from the Director. In no event, however, may that permission conflict with federal law. Consultation with ODWC would occur at the project level.
- **Texas Parks and Wildlife Code.** The Texas legislature authorized the TPWD to establish a list of endangered animals in the state in 1973. State regulations prohibit the taking, possession, transportation, or sale of any of the animal species designated as endangered or threatened without the issuance of a permit, as outlined in Chapters 6 and 68 of the Texas Parks and Wildlife Code and 31 Texas Administrative Code (TAC) § 65.171-65.176. Endangered species are those species that the Executive Director of TPWD has identified as being threatened with state-wide extinction. Threatened species are those species that the TPWD Commission has determined are likely to become endangered in the future.

State regulations prohibit commerce of threatened and endangered plants and prohibit the collection of listed plant species from public land without the issuance of a permit as outlined in Chapter 88 of the Texas Parks and Wildlife Code and 31 TAC § 69.01-69.9. Consultation with TPWD would occur at the project level.

3.7.2 Methodology

The methodology for this evaluation consists of using existing data to identify threatened and endangered species occurrences and critical habitat that could be present within the EIS Study Area for each build alternative, and evaluating the potential level of effect that each alternative could have if constructed. The build alternatives are compared with other alternatives within the same geographic section, as well as with the No Build Alternative. The No Build Alternative includes the existing transportation network (roadway, passenger rail, and air) in the Study Vicinity and committed improvements to these systems. The intensity of an effect as a result of the route alternatives is characterized as negligible, moderate, or substantial, in comparison with the No Build Alternative. For threatened and endangered species, these terms are defined as follows:

- Negligible intensity effects from construction and operation of an alternative would have no effect on threatened and endangered species or their designated critical habitat.
- Moderate intensity effects from construction and operation of an alternative may affect, but would not likely adversely affect, threatened and endangered species or their critical habitat.
- Substantial intensity effects from construction and operation of an alternative may affect, and would likely adversely affect, threatened and endangered species or their designated critical habitat.

Available information, such as special-status species occurrences and critical habitat, was used to assess the potential magnitude or intensity of the effects. To evaluate the potential effects on threatened and endangered species from construction and operation of the alternatives, the following acreages were quantified:

- **Acreage of special-status plant and wildlife occurrences.** Potential effects of each alternative were determined using special-status species data by comparing locations of known occurrences and acreages of special-status plant and wildlife species within the EIS Study Area. It should be noted that actual potential habitat for listed species would most likely be more widespread and would be determined during focused surveys conducted during a project-level National Environmental Policy Act (NEPA) analysis. Federally and state-listed species in Texas were identified through a review of the 2011 Environmental Occurrences for Federal and State Listed and Tracked Threatened, Endangered, and Rare Species spatial dataset, acquired from the TPWD Texas Natural Diversity Database (TXNDD) (Michael Baker Jr., Inc. 2012). Oklahoma federally and state-listed species were identified through a review of the county-by-county list of endangered and threatened species published by ODWC. For the service-level analysis of threatened and endangered plant and animal species, only TXNDD data and the county-by-county list were used. Based on direction received from the Texas Department of Transportation regarding the methods of analysis for each of the environmental disciplines that were considered and included in the service-level EIS, data acquired via the Ecological Mapping Systems of Texas, the National Land Cover Database, and composite data from the U.S. Environmental Project Agency's Regional Ecological Assessment Protocol were included in the *Natural Ecological Systems and Wildlife Technical Study* (Appendix G) and in Section 3.5, Natural Ecological Systems and Wildlife. Such data were used to assess the potential magnitude, or intensity, of the effects on land use coverage, ecoregions, wildlife corridors and assemblages, and sensitive plant communities and not incorporated within the threatened and endangered species analysis. During subsequent, project-level analysis, data from the Ecological Mapping Systems of Texas, National Land Cover Database, and Regional Ecological Assessment Protocol, as well as data from TXNDD and ODWC, will be used to determine if habitat is present within the study area of a preferred alternative and will be used to conduct a detailed analysis to determine actual effects on threatened and endangered species and habitats.

- **Acreage of potential critical habitat within the EIS Study Area.** Potential effects of each alternative were determined using acreages of critical habitat within the EIS Study Area. Data used for analysis were obtained from the TXNDD and the *Oklahoma Department of Transportation, High-Speed Intercity Passenger Rail I-35 Corridor, Oklahoma, Data Collection Report* (Meshek & Associates 2013).

3.7.3 Affected Environment

The EIS Study Area spans 850 miles in length from central Oklahoma to south Texas. Therefore, the alternatives are spread across a broad geographic area with typical weather patterns that include semi-arid, humid subtropical, and modified subtropical conditions. The EIS Study Area generally lies along low-elevation basins and valleys associated the Great Plains in the north and with the Coastal Plains in the south. Land cover types within the EIS Study Area include developed, vegetated with open grasslands, agricultural, shrubland, and forests. Details regarding the general climate of the Study Vicinity can be found in Section 3.5, Natural Ecological Systems and Wildlife.

As described previously, federal and state regulations protect imperiled plant species and facilitate the recovery of such species and the ecosystems upon which they depend. Federal and state regulations also provide guidance on how a species is listed and designations (endangered, threatened, etc.) of a species' sensitivity. No threatened, endangered, or rare plant species were identified as potentially occurring in the Northern or Central sections. In the Southern Section, Alternative S6 also had no threatened, endangered, or rare plant species identified. Table 3.7-1 lists the 18 sensitive plant species that potentially occur within the EIS Study Area and describes each species general habitat type and requirements.

Table 3.7-1: Sensitive Plant Species within the EIS Study Area

Common Name	Scientific Name	Status (Federal/State/ TPWD Ranking)[a]	General Habitat Type(s)
Northern Section			
Alternative N4A Conventional			
None			
Central Section			
Alternative C4A Higher-Speed Rail and C4A High-Speed Rail			
None			
Alternative C4B Higher-Speed Rail and C4B High-Speed Rail			
None			
Alternative C4C Higher-Speed Rail and C4C High-Speed Rail			
None			
Southern Section			
Alternative S4 Higher-Speed Rail			
Bailey's ballmoss	*Tillandsia baileyi*	-- / -- / S2	An air plant that grows on trees in woodland, savanna/open woodland and shrubland in Texas
Elmendorf's onion	*Allium elmendorfii*	-- / -- / S2	Savanna/open woodland; known only from the Carrizo sands of eastern Bexar, Frio, Wilson, and Atacosa counties
Falfurrias milkvine	*Matelea radiata*	-- / -- / SH	Unknown
Green Island echeandia	*Echeandia texensis*	-- / -- / S1	Grassland; on clay dunes, llanos, and open areas in Texas
Johnston's frankenia	*Frankenia johnstonii*	LE, PDL / E / S3	Shrubland; found in high-saline, rocky or eroding and reddish soil, associated with the Maverick soil series. It is found in Webb, Zapata, and Starr Counties of south Texas; also in northern Mexico
Lila de los llanos	*Echeandia chandleri*	-- / -- / S2	Grassland; coastal plains in Texas and Mexico (San Luis Potosí, Tamaulipas)
Mexican mud-plantain	*Heteranthera mexicana*	-- / -- / S1	Freshwater wetland (playas); riparian (resacas); populations are located in swales and ditches in an area that is subject to irregular rainfall
Plains gumweed	*Grindelia oolepis*	-- / -- / S2	Grassland; endemic to Texas and primarily found along roadsides and other disturbed rights-of-way

Common Name	Scientific Name	Status (Federal/State/ TPWD Ranking)[a]	General Habitat Type(s)
Runyon's cory cactus	*Coryphantha macromeris* var. *runyonii*	-- / -- / S2	Shrubland (Chihuahuan desert scrub, Tamaulipan thorn scrub), on nearly all substrates including nearly pure gypsum, gravelly soils, usually sandy alluvium or clay, rarely crevices or steep slopes in New Mexico, Texas and Mexico (Chihuahua, Coahuila, Durango, Zacatecas)
Runyon's water-willow	*Justicia runyonii*	-- / -- / S2	Shrubland and woodland in Texas, Rio Grande Valley and Northern Mexico
Sandhill woolywhite	*Hymenopappus carrizoanus*	-- / -- / S2	Savanna/open woodland (sandhills), oak woodlands on sandy soils
Slender rushpea	*Hoffmannseggia tenella*	LE / E / S1	Grassland; known to occur in four populations in Nueces and Kleberg counties in Texas
South Texas ambrosia	*Ambrosia cheiranthifolia*	LE / E / S2	Grassland; on seasonally wet clay and sands in Texas and Mexico (Tamaulipas)
St. Joseph's Staff	*Manfreda longiflora*	-- / -- / S2	Shrubland on clay slopes, dry gravelly hills or sandy prairies in Texas and Mexico (Tamaulipas).
Texas ayenia	*Ayenia limitaris*	LE / E / S1	Shrubland; known to occur in only one small population of about 20 individuals in Hidalgo county
Texas windmill-grass	*Chloris texensis*	-- / -- / S2	Grassland (coastal prairie, saline prairie)
Vasey's adelia	*Adelia vaseyi*	-- / -- / S2	Shrubland
Walker's manioc	*Manihot walkerae*	LE / E / S1	Shrubland; Historically, Walker's manioc is known only from the lower Rio Grande valley of Texas (Hidalgo and Starr counties) and northern Tamaulipas, Mexico. Now, located in three different areas on the Lower Rio Grande National Wildlife Refuge in Starr and Hidalgo Counties
Alternative S6 Higher-Speed Rail and S6 High-Speed Rail			
None			

[a] Status acronyms:

Federal and State Listing Designations
E – State endangered
DL – Delisted

TPWD Rankings
S1 - Fewer than 6 occurrences known in Texas; critically imperiled in Texas; especially vulnerable to extirpation from the state

Common Name	Scientific Name	Status (Federal/State/ TPWD Ranking)[a]	General Habitat Type(s)
LE – Federally endangered LT – Federally threatened PDL – Proposed delisted PE – Federally proposed endangered PT – Federally proposed threatened T – State threatened C - Category 1 candidate for listing as threatened or endangered by the USFWS		S2 - 6 to 20 known occurrences in Texas; imperiled in the state because of rarity; very vulnerable to extirpation from the state S3 - 21 to 100 known occurrences in Texas; either rare or uncommon in the state S4 - More than 100 occurrences in Texas; apparently secure in the state, though it may be rare in some areas of Texas S5 - Demonstrably secure in Texas SH - Historical in Texas, not verified within the past 40 years but suspected to be extant SR - Reported from Texas in literature but not verified via specimens or field observations SX - Presumed extirpated from Texas	
Source: TPWD (2014b).			

Sensitive wildlife species include federally and state-listed endangered species, federally and state-listed threatened species, and federally proposed endangered and proposed threatened species. Table 3.7-2 lists the 22 sensitive wildlife species and their general habitat requirements that potentially occur within the EIS Study Area based on the spatial dataset acquired from the TXNDD.

Table 3.7-2: Sensitive Wildlife Species within the EIS Study Area

Common Name	Scientific Name	Status (Federal/State/ TPWD Ranking[a])	General Habitat Type(s)
Northern Section			
Alternative N4A Conventional			
Arkansas River shiner	*Notropis girardi*	LT / – / –	Historically inhabited the main channels of wide, shallow, sand-bottomed rivers and larger streams of the Arkansas River basin. Adults are uncommon in quiet pools or backwaters, and almost never occur in tributaries having deep water and bottoms of mud or stone. Juveniles associated most strongly with current, conductivity (total dissolved solids), and backwater and island habitat types.
Black-capped vireo	*Vireo atricapillus*	LE / – / --	Rangelands with scattered clumps of shrubs separated by open grassland. There are two known populations of black-capped vireos in Oklahoma. One population is large (more than

Common Name	Scientific Name	Status (Federal/State/ TPWD Ranking[a])	General Habitat Type(s)
			2,000 birds) and is located in the Wichita Mountains of northern Comanche County. The other population is small (fewer than 30 birds) and occurs in the canyon lands of northern Blaine County, north of Watonga.
Black-sided darter	*Percina maculata*	-- / T / --	Clear, gravel-bottom, perennial streams.
Interior least tern	*Sterna antillarum*	LE / -- / --	Nesting habitat–bare or sparsely vegetated sand, shell, and gravel beaches, sandbars, islands, and salt flats associated with rivers and reservoirs. For feeding, needs shallow water with an abundance of small fish. Shallow water areas of lakes, ponds, and rivers located close to nesting areas are preferred. Occurs in Oklahoma during the late spring and summer breeding season (mid-May through late August) on portions of the Arkansas, Cimarron, Canadian and Red rivers.
Piping plover	*Charadrius melodus*	LT / -- / --	Estuary/estuarine and coastal. Winter – beaches, sand flats, mudflats, algal mats, emergent sea grass beds, wash-over passes, and very small dunes where seaweed (sargassum) or other debris has accumulated sand; spoil islands along the Intracoastal Waterway; bare or sparsely vegetated coastal areas. There are two nesting records for the piping plover in the Oklahoma panhandle, but it is normally a spring and fall migrant through the state. Most records for migrating piping plovers occur across the main body of the state, with recent records including Woodward, Alfalfa, Oklahoma, Cleveland, Tulsa, and Washington counties.
Whooping crane	*Grus Americana*	LE / -- / --	Saltwater wetland and estuary. Winter – primarily freshwater and brackish marshes of south Texas, salt marshes, and tidal flats on the mainland and barrier islands

Common Name	Scientific Name	Status (Federal/State/ TPWD Ranking[a])	General Habitat Type(s)
			dominated by salt grass, saltwort, smooth cordgrass, glasswort, and sea ox-eyebut; recently a few flocks have used waterbodies (e.g., Granger Lake), stopping short of coastal destination; shallow, seasonally and semi-permanently flooded palustrine wetlands for roosting, and various cropland and emergent wetlands. During migration, whooping cranes pass through the western half of Oklahoma, with most sightings occurring west of Interstate Highway (IH)-35 and east of Guymon, in the panhandle.
Central Section			
Alternative C4A Higher-Speed Rail and C4A High-Speed Rail			
Mountain plover	*Charadrius montanus*	PT / -- /S2	Agricultural and grassland. Winter – shortgrass prairie, heavily grazed rangelands and agricultural fields in south Texas. Breeding – short- and mixed-grass prairie, prairie dog colonies, agricultural lands, and semidesert habitats in west Texas and panhandle. Nest locally in the western Great Plains from Montana south to New Mexico, in Utah, and in Mexico; winter in a broad band from Texas west and north to the Central Valley of California.
Texas garter snake	*Thamnophis sirtalis annectens*	-- / -- / S3	Riparian, around lacustrine and cultural aquatic sites; marshy, flooded pastureland or meadows, particularly in spring when frogs are present in numbers; at other times, grassy or brushy terrain near hill country streams and ponds. Central and north Texas and Oklahoma.
Alternative C4B Higher-Speed Rail and C4B High-Speed Rail			
Mountain plover	*Charadrius montanus*	PT / -- /S2	See above.
Texas garter snake	*Thamnophis sirtalis annectens*	-- / -- / S3	See above.

Common Name	Scientific Name	Status (Federal/State/ TPWD Ranking[a])	General Habitat Type(s)
Alternative C4C Higher-Speed Rail and C4B High-Speed Rail			
Mountain plover	*Charadrius montanus*	PT / -- /S2	See above.
Texas garter snake	*Thamnophis sirtalis annectens*	-- / -- / S3	See above.
Southern Section			
Alternative S4 Higher-Speed Rail			
Black-spotted newt	*Notophthalmus meridionalis*	-- / -- / S2	Freshwater wetland, riparian, riverine, cultural aquatic; edaphically limited: deep, poorly drained, clayey sediments (such as the Tiocano and Edroy clay soils) with slow permeability allow formation of ephemeral ponds or wetlands during periods of heavy rain, within a matrix of native, intact Tamaulipan thornscrub; permanent and temporary ponds, roadside ditches, and pools of small streams may also be used; breed in shallow ephemeral ponds ranging in depth from 0.5 to 2 meters, with firm clay bottoms, and some with rooted macrophytes; salinities ranging from 0.5 to 1.0%; not found in water bodies with predatory fish, high salinity, intense cattle usage, or agricultural runoff. Texas counties bordering the Gulf Coast, south from Aransas and Refugio counties, and the central portion of the Tamaulipan Province, south from Bexar County.
Black-striped snake	*Coniophanes imperialis*	-- / -- / S2	Savannas, thornscrub, agricultural landscapes, and edges of wet or marshy areas; semiarid coastal sandplain; also survives around buildings and in vacant lots in localized suburban areas. South Texas along the Gulf Coast to Veracruz, Mexico.
Jaguar	*Panthera onca*	LE / E / SH	Forest, woodland, and riparian. Broadleaf deciduous and mixed mature forest, canyons and rocky caves or dense thickets for denning, large blocks.

Common Name	Scientific Name	Status (Federal/State/ TPWD Ranking[a])	General Habitat Type(s)
Jaguarundi[b]	*Herpailurus yaguarondi*	LE / E/ S1	Shrubland; dense thornscrub over loamy clay soils (holding moisture); riparian areas and brushy arroyos.
Keeled earless lizard	*Holbrookia propinqua*	-- / -- / S3	Coastal, barren/sparse vegetation, shrubland; native coastal grasslands, barrier islands. South Texas and along the Gulf Coast of Mexico.
Mexican blackhead snake	*Tantilla atriceps*	-- / -- / S1	Shrubland; wooded and grassland/thorn brush communities, desert flats to wooded mountain canyons. Restricted to two counties (Kleburg and Duval) in south Texas. In Mexico, occurs from central Coahuila south to San Luis Potosi, with isolated populations found in Tamaulipas.
Mexican treefrog	*Smilisca baudinii*	-- / -- / S3	Riparian, freshwater wetland, cultural aquatic, woodland; nocturnal and most active after rains; forested and brushy areas around streams, resacas, and roadside ditches; observed in tops of palm trees; seek shelter from heat and dry conditions under loose tree bark, in tree holes, in damp soil, and in the leaves of palms, banana plants, and other broadleaves. Restricted to the extreme southern tip of Texas, in Cameron and Hidalgo counties.
Northern cat-eyed snake	*Leptodeira septentrionalis*	-- / T / S2	Forest, woodland, thornscrub with ponds or streams (frogs and toads are primary food). Restricted to counties along the Rio Grande Valley in the few remaining stretches of thornscrub and subtropical habitats.
Reticulate collared lizard	*Crotaphytus reticulatus*	-- / T / S2	Desert scrub, scrubland; thorn-scrub vegetation, usually on well-drained rolling terrain of shallow gravel, caliche, or sandy soils; scattered flat rocks below escarpments or isolated rock outcrops among scattered clumps of prickly-pear and mesquite; mesquite savanna and grasslands near rocky outcrops; shrub and rock structure in habitat are important. Occurs in the Rio Grande Valley of south Texas and Mexico, excluding the coastal areas.

Common Name	Scientific Name	Status (Federal/State/ TPWD Ranking[a])	General Habitat Type(s)
Sheep frog	*Hypopachus variolosus*	-- / T / S2	Shrubland, riparian, cultural aquatic; thornscrub, oak woodland, mesquite savanna, short and mixed grassland, agricultural areas and other open areas; ephemeral and permanent wetlands key for breeding. Occurs from the eastern half of south Texas, from Bee County south to Cameron, Hidalgo, and Starr counties.
South Texas siren (large form)	*Siren sp. 1*	-- / T / S2	Freshwater wetland, cultural aquatic, lacustrine; wholly aquatic; shallow, muddy, vegetated wetlands, resacas, ditches, swamps, ponds and larger lakes and streams; structure (thick vegetation, rocks, and logs) and muddy bottom typically associated with unmanaged or unmanipulated waterways. Eastern third of Texas, from the lower Rio Grande Valley northward along the Gulf Coast to Louisiana.
Texas Indigo Snake	*Drymarchon melanurus erebennus*	-- / T / S4	Shrubland, savanna; riparian corridors in thorn brush woodland, mesquite savanna of the coastal plain, mixed-grass prairies, coastal sandhills, and desert scrubland; often uses small mammal burrows (e.g., gopher [Geomys]). Southern Texas south into Mexico.
Texas scarlet snake	*Cemophora coccinea lineri*	-- / T / S1	Coastal, shrubland, and desert scrub. Known to occur in several counties located along the Texas coastal bend and in adjunct south Texas.
Alternative S6 Higher-Speed Rail and S6 High-Speed Rail			
Texas tortoise	*Gopherus berlandieri*	-- / -- / S2	Savanna, shrubland; semi-desert scrub and barrier islands, on sand, clay or caliche; lomas surrounded by salt flats and marshes; south of a line through Del Rio, San Antonio, and Rockport, Texas.

Common Name	Scientific Name	Status (Federal/State/ TPWD Ranking[a])	General Habitat Type(s)

[a] Status acronyms:

Federal and State Listing Designations

E – State endangered

DL – Delisted

ET – State threatened

LE – Federally endangered

LT – Federally threatened

PDL – Proposed delisted

PE – Federally proposed endangered

PT – Federally proposed threatened

C = Category 1 candidate for listing as threatened or endangered by the USFWS

TPWD Rankings

S1 - Fewer than 6 occurrences known in Texas; critically imperiled in Texas; especially vulnerable to extirpation from the state

S2 - 6 to 20 known occurrences in Texas; imperiled in the state because of rarity; very vulnerable to extirpation from the state

S3 - 21 to 100 known occurrences in Texas; either rare or uncommon in the state

S4 - More than 100 occurrences in Texas; apparently secure in the state, though it may be rare in some areas of Texas

S5 - Demonstrably secure in Texas

SH - Historical in Texas, not verified within the past 40 years but suspected to be extant

SR - Reported from Texas in literature but not verified via specimens or field observations

SX - Presumed extirpated from Texas

[b] Texas Department of Transportation (TxDOT) staff noted that jaguarundi are no longer found in Texas; however, the species was included in information from the resource agency databases and is therefore referenced in this document. TxDOT staff also noted that black bear and ocelot are found in the area. These species were not included in the resource agency databases and are, therefore, not referenced in this document. Assessment of these species will be included in project-level analysis as appropriate.

Sources: Meshek & Associates (2013); Michael Baker Jr., Inc. (2012); Southwestern Center for Herpetological Research (2014); ODWC (2014a); ODWC (2014b); Texas Natural Sciences Center (2014), TPWD (2014a); TPWD (2014b)

3.7.3.1 Northern Section: Oklahoma City to Dallas and Fort Worth

3.7.3.1.1 Sensitive Plant Species

Based on the spatial dataset acquired from TXNDD and the ODWC endangered and threatened species list, no federally or state-listed or state-ranked plant species occur within the EIS Study Area for Alternative N4A Conventional.

3.7.3.1.2 Sensitive Wildlife Species

Based on the spatial dataset acquired from TXNDD and the ODWC endangered and threatened species list, and shown in Table 3.7-2, six listed wildlife species potentially occur within the EIS Study Area for Alternative N4A Conventional.

3.7.3.1.3 Critical Habitat

Based on the spatial dataset acquired from TXNDD and ODWC, critical habitat for one animal species (Arkansas River shiner) is located within the EIS Study Area for Alternative N4A Conventional. Based on the spatial dataset acquired from TXNDD and ODWC, approximately 34 acres of designated final critical habitat for the federally threatened Arkansas River shiner are located within the EIS Study Area for Alternative N4A Conventional. As shown on Figure 3.7-1, the critical habitat for the Arkansas River shiner in the EIS Study Area includes the Canadian River that follows the existing rail alignment in McClain County, Oklahoma, and intersects perpendicularly to the EIS Study Area south of Norman, Oklahoma. No other designated critical habitat areas were identified.

3.7.3.2 Central Section: Dallas and Fort Worth to San Antonio

3.7.3.2.1 Sensitive Plant Species

Based on the spatial dataset acquired from TXNDD, no federally or state-listed or state-ranked plant species occur within the EIS Study Areas for the Central Section alternatives.

3.7.3.2.2 Sensitive Wildlife Species

Based on the spatial dataset acquired from TXNDD, and shown in Table 3.7-2, two special-status wildlife species have the potential to occur within the EIS Study Area for Alternative C4A. Based on the dataset, 324 acres of mountain plover habitat and 1,490 acres of Texas garter snake habitat potentially occur within the EIS Study Area. As shown on Figures 3.7-2 and 3.7-3, the recorded occurrences of sensitive wildlife species identified within the EIS Study Area are represented by relatively large areas intersected by the EIS Study Area. In addition, the occurrences are in the portions of the alternative outside existing transportation corridors.

Based on the spatial dataset acquired from TXNDD, two special-status wildlife species also have the potential to occur within the EIS Study Area for Alternative C4B. Based on the dataset, the EIS Study Area for Alternative C4B contains the same number of acres of mountain plover habitat as Alternative C4A (324 acres) and slightly more Texas garter snake habitat (1,493 acres, compared with 1,490 acres in Alternative C4A). As shown on Figures 3.7-2 and 3.7-3, the recorded occurrences of sensitive wildlife species identified within the EIS Study Area are represented by relatively large areas intersected by the EIS Study Area.

Based on the spatial dataset acquired from TXNDD, two special-status wildlife species also have the potential to occur within the EIS Study Area for Alternative C4C. Based on the dataset, the EIS Study Area for Alternative C4C contains the same number of acres of mountain plover habitat as Alternatives C4A and C4B (324 acres), but more Texas garter snake habitat (1,604 acres, compared with 1,490 and 1,493 acres in Alternatives C4A and C4B, respectively). As shown on Figures 3.7-2 and 3.7-3, the recorded occurrences of sensitive wildlife species identified within the EIS Study Area are represented by relatively large areas intersected by the EIS Study Area.

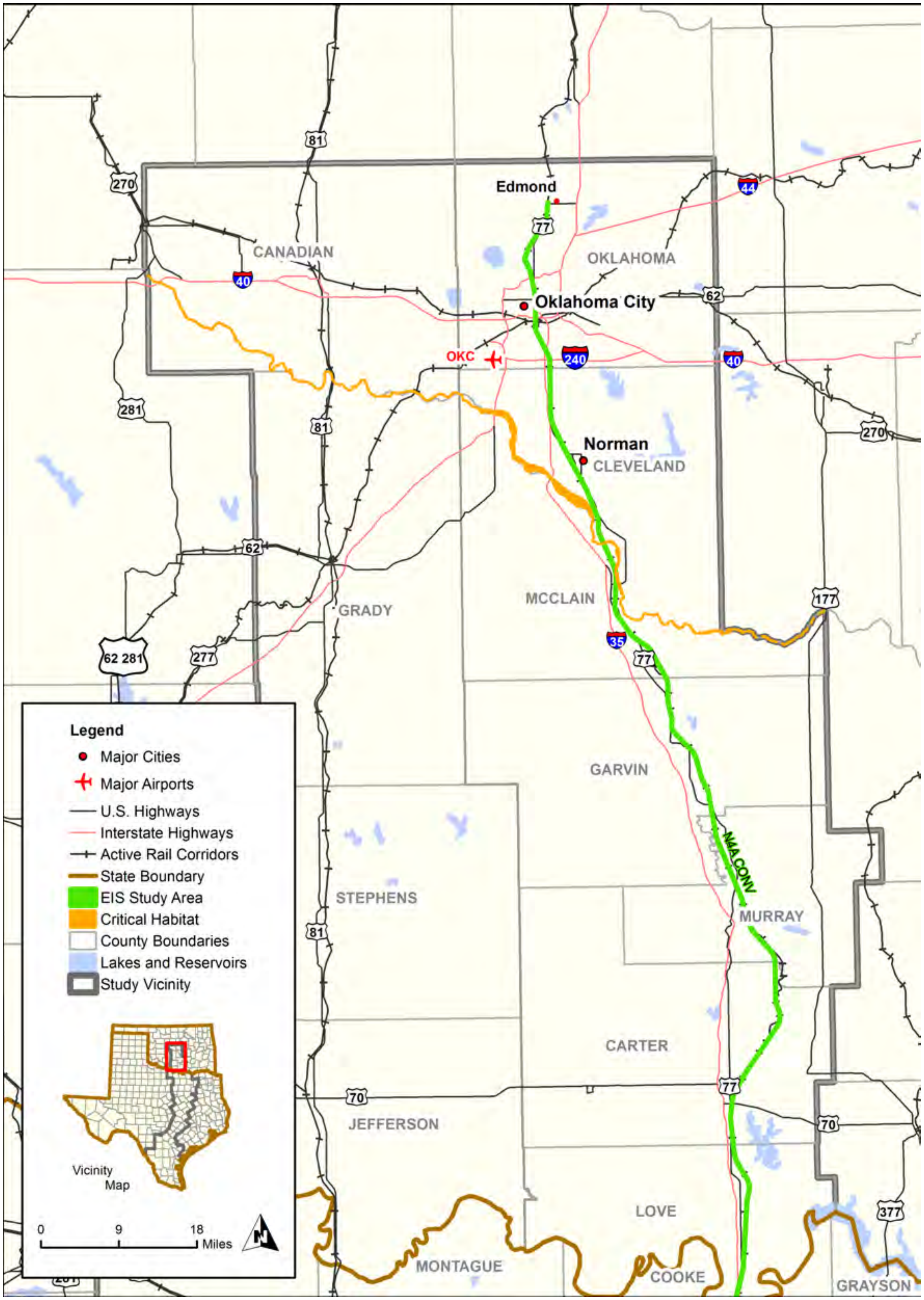

Figure 3.7-1: Critical Habitat – Northern Section Alternative

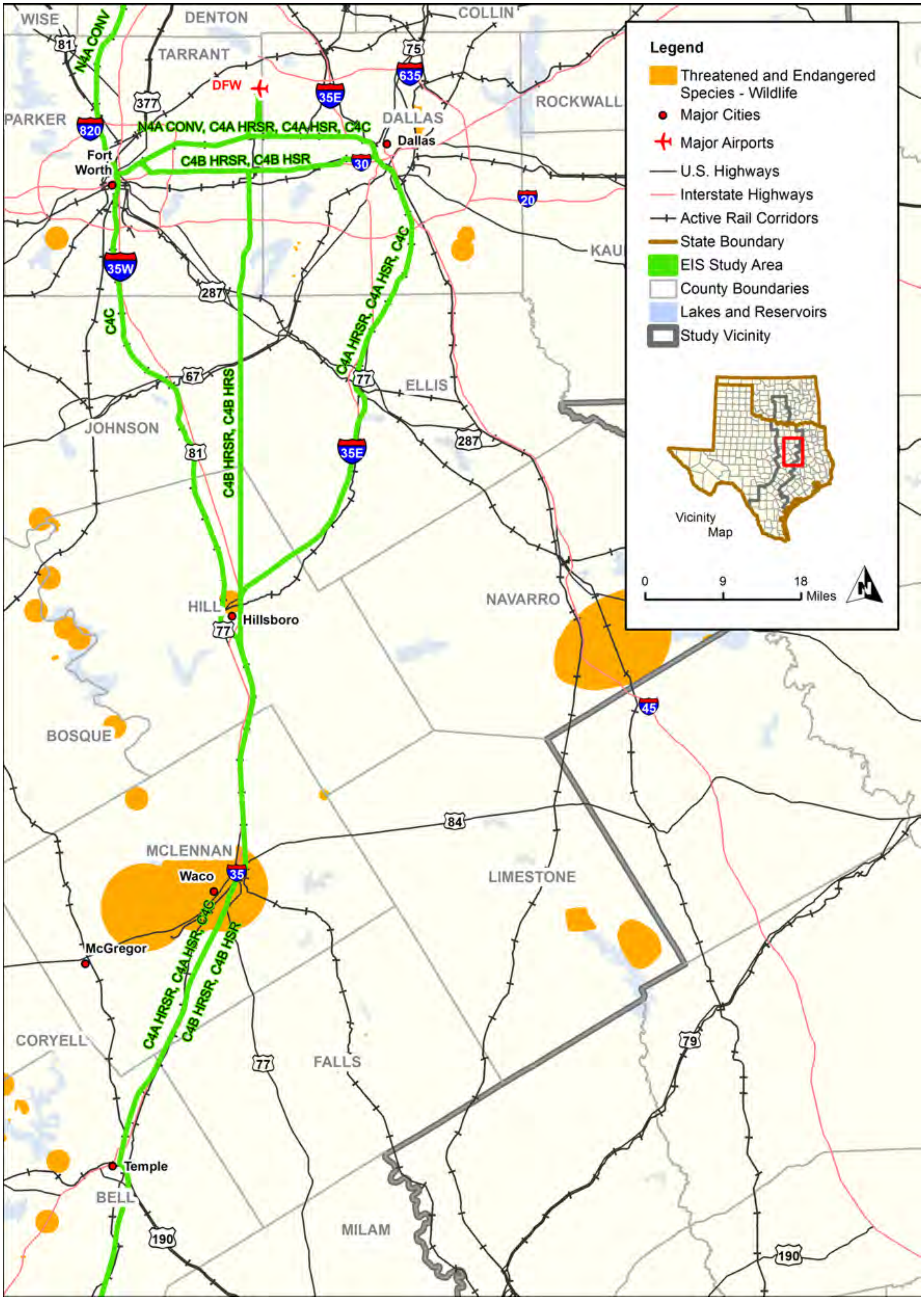

Figure 3.7-2: Sensitive Wildlife Species Occurrences – Central Section Alternatives

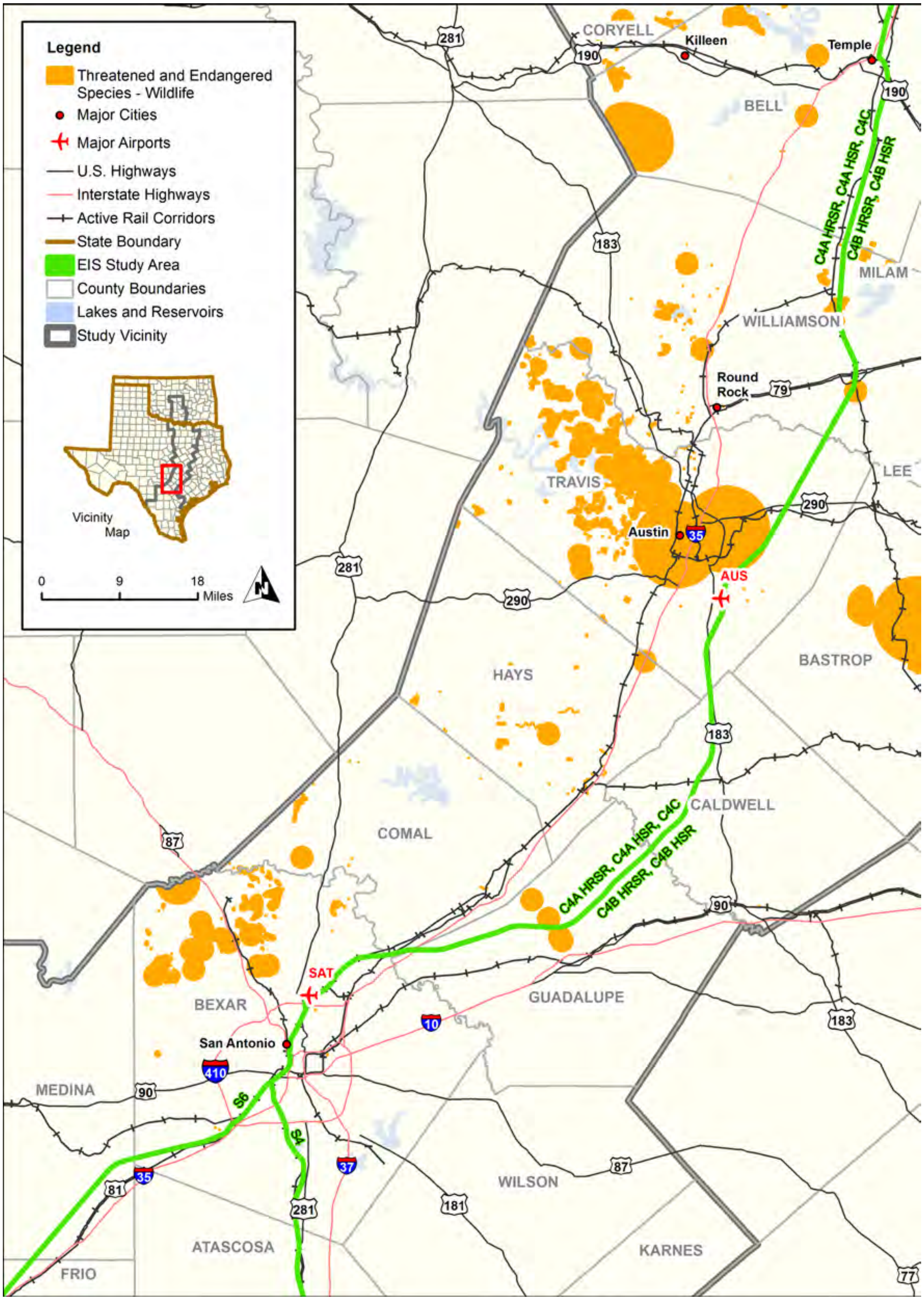

Figure 3.7-3: Sensitive Wildlife Species Occurrences – Central Section Alternatives

3.7.3.2.3 Critical Habitat

Based on the spatial dataset acquired from TXNDD, no designated critical habitat areas were identified within the EIS Study Areas for the Central Section alternatives.

3.7.3.3 Southern Section: San Antonio to South Texas

3.7.3.3.1 Sensitive Plant Species

Based on the spatial dataset acquired from TXNDD, and shown in Table 3.7-1, 18 federally and state-listed or state-ranked plant species potentially occur within the Southern Section, all within the EIS Study Area for Alternative S4 Higher-Speed Rail. Table 3.7-3 lists the acres of potential sensitive plant occurrences within the EIS Study Area for Alternative S4 Higher-Speed Rail.

Table 3.7-3: Acres of Potential Sensitive Plant Occurrences within EIS Study Area – Alternative S4 Higher-Speed Rail

Common Name	Acres of Potential Habitat
Bailey's ballmoss	521
Elmendorf's onion	76
Falfurrias milkvine	600
Green Island echeandia	474
Johnston's frankenia	1
Lila de los llanos	170
Mexican mud-plantain	1,767
Plains gumweed	453
Runyon's cory cactus	384
Runyon's water-willow	304
Sandhill woolywhite	624
Slender rushpea	18
South Texas ambrosia	195
St. Joseph's Staff	546
Texas ayenia	693
Texas windmill-grass	577
Vasey's adelia	120
Walker's manioc	600
Sources: Meshek & Associates (2013); Michael Baker Jr., Inc. (2012)	

As shown on Figures 3.7-4 through 3.7-6, most of the known occurrences of the 18 listed plant species that intersect with the EIS Study Area for Alternative S4 Higher-Speed Rail are in Atascosa, Bexar, Brooks, Cameron, Hidalgo, Jim Wells, and Nueces Counties, in areas of the alternative that would be constructed on an existing abandoned rail and in areas that have already been disturbed by prior rail development.

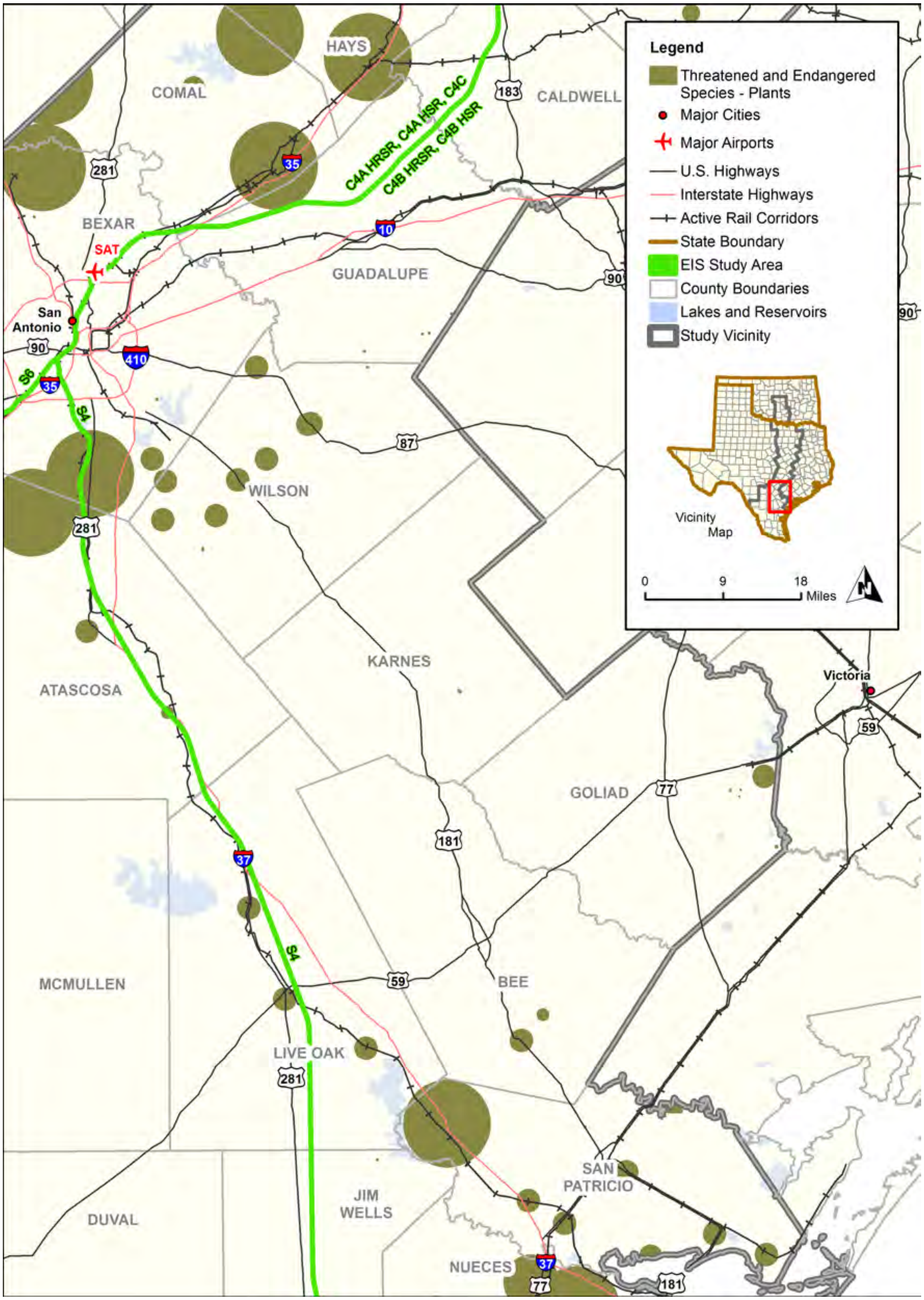

Figure 3.7-4: Sensitive Plant Species Occurrences – Alternative S4

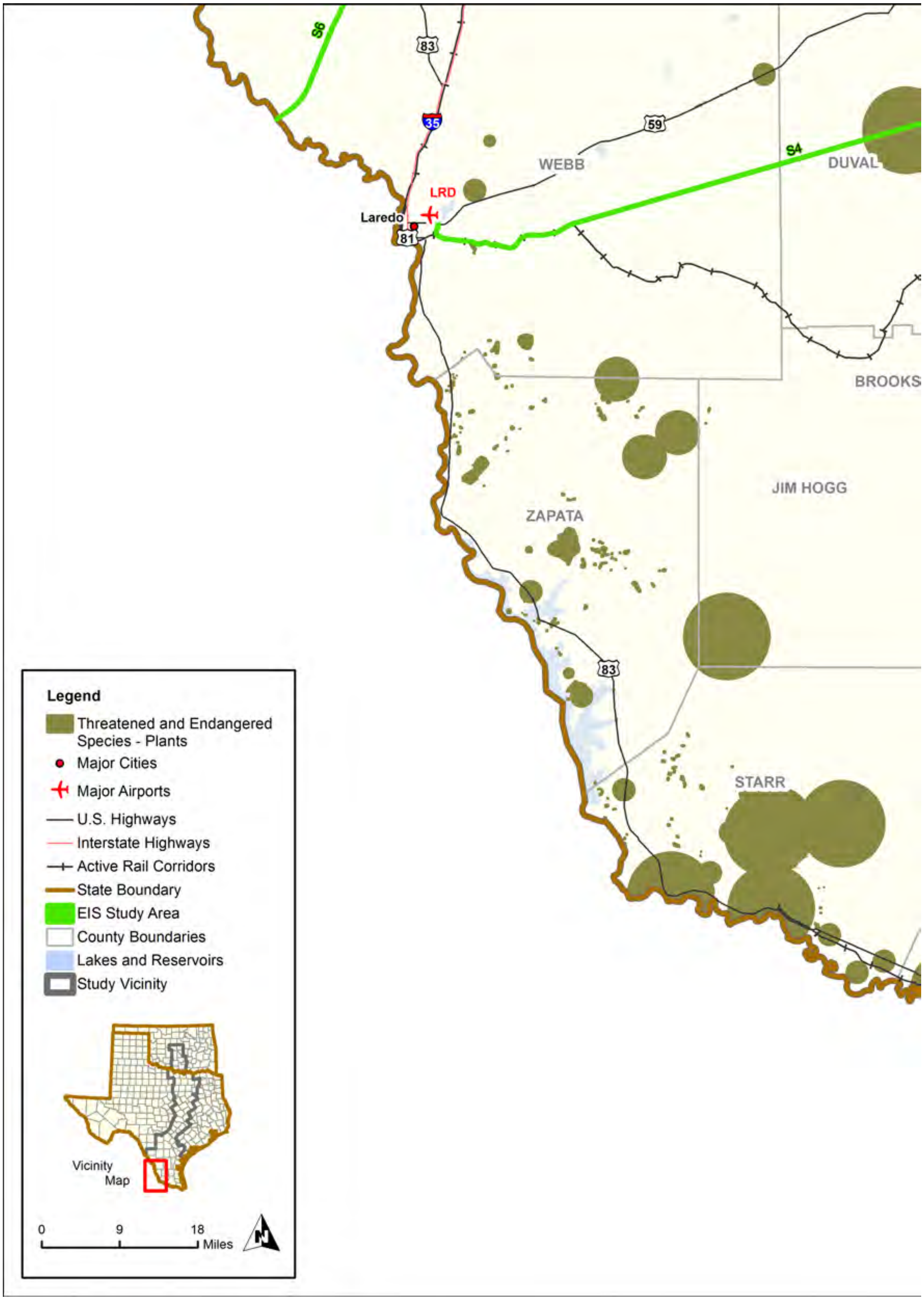

Figure 3.7-5: Sensitive Plant Species Occurrences – Alternative S4

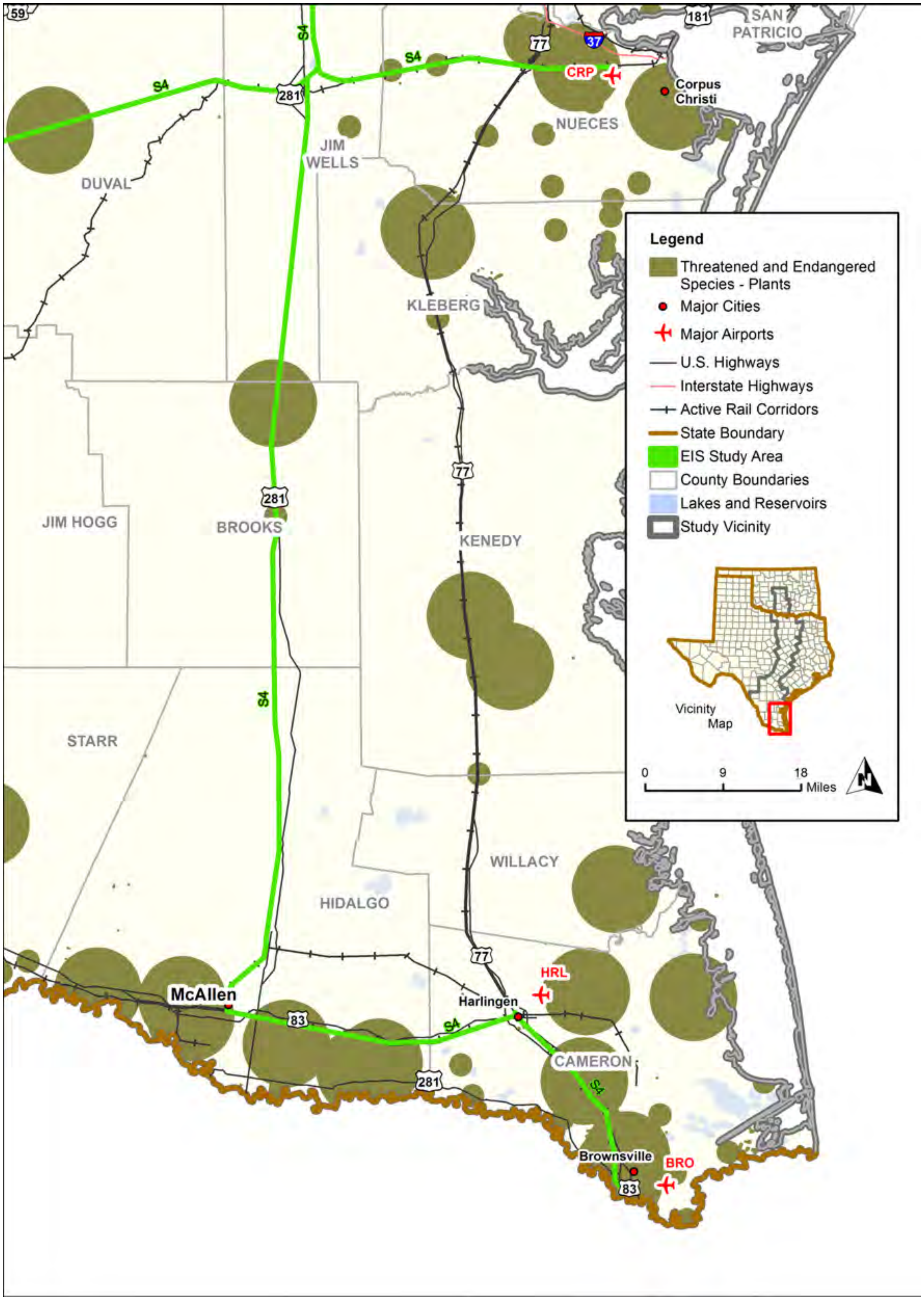

Figure 3.7-6: Sensitive Plant Species Occurrences – Alternative S4

3.7.3.3.2 Sensitive Wildlife Species

Based on the spatial dataset acquired from TXNDD, and shown in Table 3.7-2, 14 listed wildlife species potentially occur within the EIS Study Areas for the Southern Section alternatives.

Table 3.7-4 lists the acres of potential sensitive wildlife habitat within the EIS Study Area of Alternative S4 Higher-Speed Rail.

Table 3.7-4: Acres of Potential Sensitive Wildlife Habitat within EIS Study Area – Alternative S4 Higher-Speed Rail

Common Name	Acres of Potential Habitat
Black-spotted newt	1,477
Black-striped snake	160
Jaguar	601
Jaguarundia	515
Keeled earless lizard	150
Mexican blackhead snake	151
Mexican treefrog	402
Northern cat-eyed snake	374
Reticulate collared lizard	94
Sheep frog	906
South Texas siren (large form)	1,288
Texas indigo snake	1,195
Texas scarlet snake	3

[a] TxDOT staff noted that jaguarundi are no longer found in Texas; however, the species was included in information from the resource agency databases and is therefore referenced in this document. TxDOT staff also noted that black bear and ocelot are found in the area. These species were not included in the resource agency databases and are, therefore, not referenced in this document. Assessment of these species will be included in project-level analysis as appropriate.

Sources: Meshek & Associates (2013); Michael Baker Jr., Inc. (2012)

As shown on Figures 3.7-7 through 3.7-9, most of the 13 known occurrences of listed wildlife species that intersect with the EIS Study Area of Alternative S4 Higher-Speed Rail are in Brooks, Cameron, Hidalgo, Jim Wells, Live Oak, and Nueces Counties, in areas of the alternative that would be constructed on an existing abandoned rail.

Based on the spatial dataset acquired from TXNDD, 3 acres of listed wildlife habitat (state-listed Texas tortoise) are within the EIS Study Area for Alternative S6 Higher-Speed Rail.

3.7.3.3.3 Critical Habitat

Based on the spatial dataset acquired from TXNDD, no designated critical habitat areas were identified within the EIS Study Areas for the Southern Section alternatives.

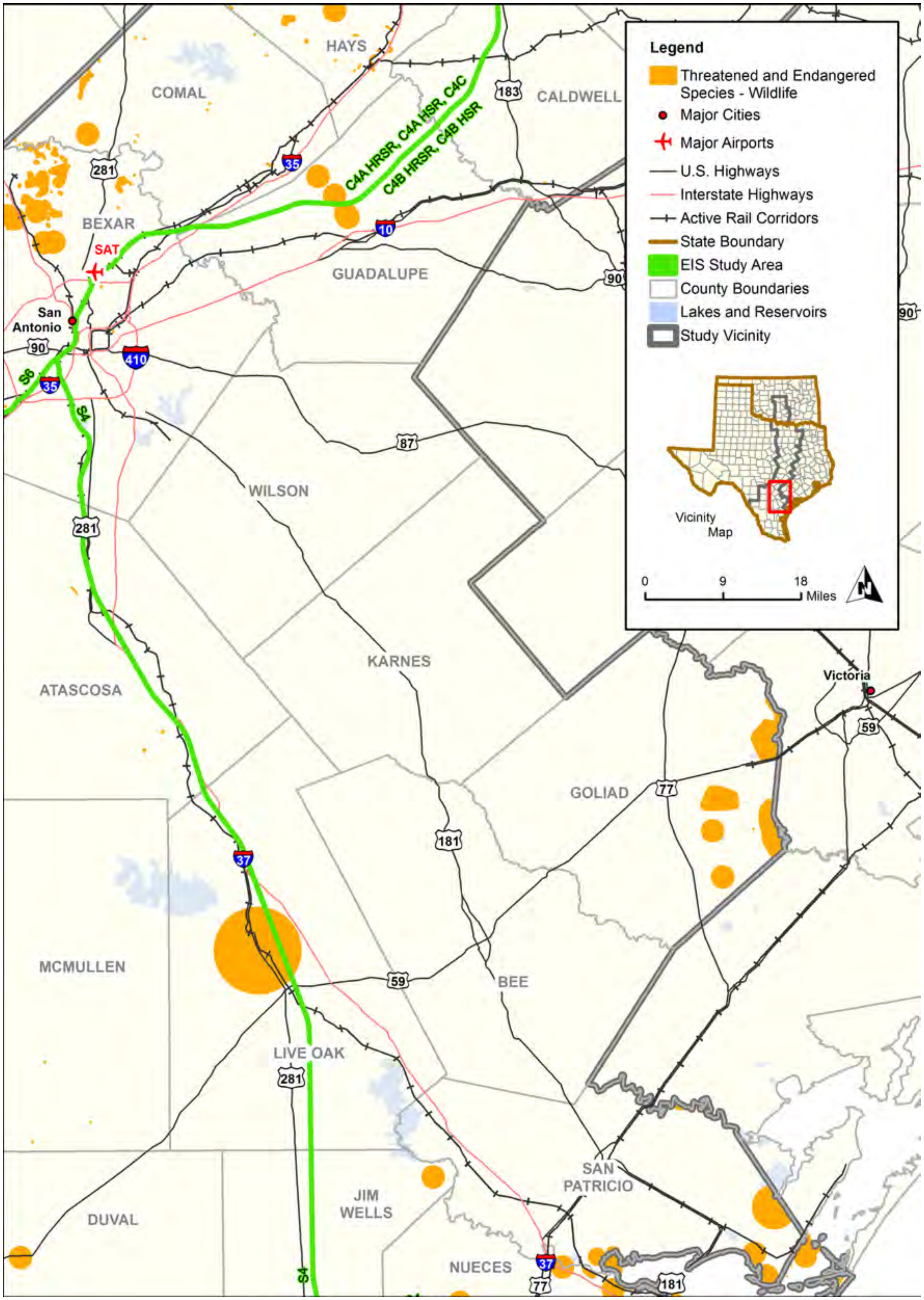

Figure 3.7-7: Sensitive Wildlife Species Occurrences – Alternative S4

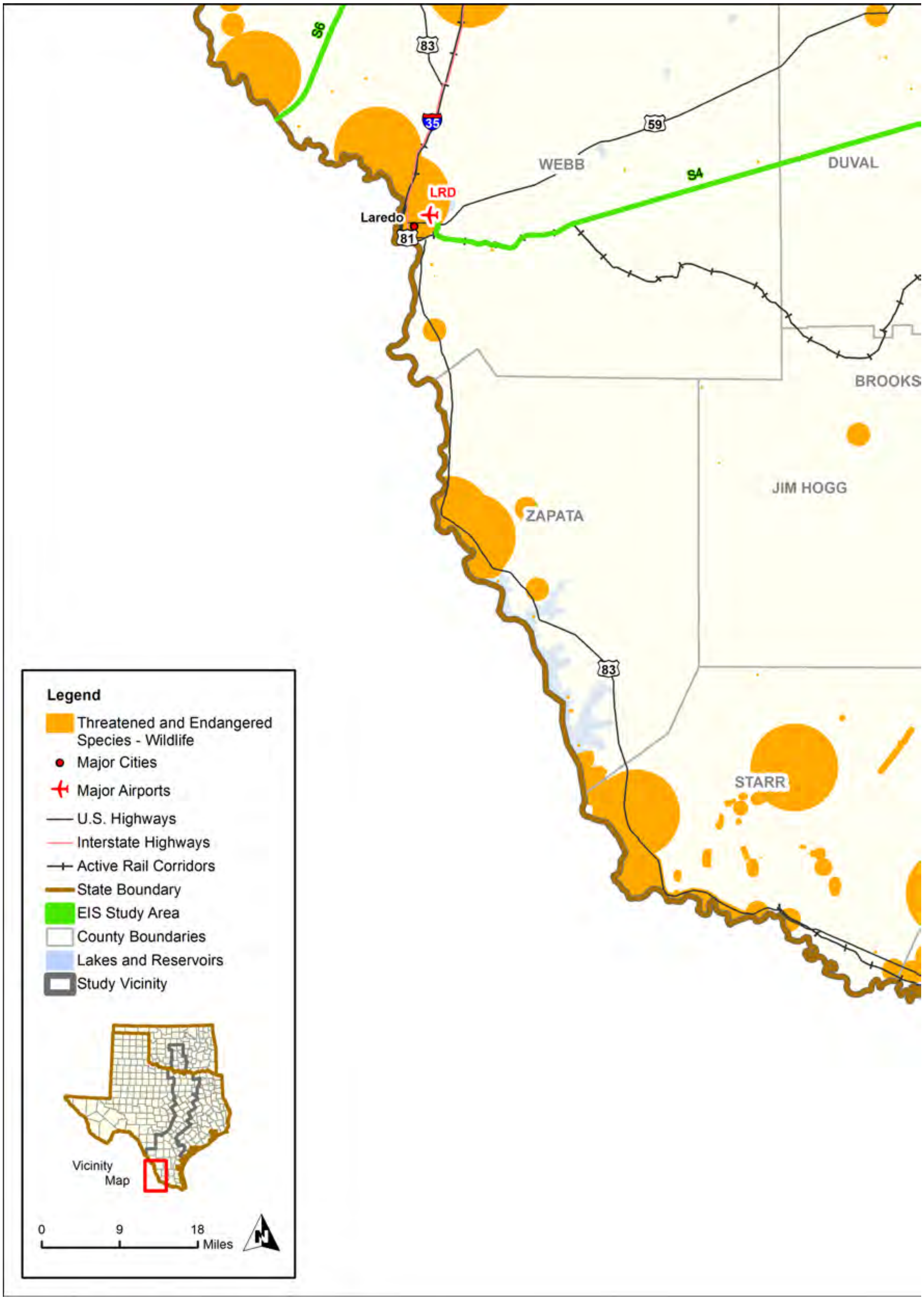

Figure 3.7-8: Sensitive Wildlife Species Occurrences – Alternative S4

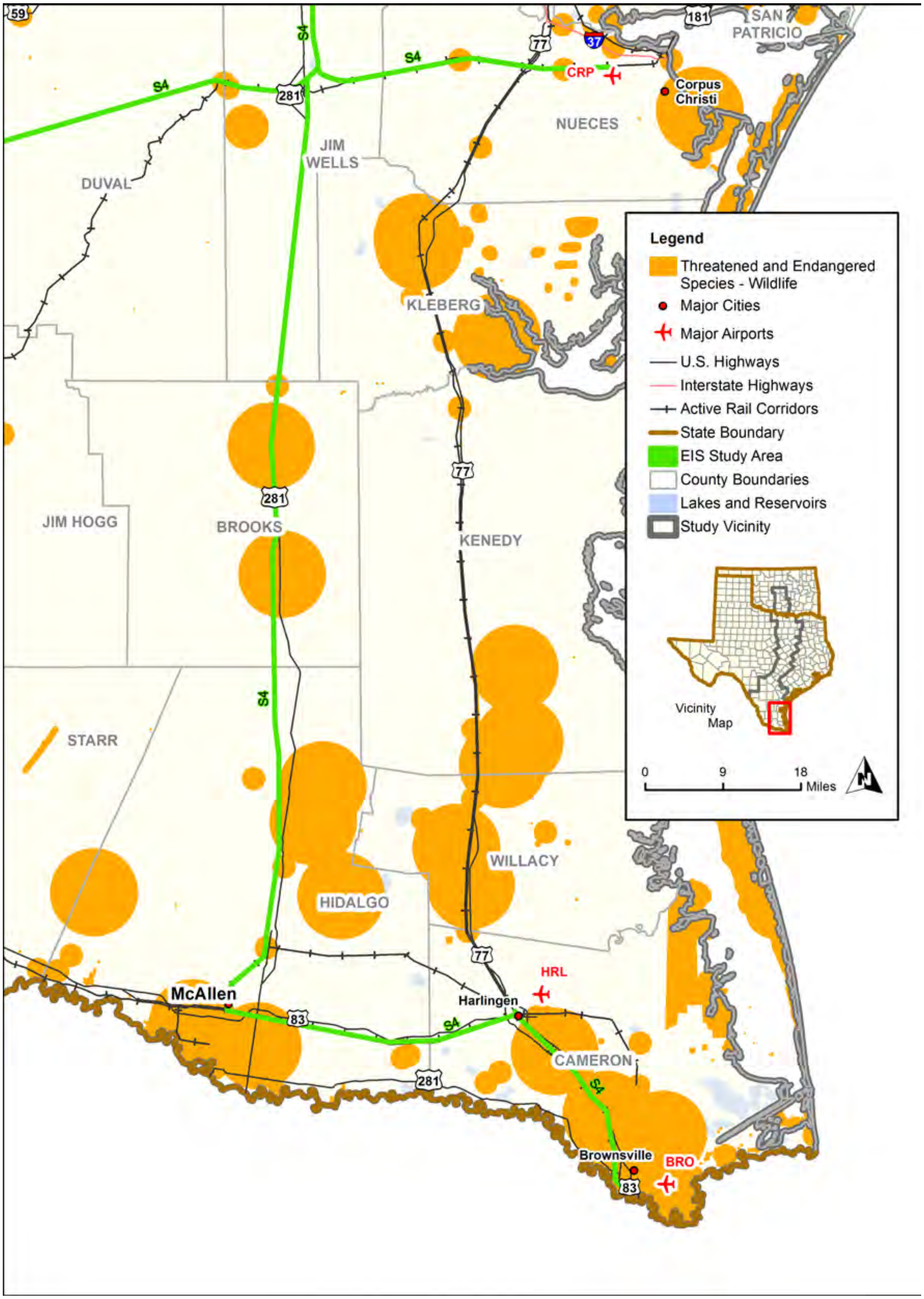

Figure 3.7-9: Sensitive Wildlife Species Occurrences – Alternative S4

3.7.4 Environmental Consequences

3.7.4.1 Overview

Effects from the alternatives and associated infrastructure can be broadly classified into construction and operations effects.

Long-term or permanent effects and short-term effects on threatened and endangered species and habitats would be anticipated as a result of constructing any of the build alternatives. Long-term or permanent effects on vegetation, including sensitive plant species, would occur from clearing for construction, staging of equipment, and stockpiling of soil, ballast, or other construction materials, as well as from permanent structures. Short-term effects on adjacent habitats and their corresponding wildlife, including threatened and endangered species, would be caused by noise, vibration, and air pollution from construction equipment and activities. In general, conventional rail would have fewer construction effects on threatened and endangered species because it would follow existing rail alignments, with minimal new right-of-way. Higher-speed and high-speed rail service types would have greater effects during construction because some or all of the alternative would be constructed in new corridors, outside existing transportation corridors.

Operations effects on wildlife for conventional and higher-speed rail would include making wildlife movement vulnerable to an increased risk of strikes from the additional rail traffic along the routes. High-speed rail would be completely fenced; therefore, the risk of strikes would be lower for this service type. Additionally, construction of new tracks on rail bed elevated above the floodplain could create barriers to wildlife movement. High-speed rail would be fully grade-separated; therefore, more passages for wildlife would likely be included.

3.7.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2, Section 2.2, and Chapter 3, Introduction, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect threatened, endangered, or sensitive species, nor any critical habitat.

3.7.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.7.4.3.1 Alternative N4A Conventional

Sensitive Plant Effects

No federally or state-listed plant species occurrences were identified within the EIS Study Area for Alternative N4A Conventional. Therefore, effects on sensitive plant species from construction and operation of Alternative N4A Conventional would be negligible.

Sensitive Wildlife Effects

Based on the ODWC endangered and threatened species list, six special-status species (five of which are federally listed as endangered or threatened) are known to occur in the counties crossed by Alternative N4A Conventional.

However, Alternative N4A Conventional would follow the existing Burlington Northern Santa Fe (BNSF) rail alignment and Trinity Railway Express (TRE) tracks. Construction of this alternative would likely occur in existing right-of-way, in areas that have already been disturbed by prior rail development. Furthermore, the probability of the six listed species occurring within existing rights-of-way is low because of the noise and land disturbances associated with the active rail line operation and maintenance. Therefore, construction effects on sensitive wildlife species of Alternative N4A Conventional would be negligible.

Operations effects for Alternative N4A Conventional would be moderate because this alternative would not likely be fenced, making wildlife, including the listed species known to occur in the EIS Study Area, vulnerable to an increased risk for strikes from the additional rail traffic along the route. Additionally, more noise and vibration from the added rail traffic along the route could disrupt listed species in the area. Various habitats throughout the EIS Study Area could be potential roosting/nesting habitat for a variety of migratory and resident birds (including federally and state-listed species). Removal of, or disturbance to the habitat during the bird nesting season (February 1 to September 15) could result in effects on nesting species that are protected by the MBTA. Such effects would have a noticeable effect on wildlife, including sensitive species, but could be reduced by the use of best management practices (BMPs) (see Section 3.7.5, Avoidance, Minimization, and Mitigation Strategies).

Critical Habitat Effects

Construction of this alternative would likely occur in existing transportation corridors, in areas that have already been disturbed by prior rail development. Therefore, potential effects on critical habitat from construction and operation of Alternative N4A Conventional would be negligible. If disturbance outside existing rail corridors are necessary (i.e., vegetation clearance, staging), BMPs could be implemented during construction and operation to limit potential effects on the small, linear area of critical habitat (see Section 3.7.5, Avoidance, Minimization, and Mitigation Strategies).

3.7.4.4 Central Section: Dallas and Fort Worth to San Antonio

Most potential effects on threatened and endangered species would be the same among the Central Section alternatives. No occurrences of sensitive plant species or critical habitat were identified within the EIS Study Area for any of the alternatives. The EIS Study Area for each alternative in the Central Section includes the same acreage of mountain plover habitat, but the acreage of Texas garter snake habitat varies. These potential effects are described below.

3.7.4.4.1 Alternative C4A Higher-Speed Rail

Sensitive Plant Effects

No federally or state-listed plant species occurrences were identified within the EIS Study Area for Alternative C4A Higher-Speed Rail. Therefore, construction and operation effects on sensitive plant species from Alternative C4A Higher-Speed Rail would be negligible when compared with the No Build Alternative.

Sensitive Wildlife Effects

The potential effects on listed wildlife species of construction of Alternative C4A Higher-Speed Rail would be substantial because construction would occur outside existing transportation corridors that would have a noticeable, inevitable effect on these resources within the EIS Study Area. Short- and long-term effects on mountain plover and Texas garter snake could occur as a result of constructing Alternative C4A Higher-Speed Rail and could include the temporary clearing of potential habitat for construction equipment and the stockpiling of soil, ballast, or other construction materials. Additionally, short-term noise, vibration, and air pollution from construction equipment and activities could temporarily affect listed species by disrupting life history requirements (foraging, nesting). Potential operations effects would be moderate from disruption of listed species from noise and vibration from the added rail traffic along the route. Operations effects would have a noticeable effect on wildlife, but the effects could be reduced by the use of BMPs (see Section 3.7.5, Avoidance, Minimization, and Mitigation Strategies).

Critical Habitat Effects

No critical habitat was identified within the EIS Study Area for C4A Higher-Speed Rail. Therefore, effects on critical habitat from construction and operation would be negligible.

3.7.4.4.2 Alternative C4A High-Speed Rail

Sensitive Plant Effects

Potential effects on sensitive plants would be the same as those discussed for Alternative C4A Higher-Speed Rail because both service types would share the same route. Construction and operations effects would be negligible when compared with the No Build Alternative.

Sensitive Wildlife Effects

Potential construction effects on sensitive wildlife species would be the same as those discussed for Alternative C4A Higher-Speed Rail (substantial) because both service types would share the same route. Alternative C4A High-Speed Rail would likely be fully fenced, lessening the likelihood of strikes when compared with the higher-speed rail option. However, Alternative C4A High-Speed Rail would have a higher potential for operations effects because the noise and vibration generated by high-speed rail would travel farther than the noise generated by higher-speed rail. Overall, the potential operations effects on sensitive wildlife would be moderate.

Critical Habitat Effects

Potential effects on critical habitat would be the same as those discussed for Alternative C4A Higher-Speed Rail because both service types would share the same route. Construction and operations effects would be negligible.

3.7.4.4.3 Alternative C4B Higher-Speed Rail

Sensitive Plant Effects

No federally or state-listed plant species occurrences were identified within the EIS Study Area for Alternative C4B Higher-Speed Rail. Therefore, effects on sensitive plant species from construction and operation would be negligible.

Sensitive Wildlife Effects

The potential effects on listed wildlife species from construction of Alternative C4B Higher-Speed Rail would be substantial because construction of the portions of the alternative that would be located outside existing transportation corridors would have a noticeable, inevitable effect on these resources within the EIS Study Area. Short- and long-term effects on mountain plover and Texas garter snake could occur as a result of constructing Alternative C4B Higher-Speed Rail and could include the temporary clearing of potential habitat for construction equipment and the stockpiling of soil, ballast, or other construction materials. Additionally, short-term noise, vibration, and air pollution from construction equipment and activities could temporarily affect listed species by disrupting life history requirements (foraging, nesting). Potential operations effects would be considered moderate because of disruption of listed species from noise and vibration from the added rail traffic along the route. Such effects would have a noticeable effect on wildlife, but the effects could be reduced by the use of BMPs (see Section 3.7.5, Avoidance, Minimization, and Mitigation Strategies).

Critical Habitat Effects

No critical habitat was identified within the EIS Study Area for Alternative C4B Higher-Speed Rail. Therefore, construction and operations effects on critical habitat would be negligible.

3.7.4.4.4 Alternative C4B High-Speed Rail

Sensitive Plant Effects

Potential effects on sensitive plants would be the same as those discussed for Alternative C4B Higher-Speed Rail because both service types would share the same route. Construction and operations effects would be negligible when compared with the No Build Alternative.

Sensitive Wildlife Effects

Potential construction effects on sensitive wildlife species would be the same as those discussed for Alternative C4B Higher-Speed Rail (substantial) because both service types would share the same route. Alternative C4B High-Speed Rail would likely be fully fenced, lessening the likelihood of strikes when compared with the higher-speed rail option. However, Alternative C4B High-Speed Rail would have a higher potential for operations effects because the noise and vibration generated by high-speed rail would travel farther than the noise generated by higher-speed rail. Overall, the potential operations effects on sensitive wildlife would be moderate.

Critical Habitat Effects

Potential effects on critical habitat would be the same as those discussed for Alternative C4B Higher-Speed Rail because both service types would share the same route. Construction and operations effects would be negligible because no critical habitat was identified in the EIS Study Area for Alternative C4B High-Speed Rail.

3.7.4.4.5 Alternative C4C Higher-Speed Rail

Sensitive Plant Effects

No federally or state-listed plant species occurrences were identified within the EIS Study Area for Alternative C4C Higher-Speed Rail. Therefore, effects on sensitive plant species from construction and operation of Alternative C4C Higher-Speed Rail would be negligible.

Sensitive Wildlife Effects

The potential effects on listed wildlife species from construction of Alternative C4C Higher-Speed Rail would be substantial because construction of the portions of the alternative that would be located outside existing transportation corridors would have a noticeable, inevitable effect on these resources within the EIS Study Area.

Short- and long-term effects on mountain plover and Texas garter snake could occur as a result of constructing Alternative C4C Higher-Speed Rail and could include the temporary clearing of potential habitat for construction equipment and the stockpiling of soil, ballast, or other construction materials. Additionally, short-term noise, vibration, and air pollution from construction equipment and activities could temporarily affect listed species by disrupting life history requirements (foraging, nesting). Potential operations effects would be moderate because of disruption of listed species from noise and vibration from the added rail traffic along the route. Such effects would have a noticeable effect on wildlife, but the effects could be reduced by the use of BMPs (see Section 3.7.5, Avoidance, Minimization, and Mitigation Strategies).

Critical Habitat Effects

No critical habitat was identified within the EIS Study Area for Alternative C4C Higher-Speed Rail.

Therefore, construction and operations effects on critical habitat from construction and operation of Alternative C4C Higher-Speed Rail would be negligible.

3.7.4.4.6 Alternative C4C High-Speed Rail

Sensitive Plant Effects

Potential effects on sensitive plants would be the same as those discussed for Alternative C4C Higher-Speed Rail because both service types would share the same route. Construction and operations effects would be negligible when compared with the No Build Alternative.

Sensitive Wildlife Effects

Potential construction effects on sensitive wildlife species would be the same as those discussed for Alternative C4C Higher-Speed Rail (substantial) because both service types would share the same route. Alternative C4C High-Speed Rail would likely be fully fenced, lessening the likelihood of strikes when compared with the higher-speed rail option. However, Alternative C4C High-Speed Rail would have a higher potential for operations effects overall on wildlife corridors and assemblages within the EIS Study Area because the noise and vibration generated by high-speed rail would travel farther than the noise generated by higher-speed rail. Overall, the potential operations effects on sensitive wildlife would be moderate.

Critical Habitat Effects

Potential effects on critical habitat would be the same as those discussed for Alternative C4C Higher-Speed Rail because both service types would share the same route. Construction and operations effects would be negligible because no critical habitat was identified in the EIS Study Area for Alternative C4C High-Speed Rail.

3.7.4.5 Southern Section: San Antonio to South Texas

In the Southern Section, overall potential effects on threatened and endangered species would be greater under Alternative S4 Higher-Speed Rail compared with the two S6 alternatives. Alternative S6 Higher-Speed Rail would have the same potential construction effects as S6 High-Speed Rail, but because noise and vibration from high-speed rail travel farther than they do with higher-speed rail, Alternative S6 Higher-Speed rail would have less overall potential operations effects than S6 High-Speed Rail. These potential effects are described below.

3.7.4.5.1 Alternative S4 Higher-Speed Rail

Sensitive Plant Effects

Although significant portions of Alternative S4 Higher-Speed Rail would be constructed within existing routes (e.g., Kansas City Southern Railway and revitalization of abandoned tracks), effects during construction on sensitive plant species along the portions of the route outside existing transportation corridors would be considered a substantial potential effect when compared with the No Build Alternative. Effects on listed plant species outside existing transportation corridors would primarily occur during construction and could include the clearing of vegetation for construction equipment and the stockpiling of soil, ballast, or other construction materials. Such effects would be considered long-term to permanent for portions of the alternative outside existing transportation corridors and would have a noticeable, inevitable effect on listed plant species.

Effects on sensitive plants are typically related to construction activities such as grading and vegetation removal; therefore, operation of Alternative S4 Higher-Speed Rail are not expected to cause additional effects, and thus would be considered negligible.

Sensitive Wildlife Effects

Although significant portions of Alternative S4 Higher-Speed Rail would be constructed within existing routes, effects on sensitive wildlife species along the portions of the route that would be outside existing transportation corridors would be a substantial potential effect. Effects on listed wildlife species could occur as a result of constructing the portions of Alternative S4 Higher-Speed Rail outside existing transportation corridors. Effects could include the clearing of vegetation for construction equipment and the stockpiling of soil, ballast, or other construction materials. Such effects would be considered long-term to permanent. Additionally, short-term noise, vibration, and air pollution from construction equipment and activities could temporarily affect listed species by disrupting life history requirements or causing avoidance behavior.

Potential operations effects would be moderate because of disruption of listed species from noise and vibration from the added rail traffic along the route. Such effects would have a noticeable effect on wildlife, but the effects could be reduced by the use of BMPs (see Section 3.7.5, Avoidance, Minimization, and Mitigation).

Critical Habitat Effects

No critical habitat was identified within the EIS Study Area for Alternative S4 Higher-Speed Rail. Therefore, effects on critical habitat from construction and operation of Alternative S4 Higher-Speed Rail would be negligible.

3.7.4.5.2 Alternative S6 Higher-Speed Rail

Sensitive Plant Effects

No federally or state-listed plant species occurrences were identified within the EIS Study Area for Alternative S6 Higher-Speed Rail. Therefore, effects on sensitive plant species from construction and operation of Alternative S6 Higher-Speed Rail would be negligible.

Sensitive Wildlife Effects

Based on the spatial dataset acquired from TXNDD, 3 acres of listed wildlife habitat (state-listed Texas tortoise) are within the EIS Study Area for Alternative S6 Higher-Speed Rail. Potential effects on sensitive wildlife species from construction of Alternative S6 Higher-Speed Rail would be negligible because effects on this particular species (Texas tortoise) could be reduced with preconstruction surveys and monitoring. Potential operations effects would be moderate because of disruption of listed species from noise and vibration from the added rail traffic along the route. Such effects would have a noticeable effect on wildlife, but the effects could be reduced by the use of BMPs.

Critical Habitat Effects

No critical habitat was identified within the EIS Study Area for Alternative S6 Higher-Speed Rail. Therefore, effects on critical habitat from construction and operation of Alternative S6 Higher-Speed Rail would be negligible.

3.7.4.5.3 Alternative S6 High-Speed Rail

Sensitive Plant Effects

Potential effects on sensitive plants would be the same as those discussed for Alternative S6 Higher-Speed Rail because both service types would share the same route. The construction and operations effects would be negligible.

Sensitive Wildlife Effects

Potential construction effects on sensitive wildlife species would be the same as those discussed for Alternative S6 Higher-Speed Rail because both service types would share the same route. Alternative S6 High-Speed Rail would likely be fully fenced, lessening the likelihood of strikes when compared with the higher-speed rail option. However, Alternative S6 High-Speed Rail would have a higher potential for operations effects because the noise and vibration generated by high-speed rail would travel farther than the noise generated by higher-speed rail. Overall, the potential operations effects on sensitive wildlife would be moderate.

Critical Habitat Effects

Potential effects on critical habitat would be the same as those discussed for Alternative S6 Higher-Speed Rail because both service types would share the same route. The construction and operations effects would be negligible.

3.7.4.6 Summary of Potential Effects

The construction of Alternative N4A Conventional Rail would have a negligible effect on sensitive plants, wildlife, and critical habitat because the alternative would be constructed within existing transportation corridors, in areas already disturbed by development. However, from an operations standpoint, Alternative N4A would have a moderate effect on wildlife species. The alternative would not likely be fenced, making wildlife (including listed species) vulnerable to an increased risk for strikes from the additional rail traffic that would occur.

The Central Section build alternatives would have a negligible effect on sensitive plant species and critical habitat because there are no occurrences of these resources within the EIS Study Area. However, construction of the Central Section build alternatives would have a substantial effect on sensitive wildlife species because significant acreage of one federally listed and one sensitive species are known to occur in the portions of the EIS Study Area. From an operations standpoint, effects would be moderate, because disruption of wildlife species from noise and vibration would occur.

Alternative S4 Higher-Speed Rail in the southern section would have a substantial effect on sensitive plant and wildlife species. Seven federally listed and 24 other sensitive plant and wildlife species have the potential to occur within the EIS Study Area. Within portions of the alternative outside existing transportation corridors, effects would be long-term or permanent and would likely adversely affect threatened and endangered species. Although the S6 alternatives would be constructed in a new, direct route, outside existing transportation corridors, construction of the alternatives in the Southern Section would be negligible because only 3 acres of one sensitive wildlife species (Texas tortoise) and no plant species or critical habitat occurs within the EIS Study Area.

Table 3.7-5 summarizes the qualitative assessment of potential effects (negligible, moderate, or substantial) for the alternatives and also includes measures that could be taken to avoid or reduce the potential effects of the alternatives. As stated previously, this service-level analysis did not include detailed fieldwork to identify potential habitats or populations of threatened and endangered species. Acreages listed below are not the actual areas of effect associated with construction and operation of any of the alternatives. This service-level analysis uses the 500-foot EIS Study Area to determine the types of resources that may be affected, and, more importantly, the relative magnitude of resources that may be affected. Some alternatives could be built alone or combined with other section alternatives. In addition, more than one alternative in the Central and Southern sections could be built in the future because the alternatives provide different service options for the independent destinations. Details about how alternatives might connect, as well as measures to reduce effects, would be analyzed at the project-level EIS phase.

3.7.5 Avoidance, Minimization, and Mitigation Strategies

Avoidance and minimization of effects will be incorporated when feasible. If effects can’t be avoided or minimized, mitigation strategies will be implemented. All BMPs, design features, and mitigation measures to reduce or eliminate impacts on sensitive habitats and species would be coordinated with federal and state agencies. To minimize construction effects and minimize disturbance of terrestrial and aquatic habitats and wildlife, BMPs used during construction and operation would include, but not be limited to, the following:

- Confirm the boundaries of listed plant and wildlife habitat prior to the start of construction to avoid or minimize effects on these areas.
- Conduct preconstruction surveys and monitoring in advance of clearing, grading, or construction to identify protected nest sites and avoid these areas until nesting has completed.
- Implement seasonal restrictions on construction work during key breeding, nesting, migration, and growth periods to protect individual species.
- Construct multiple and varying crossing structures at crossing points to provide connectivity for species likely to use a given area.
- Construct at least one crossing structure within an individual's home range and where suitable habitat for species occurs (if possible) on both sides of the crossing structure.
- Monitor structures for obstructions, such as detritus or silt blockages, that impede movement.
- Manage human activity near crossing structures with the use of fencing, signage, etc.
- Provide for the mitigation of project areas by improving marginal habitats or creating mitigation banks at key locations within the affected watersheds and habitat ranges, as necessary.

Local ordinances would be followed for erosion, sediment, and stormwater controls during construction to minimize potential effects on aquatic resources. For terrestrial habitats that might be temporarily disturbed by construction, pre-construction conditions or better would be restored once construction is complete.

3.7.6 Subsequent Analysis

Once a preferred alternative is selected, field investigations or surveys will be conducted to define actual critical habitats, to develop avoidance and minimization strategies, and to determine the likelihood of impacts on listed species and their habitats within the EIS Study Area during subsequent analysis. Critical habitats and species assessments will be conducted in accordance with federal and state regulations, including formal biological assessments for protected species and consultation with USFWS, TPWD and ODWC, as needed. The boundaries of listed plant and wildlife habitat will be confirmed to avoid or minimize effects on these areas. Habitat and species assessments will be conducted in accordance with applicable federal and state regulations.

Table 3.7-5: Summary of Effects on Threatened and Endangered Species and Their Critical Habitat

Alternative[a]	Sensitive Plants		Sensitive Wildlife		Critical Habitat	
	Construction	Operations	Construction	Operations	Construction	Operations
N4A CONV	**Negligible** ▪ No occurrences	**Negligible** ▪ No occurrences	**Negligible** ▪ 5 federally listed species ▪ 1 other sensitive species ▪ Alternative would be located within existing transportation corridors	**Moderate** ▪ Alternative would not likely be fenced, making wildlife movement vulnerable to increased risk for strikes from additional rail traffic ▪ Best management practices could mitigate effects	**Negligible** ▪ 34 acres of Arkansas River shiner critical habitat ▪ Alternative would be located within existing transportation corridors	**Negligible** ▪ Most effects would be during construction ▪ Alternative would be located within existing transportation corridors, in areas already disturbed by rail development
C4A HrSR	**Negligible** ▪ No occurrences	**Negligible** ▪ No occurrences	**Substantial** ▪ 1 federally listed species ▪ 1 other sensitive species ▪ Most of alternative outside existing transportation corridors ▪ Effects would be considered long-term or permanent and would likely adversely affect threatened and endangered species	**Moderate** ▪ Disruption of species from noise and vibration would occur ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Negligible** ▪ No critical habitat	**Negligible** ▪ No critical habitat
C4A HSR	Same as C4A HrSR	Same as C4A HrSR	Same as C4A HrSR	**Moderate** • Would likely be fully fenced, lessening the likelihood of strikes when compared with C4A HrSR. • Higher overall potential for effects as noise and vibration generated would travel farther than that generated by HrSR	Same as C4A HrSR	Same as C4A HrSR
C4B HrSR	**Negligible** ▪ No occurrences	**Negligible** ▪ No occurrences	**Substantial** ▪ 1 federally listed species ▪ 1 other sensitive species ▪ Most of alternative outside existing transportation corridors ▪ Effects would be considered long-term or permanent and would likely adversely affect threatened and endangered species	**Moderate** ▪ Disruption of species from noise and vibration would occur ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Negligible** ▪ No critical habitat	**Negligible** ▪ No critical habitat

Alternative[a]	Sensitive Plants		Sensitive Wildlife		Critical Habitat	
	Construction	Operations	Construction	Operations	Construction	Operations
C4B HSR	Same as C4B HrSR	Same as C4B HrSR	Same as C4B HrSR	**Moderate** • Would likely be fully fenced, lessening the likelihood of strikes when compared with C4B HrSR • Higher overall potential for effects as noise and vibration generated would travel farther than that generated by HrSR	Same as C4B HrSR	Same as C4B HrSR
C4C HrSR	**Negligible** ▪ No occurrences	**Negligible** ▪ No occurrences	**Substantial** ▪ 1 federally listed species ▪ 1 other sensitive species ▪ Most of alternative outside existing transportation corridors ▪ Effects would be considered long-term or permanent and would likely adversely affect threatened and endangered species	**Moderate** ▪ Disruption of species from noise and vibration would occur ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Negligible** ▪ No critical habitat	**Negligible** ▪ No critical habitat
C4C HSR	Same as C4C HrSR	Same as C4C HrSR	Same as C4C HrSR	**Moderate** • Would likely be fully fenced, lessening the likelihood of strikes when compared with C4C HrSR • Higher overall potential for effects as noise and vibration generated would travel farther than that generated by HrSR	Same as C4C HrSR	Same as C4C HrSR
S4 HrSR	**Substantial** ▪ 5 federally listed species ▪ 13 other sensitive species ▪ Portions of alternative outside existing transportation corridors ▪ Effects would be considered long-term or permanent and would likely adversely affect threatened and endangered species	**Negligible** ▪ Most effects would be during construction	**Substantial** ▪ 2 federally listed species ▪ 11 other sensitive species ▪ Portions of alternative outside existing transportation corridors ▪ Effects would be considered long-term or permanent and would likely adversely affect threatened and endangered species	**Moderate** ▪ Disruption of species from noise and vibration would occur ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Negligible** ▪ No critical habitat	**Negligible** ▪ No critical habitat

Alternative[a]	Sensitive Plants		Sensitive Wildlife		Critical Habitat	
	Construction	Operations	Construction	Operations	Construction	Operations
S6 HrSR	**Negligible** ▪ No occurrences	**Negligible** ▪ No occurrences	**Negligible** ▪ 1 sensitive species ▪ Effects could be reduced with preconstruction surveys, translocation, and monitoring	**Moderate** ▪ Disruption of species from noise and vibration would occur ▪ Alternative could be designed with alternative pathways or undercrossings to maintain wildlife migratory paths or corridors	**Negligible** ▪ No critical habitat	**Negligible** No critical habitat
S6 HSR	Same as S6 HrSR	Same as S6 HrSR	Same as S6 HrSR	**Moderate** • Would likely be fully fenced, lessening the likelihood of strikes when compared with S6 HrSR • Higher overall potential for effects as noise and vibration generated would travel farther than that generated by HrSR	Same as S6 HrSR	Same as S6 HrSR

[a] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

3.8 Flood Hazards and Floodplain Management

This section describes the floodplains and large federal flood-control projects (i.e., levees and man-made floodways) within the environmental impact statement (EIS) Study Area and describes a preliminary assessment of potential effects on these resources. Preliminary avoidance, minimization, and mitigation strategies and further analyses needed in the project-level National Environmental Policy Act (NEPA) process are identified at the end of the section. The introduction to Chapter 3 describes the EIS Study Area and use of terms such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.8.1 Laws, Regulations, and Orders

Applicable federal and state legislation, regulations, and orders pertaining to flood hazards and floodplain management within the EIS Study Area include the following. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.8.1.1 Federal

- **National Flood Insurance Act of 1968, as amended, and Flood Disaster Protection Act of 1973, as amended.** The Federal Emergency Management Agency (FEMA) defines floodplains as “Any land area susceptible to being inundated by flood waters from any source” (44 Code of Federal Regulations [CFR] §59.1). The National Flood Insurance Program was established pursuant to the National Flood Insurance Act of 1968, as amended (42 U.S. Code [U.S.C.] § 4001), and the Flood Disaster Protection Act of 1973, as amended (42 U.S.C. § 4001), to encourage sound floodplain management programs at the state and local levels. To provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the “flood having a one percent chance of being equaled or exceeded in any given year” (44 CFR § 59.1). Regulations promulgated by the Act (44 CFR §§ 59 to 80) also contain the basic policies and procedures to regulate floodplain management and analyze, identify, and map floodplains for flood insurance purposes.
- **Executive Order 11988, Floodplain Management (1977).** Executive Order 11988, Floodplain Management (1977) requires federal agencies to avoid adverse impacts on floodplains, to the extent possible, and to avoid situations that would support floodplain development if a practicable alternative exists.
- **U.S. Department of Transportation (USDOT) Order 2650.2 (1979).** USDOT Order 5650.2 describes policies and procedures for “ensuring that proper consideration is given to avoidance and mitigation of adverse floodplain impacts in agency actions, planning programs, and budget requests.”
- **Rivers and Harbors Appropriations Act of 1899.** The U.S. Army Corps of Engineers (USACE), under Section 408 of the Rivers and Harbors Appropriations Act of 1899 (33 U.S.C. § 408), maintains it is “unlawful for any person or persons to build upon, alter, deface work built by the

U.S. to prevent floods unless [the Secretary of the Army] grants permission." Because the Program would include levee crossings, the Section 408 approval process may apply in areas where a new alignment would cross a levee and cannot use an existing crossing.

- **Section 404 of the Clean Water Act of 1972.** If a portion of the floodway also qualifies as a Water of the United States, placement of dredged or fill material in that area will be regulated by USACE under Section 404 of the Clean Water Act (33 U.S.C 1344). Section 404 requires the issuance of a Department of the Army permit by USACE prior to the discharge of dredged or fill material into Waters of the United States.

3.8.1.2 State

In Texas and Oklahoma, local governments enforce floodplain regulations in their jurisdictions with assistance from the Texas Water Development Board (TWDB) and the Oklahoma Water Resources Board (OWRB). Most Texas and Oklahoma communities (a county, city, town, or village is considered a community) participate in the National Flood Insurance Program. Each participating community has a designated floodplain administrator whose main responsibility is overseeing the management of, and development within, the community's floodplains.

- **Oklahoma Floodplain Management Act of 1980, as amended.** The Oklahoma Floodplain Management Act, Title 82, Oklahoma Statute 2001, §1601 – 1618, as amended, was passed by the Oklahoma State Legislature in 1980 and establishes a state and local partnership to reduce flood damages through sound floodplain management.
- **Texas House Bill 1018 (1999).** Texas House Bill 1018 (1999) amended the State Water Code to require all communities to adopt floodplain regulations in order to be eligible for inclusion in the National Flood Insurance Program.

3.8.2 Methodology

Floodplains within the 500-foot EIS Study Area were identified using National Flood Hazard Layer data acquired from FEMA. The National Flood Hazard Layer incorporates Digital Flood Insurance Rate Map databases published by FEMA and Letters of Map Revision that have been issued against those databases since their publication dates.

In addition to floodplains, the USACE geospatial National Levee Database (NLD) platform was used to identify levee crossings and other major flood control projects within the EIS Study Area. Because only 10 percent of the nation's levees fall under USACE management, U.S. Geological Survey (USGS) quadrangle maps were reviewed for the presence of flood control measures in areas where the build alternatives would cross major water features. The National Hydrography Dataset was also used to identify major stream crossings where flood control measures are likely to be present.

To compare floodplain effects among alternatives, information from the National Flood Hazard Layer and NLD was used to estimate the acreage of floodplains and floodways within the EIS Study Area and the number of levees that would be crossed. The final alignments of the alternatives in the EIS Study Area will not be determined until project-level studies are conducted, and therefore the acreages of floodplains within the EIS Study Area provide an estimate of the magnitude of potential effects.

Effects as a result of the route alternatives are characterized as negligible, moderate, or substantial compared with the No Build Alternative. For flood hazards and floodplain management, these terms are defined as follows:

- Negligible intensity effects are those that would not contribute to a violation of regulatory standards or exceed the capacity of the existing facilities.
- Moderate intensity effects are those that would contribute to a violation of regulatory standards or exceed the capacity of existing facilities. An example of a moderate effect to a floodplain could include bank re-contouring, riprap, or other grading that changes the hydraulics of the stream or causes a rise in floodplain elevation of up to 1 foot.
- Substantial intensity effects are those that would contribute to a violation of regulatory standards or exceed the capacity of existing facilities. An example of a substantial effect to a floodplain could include constructing a river crossing that causes the upstream or downstream flood elevation to rise more than 1 foot or causes any amount of rise in the regulatory floodway.

3.8.3 Affected Environment

3.8.3.1 Overview

A floodplain is composed of two major parts: the floodway and the area between the floodway and the limit of the floodplain. The floodway is the main channel of a watercourse that must be kept free of encroachment in order to discharge flood waters. FEMA prohibits development within the floodway unless it can be shown that the development does not increase the height of flooding during a 100-year equivalent event. Development outside the floodway, but still within the floodplain, is permitted provided the development meets National Flood Insurance Program and any local floodplain regulations. If a portion of the floodplain is also considered a water of the United States under Section 404 of the Clean Water Act, a Department of the Army permit is required prior to the placement of dredged or fill material.

The floodplains and floodways within the Northern and Central sections are primarily associated with Mississippi River tributaries of varying sizes, in addition to several large open water features, such as Lake Texoma. In the Southern Section, floodplains and floodways are associated with the prominent rivers in the corridor; however, instead of flowing east and ultimately into the Mississippi River, these watercourses ultimately flow into the Gulf of Mexico (Gulf).

3.8.3.2 Northern Section: Oklahoma City to Dallas and Fort Worth

The Northern Section includes seven Oklahoma counties (Carter, Cleveland, Garvin, Love, McClain, Murray, and Oklahoma) and four Texas counties (Cooke, Dallas, Denton, and Tarrant). National Flood Hazard Layer data are available for nearly all intersected communities (FEMA 2014). The notable exceptions in data coverage are Murray and Love Counties in Oklahoma, where four out of 17 communities (including the unincorporated areas) are represented. The National Flood Hazard Layer data used in the floodplain analysis identified 815,133 acres of mapped floodplains, including 151,237 acres of floodways, within the 11 counties intersected by the EIS Study Area in the Northern Section. The NLD identifies 27 levees within the same area, 25 of which are located in Tarrant and Dallas counties.

Three rivers constitute the major sources of floodplain acreages in the Northern Section: the Canadian River, the Washita River, and the Red River. All three rivers flow east from their headwaters in the Rocky Mountain Front Range and then cross through the EIS Study Area before converging with other Mississippi River tributaries and eventually flowing into the Gulf. All three of these rivers also have floodways identified along at least part of their reaches. In addition to these major floodplain sources, hundreds of their minor tributaries make up most of the remainder of mapped floodplains. The largest open water features are Lewisville Lake, Grapevine Lake, and Lake Ray Roberts—all located within Denton County, Texas.

Table 3.8-1 identifies the number of acres of floodplains and floodways within the EIS Study Area for Alternative N4A.

Table 3.8-1: Floodplain and Floodway Acreages within the EIS Study Area for Route Alternative N4A

State	County	Floodplain (acres)[a]	Floodway (acres)[a]
OK	Oklahoma	19	13
OK	Cleveland	130	26
OK	McClain	302	124
OK	Garvin	530	25
OK	Murray	N/A[b]	N/A[b]
OK	Carter	182	0.0
OK	Love	N/A[b]	N/A[b]
TX	Cooke	208	62
TX	Denton	268	75
TX	Tarrant	282	31
TX	Dallas	84	54
Total		**2,005**	**410**

[a] Acreage rounded to the nearest whole.

[b] Floodplain data not available.

N/A = not available

Source: FEMA (2014).

3.8.3.3 Central Section: Dallas and Fort Worth to San Antonio

The Central Section includes 14 Texas counties: Bell, Bexar, Caldwell, Comal, Dallas, Ellis, Falls, Guadalupe, Hill, Johnson, McLennan, Tarrant, Travis, and Williamson. National Flood Hazard Layer is available for all counties except Falls County. The floodplain analysis identified 1,091,182 acres of floodplains, including 183,980 acres of floodways, in the counties within the Central Section (data not available for Falls County). The NLD indicates 33 levees present within the 14 counties.

Unlike the Northern Section, where most floodplains and floodways are connected to major tributaries of the Mississippi, the floodplains and floodways of the Central Section are connected to tributaries flowing directly into the Gulf. The five major water courses in the Central Section are the Trinity, Brazos, Colorado, Guadalupe, and San Antonio rivers—all of which outfall into the Gulf. Each of the five rivers has at least one segment of floodways identified within an intersected county. Aside from these watercourses, the major open water features in the counties in the Central Section include Lake Travis (Travis County), Canyon Lake (Comal County), Belton Lake (Bell County), Worth Lake (Tarrant County), Waco Lake (McClellan County), and Whitney Lake (Hill County).

Tables 3.8-2 through 3.8-4 identify the number of acres of floodplains and floodways within the EIS Study Areas of Alternatives C4A, C4B, and C4C.

Table 3.8-2: Floodplain and Floodway Acreages within EIS Study Area of Alternatives C4A Higher-Speed and High-Speed Rail

State	County	Floodplain (acres)[a]	Floodway (acres)[a]
TX	Bell	122	242
TX	Bexar	160	5
TX	Caldwell	216	0
TX	Comal	2	2
TX	Dallas	248	320
TX	Ellis	211	0
TX	Falls	N/A[b]	N/A[b]
TX	Guadalupe	157	55
TX	Hill	79	0
TX	McLennan	168	20
TX	Tarrant	232	20
TX	Travis	426	53
TX	Williamson	191	98
Total		**2,212**	**815**

[a] Acreage rounded to the nearest whole.
[b] Floodplain data not available.
N/A = not available
Source: FEMA (2014).

Table 3.8-3: Floodplain and Floodway Acreages within the EIS Study Area of Alternatives C4B Higher-Speed and High-Speed Rail

State	County	Floodplain (acres)[a]	Floodway (acres)[a]
TX	Bell	122	242
TX	Bexar	160	5
TX	Caldwell	216	0
TX	Comal	2	2
TX	Dallas	56	49
TX	Ellis	166	38
TX	Falls	N/A[b]	N/A[b]
TX	Guadalupe	157	55
TX	Hill	135	0
TX	Johnson	303	0
TX	McLennan	168	20
TX	Tarrant	91	20
TX	Travis	426	53
TX	Williamson	191	98
Total		**2,193**	**582**

[a] Acreage rounded to the nearest whole.
[b] Floodplain data not available.
N/A = not available
Source: FEMA (2014).

Table 3.8-4: Floodplain and Floodway Acreages within the EIS Study Area of Alternative C4C

State	County	Floodplain (acres)[a]	Floodway (acres)[a]
TX	Bell	122	242
TX	Bexar	160	5
TX	Caldwell	216	0
TX	Comal	2	2
TX	Dallas	248	320
TX	Ellis	211	0
TX	Falls	N/A[b]	N/A[b]
TX	Guadalupe	157	55
TX	Hill	243	10
TX	Johnson	272	16
TX	McLennan	168	20
TX	Tarrant	275	140
TX	Travis	426	53
TX	Williamson	191	98
Total		**2,691**	**961**

[a] Acreage rounded to the nearest whole.
[b] Floodplain data not available.
N/A = not available
Source: FEMA (2014).

3.8.3.4 Southern Section: San Antonio to South Texas

The Southern Section includes 14 Texas counties: Atascosa, Bexar, Brooks, Cameron, Dimmit, Duval, Frio, Hidalgo, Jim Wells, La Salle, Live Oak, Medina, Nueces, and Webb. National Flood Hazard Layer data are more limited in the Southern Section than in the other sections. FEMA floodplain data in Dimmit County have not been digitized, and no floodplains or floodways have been mapped in Frio, Jim Wells, or La Salle counties. Although specific floodplains and floodways could not be identified in these counties in the absence of National Flood Hazard Layer data, the floodplain data provided from FEMA did include county floodplain acreage totals, which were included in the analysis.

The National Flood Hazard Layer data used in the floodplain analysis identified 1,152,343 acres of mapped floodplains, including 4,695 acres of floodways, within nine of the 10 counties intersected by Alternative S4 Higher-Speed Rail (data not available for Jim Wells County). For Alternative S6, National Flood Hazard Layer data identified 559,843 acres of floodplain and 9,353 acres of floodway within three of the six intersected counties (data not available for Dimmit, Frio, or La Salle counties). The National Levee Database showed one levee in Live Oak County, one levee in Jim Wells County for Alternative S4 Higher-Speed Rail, and no levees in any county in the EIS Study Area for Alternative S6.

The tributaries in the Southern Section flow into the Nueces, Pecos, and Rio Grande rivers. Closer to the Gulf, Nueces Bay, Baffin Bay, and South Bay provide the outfall for these watercourses. Major open water features in the Southern Section include Choke Canyon Reservoir and Lake Corpus Christi in Live Oak County and Donna Reservoir in Hidalgo County near the southern terminus of Alternative S4 Higher-Speed Rail.

Tables 3.8-5 and 3.8-6 identify the number of acres of floodplains and floodways within the EIS Study Areas of Alternatives S4 and S6.

Table 3.8-5: Floodplain and Floodway Acreages within the EIS Study Area of Alternative S4

State	County	Floodplain (acres)[a]	Floodway (acres)[a]
TX	Atascosa	372	0
TX	Bexar	117	0
TX	Brooks	331	0
TX	Cameron	89	0
TX	Duval	184	0
TX	Hidalgo	376	0
TX	Jim Wells	N/A[b]	N/A[b]
TX	Live Oak	655	0
TX	Nueces	467	0
TX	Webb	420	4
Total		**3,011**	**4**

[a] Acreage rounded to the nearest whole.
[b] Floodplain data not available.
N/A = not available
Source: FEMA (2014).

Table 3.8-6: Floodplain and Floodway Acreages within the EIS Study Area of Alternative S6

State	County	Floodplain (acres)[a]	Floodway (acres)[a]
TX	Bexar	N/A[b]	N/A[b]
TX	Dimmit	N/A[b]	N/A[b]
TX	Frio	N/A[b]	N/A[b]
TX	La Salle	74	12
TX	Medina	229	0
TX	Webb	N/A[b]	N/A[b]
Total		**453**	**12**

[a] Acreage rounded to the nearest whole.
[b] Floodplain data not available.
N/A = not available
Source: FEMA (2014).

3.8.4 Environmental Consequences

3.8.4.1 Overview

The following sections describe potential encroachments on mapped areas of 100-year floodplains and floodways. The installation of tracks on existing former rail embankments, signals, and other ancillary facilities would in many instances involve minimal effects on or changes to ground surface elevations; installation of new railroad embankments may have a greater effect on surface topography. Work for new bridge construction within a floodway may have a greater effect on flood elevations. In general, any new embankment material or structures, such as bridges, placed within a floodway may alter the 100-year floodplain limits. Changes to existing drainage structures, such as culverts through the embankment, or addition of new waterway crossings or culverts may change the hydraulic capacity, which could affect peak flow rates and flood elevations upstream and downstream of the crossing.

It is assumed for this evaluation that all new structures, embankments, fill, pavement, or other modifications to open channels in floodways would be considered a floodplain encroachment. Although this study does not include an identification and effect analysis of specific station locations, a general discussion of potential effect intensity on floodplains is included for each alternative. Encroachments on the floodplain or floodway would not necessarily result in an unacceptable rise to the 100-year surface water elevation, but would require hydrologic analysis during project-level evaluations to verify site-specific effects on floodplains and floodways.

Temporary encroachments on the floodplain or floodway may occur during construction. Elements of linear construction projects often include access roads, staging areas, temporary access roads, and areas of earth excavation or temporary soil storage. These elements may have temporary effects on a floodplain through modification of topography and removal of vegetation. The most effective way to avoid construction effects on floodplains is to situate construction elements outside the floodplain. In circumstances where construction elements are located within a floodplain, best management practices (BMPs) are necessary to reduce potential effects (refer to Section 3.8.5, Avoidance, Minimization, and Mitigation Strategies). With the implementation of BMPs throughout the construction period, effects on floodplains and floodways would likely be reduced to negligible intensity.

Table 3.8-7 in Section 3.8.4.6, Summary of Potential Effects, summarizes the floodplain acreage for all the alternatives in the EIS Study Area and lists the potential intensity of effects.

3.8.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect floodplains and floodways.

3.8.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

Table 3.8-1 identifies the number of acres of floodplains and floodways in the EIS Study Area in the Northern Section. Environmental consequences associated with each alternative are detailed below.

3.8.4.3.1 Alternative N4A Conventional

Alternative N4A Conventional would operate completely within the existing BNSF right-of-way from Edmond, Oklahoma to Fort Worth, Texas, and completely within the Trinity Railway Express (TRE) right-of-way from Fort Worth to Dallas. Where feasible, existing railroad track would be used. Modifications within the existing BNSF and TRE rights-of-way, such as double-tracking, would be used to accommodate additional trains in areas where shared track is not feasible. Because existing tracks would be used or new tracks would be placed parallel to and at the same elevation as existing tracks with matching or larger flood conveyance capacity, incremental flood effects would be negligible in comparison to the No Build Alternative. In addition, by using BNSF right-of-way and crossings, the potential to trigger the USACE Section 408 process as a result of levee crossings—of which there are three in the Northern Section—would be reduced because Alternative N4A Conventional may be able to use existing levee crossings either on existing track or by placing new track parallel to existing track within the same existing levee crossing location (33 U.S.C. §408, Rivers and Harbors Appropriations Act of 1899).

In instances of large river crossings, such as the Canadian, Red, and Trinity rivers, installing piers in the floodplain or floodway would be unavoidable. Alternative N4A Conventional would include design features at stream crossings to compensate for pier placement within the floodway or floodplain (see Section 3.8.5, Avoidance, Minimization, and Mitigation Strategies). Additionally, Trinity River USACE levee crossings near the Central Wastewater Treatment Facility are anticipated with this alternative. Although not all of the 700 water features that would be crossed by Alternative N4A Conventional have an associated floodway or floodplain, this alternative would have a negligible effect on those that do, in comparison to the No Build Alternative, because the channel capacity design features listed above would be included in the design.

Potential station locations have not been identified for the Northern Section. Because Alternative N4A would use conventional rail technology, likely on existing infrastructure, station locations are not likely to change from the Amtrak Heartland Flyer and Texas Eagle station locations. Alternative N4A stations are likely to re-use existing stations and infrastructure and would, therefore, cause no or negligible effects on floodplains and floodways in comparison to the No Build Alternative because no or limited new construction would take place.

3.8.4.4 Central Section: Dallas and Fort Worth to San Antonio

In the Central Section, the C4C alternatives have the highest potential for effects, based on the presence of the greatest amount of floodplains and floodways within the EIS Study Area and because of the alternatives' longer lengths. The C4B alternatives have the least potential for effects, based on the least amount of floodplains and floodways within the EIS Study Area and because of the alternatives' shorter lengths. Although station locations, which are not included in this study, might vary between alternatives, effects on floodplains and floodways are not anticipated to differ as a result of different types of service along the same alignment.

3.8.4.4.1 Alternative C4A Higher-Speed Rail

Table 3.8-2 identifies the number of acres of floodplains and floodways in the EIS Study Area for Alternative C4A Higher-Speed Rail. From Fort Worth to Dallas, Alternative C4A Higher-Speed Rail shares floodplain and floodway attributes with Alternative N4A Conventional, with the exception of a loop that extends to the Dallas/Fort Worth International Airport (DFW). The DFW loop would require multiple new crossings of the Bear Creek floodway in addition to approximately 3.5 miles of new track within the Bear Creek floodplain south of DFW. Turning south from Dallas, where Alternative N4A Conventional ends, Alternative C4A Higher-Speed Rail follows the BNSF track south toward Waxahachie before entering a corridor outside of an existing transportation facility to Hillsboro. This portion of Alternative C4A Higher-Speed Rail extends from Hillsboro to just northeast of San Antonio, near the southern extent of the alternative, and represents the largest segment of the alternative. In this segment, large floodplains are encountered at the Brazos River, near Waco, and the Colorado River, just southeast of Austin. As the alternative extends to San Antonio, it re-enters the railroad right-of-way and enters the Olmos Creek floodplain before terminating east of Lackland Air Force Base.

Alternative C4A Higher-Speed Rail would require most track to be constructed outside of an existing transportation corridor. In instances of large river crossings, such as the Trinity, Colorado, and Guadalupe rivers, installing piers in the floodplain or floodway would be unavoidable. Alternative

C4A Higher-Speed Rail would include design features at stream crossings to compensate for pier placement within the floodway or floodplain (see Section 3.8.5, Avoidance, Minimization, and Mitigation Strategies). Additionally, Trinity River USACE levee crossings near the Central Wastewater Treatment Facility are anticipated with this alternative. Although not all of the 700 water features that would be crossed by the alternative have an associated floodway or floodplain, the alternative would have a negligible effect on those that do, in comparison to the No Build Alternative, because the channel capacity design features would be included in the design.

Although the Study does not include the identification of specific station locations, new stations would be necessary to meet the higher-speed service-type needs in areas outside of existing transportation corridors. The longest such segment in this alternative exists from just south of the Waxahachie to just north of San Antonio, with the option of direct service to downtown Austin. The stations located in the cities between Waxahachie and San Antonio (e.g., Waco, Temple, Austin) would likely occur in suburban areas where floodways and floodplains are most likely to have been identified. If stations are located at-grade and in a mapped floodway or floodplain, effects would be moderate or substantial due to the large space requirements, often several acres, required for higher-speed train stations. However, in these instances, effects could be reduced using design features such as flood openings and channel training. With the implementation of design features, likely effects on floodplains and floodways from stations would be reduced to negligible intensity in comparison to the No Build Alternative.

3.8.4.4.2 Alternative C4A High-Speed Rail

Alternative C4A High-Speed Rail would have the same effects on floodplains, floodways, and levees as Alternative C4A Higher-Speed Rail because both alternatives would follow the same alignment (see Tables 3.8-2 and 3.8-7). The alternative would have a negligible effect in comparison to the No Build Alternative because channel capacity design features would be included in the design.

3.8.4.4.3 Alternative C4B Higher-Speed Rail

Table 3.8-3 identifies the number of acres of floodplains and floodways within the EIS Study Area for the C4B alternatives. As Alternative C4B Higher-Speed Rail extends from Fort Worth to Dallas along its east-west segment, encroachments on the Trinity River and immediate tributaries represent the greatest potential for effects, especially near the Mountain Creek confluence. By using the existing Interstate Highway (IH)-30 infrastructure between Fort Worth and Dallas, floodplain effects on the Trinity River and its tributaries would be reduced to negligible intensity. The same would be true for the north-south portion of Alternative C4B Higher-Speed Rail, which could use the State Highway (SH)-360 infrastructure between the northern pivot point and SH-287. South of SH-287, where the alternative would be located outside of existing transportation corridors, the greatest potential for floodplain and floodway effects would exist at the Boggy Branch Creek and Soap Creek crossings, where the floodway or floodplain extend for 0.5 mile or greater. Additionally, Trinity River USACE levee crossings southwest of Dallas are anticipated with this alternative.

Alternative C4B Higher-Speed Rail would require most of its track to be constructed outside of existing transportation corridors. In instances of large river crossings, such as the Trinity River and the previously mentioned creeks, installing piers in the floodplain or floodway would be unavoidable. Alternative C4B Higher-Speed Rail would include design features at stream crossings to compensate for pier placement within the floodway or floodplain (see Section 3.8.5, Avoidance, Minimization, and Mitigation). Although not all of the 650 water features that would be crossed by the alternative have an associated floodway or floodplain, the alternative would have a negligible effect on those that do because channel capacity design features would be included in the design.

Although this study does not include the identification of specific station locations, new stations would be necessary to meet the higher-speed service type needs in areas outside of existing transportation corridors. The longest such segment in this alternative exists from just south of U.S. Highway (US)-287 to just north of San Antonio, with the option of direct service to downtown Austin. The stations located in the cities between US-287 and San Antonio (e.g., Waco, Temple, Austin) would likely occur in suburban areas where floodways and floodplains are most likely to have been identified. If stations are located at-grade and in a mapped floodway or floodplain, effects would be moderate or substantial due to the large space requirements, often several acres, required for higher-speed train stations. However, in these instances, effects could be reduced using design features such as flood openings and channel training. With the implementation of design features, likely effects on floodplains and floodways from stations would be reduced to negligible intensity.

3.8.4.4.4 Alternative C4B High-Speed Rail

Alternative C4B High-Speed Rail would have the same effects on floodplains, floodways, and levees as Alternative C4B Higher-Speed Rail because the both alternatives would follow the same alignment. Although station locations, which are not included in the study, might vary between alternatives, effects on floodplains and floodways are not anticipated to differ as a result of different types of service along the same alignment (see Tables 3.8-3 and 3.8-7). The alternative would have a negligible effect in comparison to the No Build Alternative because channel capacity design features would be included in the design.

3.8.4.4.5 Alternative C4C Higher-Speed Rail

Table 3.8-4 identifies the number of acres of floodplains and floodways for Alternative C4C Higher-Speed Rail. Alternative C4C Higher-Speed Rail requires most of its track to be constructed outside of existing transportation corridors, although a segment from Fort Worth to Hillsboro would occur along the existing UPRR corridor. Alternative C4C Higher-Speed Rail shares most of its alignment with Alternative C4A, including the large floodplain crossings at the Trinity, Colorado, and Guadalupe Rivers. In addition, the same USACE Trinity River Levees would be crossed south of Dallas with this alternative. The segment of this alternative not shared with Alternative C4A—from Fort Worth to Hillsboro—is most notable for an approximate 6-mile stretch of the Chambers Creek floodplain northwest of Alvarado.

In instances of large river crossings, such as the Trinity, Colorado, and Guadalupe rivers, installing piers in the floodplain or floodway would be unavoidable. Alternative C4C Higher-Speed Rail would include design features at stream crossings to compensate for pier placement within the floodway or floodplain (see Section 3.8.5, Avoidance, Minimization, and Mitigation Strategies). Although not all of the 850 water features that would be crossed by the alternative have an associated floodway or floodplain, the alternative would have a negligible effect on those that do because channel capacity design features would be included in the design.

Although the Study does not include the identification of specific station locations, new stations would be necessary to meet the higher-speed service-type needs in areas outside of existing transportation corridors. The longest such segment in this alternative exists from just south of the City of Waxahachie to just north of San Antonio, with the option of direct service to downtown Austin. The stations located in the cities between Waxahachie and San Antonio (e.g., Waco, Temple, Austin) would likely occur in suburban areas where floodways and floodplains are most likely to have been identified. If stations are located at-grade and in a mapped floodway or floodplain, effects would be moderate or substantial due to the large space requirements, often several acres, required for higher-speed train stations. However, in these instances effects could be reduced using design features, such as flood openings and channel training. With the implementation of design features, likely effects on floodplains and floodways from stations would be reduced to negligible intensity.

3.8.4.4.6 Alternative C4C High-Speed Rail

Alternative C4C High-Speed Rail would have the same effects on floodplains, floodways, and levees as Alternative C4C Higher-Speed Rail because both alternatives would follow the same alignment. Although station locations, which are not included as part of this study, might very between alternatives, effects on floodplains and floodways are not anticipated to differ as a result of different types of service along the same alignment (see Tables 3.8-4 and 3.8-7). The alternative would have a negligible effect in comparison to the No Build Alternative because channel capacity design features would be included in the design.

3.8.4.5 Southern Section: San Antonio to South Texas

Of the Southern Section alternatives, Alternative S4 has more potential for effects based on the presence of floodplains and floodways within the EIS Study Area than the S6 alternatives; however, the data are incomplete for a large portion of the EIS Study Area for the S6 alternatives. Although station locations, which are not included as part of this Study, might vary between alternatives, effects on floodplains and floodways are not anticipated to differ as a result of different types of service along the same alignment.

3.8.4.5.1 Alternative S4 Higher-Speed Rail

As identified in Table 3.8-5 and compared in Table 3.8-7, there are more acres of identified floodplains and floodways within the EIS Study Area of Alternative S4 Higher-Speed Rail than exist in the EIS Study Areas of the S6 alternatives. However, National Flood Hazard Layer data are not available for analysis for a large portion of the EIS Study Area for the S6 alternatives, and those floodplains must be identified before an informative comparison can be made.

Alternative S4 Higher-Speed Rail consists of both alignment within existing railroad right-of-way and alignment outside of existing transportation corridors. Unlike the Central Section, shared railroad right-of-way would occur with the Kansas City Southern Railway Company (KCS) and not with BNSF or UPRR. The higher-speed rail service type could potentially share track with existing railroad, and, therefore, could potentially use existing infrastructure, such as bridges and other stream crossings, to reduce construction- and operation-related effects on floodplains in areas where the alignments are shared. USACE levees are crossed at San Diego Creek in two locations north of SH-44.

In instances of large river crossings, such as the Nueces River and Palo Blanco Creek, installing piers in the floodplain or floodway would be unavoidable. Alternative S4 Higher-Speed Rail would include design features at stream crossings to compensate for pier placement within the floodway or floodplain (see Section 3.8.5, Avoidance, Minimization, and Mitigation Strategies). Although not all of the 369 water features that would be crossed by the alternative have an associated floodway or floodplain, the alternative would have a negligible effect on those that do, in comparison to the No Build Alternative, because channel capacity design features would be included in the design.

Although this study does not include the identification of specific station locations, new stations would be necessary to meet the higher-speed service-type needs in areas outside of existing transportation corridors. The stations located in the cities between San Antonio and Brownsville (e.g., Laredo, Corpus Christi, and McAllen) would likely occur in suburban areas where floodways and floodplains are most likely to already be identified for insurance purposes. If stations are located at-grade and in a mapped floodway or floodplain, effects would be moderate or substantial due to the large space requirements, often several acres, required for higher-speed train stations. However, in these instances effects could be reduced using design features, such as flood openings and channel training. With the implementation of design features, effects on floodplains and floodways from stations would be reduced to negligible intensity in comparison to the No Build Alternative.

3.8.4.5.2 Alternative S6 Higher-Speed Rail

Table 3.8-6 identifies the number of acres of floodplains and floodways within Alternative S6 Higher-Speed Rail. Alternative S6 Higher-Speed Rail would be constructed and operated entirely outside of existing transportation corridors. In instances of large river crossings, such as the Medina and Rio Grande rivers, installing piers in the floodplain or floodway would be unavoidable. Alternative S6 Higher-Speed Rail would include design features at stream crossings to compensate for pier placement within the floodway or floodplain (see Section 3.8.5, Avoidance, Minimization, and Mitigation Strategies). Additionally, no levee crossings are anticipated with this alternative. Although not all of the 700 water features that would be crossed by the alternative have an associated floodway or floodplain, the alternative would have a negligible effect on those that do because channel capacity design features would be included in the design.

Although this Study does not include the identification of specific station locations, new stations would be necessary to meet the higher-speed service-type needs in areas outside of existing transportation corridors. The stations located in San Antonio, including downtown and the airport, would likely occur in areas where floodways and floodplains are most likely to already be identified for insurance purposes. If stations are located at-grade and in a mapped floodway or floodplain, effects would be moderate or substantial due to the large space requirements, often several acres, required for higher-speed train stations. However, in these instances effects could be reduced using design features, such as flood openings and channel training. With the implementation of design features, effects on floodplains and floodways from stations would be reduced to negligible intensity.

3.8.4.5.3 Alternative S6 High-Speed Rail

Alternative S6 High-Speed Rail would have the same effects on floodplains, floodways, and levees as Alternative S6 Higher-Speed Rail because they would follow the same alignment (see Tables 3.8-6 and 3.8-7). The alternative would have a negligible effect in comparison to the No Build Alternative because channel capacity design features would be included in the design.

3.8.4.6 Summary of Potential Effects

Each of the alternatives in the Northern, Central, and Southern sections contains floodways and floodplains within their respective portions of the larger EIS Study Area. The longest alternatives in each geographic section (Alternatives C4C and S4) contain the most floodways and floodplains within their EIS Study Areas, and therefore have the greatest potential for effects. However, with the implementation of BMPs during construction and design features during operation, effects would be reduced to negligible intensity, regardless of the amount of floodplains and floodways within the EIS Study Area.

Table 3.8-7 summarizes the floodplain acreage for all alternatives in the EIS Study Area, including the No Build Alternative, and lists the potential intensity of effects by alternative.

Table 3.8-7: Summary of Floodplain and Floodway Effects by Alternative

Section	Alternative[a]	Context		Potential Intensity of Effects (Negligible, Moderate, or Substantial)
		Floodplain (acres)[b]	Floodway (acres)[b]	
No Build Alternative[c]		0	0	No effect
Northern	N4A CONV	2,005	410	Negligible
Central	C4A HrSR	2,212	815	Negligible
	C4A HSR	2,212	815	Negligible
	C4B HrSR	2,193	582	Negligible
	C4B HSR	2,193	582	Negligible
	C4C HrSR	2,691	961	Negligible
	C4C HSR	2,691	961	Negligible

Section	Alternative[a]	Context		Potential Intensity of Effects (Negligible, Moderate, or Substantial)
		Floodplain (acres)[b]	Floodway (acres)[b]	
Southern	S4 HrSR	3,011	4[c]	Negligible
	S6 HSR	453[d]	12	Negligible
	S6 HrSR	453[d]	12	Negligible

[a] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

[b] Acreage rounded to the nearest whole.

[c] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

[d] Floodplain or floodway data not available for a large portion of this alternative.

Source: (FEMA, 2014).

3.8.5 Avoidance, Minimization, and Mitigation Strategies

Where construction elements are unavoidably located within a floodplain, BMPs are necessary to reduce potential effects. BMPs can include creating temporary diversion channels capable of handling a flood event, creating cofferdams (or other temporary work structures) so as not to create a rise in downstream or upstream flood levels, limiting construction during the rainy season, and maintaining vegetative buffers between the construction site and the edge of the right-of-way.

When considering mitigation for floodplain encroachments, avoidance is always the most effective way to minimize effects. In circumstances where floodplain avoidance is neither prudent nor feasible, project-level mitigation measures and design features can reduce floodplain encroachment during operation to a practicable extent. Measures to minimize floodplain effects would include, but are not limited to, the following:

- Maximize the spans of bridges and box culverts to reduce the amount of fill material at the approach. Where feasible—and as part of Texas Department of Transportation (TxDOT 2004), Oklahoma Department of Transportation (ODOT 2009) and rail design standards (BNSF/UPRR 2007)—new stream crossings would take into consideration the 100-year flow and provide hydrologic connectivity to the adjacent watercourses. Hydrologic modeling would be used to confirm flood capacities are maintained and floodplain extents and depths would not affect previously unaffected properties adjacent to the EIS Study Area.
- Provide compensatory flood storage in other Program areas.
- Minimize the amount of upstream and downstream channelization.
- Minimize the amount of soil and vegetation disturbance during construction.
- Elevate new construction above the 100-year floodplain.

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- Provide flood openings in new construction.
- Provide channel training in areas of ephemeral or intermittent flow.
- Maintain vegetative buffers between project work and the flooding source (Association of State Floodplain Managers 2002).

The appropriate mitigation strategy is determined by the feasibility, practicability, and site-specific conditions of the affected floodplain. Coordination with the emergency management agencies and departments of natural resources of each state, as well as local floodplain administrators, would be initiated to discuss floodplain development permitting and potential mitigation measures. Specific mitigation measures, to the extent required, would be identified and discussed during project-level analysis after design details are known, recorded in NEPA documents as specific impacts are identified, and implemented prior to construction.

If, during a project-level analysis, a floodplain were found to receive a significant impact (more than a foot rise in water elevation in floodplain areas or any rise in floodway areas), a Conditional Letter of Map Revision followed by a Letter of Map Revision would be prepared to request a modification of the applicable Digital Flood Insurance Rate Map(s). Proposed modifications to floodplains would be submitted to FEMA, through coordination with the local community, for approval of the Conditional Letter of Map Revision prior to construction. Where the floodplain elevations and/or limits would be changed by the project, the Letter of Map Revision application must be filed with FEMA after construction is complete.

3.8.6 Subsequent Analysis

Impacts on the 100-year floodplains and floodways will be assessed during project-level analysis, and would include a discussion of the no-rise requirement in floodway areas. In accordance with Executive Order 11988 (42 Federal Register 26951), these discussions would also include avoidance and minimization measures, potential impacts on the natural and beneficial floodplain values, significant changes in flooding risks or damage, and the potential for incompatible floodplain development.

The Federal Railroad Administration (FRA) *Procedures for Considering Environmental Impacts* states that each project shall determine whether any of the alternatives would affect the base (i.e., the 100-year) floodplain. If one or more alternatives would affect a base floodplain, the project-level analysis will discuss any risk associated with each such alternative, the degree to which the alternative supports incompatible development in the base floodplain, and the adequacy of the methods proposed to minimize harm (FRA 2014).

During project-level assessments, impacts on floodplains will be determined based on design, site-specific mapping, and hydrologic analysis. Project development in future NEPA phases will require coordination at the federal, state, and local levels of floodplain regulation. For counties in this service-level EIS analysis where flood maps are not available, the project-level analysis will include coordination with FEMA and the local community to identify floodplains in or adjacent to the

EIS Study Area. Potential floodplain impacts in counties where floodplain data have yet to be included in the National Flood Hazard Layer will require a Digital Flood Insurance Rate Map-level review during project-level analysis.

If floodplain impacts necessitate preparation of a Conditional Letter of Map Revision and Letter of Map Revision, the local community and FEMA will be engaged in the subsequent revision to effective flood maps. The Conditional Letter of Map Revision/Letter of Map Revision process generally involves the following steps:

- Complete application and letter of request for conditional approval of a change in the Digital Flood Insurance Rate Map, known as a Conditional Letter of Map Revision.
- Conduct an evaluation of alternatives which, if carried out, would not result in an increase in the base flood elevation more than allowed, along with documentation as to why the alternatives not selected are not feasible.
- Provide public notification in the form of documentation of individual legal notice to all affected property owners (anyone affected by the increased flood elevations, within and outside of the community) explaining the impact of the proposed action on their properties.
- Receive concurrence, in writing, from the chief executive officer of any other communities affected by the proposed actions.
- Provide certification that no structures are located in areas that would be affected by the increased base flood elevation (unless they have been purchased for relocation or demolition).
- Request revision of base flood elevation determinations in accordance with the provisions of 44 CFR 65.6 of the FEMA regulations.

3.9 Coastal Zone Management

This section identifies the managed coastal resources within the 500-foot environmental impact statement (EIS) Study Area upon which alternatives encroach and the general extent to which each alternative is consistent with approved coastal zone management programs (CZMPs). Preliminary avoidance, minimization, and mitigation strategies and further analyses needed in the project-level National Environmental Policy Act (NEPA) process are identified at the end of this section. The introduction to Chapter 3 describes the EIS Study Area and use of terms such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.9.1 Laws, Regulations, and Orders

Applicable legislation and regulations pertaining to coastal zone management within the EIS Study Area include the following. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.9.1.1 Federal

Coastal Zone Management Act of 1972. The Coastal Zone Management Act, as amended (16 U.S. Code [U.S.C.] §1451), provides for the preservation, protection, development, and, where feasible, restoration and enhancement of the nation's coastal zone resources. Following the passage of the Texas Coastal Coordination Act in 1991 by the Texas Legislature, the Texas Coastal Management Program (TCMP) was finalized in 1997 and accepted into the federal Coastal Zone Management Program by the National Oceanic and Atmospheric Administration (NOAA) in 1997. The TCMP is audited every three years by NOAA to ensure continued compliance with the Coastal Zone Management Act.

3.9.1.2 State

Texas Coastal Coordination Act of 1991 and TCMP adopted in 1997. The TCMP is based primarily on the Texas Coastal Coordination Act (33 Texas Natural Resources Code Ann. 201 et. seq.), as amended by House Bill 3226 (1995). That legislation requires development of a comprehensive coastal program based on existing statutes and regulations. Key elements of the Texas Coastal Coordination Act and its implementation regulations (31 Texas Administrative Code [TAC] §501, 503, 505, and 506) include establishment of the Coastal Coordination Council for policy development and TCMP implementation; foundational legal requirements; program boundaries and Areas of Particular Concern; and networked state and local implementation, adherence, and enforcement.

The physical boundary set forth in the TCMP, known as the Texas Coastal Management Zone (CMZ), was delineated in accordance with the requirements of the Coastal Zone Management Act (1972), federal program development and approval regulations, and the Coastal Coordination Act. Coastal waters are considered as waters in the open Gulf of Mexico and waters under tidal influence.

The TCMP seeks to improve the management of Texas Coastal Natural Resource Areas within the CMZ and to provide long-term ecological and economic productivity of the coast. The TCMP is managed by the Commissioner of the Texas General Land Office (GLO) and administered by the Coastal Coordination Council, which coordinates state, local, and federal programs and activities within the CMZ. Federal actions, including federally issued licenses and permits, within the CMZ must be consistent with the goals and policies of the TCMP, focusing on the management of the following 16 Coastal Natural Resource Areas identified in 31 TAC §501.31:

- Waters of the open Gulf of Mexico
- Waters under tidal influence
- Submerged lands
- Coastal wetlands
- Submerged aquatic vegetation
- Tidal sand and mud flats
- Oyster reefs
- Hard substrate reefs
- Coastal barriers
- Coastal shore areas
- Gulf beaches
- Critical dune areas
- Special hazard areas
- Critical erosion areas
- Coastal historic areas
- Coastal preserves

Federal Highway Administration, Federal Railroad Administration (FRA), and Texas Department of Transportation (TxDOT) construction and maintenance projects must comply with the following transportation policies of the TCMP (31 TAC §501.31):

1. Pollution prevention procedures shall be incorporated into the construction and maintenance of transportation projects to minimize pollutant loading to coastal waters from erosion and sedimentation, use of pesticides and herbicides for maintenance of rights-of-way, and other pollutants from stormwater runoff.
2. Transportation projects shall be located at sites that to the greatest extent practicable avoid and otherwise minimize the potential for adverse effects from construction and maintenance of additional roads, bridges, causeways, and other development associated with the project; and direct release to Coastal Natural Resource Areas of pollutants from oil or hazardous substance spills, contaminated sediments, or stormwater runoff.
3. Where practicable, transportation projects shall be located in existing rights-of-way or previously disturbed areas if necessary to avoid or minimize adverse effects.
4. Where practicable, transportation projects shall be located at sites at which future expansion will not require development in coastal wetlands except where such construction is determined to be essential for evacuation in the case of a natural disaster.
5. Construction and maintenance of transportation projects shall avoid the impoundment and draining of coastal wetlands. If impoundment or draining cannot be avoided, adverse effects to

the impounded or drained wetlands shall be mitigated in accordance with the sequencing requirements of §501.23 of this title.

6. Construction of transportation projects shall occur at sites and times selected to have the least adverse effects practicable on recreational uses of Coastal Natural Resource Areas and on spawning or nesting seasons or seasonal migrations of terrestrial or aquatic species.
7. Beach-quality sand from maintenance of roadways adjacent to Gulf beaches shall be beneficially used by placement on Gulf beaches where practicable. Where placement on Gulf beaches is not practicable, the material shall be placed in critical dune areas.

3.9.1.3 Local

The GLO is the designated lead agency that coordinates the development and implementation of the TCMP. The Coastal Coordination Council administers the coastal management program and adopts uniform goals and policies to guide decision-making by entities regulating or managing natural resource use within the Texas coastal area. Local authorities work with the Coastal Coordination Council to identify local issues.

3.9.2 Methodology

The TCMP was identified as the only CZMP within the EIS Study Area. The locations of build alternatives were compared to the TCMP Map Index and the narrative of the TCMP boundary as described in 31 TAC §503.1 to determine overlap in boundaries.

The intensity of an effect resulting from each of the route alternatives is characterized as negligible, moderate, or substantial compared with the No Build Alternative. In relation to activities under the TCMP, these terms are defined as follows:

- Negligible intensity effects are those that would not result in perceptible change to the natural resources of the coastal zone (consisting of waters under tidal influence, submerged lands, coastal wetlands, submerged aquatic vegetation, tidal sand and mud flats, oyster reefs, hard substrate reefs, coastal barriers, coastal shore areas, critical dune areas, Gulf beaches, special hazard areas, critical erosion areas, coastal historic areas, and coastal preserves).
- Moderate intensity effects are those that would result in physical alteration to the natural resources within the coastal zone, but not ecological, recreational, or economic effects on the coastal zone (see above).
- Substantial intensity effects are those that would result in altering or changing the coastal area to the extent of affecting the coastal ecology, recreational values, and/or economic values of the natural resources of the coastal zone.

3.9.3 Affected Environment

3.9.3.1 Overview

The boundary of the CMZ extends across 18 coastal counties. Of these 18 counties, the EIS Study Area crosses Nueces and Cameron counties. Only Alternative S4 Higher-Speed Rail in the Southern

Section passes through the CMZ boundary in Nueces County; therefore, this alternative must comply with the TCMP. Alternative S4 Higher-Speed Rail is also in Cameron County; however, it is not within the TCMP boundary and, therefore, TCMP requirements do not apply. The other geographic sections and alternatives are not discussed.

3.9.3.2 Southern Section: San Antonio to South Texas

The EIS Study Area for Alternative S4 Higher-Speed Rail is primarily inland avoiding the CMZ; however, the alternative extends eastward from U.S. Highway (US) 281 in Nueces County and enters the western boundary of the CMZ near the City of Robstown. Alternative S4 Higher-Speed Rail crosses US-77 in Robstown and continues eastward along the north side of State Highway 44 (SH-44) within the Kansas City Southern (KCS) railroad right-of-way to service Corpus Christi International Airport.

An approximately 10-mile segment of the Alternative S4 Higher-Speed Rail alignment lies within the Nueces County CMZ. Of these 10 miles, 4 miles of the alignment parallel Oso Creek from approximately US-77 to County Road 71 where it bridges across Oso Creek.

3.9.4 Environmental Consequences

The primary effect on coastal areas would be encroachment into the CMZ and the potential for inhibiting coastal processes, water flow, or the potential to pollute these ecosystems. These effects do not vary by service type. Only Alternative S4 Higher-Speed Rail must comply with the TCMP. The other geographic sections and alternatives are not discussed because no effects would occur.

3.9.4.1 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect coastal resources.

3.9.4.2 Southern Section: San Antonio to South Texas

3.9.4.2.1 Alternative S4 Higher-Speed Rail

Alternative S4 Higher-Speed Rail can improve and share the existing KCS railroad track or be constructed adjacent to the existing railroad, potentially within its right-of-way. It can also include at-grade roadway crossings and use existing stations or nearby buildings as stations. However, compared with the No Build Alternative, it would still encroach in one CMZ area.

Of the 16 Coastal Natural Resource Areas listed in the TCMP, coastal wetlands are the only natural resource area identified within the CMZ that Alternative S4 Higher-Speed Rail would potentially affect. The alternative would enter the CMZ as it crosses US-77 eastbound toward Corpus Christi International Airport. Alternative S4 Higher-Speed Rail would use the existing KCS tracks located on the north side of SH-44. A preliminary review of U.S. Fish and Wildlife Service (USFWS) National

Wetland Inventory (NWI) mapping indicates freshwater forested/shrub wetlands adjacent to Oso Creek on the south side of SH-44.

This segment of Oso Creek is not tidally influenced. Because this wetland area is separated from Alternative S4 Higher-Speed Rail by SH-44, effects on these coastal wetlands are not anticipated.

Coastal consistency determinations are required for projects within the CMZ that require permit authorization under Section 10 of the Rivers and Harbors Act of 1899 and/or Section 404 of the Clean Water Act for impacts on Waters of the U.S. Improvements to the crossing of the Oso Creek railroad bridge to accommodate Alternative S4 Higher-Speed Rail would likely require a Section 404 permit, which would necessitate coordination with the U.S. Army Corps of Engineers (USACE) and GLO, as well as compliance with TCMP policies for transportation projects.

Table 3.9-1 summarizes the transportation policies and the potential effects of Alternative S4 Higher-Speed Rail. Alternative S4 Higher-Speed Rail would have a negligible effect on coastal resources and would comply with TCMP policies.

Table 3.9-1: TCMP Policies for Alternative S4 Higher-Speed Rail

No.	TCMP Policy for Transportation Projects	Potential Environmental Consequences and the Intensity During Construction	Potential Environmental Consequences and the Intensity During Operation and Maintenance	Potential Mitigation Strategies
1	Pollution prevention procedures incorporated into construction and maintenance	Water quality effects from dust, sediment, trash, spills, and incidental pollutants during stormwater runoff or high-wind events. These effects would likely be negligible. Modification of the existing rail bridge or construction of a new rail bridge over Oso Creek could result in minor filling of the creek or adjacent wetlands which could have moderate effects.	Train derailment into Oso Creek, diesel spills, oil and grease on the track, use of herbicides, and resulting stormwater water quality effects. These potential occurrences would be rare and therefore considered negligible, but the effect if it were to occur would be moderate.	Potential effects would be moderate before mitigation, but easily mitigated using standard approaches. Standard train safety would minimize the risk of train derailment. BMPs would be incorporated into construction and maintenance in accordance with TxDOT policies and TCEQ requirements to mitigate potential effects to Oso Creek and the train corridor.

No.	TCMP Policy for Transportation Projects	Potential Environmental Consequences and the Intensity During Construction	Potential Environmental Consequences and the Intensity During Operation and Maintenance	Potential Mitigation Strategies
2	Located at sites to avoid or minimize effects from construction and maintenance of additional roads	Alternative S4 Higher-Speed Rail is within or immediately adjacent to existing facilities. Temporary easements may be needed during construction for site access or to facilitate construction. Given the absence of Coastal Natural Resource Areas (based on preliminary review of USFWS NWI mapping), effects would be negligible.	Additional roads would not be needed during operation and maintenance.	Additional right-of-way required would be immediately adjacent to existing facilities/right-of-way. Access to the project or local traffic circulation would use the existing roadway network.
3	Located within existing right-of-way or previously disturbed areas	Alternative S4 Higher-Speed Rail is primarily within existing right-of-way or previously disturbed areas. Temporary easements may be needed during construction for site access or to facilitate construction. Given the absence of Coastal Natural Resource Areas, effects would be negligible.	Operations and maintenance activities would not likely require additional right-of-way or affect undisturbed areas. Effects would be negligible.	Additional right-of-way or easements required would be immediately adjacent to existing facilities/right-of-way. The adjacent areas have been previously disturbed.

No.	TCMP Policy for Transportation Projects	Potential Environmental Consequences and the Intensity During Construction	Potential Environmental Consequences and the Intensity During Operation and Maintenance	Potential Mitigation Strategies
4	Future expansion would not require development of coastal wetlands except for evacuation for a natural disaster	Future expansion is not anticipated; therefore, coastal wetlands would not be affected.	Future expansion is not anticipated; therefore, coastal wetlands would not be affected.	N/A
5	Avoid impounding or draining coastal wetlands	Impounding or draining coastal wetlands is not anticipated during construction.	Impounding or draining coastal wetlands is not anticipated during operation and maintenance.	N/A
6	No adverse effects on recreational values, spawning or nesting seasons, and migratory seasons for terrestrial and aquatic species	Alternative S4 Higher-Speed Rail is not anticipated to affect recreational values, spawning or nesting seasons, and migratory seasons for terrestrial and aquatic species. Effects would be negligible.	During operations and maintenance, migratory bird nesting may occur within associated structures. However, such nesting activities typically do not conflict with operations; thus, effects would be negligible.	To comply with the Migratory Bird Treaty Act, clearing and grubbing vegetation would not occur during the migratory bird nesting season (April 1 to July 15), or measures would be implemented to discourage birds from nesting in existing structures.
7	Excess beach-quality sand from maintenance relocated to Gulf beaches	The underlying soil classification of the EIS Study Area is that of the Victoria Association. These soils are composed of calcareous heavy clays. Beach-quality sand would not be encountered.	The underlying soil classification of the EIS Study Area is that of the Victoria Association. These soils are composed of calcareous heavy clays. Beach-quality sand would not be encountered.	N/A

No.	TCMP Policy for Transportation Projects	Potential Environmental Consequences and the Intensity During Construction	Potential Environmental Consequences and the Intensity During Operation and Maintenance	Potential Mitigation Strategies

BMP = best management practice

N/A = not applicable

TCEQ = Texas Commission on Environmental Quality

Source: 31 TAC Part 16 Chapter 501 Subchapter B RULE §501.31, Policies for Transportation Projects.

3.9.4.3 Summary of Potential Effects

Only one alternative, Alternative S4 Higher-Speed Rail, may encroach upon coastal areas protected by the TCMP. Compared with the No Build Alternative, Alternative S4 Higher-Speed Rail would result in negligible effects under construction and normal operation. Moderate effects are only possible if a derailment were to occur and result in a spill. However, the potential for such an incident is rare and, therefore, effects would be negligible. Table 3.9-2 identifies the presence of CMZ and potential intensity of effects for each alternative.

Table 3.9-2: Potential Intensity of Effects on Coastal Management Zone Areas

Section	Alternative[a]	Presence of CMZ	Potential Intensity of Effects (negligible, moderate, or substantial)
No Build Alternative[b]		N/A	No effect
Northern	N4A CONV	None	N/A
Central	C4A HrSR	None	N/A
	C4A HSR	None	N/A
	C4B HrSR	None	N/A
	C4B HSR	None	N/A
	C4C HrSR	None	N/A
	C4C HSR	None	N/A
Southern	S4 HrSR	Presence	Negligible
	S6 HrSR	None	N/A
	S6 HSR	None	N/A

[a] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

[b] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

3.9.5 Avoidance, Minimization, and Mitigation Strategies

Avoidance and minimization of effects at the project level would be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies would be implemented at the project level. Pollution prevention procedures would be incorporated into construction and maintenance planning. BMPs would be incorporated into the construction and maintenance of Alternative S4 Higher-Speed Rail in accordance with TxDOT policies of the TCMP (31 TAC §501.31) and TCEQ requirements to mitigate potential effects to stormwater and the train corridor. BMPs for stormwater management to address pollution and erosion prevention are published the TxDOT publication *Storm Water Management Guidelines for Construction Activities* (TxDOT 2002), which details the department's procedures and recommended BMPs to be included in a Stormwater Pollution Prevention Plan for proposed projects, which is augmented on the Texas Coastal BMPs website, specifically under the County Roads and Bridges subdirectory (http://txcoastalbmp.org/). These guidelines provide BMPs such as stormwater detention and retention systems, sediment and filtration systems to remove debris, suspended solids, and insoluble pollutants, and vegetation buffers to reduce transportation of pollutants.

Design development would remain within the existing railroad right-of-way to the extent possible and avoid filling within the CMZ beyond current fills. A potential exception could be any filling associated with the modification or replacement of the bridge crossing Oso Creek, which will be determined at the project level. Additional required rights-of-way would be adjacent to existing transportation facilities and rights-of-way. Access to the project or local traffic circulation would use the existing roadway network. Design would avoid impounding or draining coastal wetlands to the extent possible.

During operations, standard train safety would minimize the risk of coastal resources affected by spills associated with train derailment.

3.9.6 Subsequent Analysis

The presence or absence of Coastal Natural Resource Areas will be confirmed during future project-level analyses. Section 404 permitting needs within the CMZ would be coordinated with USACE and GLO. A Section 404 permit or pre-construction notification would be coordinated with USACE, and a *Consistency with the Texas Coastal Management Program* form would be coordinated with GLO's Coastal Permit Service Center in Corpus Christi.

3.10 Use of Energy Resources

This section describes the energy sources and needs within the environmental impact statement (EIS) Study Area and provides a preliminary assessment of potential effects on these resources. Avoidance, minimization, and mitigation strategies and further analyses needed in the project-level analysis are identified at the end of this section. The introduction to Chapter 3 describes the EIS Study Area and the use of terms, such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.10.1 Laws, Regulations, and Orders

Applicable legislation, regulations, and orders pertaining to energy within the EIS Study Area are described below. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.10.1.1 Federal

- **Energy Policy Act (42 U.S.C. 149.15801 et seq).** The Energy Policy Act provides tax incentives and loan guarantees for energy production of various types.
- **Energy Independence and Security Act (42 U.S.C. 152).** The stated purpose is to move the United States toward greater energy independence and security by increasing the production of clean renewable fuels, to increase efficiency of energy use, to protect consumers, and to improve the energy performance of the federal government.
- **Executive Order 12185, Conservation of Petroleum and Natural Gas (44 Code of Federal Regulations § 75093).** Executive Order 12185 encourages additional conservation of petroleum and natural gas by recipients seeking federal funding.

3.10.1.2 State

- Texas Administrative Code Chapter 25, Electric Substantive Rules, § 25.181, was created to help the Public Utility Commission of Texas (PUC) meet its goals for energy consumption, regulation, and efficiency. PUC goals with respect to electrical services include establishing the rights and responsibilities of the electric utilities, including transmission and distribution utilities, non-utility wholesale and retail market participants, and electric customers.

3.10.2 Methodology

For this service-level analysis, the design of the alternatives is conceptual; therefore, the amount of energy needed to construct and operate the alternatives is not quantifiable. To evaluate the potential effects of the demand for the new rail system, a travel demand model was developed to forecast existing and future conditions (year 2035) by mode (auto, passenger rail, intercity bus, and air travel) within the EIS Study Area for each alternative. The model outputs were used to compare the No Build Alternative against the rail alternatives. The methodology used to estimate the existing and predicted energy consumptions for the 500-foot-wide EIS Study Area for each alternative is as follows:

- Developed an order-of-magnitude estimate of the existing and forecasted use and demand for energy resources in the study area, including the existing energy use for transportation. For this study, energy consumption by mode was calculated by converting the passenger miles traveled.
- Developed an order-of-magnitude estimate of energy use during construction and operations (irreversible and irretrievable commitment of energy resources during construction) by alternative.
- Identified the variation/shift in the type of energy that would be consumed by each alternative and measures to reduce energy consumption during construction.

Energy was measured in British Thermal Units (Btu) to compare the overall energy effects expected to result from the construction and operation of the Program with the No Build Alternative. A Btu is defined as the amount of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit.

Effects as a result of the alternatives are characterized as negligible, moderate, or substantial compared to the No Build Alternative. Because effects on energy resources differ depending on energy type (e.g., fossil fuels or renewable sources), effects can be either adverse or beneficial. The conclusions were determined based on a comparison of the magnitude of potential effects. For energy, these terms are defined as follows:

- Negligible intensity adverse effects are those that would have a slightly increased use of energy resources (increased annual energy consumption) but are close to existing conditions.
- Moderate intensity adverse effects are those that would have a noticeable increased use of energy resources (increased annual energy consumption) but would not have wide-ranging effects over time.
- Substantial intensity adverse effects are those that would have a relatively large increased use of energy resources (increased annual energy consumption).
- Negligible intensity beneficial effects are those that would have a slight decrease in use of energy resources (decreased annual energy consumption) and/or a slight increase in use of energy from renewable sources, compared to non-renewable sources, but are close to existing conditions.
- Moderately beneficial effects are those that would have a noticeable decreased use of energy resources (decreased annual energy consumption) and/or a noticeable increase in use of energy from renewable sources, compared to non-renewable sources, but would not have wide-ranging effects over time.
- Substantially beneficial effects are those that would have a relatively large decreased use of energy resources (decreased annual energy consumption) or a relatively large increase in use of energy from renewable compared to non-renewable sources.

This section uses a slightly different format than the other sections in Chapter 3 to present the Environmental Consequences (Section 3.10.4). The format used provides a clearer description of the findings.

3.10.3 Affected Environment

3.10.3.1 Overview

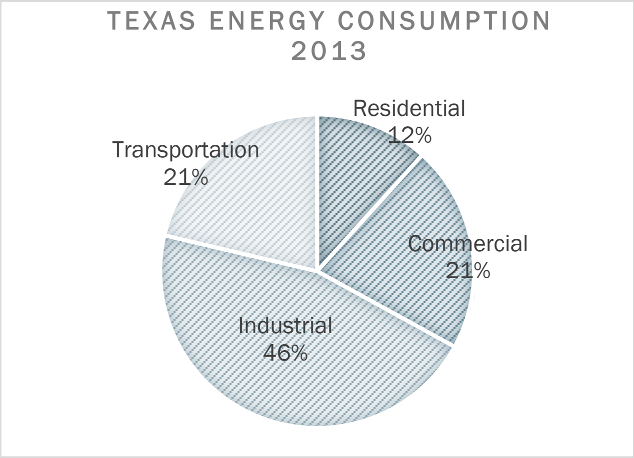
For transportation projects, energy usage is predominantly influenced by the amount of fuel used. The average Btu content of fuel is the heat value (or energy content) per volume of fuel as determined from tests of fuel samples. A gallon of gasoline produces approximately 120,476 Btu (U.S. Energy Information Administration [EIA] 2015). Energy can be measured in two ways: direct energy, which would be the energy used to maintain and operate the Program, and indirect energy, which would be used during construction activities.

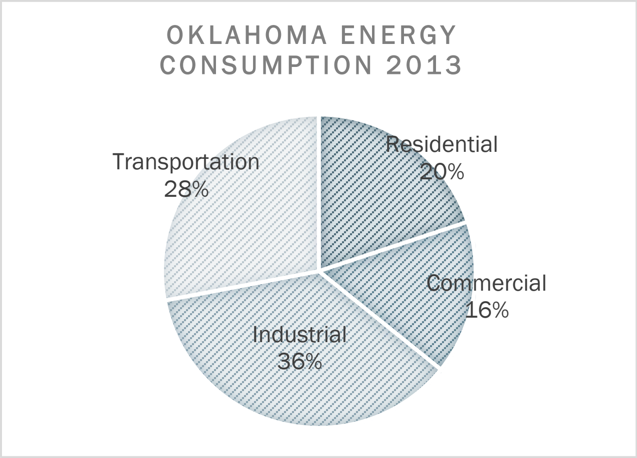
Primary energy sources take many forms, including nuclear energy, fossil energy (coal, oil, and natural gas), and renewable resources, such as wind, solar, and hydropower. These primary sources are turned into secondary sources, such as electricity. The major primary energy sources consumed in the United States are petroleum (oil), natural gas, coal, nuclear energy, and renewable energy. The *Transportation Energy Data Book* (Oak Ridge National Laboratory 2015) reported that the United States used 21 percent of worldwide oil consumption in 2013. Petroleum products (gasoline, diesel, and jet fuel) make up 92 percent of the U.S. usage of crude oil. Within the U.S. oil consumption, 27 percent was used for transportation in 2014. Over half of that energy usage was devoted to highway travel with cars and light trucks (EIA 2015).

In 2013, Texas was sixth in the nation for total energy consumed per capita with 448 million Btu (MBtu). Oklahoma was ranked 10th with 421 MBtu total energy consumed (EIA 2015). The U.S. Department of Transportation (USDOT)'s Bureau of Transportation Statistics ranked all 50 states for transportation energy consumption per capita in 2012. Texas was ranked ninth with 110.16 MBtu, and Oklahoma was ranked seventh with 120.14 MBtu.

In 2013, transportation and construction were the second highest uses of energy in Texas, expending 21 percent of total energy consumption each. Oklahoma used 28 percent of its total energy use toward transportation. Figure 3.10-1 shows energy usage per mode for Texas and Oklahoma during 2013.

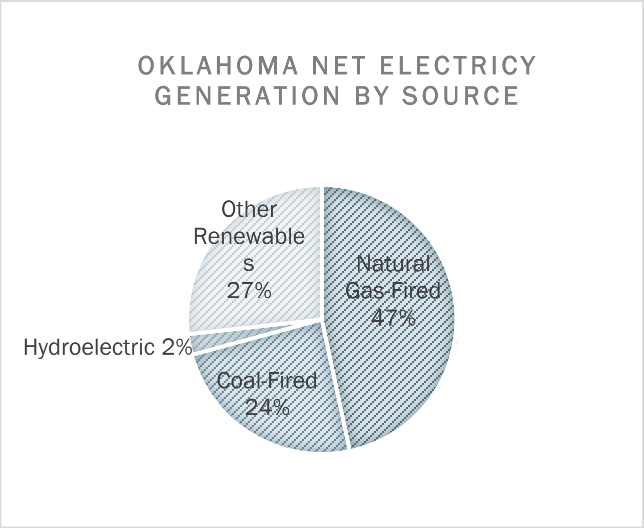
As shown on Figure 3.10-2, Oklahoma generates 29 percent of its electricity from renewable resources (including hydroelectric), and Texas generates 16 percent. In recent years, there has been a push to move toward cleaner, more efficient transportation and renewable energy sources that can generate electricity with minimal pollution emissions. Transportation that runs on electricity is overall cleaner and has fewer impacts on the environment than petroleum or coal-based fossil fuels.

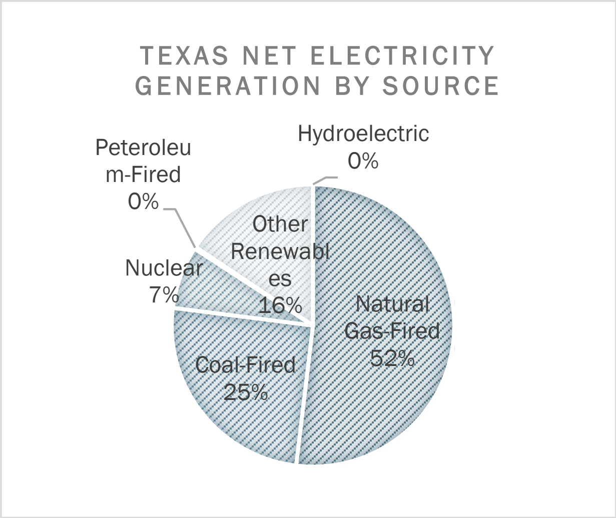




Source: EIA (2015).

Figure 3.10-1: Texas and Oklahoma Energy Usage by Mode





Source: EIA (2015).

Figure 3.10-2: Oklahoma and Texas Electricity Generation by Source

3.10.3.2 Northern Section: Oklahoma City to Dallas and Fort Worth

Table 3.10-1 shows the annual passenger miles of travel for Alternative N4A Conventional. As shown, most passengers travel by auto. The least amount of passengers uses passenger rail available in the area compared with other travel modes.

Table 3.10-1: Existing Annual Passenger Miles of Travel for the Northern Section Alternative (2013)

Alternative	Auto	Bus	Air	Passenger Rail	Total
N4A Conventional	3,097,358,810	19,325,625	17,899,083	13,724,941	3,148,308,459

Table 3.10-2 shows the annual energy consumption for Alternative N4A Conventional. As shown, the existing transportation energy use is heavily composed of auto travel, using most of the total energy used along the corridor.

Table 3.10-2: Existing Annual Energy Consumption (MBtu) for the Northern Section Alternative (2013)

Alternative	Auto	Bus	Air	Passenger Rail	Total
N4A Conventional	14,522,653	64,603	54,732	22,351	14,664,339

3.10.3.3 Central Section: Dallas and Fort Worth to San Antonio

Tables 3.10-3 and 3.10-4 show the annual passenger miles of travel and energy use for the Central Section alternatives, respectively. Existing passenger miles traveled and energy consumption for the Central Section are similar to those for the Northern Section, as shown in the tables. In the Central Section, most passengers travel by auto, and existing transportation energy use is heavily composed of auto travel.

Table 3.10-3: Existing Annual Passenger Miles of Travel for the Central Section Alternatives (2013)

Alternative	Auto	Bus	Air	Passenger Rail	Total
C4A Higher-Speed Rail	3,330,631,173	230,771,057	264,509,706	11,281,605	3,837,193,541
C4A High-Speed Rail	3,169,453,125	228,446,109	267,532,192	11,281,605	3,676,713,031
C4B High-Speed Rail	3,205,786,898	234,088,219	272,510,307	11,281,605	3,723,667,029
C4C High-Speed Rail	3,220,333,947	236,359,690	270,828,004	11,281,605	3,738,803,246

Note: Because of the type of service and comparable rates of ridership, Alternatives C4B Higher-Speed Rail and C4C Higher-Speed Rail are evaluated based on a proportional relationship between the trends that are seen between Alternatives C4A Higher-Speed Rail and C4A High-Speed Rail; therefore, Alternatives C4B Higher-Speed Rail and C4C Higher-Speed Rail are not shown in the table. The numerical values shown for Alternative C4A Higher-Speed Rail are comparable values for application to Alternatives C4B Higher-Speed Rail and C4C Higher-Speed Rail.

Table 3.10-4: Existing Annual Energy Consumption (MBtu) for the Central Section Alternatives (2013)

Alternative	Auto	Bus	Air	Passenger Rail	Total
C4A Higher-Speed Rail	15,616,402	771,441	808,815	18,372	17,215,029
C4A High-Speed Rail	14,860,683	763,669	818,057	18,372	16,460,780
C4B High-Speed Rail	15,031,042	782,530	833,279	18,372	16,665,222
C4C High-Speed Rail	15,099,249	790,123	828,135	18,372	16,735,878

Note: Because of the type of service and comparable rates of ridership, Alternatives C4B Higher-Speed Rail and C4C Higher-Speed Rail are evaluated based on a proportional relationship between the trends that are seen between Alternatives C4A Higher-Speed Rail and C4A High-Speed Rail; therefore, Alternatives C4B Higher-Speed Rail and C4C Higher-Speed Rail are not shown in the table. The numerical values shown for Alternative C4A Higher-Speed Rail are comparable values for application to Alternatives C4B Higher-Speed Rail and C4C Higher-Speed Rail.

3.10.3.4 Southern Section: San Antonio to South Texas

Table 3.10-5 provides the annual passenger miles of travel for the Southern Section alternatives. Alternative S6 (both service types) would take a different path than Alternative S4, traveling directly from San Antonio to a station located outside Laredo and potentially into Mexico. Alternative S6 (both service types) has significantly less ridership for all modes than Alternative S4 as air and passenger rail travel is not currently available in these areas.

Table 3.10-5: Existing Annual Passenger Miles of Travel for the Southern Section Alternatives (2013)

Alternative	Auto	Bus	Air	Passenger Rail	Total
S4 Higher-Speed Rail	6,941,960,529	169,106,063	22,113,352	0	7,133,179,944
S6 Higher-Speed Rail	1,387,800,691	127,167,538	0	0	1,514,968,229
S6 High-Speed Rail	1,387,800,691	127,167,538	0	0	1,514,968,229

The Southern Section does not currently have passenger rail available as a travel option. This significantly increases the numbers for existing auto, bus, and air travel. Of the three Southern Section alternatives, Alternative S4 currently consumes the most energy resources annually with 33 MBtu, as shown in Table 3.10-6. Alternative S6 (both service types) currently consumes the least amount of energy resources due to low passenger numbers.

Table 3.10-6: Existing Annual Energy Consumption (MBtu) for the Southern Section Alternatives (2013)

Alternative	Auto	Bus	Air	Passenger Rail	Total
S4 Higher-Speed Rail	32,548,919	565,302	67,618	0	33,181,839
S6 Higher-Speed Rail	6,507,011	425,106	0	0	6,932,117
S6 High-Speed Rail	6,507,011	425,106	0	0	6,932,117

3.10.4 Environmental Consequences

This section describes the environmental consequences and effects on energy resources for each alternative.

3.10.4.1 Overview

Irreversible and irretrievable commitments of energy resources would include non-renewable uses of energy, such as petroleum, natural gas, and coal. These effects would be seen during the construction of the build alternatives, the operation of the Program, and maintenance of the rails. The higher the commitments, the more substantial the effects on energy resources become. These effects would depend on the length, the alternative selected, and the size and scale of construction required. Energy would be consumed during the production of construction materials, operations and maintenance of construction machines and equipment, and transportation of material and labor to the site. The amount of energy used during construction is roughly proportional to the cost of the project. Because costs are not yet available for the Program, it is assumed that the longer the length and greater infrastructure needs of each alternative, the higher the cost of that alternative. Conventional rail is generally less expensive to construct on a per-mile basis due to use of existing structures. High-speed rail would have the most construction energy consumption as a result of the amount and type of construction required.

The build alternatives for the Program vary among three types of rail as described. The energy use for each rail type varies between diesel-powered and electric.

The energy source for conventional rail is typically diesel-powered, steel-wheeled trains operating on steel tracks. Conventional rail would be operated at speeds up to 79 to 90 miles per hour (mph), and existing railroad track may be used, which means it would use more fuel than the current trains operating at approximately 55 mph. For construction impacts, conventional rail would consume a relatively small amount of energy resources during construction because it will continue to use existing rail.

Higher-speed rail would use diesel-powered/petroleum-based resources. The higher-speed rail is similar to conventional rail, as it can run on the same alignments as conventional rail. However, the higher speeds, 110 to 125 mph, would require additional improvements to existing tracks. Construction impacts for higher-speed rail would be slightly higher in energy consumption than the conventional-based track because the existing tracks would have to modified to handle higher speeds and some new rail would need to be constructed.

High-speed rail includes electric trains powered by an overhead power supply system. High-speed rail would be operated at speeds up to 220 to 250 mph. The entire right-of-way would be fenced and fully grade-separated. High-speed rail would run entirely on the electrical grid and would have the potential to use renewable generated electricity. The high-speed rail would have the most energy impacts during construction because the rail would be built without relying on existing constructed areas.

Current statistics (2013) show that along the Program corridor, passenger numbers vary from 52 million to 89 million passengers per year using auto, air, bus, and passenger rail travel. The No Build Alternative and the build alternatives vary because the proposed rail would bring an alternative mode of transportation and would increase overall ridership in total. Table 3.10-7 presents the passengers per year by alternative.

Table 3.10-7: Passengers per Year for the Program – All Alternatives[a,b]

Alternatives[c]	Existing (2013)	No Build Alternative	Build Alternatives (2035)
N4A CONV	22,920,866	38,502,166	38,726,250
C4A HrSR	21,669,993	40,043,865	41,387,072
C4A HSR	20,218,971	37,556,672	41,387,072
C4B HSR	20,379,576	37,588,342	43,138,673
C4C HSR	20,310,579	37,455,567	40,039,488
S4 HrSR	44,270,832	140,864,835	140,931,725
S6 HrSR	9,562,652	15,403,486	15,485,793
S6 HSR	9,562,652	15,403,486	15,438,318

Notes:

[a] Includes all modes of travel: auto, bus, air and rail.

[b] Because of the type of service and comparable rates of ridership, Alternatives C4B HrSR and C4C HrSR are evaluated based on a proportional relationship between the trends that are seen between Alternatives C4A HrSR and C4A HSR; therefore, Alternatives C4B HrSR and C4C HrSR are not shown in the table. The numerical values shown for Alternative C4A HrSR are comparable values for application to Alternatives C4B HrSR and C4C HrSR.

[c] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

Passenger rail uses the least amount of energy per passenger miles at approximately 1,608 Btu per mile. Auto, which consumes petroleum resources, uses the most at approximately 3,843 Btu per mile (USDOT Bureau of Transportation Statistics 2015). Bus and air travel are second and third with 3,304 and 2,366 Btu, respectively.

3.10.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program. Under the No Build Alternative, there would be potential negative effects on future energy use as the result of increased population without provisions for an efficient, potentially cleaner mode of travel.

3.10.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.10.4.3.1 Alternative N4A Conventional

In 2013, a total of 3 billion passenger miles were traveled to and from Oklahoma City and the Dallas and Fort Worth area. With predicted population growth and rates of travel, the Northern Section would increase to 4 billion passenger miles in 2035. Although the total number of projected passenger miles in 2035 would not change noticeably between the No Build Alternative and Alternative N4A Conventional, a substantial change in travel mode usage is projected. This is most noticeable in the number of rail passengers in the build alternative, as shown in Table 3.10-8; passenger rail usage would increase by 195 percent under Alternative N4A Conventional. Table 3.10-9 shows the predicted annual energy for Alternative N4A Conventional.

Table 3.10-8: Projected Annual Passenger Miles of Travel for the Northern Section Alternative (2035)

Alternative	Auto	Bus	Air	Passenger Rail	Total
No Build	4,870,077,397	23,080,357	28,422,931	20,295,439	4,941,876,124
N4A CONV	4,841,296,005	11,871,400	16,302,506	78,757,294	4,948,227,205

Table 3.10-9: Projected Annual Energy Consumption (MBtu) for the Northern Section Alternative (2035)

Alternative	Auto	Bus	Air	Passenger Rail	Total
No Build	22,834,437	77,155	86,911	33,051	23,031,554
N4A CONV	22,699,489	39,685	49,850	128,256	22,917,279

Under Alternative N4A, reduced reliance on auto, bus, and air travel would decrease total energy usage by approximately 114,000 MBtu. The overall energy use would decline due to added rail ridership in 2035. The No Build Alternative shows an increase in overall energy mainly due to gained usage in auto, bus, and air travel, with little increase in rail ridership. Therefore, operation of Alternative N4A Conventional would have a negligible beneficial effect on energy consumption.

Alternative N4A, at 280 miles in length, would use most of the same rail line that has been upgraded as part of an ongoing passenger rail improvement program and would use minimal amounts of energy consumption during construction. The overall demand for energy would be slightly increased during construction; however, effects would be negligible with implementation of measures presented in Section 3.10.5, Avoidance, Minimization, and Mitigation Strategies.

3.10.4.4 Central Section: Dallas and Fort Worth to San Antonio

In 2013, annual passenger miles traveled from Dallas and Fort Worth to San Antonio totaled around 3 billion miles. In 2035, those numbers are projected to increase to 7 billion.

3.10.4.4.1 Alternative C4A Higher- and High-Speed Rail

Alternative C4A Higher-Speed Rail would use diesel fuel during operation, and Alternative C4A High-Speed Rail would use electricity. Table 3.10-10 shows the projected passenger miles for Alternative C4A (both service types).

Table 3.10-10: Projected Annual Passenger Miles of Travel for the Central Section Alternatives[a,b] (2035)

Alternative[c]	Auto	Bus	Air	Passenger Rail	Total
No Build (C4A HrSR)	6,644,406,781	305,350,066	436,578,667	16,682,413	7,403,017,927
C4A HrSR	6,432,373,308	269,688,588	284,455,103	575,301,232	7,561,818,231
No Build (C4A HSR)	6,478,858,003	301,713,412	439,404,869	16,682,413	7,236,658,697
C4A HSR	5,913,368,568	244,505,366	148,627,628	1,195,013,227	7,501,514,789
No Build (C4B HSR)	6,503,779,134	309,854,425	444,716,161	16,682,413	7,275,032,133
C4B HSR	5,896,021,430	246,272,939	140,765,619	1,076,906,224	7,359,966,212
No Build (C4C HSR)	6,515,447,029	312,723,344	443,001,606	16,682,413	7,287,854,392
C4C HSR	6,039,629,396	260,399,225	117,392,438	124,868,579	7,602,289,638

Notes:

[a] Includes all modes of travel: auto, bus, air and rail.

[b] Because of the type of service and comparable rates of ridership, Alternatives C4B HrSR and C4C HrSR are evaluated based on a proportional relationship between the trends that are seen between Alternatives C4A HrSR and C4A HSR; therefore, Alternatives C4B HrSR and C4C HrSR are not shown in the table. The numerical values shown for Alternative C4A HrSR are comparable values for application to Alternatives C4B HrSR and C4C HrSR.

[c] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

According to the modeling results shown in Table 3.10-11, Alternative C4A High-Speed Rail would use the least amount of energy to operate and transport passengers in 2035. Alternative C4A Higher-Speed Rail and the No Build Alternative would use more energy which can be attributed to increased petroleum usage. While construction cost and energy use would be relatively high for Alternative C4A High-Speed Rail, operation would reduce energy consumption as passengers would be more likely to choose rail travel than other forms of transportation. Additionally, operation energy consumption would be reduced as compared to Alternative C4A Higher-Speed Rail as more passengers would likely choose bus and air travel with the higher-speed alternative as compared to the high-speed alternative.

As summarized in Table 3.10-11, construction of Alternative C4A High-Speed Rail would have substantial adverse effects on energy consumption after mitigation measures are implemented; however, the operation of Alternative C4A High-Speed Rail would have substantial beneficial effects over time as consumption of non-renewable energy sources would be less. Construction of Alternative C4A Higher-Speed Rail would have moderately adverse construction-related effects after implementation of the measures included in Section 3.10.5, Avoidance, Minimization, and Mitigation Strategies, and would have moderate beneficial operations effects.

Table 3.10-11: Projected Annual Energy Consumption (MBtu) for the Central Section Alternatives[a,b] (2035)

Alternative	Auto	Bus	Air	Passenger Rail	Total
No Build (C4A HrSR)	31,153,773	1,020,750	1,334,965	27,167	33,536,655
No Build (C4A HSR)	30,377,561	1,008,593	1,343,607	27,167	32,756,928
C4A HrSR	30,159,607	901,538	869,803	936,875	32,867,823
C4A HSR	27,726,138	817,353	454,472	1,946,073	30,944,036
No Build (C4B HSR)	30,494,409	1,035,807	1,359,848	27,167	32,917,231
C4B HSR	27,644,802	823,262	430,431	1,753,736	30,652,232
No Build (C4C HSR)	30,549,116	27,167	1,354,605	27,167	32,976,286
4C HSR	28,318,140	1,831,843	542,428	1,831,843	31,562,895

Notes:

[a] Includes all modes of travel: auto, bus, air and rail.

[b] Because of the type of service and comparable rates of ridership, Alternatives C4B HrSR and C4C HrSR are evaluated based on a proportional relationship between the trends that are seen between Alternatives C4A HrSR and C4A HSR; therefore, Alternatives C4B HrSR and C4C HrSR are not shown in the table. The numerical values shown for Alternative C4A HrSR are comparable values for application to Alternatives C4B HrSR and C4C HrSR.

[c] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

3.10.4.4.2 Alternative C4B Higher- and High-Speed Rail

The trends in annual passenger miles between Alternative C4A Higher-Speed Rail and Alternative C4A High-Speed Rail are applicable to Alternative C4B. As with Alternative C4A, more people would likely use higher-speed rail than high-speed rail due to a potentially planned station located in downtown Austin for the higher-speed alternative as opposed to outside of Austin for the high-speed alternative. However, this would not change the intensity of effect on energy consumption. As described in Section 3.10.4.1, construction of the high-speed rail alternative would consume more energy than the higher-speed rail alternative as a result of the amount and type of construction required. However, operation of the high-speed rail alternative would consume less energy than the higher-speed rail alternative. The No Build Alternative would result in the most energy consumption. Table 3.10-10 provides the annual passenger miles of travel for Alternative C4B High-Speed Rail. Table 3.10-11 shows the predicted annual energy use by Alternative C4B High-Speed Rail.

Construction of Alternative C4B High-Speed Rail would have substantial adverse effects on energy consumption after mitigation procedures are implemented; however, the operation of Alternative C4B High-Speed Rail would have substantial beneficial effects over time as consumption of non-renewable energy sources would be less. With implementation of measures presented in Section 3.10.5, Avoidance, Minimization, and Mitigation Strategies, construction of Alternative C4B Higher-Speed Rail would have moderately adverse construction-related effects and would have moderate beneficial operations effects.

3.10.4.4.3 Alternative C4C Higher- and High-Speed Rail

As described for Alternative C4B, the trends in annual passenger miles between Alternative C4A Higher-Speed Rail and Alternative C4A High-Speed Rail are applicable to Alternative C4C. As with Alternative C4A, more people would likely use higher-speed rail than high-speed rail due to the potential for a station located in downtown Austin for the higher-speed alternative as opposed to outside of Austin for the high-speed alternative. However, this would not change the intensity of effect on energy consumption. Table 3.10-10 provides the annual passenger miles of travel for Alternative C4C High-Speed Rail Alternative. Table 3.10-11 shows the predicted energy use by Alternative C4C High-Speed Rail.

Construction of Alternative C4C High-Speed Rail would have substantial adverse effects on energy consumption after mitigation procedures are implemented; however, the operation of Alternative C4C High-Speed Rail would have substantial beneficial effects over time as consumption of non-renewable energy sources would be less. Construction of Alternative C4C Higher-Speed Rail would have moderately adverse construction-related effects after mitigation and would have moderate beneficial operations effects.

3.10.4.4.4 Central Section Alternatives: Summary of Potential Effects

Irreversible and irretrievable commitments to resources during construction are attributed to the size and scale of the construction. Of the six build alternatives in the Central Section, the longest alternative is Alternative C4C (both service types) at 428 miles. Alternative C4C High-Speed Rail would cost the most to construct and would use the most irretrievable and irreversible resources during construction, thereby adding substantial intensity effects after mitigation is implemented. Mitigation is discussed in more detail in Section 3.10.5, Avoidance, Minimization, and Mitigation Strategies. However, because they are elevated, the high-speed rail alternatives result in the most energy savings as long-term net benefits, as discussed in Section 3.10.4.1. In effect and according to the results of the demand forecast model, the high-speed rail alternatives would increase the initial demand for electricity and energy with substantial construction effects, but would reduce the overall demand for energy over time. Alternative C4B High-Speed Rail would be the shortest to construct (317 miles) and would entail the lowest energy usage per year compared to the other Central Section alternatives.

Tables 3.10-12 and 3.10-13 present the Central Section alternatives by relative order of effect (greatest to least) during construction and operation, respectively, and show that Alternative C4C High-Speed Rail is the alternative with the greatest effects during construction and the least long-term benefits during operation. Alternative C4B High-Speed Rail brings more long-term net benefits and has the least amount of effects during construction among the high-speed rail alternatives. Compared with the No Build Alternative, the alternative with the least amount of long-term benefits is Alternative C4C Higher-Speed Rail, which has moderate beneficial effects. Alternative C4B High-Speed Rail has substantial effects during construction; however, as shown in the tables, this alternative has the most substantial beneficial effects over time of all the Central Section alternatives.

Table 3.10-12: Potential Short-Term Impacts on Energy Consumption During Construction

Alternative	Intensity of Effects
C4C HSR	Substantial Adverse
C4A HSR	Substantial Adverse
C4B HSR	Substantial Adverse
C4C HrSR	Moderate Adverse
C4A HrSR	Moderate Adverse
C4B HrSR	Moderate Adverse

Table 3.10-13: Potential Net Benefits to Energy During Operation

Alternative	Annual Energy Savings (MBtu)	Intensity of Effects
C4B HSR	2,264,999	Substantial Beneficial
C4A HSR	1,812,892	Substantial Beneficial
C4C HSR	1,413,391	Substantial Beneficial
C4B HrSR	[a]	Moderate Beneficial
C4A HrSR	668,832	Moderate Beneficial
C4C HrSR	[a]	Moderate Beneficial

[a] The trends in annual passenger miles between Alternative C4A HSR and Alternative C4A HrSR are applicable to Alternative C4B HSR and Alternative C4B HrSR. This is also true for Alternatives C4C HSR and C4C HrSR. Alternative C4B HrSR is assumed to have more annual energy consumption savings because of the length of the project.

3.10.4.5 Southern Section: San Antonio to South Texas

In 2013, the annual number of passenger miles traveled varied from 1 billion for Alternative S6 (both service types) to 7 billion for Alternative S4. In 2035, those numbers are expected to increase to 2 billion for Alternative S6 (both service types) and 22 billion for Alternative S4. The increase for Alternative S4 can be explained by the rapid growth in the cities in the Southern Section connected to Alternative S4, but not connected by Alternative S6, which only services San Antonio to Laredo.

3.10.4.5.1 Alternative S4 Higher-Speed Rail

Table 3.10-14 provides the annual passenger miles of travel for Alternative S4 Higher-Speed Rail. The annual energy consumption savings for Alternative S4 Higher-Speed Rail would be minimal compared with the No Build Alternative, as shown in Table 3.10-15. With implementation of measures identified in Section 3.10.5, Alternative S4 Higher-Speed Rail would have moderate adverse construction effects as compared to the No Build Alternative, due to the type of rail and the length of the project. Alternative S4 Higher-Speed Rail would have moderate beneficial effects during operation as the use of rail, as opposed to other modes of transportation, increases.

Table 3.10-14: Projected Annual Passenger Miles of Travel for the Southern Section Alternatives (2035)

Alternative	Auto	Bus	Air	Passenger Rail	Total
No Build (S4)	22,502,787,357	200,921,851	33,245,260	0	22,736,954,468
S4 HrSR	22,458,553,217	154,724,916	12,481,483	120,540,661	22,746,300,277
No Build (S6)	2,277,816,643	161,214,415	0	0	2,439,031,058
S6 HrSR	2,178,053,434	145,115,302	0	139,046,225	2,462,214,961
S6 HSR	2,143,289,475	131,389,002	0	203,842,590	2,478,521,067

Table 3.10-15: Projected Annual Energy Consumption (MBtu) the Southern Section Alternatives (2035)

Alternative	Auto	Bus	Air	Passenger Rail	Total
No Build (S4)	105,509,303	671,658	101,657	0	106,282,618
S4 HrSR	105,301,901	196,300	517,227	38,166	106,053,594
No Build (S6)	10,680,048	538,921	0	0	11,218,969
S6 HrSR	10,212,286	485,104	0	226,436	10,923,826
S6 HSR	10,049,287	439,218	0	331,957	10,820,462

3.10.4.5.2 Alternative S6 Higher- and High-Speed Rail

Table 3.10-14 provides the annual passenger miles of travel for Alternative S6 (both service types), and Table 3.10-15 provides the annual energy consumption for the alternative. Alternative S6 (both service types) would cover less distance than Alternative S4 and would therefore have noticeably fewer passengers and less energy consumption as compared to Alternative S4 in 2035. Projected energy consumption for Alternative S6 (both service types) is less than the No Build Alternative. Alternative S4 would use significantly more energy per year than Alternative S6 (both service types) because of more city linkages by the route. Although the ridership numbers are considerably lower than Alternative S4, Alternative S6 High-Speed Rail, out of the three Southern Section alternatives, would use the least amount of energy in the future to operate.

Construction of Alternative S6 High-Speed Rail would have substantial adverse effects on energy consumption after mitigation procedures are implemented; however, the operation of Alternative S6 High-Speed Rail would have substantial beneficial effects over time as consumption of non-renewable energy sources would be less. Alternative S6 Higher-Speed Rail would have moderately adverse construction-related effects after mitigation and would have moderate beneficial effects related to operations.

Tables 3.10-16 and 3.10-17 present the Southern Section alternatives by relative order of effect (greatest to least) during construction and operation, respectively.

Table 3.10-16: Potential Short-Term Impacts on Energy Consumption During Construction

Alternative	Intensity of Effects
S6 HSR	Substantial Adverse
S4 HrSR	Moderate Adverse
S6 HrSR	Moderate Adverse

Table 3.10-17: Potential Net Benefits to Energy During Operation

Alternative	Annual Energy Savings (MBtu)	Intensity of Effects
S6 HSR	398,507	Substantial Beneficial
S6 HrSR	295,143	Moderate Beneficial
S4 HrSR	229,024	Moderate Beneficial

3.10.4.5.3 Southern Section Alternatives: Summary of Potential Effects

Although Alternative S6 High-Speed Rail is the shortest of the Southern Section alternatives at 143 miles, it would consume the most energy during construction based on the type of construction required. Therefore, it would initially entail the most irretrievable and irreversible commitments and more mitigation planning, but would be a benefit to energy resources in the long term through annually energy consumption savings during operation.

The No Build Alternative would increase demand for non-renewable fuel resources as compared to each of the Southern Section alternatives. With increasing population under the No Build Alternative, travelers would turn to the most convenient and fastest form of travel, which, without an improved rail, would be auto and air (where available), followed by buses and existing rail. Auto and air travel use the most energy per passenger mile and, in turn, increase the demand for non-renewable energy resources.

Operation of the build alternatives would result in a long-term net energy benefit because of change in ridership from high-energy consumption modes of travel to the lower energy mode—passenger rail. Electric high-speed rail provides the greatest benefits due to a transition from non-renewable diesel energy to electricity, a renewable resource. Therefore, Alternative S6 High-Speed Rail would have substantial effects on energy consumption during construction after mitigation is implemented, but would also have the most substantial beneficial effects over time out of the three Southern Section alternatives.

3.10.4.6 Summary of Potential Effects

The high-speed rail alternatives would have the greatest construction effects and would require avoidance, minimization, and mitigation strategies identified in Section 3.10.5; however, the overall use of electric energy over time would help to offset the initial effects. In comparison, the No Build Alternative would have no energy effects during construction, but would eventually lead to effects over time with population growth and more people depending on energy resources for other modes of travel, most noticeably increasing auto travel. Table 3.10-18 summarizes the potential intensity of effects by alternative. These effects are presented as energy effects during construction and predicted effects during operation with implementation of measures described in Section 3.10.5, Avoidance, Minimization, and Mitigation Strategies.

Table 3.10-18: Summary of Energy Effects by Alternative

Section		Potential Intensity of Effects During Construction (Negligible, Moderate, or Substantial)	Potential Effects During Operation (Negligible, Moderate, or Substantial)
No Build Alternative[a]		No Effect	Substantial Adverse
Northern	N4A CONV	Negligible Adverse	Negligible Beneficial
Central	C4A HrSR	Moderate Adverse	Moderate Beneficial
	C4A HSR	Substantial Adverse	Substantial Beneficial
	C4B HrSR	Moderate Adverse	Moderate Beneficial
	C4B HSR	Substantial Adverse	Substantial Beneficial
	C4C HrSR	Moderate Adverse	Moderate Beneficial
	C4C HSR	Substantial Adverse	Substantial Beneficial

Section		Potential Intensity of Effects During Construction (Negligible, Moderate, or Substantial)	Potential Effects During Operation (Negligible, Moderate, or Substantial)
Southern	S4 HrSR	Moderate Adverse	Moderate Beneficial
	S6 HrSR	Moderate Adverse	Moderate Beneficial
	S6 HSR	Substantial Adverse	Substantial Beneficial
[a] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.			

As discussed in Section 3.10.4.2, the No Build Alternative could lead to substantial effects on energy use in the future. Alternative N4A Conventional would have negligible impacts during construction after mitigation is implemented, and negligible beneficial impacts over time due to a slight increase in passenger rail travel from other modes. However, it would still require a non-renewable energy source (diesel). The higher-speed rail alternatives in the Central and Southern sections would have moderate impacts on energy during construction and operation due to diesel usage. The high-speed rail alternatives in the Central and Southern sections would have substantial effects initially during construction, but during operation, the effects on energy usage would be substantially beneficial, with electricity potentially coming from renewable energy sources.

3.10.5 Avoidance, Minimization, and Mitigation Strategies

Avoidance of energy resources will be performed to a practicable extent during construction. Implementation of minimization and mitigation measures will be required during construction of the Program.

Mitigation strategies would reduce construction impacts. Minimization and mitigation strategies will include the following:

- Use energy-saving equipment and facilities to reduce electricity demand.
- Develop and implement a construction energy conservation plan.
- Locate construction material production facilities onsite or within proximity to the project site.
- Use newer and more energy-efficient construction vehicles.
- Implement a program to encourage construction workers to carpool or use public transportation for travel to and from the construction site.

3.10.6 Subsequent Analysis

Once a preferred alternative is selected, field investigations or surveys would be conducted to determine the likelihood of energy impacts within the EIS Study Area. A project-level NEPA study would use more detailed traffic and electrical input data for the energy consumption analysis. Energy consumption will be updated and modeled using the latest available data. When an accurate cost has been developed, a more detailed analysis of the energy use per mile during construction can be obtained. Detailed construction, staging, sequencing, methods, and practices will be necessary to support a quantitative analysis of construction energy consumption. When a preferred alternative is selected, a mitigation plan and a project-specific design will be developed.

3.11 Utilities

This section describes the major utilities likely to occur within the environmental impact statement (EIS) Study Area and describes a preliminary assessment of potential effects on these utilities. This analysis presents a preliminary investigation and is not a detailed inventory of utilities along the Program alignments. Preliminary avoidance, minimization, and mitigation strategies and further analyses needed in the project-level National Environmental Policy Act (NEPA) process are identified at the end of this section. The introduction to Chapter 3 describes the EIS Study Area and use of terms, such as Study Vicinity and transportation corridor, along with the standard organization of each analysis. The existing and predicted energy consumption for the 500-foot-wide EIS Study Area is discussed in Section 3.10, Use of Energy Resources.

3.11.1 Laws, Regulations, and Orders

Applicable federal and state legislation, regulations, and orders pertaining to utilities within the EIS Study Area are described below. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.11.1.1 Federal

- **Power Plant and Industrial Fuel Use Act of 1978 (Public Law 95-620).** Section 403(b) of the Power Plant and Industrial Fuel Use Act encourages conservation of petroleum and natural gas by recipients of federal financial assistance and directs the President to issue an Executive Order. Executive Order 12185 was issued and is described below.
- **Executive Order 12185, Conservation of Petroleum and Natural Gas (December 17, 1979, 44 Federal Register 75093, as amended).** This Executive Order encourages conservation of petroleum and natural gas by recipients of federal financial assistance.

3.11.1.2 State

The Oklahoma Administrative Procedures Act (75 Oklahoma Statute., Sections 250 et seq) requires the Secretary of State's Office of Administrative Rules to publish the Oklahoma Administrative Code and the Oklahoma Register. Title 165 Corporation Commission, in the Oklahoma Administrative Code, provides the authority to the Corporation Commission to regulate public services, those business services that are considered essential to the public welfare. These businesses include electric, oil and gas, pipeline, telephone, and water utilities (State of Oklahoma 2016).

The Texas Administrative Code (TAC) is a compilation of all state agency rules in Texas. The Public Utility Commission (PUC) rules are under TAC, Title 16, Part II, and include rules and agreements for telecommunications service providers, water and sewer service providers, electric service providers, telecommunications service providers, and cable and video service providers (PUC 2016).

3.11.2 Methodology

Utilities include natural gas, water, electricity, sewage, communications, and other systems. For this service-level analysis, two of the most common major utilities were identified to best represent potential utility effects: electrical facilities (electrical transmission lines and substations) and natural gas pipelines. Electrical facilities were defined as electrical transmission lines that meet or exceed a power rating of 69 kilovolts (kV) and electrical substations.

These utilities within the EIS Study Area were identified using available utility mapping (geographical information system [GIS] data) obtained from Platts, a Division of McGraw Hill Financial and an independent provider of information including maps and geospatial data for the natural gas and electrical power industries (Platts 2013, 2016). In addition to utility mapping, aerial photography was reviewed for the presence of utility infrastructure within the EIS Study Area (Google Earth 2016). The methodology used to assess potential effects included examining available aerial photography and overlaying the available utility mapping with the alternative alignments to identify major utilities within the EIS Study Area.

Electrical transmission lines and natural gas pipelines that exist within the EIS Study Area typically either cross the study area perpendicular to the alignment or exist within the EIS Study Area parallel to the alignment (i.e., within an existing transportation corridor or along an existing railway). Because electrical transmission lines and natural gas pipelines are prevalent throughout the EIS Study Area in each geographic area of the Program, it was not practical to assess each potential crossing. Therefore, estimates of the approximate number of crossings of these utilities within the EIS Study Area are based on available GIS data (Platts 2016).

Electrical transmission lines and natural gas pipelines within the EIS Study Area would be unlikely to be substantially affected by an alternative because they could be avoided or minimized by routing either the utility or the alignment over, under, or around the utility. In addition, avoidance measures, such as encasing existing utilities in strong culverts or conduits where new rail alignments would cross, would prevent damage and allow utility companies to access and maintain utilities as necessary without disturbing the rail alignment. However, alternatives that conflict with fixed utilities, such as electrical substations, may result in a substantial effect because relocation would require considerable engineering, design, and permitting if it is determined to be feasible.

Effects as a result of the route alternatives are characterized as negligible, moderate, or substantial compared with the No Build Alternative. For utilities evaluated in this service-level analysis, these terms are defined as follows:

- Negligible intensity effects would occur in areas where the Program would result in a low probability for having to move or relocate existing utilities. This would typically occur in rural locations where few utilities exist and in locations where existing track would be used.
- Moderate intensity effects would occur where utilities are present; however, the utility could be moved outside of the Program alignment or could be encased in strong culverts or conduit to prevent damage as a result of the Program. This would typically include locations throughout the EIS Study Area such as urban areas where utilities are prevalent and the alignment could not be

moved to avoid the utility. Moderate intensity effects would also occur in locations where existing track would be used for the alternative route and new track would not be constructed. In these cases, existing utilities may not require relocation but could require encasement to prevent damage, resulting in a moderate intensity effect. In addition, moderate intensity effects could occur where fixed utilities (such as electrical substations) are present within the EIS Study Area where the alternative route would use existing track, and new track would not be constructed. Moderate intensity effects would also occur in rural areas where the alignment could be moved to avoid the fixed utility.

- Substantial intensity effects would occur where fixed utilities (such as electrical substations) are present within the EIS Study Area in urban areas where new or elevated track would be constructed and the alignment could not likely be moved to avoid the fixed utility. Substantial intensity of effects would also occur in areas where there is a high density of utilities , such as in urban areas, where existing track would not be used, and new track would be constructed (i.e., for the high-speed rail alternatives).

For this service-level analysis, any crossing of an existing major utility within the EIS Study Area would be considered a potential effect during construction. The level of effect was determined by analyzing the density of utility crossings in relation to the probable construction activities that would be required for the implementation of each alternative. For example, in rural areas with few utility crossings and where existing tracks would be used, the magnitude of construction would be minimal, resulting in a negligible effect on utilities for such locations. An area with a higher density of utility crossings, and where existing tracks would be used, would result in a moderate effect because utilities would need to be either relocated or encased during construction. Areas with a higher density of utilities, or where fixed utilities are present and where new or elevated tracks would be constructed, could result in a substantial effect because the magnitude of construction activities would be greater and would require considerable engineering, design, and permitting.

Numerous electrical substations were identified within the EIS Study Area. For electrical substations located where existing tracks would be used, a moderate effect would result because it would be unlikely that the electrical substation would need to be relocated during construction. However, in locations where electrical substations are within the EIS Study Area and new or elevated tracks would be constructed, a substantial effect would result because more significant constraints, such as routing the alternative alignment over, under, or around the utility, or relocating the fixed utility to another location, would be required. It should be noted that potential conflicts could be avoided through coordination with utility representatives during design and construction of the alignments.

3.11.3 Affected Environment

The following sections provide a generalized description of the utilities that occur within the EIS Study Area for each geographic section (i.e., Northern, Central, and Southern sections). In general, the geographic sections of the Program can be characterized as urban and rural areas. These areas typically include aboveground and underground electrical transmission lines, aboveground electrical substations, and underground natural gas pipelines that provide power and natural gas service to residential, business, manufacturing, and agricultural land uses. The greatest densities of utilities occur in urban areas where there are a greater number of residential, business, and manufacturing uses, whereas lower densities of utilities occur in rural areas and areas that are mainly used for agricultural purposes.

Table 3.11-1 summarizes the approximate number of utility crossings for each alternative. Further detail regarding utilities that cross within the EIS Study Area for each alternative is provided in the sections below.

Table 3.11-1 Summary of Potential Utility Crossings for Alternatives

Alternatives[a]	Electrical Transmission Lines[b]	Electrical Substations	Natural Gas Pipelines	Total Crossings
N4A CONV	150	5	206	361
C4A HrSR, HSR	253	7	164	424
C4B HrSR, HSR	157	3	155	315
C4C HrSR, HSR	296	8	440	744
S4 HrSR	79	2	766	847
S6 HrSR, HSR	21	0	63	84

[a] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

[b] Total number of electrical transmission lines that are either existing or proposed and meet or exceed a power rating of 69 kV.

Sources: Platts (2016); Google Earth (2016).

Figures 3.11-1 through 3.11-5 provide an overview of existing electrical transmission lines that meet or exceed a power rating of 69 kV, natural gas pipelines of various sizes, and approximate locations of electrical substations in relation to the EIS Study Area[1].

3.11.3.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Electrical transmission facilities and natural gas pipelines within the Northern Section are mapped on a regional level as shown on Figures 3.11-1 and 3.11-2, which also show the approximate location of electrical substations.

[1] Electrical substations shown on Figures 3.11-1 through 3.11-5 are representative and do not indicate precise substation locations. GIS data mapped electrical substations approximately 30 miles apart, each estimated to be an outdoor electric yard of approximately 200 feet square on each side (Platts 2016). Because the locations are approximate, the presence of electrical substations within the EIS Study Area was determined by review of alternative alignments overlaying aerial photography.

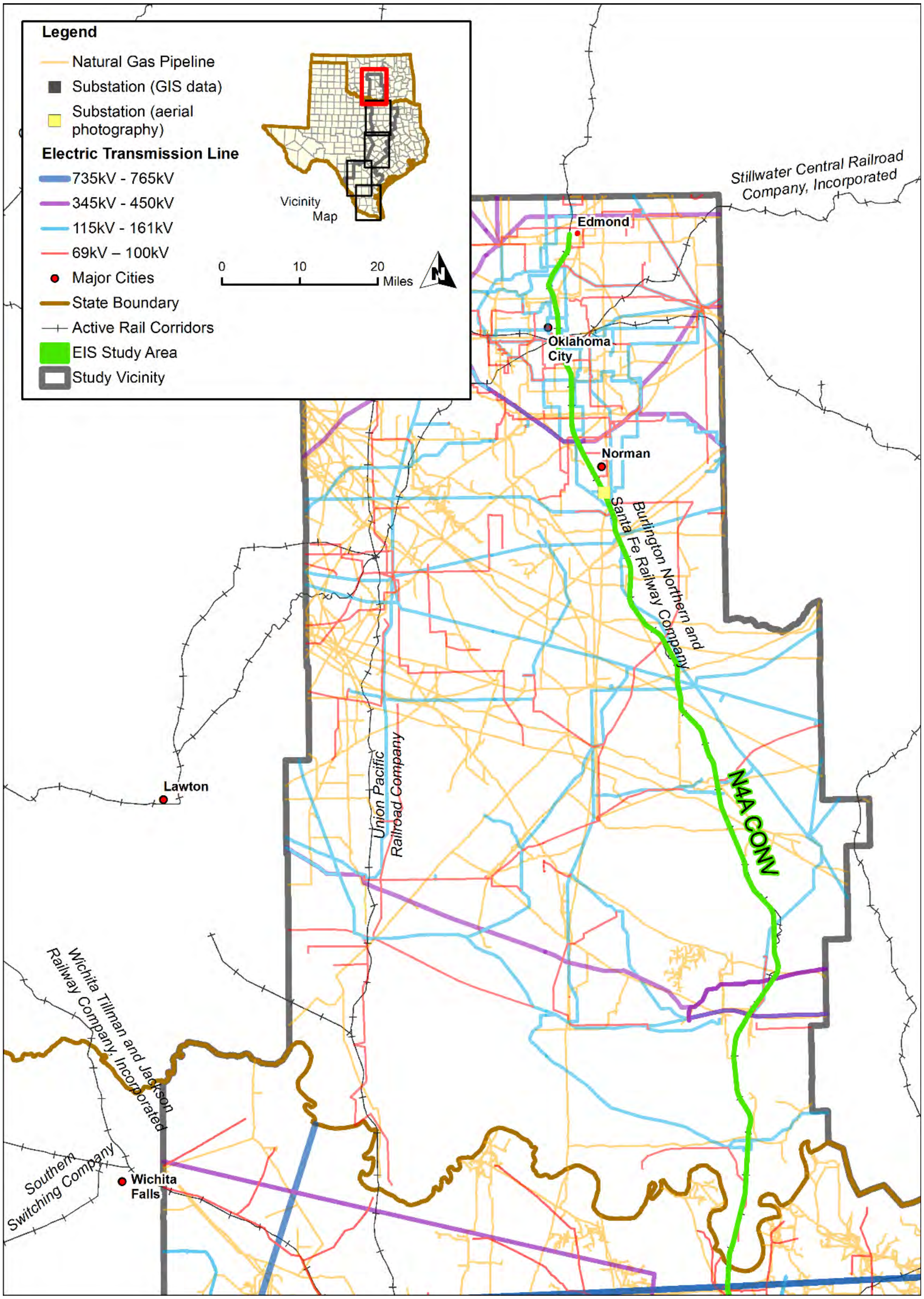


Figure 3.11-1: Utilities within the Vicinity of the Alternatives (Map 1)

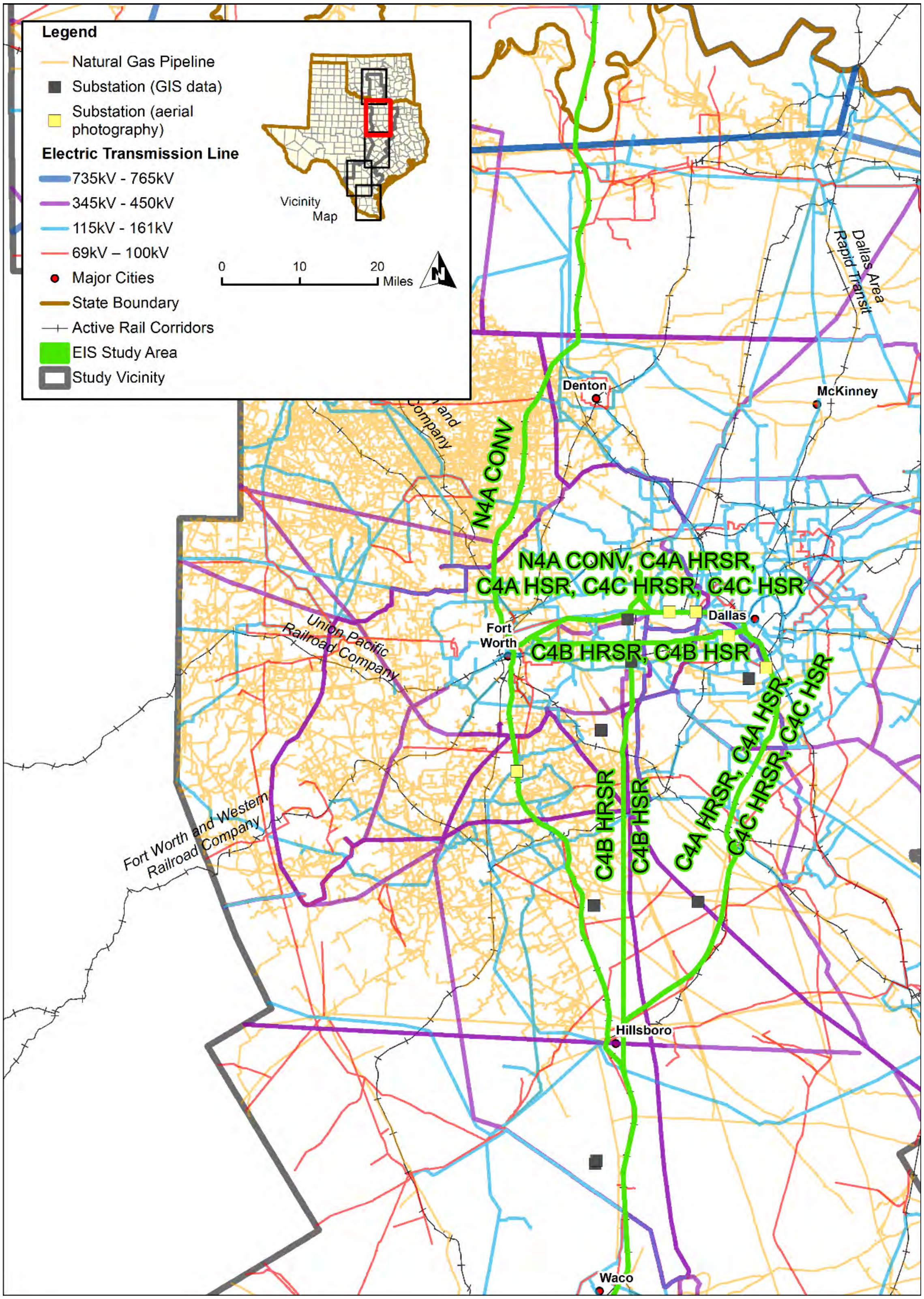


Figure 3.11-2: Utilities within the Vicinity of the Alternatives (Map 2)

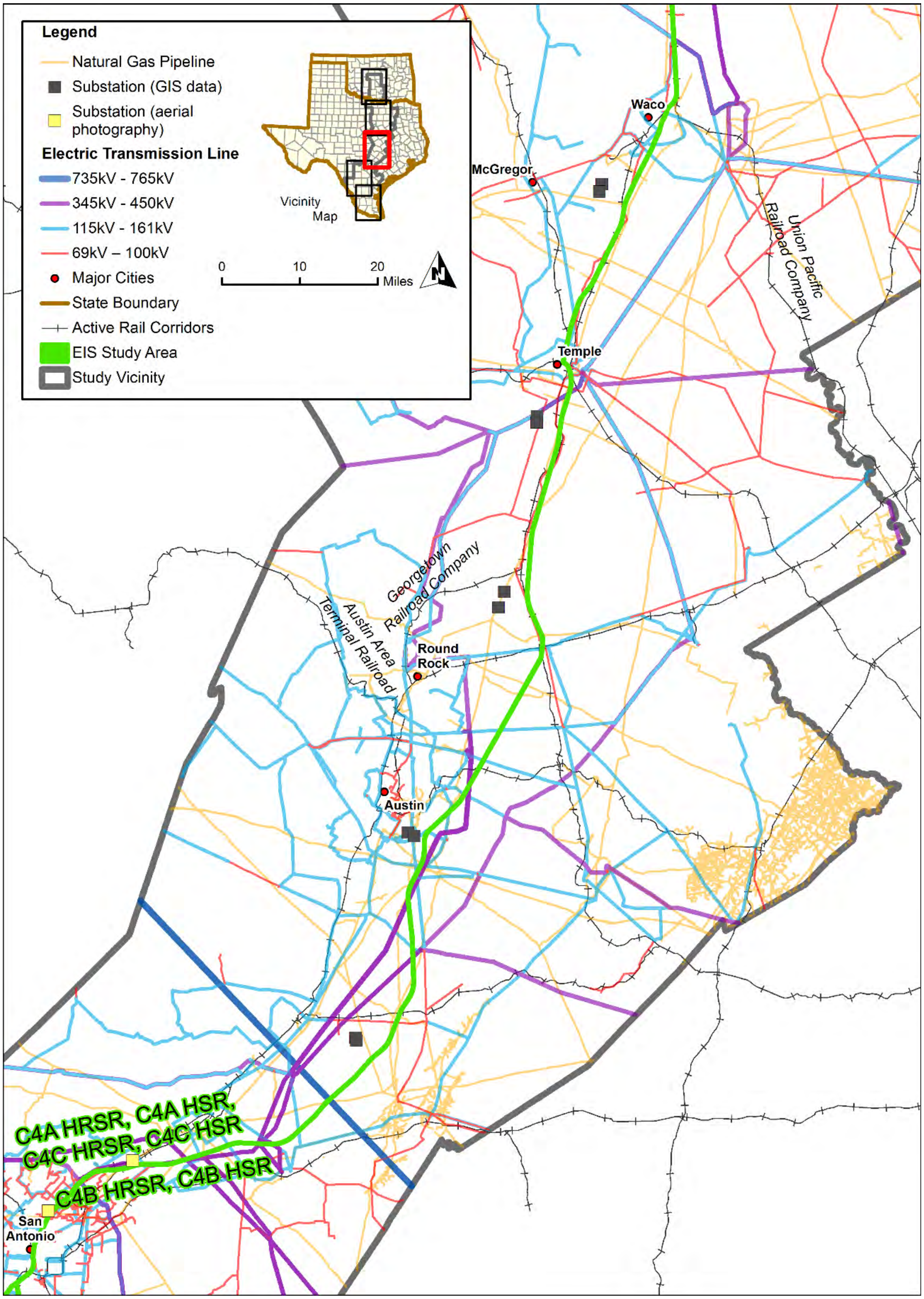


Figure 3.11-3: Utilities within the Vicinity of the Alternatives (Map 3)

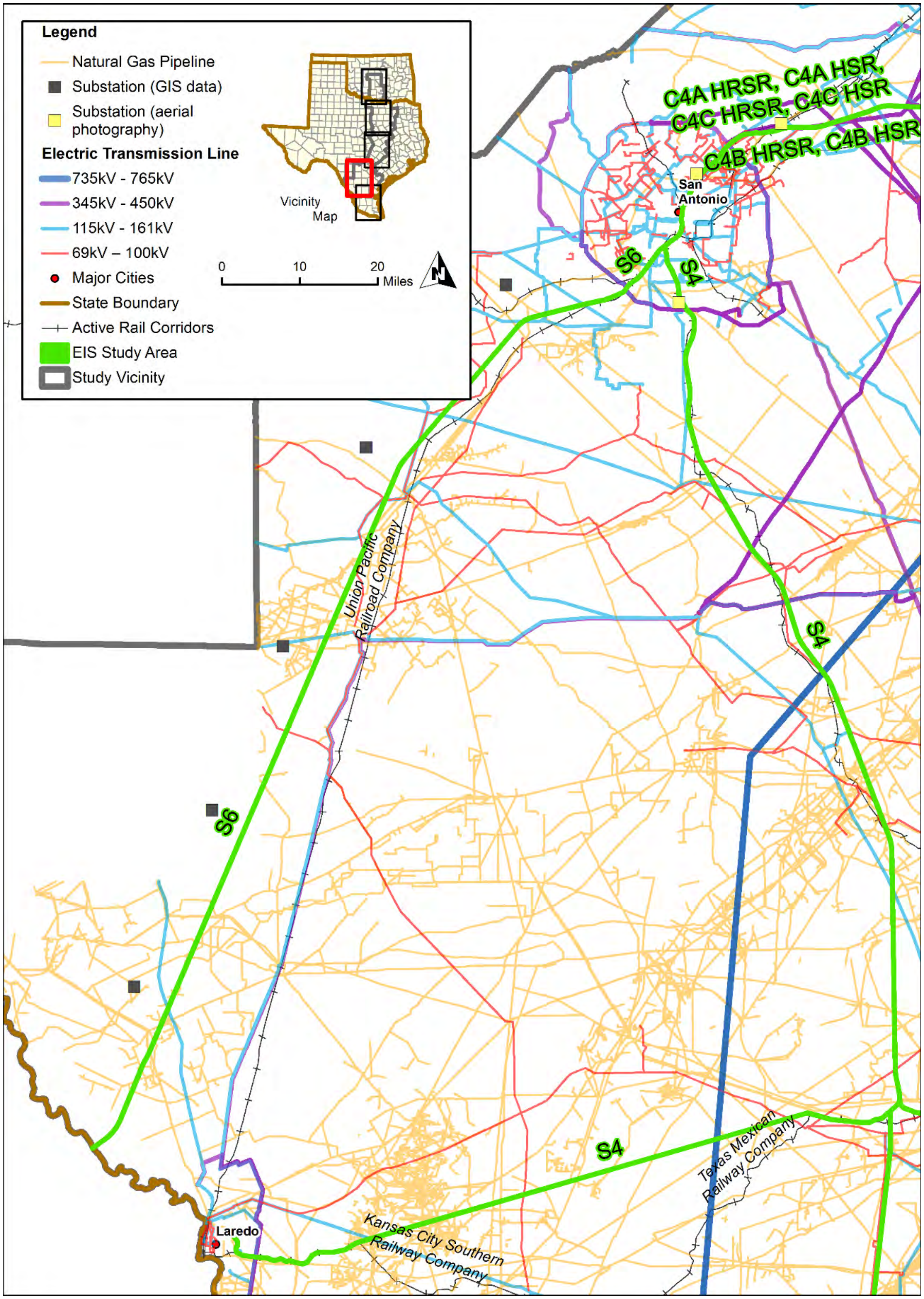


Figure 3.11-4: Utilities within the Vicinity of the Alternatives (Map 4)

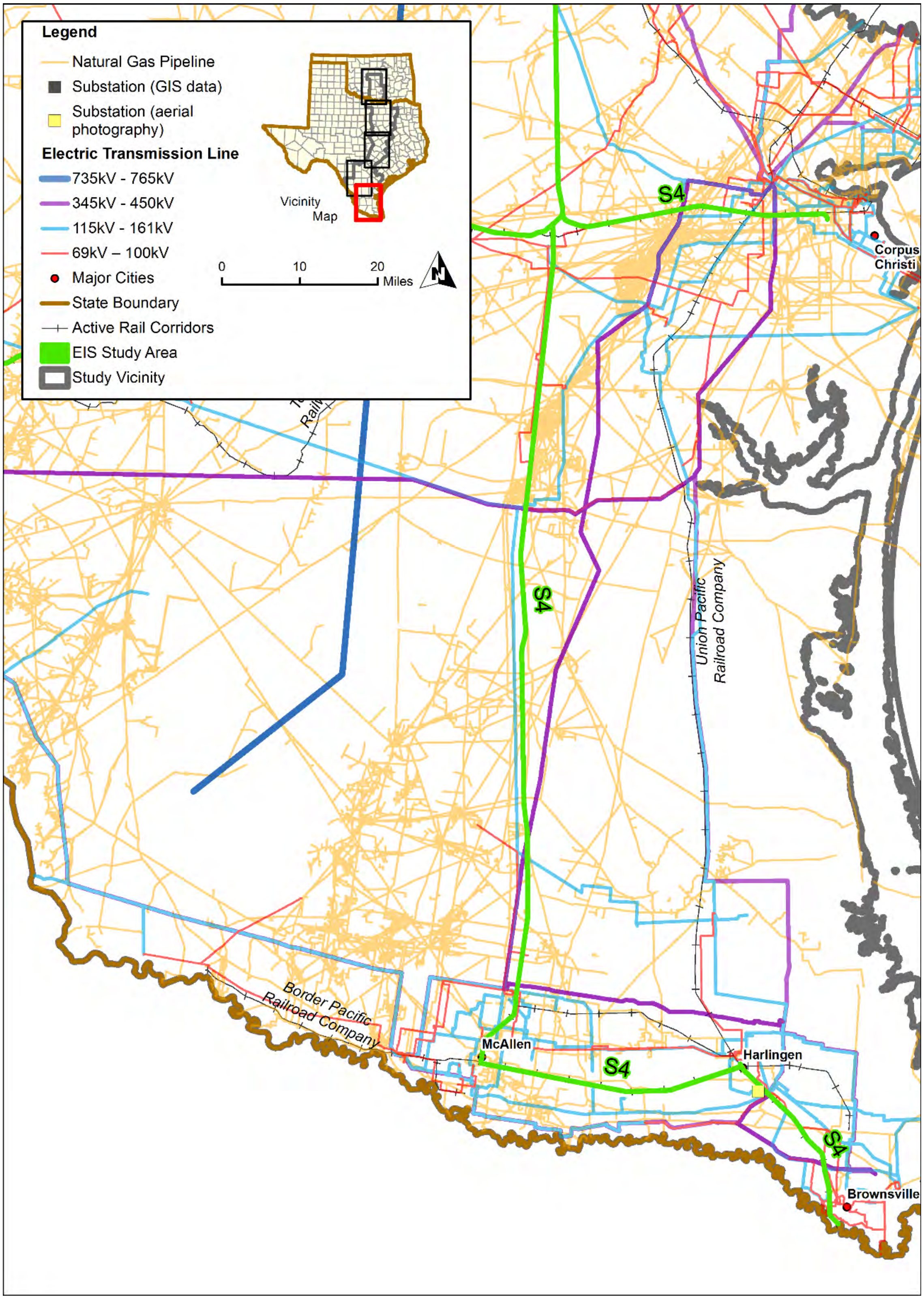


Figure 3.11-5: Utilities within the Vicinity of the Alternatives (Map 5)

In the Oklahoma portion of the Northern Section EIS Study Area, key providers of electricity include Oklahoma Gas and Electric Company, Public Service Company of Oklahoma, Central Illinois Light Company, and Western Farmers Electric Co-Op. In the Texas portion of the Northern Section EIS Study Area, key providers consist of Oncor Electric Delivery Company, AEP Energy Services Inc., TXU Electric Company, and Barry Electric Co-Op (Platts 2013).

In the Oklahoma portion of the Northern Section EIS Study Area, key providers of natural gas include Enogex LLC, Oklahoma Natural Gas Co., Oneok Gas Transportation LLC, Southern Star Central Gas Pipeline, and Natural Gas Pipeline Co. of America. In the Texas portion of the Northern Section EIS Study Area, key providers include Atmos Pipeline, Atmos Energy Corporation, Barnett Gathering LP, Crosstex North Texas Gathering LP, Enbridge Gathering LP, Energy Transfer Company, and Southwestern Gas Pipeline Inc. (Platts 2013).

3.11.3.1.1 Alternative N4A Conventional

Alternative N4A extends through urban areas in Oklahoma City and south from Denton, through Fort Worth and Dallas. Notably, from Denton south, there is a high density of utility crossings (see Figure 3.11-2). In addition to urban areas, Alternative N4A would extend through rural areas in southern Oklahoma and northern Texas where utility crossings are fewer than those in the urban areas (see Figures 3.11-1 and 3.11-2).

Electrical facilities in the vicinity of Alternative N4A include 150 electric transmission lines. Of these, 19 have a power rating of 69 kV, 114 have a power rating of 138 kV, 16 have a power rating of 345 kV, and one proposed line has a power rating of 765 kV. Of the 150 electrical utilities, 144 are existing and six are proposed for future construction. All electrical transmission lines are overhead with the exception of one line that runs underground and one line that runs both overhead and underground (Platts 2013). Review of aerial imagery indicates that there are approximately five electrical substations in the vicinity of Alternative N4A (Google Earth 2016). One electrical substation is located south of Norman, Oklahoma, along the BNSF alignment, and four are located along the Trinity Railway Express (TRE) tracks west of Dallas.

There are approximately 206 natural gas pipelines of various sizes in the vicinity of Alternative N4A (Platts 2013).

3.11.3.2 Central Section: Dallas and Fort Worth to San Antonio

Figures 3.11-2 and 3.11-3 show electrical transmission facilities, natural gas pipelines, and the approximate location of electrical substations in the Central Section EIS Study Area.

Key providers of electricity in the Central EIS Study Area include Oncor Electric Delivery Company, AEP Energy Services Inc., TXU Electric Company, the Lower Colorado River Authority, Constellation Power Source Generation, Inc., City Public Service Board of San Antonio, and Barry Electric Co-Op (Platts 2013).

Key providers of natural gas in the Central EIS Study Area include Atmos Pipeline, Atmos Energy Corporation, Chesapeake Midstream Partners LLC, Barnett Gathering LP, DFW Midstream Services

LLC, Energy Transfer Company, Enterprise Products Operating LLC, Gulf South Pipeline Company LP, Magellan Pipeline Company LP, Texas Midstream Gas Services, and Southwestern Gas Pipeline Inc. (Platts 2013).

3.11.3.2.1 Alternative C4A Higher-Speed and High-Speed Rail

In the Alternative C4A EIS Study Area, the highest density of utility crossings exists in Fort Worth, Dallas, and south to Hillsboro (see Figure 3.11-2). Utility crossings are less dense south of Hillsboro to San Antonio; however, through urban areas near Austin and San Antonio, there is an increase in the number of utility crossings compared to rural areas (see Figure 3.11-3).

Electrical facilities in the vicinity of Alternative C4A include 253 electric transmission lines. Of these, 45 have a power rating of 69 kV, 174 have a power rating of 138 kV, 33 have a power rating of 345 kV, and one proposed line has a power rating of 765 kV. Of the 253 electrical utilities, 250 are existing and three are proposed for future construction. All electrical transmission lines are overhead with the exception of two lines that run both overhead and underground (Platts 2013). Review of aerial imagery indicates that there are approximately seven electrical substations in the vicinity of Alternative C4A (Google Earth 2016). Four electrical substations are located along the TRE tracks west of Dallas, one is located along the existing BNSF tracks south of Dallas, and two are located north of San Antonio.

There are approximately 164 natural gas pipelines of various sizes in the vicinity of Alternative C4A (Platts 2013).

3.11.3.2.2 Alternative C4B Higher-Speed and High-Speed Rail

In the Alternative C4B EIS Study Area, the highest density of utility crossings exists in Fort Worth, Dallas, and south to Hillsboro (see Figure 3.11-2). Utility crossings are less dense south of Hillsboro to San Antonio; however, through urban areas near Austin and San Antonio, there is an increase in the number of utility crossings compared to rural areas (see Figure 3.11-3).

Electrical facilities in the vicinity of Alternative C4B include 157 electric transmission lines. Of these, 35 have a power rating of 69 kV, 83 have a power rating of 138 kV, 38 have a power rating of 345 kV, and one proposed line has a power rating of 765 kV. Of the 157 electrical utilities, 153 are existing and four are proposed for future construction. All electrical transmission lines in the vicinity of Alternative C4B are overhead transmission lines (Platts 2013). Review of aerial imagery indicates that there are approximately three electrical substations in the vicinity of Alternative C4B (Google Earth 2016). One electrical substation is located along the existing BNSF tracks south of Dallas, and two are located north of San Antonio.

There are approximately 155 natural gas pipelines of various sizes in the vicinity of Alternative C4B (Platts 2013).

3.11.3.2.3 Alternative C4C Higher-Speed and High-Speed Rail

In the Alternative C4C EIS Study Area, the highest density of utility crossings exists in Fort Worth, Dallas, south to Hillsboro, and in the link from Hillsboro directly to Fort Worth (see Figure 3.11-2).

As discussed above for Alternatives C4A and C4B, crossings are less dense south of Hillsboro to San Antonio; however, through urban areas near Austin and San Antonio, there is an increase in the number of utility crossings compared to rural areas (see Figure 3.11-3).

Electrical facilities in the vicinity of Alternative C4C include 296 electric transmission lines. Of these, 58 have a power rating of 69 kV, 195 have a power rating of 138 kV, 42 have a power rating of 345 kV, and one proposed line has a power rating of 765 kV. Of the 296 electrical utilities, 290 are existing and six are proposed for future construction. All electrical transmission lines are overhead with the exception of five lines that run underground and two lines that run both overhead and underground (Platts 2013). Review of aerial imagery indicates that there are approximately eight electrical substations in the vicinity of Alternative C4C (Google Earth 2016). Four electrical substations are located along the TRE tracks west of Dallas, one is located along the existing BNSF tracks south of Dallas, one is located north of Hillsboro, and four are located north of San Antonio.

There are approximately 440 natural gas pipelines of various sizes in the vicinity of Alternative C4C (Platts 2013).

3.11.3.3 Southern Section: San Antonio to South Texas

Electrical transmission facilities and natural gas pipelines are mapped for the Southern Section on a regional level, as shown on Figures 3.11-4 and 3.11-5. The figures also show the approximate location of electrical substations in the Southern Section EIS Study Area.

Key providers of electricity in the Southern EIS Study Area include AEP Energy Services Inc., AEP Texas Central Company, Lower Colorado River Authority, Guadalupe Valley Electric Co-Op, Inc., South Texas Electric Co-Op, Inc., City Public Service Board of San Antonio, Magic Valley Electric Co-Op, Inc., and Mosbacher Operating Ltd. (Platts 2013)

Key providers of natural gas in the Southern EIS Study Area include Conoco Phillips Company, Copano Pipelines South Texas LP, DCP Intrastate Network LLC, DCP Midstream LP, Enerfin Field Services LLC, Enterprise Products Operating LLC, Exxon Mobil Corporation, Houston Pipe Line Company LP, Kinder Morgan Texas Pipeline LLC, Koch Midstream Services Co. LLC, Lobo Pipeline Company LP, Oxy USA Inc., Southcross CCNG Transmission Ltd, Tennessee Gas Pipeline Company, Texas Gas Service Company, Triad Energy Corporation, Enterprise Products Operating LLC, and Tercero Navarro, Inc. (Platts 2013).

3.11.3.3.1 Alternative S4 Higher-Speed Rail

In the vicinity of Alternative S4, the highest density of utility crossings is located near George West south to Alice. A high density of utility crossings is located in urban areas east of Laredo (see Figure 3.11-4), south to McAllen, and east to Corpus Christi (see Figure 3.11-5). The least number of utility crossings occurs in rural areas south of San Antonio (see Figure 3.11-4).

Electrical facilities in the vicinity of Alternative S4 include 79 electric transmission lines. Of these, 24 have a power rating of 69 kV, 43 have a power rating of 138 kV, 11 have a power rating of 345 kV, and one proposed line has a power rating of 765 kV. Of the 79 electrical utilities, 73 are existing and six are proposed for future construction. All electrical transmission lines in the vicinity of Alternative S4 are overhead (Platts 2013). Review of aerial imagery indicates that there are approximately two electrical substations in the vicinity of Alternative S4 (Google Earth 2016). One electrical substation is located southeast of San Antonio, and one is located near Harlingen, north of Brownsville.

There are approximately 766 natural gas pipelines of various sizes in the vicinity of Alternative S4 (Platts 2013).

3.11.3.3.2 Alternative S6 Higher-Speed and High-Speed Rail

Alternative S6 is located in rural areas, where there is a low density of utility crossings throughout the EIS Study Area (see Figure 3.11-4).

Electrical facilities in the vicinity of Alternative S6 include 21 electric transmission lines. Of these, six have a power rating of 69 kV, 13 have a power rating of 138 kV, and two have a power rating of 345 kV. Of the 21 electrical utilities, 20 are existing and one is proposed for future construction (Platts 2013). Review of aerial imagery indicates that there are no electrical substations in the vicinity of Alternative S6 (Google Earth 2016).

There are approximately 63 natural gas pipelines of various sizes in the vicinity of Alternative S6 (Platts 2013).

3.11.4 Environmental Consequences

3.11.4.1 Overview

For this service-level analysis, it is anticipated that effects on utilities would not occur during operations because once construction is complete, the utilities would be in fixed locations operating independently of the Program; therefore, these utilities would not be affected by Program operations. This includes electromagnetic interference, which is a disturbance from one electrical circuit to another (electromagnetic induction or electrostatic coupling). This can either degrade performance, interfere with the utility's function, or result in corrosion of the utility. However, lack of attention to this problem could lead to substantial effects. As a result, track and transmission designers include insulation in the design details to avoid these impacts during operations; therefore, this effect is not discussed further in this service-level analysis.

For this utility effect analysis, the level of effect was determined by analyzing the density of utility crossings in relation to the probable construction activities that would be required for the implementation of each alternative. Negligible effect would be anticipated in areas with few utility crossings and where existing tracks would be used and minimal improvements would be constructed outside of the existing rights-of-way. Moderate effects may occur in areas with a higher density of utility crossings where existing tracks would be used because utilities would need to be either relocated or encased during construction. Areas with a higher density of utilities, or where fixed utilities are present and where new or elevated tracks would be constructed, could result in a substantial effect because the magnitude of construction activities would be greater and would require considerable engineering, design, and permitting.

This utilities effect analysis is service-level and addresses only representative major utilities. Project-level analysis would address all utilities and local issues once the alignments are defined. In locations where a utility conflict exists and the utility would either need to be relocated or encased, construction could result in the potential for disruption of service provided by the utility or the potential release of a hazardous substance (e.g., natural gas).

3.11.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect existing utilities.

3.11.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

Table 3.11-1 identifies the number of utility crossings in the EIS Study Area for the Northern Section.

3.11.4.3.1 Alternative N4A Conventional

Alternative N4A would extend through both urban and rural locations, with a high density of utility crossings located in urban areas as discussed in Section 3.11.3.1.1. Alternative N4A Conventional would use the existing BNSF and TRE tracks, and minimal improvements would be constructed outside of the existing rights-of-way. Therefore, the potential effects on existing utilities would be negligible.

There are approximately five existing electrical substations located within the Alternative N4A EIS Study Area, as discussed in Section 3.11.3.1.1. Alternative N4A Conventional would use the existing BNSF and TRE tracks, and minimal improvements would be constructed outside of the existing rights-of-way. Therefore, the potential effects on electrical substations would be negligible.

Potential improvements within and directly adjacent to the existing right-of-way would be unlikely to require relocation of existing natural gas pipelines. The effect would be negligible.

3.11.4.4 Central Section: Dallas and Fort Worth to San Antonio

Each of the Central Section alternatives has a similar number of identified electrical transmission line crossings, with Alternative C4B having the least and Alternative C4C having the most. However, Alternative C4C has a higher number of natural gas pipeline crossings than either Alternative C4A or C4B. Each of the Central Section alternatives contains electrical substations within the EIS Study Area, with Alternative C4C having the most and Alternative C4B having the least.

Table 3.11-1 identifies the number of utility crossings in the EIS Study Area for the Central Section.

3.11.4.4.1 Alternative C4A Higher-Speed Rail

From Fort Worth, east to Dallas and south to Waxahachie, the Alternative C4A Higher-Speed Rail alignment follows existing tracks through urban areas where there is a high density of electrical transmission line and pipeline utility crossings. However, because minimal improvements would be constructed outside of the existing-rights-of-way, the potential effects on existing utility crossings in these locations would be considered negligible compared with the No Build Alternative. Five electrical substations are located along the TRE and BNSF tracks; however, because minimal improvements would be constructed outside of the existing rights-of-way, the potential effects on electrical substations would be considered negligible.

From Waxahachie south to San Antonio, the Alternative C4A Higher-Speed Rail alignment would enter a new alignment and new track would be constructed, although the alignment would generally follow the existing BNSF alignment south to San Antonio. These areas are generally rural and have fewer electrical transmission line and natural gas pipeline crossings compared with the urban areas near Fort Worth and Dallas. From Waxahachie south, there is potential for the existing electrical transmission line and natural gas pipelines to be moved outside the alignment or encased to prevent damage. In addition, two electrical substations are located north of San Antonio in an area where new track would be constructed; however, this is a rural area and the alignment could be located to avoid these substations. Because these areas are generally rural and the existing utilities could be either moved or encased or the alignment could potentially be located to avoid substations, the potential effects on existing utilities for these areas would be considered moderate.

3.11.4.4.2 Alternative C4A High-Speed Rail

From Fort Worth to Dallas and south to Waxahachie, the Alternative C4A High-Speed Rail alignment would be constructed on new high-speed railway alignment elevated track. Because this section of the alignment would be constructed on new track through urban areas where there is a high density of electrical transmission line and gas pipeline utility crossings and electrical substations, the potential effects on existing utilities would be considered substantial compared with the No Build Alternative. In addition, because of the high density of electrical transmission line and gas pipeline crossings and the magnitude of construction, there is a higher potential for disruption of utility service.

Alternative C4A High-Speed Rail would have the same potential for moderate effects on utilities as Alternative C4A Higher-Speed Rail from Waxahachie south to San Antonio because both alternatives would follow the same alignment.

3.11.4.4.3 Alternative C4B Higher-Speed Rail

From Fort Worth to Dallas, the Alternative C4B Higher-Speed Rail alignment follows existing tracks through urban areas where a high density of utility crossings exists. In addition, one substation is located within the alignment east of Dallas. Because existing track would be used and no new track would be constructed in this location, the potential effects on transmission line and pipeline crossings would be considered negligible, and the potential effects on substations would be considered moderate.

Between Dallas and Fort Worth, the alternative would turn south to Hillsboro on an alignment outside of existing transportation corridors in an area with a high density of utility crossings. Because this section of the alignment would be constructed on new track through urban areas where a high density of electricity transmission line and pipeline crossings exist, the potential effects on existing utilities would be considered substantial compared with the No Build Alternative. In addition, because of the high density of utility crossings and the magnitude of construction, there is a higher potential for disruption of utility service.

Alternative C4B Higher-Speed Rail would have a similar potential for transmission line and pipeline crossings and substations as Alternative C4A Higher-Speed Rail from Hillsboro south to San Antonio, as both alternatives would follow the same alignment south of Hillsboro. New track would be constructed in a new alignment through areas with a low density of transmission line and pipeline crossings, and the alignment could potentially be located to avoid substations.

3.11.4.4.4 Alternative C4B High-Speed Rail

From Fort Worth to Dallas, the Alternative C4B Higher-Speed Rail alignment would be constructed on new high-speed railway elevated track. Because this section of the alignment would be constructed on new track through urban areas where there is a high density of electricity transmission line and pipeline crossings and substations, the potential effects on existing utilities would be considered substantial compared with the No Build Alternative. In addition, because of the high density of utility crossings and the magnitude of construction, there is a higher potential for disruption of utility service.

Alternative C4B High-Speed Rail would have the same potential for moderate effects on utilities as Alternative C4B Higher-Speed Rail from Hillsboro south to San Antonio, as both alternatives would follow the same alignment. New track would be constructed in a new alignment through areas with a low density of transmission line and pipeline crossings and the alignment could potentially be located to avoid substations.

3.11.4.4.5 Alternative C4C Higher-Speed Rail

As discussed in Section 3.11.3.2.3, Alternative C4C Higher-Speed Rail requires most of its track to be constructed outside of existing transportation corridors, although a segment from Fort Worth to Hillsboro would occur parallel to the existing UPRR corridor. Alternative C4C Higher-Speed Rail shares most of its alignment with Alternative C4A.

Because Alternative C4C Higher-Speed Rail shares most of its alignment with Alternative C4A, the same potential for moderate effects would occur as discussed above for Alternative C4A Higher-Speed Rail (with the exception of the segment from Hillsboro to Fort Worth). The segment between Hillsboro and Fort Worth would be constructed parallel to the existing UPRR corridor, on new track, through an area with a high density of electricity transmission line and pipeline crossings and one substation; therefore, the potential effects on existing utilities would be considered substantial compared with the No Build Alternative.

3.11.4.4.6 Alternative C4C High-Speed Rail

Alternative C4C High-Speed Rail would have the same potential for effects on utilities as the Alternative C4A High-Speed Rail, as both alternatives would follow the same alignment (with the exception of the segment from Hillsboro to Fort Worth). The segment between Hillsboro and Fort Worth would be constructed on new track, through an area with a high density of electricity transmission line and pipeline crossings and one substation; therefore, the potential effects on existing utilities would be considered substantial compared with the No Build Alternative.

3.11.4.5 Southern Section: San Antonio to South Texas

Of the Southern Section alternatives, Alternative S4 has more potential for effects, based on the presence of a higher density of existing utilities, including substations, within the EIS Study Area than Alternative S6.

Table 3.11-1 identifies the number of utility crossings in the EIS Study Area for the Southern Section.

3.11.4.5.1 Alternative S4 Higher-Speed Rail

As discussed in Section 3.11.3.3.1, Alternative S4 travels through both urban and rural locations, with a high density of electricity transmission line and pipeline crossings located in urban areas. In locations where existing tracks would be used and no new track would be constructed, the potential effects on existing utilities would be considered negligible compared with the No Build Alternative. These areas are either rural or urban, with various densities of utilities, and include areas from San Antonio to Alice, a portion of the leg from Alice to Laredo (western portion that follows the Kansas City Southern [KCS] tracks), and the leg from Alice to Corpus Christie.

Alternative S4 also includes rural areas with low density of electricity transmission line and pipeline crossings where new track would be constructed. These areas include a portion of the section south of San Antonio, the leg from Alice to Laredo (eastern portion that does not follow the KCS tracks), and the leg from Alice to Brownsville. In these areas, the potential effects on existing utilities, which include two substations, would be considered moderate compared with the No Build Alternative because there is potential for the existing utilities to be moved outside the alignment, encased to prevent damage, or the alignment could potentially be located to avoid the substations.

3.11.4.5.2 Alternative S6 Higher-Speed Rail

As discussed in Section 3.11.3.3.2, Alternative S6 Higher-Speed Rail would be constructed and operated entirely outside of existing transportation corridors in rural areas where there is a low density of electricity transmission line and pipeline crossings and no substations.

Because construction of Alternative S6 Higher-Speed Rail would require construction of new track, it would pose a moderate potential effect on existing utilities compared with the No Build Alternative. However, there is the potential for existing utilities to be moved outside the alignment or encased to prevent damage. In addition, in rural areas, the alignment may be able to be located to avoid existing utilities.

3.11.4.5.3 Alternative S6 High-Speed Rail

Alternative S6 High-Speed Rail would have the same effects on utilities as the Alternative S6 Higher-Speed Rail because it would follow the same alignment and new track would be constructed. This alternative would have a moderate potential effect on existing utilities.

3.11.4.6 Summary of Potential Effects

Conventional rail would use existing track, and therefore, Alternative N4A would have a lower magnitude of effect than the other alternatives. The higher-speed rail alternatives would require new track to be constructed along portions of their alignments. Within urban areas, existing track would be used, and existing utilities may not need relocation. Therefore, in general, the higher-speed rail alternatives are anticipated to have moderate or substantial effects depending on the alignment. The Central Section High-Speed Rail alternatives would require new track along their entire alignments, and all travel would occur through urban areas with high density of electricity transmission lines, gas pipelines, and substations, thereby resulting in the potential for substantial effects. Alternative S6 High-Speed Rail would require new track along the entire alignment; however, this alternative would travel through rural locations, resulting in the potential for moderate effects.

Table 3.11-2 lists the potential intensity of effects on utilities by alternative.

Table 3.11-2: Summary of Utility Effects

Section	Alternative	Potential Intensity of Effects (Negligible, Moderate, or Substantial)[a, b]
No Build Alternative[c]		No effect
Northern	N4A CONV	Negligible
Central	C4A HrSR	Moderate
	C4A HSR	Substantial
	C4B HrSR	Substantial
	C4B HSR	Substantial
	C4C HrSR	Substantial
	C4C HSR	Substantial
Southern	S4 HrSR	Moderate
	S6 HrSR	Moderate
	S6 HSR	Moderate

Note: This table is a summary of the effects documented in this section.

[a] Limited to construction-phase effects only.

[b] The most intense effect for each alternative is presented in the table; however, alternatives may include additional less intense effects depending on urban or rural locations, density of utilities, and if existing or new track would be constructed.

[c] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area. However, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

3.11.5 Avoidance, Minimization, and Mitigation Strategies

Specific impacts on utilities have not been identified, and, therefore, precise mitigation measures cannot be recommended at this time. However, it should be possible to minimize most impacts through utility operator/owner involvement during preliminary design of an alternative. If utilities are affected, coordination with municipalities and utility owners and operators would be conducted to develop relocation and construction phasing plans around peak usage hours to minimize utility disruptions.

Proposed general mitigation strategies for potential utility conflicts should first focus on avoidance of the potential conflicts. If such conflicts are unavoidable, focus should be on reducing and minimizing the potential impact. The mitigation strategies would be refined during subsequent project-specific analysis.

Potential strategies to avoid and/or mitigate potential utility conflicts would include the following:

- Relocate utilities outside of the alignments.
- Make adjustments to the rail alignments and profiles to avoid major utility lines or facilities.
- Provide insulation against electromagnetic interference.
- Encase existing utilities in strong culverts or conduits where new alignments would cross to prevent damage.
- During final design, consult with each utility provider/owner to avoid or reduce potential impacts on existing and planned utilities through design refinements.

If avoidance is not feasible and adjustment of alignments has not removed potential conflict, relocation/reconstruction/restoration of the utility, in close consultation and coordination with the utility owner, could be considered as a mitigation strategy.

3.11.6 Subsequent Analysis

The utilities effect analysis is a service-level analysis and addresses only representative utilities; it does not address all utilities and levels of utility service. The subsequent analyses required for effects on utilities will be assessed during project-level analysis. Areas of further study will include the following:

- Identification of existing utilities
- Coordination with utility providers to determine utility locations
- Development of plans to minimize utility impacts, including electromagnetic interference

Project-level analysis will focus on project-specific effects that reflect more precise inventory of the existing utilities. Subsequent analysis will include detailed information on the following utilities:

- Electrical facilities
- Water supply lines
- Wastewater conveyance lines and water pump stations

- Storm drains
- Fiber-optic lines
- Telecommunication lines
- Pipeline identification to include natural gas, crude oil, petroleum, etc.

3.12 Geologic Resources

This section describes the existing geologic conditions, topography, soils, and mineral resources within the 500-foot environmental impact statement (EIS) Study Area. The broader geologic context is also provided in this section, which includes a regional description of geologic formations, features, hazards, and geologic risks. The geologic considerations influence the type of construction methods used, which, if not adequately considered during project design, could affect the long-term operation and safety of the Program. This section discusses the effects of the alternatives on geology, soils, and seismicity, and how the soil and geology within the EIS Study Area for the proposed alternatives may affect project design, construction, or operation. In addition, mineral resources are reported to determine if valuable resources and access to them would be affected by the Program. Other sections of this EIS discuss attributes of geologic resources, such as soil erodibility (see Section 3.2, Water Quality) and drainage classifications (see Section 3.2, Water Quality and Section 3.6, Wetlands). The introduction to Chapter 3 describes the EIS Study Area and use of terms such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.12.1 Laws, Regulations, and Orders

Applicable state legislation and regulations pertaining to geologic resources within the EIS Study Area are listed and described below. Additional local and regional laws, regulations, orders may be applicable and will be addressed in project-level analysis.

3.12.1.1 State

- **International Building Code.** The 2006 and 2009 International Building Codes (Chapter 18), published by the International Building Council, Inc., have been adopted by Texas and Oklahoma, respectively. The codes require geotechnical investigations to be performed to assess the soil and bedrock conditions that may affect the proposed structures and facilities. The codes provide engineering design standards for foundations and grading based on the site-specific conditions. Minimum standards for earthquake design are also provided for all portions of the EIS Study Area.

- **Texas Natural Resources Code.** State guidance relating to mineral resources are contained in the Natural Resources Code of the Texas Statutes (*Natural Resources Code*, Title 2. Public Domain, Subtitle D. Disposition of the Public Domain, Chapter 53. Minerals).

3.12.2 Methodology

Geology, topography, and mineral resource information was obtained from maps and reports available from the U.S. Geological Survey (USGS) and others. Soil information was obtained from the Natural Resources Conservation Service (NRCS) (under the U.S. Department of Agriculture) and U.S. Environmental Protection Agency (EPA). Supplemental information was obtained from websites and cited, as appropriate.

To evaluate the effects of geologic resources, the following resources within the EIS Study Area were assessed:

- Geologic formations, features, and hazards
- Soil types and associated properties
- The presence of recoverable, mined minerals

General qualitative conclusions were prepared based on a review of the soils and geologic conditions within the EIS Study Area to describe the relative difference in effects among the alternatives. The No Build Alternative is the primary basis of comparison.

The design and engineering of each of the alternatives would incorporate geotechnical survey results and meet applicable design standards which address geologic hazards in the EIS Study Area. The design and construction of the alternatives would be required to follow guidelines of the American Association of State Highway and Transportation Officials, American Railway Engineering and Maintenance-of-Way Association, Oklahoma Department of Transportation, Texas Department of Transportation, and International Building Code.

The principal geotechnical and geologic risk considerations for project operation include low soil-bearing strength, soil settlement, shrink-swell characteristics, corrosive soils, slope instability, and ground shaking. For a small part of the EIS Study Area in the Southern Section near the gulf coast, land subsidence from extraction of underground resources, such as water or gas, and tsunamis may present some risk to the Program. However, with proper incorporation of the design guidelines listed above, effects on the stations, structures, and railway would be limited.

Effects as a result of the route alternatives are characterized as negligible, moderate, or substantial compared with the No Build Alternative. For geologic resources, these terms are defined as follows:

- Negligible intensity effects are those where there is little to no likelihood for detrimental effects to the Program from geologic risks (seismic events, faults, sinkholes) and instability of soils. Conditions are relatively flat, soils are stable and compact or with excavation and replacement foundation soils would become stable, or bedrock is present at a shallow depth. Also, geologic resources are abundant and therefore use of construction materials would not threaten availability and/or the Program does not impede access to valuable resources.

- Moderate intensity effects are those where there is a likelihood for detrimental effects to the Program from geologic risks (seismic events, faults, sink holes) and from slopes that have some areas of instability. Also, geologic resources are available but nearby resources are being depleted and/or the Program does impede access to valuable resources, but access can be designed into the Program at a higher cost.

- Substantial intensity effects are those where there is a high likelihood for detrimental effects to the Program from geologic risks (seismic events, faults, sinkholes) and instability of soils. Also, geologic resources are already over-mined and therefore the use of construction materials would threaten availability and/or the Program does impede access to valuable resources.

3.12.3 Affected Environment

The following subsections describe the geology, soil types, and mineral resources that occur within each geographic area of the Program.

3.12.3.1 Northern Section: Oklahoma City to Dallas and Fort Worth

3.12.3.1.1 Geology

Nearly the entire length of the Northern Section EIS Study Area is in the Osage Plains and Grand Prairie physiographic provinces as shown on Figure 3.12-1 (USGS 1970). The Northern Section is underlain by Ordovician to Permian shale, sandstone, and limestone bedrock, with quaternary alluvial deposits in many of the Northern Section areas (Heran et al. 2003).

Generally, the topography of the Northern Section is gradually sloped with gently rolling hills. In higher relief areas, such as the Arbuckle Mountains, the rail lines follow low relief valley floors. The landscape is derived from a shallow continental sea that covered the region during the Cretaceous Period, which deposited carbonate rocks that were overlain by sedimentary deposits from the Rocky Mountains. The average relief is between 300 and 500 feet. Rivers generally flow from west to east because the plains slope in that direction (Oklahoma Historical Society 2007a).

Historically, seismic hazards have been of moderate concern in the vicinity of the Northern Section. In 1952, an earthquake of magnitude 5.5 near El Reno, Oklahoma, caused a 50-foot-long crack in the state capitol building. El Reno is located approximately 20 miles to the west of Oklahoma City and in the northernmost extent of the Northern Section EIS Study Area. The largest earthquake on record, with a magnitude of 5.6, occurred in 2011 approximately 38 miles to the east of the Northern Section EIS Study Area, and caused buckling of pavement on U.S. Highway 62, and damages to structures (Los Angeles Times 2011). There has been an increase in shallow, low-magnitude earthquakes in Oklahoma over the last few years. From 1990 to 1999, 788 earthquakes were recorded; 358 earthquakes were recorded from 2000 to 2009. The recorded earthquakes increased to 1,047 events in 2010, 1,470 events in 2011, 980 events in 2012, and 2,848 events in 2013. The number of earthquakes in 2014 has already exceeded the number from 2013 (USGS 2013). The cause of these earthquakes is being studied, but the earthquakes are not currently associated with known active faults. Some speculate that the increase may be attributed to mineral extraction techniques. These earthquakes, although numerous, generally have not affected transportation systems in the area because of the small magnitude. The exceptions are two earthquakes that exceeded magnitude 5.0 that occurred within approximately 40 miles of the Northern Section.

The proposed alternatives cross through fault zones, but these geologic faults are classified by USGS as inactive. One active fault approximately 60 miles west of the existing railway lines, the Meers Fault, is capable of generating a magnitude of up to 7.0 (USGS and University of Texas 2006) and has moderate potential for strong ground motion.

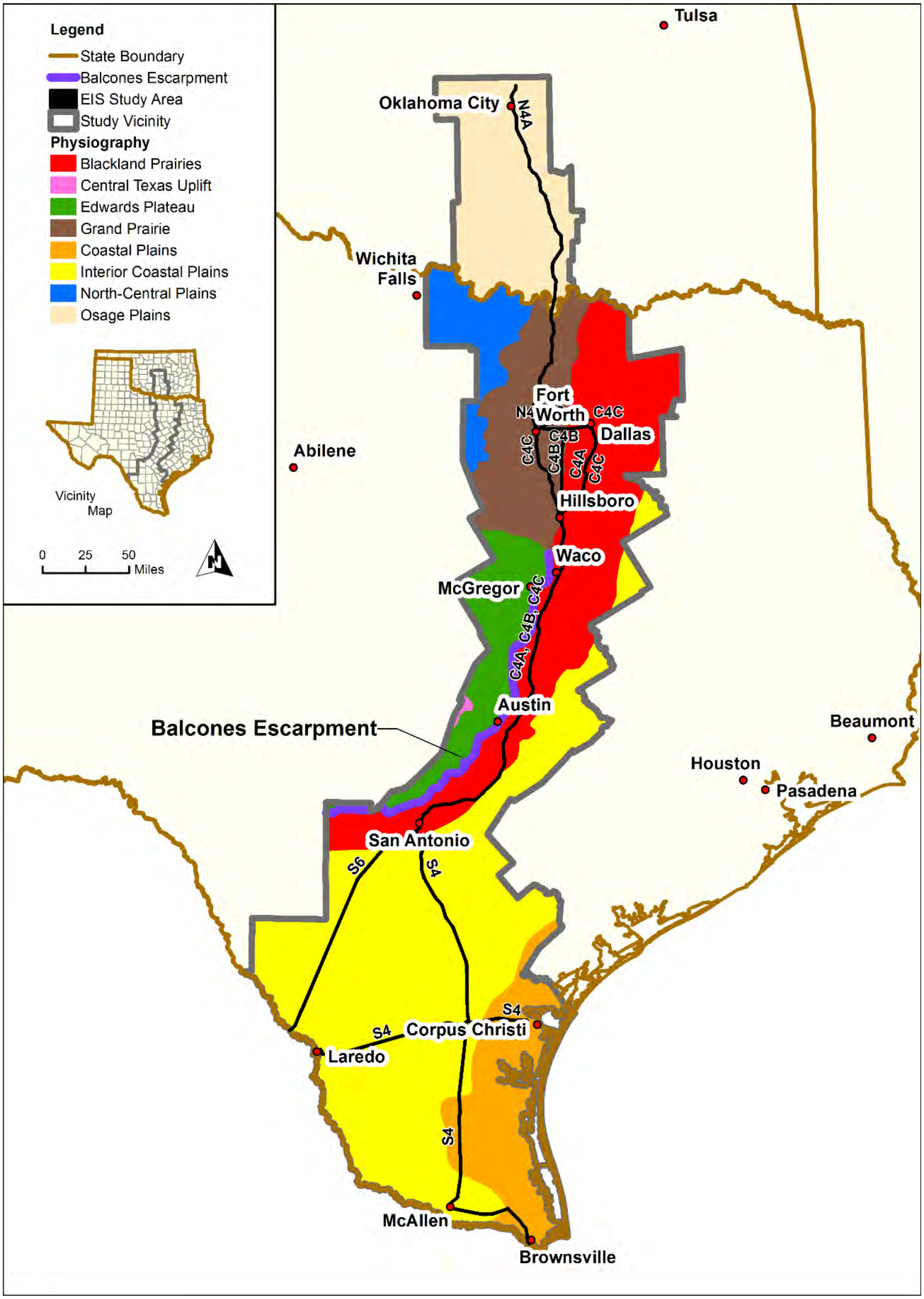


Figure 3.12-1: Physiographic Provinces in the EIS Study Area

In areas with soluble subsurface rock, such as limestone, karst topography can form from dissolution by groundwater. Surface manifestations include sinkholes, voids, and erratic surface drainage, all of which may already exist or manifest in the future. Some carbonate karst features may exist below the clay soil in the Northern Section EIS Study Area in southern Oklahoma where carbonate rock is mapped (see Figure 3.12-2) (Texas Speleological Survey 2007).

3.12.3.1.2 Soils

Soils in the Northern Section consist mainly of gravel, sand, silt, and clay in alluvial and terrace deposits; and colluvial soil derived from weathered shale, limestone, sandstone, and siltstone (Heran et al. 2003). These include water-soluble rocks, such as the carbonate limestone formations. Based on a review of NRCS soil mapping, dominant soil series within the Northern Section EIS Study Area include a mix of Watonga clay, Urban land, Trinity-Urban land complex, Sanger clay, Gracemont fine sandy loam, Bastsil-Urban land complex, and Kiti-rock outcrops. These soils generally have shallow slopes (0 to 3 percent) and are moderately well drained to well drained.

The clay soils in the Northern Section EIS Study Area are mapped as having low to moderate expansive characteristics or low frequency of expansive behavior (U.S. Army 1983; Luza and Johnson 2005). During drought years, an increase in damages to pipelines and roads around Oklahoma City have been reported, most likely due to shrinking clay (Flanagan & Associates 2013). There is potential for encountering high expansive clay in this vicinity.

3.12.3.1.3 Mineral Resources

Oklahoma ranked 32nd in the United States for non-fuel mineral production in 2012, with a production of value of $651 million. Minerals mined in Oklahoma include coal, limestone, sand and gravel, gypsum, clay and shale, granite, ash, Tripoli, salt, bentonite, iron ore, asphalt, copper, and chat (Oklahoma Mining Commission 2012). Other minerals mined currently and in the past include lead, zinc, copper, manganese, titanium, and uranium. Oklahoma is the nation’s sole producer of iodine and often leads the nation in production of gypsum (Oklahoma Historical Society 2007b). The Northern Section also crosses into northern Texas where sources of sand, gravel, gypsum, and limestone are present (University of Texas 2010).

The Northern Section EIS Study Area does not include identified deposits of coal, which is generally located in the eastern portion of Texas and Oklahoma. Zinc mines are present in the Arbuckle Mountains, but the Northern Section crosses through these mountains in the alluvial valleys and would not affect these deposits. It is possible the Northern Section EIS Study Area overlays sand and gravel resources within the alluvial and terrace deposits.

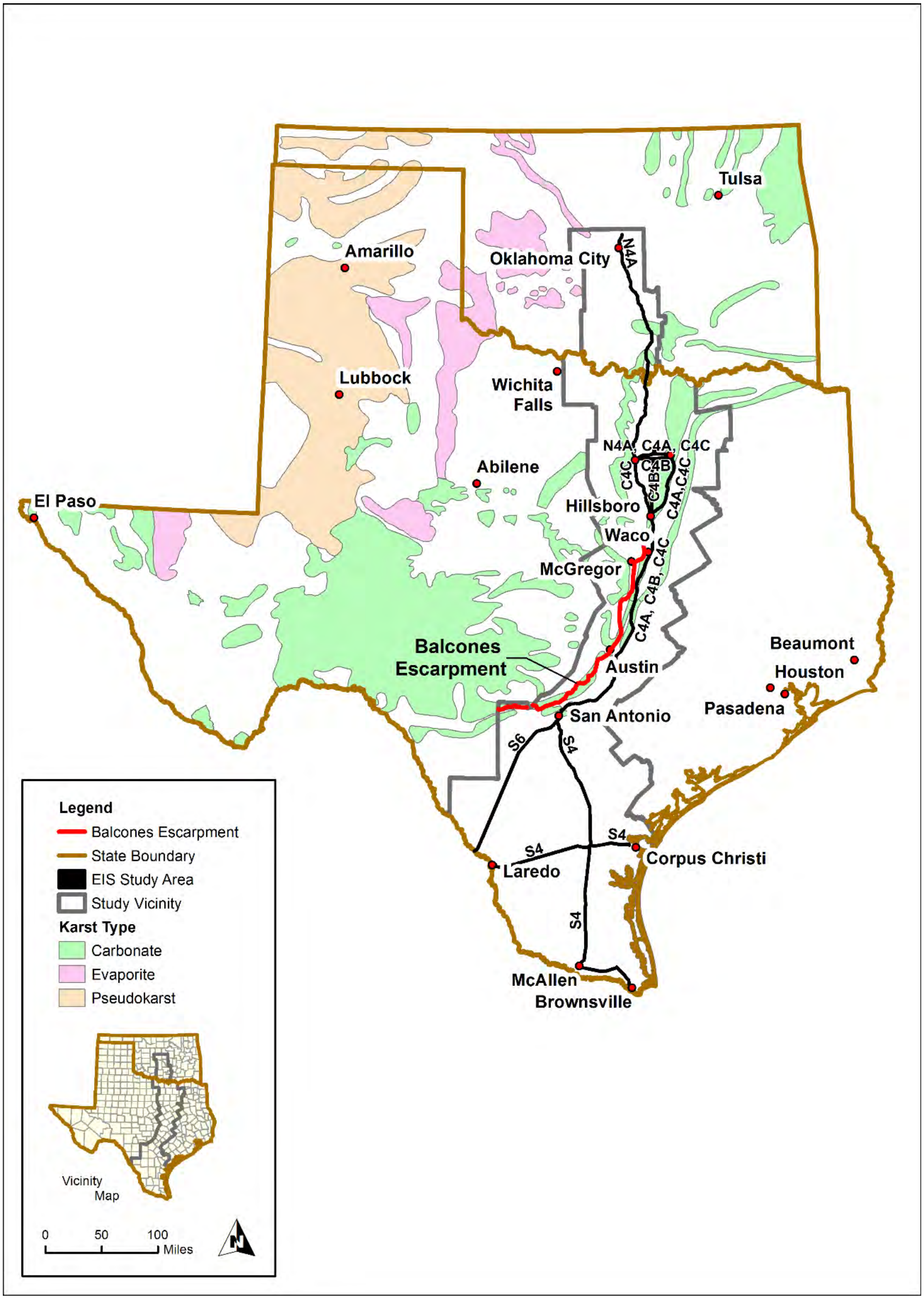


Figure 3.12-2: Map of Areas with Potential Karst Hazards for the EIS Study Area

3.12.3.2 Central Section: Dallas and Fort Worth to San Antonio

3.12.3.2.1 Geology

The Central Section EIS Study Area is located within the Blackland Prairies physiographic province of Texas (University of Texas 1996). The geologic structure beneath the Central Section consists of sedimentary beds that dip toward the southeast, resulting in the increasing geologic age of exposed formations from east to west. A sharp change in elevation is present along the Balcones Escarpment, as shown on Figure 3.12-1, which separates the deeply dissected and hilly limestone terrain of the Edwards Plateau from the gently sloping, undulating terrain of the Coastal Plain. This escarpment is the result of a crustal movement that caused approximately 700 feet of uplift during the Cretaceous Era and left behind faults and disturbances throughout the escarpment area. Most of the Central Section EIS Study Area passes beneath the eastern edge of this escarpment. The exposed formations consist of Cretaceous marine deposits that include shales, marls, and chalks (USFS 1994).

Landforms in the Blackland Prairies province are level to rolling plains (USFS 1994). The elevation along the Central Section EIS Study Area ranges from approximately 450 to 750 feet and increases gradually to the north and west, with an abrupt increase in elevation at the Balcones Escarpment. Large rivers that cross the area generally flow southeast and east and have broad, shallow valleys.

The Central Section EIS Study Area crosses numerous fault zones, especially those associated with the Balcones Escarpment. The faults in the Balcones Fault Zone do not show evidence of rupture since the Miocene Epoch (12 to 27 million years ago) and are classified by USGS as inactive (USGS and University of Texas 2006).

Historical earthquakes larger than magnitude 4.0 have not been recorded in the vicinity of the Central Section EIS Study Area during the last 100 years. Earthquakes with magnitude less than 3.0 are common at the northern end of the Central Section, near Dallas and Fort Worth (USGS 2013).

Karst-susceptible areas are generally located west of the Balcones Escarpment, although some localized carbonate karst features may exist below the clay soil in the Central Section EIS Study Area, especially in the vicinity around Dallas (see Figure 3.12-2) (Texas Speleological Survey 2007).

3.12.3.2.2 Soils

Soils within the Central Section are formed from the weathering of limestone, marl, chalk, and shale deposited during the Cretaceous Period. These major soil orders include vertisols, mollisols, alfisols, entisols, and inceptisols. Soils have a thermic temperature regime, ustic or aquic moisture regime, and montmorillontic, mixed, or carbonatic mineralogy (Soil Conservation Service 1981). The soils are generally deep. Dominant soil series within the Central Section EIS Study Area include a mix of Trinity-Urban land complex, Branyon clay, Urban land, Houston Black clay, and Wilson clay.

The clay soils present in the Central Section include highly expansive clays, especially within geologic formations, such as the Del Rio clay. Historically, there has been extensive damage to structures caused by expansive behavior. The majority of the Central Section EIS Study Area is mapped as having highly expansive soil or high frequency of occurrence in regards to expansive behavior (U.S. Army 1983).

Landslides or slumping slopes are prevalent along the Balcones Escarpment, but the Central Section EIS Study Area is generally below the escarpment in the more gently sloped plains.

3.12.3.2.3 Mineral Resources

Texas produced more than $2 billion worth of non-fuel mineral resources in 2012. Minerals mined in Texas include sand and gravel, crushed stone, and metals, including silver and titanium. Other minerals mined include iron ore, salt, phosphate, clay, bauxite, copper, lead, zinc, soda ash, and manganese. Commodities mined within the vicinity of the Central Section EIS Study Area include crushed stone, limestone, perlite, sand and gravel, sulfur, and clay (University of Texas 2010).

The predominant mined resources in the Central Section are limestone (for cement), sand and gravel, and crushed stone. These resources would be important for infrastructure construction such as structures, foundations, and embankments associated with the three route alternatives in the Central Section.

3.12.3.3 Southern Section: San Antonio to South Texas

3.12.3.3.1 Geology

The Southern Section EIS Study Area is located predominantly in the Interior Coastal Plain physiographic province; however, a small portion of the EIS Study Area is in the Coastal Prairies physiographic province (refer to Figure 3.12-1). Geologic formations beneath the study area are Tertiary marine deposits that include sandstone, mudstone, limestone, shales, and marls (USFS 1994).

The land in the Coastal Plains province gradually rises from the gulf coast towards the west and northwest. Landforms are mainly irregular plains, with some flat plains and plains with hills (USFS 1994). The elevation ranges from approximately 100 to 700 feet along the Southern Section EIS Study Area. A few rivers cross the area, and generally flow southeast and east with dendritic drainage patterns.

The Southern Section EIS Study Area crosses fault traces that are scattered through the region. Evidence of rupture in Quaternary time has not been observed, and these faults are classified by the USGS as inactive (USGS and University of Texas 2006). Within approximately 100 miles of the Southern Section EIS Study Area, 17 earthquakes with magnitudes ranging from 3.0 to 4.8 have occurred during the past 100 years. Of those events, only two events, one in 1993 and one in 2011, were greater than magnitude 4.0 (USGS 2013).

Karst-susceptible areas are generally located north and west of the Balcones Escarpment. As shown on Figure 3.12-2 (Texas Speleological Survey 2007) the Southern Section EIS Study Area is located below the escarpment, and is not underlain by mapped karst-susceptible areas.

3.12.3.3.2 Soils

Soils in the Southern Section were formed from the weathering of marine sediments of limestone, shale, and sandstone in addition to alluvial plains. Dominant soil series within the EIS Study Area include a mix of Victoria clay, Hidalgo sandy clay loam, Maverick-Catarina complex, Duval loamy fine sand, Falfurrias fine sand, Nueces fine sand, and Urban land. These soils generally have gently rolling or gently undulating slopes and are moderately well drained to well drained. Approximately one-half of the Southern Section EIS Study Area is mapped as having highly expansive soil or high frequency of occurrence in regards to expansive behavior (U.S. Army 1983). Sand dunes are also present within the Southern Section EIS Study Area.

3.12.3.3.3 Mineral Resources

Mineral resources mined within the vicinity of the Southern Section include uranium, crushed stone, sand and gravel, zeolites, clay, aluminum, and barite (University of Texas 2010). Oil and natural gas production is ongoing in areas along the Gulf Coast Plains. It is possible in the Southern Section that alignments could traverse deposits of these mineral resources.

3.12.4 Environmental Consequences

3.12.4.1 Overview

This section discusses effects common to the build alternatives-related geology, soil, and mineral resources. The alternatives in the Northern, Central, and Southern sections would experience the same potential geology, soil, and mineral resources effects; as a result, effects are discussed by entire section below, rather than by alternative.

3.12.4.1.1 Geology- and Soil-Related Hazards

Geologic conditions are complex in the EIS Study Area, because of uplift and displacements along ancient faults. The geologic hazards are similar for the construction and operation phases of the Program; therefore, they are not separate discussions in this EIS.

The geology in the EIS Study Area varies from Ordovician rock formations to Quaternary deposits. Many of the geologic formations include clay soil with a known propensity of high shrink/swell potential, especially around central Texas. In many years, expansive soil is responsible for more damage to structures than all other geologic hazards and natural disasters combined. This is a concern because of the affects it may have on the Program.

Water-soluble rocks, such as the carbonate limestone formations in the EIS Study Area, can lead to the development of sinkholes from collapsing underground voids. This is a concern because of the effects it may have on the Program.

Historically, seismic hazards have been negligible in the EIS Study Area. However, parts of Oklahoma and Texas have a high occurrence of shallow, low magnitude (up to magnitude 5.6) earthquakes, especially over the last 5 years. The EIS Study Area crosses numerous fault zones, but the geologic faults are classified by the USGS as inactive. For purposes of evaluating significance for the EIS Study Area, earthquakes less than magnitude 5.0 generally do not result in damage to railway systems significant enough to cause closure of the railway. For example, after the 1989 Loma Prieta earthquake in California (magnitude 6.9), the Bay Area Rapid Transport was placed online within 2 hours following the earthquake (Robinson and Kapoor 2009). For the southeastern part of the United States, earthquake events at distances greater than 100 miles are unlikely to produce strong ground motion sufficient for causing significant damage to structures; earthquakes at farther distances are disregarded.

Liquefaction can occur within alluvial sand deposits when subjected to strong ground motion. Generally, liquefaction is of low concern where the peak horizontal ground acceleration from earthquakes does not exceed 0.3 g, because only very loose sand is subject to potential liquefaction at that level of shaking. Less than 5 percent of the EIS Study Area is mapped with characteristic peak ground accelerations above 0.05 g, and the peak ground acceleration is unlikely to exceed 0.2 g over any part of the EIS Study Area. The risk of liquefaction effects on the route alternatives is, therefore, negligible.

The effects on or from geologic and soil resources are similar for Program construction and operation, except for the following areas. First, the exposure to seismic activity is greatest for long-term operation of the rail services compared with the temporary construction period. Second, project construction may require a certain quantity of geologic materials for constructing new railway foundations or embankments. No additional materials would be used for operation, but the reduction in mineral resources is permanent.

Soil types and geologic formations are indications of stability for the Program structures and longevity of service. Soils with high clay content often have high shrink/swell potential and are generally poorly suited for railway, road, or foundation bases. Such soils may need to be excavated and replaced prior to construction, or treated in place to limit effects on proposed structures. Deep foundations can also be used to bypass the zone of moisture fluctuation where expansion/contraction occurs. Expansive clays have an effect on construction and operation.

Construction activities may disturb or modify the soils and slopes. The effects of these conditions must be managed through standard engineering practices and design to avoid and minimize the potential risk to the project and safety during both construction and operation. Landslides can occur in fill or cut slopes. Cut slope instability is a concern in much of the EIS Study Area for slopes steeper than 4 (Horizontal):1 (Vertical) inclination because of the low-strength, high-plasticity clays.

Because of the existing geologic conditions, volcanic eruptions, liquefaction from earthquake shaking, and ground ruptures from faults would have a negligible effect on all of the alternatives.

3.12.4.1.2 Mineral Resources

The presence of recoverable minerals is an indication of the potential for the build alternatives to result in removing resources that could be irretrievable. Additionally, the build alternatives may affect loss of availability or accessibility of known mineral, petroleum, or natural gas resources of regional or statewide value. The effects on these resources are long-term and, therefore, are effects attributable to both the construction and operation of the alternatives.

3.12.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect geology, soils, or mineral resources.

3.12.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.12.4.3.1 Geology- and Soil-Related Hazards

Effects on geological resources from Alternative N4A Conventional would be negligible compared with the No Build Alternative because disturbances would be limited to surface elevations, and excavation and grading would be minimal because the alternative follows existing railway corridors.

Landslides would have a negligible effect for this alternative because of the low topographic relief.

The effect of seismic ground-shaking on Alternative N4A Conventional is potentially substantial, but it is of low frequency according to historical seismicity, and structures can be designed in accordance with building codes to withstand estimated strong ground motions (see Section 3.12.2, Methodology). Therefore, the effect of seismic hazards on the Northern Section EIS Study Area would be moderate.

No active faults are identified in the Northern Section EIS Study Area, and the potential for ground surface rupture would be negligible. Strong ground shaking is possible even without active faults, as is evident from the increase in earthquakes in recent years, some of which have caused damages to structures.

Water-soluble rocks, such as the carbonate limestone formations in the Northern Section, can lead to the development of sinkholes from collapsing underground voids. This is a concern because of the effects it may have on the Program.

The potential for effects in the Northern Section EIS Study Area from expansive clay is estimated to be negligible for approximately 80 percent of the length, and moderate to substantial for 20 percent of the length (Luza and Johnson 2005). Where expansive clays are encountered, the clay could be over-excavated and replaced with non-expansive material, or the expansive soil could be treated in place with lime or other material to avoid vertical displacement in the track over time to reduce the effect to moderate. The required depth of over-excavation or treatment would depend on the depth of moisture fluctuation for the specific areas and would be determined as part of the project-level analysis.

3.12.4.3.2 Mineral Resources

One active sand mining operation was identified in the Northern Section EIS Study Area. The sand mine is located in Cleveland County, Oklahoma. Sand is considered a commonly available resource, and the effect from Alternative N4A Conventional on sand mining would be negligible. Additionally, the track would most likely remain on existing railway rights-of-way.

Some sand and gravel resources would be used if borrow materials are required for construction of additional rail lines, but sand and gravel resources are abundant in the EIS Study Area; therefore, the effect would be negligible. Construction effects on other minerals would be negligible.

3.12.4.4 Central Section: Dallas and Fort Worth to San Antonio

3.12.4.4.1 Geology- and Soil-Related Hazards

Effects on geologic and topographic resources in the EIS Study Area for the Central Section would be negligible compared with the No Build Alternative because disturbances would be limited to surface elevations, and excavation and grading would be minimal.

The Central Section EIS Study Area is essentially devoid of seismic activity except for a swarm of low-magnitude (less than magnitude 4.0) earthquakes over the last 5 years between Dallas and Hillsboro. The potential for ground surface rupture is negligible. The potential for ground motion strong enough to damage railways is also negligible based on the absence of earthquakes through the Central Section of the EIS Study Area.

Water-soluble rocks, such as the carbonate limestone formations in the EIS Study Area, can lead to the development of sinkholes from collapsing underground voids. The Central Section crosses through many zones of potential karst hazards, as shown on Figure 3.12-2. This is a concern because of the effects it may have on the Program.

The construction and operational effects of expansive clays could be substantial, but can be avoided and minimized to a moderate effect through in-place treatment or excavation and replacement with non-expansive foundation materials Increased settlement and low bearing pressures are generally also directly correlated to clay soil with high expansive potential. For structures such as elevated railways, deep foundations can be designed to bear below the depth of moisture fluctuation. The expansive soil that is prevalent in the Central Section EIS Study Area may result in the need for deep foundations.

The Central Section EIS Study Area is located west of the Balcones Escarpment, and the relatively low slope topography means that the potential effect of landslides within the EIS Study Area in the Central Section would be negligible.

3.12.4.4.2 Mineral Resources

Sand and gravel, crushed stone, clay, and limestone mining operations were identified within the Central Section EIS Study Area. Effects on mineral resources would be negligible because of the lack of active mines currently present within the route alternatives and the abundant availability of these resources.

Limestone (for cement), sand, and gravel would be required for construction. Because the reserves for these commodities are substantial and would not be significantly depleted by the alternative, construction effects on the minerals would be negligible.

3.12.4.5 Southern Section: San Antonio to South Texas

3.12.4.5.1 Geology- and Soil-Related Hazards

Effects in the EIS Study Area for the Southern Section would be negligible for geologic and topographic resources compared with the No Build Alternative because disturbances would be limited to surface elevations, and excavation and grading would be minimal.

Earthquakes are likely to occur in the vicinity of the EIS Study Area; however, the potential for damage to the Program from earthquakes would be negligible because of the potential earthquake magnitudes being smaller than 5.0. There are no active faults crossing the EIS Study Area, and therefore the potential for ground surface rupture would be negligible in the Southern Section.

The construction and operational effect of expansive clays would be moderate, based on the ability to mitigate the expansive clay through in-place treatment or excavation and replacement with suitable foundation materials.

The Southern Section EIS Study Area is not underlain by bedrock that is conducive to karst development. As shown on Figure 3.12-2, karst hazards are not identified to be of concern in the Southern Section EIS Study Area.

The potential effect of landslides on the route alternatives in the Southern Section would be negligible because the terrain is gently sloped.

3.12.4.5.2 Mineral Resources

No active non-fuel mining operations were identified within the South Section EIS Study Area. Oil and gas resources exist deep below the Southern Section EIS Study Area. Effects on mineral resources would be negligible because of the lack of active mines currently present within the Southern Section, and the deep oil and gas resources would not be affected by surface infrastructure.

3.12.4.6 Summary of Potential Effects

Table 3.12-1 presents the potential intensity of effects from geologic hazards during the construction and operational phases after engineering standards are applied during the final engineering phase. None of the geologic conditions present a substantial effect for any of the alternatives. The table also reflects the potential intensity of effects on inhibiting access to and use of mineral resources due to the implementation of alternatives. Commitment of nonrenewable and irretrievable resources is addressed in Section 3.22.

Table 3.12-1: Summary of Geology and Soil Effects

Section	Alternative[a]	Geologic Risk Hazard	Mineral Resources
		Potential Intensity of Effects (Negligible, Moderate, Substantial)[b]	Potential Intensity of Effects (Negligible, Moderate, Substantial)
No Build Alternative[c]		None	No Effect
Northern	N4A CONV	Moderate	Negligible
Central	C4A HrSR	Moderate	Negligible
	C4A HSR	Moderate	Negligible
	C4B HrSR	Moderate	Negligible
	C4B HSR	Moderate	Negligible
Southern	S4 HrSR	Moderate	Negligible
	S6 HrSR	Moderate	Negligible
	S6 HSR	Moderate	Negligible

[a] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail
[b] The most intense effect for each alternative is presented in the table. However, alternatives may include additional, less intense effects depending on specific geologic hazards.
[c] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

3.12.5 Avoidance, Minimization, and Mitigation Strategies

Effects described for geologic- and soil-related hazards would be considered negligible to moderate because they can be avoided or minimized through design practices that address existing geologic and soil conditions. Implementation of engineering standards would be in accordance with local requirements or industry standards, including the International Building Code. Erosion and sediment control plans will be prepared and implemented at the project level. The loss of recoverable minerals would be negligible for all route alternatives. At the project-level NEPA evaluation, further review of minerals will consider design avoidance strategies.

3.12.6 Subsequent Analysis

During the project-level NEPA evaluation, review will include site-specific subsurface investigations, in addition to information from published maps documenting regional characteristics. Characteristics, such as bearing strength, settlement potential, shrink-swell characteristics, and soil corrosivity, require laboratory testing and analyses to evaluate potential impacts on proposed structures. Subsequent analyses would include the following:

- Site geotechnical investigations to determine site-specific underlying geologic and soil conditions
- Coordination with the Oklahoma Department of Mines and the Texas Commission on Environmental Quality for details regarding mines within the project vicinity.

3.13 Aesthetic and Visual Resources

This section provides an overview of the existing aesthetic and visual conditions of the environmental impact statement (EIS) Study Area and describes a preliminary assessment of the potential visual and aesthetic effects of the alternatives on sensitive viewers. Preliminary avoidance, minimization, and mitigation strategies and further analysis needed in the project-level National Environmental Policy Act (NEPA) process are identified at the end of this section. The introduction to Chapter 3 describes the EIS Study Area and use of terms such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.13.1 Laws, Regulations, and Orders

3.13.1.1 Federal

NEPA, 42 United States Code (U.S.C.) Section 4321. NEPA requires that all major actions sponsored, funded, permitted, or approved by federal agencies undergo planning so that environmental considerations are given due weight in decision-making. There are no applicable laws, regulations, or executive orders regarding the specific assessment of aesthetic and visual resources. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.13.2 Methodology

This assessment is based on the Federal Highway Administration (FHWA) visual impact assessment methodology. FRA does not have specific visual assessment guidelines, and defers to the FHWA guidance for visual impact assessment. The FHWA methodology has been successfully applied by FHWA and state highway departments on a variety of transportation projects (such as rail), to evaluate impacts from these projects on visual and aesthetic resources. The FHWA methodology, published in the *Visual Impact Assessment for Highway Projects,* provides a systematic and objective approach to evaluating the visual impacts that would potentially result from implementation of proposed transportation projects (FHWA 1988). There are several steps in the FHWA approach that are common to all visual impact assessments and are used in this service-level assessment. They are as follows:

1. Determine the areas from which a project could be seen (a project's "area of visual influence").
2. Determine the existing landscape character and visual quality of the areas in which a proposed project would be located.
3. Identify the types and locations of sensitive viewers who might view changes caused by a proposed project.
4. Determine the change (enhancement or degradation) to existing landscape character and visual quality from a proposed project after application of avoidance and minimization measures.

The area of visual influence through which the alternatives would extend and potentially be seen by sensitive viewers was determined to consist of a corridor within the 500-foot EIS Study Area. Landscape character is an objective assessment of a landscape view that is composed of natural and human-built elements. Visual quality is determined by assessing the composition of the character defining features of a viewed landscape in terms of how vivid (or memorable) the viewed landscape is, how intact (the level of disturbance or visual consistency) it is, and how unified (is it harmonious or chaotic?) the landscape is. The FHWA methodology assigns visual quality ratings that range from 1 (low) to 7 (high). The Aesthetics and Visual Resources Technical Study (see Appendix I) describes these concepts in detail.

Describing the existing conditions of a project of this scale relied heavily on qualitative descriptions that were obtained from several sources. To describe the existing conditions of the alternatives, the following sources were consulted:

- 3-D Google map applications
- Geographic Information System (GIS) mapping data, which include aerial photographs
- Knowledge of the Oklahoma and Texas environment and landscape types

After consulting the sources identified above, general descriptions of the landscape setting of the areas through which the alternatives would extend were developed and summarized in Section 3.13.3, Affected Environment.

The FHWA visual impact assessment methodology recognizes that a project would be seen by a variety of people (or viewer types) with different sensitivities to changes in the landscape that they view. The degree of sensitivity (high, medium, or low) to changes in the viewed landscape varies among viewer types and affects viewer response to changes associated with a project. Viewer sensitivity is strongly influenced by a viewer's awareness of his or her surroundings, the activities they are engaged in (which may distract attention away from the nearby landscape), and the amount of time spent looking at a view (viewer duration). Table 3.13-1 identifies typical visual sensitivity categories (high, medium, low) that are used in this assessment and describes viewer types for each sensitivity category.

Table 3.13-1: Typical Viewer Sensitivity Categories and Types

Sensitive Category	Viewer Types	Justification for Categorization
High	Resident, park user, tourist, sightseeing	Viewers who seek scenic areas; surroundings are likely to influence their location choice and affect their overall experience of the place and/or their quality of life.
Medium	Office worker, business or retail customers, students, faculty, members of religious congregations	Viewers who expect a somewhat pleasant visual setting for the establishments they frequent; however, their focus is on daily activities other than viewing the landscape.
Low	Commuters, industrial workers	Viewers who cannot be, or are not, attentive to the landscape because they may be focusing on other activities or are indifferent to views.

A purpose of the assessment was to identify sensitive viewer types for the alternatives to determine the likely effects of the alternatives on sensitive viewers. Viewers with high viewer sensitivity would likely be most affected by changes to the viewed landscape as a result of the project. This assessment focused on residents but also considered other viewers with high sensitivity, such as park users and visitors to cemeteries. Viewers of all types who view a landscape that currently contains major transportation infrastructure, such as railroads or major highways, would be less sensitive to changes to the viewed landscape caused by a proposed project compared with viewers who do not currently view railroads or major highway. The four types of viewers with high viewer sensitivity that are found in the EIS Study Area include:

- Urban Residential: Densely populated areas found in urban locations. These include multifamily buildings or dense groupings of single-family dwellings. In the areas of visual influence through which the alternatives would extend, many of the urban residential areas would be located near, or along, existing railroads or major highways that extend through urban areas.
- Suburban Residential: Less dense than urban residential areas and generally composed of single-family dwellings. They are generally found in suburban communities or residential areas of small towns. Similar to the urban residential area, many of the suburban residential areas, particularly in small to mid-sized towns that were built along railroad lines, are also located in the vicinity of major highways.
- Rural Residential: Isolated rural residences, including clusters or concentrations of rural residences. Because there are so many small, scattered areas containing clusters of rural residences, selected areas were identified and used to represent potential effects on rural residential areas.
- Other Areas with Sensitive Viewers: In addition to residential viewers, people engaged in activities of recreation and/or visiting cultural and/or historic sites, as well as cemeteries, are concerned with the appearance of the landscape surrounding the locations in which they are participating in activities. These people are also considered sensitive viewers.

The GIS data used in the assessment included aerial photographs along with 3-D Google map applications to determine where along the alternatives the four sensitive viewer types were located. GIS markers were placed at the beginning and end of sections, including sensitive viewer types. In these locations the linear distances of the viewer types were measured and aggregated for each alternative.

Although the section lengths contain various types of sensitive viewers, they are not precise due to the limitations of GIS aerial photographs. The quantified data are useful for comparing an approximation of how many and what kind of sensitive viewers are found for the alternatives. These data were also used for estimating and comparing potential effects to sensitive viewers along each alternative. It should also be noted that although actual numbers of residents in the areas were not obtained, the relative density of residences per mile was assumed by sensitive viewer type. For example, urban residential areas would contain more residents than suburban residential areas, which would in turn have more residents than areas classified as rural residential.

The determination of the intensity of the effects that the various alternatives would have on sensitive viewers compared with the No Build Alternative (Section 3.13.4.2) considered the likely relative change to the visual quality of landscapes that would be seen by sensitive viewers. Although the visual quality of areas along the alternatives was not determined as part of this assessment, it is assumed that the general visual quality is average, with occurrences of high visual quality and low visual quality areas. To determine the intensity of the effects on sensitive viewers, the following factors were considered:

- **Existing landscape setting:** Primary considerations included whether the alternative would closely parallel existing transportation infrastructure such as existing railroads or major highways, extend through areas outside existing transportation corridors, or pass through urban, suburban, or rural areas.
- **Anticipated changes to the existing viewed landscape by service type:** Key physical differentiators were reviewed between conventional rail, higher-speed rail, and high-speed rail that would be seen in the viewed landscape.
- **Consideration of the degree of viewer sensitivity to infrastructure-induced changes to the viewed landscape:** This factor is based on the categories of urban, suburban, and rural residents, and other sensitive viewers.

For this assessment, the intensity of effect is classified as negligible, moderate, or substantial, with detailed definitions provided as follows:

- Negligible: A negligible effect would have a low potential to change existing visual quality, regardless of viewer sensitivity.
- Moderate: A moderate effect would occur when there would likely be a reduction in visual quality so that sensitive viewers would notice the change, but not enough of a change to be considered a substantial effect.
- Substantial: A substantial effect represents the high likelihood that the alternative would lower the existing visual quality of the landscape viewed by nearby sensitive viewers. A substantial effect would occur where there would likely be a reduction of general visual quality from high to average or from average to low.

Table 3.13-2 provides an overview by speed convention of the level of potential influence the alternatives would likely have on the visual quality of views seen by nearby viewers. The overview provided by Table 3.13-2 assisted in determining the intensity of effect on sensitive viewers from higher-speed rail and high-speed rail alternatives that are discussed and analyzed in Section 3.13.4, Environmental Consequences. Because the entire length of Alternative N4A would essentially use existing railroad rights-of-way, the required modifications would result in relatively minor physical changes to the landscape and its contributing features. In addition, because these changes are already present in the views of nearby sensitive viewers they would likely be minor or unnoticeable; therefore, Alternative N4A is not included in Table 3.13-2.

Table 3.13-2: Likelihood That Higher-Speed and High-Speed Rail Alignment Types Would Affect the Visual Quality of Views Seen by Sensitive Viewers

Sensitive Viewer Type	Alignment Type		
	New Rail Alignment Within or Next to Existing Rail Corridor	New Rail Next to Major Highway	New Rail Alignment Outside of Existing Transportation Corridors
Higher-Speed Rail Alternatives			
Urban Residential	Low	Low	High
Suburban Residential	Low	Low	High
Rural Residential	Low	Low	Medium
Other Areas with Sensitive Viewers	Low	Low	Medium
High-Speed Rail Alternatives			
Urban Residential	Medium	Medium	High
Suburban Residential	Medium	Medium	High
Rural Residential	Medium	Medium	High
Other Areas with Sensitive Viewers	Medium	Medium	High

3.13.3 Affected Environment

3.13.3.1 Overview

The following sections provide a generalized description of the landscape and aesthetic environment within the EIS Study Area for the alternatives in the three geographic sections. Due to the scale and variety of environments evaluated in this service-level EIS, a determination of the high, average, or low visual quality was not made. It can be assumed that the visual quality of most of the areas the build alternatives would pass through would be average, which is the most common category of visual quality. It can also be assumed that there would be areas of both high and low visual quality along the alternatives, although these areas were not identified as part of this service-level assessment.

3.13.3.2 Northern Section: Oklahoma City to Dallas and Fort Worth

The northern portion of this section is in southern Oklahoma in an area of gently rolling topography. Between Edmond and Norman, Oklahoma, Alternative N4A would follow the BNSF rail corridor as it travels through heavily urbanized areas. South of Purcell and Lexington, the landscape is rural and composed of rolling hills covered with forests and dispersed areas of field and row crops, and small communities. Just north of Pauls Valley, the BNSF corridor starts to parallel the Washita River, and extends in a flat valley along the river and through the Arbuckle Mountains. Much of this area is devoted to agriculture, but includes forested areas and a number of small communities. South of the Arbuckle Mountains the BNSF corridor extends across a rolling, mostly rural landscape and through a large urbanized area near Ardmore.

After crossing the Red River into Texas, the BNSF corridor passes through a flat to rolling rural landscape containing a series of widely separated communities. As the BNSF corridor leaves Krum it enters urbanized areas on its way to the Fort Worth Intermodal Transportation Center (ITC). From the Fort Worth ITC east to Dallas Union Station (DUS), Alternative N4A would follow the Trinity Railway Express (TRE) corridor through a heavily urbanized, flat landscape.

3.13.3.3 Central Section: Dallas and Fort Worth to San Antonio

All three Central Section alternatives would provide access between Fort Worth and Dallas and south to Austin and San Antonio. The combinations of routes that would provide access to these four cities and areas in between them would differ by alternative.

3.13.3.3.1 Alternative C4A

From the Fort Worth ITC east to the DUS, and north via a spur to the Dallas/Fort Worth International Airport, Alternative C4A would pass through urbanized areas composed of residential, commercial, industrial, airport related, and vacant lands. From the DUS south to Waxahachie, Alternative C4A would extend along a BNSF corridor through areas that are largely urbanized and contain industrial areas, lower-density suburban residential areas, and the centers of established communities (including residential neighborhoods). South of Waxahachie, the alternative would leave the BNSF corridor and urbanized areas and extend along a new rail alignment. The route would generally parallel Interstate Highway (IH)-35 to Hillsboro as it passed through largely rural areas composed of agricultural lands and scattered communities.

From Hillsboro to San Antonio, the alternative would follow IH-35 as it passed near or through a number of small communities with residential areas, as well as Waco and Temple. After passing through downtown Waco, the alternative would cross the Brazos River and continue through flat agricultural lands to Temple. After departing Temple, the alternative would pass near Granger and through Taylor. Before entering Austin, the alternative would pass rural residential areas and cross the Colorado River. It would connect with, and extend through, the Austin-Bergstrom International Airport. After departing the airport, the alternative would extend along a new rail alignment through a largely agricultural landscape containing scattered rural residential areas to the western outskirts of Lockhart. From Lockhart, the alternative would cross the San Marcos River, extend between New Braunfels and Seguin, pass over the Guadalupe River, and continue southwest towards San Antonio. At Shertz, Alternative C4A would enter the San Antonio urbanized area and pass next to residential and commercial developments on its way to the San Antonio International Airport.

3.13.3.3.2 Alternative C4B

From the Fort Worth ITC, Alternative C4B would head east along the TRE through a flat area that is primarily industrial and would cross over to the median of IH-30 and pass through heavily developed residential and commercial areas. From the DUS, Alternative C4B would head south and west within the UPRR corridor through industrial areas and several residential neighborhoods. The alignment would intersect IH-30 and continue in the median of the freeway to the State Highway (SH)-360 (the Angus G. Wynne Jr. Freeway) departure point.

From the SH-360 departure point, Alternative C4B would travel south through rolling terrain and residential areas past Joe Pool Lake to U.S. Highway (US)-287. South of US-287, Alternative C4B would leave the SH-360 corridor and continue south along a new rail alignment to just north of Hillsboro, where it would connect with the IH-35 corridor and follow the same route to San Antonio described above for Alternative C4A.

3.13.3.3.3 Alternative C4C

Alternative C4C would form a loop from Hillsboro where it would head north to Fort Worth, east to Dallas, and south back to Hillsboro. The portion of the loop between Fort Worth and Dallas and south from Dallas to Hillsboro would be the same as the route that would be used for Alternative C4A, described above. The portion of the alternative from Fort Worth to Hillsboro is unique and is described below.

From the Fort Worth ITC, Alternative C4C would head south through urbanized Fort Worth along an existing BNSF rail corridor and connect with a UPRR corridor. The northern part of this alternative would pass a mixture of land uses including industrial, commercial, and urban residential neighborhoods. Between the IH-820 loop and the town of Burleson, Alternative C4C would pass near a series of residential subdivisions and open areas, including parks. From Burleson south to Hillsboro, Alternative C4C would extend through generally flat agricultural lands and small communities such as Alvarado, Grandview, and Itasca that contain residential areas before passing through Hillsboro and traveling to San Antonio via the route described above for Alternative C4A.

3.13.3.4 Southern Section: San Antonio to South Texas

Both of the route alternatives in the Southern Section would begin in San Antonio, but would take different routes to the cities located at the alternatives terminus.

3.13.3.4.1 Alternative S4

Alternative S4 would follow the UPRR corridor southeast through San Antonio to IH-37 while traveling through a mix of land uses that include industrial, commercial, and numerous residential areas. The UPRR corridor the alternative would follow generally parallels IH-37/US-281 through the Lipan Hills to north of the town of Three Rivers. At Three Rivers it would depart the UPRR corridor and extend via a new rail alignment east of US-281 to the town of Alice. The portion of the route between the urbanized fringes of San Antonio and Alice would extend through a mixture of agriculture, undeveloped areas, and lands that have received extensive energy exploration and development. This area is generally sparsely populated, but isolated rural residences and clusters of rural residences are found on the outskirts of towns like Leming and Pleasanton.

From Alice, Alternative S4 has legs that would head in three different directions. The southern leg would pass isolated rural residences as well as clusters of rural residences south of Alice, before extending through a series of oil fields where exploration activities and production are evident. It would parallel US-281 through the towns of Fremont and Falfurrias and would depart US-281 north of Encino. From this point, the alternative would extend south through flat sparsely populated areas to the Rio Grande Valley and on to McAllen, where it would pass near a number of suburban and urban residential areas. From McAllen, Alternative S4 would head east through the Rio Grande Valley along an existing rail corridor to Harlingen. This portion of Alternative S4 would pass through largely developed areas that include residential areas and a number of small towns.

The western leg would leave Alice and follow the Kansas City Southern (KCS) railroad corridor past scattered residential areas before traveling through the town of San Diego. From San Diego, Alternative S4 would extend towards Laredo along a new rail alignment that would traverse a series of oil fields and sparsely populated areas. As the alternative would approach Laredo, it would pass residential areas and Casa Blanca Lake before ending near Laredo International Airport.

The eastern leg would extend east along the KCS railroad corridor through flat agricultural lands and near several small towns, such as Agua Dulce, Banquete, and Robstown. Alternative S4 would pass isolated rural residences, clusters of rural residences, and suburban residential areas before terminating at Corpus Christi International Airport.

3.13.3.4.2 Alternative S6

From San Antonio, Alternative S6 (higher-speed and high-speed) would follow the UPRR corridor southwest past industrial lands and scattered residential areas. It would pass under the IH-410 loop and travel to the eastern edge of the Von Ormy Oil Field. The alternative would depart the UPRR corridor in the oil field and continue southwest between IH-35 through unpopulated areas that are undeveloped and/or have received extensive energy exploration. Alternative S6 would then pass the outskirts of small towns such as Lytle, Devine, and Pearsall, where it would pass isolated rural residences and clusters of rural residences. The alternative would pass over features such as the Nueces River and US-83 before terminating at the Mexico border.

3.13.3.5 Existing Sensitive Viewers Near the Alternatives

To assess potential visual and aesthetic effects, it was necessary to establish where sensitive viewers were located along the alignment types associated with the alternatives. Table 3.13-3 identifies existing conditions found along the alignments type alternatives in terms of miles of existing sensitive viewers by type. This table is not intended to assess effects of the alternatives on sensitive viewers (Table 3.13-4 in Section 3.13.4.6 summarizes the effects of the alternatives on sensitive viewers). While actual design development may change the detail of the final alignments, for this assessment, higher-speed rail and high-speed rail alternatives that pass through the same aesthetic and visual resource study area were assumed to pass by the same existing sensitive viewers identified in Table 3.13-3.

Table 3.13-3: Miles of Existing Sensitive Viewer Types Adjacent to Each Alternative

Viewer Types	Alignment Type (miles)			Total Miles Near Sensitive Viewers
	Existing Rail Corridor	New Rail Alignment	New Rail Alignment Next to Major Highway	
Alternative N4A				
Urban Residential	3	1	1	5
Suburban Residential	22	1	1	24
Rural residential	10	1	2	13
Other Areas with Sensitive Viewers	6	0	1	7
Total Miles Near Sensitive Viewers	**41**	**3**	**5**	**49**
Alternative C4A				
Urban Residential	2	0	1	3
Suburban Residential	16	1	4	21
Rural Residential	3	8	2	13
Other Areas with Sensitive Viewers	6	2	2	10
Total Miles Near Sensitive Viewers	**27**	**11**	**9**	**47**

Viewer Types	Alignment Type (miles)			Total Miles Near Sensitive Viewers
	Existing Rail Corridor	New Rail Alignment	New Rail Alignment Next to Major Highway	
Alternative C4B				
Urban Residential	2	1	9	12
Suburban Residential	10	1	7	18
Rural Residential	3	10	0	13
Other Areas with Sensitive Viewers	3	1	2	6
Total Miles Near Sensitive Viewers	**18**	**13**	**18**	**49**
Alternative C4C				
Urban Residential	5	0	1	6
Suburban Residential	25	1	4	30
Rural Residential	5	8	2	15
Other Areas with Sensitive Viewers	7	2	2	11
Total Miles Near Sensitive Viewers	**42**	**11**	**9**	**62**
Alternative S4				
Urban Residential	5	1	0	6
Suburban Residential	16	7	10	33
Rural Residential	3	5	2	10
Other Areas with Sensitive Viewers	0	0	1	1
Total Miles Near Sensitive Viewers	**24**	**13**	**13**	**50**
Alternative S6				
Urban Residential	0	0	0	0

Viewer Types	Alignment Type (miles)			Total Miles Near Sensitive Viewers
	Existing Rail Corridor	New Rail Alignment	New Rail Alignment Next to Major Highway	
Suburban Residential	0	2	0	2
Rural Residential	0	16	0	16
Other Areas with Sensitive Viewers	0	0	0	0
Total Miles Near Sensitive Viewers	**0**	**18**	**0**	**18**

Source: The data source for the information in this table was from the GIS data developed internally by CH2M HILL.

3.13.4 Environmental Consequences

3.13.4.1 Overview

This section assesses whether or not the alternatives evaluated in this EIS would lower or potentially enhance the visual quality of the existing environment seen by sensitive viewers. Because conventional rail would use existing railroad rights-of-way in most places, it would introduce limited changes to existing aesthetic and visual conditions and visual quality. In areas where new tracks, double tracks, or roadway crossings might be needed, conventional rail could change the aesthetic and visual conditions of adjacent areas, but the likelihood of the changes reducing visual quality would be low.

Where higher-speed rail alternatives are proposed to be located within or next to existing rail or transportation corridors, the presence of the higher-speed tracks would not be out of character for a transportation corridor containing major infrastructure elements that are currently part of the viewed landscape. The presence of the higher-speed rail alternatives would likely not detract from the existing visual quality of views toward portions of the rail corridors that are already seen by nearby sensitive viewers.

Where higher-speed rail alignments would be constructed outside of existing transportation corridors, there would be a high potential to lower the visual quality of the areas they would pass through that are seen by sensitive viewers. Where new tracks (and support features such bridges and fencing) outside of existing transportation corridors would be constructed near sensitive viewers in densely populated areas containing urban and suburban residential viewers, it is assumed that they would potentially lower visual quality more than other areas, resulting in substantial effect to sensitive viewers. Although these potential effects could also be experienced by sensitive rural residential and other viewers (e.g., from parks), it is assumed that views of the new higher-speed rail alignments outside of existing transportation corridors would alter the viewed landscape to a lesser degree than in more densely populated areas and would likely produce fewer changes to visual quality. This is based upon a broad assessment of the rural areas where there are fewer viewers than in urban and suburban areas. A service-level review of rural residential areas along several alignments using GIS aerial maps indicted that existing vegetation and other outbuildings would frequently screen or partially screen views from residences toward the alignments.

High-speed rail alternatives are the least adaptable of the service types in terms of attempting to align them in ways that would reduce visual and aesthetic effects. This is because they require greater turning radii and more elevated structures to maintain grade-separations than higher-speed rail alignments. They also would produce more alteration of the landscape beyond existing rail corridors compared with the higher-speed rail alternatives. Therefore, when high-speed rail alternatives would extend into or near an existing rail or major highway corridor, the intensity of their effects on sensitive viewers would be assumed to be moderate, rather than the negligible intensity effects associated with higher-speed rail alternatives. New high-speed rail alternatives located outside of existing transportation corridors, including areas with rural residents and viewers from other sensitive areas located outside of existing transportation corridors, would alter the viewed landscape to a greater degree than higher-speed rail alternatives, and would likely be very noticeable to all sensitive viewer types.

3.13.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect visual resources.

3.13.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.13.4.3.1 Alternative N4A Conventional

Most of the 49 miles of Alternative N4A Conventional that would pass sensitive viewers would use existing railroad rights-of-way, as reflected in Table 3.13-3. Modifications that would be required along existing railroad rights-of-way would result in relatively minor physical changes to the landscape. These changes would likely be unnoticeable to sensitive viewers and would have negligible effects. In areas were new rail would be required next to sensitive viewers in urban and suburban areas, the alternative would produce approximately 2 miles of substantial effects. New rail next to areas containing scattered rural residences and areas with other sensitive viewers would produce moderate effects along approximately 1 mile of the alternative (see Table 3.13-4 in Section 3.13.4.6).

Effects of light and glare would be possible during night-time operation of the trains in areas where there is no existing transportation infrastructure, at stations and parking facilities, and at maintenance facility locations. Generally, the larger the infrastructure, the more potential there would be for light and glare effects. Therefore, because conventional rail would follow existing rail alignments used by trains (which includes light and glare produced by trains, Alternative N4A would have the least potential for producing effects from light and glare. Detailed analysis regarding the potential for these effects will be conducted during project-level analysis.

Construction activities that would disrupt the landscape and potentially affect sensitive viewers would be temporary and would likely include mobilization and ground preparation, including utility relocation and staging areas for storing materials and equipment. Staging and storage would be located on vacant land or within rights-of-way, and would likely be surrounded by fencing. Mechanized equipment, lights for evening work, material storage and delivery, and the removal of excavated material would be seen to varying degrees by sensitive viewers near the construction activities. The closer the construction location is to nearby sensitive viewers, the greater the likelihood that the viewers would find construction activities aesthetically and visually disruptive. Because construction activities would be experienced by the sensitive viewers affected by project operations, and because locations where construction-period activities would occur are not known at this time, this service-level evaluation does not differentiate between effects associated with construction and operation phases.

Based on the assessment conducted while taking into account the length of this alternative (49 miles that would pass sensitive viewers) and the context of potential effects (1 mile of moderate effects and 2 miles of substantial effects) the overall intensity of effects for Alternative N4A Conventional Rail would be negligible.

3.13.4.4 Central Section: Dallas and Fort Worth to San Antonio

3.13.4.4.1 Alternative C4A Higher-Speed Rail

Alternative C4A Higher-Speed Rail would pass approximately 47 miles of sensitive viewers and have substantial effects along approximately 1 mile of its route, moderate effects along 10 miles, and negligible effects along 36 miles (see Table 3.13-4 in Section 3.13.4.6). The 1 mile of substantial effects would be attributed to new rail alignments outside existing transportation corridors adjacent to scattered residential areas in or near Lancaster, Waco, Lorena, Bruceville-Eddy, Troy, and Temple. Approximately 10 miles of moderate effects would occur along new rail alignment in areas outside existing transportation corridors along segments in the vicinity of IH-35 between Dallas and Waxahachie, Waxahachie and Hillsboro, Hillsboro and Waco, Waco and Temple, Temple and Austin, and Austin and the outskirts of San Antonio near Selma. Moderate effects would also occur near other areas with sensitive viewers, in areas such as Harmon Field Park and the East Fork Trinity River in Fort Worth; sections of the Trinity River in Fort Worth and Dallas; Country View Golf Course and Bear Creek Nature Park south of Lancaster; Red Oak Valley Golf Club in Red Oak; Waxahachie City Cemetery and Rickards Park in Waxahachie; Lake Waxahachie; Lions Park and Greenwood Cemetery in Bellmead; Fort Fisher Park and First Street Cemetery in Waco; a park on S. 11th Street and W. Central Avenue in Temple; and Richard Moya Park in Del Valle.

The potential effects of light and glare described under Alternative N4A Conventional would be similar to the sections of this alternative that would require new alignments near sensitive viewers and who would also view the light and glare produced from passing trains. As described above, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for this alternative would disrupt more of the landscape and potentially temporarily affect more sensitive viewers than Alternative N4A Conventional. Therefore, the description of construction impacts would be greater than those identified for Alternative N4A Conventional due to the additional areas of new rail alignment.

Based on the assessment and considering the miles of this alternative (47 miles), along with the context of potential effects (10 miles of moderate and 1 mile of substantial effects) the overall intensity of effects for Alternative C4A Higher-Speed Rail would be moderate.

3.13.4.4.2 Alternative C4A High-Speed Rail

The alterations to the landscape that would be required with Alternative C4A High-Speed Rail would result in substantial effects on sensitive viewers along approximately 11 miles of the 47-miles of the route that would be near sensitive viewers and moderate effects along its remaining 36 miles (see Table 3.13-4 in Section 3.13.4.6). Substantial effects would occur where new rail alignments outside of existing transportation corridors would be required near approximately 1 mile of suburban residential areas and 8 miles near rural residences along segments of the route in, near, or between Lancaster, Waco, Lorena, Bruceville-Eddy, Troy, and Temple. Substantial effects on approximately 2 miles of areas where other sensitive viewers are located would occur in or near areas such as Harmon Field Park and the East Fork Trinity River in Fort Worth; sections of the Trinity River in Fort Worth and Dallas; Country View Golf Course and Bear Creek Nature Park south of Lancaster; Red Oak Valley Golf Club in Red Oak; Waxahachie City Cemetery and Rickards Park in Waxahachie; Lake Waxahachie; Lions Park and Greenwood Cemetery in Bellmead; Fort Fisher Park and First Street Cemetery in Waco; a park on S. 11th Street and W. Central Avenue in Temple; and Richard Moya Park in Del Valle. Moderate effects would occur where the alternative would be sited in or near existing rail corridors and major highways along the portion of Alternative C4A that would follow the TRE between Fort Worth and Dallas and along existing rail and highway corridors between Dallas and Waxahachie; within or near Hillsboro and San Antonio; and in communities between Hillsboro and San Antonio such as West, Waco, Lorena, Bruceville, Temple, and Taylor.

The effects of light and glare described under Alternative C4A Higher-Speed Rail would be similar to the sections of this alternative in areas that would require new alignments. This would be applicable in areas near sensitive viewers who would view the light and glare produced from passing trains. As discussed previously, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for this alternative, based on the requirement for a fully access-controlled and grade-separated alignment, would likely disrupt more of the landscape and temporarily affect more sensitive viewers than Alternative C4A Higher-Speed Rail. Based on the assessment and considering the length of this alternative (47 miles), along with the context of potential effects (36 miles of moderate and 11 miles of substantial effects), the overall intensity of effects for Alternative C4A High-Speed Rail would be substantial.

3.13.4.4.3 Alternative C4B Higher-Speed Rail

Alternative C4B Higher-Speed Rail would pass approximately 49 miles of areas containing sensitive viewers. Substantial effects would occur along approximately 2 miles of its route, moderate effects along 11 miles, and negligible effects along 36 miles, as provided in Table 3.13-4 in Section 3.13.4.6. The substantial effects would occur near urban and suburban residential areas where new rail alignment outside existing transportation corridors would be required along small segments of the route between Waco and San Antonio. Moderate effects would occur along a series of small rural residential areas near new rail alignments outside existing transportation corridors including rural residences between US-287 and Hillsboro, Hillsboro and Waco, Waco and Temple, Temple and Austin, and Austin and the outskirts of San Antonio near Selma. Moderate effects would also occur near several areas with other sensitive viewers.

The effects of light and glare described under Alternative C4A Higher-Speed Rail would be similar to the sections of this alternative in areas that would require new alignments in areas containing sensitive viewers who would view the light and glare produced from passing trains. This is particularly applicable to the new elevated alignment over IH-30 in Arlington. As discussed previously, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for this alternative would be similar to the temporary effects associated with Alternative C4A Higher-Speed Rail.

Based on the assessment conducted and evaluating the length of this alternative (49 miles near sensitive viewers), while also considering the context of potential effects (11 miles of moderate and 2 miles of substantial effects) the overall intensity of effects for Alternative C4B Higher-Speed Rail would be moderate.

3.13.4.4.4 Alternative C4B High-Speed Rail

This high-speed rail alternative would pass near approximately 49 miles of sensitive viewers. Substantial effects would occur along approximately 13 miles of the alternative and moderate effects along 36 miles. Substantial effects would occur along small segments of the route where new rail alignments outside existing transportation corridors would be required. These areas would include urban and suburban residential areas between Waco and San Antonio and rural residential areas between US-287 and Hillsboro, Hillsboro and Waco, Waco and Temple, Temple and Austin, and Austin and the outskirts of San Antonio near Selma. Moderate effects to urban and suburban residents would occur were the alternative would follow existing transportation corridors along IH-30 between Fort Worth and Dallas and along SH-360 between Arlington and US-287. Moderate effects on other sensitive viewers would occur along existing rail corridors between Hillsboro and San Antonio and along segments of the route in the vicinity of West, Waco, Lorena, Bruceville, Temple, Taylor, and San Antonio.

The effects of light and glare described under Alternative C4B Higher-Speed Rail would be similar for this alternative in areas that would require new alignments near sensitive viewers who would view the light and glare produced from passing trains. As discussed for the C4B Higher-Speed Rail alternative, the new elevated alignment over IH-30 in Arlington would be an additional and applicable feature. Also as discussed previously, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for this alternative, based on an access-controlled and grade-separated alignment, would likely disrupt more of the landscape and temporarily affect more sensitive viewers than Alternative C4B Higher-Speed Rail.

Drawing from the assessment conducted and length of this alternative (49 miles), along with the context of potential effects (36 miles of moderate and 13 miles of substantial effects), the overall intensity of effects for Alternative C4B High-Speed Rail would be substantial.

3.13.4.4.5 Alternative C4C Higher-Speed Rail

Alternative C4C Higher-Speed Rail would travel past approximately 62 miles of sensitive viewers. It would have substantial effects along approximately 1 mile of its route, moderate effects along 10 miles, and negligible effects along the remaining 51 miles. Substantial effects on urban and suburban residential areas would be found along small segments of the new rail alignment in or near Lancaster, Waco, Lorena, Bruceville-Eddy, Troy, and Temple. Moderate effects to rural residences and areas with other viewers would occur outside of existing transportation corridors in areas between US-287 and Hillsboro, Hillsboro and Waco, Waco and Temple, Temple and Austin, and Austin and the outskirts of San Antonio near Selma.

The effects of light and glare described under Alternative C4B Higher-Speed Rail would be similar for Alternative C4C Higher-Speed Rail in areas that would require new alignments near sensitive viewers who would view the light and glare produced from passing trains. As discussed in the previous alternatives, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for this alternative would be similar to the temporary effects associated with the C4A and C4B Higher-Speed Rail alternatives.

Drawing from the assessment conducted and considering the length of this alternative (62 miles near sensitive viewers), along with the context of potential effects (10 miles of moderate and 1 mile of substantial effects), the overall intensity of effects for Alternative C4C Higher-Speed Rail would be moderate.

3.13.4.4.6 Alternative C4C High-Speed Rail

This high-speed rail alternative would pass near approximately 62 miles of sensitive viewers. Alternative C4C High-Speed Rail would have substantial effects on the landscape seen by sensitive viewers along 11 miles of its route and moderate effects along 51 miles. Substantial effects would occur near areas requiring new rail alignments outside existing transportation corridors. Approximately 2 miles of the substantial effects would be adjacent to segments of suburban areas in or near Lancaster, Waco, Lorena, Bruceville-Eddy, Troy, and Temple, and 9 miles would be near a series of small rural residential areas and areas with other sensitive viewers between US-287 and Hillsboro, Hillsboro and Waco, Waco and Temple, Temple and Austin, and Austin and the outskirts of San Antonio near Selma. Moderate effects would occur along segments of existing transportation corridors between Fort Worth and Dallas, Dallas and Waxahachie, Waxahachie and Hillsboro, Hillsboro and San Antonio, and Fort Worth and Hillsboro.

The effects of light and glare described under Alternative C4C High-Speed Rail would be similar for Alternative C4C Higher-Speed Rail in areas that would require new alignments near sensitive viewers who would view the light and glare produced from passing trains. As discussed in the previous alternatives, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for this alternative, based on an access-controlled and grade-separated alignment, would likely disrupt more of the landscape and temporarily affect more sensitive viewers than the C4C Higher-Speed Rail alternative.

Drawing from the assessment conducted and considering the length of this alternative (62 miles near sensitive viewers), along with the context of potential effects (11 miles of substantial and 10 miles of moderate effects), the overall intensity of effects for Alternative C4C High-Speed Rail would be substantial.

3.13.4.5 Southern Section: San Antonio to South Texas

3.13.4.5.1 Alternative S4 Higher-Speed Rail

Alternative S4 Higher-Speed Rail would pass approximately 50 miles of sensitive viewers. Alternative S4 Higher-Speed Rail would have substantial effects along 8 miles of its route, moderate effects along 5 miles, and negligible effects along the remaining 37 miles. Substantial effects on suburban and urban residential areas would be found in and near communities such as Alice, Falfurrias, McAllen, Mercedes, and Harlingen. Moderate effects would occur along 5 miles of the alternative near a series of rural residential areas, most of which would be along the IH-37 corridor.

The effects of light and glare described under Alternative C4A Higher-Speed Rail would be similar to the sections of this alternative in areas that would require new alignments. This would be applicable in areas near sensitive viewers who would view the light and glare produced from passing trains. As discussed previously, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for this alternative would be similar to the temporary effects associated with the C4A Higher-Speed Rail alternative.

Drawing from the assessment conducted and considering the length of this alternative (50 miles near sensitive viewers), along with the context of potential effects (8 miles of substantial and 5 miles of moderate effects) the overall intensity of effects for Alternative S4 Higher-Speed Rail would be moderate.

3.13.4.5.2 Alternative S6 Higher-Speed Rail

Alternative S6 Higher-Speed Rail would pass near approximately 18 miles of areas with sensitive viewers. It would have substantial effects along approximately 2 miles of its route and moderate effects along 16 miles. The substantial effects would be on suburban residential areas in San Antonio. Moderate effects would occur along areas of new rail alignment that would pass rural residential areas between San Antonio and a location west of Dilley.

The effects of light and glare described under Alternative C4A Higher-Speed Rail would be similar to the sections of this alternative in areas that would require new alignments. This would be applicable in areas near sensitive viewers who would view the light and glare produced from passing trains. As discussed previously, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for this alternative would be similar to the temporary effects associated with Alternative C4A Higher-Speed Rail.

Drawing from the assessment conducted and considering sensitive viewers within the length of this alternative (18 miles near sensitive viewers), along with the context of potential effects (2 miles of substantial and 16 miles of moderate effects), the overall intensity of effects for Alternative S6 Higher-Speed Rail would be moderate.

3.13.4.5.3 Alternative S6 High-Speed Rail

This high-speed rail alternative would have substantial effects along 18 miles of its route, 2 miles of which would occur near suburban residential areas in southwest San Antonio where new rail line outside of existing transportation corridors would be required. The rest of the substantial effects would occur where new rail line outside of existing transportation corridors would pass residents in along the portion of the route south of San Antonio and west of Dilley.

The effects of light and glare described under Alternative C4A High-Speed Rail would be similar to the sections of this alternative in areas that would require new alignments. This would be applicable in areas near sensitive viewers who would view the light and glare produced from passing trains. As discussed previously, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for this alternative would be similar to the temporary effects associated with Alternative C4A Higher-Speed Rail. Construction activities for this alternative, based on an access-controlled and grade-separated alignment, would likely disrupt more of the landscape and temporarily affect more sensitive viewers than Alternative S6 Higher-Speed Rail

Drawing from the assessment conducted and considering the length of this alternative (18 miles near sensitive viewers), along with the context of potential effects (18 miles of substantial effects), the overall intensity of effects for Alternative S6 High-Speed Rail would be substantial.

3.13.4.6 Summary of Potential Effects

Each of the alternatives in the Northern, Central, and Southern sections of the project area contains areas where the alternatives would potentially have substantial effects on sensitive viewers. Most of the alternatives would produce considerably more moderate or negligible effects on sensitive viewers than substantial effects, with the exception of the high-speed rail alternatives in the Central and Southern sections.

Alternative N4A Conventional would potentially affect the fewest sensitive viewers because most of its alignment would follow existing rail corridors. For the Central and Southern section alternatives, the primary difference in potential effects is between the higher- and high-speed conventions and the corresponding features. Because high-speed rail alignments would be fully access-controlled, grade-separated, require greater turning radii, include more elevated structures, and more new rail alignment outside of existing transportation corridors than other service types, high-speed rail alternatives would have a greater potential to alter the landscape seen by sensitive viewers than other service-type alternatives. All of the high-speed rail alternatives would potentially have substantial effects on more miles of landscape seen by sensitive viewers than the higher-speed alternatives for the same route. The high-speed alternatives would also have more moderate effects on sensitive viewers than their corresponding higher-speed rail alternatives. Table 3.13-4 summarizes the intensity of the effects of the alternatives on sensitive viewers.

Table 3.13-4: Miles of Effects near Areas with Sensitive Viewers

Section	Alternative	Effect Category (miles)			Total Miles of Effects Near Sensitive Viewers	Intensity of Effect
		Negligible	Moderate	Substantial		
No Build Alternative[a]		0	0	0	0	
Northern	N4A CONV	46	1	2	49	Negligible
Central	C4A HrSR	36	10	1	47	Moderate
	C4A HSR	0	36	11	47	Substantial
	C4B HrSR	36	11	2	49	Moderate
	C4B HSR	0	36	13	49	Substantial
	C4C HrSR	51	10	1	62	Moderate
	C4C HSR	0	51	11	62	Substantial
Southern	S4 HrSR	36	5	8	50	Moderate
	S6 HrSR	0	16	2	18	Moderate
	S6 HSR	0	0	18	18	Substantial

[a] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

3.13.5 Avoidance, Minimization, and Mitigation Strategies

At the service level, detailed avoidance, minimization, and mitigation strategies are only presented and developed as proposed strategies and according to service type (conventional, higher-speed, or high-speed rail). The pursuit of avoidance and minimization of effects will be incorporated when feasible. If effects can't be avoided or minimized, mitigation strategies will be implemented.

The ability to minimize visual disruption during construction and from construction activities will include adherence to local jurisdiction's construction requirements. Additional construction minimization elements will include, but not be limited to, the following activities:

- Minimize pre-construction clearing.
- Limit the removal of buildings to those that would obstruct project components.
- When possible, preserve existing vegetation, particularly vegetation along the edge of construction areas that may help screen views.
- After construction, regrade areas disturbed by construction, staging, and storage to original contours and revegetate with plant material similar in replacement numbers and type.
- Avoid locating construction staging sites within immediate foreground distance (0 to 500 feet) of the sensitive viewer types.
- Minimize light disturbance during construction so that the lighting will be shielded and directed downward.

The potential mitigation strategies for operational effects will be adapted to the environment where the alternative would be located. The strategies will include use of specific design guidelines applicable to major design features, while also taking into account the surrounding visual quality features where they would be located. Application of the design guidelines to project elements will allow for integration into their settings. Additional strategies will include the use of appropriate materials, color, finishes, and vegetation evaluated and developed in conjunction with the local jurisdictions during final design.

Minimization strategies will include treatments that would vary by location but will be compatible with the context of adjacent areas. Treatments will include, but not be limited to, some or all of the following:

- Minimize visual disruption by screening elevated guideways adjacent to residential areas.
- Establish consultation with local jurisdictions to identify and integrate local design features into the key project features and future station designs through a collaborative, context-sensitive solutions approach.
- Where appropriate, plant trees along the edges of the rights-of-way in locations adjacent to residential areas.

- Incorporate fencing or screening in areas with new project features in proximity to sensitive viewers.
- Include full shielding of all new and replacement lighting features.
- Incorporate vegetation around structures, columns, and other components associated with the alternatives.
- Utilize complimentary and consistent colors, patterns, and textures on structures, columns, and noise barriers associated with the alternatives.
- Incorporate pavement treatments at future stations commensurate with context sensitive solutions.
- Utilize vegetation (to block access) and surface coatings on alternative components that would be resistant to graffiti and weather.
- Minimize and mitigate visual disruption from sound barriers by providing surface treatments (color and texture) along with the use of alternate materials (transparent mediums where appropriate).

3.13.6 Subsequent Analysis

More specific engineering data, including locations and components, related to alternatives will be evaluated at the project level. Therefore, the project-level evaluation will involve a more detailed assessment of the existing visual conditions of the landscape through which each alternative would pass. This will involve identifying landscape units that are composed of consistent visual characteristics so that the study area can be broken down into smaller, more understandable geographic areas. In addition, key observation points (KOPs) will be selected as representative views within each landscape unit to establish existing landscape character and visual quality. The use of KOPs will also provide the analysts and public reviewers the ability to visualize and assess the actual change to visual character and quality of that landscape unit, in terms of the composite change on the vividness, intactness, and unity of the landscape. The updated information will be based on the current project design features and will allow more specific identification of the locations of the various types of sensitive viewers discussed in this technical study, their orientation to the alignment if possible, and locations of other types of areas (such as historic areas, parks, and trails) that will be considered when identifying locations that might contain sensitive viewers. Also, the assessment will describe effects of construction, as well as light and glare.

3.14 Land Use and Prime Farmland

This section describes existing generalized land uses and areas of prime farmland within the environmental impact statement (EIS) Study Area and describes the potential effects on these resources. Avoidance, minimization, and mitigation strategies and further analyses needed in the project-level analysis are identified at the end of this section. The introduction to Chapter 3 describes the EIS Study Area and the use of terms, such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.14.1 Laws, Regulations, and Orders

Applicable laws, regulations, and orders pertaining to land use and farmland within the EIS Study Area are described below. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.14.1.1 Federal

- **Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (42 United States Code [U.S.C] 61).** The act provides for uniform and equitable treatment of persons displaced from their homes, businesses, or farms by federal and federally assisted programs and establishes uniform and equitable land acquisition policies for federal and federally assisted programs.
- **Farmland Protection Policy Act of 1981 (7 U.S.C. 73).** The act is intended to protect farmland and requires federal agencies to coordinate with the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) if their project or activities may irreversibly convert farmland either directly or indirectly to non-agricultural uses.
- **Agricultural Act of 2014 (also known as the Farm Bill) (House Resolution 2642; Public Law 113–79).** The act is the primary agricultural and food policy tool of the federal government and addresses both agriculture and other affairs under the purview of USDA. A key provision of the act is the creation of the Agricultural Conservation Easement Program. This program provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. There are options for both permanent easements and 30-year easements, and the program is managed by NRCS.

3.14.1.2 State

- **Texas Parks and Wildlife Code, Title 5, Subtitle E, Chapter 84.** The Texas Farm and Ranch Lands Conservation Program complements the Texas Parks and Wildlife Department's mission to conserve natural resources by protecting working lands from fragmentation and development. The program maintains and enhances the ecological and agricultural productivity of these lands through agricultural conservation easements. The purpose of the program is to enable and facilitate the purchase and donation of agricultural conservation easements.

3.14.1.3 Local

General plans for the counties and cities in the EIS Study Area contain goals, objectives, and policies related to land use, farmland, and socioeconomics and are typically found in the following elements: Land Use, Transportation and Circulation, Housing, Open Space and Conservation, Community Facilities and Services, and Economic Development. The general plans that are applicable to the project level will be reviewed as part of future project-level analyses to determine the consistency of the project with applicable goals, policies, and objectives.

3.14.2 Methodology

The following provides information on the service-level analysis for land use and farmland. Effects as a result of the route alternatives are characterized as negligible, moderate, or substantial compared with the No Build Alternative. For this analysis, these terms are defined as follows:

- Negligible intensity effects are those where the likelihood of conversion of existing land uses or farmland to transportation-related use would be limited and would be adjacent to existing transportation corridors.
- Moderate intensity effects are those where there is a likelihood of land use or farmland conversion, but conversion would be moderate if the existing land use is not associated with residential areas or prime farmland and is adjacent to existing transportation corridors.
- Substantial intensity effects are those that have a high likelihood of converting the land use of large areas or farmland areas that have low compatibility (see definition below) that would not be adjacent to existing transportation corridors.

3.14.2.1 Land Use

This service-level analysis for land use considers the existing land uses that could be converted to a transportation use as a result of new rights-of-way requirements, as well as the potential compatibility of the alternatives with the existing land uses. The evaluation is based on the sensitivity of various land uses to the changes that may occur with the introduction of conventional, higher-speed, or high-speed passenger rail service and associated infrastructure. For this service-level analysis, the potential for land use effects would be minimized if the existing land uses in the EIS Study Area are compatible with the alternative. Summarized below are the generalized potential compatibility ratings of existing land use types used for the service-level analysis:

- **Low Compatibility:** Program would require new rights-of-way, and existing land uses are residential (single-family and multi-family) both within urban areas and outside of urban areas where there are a large number of residences in proximity, open space, and pasture and cropland.
- **Medium Compatibility:** Rights-of-way acquisitions are adjacent to existing transportation corridors. Land uses are moderate-density developed areas that include commercial and

industrial with some residential and larger tracts of land consisting of grasslands (used for grazing).

- **High Compatibility:** Program is within existing transportation corridors and land uses are higher-density developed areas that include commercial and industrial with limited residential development, areas with single-family residential on larger lots, and larger tracts of undeveloped land not used for agricultural uses.

The consistency with regional and local plans and polices would be evaluated during the project-level analysis.

Although cities that could have stations have been identified, the land use analysis does not include evaluation related to indirect effects of transit-oriented development. The project-level analysis would address transit-oriented development.

3.14.2.2 Prime Farmland

Prime farmland, as defined by USDA, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. Because of the importance of areas defined as prime farmland for agricultural operations, the service-level analysis includes a review of the potential for effects. The service-level analysis for effects on farmland is qualitative and based on data from the NRCS website for those soils designated as prime farmland.

Geographic information system (GIS) soils data were collected for the 500-foot-wide EIS Study Area for each of the alternatives to determine the potential for effects on prime farmland soils that would result from conversion to a transportation use. The project-specific analysis will include a more detailed analysis of the quantitative effects on all farmland, including farmland of statewide importance, unique farmland, and farmland of local importance, as required by the Farmland Protection Policy Act of 1981.

The service-level analysis does not consider a parcel-by-parcel analysis and the potential for impacts since the details on the project are not known. The service-level analysis reviewed the locations where the alternatives do not follow existing transportation corridors using Google Earth and the study area boundaries to determine qualitatively the potential for bisection of farmland that could isolate areas of prime farmland. The project-specific analysis associated with that level of detail will consider parcel-specific effects and if areas would be isolated along with design or mitigation measures to avoid or minimize effects.

3.14.3 Affected Environment

3.14.3.1 Overview

The 850-mile corridor passes through all types of communities and land uses, and much of the corridor is located in areas outside of urbanized areas and within areas associated with agricultural uses.

3.14.3.2 Northern Section: Oklahoma City to Dallas and Fort Worth

Table 3.14-1 provides information on the acres of prime farmland within Alternative N4A and the percentage of the total area of the alternative that is designated as prime farmland.

Table 3.14-1: Prime Farmland within the Northern Section Alternative

Alternative	EIS Study Area (Acres)	Acres of Prime Farmland	Prime Farmland (%) of EIS Study Area
N4A	15,107	6,140	41%

3.14.3.2.1 Alternative N4A Conventional Rail

Alternative N4A would be located within the existing BNSF corridor. From Edmond to the southern end of Norman, Alternative N4A would follow the BNSF corridor as it extends through a heavily urbanized area. Much of the land use adjacent to the portions of the rail corridor in Edmond and Oklahoma City is industrial and commercial. South of Oklahoma City, residential areas are more frequently interspersed along the corridor between the more prevalent commercial and industrial areas. South of Norman, the intensity of development adjacent to the corridor decreases, and by Purcell, adjacent areas are primarily rural. These rural areas are composed of undeveloped grassland and forest areas as well as agricultural lands. In the Washita River Valley, Alternative N4A would extend through agricultural areas, forested areas, and small communities including Wayne, Paoli, Pauls Valley, Wynnewood, and Davis located at regular intervals along the rail corridor. Alternative N4A would pass through the larger city of Ardmore, but most of the areas along the rail corridor are rural, consisting of agricultural uses and forested areas. At the Red River, Alternative N4A would leave Oklahoma and enter Texas; here, most of the land use is agricultural. As Alternative N4A would continue south, it would pass through smaller communities such as Gainesville, Sanger, and Krum. Below Saginaw, the urbanized areas become more frequent and include more areas of single-family residential adjacent to the rail corridor. From the Tarrant County line southward to the Fort Worth Intermodal Transportation Center (ITC), Alternative N4A would pass through almost completely urbanized areas with most of the adjacent land associated with industrial and commercial uses. From the Fort Worth ITC to Dallas Union Station (DUS), Alternative N4A would pass through a heavily urbanized area with a mixture of uses, including single-family residential, commercial, industrial, and open spaces.

3.14.3.3 Central Section: Dallas and Fort Worth to San Antonio

Table 3.14-2 provides information on the acres of prime farmland within each alternative in the Central Section and the percentage of the total area of the alternative that is designated as prime farmland. Because there are no differences between higher- and high-speed rail alternatives outside of urbanized areas, they are combined in Table 3.14-2.

Table 3.14-2: Prime Farmland within the Central Section Alternatives

Alternative	EIS Study Area (Acres)	Acres of Prime Farmland	Prime Farmland (%) of EIS Study Area
C4A	20,128	10,440	52%
C4B	18,675	10,217	55%
C4C	23,714	12,435	52%

3.14.3.3.1 Alternative C4A Higher- and High-Speed Rail

From the Fort Worth ITC east to DUS, Alternative C4A would pass through urbanized areas with a mix of land uses that include residential, commercial, industrial, airport, and vacant lands. From DUS south to Waxahachie, Alternative C4A would travel along large portions of the BNSF corridor where adjacent land uses are primarily single-family residential in urbanized areas and agricultural uses outside of the urban areas. South of Waxahachie, Alternative C4A would largely parallel Interstate Highway (IH)-35 and travel through a rural landscape containing primarily agricultural uses to just north of Hillsboro.

South of Hillsboro, Alternative C4A would be within the existing railroad corridor to Waco. The adjacent land uses along this portion of the alternative are primarily agricultural. Alternative C4A would pass near smaller communities along this part of its route including Abbot and West before entering Waco. In Waco, Alternative C4A would pass through the downtown area, cross the Brazos River, and extend near a park, a cemetery, and the Baylor University campus. From Waco to Temple, Alternative C4A would travel through more agricultural areas before passing through the urban core of Temple next to mostly commercial and industrial lands. Between Temple and Austin, Alternative C4A would pass through agricultural areas and extend through communities such as Granger and Taylor. As Alternative C4A would approach the northeast side of Austin, it would pass more rural residential areas and cross the Colorado River several times before connecting with and extending through the Austin-Bergstrom International Airport. South of the airport, Alternative C4A would pass through parklands and continue along a new rail alignment through an agricultural landscape with scattered rural residential development. Alternative C4A would pass the western outskirts of Lockhart, cross the San Marcos River, extend between New Braunfels and Seguin, pass over the Guadalupe River, and continue southwest to San Antonio. At Shertzc, Alternative C4A would enter the San Antonio urbanized region and pass adjacent to areas of residential development. After crossing Texas Loop 1604 (Charles Anderson Loop), Alternative C4A would follow the UPRR corridor as it extends through heavily urbanized areas with a mix of residential, commercial and industrial land uses adjacent to the corridor. As it would extend toward downtown, Alternative C4A would pass several parks, the San Antonio International Airport, and residential and commercial areas. Parts of this section of the UPRR corridor parallel major roads. Alternative C4A would terminate approximately 1 mile west of downtown San Antonio.

3.14.3.3.2 Alternative C4B Higher- and High-Speed Rail

This alternative forms a "T"-shape route before connecting with the segment between Hillsboro and San Antonio. The upper, horizontal part of the T would begin in Fort Worth and continue east to Dallas. The bottom, vertical part of the T would begin between Arlington and Grand Prairie and continue south to Hillsboro where it would connect with the route between Hillsboro and San Antonio.

From the Fort Worth ITC, Alternative C4B would head east along the Trinity Railway Express (TRE) through undeveloped, residential, industrial, and commercial areas. It would continue east along the TRE through a flat area that is primarily industrial. At Haltom Road, the alternative would leave the TRE corridor and head southeast through largely undeveloped areas to IH-30. Alternative C4B would follow the median of IH-30 east to Arlington. The IH-30 corridor cuts through the heavily developed residential and commercial areas adjacent to it. Where IH-30 approaches State Highway (SH)-360 (the Angus G. Wynne Jr. Freeway) in Arlington, the alternative would make a right turn at its SH-360 departure point and head south toward Hillsboro.

From the east end of the top of the T in Dallas, Alternative C4B would head west from DUS toward SH-360 within the UPRR corridor. It would cross along and over the Trinity River on undeveloped lands that are part of Trinity Park. The alternative would continue westward in the UPRR corridor through industrial areas and several residential neighborhoods. Near West Westmoreland Road, the alternative would follow a rail spur that travels southwestwardly to IH-30, where the alternative would continue in the median of IH-30 to its SH-360 departure point, where it would make a left turn and head south toward Hillsboro.

From the SH-360 departure point, Alternative C4B would head south in the SH-360 corridor past Joe Pool Lake to U.S. Highway (US)-287. This portion of the alternative would travel through heavily developed areas, with residential areas separated by undeveloped lands.

South of US-287, the alternative would leave the SH-360 corridor and continue south along a new rail alignment to just north of Hillsboro, where it would connect with the IH-35 corridor and follow the same route to San Antonio described above for Alternative C4A.

3.14.3.3.3 Alternative C4C Higher- and High-Speed Rail

Alternative C4C would form a loop from Hillsboro that would head north to Fort Worth, east to Dallas, and south back to Hillsboro. The portion of the loop between Fort Worth and Dallas and south from Dallas to Hillsboro would be the same as the route used for Alternative C4A described previously. The portion of the alternative from Fort Worth to Hillsboro is described below.

From the Fort Worth ITC, Alternative C4C would head south through urbanized Fort Worth along an existing BNSF corridor and connect with a UPRR corridor. The northern part of this alternative would pass a mixture of land uses including industrial, commercial, and urban residential neighborhoods. Between the IH-820 loop and Burleson, Alternative C4C would follow the rail corridor past a series of residential subdivisions and open areas, including parks. From Burleson south to Hillsboro, the rail corridor route would pass through generally flat agricultural lands and small communities such as Alvarado, Grandview, and Itasca before passing through Hillsboro.

3.14.3.4 Southern Section: San Antonio to South Texas

Table 3.14-3 provides information on the acres of prime farmland within each alternative in the Southern Section and the percentage of the total area of the alternative that is designated as prime farmland. Because there are no differences between the higher- and high-speed rail alternatives outside of urbanized areas, they are combined in Table 3.14-3.

Table 3.14-3: Prime Farmland within the Southern Section Alternatives

Alternative	EIS Study Area (Acres)	Acres of Prime Farmland	Prime Farmland (%) of EIS Study Area
S4	25,191	11,814	47%
S6	8,666	4,810	56%

3.14.3.4.1 Alternative S4 Higher-Speed Rail

From San Antonio, Alternative S4 would follow the UPRR corridor southeast through a mix of land uses that include industrial, commercial, and residential areas. After passing under the IH-410 loop, the alternative would pass between Texas A&M University-San Antonio and Mitchell Lake and weave its way southwest of US-281 past Leming and Pleasanton to IH-37. The UPRR corridor generally follows IH-37/US-281 through the Lipan Hills north of Three Rivers. From near Three Rivers, the alternative would depart the UPRR corridor and travel via a new rail alignment east of US-281 to Alice. The area between San Antonio and Alice is a mixture of agricultural uses and undeveloped areas. There are also areas that have received extensive energy exploration and development. This area is generally rural with areas of rural residences found on the outskirts of towns like Leming and Pleasanton. From Alice, the alternative has legs that would head in three directions.

The Alternative S4 leg that continues south past Alice would first pass areas of rural residences before traveling through a series of oil fields where exploration activities and production are evident. It would parallel US-281 through Premont and Falfurrias and would depart US-281 north of Encino. From this point, the alternative would travel south through rural areas with limited development to the Rio Grande Valley and on to McAllen. The alternative would pass near a number of residential land uses of mostly single-family residences in the McAllen area. From McAllen, Alternative S4 would head east through the Rio Grande Valley along an existing rail corridor to Harlingen. This portion of the alternative would pass through urbanized developed areas that include residential areas and small towns such as Alamo, Weslaco, and Mercedes.

The Alternative S4 leg that heads west from Alice would follow the Kansas City Southern (KCS) corridor and pass rural residential areas before traveling through San Diego. From San Diego, the alternative would travel toward Laredo along a new rail alignment that would traverse rural areas with extensive undeveloped lands as well as areas of energy-related development. As the alternative approaches Laredo, it would pass residential areas and Casa Blanca Lake before ending near the Laredo International Airport.

The Alternative S4 leg that heads east from Alice would travel along the KCS corridor; it would pass through existing agricultural lands and near rural towns, such as Agua Dulce, Banquete, and Robstown. The alternative would pass areas of rural residences, clusters of rural residences, and suburban residential areas before terminating at the Corpus Christi International Airport.

3.14.3.4.2 Alternative S6 Higher- and High-Speed Rail

From San Antonio, Alternative S6 would follow the UPRR corridor southwest past industrial lands and rural residential areas. Alternative S6 would extend southeast of Kelly Air Force Base and through undeveloped, residential, commercial, and industrial lands to the IH-410 loop. It would pass under the IH-410 loop and extend to the eastern edge of the Von Ormy Oil Field. The alternative would depart the UPRR corridor in the oil field and continue southwest as it roughly parallels IH-35 through areas that are undeveloped grasslands and agriculture (including areas of irrigated fields). Between approximately Dilley and the terminus of Alternative S6, the alternative would pass areas where there has been energy exploration and development. The alternative would pass the outskirts of small towns such as Lytle, Devine, and Pearsall, as well as many isolated rural residences.

3.14.4 Environmental Consequences

3.14.4.1 Overview

Construction of the Program would result in short-term effects on adjacent land uses and areas used for agriculture with temporary increases in noise, vibration, and dust; temporary effects on vehicle and non-motorized (including pedestrian) access; and visual effects. Although land use or prime farmland acquisitions would occur as part of construction, because of the long-term effects and the permanent changes to existing land uses and prime farmland, the effects are addressed as part of operation.

Where the Program would require acquisitions of new rights-of-way outside of existing transportation rights-of-way, there would be a conversion of the existing land uses to a transportation use. For those areas with low compatibility, the potential effects would be substantial in intensity. For areas outside of the urbanized areas that require new rights-of-way and are adjacent to the existing transportation corridors, the compatibility would be medium. Because of this proximity to the existing transportation and because these areas are also not associated with denser residential land uses, the intensity effects would be moderate. The areas that are adjacent and related to agriculture or not adjacent to the transportation corridors would have a low to medium compatibility. Based on these types of existing land uses and their proximity, the intensity effects would be moderate. Because the alternatives would use existing transportation corridors through much of the urbanized areas, there would be a medium to high compatibility with existing land uses, and the corresponding intensity effects would be negligible.

Although this Study does not include the identification of specific station locations, new stations would be necessary to meet the higher-speed service-type needs in areas outside of existing transportation corridors. Station locations might vary among alternatives, but overall effects on land use are not anticipated to differ as a result of different types of service along the same alignment. However, potential new station locations could have indirect effects of potential new development in the station areas. The type and scale of the development would depend on the need, allowed uses in the proposed station areas, and specific plans for station area development. The project-specific land use analysis will include information on the benefits and potential effects associated with stations and the changes to the surrounding land uses.

For those areas that are designated as prime farmland and where new rights-of-way are required outside of the existing transportation corridors, there is the potential to convert prime farmland to non-agricultural use. The potential effects would be moderate if the conversion of the prime farmland is adjacent to transportation corridors and substantial if they are not adjacent and potentially bisecting areas of prime farmland. Because an area may be identified as prime farmland does not necessarily mean the area is currently being used for agricultural uses. The current use of those areas defined as prime farmland would be verified as part of the project-level analysis, which will also include information on other types of farmland and how those areas designated as farmland are currently used.

3.14.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect land use or farmland.

3.14.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.14.4.3.1 Alternative N4A Conventional Rail

Alternative N4A would have high compatibility with the land use because this alternative would primarily use the existing rail corridor. The adjacent land uses are primarily industrial uses in urban areas and single-family residential and agricultural outside of the urban areas. Where additional right-of-way would be required, it would be adjacent to existing transportation corridors and would not bisect areas of prime farmland. The intensity of the effect on land use and prime farmland would be negligible.

3.14.4.4 Central Section: Dallas and Fort Worth to San Antonio

In the Central Section, Alternative C4C has the highest potential for effects because of this alternative's longer length and the correspondingly greater potential to convert existing land uses to transportation use. Alternative C4B has the least potential for effects because of this alternative's shorter length.

3.14.4.4.1 Alternative C4A Higher-Speed Rail

Alternative C4A Higher-Speed Rail would use existing railroad corridors for portions of the alternative, but would also require new rights-of-way including areas that would be adjacent to the existing rights-of-way. The new transportation corridor for the alternative would convert existing land use and areas of prime farmland to transportation use, but effects related to the isolation of prime farmland would be minimized because in many locations the alternative is adjacent to existing transportation corridors. A large portion of the EIS Study Area is considered prime farmland (see Table 3.14-2), and there would be a high likelihood of effects. However, because most of the area to be acquired would be adjacent to existing transportation corridors, the land use compatibility would be medium and the intensity of the effect on land use and farmland would be moderate.

3.14.4.4.2 Alternative C4A High-Speed Rail

Alternative C4A High-Speed Rail would use some existing railroad corridors for portions of the alternative but would also require new rights-of-way, and the land use compatibility would be medium. Alternative C4A High-Speed Rail would convert prime farmland adjacent to existing transportation corridors to non-agricultural use. The intensity of the effect would be moderate for land use and farmland since large portions of the alternative would be adjacent to existing transportation corridors.

3.14.4.4.3 Alternative C4B Higher-Speed Rail

South of Hillsboro, this alternative would have the same effects on land use and farmland as those described above under Alternative C4A Higher-Speed Rail because the alignment would be the same from Hillsboro to San Antonio. Outside of these areas, the alternative would require new rights-of-way, and the new transportation corridor would convert existing land use and areas of prime farmland to a transportation-related use. Similar to Alternative C4A, a large portion of Alternative C4B has the potential to affect prime farmland (Table 3.14-2). Because most of the area to be acquired would not be adjacent to existing transportation corridors, the land use compatibility would be low and the intensity of the effect would be moderate for land use. The intensity of the effect would be substantial for prime farmland because the new corridor would not be adjacent to existing transportation corridors and could isolate areas of prime farmland.

3.14.4.4.4 Alternative C4B High-Speed Rail

Alternative C4B High-Speed Rail would have the same effects on land use as Alternative C4B Higher-Speed Rail because both alternatives would follow the same alignment and require new rights-of-way. The land use compatibility would be low, and the intensity of the effect would be moderate; in addition, the intensity would be substantial for prime farmland because of the potential to isolate areas.

3.14.4.4.5 Alternative C4C Higher-Speed Rail

Alternative C4C Higher-Speed Rail requires new transportation corridors to be constructed outside of existing transportation corridors and would require larger areas that would be converted. The land use compatibility would be medium, and the intensity of the effect would be substantial. The farmland effect would also be substantial because Alternative C4C has a greater potential to affect prime farmland compared to other alternatives in the Central Section (Table 3.14-2).

3.14.4.4.6 Alternative C4C High-Speed Rail

Alternative C4C High-Speed Rail would have the same effects on land use as Alternative C4C Higher-Speed Rail because both alternatives would follow the same alignment. The land use compatibility would be medium, and the intensity of the effects would be substantial. The intensity of the effects would also be substantial on prime farmland because the new corridor has the potential to affect a larger area overall given the alignment.

3.14.4.5 Southern Section: San Antonio to South Texas

Of the Southern Section alternatives, Alternative S4 has more potential for land use effects within the EIS Study Area than Alternative S6 because of the greater length of Alternative S4. However, because Alternative S6 would be entirely outside of existing transportation corridors, this factor has also been considered regarding the potential for land use effects.

3.14.4.5.1 Alternative S4 Higher-Speed Rail

Alternative S4 Higher-Speed Rail consists of both an alignment within existing railroad right-of-way and an alignment outside of existing transportation corridors. The higher-speed rail service could potentially share track with existing railroad. The new transportation corridor for the alternative would convert existing land use to a transportation-related use, and because most of the area to be acquired would not be adjacent to existing transportation corridors, the land use compatibility would be low and the intensity of the effect would be moderate. The new transportation corridor could convert areas considered prime farmland; nearly 50 percent of the Alternative S4 EIS Study Area is considered prime farmland (Table 3.14-3). Because the new corridor would not be adjacent to existing transportation corridors and could isolate areas of prime farmland, the intensity of the effect would be substantial.

3.14.4.5.2 Alternative S6 Higher-Speed Rail

Alternative S6 Higher-Speed Rail alignment would be entirely outside of existing transportation corridors. As a result, the land use compatibility would be low, and the intensity of the effect would be substantial. This alternative would include areas where prime farmland could be converted and potentially bisect farmland. Prime farmland is found within 56 percent of the EIS Study Area for Alternative S6, and while it has the highest percentage of prime farmland of all sections, it also has the smallest area that could be affected (Table 3.14-3). However, because of the potential to bisect farmlands, the intensity of the effects would be substantial.

3.14.4.5.3 Alternative S6 High-Speed Rail

Alternative S6 High-Speed Rail would have the same effects on land use as Alternative S6 Higher-Speed Rail because they would follow the same alignment. The land use compatibility would be low, and the intensity of the effects would be substantial for both land use and farmland.

3.14.4.6 Summary of Potential Effects

Each of the alternatives in the Northern, Central, and Southern sections would require the conversion of existing land uses to a transportation-related use within their respective portions of the larger EIS Study Area. The alternatives that include new alignments outside of existing transportation corridors (Alternatives C4B and S6) would have the greatest potential for effect.

Tables 3.14-4 and 3.14-5 list the potential intensity of effects by alternative for land use and for prime farmland, respectively.

Table 3.14-4: Summary of Land Use Effects by Alternative

Section	Alternative[a]	Context: Land Use Compatibility	Potential Intensity of Effects (Negligible, Moderate, or Substantial)
No Build Alternative		Not applicable	Not applicable
Northern	N4A CONV	High	Negligible
Central	C4A HrSR	Medium	Moderate
	C4A HSR	Medium	Moderate
	C4B HrSR	Low	Moderate
	C4B HSR	Low	Moderate
	C4C HrSR	Medium	Substantial
	C4C HSR	Medium	Substantial

Section	Alternative[a]	Context: Land Use Compatibility	Potential Intensity of Effects (Negligible, Moderate, or Substantial)
Southern	S4 HrSR	Low	Moderate
	S6 HSR	Low	Substantial
	S6 HrSR	Low	Substantial

[a] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

Table 3.14-5. Summary of Potential Farmland Effects by Alternative

Section	Alternative[a]	Context: Potential Prime Farmland Conversion and Bisection	Potential Intensity of Effects (Negligible, Moderate, or Substantial)
No Build Alternative		Not applicable	Not applicable
Northern	N4A CONV	Low	Negligible
Central	C4A HrSR	Medium	Moderate
	C4A HSR	Medium	Moderate
	C4B HrSR	Low	Substantial
	C4B HSR	Low	Substantial
	C4C HrSR	High	Substantial
	C4C HSR	High	Substantial
Southern	S4 HrSR	High	Substantial
	S6 HSR	High	Substantial
	S6 HrSR	High	Substantial

3.14.5 Avoidance, Minimization, and Mitigation Strategies

Avoidance and minimization of effects at the project level will be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies will be implemented. Specific mitigation measures for land use and farmland are not identified as part of the service-level analysis and will be identified during the project-level analysis when details on the alternatives and specific station locations and other facilities are known.

To avoid land use acquisitions, the project-level analysis will need to consider, to the extent feasible, alignment adjustments and design changes. In addition, analysis at the project level will consider relocation assistance in accordance with the Uniform Relocation and Real Property Acquisition Policies Act of 1970, as amended. Coordination with NRCS will also occur during the project-level analysis with regard to farmland and potential effects.

3.14.6 Subsequent Analysis

The project-level analysis will need to include a quantification of the land use acquisitions to determine the number of acres within each section. Coordination will be required with local jurisdictions to develop information on existing and future land uses that would be affected by the conversion of existing land uses to transportation use. The land use analysis will also require a review of applicable plans to determine the consistency of the project with goals, objectives, and policies, which would also require coordination with local jurisdictions. In addition, for those areas with a station, an analysis of potential transit-oriented development will be prepared.

GIS data will need to be collected, and information mapped on each alternative to quantify the types of farmland, identify areas where prime farmland could be bisected and result in additional potential effects, and quantify farmland acquisitions. If farmland effects cannot be avoided through design of the project, coordination with NRCS will be needed to address farmland effects and the completion of Form NRCS-CPA-106. The subsequent analysis will include a review of regional and local plans that address farmland and the information on preserving and protecting these areas. The project-level analysis will need to determine the potential effects from construction and quantify the area of farmland that will be temporarily affected, as well as determine the potential for farm animals to be adversely affected by construction and operation.

3.15 Socioeconomics and Environmental Justice

This section describes socioeconomics within the environmental impact statement (EIS) Study Area, which includes information on demographic characteristics such as population, housing, employment, and environmental justice populations. This section presents a preliminary assessment of the potential effects on these resources and information about the regional economy and the potential economic effects. Avoidance, minimization, and mitigation strategies and further analyses needed in the project-level analysis are identified at the end of this section. The introduction to Chapter 3 describes the EIS Study Area and use of terms, such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.15.1 Laws, Regulations, and Orders

Applicable laws, regulations, and orders include the following:

- **Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended**. This act provides for uniform and equitable treatment of persons displaced from their homes, businesses, or farms by federal and federally assisted programs and establishes uniform and equitable land acquisition policies for federal and federally assisted programs.
- **Title VI of the Civil Rights Act of 1964.** This act prohibits discrimination on the basis of race, color, national origin, age, sex, or disability in programs and activities receiving federal financial assistance.
- **Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.** Executive Order 12898 includes the requirement for federal agencies to ensure effective public participation and access to information. Consequently, a key component of compliance with Executive Order 12898 is outreach to potentially affected minority and/or low-income populations to discover issues of importance that may not otherwise be apparent.
- **U.S. Department of Transportation (USDOT) Order 5610.2(a)**. This order establishes the process that the Office of the Secretary and each Operating Administration within USDOT will use to incorporate environmental justice principles (as embodied in the Executive Order 12898) into existing programs, policies, and activities.
- **The Americans with Disabilities Act of 1990 (PL 110-325)**. This act provides for equal opportunity for individuals with disabilities to access public and private facilities.
- **Executive Order 13166: Improving Access to Services for Persons with Limited English Proficiency.** This order requires each federal agency to ensure that recipients of federal financial assistance provide meaningful access to their programs and activities by limited English proficiency (LEP) applicants and beneficiaries.

Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.15.2 Methodology

The service-level analysis of potential effects was conducted at the corridor level as opposed to a specific alignment of the alternative. The evaluation of effects is qualitative with information on potential construction and operation effects and the identification of potential mitigation strategies for construction or operation effects. The socioeconomic service-level analysis addresses demographic characteristics of population such as minority and low-income populations (environmental justice), housing, employment, and information on the regional economies.

Effects as a result of the route alternatives are characterized as negligible, moderate, or substantial compared to the No Build Alternative. For this analysis, these terms are defined as follows:

- Negligible intensity effects are those effects in which the likelihood of any potential for socioeconomic effects is low, including the potential for adverse effects on minority and/or low-income populations.
- Moderate intensity effects are those effects that would not result in socioeconomic effects and would not negatively affect the social and economic elements (i.e., result in new barriers to access or disrupt community interaction). The alternative would also have the potential to result in adverse effects that could cause disproportionate effects on minority and/or low-income populations.
- Substantial intensity effects are those effects that have a high likelihood of new barriers and effects that negatively affect community character. The alternative would have the potential to result in adverse effects that could cause disproportionate effects on minority and/or low-income populations.

3.15.2.1 Demographic Characteristics

Demographic characteristics include population, housing, and employment characteristics for the EIS Study Area. Population characteristics incorporate data from the U.S. Census Bureau and the states of Oklahoma and Texas to develop a general profile of the EIS Study Area compared with reference geographies including counties and states. Population characteristics data were collected on the forecasted population growth, and data on total population, minority population, low-income population, elderly, disabled, and LEP populations were collected for the EIS Study Area, as well as reference geographies. Data were collected to provide a general profile of housing, the employment force, and information on the regional economies.

The EIS Study Area for each of the alternatives encompasses a number of communities from small towns to large urban centers. Because of the large geographic area of the project corridors, information is not provided on the community character or the location of any community facilities (e.g., schools [public and private] and religious institutions). The project-level analysis will include detailed information on the communities and community facilities. Special focus will be placed on the communities in the vicinity of stations because of the potential effects the station could have on the area. The service-level analysis includes a qualitative analysis of the potential for the alternatives to bisect any of the communities and the potential for effects on those living in the communities, which would include noise and vibration, air quality, and access primarily as a result of proximity to the project.

3.15.2.2 Environmental Justice

The demographic characteristics also provide information on the minority, low-income, and LEP populations in the EIS Study Area. The service-level analysis includes a review of the potential for adverse effects on environmental justice populations, including evaluations related to acquisitions and displacements, transportation, air quality, noise and vibration, public health, water quality, hazardous materials, and cultural resources. However, because this service-level analysis does not entail specific analysis on the potential for adverse effects, it could not determine as to whether the Program would result in disproportionately high and adverse effects on minority and/or low-income populations. This is because the analysis for other resources does not include specific/quantitative effects or identification of any specific mitigation measures that would avoid or minimize effects on environmental justice populations. The project-level analysis will include a review of these resources which will be used to determine if the acquisitions will result in effects on those in the EIS Study Area.

For this analysis, a person is considered a minority if he or she meets the following criteria:

- Black – a person having origins in any of the black racial groups of Africa.
- American Indian or Alaska Native – a person having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition.
- Asian American – a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands.
- Hispanic – a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.

A person is considered to be low-income if his or her median household income is at or below the U.S. Department of Health and Human Services (DHHS) poverty guidelines. In 2016, for a four-person household with two related children, the poverty threshold is $24,300 (DHHS 2016).

3.15.2.3 Economics

The service-level analysis provides qualitative information on the potential economic effects of construction and operation of the project, including construction employment, property tax effects, and operational benefits. The analysis is based on the type of service associated with the alternative, so if the alternative is conventional rail within existing transportation corridors, the economic effects would not be the same as a high-speed rail alternative in new corridors with larger stations. The project-level analysis will include a quantitative analysis that includes the number of short-term benefits associated with construction along with the potential property tax losses associated with property acquisitions.

3.15.3 Public Involvement

The following section provides information on the public involvement activities that have been conducted to date for the project, including information on the targeted outreach to minority and low-income populations. A Public Involvement Plan (see Chapter 8) describes the efforts to engage the public and targeted stakeholders. The Public Involvement Plan includes goals of the public involvement process, which include meeting the regulatory requirements of Executive Order 12898 and Title VI by using information and outreach activities to solicit public and agency input, providing ample notification and access to public and agency involvement opportunities, and assessing public values and preferences and integrating those into study planning and documentation.

The Public Involvement Plan includes a demographic overview of the counties in the project corridors, and based on the findings of the overview, recommendations of additional targeted outreach where there are higher concentrations of minority and low-income populations. The overview also assists the public involvement team in understanding the need to translate documents and provide interpreters at public events and meetings.

For the public events and meetings conducted to date, information has been provided in both English and Spanish. This includes the distribution of notices, posters, and newsletters to local organizations that then distribute the information to their constituencies. At the meetings, PowerPoint presentations and displays boards were made available in Spanish and there were Spanish translators to answer questions. In addition, an online open house was conducted where people could learn about the project and provide comments. Future meetings and open houses will continue to include information in Spanish and ensure targeted outreach is conducted.

3.15.4 Affected Environment

3.15.4.1 Overview

Table 3.15-1 provides information on existing and forecasted populations for the Northern, Central, and Southern sections and Oklahoma and Texas (refer to Appendix M for further detail). The Northern Section, which includes Oklahoma and Texas, is projected to grow faster (percentage change in population) than Oklahoma as a whole and is projected to have the lowest annual average growth rate of the three sections for the 30-year period between 2010 and 2040. The Southern Section is projected to have the highest growth rate of the three sections and to grow faster than Texas as a whole.

Table 3.15-1: Existing and Forecasted Population

Area	2000	2010	2040	Change in Population 2010-2040 (%)	Annual Average Growth Rate (2010-2040) (%)
Northern Section	5,124,946	5.985,162	8,305,826	38.8	1.3
Central Section	7,060,093	8,515,602	12,121,834	42.3	1.4
Southern Section	2,987,412	3,682,679	5,545,813	50.6	1.7
Oklahoma	3,450,654	3,751,351	4,581,319	22.1	0.7
Texas	20,851,820	25,145,561	36,550,595	45.4	1.5
Sources: Oklahoma Department of Commerce (2014); Texas State Data Center (2014).					

3.15.4.2 Northern Section: Oklahoma City to Dallas and Fort Worth

3.15.4.2.1 Population Characteristics

Table 3.15-2 summarizes data on the population characteristics for the Northern Section and compares the data to the reference population of Oklahoma and Texas (refer to Appendix M for further detail). The Northern Section has a higher handicapped population than Texas, but its LEP population is lower. The Northern Section also has a lower concentration of low-income population than Oklahoma and Texas, and the minority concentration is similar to Texas and higher than Oklahoma.

Table 3.15-2: Northern Section Population Characteristics

Area	Total Population	Elderly (%)	Handicapped (%)	Minority (%)	Low Income (%)	LEP (%)
Northern Section	5,985,162	12.7	13.5	51.5	14.9	6.3
Oklahoma	3,751,351	13.4	9.0	31.3	16.2	3.8
Texas	25,145,561	10.3	6.6	54.7	16.8	14.4
Sources: U.S. Census Bureau (2014a, 2014b).						

3.15.4.2.2 Household Characteristics

Table 3.15-3 provides information on the housing in the Northern Section compared to Oklahoma and Texas based on U.S. Census data (refer to Appendix M for further detail). Oklahoma has a higher percentage of single-family homes compared to the other areas. The vacancy rates and the average household size are similar for all areas.

Table 3.15-3: Northern Section Housing Characteristics

Area	Housing Units				Vacancy Rates	Average Household Size
	Total	Single-Family	Multifamily	Other		
Northern Section	2,366,188	1,574,828	721,742	69,618	13.8	2.6
Oklahoma	1,644,228	1,237,881	250,019	156,328	13.5	2.5
Texas	9,718,470	6,621,453	2,333,546	763,471	12.1	2.8
Sources: U.S. Census Bureau (2014a, 2014b).						

3.15.4.2.3 Regional Economy and Employment Characteristics

In 2013, Oklahoma's current-dollar gross domestic product (GDP) was $182.1 billion and ranked 29th in the United States (U.S. Bureau of Economic Analysis [BEA] 2014). Major industries in

Oklahoma include government; mining; finance, real estate, and rental and leasing; professional and business services; and education services, health care, and social assistance.

In 2013, Texas' current-dollar GDP was $1,523.6 billion and ranked second in the United States (BEA 2014). Major industries in Texas include finance, real estate, and rental and leasing; mining; government; professional and business services; and nondurable goods manufacturing.

Table 3.15-4 includes historical and current (2013) data on the civilian employment force (refer to Appendix M for further detail). The higher unemployment rates in 2010 represent the situation shortly after the economic recession began in 2007. On average, based on the 2010 data, the counties in Oklahoma had lower unemployment rates than those in Texas and for the Northern Section overall. Also, based on the 2010 data, the counties in Oklahoma had lower median household incomes than those in Texas.

Table 3.15-4: Northern Section Employment Characteristics

Area	Labor Force		Employed		Unemployment Rate	
	2010	2013	2010	2013	2010	2013
Northern Section	2,998,315	3,135,545	2,758,530	2,944,835	8.0%	6.1%
Oklahoma	1,775,398	1,816,794	1,653,020	1,718,171	6.9%	5.4%
Texas	12,287,566	12,819,871	11,280,558	12,007,330	8.2%	6.3%
Source: U.S. Bureau of Labor Statistics (2014).						

3.15.4.3 Central Section: Dallas and Fort Worth to San Antonio

3.15.4.3.1 Population Characteristics

Table 3.15-5 summarizes the data on the population characteristics for the Central Section and compares the data to the reference population of Texas (refer to Appendix M for further detail). Overall, the Central Section has a higher concentration of handicapped population and a lower concentration of LEP population compared to Texas. The minority and low-income concentrations in the Central Section are similar to those in Texas.

Table 3.15-5: Central Section Population Characteristics

Area	Population	Elderly (%)	Handicapped (%)	Minority (%)	Low Income (%)	LEP (%)
Central Section	8,515,602	11.4	12.7	56.1	15.4	8.9
Texas	25,145,561	10.3	6.6	54.7	16.8	14.4
Sources: U.S. Census Bureau (2014a, 2014b).						

3.15.4.3.2 Household Characteristics

Table 3.15-6 provides information on the housing in the Central Section compared to Texas based on U.S. Census data (refer to Appendix M for further detail). The Central Section is similar to Texas with regard to the overall percentage of single-family homes, the vacancy rate, and the average household size.

Table 3.15-6: Central Section Housing Characteristics

Area	Housing Units				Vacancy Rates	Average Household Size
	Total	Single Family	Multifamily	Other		
Central Section	3,301,234	2,171,541	1,004,330	125,363	13.1%	2.7
Texas	9,718,470	6,621,453	2,333,546	763,471	12.1%	2.8
Sources: U.S. Census Bureau (2014a, 2014b).						

3.15.4.3.3 Regional Economy and Employment Characteristics

In 2013, Texas' current-dollar GDP was $1,523.6 billion and ranked second in the United States (BEA 2014). Major industries in Texas include finance, real estate, and rental and leasing; mining; government; professional and business services; and nondurable goods manufacturing.

Table 3.15-7 includes historical and current (2013) data on the civilian employment force (refer to Appendix M for further detail). The higher unemployment rates in 2010 represent the situation shortly after the economic recession began in 2007. On average, based on the 2013 data, the counties in the Central Section had slightly lower unemployment rates than those at the state level. Based on the 2010 data, half (or 7 out of 14) of the counties in the Central Section had lower median household income than those in the entire state of Texas (see Appendix M for further detail).

Table 3.15-7: Central Section Employment Characteristics

Area	Labor Force		Employed		Unemployment Rate	
	2010	2013	2010	2013	2010	2013
Central Section	4,228,942	4,435,670	3,892,925	4,164,658	7.9%	6.1%
Texas	12,287,566	12,819,871	11,280,558	12,007,330	8.2%	6.3%
Source: U.S. Bureau of Labor Statistics (2014).						

3.15.4.4 Southern Section: San Antonio to South Texas

3.15.4.4.1 Population Characteristics

Table 3.15-8 summarizes data on the population characteristics for the Southern Section and compares the data to the reference population of Texas (refer to Appendix M for further detail). The Southern Section has higher concentrations of all population characteristics compared to Texas.

The minority concentration and low-income populations are much higher than Texas with over three-quarters considered minority and almost one-quarter low-income.

Table 3.15-8: Southern Section Demographic Characteristics

Area	Population	Elderly (%)	Handicapped (%)	Minority (%)	Low Income (%)	LEP (%)
Southern Section	3,682,679	13.4	19.2	78.2	23.9	19.6
Texas	25,145,561	10.3	6.6	54.7	16.8	14.4
Sources: U.S. Census Bureau (2014a, 2014b)						

3.15.4.4.2 Household Characteristics

Table 3.15-9 provides information on the housing in the Southern Section compared to Texas based on U.S. Census data (refer to Appendix M for further detail). About two-thirds of the housing units in the Southern Section are single-family housing units. The percentage of housing units is similar between the Southern Section and Texas as is the average household size. The vacancy rate in the Southern Section is higher than Texas.

Table 3.15-9: Southern Section Housing Characteristics

Area	Housing Units				Vacancy Rates	Average Household Size
	Total	Single Family	Multifamily	Other		
Southern Section	1,819,057	1,266,903	428,339	123,815	18.1%	2.9
Texas	9,718,470	6,621,453	2,333,546	763,471	12.1%	2.8
Sources: U.S. Census Bureau (2014a, 2014b).						

3.15.4.4.3 Regional Economy and Employment Characteristics

Table 3.15-10 includes historical and current (2013) data on the civilian employment force (refer to Appendix M for further detail). The higher unemployment rates in 2010 are likely due to the economic recession that started in 2007. The 2013 unemployment rate in the Southern Section remains higher than Texas.

Table 3.15-10: Southern Section Employment Characteristics

Area	Labor Force		Employed		Unemployment Rate	
	2010	2013	2010	2013	2010	2013
Southern Section	1,631,548	1,699,565	1,486,569	1,575,529	8.9%	7.3%
Texas	12,287,566	12,819,871	11,280,558	12,007,330	8.2%	6.3%
Source: U.S. Bureau of Labor Statistics (2014).						

3.15.5 Environmental Consequences

3.15.5.1 Overview

It is anticipated that the alternatives would have an overall positive effect on the communities along the alignment in terms of generating construction jobs, increasing the potential for new employment opportunities around station areas, reducing congestion on highways, and improving regional connectivity.

Wherever a new transportation corridor is required, there is the potential to affect communities through bisection, through large numbers of residential and business displacements, or through effects on community facilities. Much of the new transportation corridors proposed by the alternatives would be in areas outside of existing population centers and would not bisect communities. Many of the alternatives also would follow or be within existing transportation corridors through urban areas and would not further bisect communities, but could increase the intensity of noise effects. Construction of the alternatives would potentially result in temporary construction effects including an increase in noise, dust, and traffic congestion, and effects would be greater in the urban areas especially where construction occurs close to sensitive uses such as residential development and schools.

3.15.5.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect minority and/or low-income populations and would not result in beneficial effects on these populations.

3.15.5.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.15.5.3.1 Alternative N4A Conventional

Because Alternative N4A would improve the existing passenger rail service, the potential for beneficial effects would be limited, and adverse effects on socioeconomics would be negligible. The alternative is primarily within an existing transportation corridor and would not bisect any communities, and because there are already passenger and freight trains actively using this corridor, the intensity of the socioeconomic effects would be negligible. Potential effects on environmental justice populations would also be negligible.

3.15.5.4 Central Section: Dallas and Fort Worth to San Antonio

3.15.5.4.1 Alternative C4A Higher-Speed Rail

Beneficial and adverse effects on socioeconomics would be limited because Alternative C4A Higher-Speed Rail would primarily be within an existing transportation corridor, or where new rights-of-way are required, those improvements would be adjacent to an existing transportation corridor in areas with limited populations. Where the alternative is not adjacent to an existing transportation corridor, the new corridor required would not bisect any communities because there are limited populations in areas where the new transportation corridors would be constructed, and this potential effect could be avoided. The additional right-of-way requirements would likely result in the acquisition of residential properties and businesses, which would need to be quantified as part of the project-level analysis to determine potential effects. The specific displacement of businesses and residences resulting from Alternative C4A Higher-Speed Rail would also need to be identified in the project-level analysis. Property acquisitions would result in property tax revenue effects associated with Alternative C4A Higher-Speed Rail requirements because properties would be converted to a transportation-related use and property tax revenue would no longer be generated or would be reduced by partial property acquisitions; however, there would be revenues generated from rail services that may offset the lost property tax revenues. The project-level analysis would quantify the tax revenues lost and gained as a result of the project. Alternative C4A Higher-Speed Rail has the potential for effects on environmental justice populations primarily as a result of displacements and noise effects. The alternative would provide some benefits including improved mobility and access to an alternative mode of transportation, and these benefits would be greatest in the areas near stations. Specific effects would be determined during the project-level analysis. Based on the factors described above and the assessment conducted, the intensity of the socioeconomic and environmental justice effects would be moderate.

Construction would result in short-term effects on the communities including temporary increases in noise, vibration, and dust; temporary vehicle and non-motorized access effects; and visual effects. Some additional temporary effects related to roadway closures and detours and public utility service interruptions during construction may also occur. Businesses close to the construction site could experience disruptions during construction depending on the type, duration, and intensity of activities. However, the construction expenditures could have a positive, though temporary and limited, impact on local sales tax revenues and jobs creation in the counties/communities where these purchases are made and construction occurs.

3.15.5.4.2 Alternative C4A High-Speed Rail

Socioeconomic effects would be similar to those described for Alternative C4A Higher-Speed Rail. The improvements would be within an existing transportation corridor, and the potential need for improvements outside of this corridor would not bisect communities. The areas outside existing transportation corridors are associated with limited population areas outside of the urban and rural communities, and therefore, the potential for effects on communities would be limited. However, Alternative C4A High-Speed Rail would also result in additional displacements and noise effects, which could affect land uses and populations adjacent to the alignment. Alternative C4A High-Speed Rail has the potential for effects on environmental justice populations primarily as a result of displacements and noise effects; however, there are also potential mobility and access benefits. The specific details regarding these effects and benefits will be determined during project-level analysis. Based on the assessment conducted, the intensity of socioeconomic and environmental justice effects would be moderate.

Construction effects would be similar to those described for Alternative C4A Higher-Speed Rail, but the high-speed rail alternative would likely have higher construction expenditures because of the grade-separated structures that would be required for operation. As a result, there would be a greater potential for short-term construction benefits due to these expenditures.

3.15.5.4.3 Alternative C4B Higher-Speed Rail

Socioeconomic and environmental justice effects would be similar to those described for Alternative C4A Higher-Speed Rail. Because the alternative includes a new transportation corridor through areas not adjacent to existing transportation corridors, there is a potential for bisection of communities; however, because the new alignment is in a rural area, the potential bisection of communities would be limited. The new corridor could have the potential for displacements and associated acquisitions that could affect community facilities and environmental justice populations depending on how community connections are maintained, including the preservation or improvement of existing railroad crossings. Where the new transportation corridor would be constructed, the potential property acquisitions would also have a negative effect on property tax revenues. However, as referenced above, the new transportation corridor is located in rural areas within limited populations, which would minimize potential tax revenue effects. South of Hillsboro, the alternative would have the same effects on socioeconomics and environmental justice as those described for Alternative C4A Higher-Speed Rail because the alignment would be the same from Hillsboro to San Antonio. The new transportation corridor, from Arlington, between Dallas and Fort Worth, to Hillsboro, has the potential for effects on environmental justice populations, but those potential effects would be limited based on the rural makeup of the area. The intensity of socioeconomic and environmental justice effects would be moderate.

Construction effects would be similar to those described for Alternative C4A Higher-Speed Rail.

3.15.5.4.4 Alternative C4B High-Speed Rail

Socioeconomic and environmental justice effects and potential mobility and access benefits would be similar to those described for Alternative C4A High-Speed Rail. Additionally, south of Hillsboro, Alternative C4B High-Speed Rail would have the same effects on socioeconomics and environmental justice as those described for Alternative C4A High-Speed Rail because the alignment would be the same from Hillsboro to San Antonio. The intensity of socioeconomic and environmental justice effects would be moderate.

Construction effects would be similar to those described for Alternative C4A Higher-Speed Rail, but the high-speed rail alternative would likely have higher construction expenditures because of the grade-separated structures that would be required for operation. As a result, there would be a greater potential for short-term construction benefits due to these expenditures.

3.15.5.4.5 Alternative C4C Higher- and High-Speed Rail

The potential socioeconomic and environmental justice effects and the intensity would be similar to those for both the higher- and high-speed rail as described for Alternative C4A. Alternative C4C does have the potential to affect additional areas given the alignments associated with the alternative, but the intensity of the effects would still be moderate for both socioeconomic and environmental justice.

Construction effects would be similar to those described for Alternative C4A Higher- and High-Speed Rail, but the high-speed rail alternative would likely have higher construction expenditures because of the grade-separated structures that would be required for operation. As a result, there would be a greater potential for short-term construction benefits due to these expenditures.

3.15.5.5 Southern Section: San Antonio to South Texas

The Southern Section alternatives would have similar potential socioeconomic and environmental justice effects. Although Alternative S4 is longer, portions of this alternative would be within existing transportation corridors. Although Alternative S6 (higher- and high-speed rail) is shorter, it would be entirely outside of existing transportation corridors.

3.15.5.5.1 Alternative S4 Higher-Speed Rail

Alternative S4 Higher-Speed Rail includes new transportation corridors along parts of the alignment that would not be adjacent to existing transportation corridors. The new transportation corridors have the potential to bisect communities and act as barriers to interaction, and the associated acquisitions could affect community facilities and environmental justice populations. However, the new transportation corridors are located in rural areas with limited populations, which could minimize the potential effects. The potential for displacements associated with full or partial acquisitions would be limited based on the rural makeup of this alternative. Although the displacements would be limited, because of the higher concentrations of environmental justice populations in the Southern Section, there is a corresponding increase in the potential of effects on these populations. Property acquisitions would result in property tax revenue effects and rail service revenue generation that would offset lost property tax revenues. The project-level analysis would quantify the tax revenues lost and gained as a result of the project. The socioeconomic effects would have a moderate intensity, and environmental justice would have a substantial intensity.

Construction effects would be similar to those described for Alternative C4A Higher-Speed Rail and would result in short-term effects on the rural communities including temporary increases in noise, vibration, and dust; temporary vehicle and non-motorized access effects; and visual effects. Businesses close to the construction site may also experience disruptions during construction depending on the type, duration, and intensity of activities.

3.15.5.5.2 Alternative S6 Higher-Speed Rail

The potential socioeconomic and environmental justice effects for this alternative would be similar to those described for Alternative S4. Although Alternative S6 Higher-Speed Rail is substantially shorter, the alignment would be entirely within a new transportation corridor and would be located in rural areas with limited populations. The socioeconomic effects would have a moderate intensity, and environmental justice would have a substantial intensity.

Construction effects would be similar to those described for Alternative S4 Higher-Speed Rail and would result in short-term effects on the rural communities including temporary increases in noise, vibration, and dust; temporary vehicle and non-motorized access effects; and visual effects. Businesses close to the construction site may also experience disruptions during construction depending on the type, duration, and intensity of activities.

3.15.5.5.3 Alternative S6 High-Speed Rail

Effects would be the same as those described for Alternative S6 Higher-Speed Rail. Alternative S6 has a new transportation corridor but would be located in rural areas with limited populations. The socioeconomic effects would have a moderate intensity, and environmental justice would have a substantial intensity.

Construction effects would be similar to those described for Alternative S6 Higher-Speed Rail, but the high speed rail alternative would likely have higher construction expenditures because of the grade-separated structures that would be required for operation. As a result, there would be a greater potential for short-term construction benefits due to these expenditures.

3.15.5.6 Summary of Potential Effects

Tables 3.15-11 and 3.15-12 list each alternative's potential intensity of socioeconomic effects and environmental justice effects, respectively.

Table 3.15-11: Summary of Potential Socioeconomic Effects by Alternative

Section	Alternative[a]	Context: Potential to Negatively Affect Communities	Potential Intensity of Effects (Negligible, Moderate, or Substantial)
No Build Alternative		Not applicable	Not applicable
Northern	N4A CONV	No	Negligible
Central	C4A HrSR	Yes	Moderate
	C4A HSR	Yes	Moderate
	C4B HrSR	Yes	Moderate
	C4B HSR	Yes	Moderate
	C4C HrSR	Yes	Moderate
	C4C HSR	Yes	Moderate
Southern	S4 HrSR	Yes	Moderate
	S6 HSR	Yes	Moderate
	S6 HrSR	Yes	Moderate

[a] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

Table 3.15-12: Summary of Potential Environmental Justice Effects by Alternative

Section	Alternative[a]	Context: Potential to Affect Environmental Justice Populations	Potential Intensity of Effects (Negligible, Moderate, or Substantial)
No Build Alternative		Not applicable	Not applicable
Northern	N4A CONV	No	Negligible
Central	C4A HrSR	Yes	Moderate
	C4A HSR	Yes	Moderate
	C4B HrSR	Yes	Moderate
	C4B HSR	Yes	Moderate
	C4C HrSR	Yes	Moderate
	C4C HSR	Yes	Moderate
Southern	S4 HrSR	Yes	Substantial
	S6 HSR	Yes	Substantial
	S6 HrSR	Yes	Substantial

3.15.6 Avoidance, Minimization, and Mitigation Strategies

Avoidance and minimization of effects will be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies will be implemented. Specific mitigation measures are not identified as part of the service-level analysis but will be identified during the project-level analysis when details on the proposed facilities are known. Potential mitigation strategies for socioeconomics and environmental justice that would be considered during project-level analysis include the following;

- Consultation with local governments and planning agencies would be conducted, with consideration given to minimizing barrier effects to maintain neighborhood integrity, including grade-separating planned rail lines and streets, new pedestrian crossings, new cross-connection points, improved visual quality of project facilities, and traffic management plans to maintain access during and after construction.
- Design strategies would be developed for application at the project level to avoid or minimize the temporary or permanent acquisition of residential and nonresidential property.
- Potential displacement and acquisitions (temporary use and/or permanent and nonresidential property) should be avoided to the extent feasible by considering further alignment adjustments and design changes at the project level.

- Outreach to affected communities would be conducted as part of the decision-making process, and this outreach would be documented.

In addition, mitigation measures would be developed for temporary construction-related impacts on nearby neighborhoods and communities. Potential mitigation strategies to alleviate or minimize community cohesion-related effects could include the following:

- Provide opportunities for community involvement early in project-level studies.
- Conduct design workshops within each affected neighborhood to develop an understanding of key vehicle, bicycle, and pedestrian linkages across the rail corridor so that those linkages can be preserved, including the use of grade-separated crossings.
- Ensure that connectivity (pedestrian/bicycle and vehicular crossings) across the rail corridor is maintained where necessary to maintain neighborhood integrity.
- Develop a traffic management plan to reduce barrier effects during construction.
- To the extent feasible, maintain connectivity during construction.

Other resources areas analyzed during the project-level analysis, including transportation, air quality, noise, and land use, would include mitigation strategies related to socioeconomics as well as strategies for minimizing impacts on the minority and/or low income populations. This effort would lead to the identification of the appropriate mitigation strategies in the event that an alternative would result in bisection of a community.

3.15.7 Subsequent Analysis

A community profile discussing cohesion and community facilities will need to be developed including additional focus on the communities with stations. A demographic analysis at a smaller geography with project-level focus will also need to be conducted to better understand who can be affected and who could benefit from construction and operation. The demographic analysis will also focus on environmental justice populations to help determine if these populations could be adversely affected by construction and/or operation. The environmental justice analysis will review all elements of the environment to determine if there are adverse effects that could result in disproportionate effects on minority or low-income populations and review the mitigation and potential community benefits and enhancements associated with the project.

Avoiding or minimizing the community-related effects will involve working closely with local governments and planning agencies in the refinement and development of the alternatives and their corresponding alignments during the project-level analysis. Since Executive Order 12898 requires federal agencies to ensure effective public participation and access to information, a more detailed and comprehensive outreach effort to potentially affected minority and/or low-income populations will need to be completed and documented at the project level. This detailed and comprehensive outreach effort could help identify issues of importance that would otherwise not be apparent.

The project-level analysis will need to include the potential effects on the number of displaced housing and businesses as well as identification of the displacement and/or relocation of community facilities. To avoid potential residential, business, and community facility displacements including construction-related acquisitions, the project-level analysis will need to consider, to the extent feasible, further alignment adjustments and design changes. In addition, analysis at the project level will consider relocation assistance in accordance with the Uniform Relocation and Real Property Acquisition Policies Act of 1970, as amended. This information will be used to evaluate the impact on property tax revenues resulting from the removal of these properties from the tax rolls as well as the effects associated with the loss of or relocation of community facilities. Future project-level analysis will need to identify any barriers that may result in a loss of community cohesion.

The project-level analysis needs to include regional economic impact analysis, which will quantify the employment opportunities and income generated by the project during construction and operation of the project. This will need to be done by section and/or alternative depending on the availability of the cost data at these levels. The quantification of the number of jobs created by the project will be used to determine the potential effects on other socioeconomic resources such as housing, community facilities, and public services including emergency services. Additionally, local expenditures during construction and operation will be used to determine the sales tax revenues generated by the project. Finally, future project-level analysis will need to include detailed travel pattern analysis in concert with a detailed traffic analysis.

3.16 Public Safety and Hazardous Materials

This section describes public safety and security concerns within the environmental impact statement (EIS) Study Area, including railroad–highway crossing safety, operational safety, and security for the Program. This section also identifies and assesses effects on hazardous materials or hazardous materials sites for the alternatives. The introduction to Chapter 3 describes the EIS Study Area and use of terms such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.16.1 Laws, Regulations, and Orders

The following sections discuss regulatory requirements for public safety and hazardous materials. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.16.1.1 Public Safety

Applicable federal and state legislation and regulations pertaining to public safety within the EIS Study Area are listed and described below.

3.16.1.1.1 Federal

- **Rail Safety Improvement Act of 2008 (49 United States Code [U.S.C.] § 20101, et seq.)**. The act directed the Federal Railroad Administration (FRA) to promulgate new safety regulations and other regulations pertaining to railroad safety, such as the number of service hours for railroad workers, implementation of positive train control, standards for inspecting track, certifications required for locomotive conductors, and safety criteria for railroad–highway grade crossings.
- **FRA Railroad Safety Regulations (49 Code of Federal Regulations [CFR] Parts 200–299).** Parts 200–299 provide most of the federal regulations pertaining to railroad safety. Part 234 prescribes the minimum maintenance, inspection, and testing standards for warning systems at railroad–highway grade crossings.
- **Railroad Safety (49 U.S.C. § 20101 et seq.)**. Gives FRA authority over railroad safety to promote safety in all aspects of railroad operations and reduce railroad-related accidents and incidents.
- **Department of Homeland Security, Transportation Security Administration (49 CFR 1580).** The Department of Homeland Security regulations are for the purpose of strengthening the security of the nation's freight and passenger rail systems.
- **Federal Railroad Safety Act (49 U.S.C. § 20101, et seq.).** Gives the Secretary of Transportation authority to prescribe regulations for all areas of railroad safety (supplementing existing rail safety statutes and regulations) and to conduct necessary research, development, testing, evaluation, and training.
- **Highway Safety Act of 1966 (23 U.S.C. § 401, et seq.).** Gives the Federal Highway Administration (FHWA) and FRA regulatory jurisdiction over safety at railroad–highway grade

crossings and governs the distribution of federal funds to states to eliminate hazards at crossings.

- **Americans with Disabilities Act (ADA) Standards (28 CFR 35.151 §36.401 [d][ii]**. These revised regulations for Titles II and III of the ADA of 1990 set minimum requirements for newly designed and constructed or altered state and local government facilities, public accommodations, and commercial facilities to be readily accessible to and usable by individuals with disabilities. Infrastructure resulting from the Program would be expected to meet applicable portions of the ADA standards. Additional detail will be included in the project-level analysis as indicated in Section 3.16.6, Subsequent Analysis.

3.16.1.1.2 State

- **Oklahoma Statute, Title 66. Section 66-1 through 66-334.** This Oklahoma statute governs railroads and their operations in Oklahoma.
- **Oklahoma Railroad Revitalization Act, 1978 (66 Oklahoma Statute § 66-302.1).** This act specifies powers and duties of the Oklahoma Department of Transportation related to acquisition, construction, repair, operation, and maintenance of railroad right-of-way and trackage.
- **Texas Transportation Code, Sec. 455.005. Rail Fixed Guideway Mass Transportation System Safety Oversight.** Provides guidance on oversight of safety and security practices of rail fixed guideway mass transportation systems in compliance with 49 U.S.C. Section 5330.
- Texas, Transportation Code, Title 6, Roadways, Subtitle Z, Misc. Provisions, Chapter 471, Railroads and Crossings. Governs safety of railroad crossings.
- **Texas Administrative Code, Title 43, Part 1, Chapter 31, Subchapter F**. Provides rail transit agency responsibilities under the Rail Fixed Guideway, System State Safety Oversight Program.

3.16.1.2 Hazardous Materials

Applicable federal and state legislation and regulations pertaining to hazardous materials within the EIS Study Area are listed and described below.

3.16.1.2.1 Federal

- Resource Conservation and Recovery Act (RCRA) (42 U.S.C. § 6901, et seq.) and U.S. Environmental Protection Agency (EPA) regulations (40 CFR 261–268, 270–273, and 279–282). Provides rules and requirements related to the regulation of hazardous wastes including classification, generator requirements (e.g., labelling and accumulation), transporter requirements, land disposal criteria and requirements, universal waste, and used oil.
- **U.S. Department of Transportation (USDOT) regulations (40 CFR 100–185).** Provides rules and requirements related to the transportation of hazardous wastes.

- **Emergency Planning and Community Right-to-Know Act (42 U.S.C. § 11004, et seq.) regulations (42 CFR 116).** Also known as Superfund Amendments and Reauthorization Act (SARA), Title III, provides for the collection and public release of information about the presence and release of hazardous or toxic chemicals in the nation's communities. The goal is to help citizens, officials, and community leaders to be better informed about toxic and hazardous materials in their communities.

3.16.1.2.2 State

- Oklahoma Department of Environmental Quality (ODEQ), Oklahoma Administrative Code Title 252, Chapter 205. Provides rules and requirements related to the regulation of hazardous wastes in Oklahoma.
- Oklahoma Motor Carrier Safety and Hazardous Materials Transportation Act, 47 Oklahoma Statutes Annotated 230.1–230.16. Provides rules and requirements related to the transportation of hazardous wastes in Oklahoma.
- **Texas Commission on Environmental Quality (TCEQ), Title 30 Texas Administrative Code Chapter 335**. Provides rules and requirements related to the regulation of hazardous and industrial wastes in Texas.
- **Texas Department of Public Safety, Title 37 Texas Administrative Code Chapter 4.16**. Provides rules and requirements related to the transportation of hazardous and industrial wastes in Texas.

3.16.2 Methodology

3.16.2.1 Public Safety

Public safety is generally evaluated to understand the effects of passenger rail construction and operation on the following:

- Safety of construction workers and the traveling public during construction
- Public safety at railroad–highway crossings
- Safety of train passengers and operators during passenger rail operation
- Effects of construction and operations on emergency response routes and times
- Crime risk at construction sites and within the passenger rail system during operation

The National Transportation Atlas Database, Highway–Rail Crossings database (USDOT 2013) was reviewed to identify preliminary information on locations of the existing railroad–highway crossings for each alternative. Federal safety and security rules and design standards were reviewed to determine required design and operational practices for passenger rail systems.

The intensity of an effect as a result of the route alternatives is characterized as negligible, moderate, or substantial compared with the No Build Alternative. For public safety, these terms are defined as follows:

- Negligible intensity effects are those that would have a slight change in public safety risks or the risk of accidents but are very close to the existing conditions.
- Moderate intensity effects are those that would have a noticeable change in public safety risks or the risk of accidents at specific sites or localized areas, but would not have wide-ranging effects.
- Substantial intensity effects are those that would have a noticeable change in public safety risks or the risk of accidents on a regional scale.

3.16.2.2 Hazardous Materials

It is assumed that recorded hazardous materials sites could potentially affect the acquired rights-of-way in the EIS Study Area. Areas where new rights-of-way may be acquired or where more significant earth-disturbing activities would occur (e.g., at proposed station locations or for certain service type [conventional rail, higher-speed rail, and high-speed rail] requirements) have increased potential to disturb contaminated or potentially contaminated hazardous materials sites. Disturbance of contaminated sites could affect human health and the environment.

The hazardous materials sites within the EIS Study Area were identified using search records limited to the online federal and state databases that are listed below. These data sources provide preliminary information to identify potential presence of hazardous sites within the EIS Study Area. The following databases were reviewed for this service-level EIS:

- National Priority List (NPL) sites (EPA 2014a)
- Comprehensive Emergency Response Compensation and Liabilities Information System (CERCLIS) sites (EPA 2014b)
- Oklahoma NPL site summaries (ODEQ 2014a)
- Oklahoma RCRA CORRACTS sites (ODEQ 2014b)
- Oklahoma Voluntary Cleanup Program (VCP) sites (ODEQ 2014c)
- Oklahoma Institutional Control Sites (ODEQ 2014d)
- Oklahoma permitted solid waste facilities (ODEQ 2014e)
- Texas Superfund sites (TCEQ 2014a)
- Texas VCP cleanups and remediation (TCEQ 2014b)
- Texas RCRA CORRACTS sites (TCEQ 2014c)
- Texas municipal solid waste sites (TCEQ 2013)

For this service-level EIS, the analysis was limited to federal and state databases that list hazardous materials sites and hazardous wastes sites with potential for effects on the environment. For the purposes of this assessment, sites with potential effects are those included in the databases listed above, which are typically sites with serious contamination issues or those, such as leaking underground storage tank (LUST) sites that would be considered during project-level evaluations, when site-specific analysis can be based on detailed alignment plans and profiles. No site-specific investigations were conducted for this service-level EIS.

This analysis focuses on the number of identified sites from the narrowed list of federal and state databases within the EIS Study Area. For this service-level comparison of alternatives, the number of sites within an alternative's study area indicates an overall level of potential effect; more sites generally imply more potential risks to human health and the environment could occur as a result of contamination encountered during construction.

Conventional rail would mostly use existing railroad rights-of-way. Existing railroad track may be used, or in some cases, modifications such as double-tracking could be constructed within the existing right-of-way to accommodate additional trains. Because less construction would be necessary, the risk of exposure to or release of hazardous materials from disturbed contaminated sites would be less than higher-speed or high-speed rail.

Higher-speed rail can use existing track, but may require improvements such as upgraded concrete ties, improved signaling, and upgraded roadway crossings. Additional tracks could be required to accommodate separate freight and passenger services within a shared right-of-way. Outside of an existing transportation corridor, new alignment would be designed to eventually accommodate high-speed rail service. The risk of exposure to or release of hazardous materials from disturbed contaminated sites would be greater than conventional rail as the result of the need for additional construction. High-speed rail would be double-tracked and fully grade-separated. Construction would be required outside of the existing transportation corridors. The risk of exposure to or release of hazardous materials from disturbed contaminated sites would be greater for high-speed rail than either conventional rail or higher-speed rail as the need for construction would be greater.

In this comparison, each type of listing is given equal weight. The service-level analysis does not include a detailed assessment of the nature or extent of any hazardous materials or wastes that may be present at identified sites or the degree and specific nature of potential effects under the various alternatives. The analysis and identification of potential hazards within the EIS Study Area is useful for comparing alternatives and identifying areas where avoidance may be possible during project-level reviews.

The intensity of an effect as a result of the route alternatives is characterized as negligible, moderate, or substantial compared with the No Build Alternative. For hazardous materials, these terms are defined as follows:

- Negligible intensity effects are those that present no, or only slightly increased risk to the public or environment related to the potential for encountering hazardous materials or substances.
- Moderate intensity effects are those that present a localized increased risk to the public or environment related to the potential for encountering hazardous materials or substances.
- Substantial intensity effects are those that present increased risk to the public or environment related to the potential for encountering hazardous materials or substances on a regional scale.

3.16.3 Affected Environment

This section describes the affected environment related to public safety and security and hazardous materials in the Northern, Central, and Southern sections of the EIS Study Area.

3.16.3.1 Overview

3.16.3.1.1 Public Safety

At-grade crossings present a risk of collisions between trains and other travel modes, as well as a risk of collisions between vehicles, particularly rear-end-type crashes when vehicles stop at a crossing. Grade-separated crossings eliminate this type of safety risk because trains are separated from other travel modes. A study of the safety conditions at each existing crossing will occur during project-level analysis.

When emergency response routes cross at-grade crossings, response times can be inconsistent because of delays caused by passing trains. Grade-separated crossings are preferable for optimal response times and consistency. Emergency response times are generally quicker in urban areas where crossings are closer together than in rural areas where crossings are farther apart. Specific emergency response routes, times, and service areas will be evaluated during project-level analysis.

3.16.3.1.2 Hazardous Materials

Hazardous materials sites from the narrowed list of federal and state databases are discussed below for the alternatives in the EIS Study Area of each geographic section.

3.16.3.2 Northern Section: Oklahoma City to Dallas and Fort Worth

3.16.3.2.1 Public Safety

Table 3.16-1 lists the number of vehicular public and private crossings and pedestrian-only crossings of existing rail lines with the Northern Section EIS Study Area. There were 401 vehicular public and private crossings and pedestrian-only crossings of the BNSF and Trinity Railway Express (TRE) rail lines.

Table 3.16-1: Existing Crossings of BNSF and TRE Rail Lines in the Northern Section EIS Study Area

Alternative	At-grade Crossings				Grade-separated Crossings				Total
	Vehicular Public	Vehicular Private	Pedestrian	Subtotal	Vehicular Public	Vehicular Private	Pedestrian	Subtotal	
N4A	225	57	0	282	108	8	3	119	401
Source: USDOT (2013).									

3.16.3.2.2 Hazardous Materials

Table 3.16-2 lists the hazardous materials sites identified within the Northern Section EIS Study Area. Of the eight sites identified, one NPL site, one CERCLIS site, one RCRA site with Corrective Action, three VCP sites, and two institutional controls sites were identified. There is also one closed landfill. The site designated as a “Superfund[1],” site surrounds the existing BNSF rail line in Ardmore, Oklahoma. Cleanup at the site was completed; however, there are institutional controls at this site that are meant to protect the public from any contamination that remains in place (ODEQ 2013). The locations of these hazardous materials sites are shown on Figure 3.16-1.

Table 3.16-2: Hazardous Materials Sites in the Northern Section EIS Study Area

Site	Location	Type	Status[a]	Identified Contaminants
Alternative N4A				
Imperial Refining Superfund Site	Ardmore, Oklahoma	NPL, institutional controls site	Inactive	Arsenic, BTEX, chromium, lead, nickel, PAH, selenium, zinc
OKC Educare Remediation Site	Southeast Grand Blvd and Bryant Oklahoma City, Oklahoma	institutional controls site	Active	Chloride, TPH
Rail yard–Santa Fe Depot	1501 Jones St Fort Worth, Texas	VCP	Inactive	TPH
Buckley Oil Company	1809 Rock Island Dallas, Texas	VCP	Inactive	TPH
KOP-COAT, Inc.	801 East Lee Street Irving, Texas	CERCLIS	Closed	Metals, VOCs, SVOCs, pesticides

[1] The Comprehensive Environmental Response, Compensation, and Liability Act, or Superfund, is a federal law designed to clean up contaminated sites. The law authorizes EPA or Native American tribes to recover damages caused by contamination. EPA identifies the parties that are financially responsible for the cleanup.

Site	Location	Type	Status[a]	Identified Contaminants
Schnee-Morehead, Inc.	111 N. Nursery Road Irving, Texas	RCRA – Corrective Action	Active	Not listed
MU Hi Line Drive Property – North Tract	Hi Line Drive and Alamo Drive Dallas, Texas	VCP	Inactive	Metals, petroleum hydrocarbons
Sego Landfill	12700 Calloway Cemetery Road Euless, Texas	Landfill	Closed	Municipal solid waste

[a] Active: Some form of remediation or monitoring ongoing.

Inactive: No active remediation; may include ongoing monitoring; contamination may be present, but controlled on-site.

Closed: No longer under active regulatory oversight; may have contamination contained in place with land use or institutional controls.

BTEX = benzene, toluene, ethylbenzene, and xylenes; PAH = polycyclic aromatic hydrocarbon; SVOC = semivolatile organic compound; TPH = total petroleum hydrocarbon; VOC = volatile organic compound

Sources: EPA (2014a); EPA (2014b); ODEQ (2014a); ODEQ (2014b); ODEQ (2014c); ODEQ (2014d); ODEQ (2014e); TCEQ (2014a); TCEQ (2014b); TCEQ (2014c); TCEQ (2013).

3.16.3.3 Central Section: Dallas and Fort Worth to San Antonio

3.16.3.3.1 Public Safety

Table 3.16-3 lists the number of vehicular public and private crossings, and pedestrian-only crossings of existing rail lines with the Central Section EIS Study Area for each route alternative.

The study area for Alternative C4C contains the most crossings (361); the study area for C4B contains the fewest crossings (176).

Table 3.16-3: Existing Crossings of Rail Lines in the Central Section EIS Study Area

Alternative	At-grade Crossings				Grade-separated Crossings				Total
	Vehicular Public	Vehicular Private	Pedestrian	Subtotal	Vehicular Public	Vehicular Private	Pedestrian	Subtotal	
C4A	162	27	0	189	78	3	0	81	270
C4B	105	18	2	125	50	1	0	51	176
C4C	215	37	0	252	106	3	0	109	361

Source: USDOT (2013).

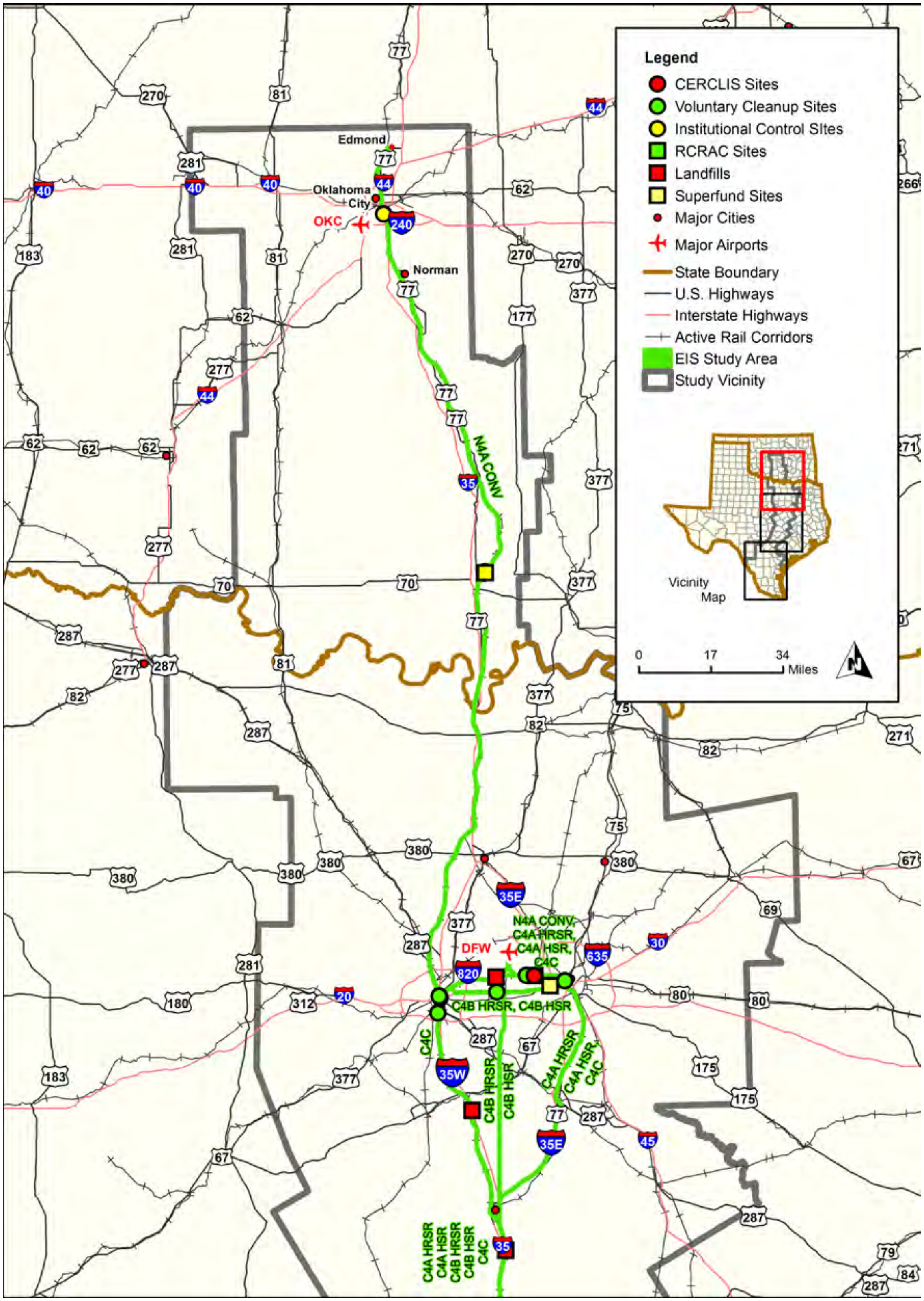


Figure 3.16-1: Hazardous Materials Sites, Oklahoma to Dallas and Fort Worth

3.16.3.3.2 Hazardous Materials

Table 3.16-4 lists the hazardous materials sites identified within the Central Section EIS Study Area. Of the sites identified, there is one NPL site, one CERCLIS site, two RCRAs with Corrective Action, and six VCP sites. In addition, there are three closed landfills and one active landfill. The locations of these hazardous materials sites are shown on Figure 3.16-2.

Table 3.16-4: Hazardous Materials Sites in the Central Section EIS Study Area

Site	Location	Type	Status[a]	Identified Contaminants
Alternatives C4A, C4B, and C4C				
Buckley Oil Company	1809 Rock Island Dallas, Texas	VCP	Inactive	TPH
General Tire, Inc.	600 S Loop Drive Waco, Texas	RCRA – Corrective Action	Inactive	TPH, PAH, PCB
DSR Enterprises, Inc.	901 Peach Street Waco, Texas	VCP	Inactive	Aldrin, chlordane, DDD, DDE, DDT, dieldrin, endrin, heptachlor, lindane, toxaphene
City of Abbott Landfill	Hill County, Texas	Landfill	Closed	Municipal solid waste
City of Austin Landfill	Travis County, Texas	Landfill	Closed	Municipal solid waste
Guadalupe County Precinct 1 Landfill	Guadalupe County, Texas	Landfill	Closed	Municipal solid waste
Alternatives C4A and C4C				
KOP-COAT, Inc.	801 E Lee Street Irving, Texas	CERCLIS	Closed	Metals, pesticides, SVOCs, VOCs
Schnee-Morehead, Inc.	111 N Nursery Road Irving, Texas	RCRA – Corrective Action	Active	Not listed
MU Hi Line Drive Property – North Tract	Hi Line Drive and Alamo Drive Dallas, Texas	VCP	Inactive	Metals, petroleum hydrocarbons
Alternative C4B				
Arlington Stadium Parking Lot	1401 Nolan Ryan Expressway Arlington, Texas	VCP	Inactive	Metals, arsenic, cadmium, lead
RSR Corp – Murph Metals	Singleton Blvd and Westmoreland Road, Texas	NPL	Active	Metals

Site	Location	Type	Status[a]	Identified Contaminants
Alternative C4C				
O.B. Marconi Company	108 Maryland Ave Fort Worth, Texas	VCP	Active	Metals, TPH
Plaza de Las Americas Center (Texas Steel)	4001 Hemphill Street Fort Worth, Texas	VCP	Inactive	Metals, PCBs, TPH, VOCs
Turkey Creek Landfill	9100 S IH-35 Alvarado, Texas	Landfill	Active	Municipal solid waste

[a] Active: Some form of remediation or monitoring ongoing.
Inactive: No active remediation; may include ongoing monitoring; contamination may be present, but controlled on-site
Closed: No longer under active regulatory oversight; may have contamination contained in place with land use or institutional controls.
DDD = dichlorodiphenyldichloroethane; DDE = dichlorodiphenyldichloroethene; DDT= dichlorodiphenyltrichloroethane
PCB = polychlorinated biphenyl
Sources: EPA (2014a); EPA (2014b); ODEQ (2014a); ODEQ (2014b); ODEQ (2014c); ODEQ (2014d); ODEQ (2014e); TCEQ (2014a); TCEQ (2014b); TCEQ (2014c); TCEQ (2013).

3.16.3.4 Southern Section: San Antonio to South Texas

3.16.3.4.1 Public Safety

Table 3.16-5 lists the number of vehicular public and private crossings and pedestrian-only crossings of existing rail lines with the Southern Section EIS Study Area for each alternative. The study area for Alternative S4 has 368 vehicular public and private crossings and pedestrian-only crossings of existing rail lines; the Alternative S6 study area has 9 crossings (Table 3.16-5).

Table 3.16-5: Existing Crossings of Rail Lines in the Southern Section EIS Study Area

Alternative	At-grade Crossings				Grade-separated Crossings				Total
	Vehicular Public	Vehicular Private	Pedestrian	Subtotal	Vehicular Public	Vehicular Private	Pedestrian	Subtotal	
S4	265	96	0	361	7	0	0	7	368
S6	1	5	0	6	3	0	0	3	9

Source: USDOT (2013).

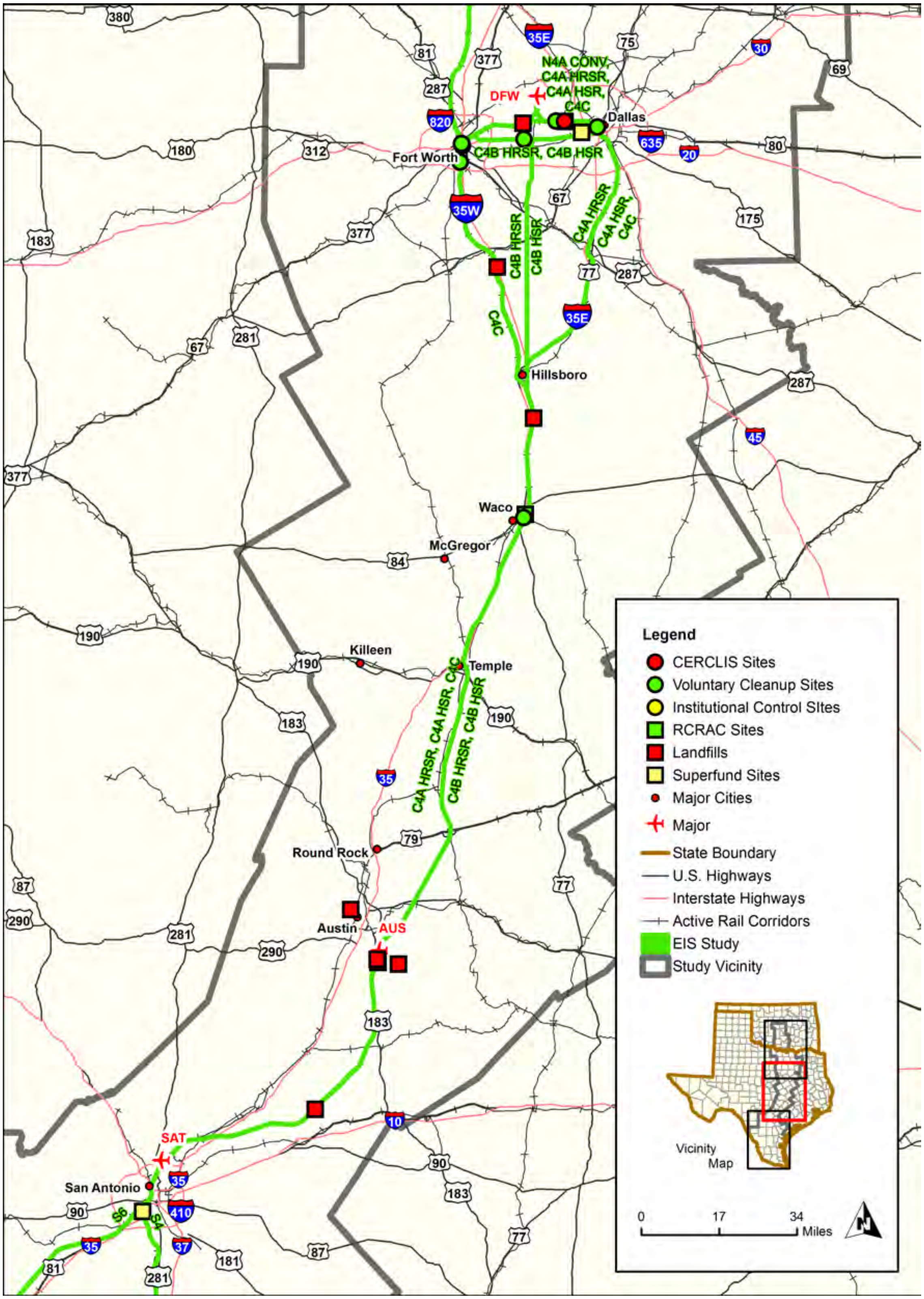


Figure 3.16-2: Hazardous Materials Sites, Dallas and Fort Worth to San Antonio

3.16.3.4.2 Hazardous Materials

Table 3.16-6 lists the hazardous materials sites identified within the Southern Section EIS Study Area. No hazardous materials sites were identified in the study area for Alternative S6. Of the sites identified in the study area for Alternative S4, two are NPL sites and one is a VCP site. In addition, there is one closed landfill. The locations of these hazardous materials sites are shown on Figure 3.16-3.

Table 3.16-6: Hazardous Materials Sites in the Southern Section EIS Study Area

Site	Location	Type	Status	Identified Contaminants
Alternative S4				
R & H Oil	403 Somerset Road Texas	NPL	Active	Petroleum-related waste and plume with 2-methyl naphthalene, arsenic, BTEX, barium, naphthalene, zinc
Clark Knapp Motor Company	801 W Business 83, McAllen, Texas	VCP	Inactive	Metals, TPH
Niagara Chemical	Commerce Street and Adams Ave Texas	NPL	Closed	Arsenic, lead, pesticides
Jim Wells Landfill	Jim Wells County, Texas	Landfill	Closed	Municipal solid waste

[a] Active: Some form of remediation or monitoring ongoing.
Inactive: No active remediation; may include ongoing monitoring; contamination may be present, but controlled on-site
Closed: No longer under active regulatory oversight; may have contamination contained in place with land use or institutional controls.
Sources: EPA (2014a); EPA (2014b); ODEQ (2014a); ODEQ (2014b); ODEQ (2014c); ODEQ (2014d); ODEQ (2014e); TCEQ (2014a); TCEQ (2014b); TCEQ (2014c); TCEQ (2013).

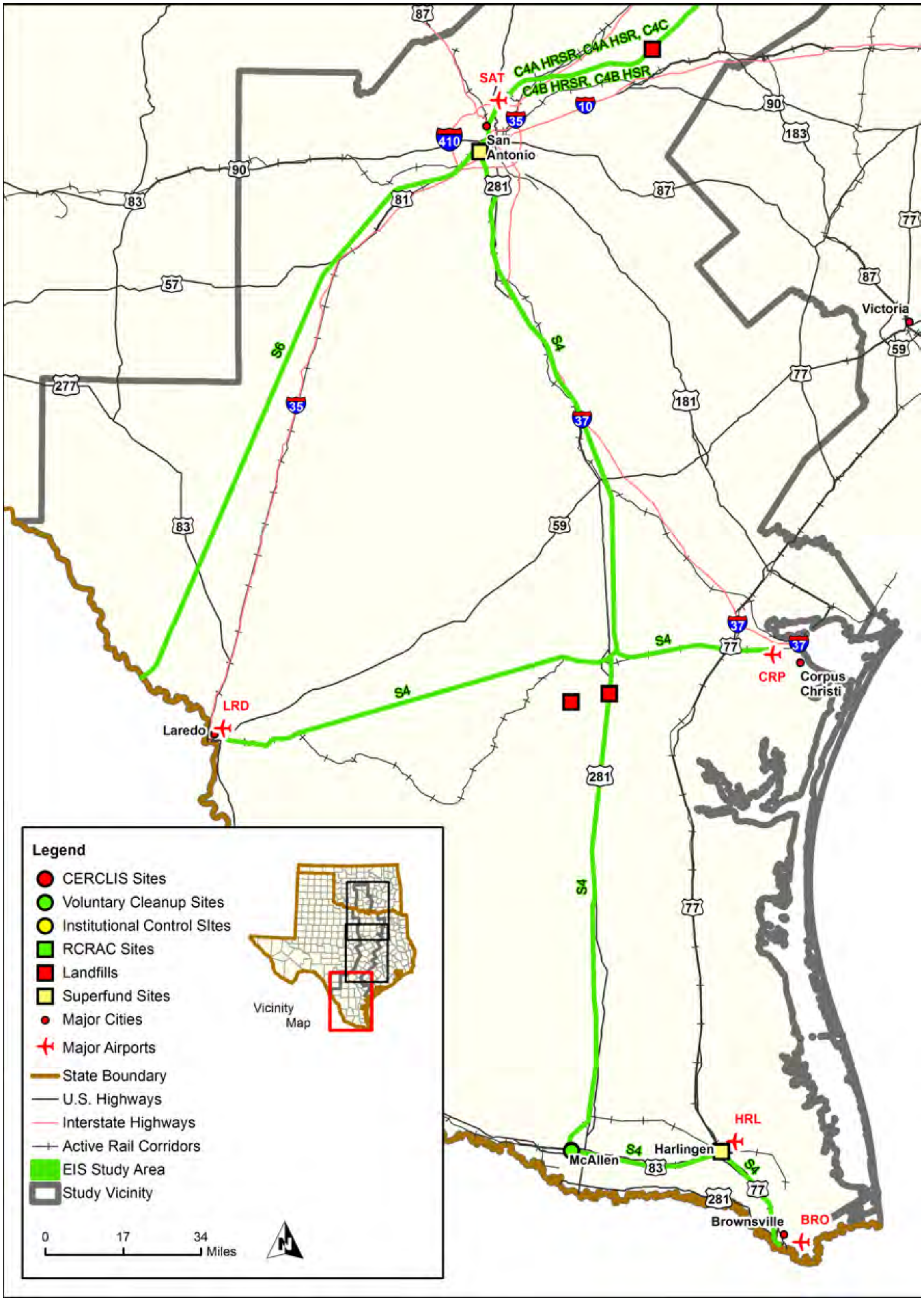


Figure 3.16-3: Hazardous Materials Sites, San Antonio to South Texas

3.16.4 Environmental Consequences

This section describes the environmental consequences and effects on public safety and security and hazardous materials for each alternative.

3.16.4.1 Overview

3.16.4.1.1 Public Safety

This section provides an overview of the public safety and security effects that would be common to all alternatives in the Northern, Central, and Southern sections. The discussion includes references to project design features and avoidance, minimization, and mitigation strategies that would be implemented as part of the Program. The features are listed in Section 3.16.5, Avoidance, Minimization, and Mitigation Strategies.

Construction

During construction, common safety effects include accidents, road closures, detours, and potential delays for emergency services or responders. These effects can cause risks to human health, including injury and death. During construction, a construction transportation plan would be implemented to limit the risks. Effects on human health would be negligible with this standard safety precautionary measure.

During construction, some new roadway overcrossings of the rail line would be built. Although at-grade crossings are allowed for conventional rail and higher-speed rail, FRA regulations require at-grade crossings to be eliminated for high-speed rail (trains that operate at 125 miles per hour or greater). Therefore, it is likely that more roadway overcrossings would be constructed for the high-speed rail than for conventional and higher-speed rail.

Two options would be available for roadway overcrossing construction, depending on site conditions: (1) the overcrossing would be built parallel to the existing roadway while traffic remains on the existing roadway or (2) the overcrossing would be built on the existing roadway alignment, which would require road closure during the overcrossing construction period.

For overcrossings built parallel to the existing roadway, traffic would be maintained on the existing roadway during the overcrossing construction period. When construction is complete, traffic would be moved to the new overcrossing and the existing roadway section removed. Temporary lane closures would be required while the final connections are made to the new road overcrossings. Because the lane closures would be temporary (likely less than 1 day), the effects on traffic and emergency response would be minimal. The resulting effects on public safety would be negligible because detour routes would be established if needed, and a construction transportation plan implemented that specifies the procedures for coordination with emergency service providers.

For overcrossings built on the existing roadway alignment, the existing roadway would be closed and it would be necessary to detour traffic onto other roads. Road closures typically last 8 to

10 months, but can be as long as 18 months. Lane closures and detours may distract automobile drivers, pedestrians, and bicyclists, possibly leading to accidents and increased congestion. Increased numbers of accidents or localized congestion could increase response times for law enforcement and emergency services. An increase in emergency evacuation times could also occur. A construction transportation plan would be implemented that specifies the procedures for coordination with emergency service providers. Other components of the plan would include traffic control measures to address temporary road closures, provisions for detours, and alternative routes. Because a construction transportation plan and associated traffic control measures would be implemented, the resulting effects on public safety and construction workers during construction would be negligible.

Criminal activity at construction sites such as equipment theft or vandalism after work hours are typical crimes that can occur at heavy construction sites. Common construction site security measures would be instituted, including securing equipment and materials after hours in locked storage areas, and the use of security personnel. With these construction security measures in place, the resulting effects on security during construction would be negligible.

Project Operation

The project-level design would include safety features that follow safety design standards. During operation, passenger train traffic routing would comply with federal and state rules for vehicular movement, such as right-of-way fencing, contemporary signaling, Positive Train Control systems[2], and adequate clearance between parallel passenger and freight rail tracks. Conventional rail would share track or rights-of-way with existing rail lines. Higher-speed rail would operate on dedicated track but could share rights-of-way with existing rail lines. High-speed rail would operate on dedicated rights-of-way, eliminating potential conflicts with other trains (such as freight trains) or other vehicles. Passenger trains must comply with FRA crash worthiness standards.

Railroad–highway at-grade crossings for conventional and higher-speed rail are required to use warning devices for safety, in compliance with FRA regulations. The safety risks associated with at-grade crossings include the potential for train collisions with other travel modes and the risk of collisions involving vehicles approaching or stopped at crossings. Because no at-grade crossings of high-speed rail corridors are allowed, the high-speed rail alternatives would present less risk to public safety than the conventional and higher-speed rail alternatives.

Emergency response times would likely be quicker and more consistent for the high-speed rail alternatives than the conventional and higher-speed rail alternatives because all crossings would be grade-separated. Grade-separated crossings would not cause the delays that occur when trains

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[2] Positive Train Control is a technology designed to automatically stop or slow a train before certain accidents occur. In particular, Positive Train Control is designed to prevent train-to-train collisions, derailments caused by excessive speed and unauthorized movement of trains onto sections of track where repairs are being made or as a result of a misaligned track switch (Association of American Railroads no date).

are passing at-grade crossings. Fewer effects on emergency response times and routes would occur in urban areas of the rail alignment because railroad–highway crossings would be closer together than in rural areas. Specific emergency response routes, times, and service areas will be evaluated during project-level analysis.

Because stations, tracks, or trains could be considered potential terrorist targets, protective measures, including access control and security monitoring systems, would be used to deter these acts and provide early detection. A safety and security plan will be prepared to cover acts of terrorism. These measures would reduce the potential for successful criminal and terrorist acts during program operation to a negligible effect.

Hazardous Materials

Construction vehicles and equipment have the potential to release hazardous materials, mainly petroleum products. Construction activities also increase the likelihood for encountering existing and unknown regulated materials. Dewatering activities during construction could potentially alter existing groundwater contamination plumes and affect additional properties. Heavy truck traffic may also increase during construction, creating an increased potential for hazardous material spills. Appropriate construction safety procedures, equipment stockpiling methods, material handling plans, and solid waste management procedures would be implemented to protect human health and the environment and minimize releases. With these procedures in place, effects related to hazardous materials during construction would be negligible.

As previously described, this service-level EIS was performed on a narrowed list of federal and state databases and does not incorporate information from other smaller sites, such as sites with LUSTs, which could contribute to local risks. These types of sites would be considered during the project-level analysis, when detailed alignment plans and profiles are developed.

Assuming that a larger number of identified hazardous materials and hazardous waste sites increases the potential for hazardous materials and hazardous waste effects, the extent of effects and cleanup or remediation would depend on the service type (conventional, higher-speed, or high-speed rail) of the route alternative and the station locations selected, as described in Section 3.16.1.2. The extent of cleanup or remediation would increase costs for construction, which could make a major difference in the practicality or feasibility of an alternative.

Specific hazardous materials site limits, contamination boundaries, and effects will be analyzed during project-level evaluation. The project-level design would avoid the affected sites to the extent possible. The nature and extent of the contaminated sites or materials require specific environmental health and safety plans and procedures to protect construction workers, surrounding communities, and the environment. Material handling plans, personal protection, workplace monitoring, alternative designs, and methods of construction would need to be evaluated and selected to limit the effect from contaminated materials. With these measures in place, effects related to disturbance and cleanup or remediation of hazardous materials sites would be negligible, but could be moderate depending on the extent of effects.

Program operation would increase the chance of accidental hazardous material releases during train refueling, maintenance operations, or from spills during operation of the trains. Such incidents can affect water quality if contaminants flow into water bodies. However, by implementing standard permanent best management practices (BMPs), water quality effects from accidental hazardous materials releases would be avoided or minimized and would be negligible.

3.16.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect safety or hazardous materials.

Public Safety

Existing safety conditions related to the identified rail crossings for motor vehicles, pedestrians, and bicyclists would not change under the No Build Alternative. Because the majority of the existing tracks in the Northern, Central, and Southern sections are at-grade, there is a potential for train and automobile accidents at at-grade crossings, and there are existing safety risks associated with pedestrians crossing the tracks illegally. Under the No Build Alternative, the potential for these types of occurrences would not change; no improvements or construction of infrastructure or stations would occur, and there would be no effects on existing railroad operations. Existing security conditions under the No Build Alternative would not change, and emergency response plans and procedures would not be affected.

Hazardous Materials

Under the No Build Alternative, no section of the proposed project would be constructed. There would be no effects on hazardous materials sites under the No Build Alternative. In comparison to the build alternatives in the Northern, Central, and Southern sections, the No Build Alternative would have the least effect related to hazardous materials sites within the project-level EIS Study Area; however, the No Build Alternative does not meet the purpose and need for the Program identified in Chapter 1.

3.16.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.16.4.3.1 Alternative N4A Conventional

Public Safety

Implementation of Alternative N4A Conventional would require changes to existing crossings of the BNSF and TRE rail lines. Some crossings would be closed, others would be upgraded to higher levels of crossing protection (e.g., four-quadrant gates[3]), and others would be grade-separated. A small number of new crossings (either at-grade or grade-separated) could be required in areas where modifications to the existing rail alignment are needed.

The project-level design would incorporate engineering safety measures and safety BMPs for at-grade and grade-separated rail crossings in accordance with federal and state regulations. These safety features would provide a warning system and physical barrier to vehicles, bicyclists, and pedestrians when a train is approaching. Because these safety measures would be implemented, some crossings would be closed, others would be updated with better crossing protection, and others would be grade-separated; crossing safety would be improved over existing conditions and the No Build Alternative. The safety risk associated with potential train collisions with vehicles, bicyclists, or pedestrians at these crossings would be negligible.

The operational relationships between passenger rail and freight rail would be assessed during a project-level analysis. Current and future freight operations would be considered so that both services operate without conflicts, and passenger rail vehicles would meet FRA crash-worthiness standards. Positive Train Control would need to be provided on any corridor that has not already implemented it, in compliance with the Rail Safety Improvement Act of 2008 (49 CFR Part 236, Subpart I).

Modifications to existing crossings could affect emergency response times, either by increasing them in the case of crossing closures or decreasing them when at-grade crossings are grade-separated. Future project-level analysis would create a comprehensive grade crossing plan that addresses a full range of options, such as consolidating groups of crossings, grade-separating heavily used crossings, closing selected crossings, and implementing proven techniques for reducing hazards at the remaining open at-grade crossings. The grade crossing plan would adhere to the practices and standards in the *Railroad–Highway Grade Crossing Handbook* (FHWA 2007).

Project-level design would include coordination with emergency responders to incorporate roadway modifications that maintain existing traffic patterns and fulfill response route needs. Because the grade crossing plan would adhere to national standards and coordination with emergency

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[3] Four-quadrant gate systems consist of a series of automatic flashing light signals and gates in which the gates extend across both the approach and the departure side of roadway lanes. Unlike two-quadrant gate systems, four-quadrant gates provide additional visual constraints and inhibit nearly all traffic movements through the crossing after the gates are lowered (FHWA 2007).

responders would occur during project-level design, effects on emergency response times would be negligible.

Passenger safety at stations would comply with FRA and ADA requirements (see Section 3.16.2). Stations that are currently used would continue to be used as improvements are made to the existing conventional rail service. Stations may be improved, such as adding a second platform, while service continues within the station. Safety and ADA access during station improvements would be addressed through standard safety precautions, such as textured warning strips along platform edges, properly designed lighting, and adequate platform depth to allow passengers to stand away from active tracks. Grade-separated pedestrian crossings would allow passengers to safely cross tracks and access all station platforms. Other station improvements that promote safety may include designating pedestrian and vehicle spaces, and adding passenger pick-up and drop-off zones. Because these safety standards would be implemented, the effects of safety risks at stations would be negligible.

Hazardous Materials

Alternative N4A Conventional has the potential to affect eight known hazardous materials sites within the Northern Section EIS Study Area, including a closed Superfund site; this site has institutional controls that are meant to protect the public from any contamination that remains in place (ODEQ 2013). Although this alternative would primarily operate on existing track, modifications to the existing track, such as curve straightening, would be needed in some locations, and associated features (e.g., roadway shifts, grade separations, construction activities, and maintenance-of-way facilities) would also occur within the Northern Section EIS Study Area.

More in-depth investigations would be required to determine the nature and severity of contamination at the affected sites. Project-level design would avoid the affected sites to the extent possible. Additionally, investigation of other smaller sites, such as LUST sites, would occur during a project-level analysis, when detailed alignment plans and profiles are developed. With the development of environmental health and safety plans and procedures, effects from hazardous materials would be negligible.

Stations in the Northern Section would use existing facilities and infrastructure. It is possible that additional hazardous materials sites may be identified near the station locations. If existing stations require renovation to accommodate passenger rail, effects on hazardous materials sites would not be expected. During renovation of a station, if hazardous materials are encountered (e.g., asbestos or lead-based paint), the applicable federal and state regulations would be followed for removal and disposal at an appropriately permitted facility. Because hazardous materials that would be potentially encountered during renovation would be removed and disposed in accordance with applicable federal and state regulations, effects would be negligible. Station locations have not yet been determined, and it is possible that additional listed hazardous materials sites may be identified near the station locations. Project-level design would avoid the affected sites to the extent possible. Additionally, investigation of other smaller sites would occur during a project-level analysis, when detailed station plans are developed. With the development of environmental health and safety plans and procedures, effects from hazardous materials associated with the stations would be negligible.

3.16.4.4 Central Section: Dallas and Fort Worth to San Antonio

3.16.4.4.1 Alternative C4A Higher-Speed Rail

Public Safety

Implementation of Alternative C4A Higher-Speed Rail would require changes to existing crossings of rail lines that would share rights-of-way with the alternative. Some crossings would be closed, others would be upgraded to higher levels of crossing protection (e.g., four-quadrant gates), and others would be grade-separated. A large number of new crossings (both at-grade and grade-separated) would be required where the alternative follows a new alignment outside of existing rail corridors and in areas where modifications to existing rail are needed.

Project design would incorporate engineering safety measures and safety BMPs for at-grade and grade-separated rail crossings in accordance with federal and state regulations. These safety features provide a warning system and physical barrier to vehicles, bicyclists, and pedestrians when a train is approaching. Because these safety measures would be implemented, crossing safety would be improved over existing conditions and the No Build Alternative, and the safety risk associated with potential for train collisions with vehicles, bicyclists, or pedestrians at these crossings would be negligible.

Though at-grade crossings would incorporate required crossing protection measures, Alternative C4A Higher-Speed Rail would have more chances for collisions than any of the high-speed rail alternatives because the latter would be fully grade-separated. Alternative C4A Higher-Speed Rail is longer than Alternative C4B Higher-Speed Rail and therefore would likely have more at-grade crossings and associated chance of collisions. Inversely, Alternative C4A Higher-Speed Rail is shorter than Alternative C4C Higher-Speed Rail, and therefore would likely have fewer at-grade crossings and associated chance of collisions.

Passenger rail tracks that parallel freight rail tracks would maintain adequate separation to prevent derailed trains from entering the adjacent trackway, or the design would include physical barriers, such as crash walls, in areas where adequate physical separation cannot be attained. These types of design features would be determined during the project-level design and analysis, and would follow the design and safety standards and recommended practices in the *2014 Manual for Railway Engineering* (American Railway Engineering and Maintenance-of-Way Association [AREMA] 2014) and federal Track Safety Standards (49 CFR Part 213).

Modifications to existing crossings could affect emergency response times by increasing them in the case of crossing closures or decreasing them when at-grade crossings are grade-separated. In areas where Alternative C4A Higher-Speed Rail would follow a new alignment outside of existing transportation corridors, some roadways crossing the new alignment could be closed and others could be constructed as at-grade or grade-separated crossings. Project-level analysis would include a comprehensive grade crossing plan that addresses a full range of options, such as consolidating groups of roadways or crossings into a single crossing, grade-separating heavily used crossings, closing selected roadways or crossings, and implementing proven techniques for reducing hazards at the remaining open at-grade crossings. The grade crossing plan would adhere to the practices and standards in the *Railroad–Highway Grade Crossing Handbook* (FHWA 2007).

Project design would include coordination with emergency responders to incorporate roadway modifications that maintain existing traffic patterns and fulfill response route needs. Because the grade crossing plan would adhere to national standards, and coordination with emergency responders would occur during design, effects on emergency response times would be negligible.

Passenger safety at stations would be the same as discussed under Alternative N4A Conventional, and would be negligible.

Hazardous Materials

Alternative C4A Higher-Speed Rail has the potential to affect nine hazardous materials sites identified from the narrowed list of federal and state databases within the Central Section EIS Study Area, which is fewer than the C4C alternatives and more than the C4B alternatives. Although this alternative could use existing track, modifications to the existing track would be needed. Additional track would be needed in some locations to accommodate separate freight and passenger services. Where located outside an existing corridor, new alignment would be designed to eventually accommodate high-speed rail. Project-level design would avoid the affected sites to the extent possible. Additionally, investigation of other smaller sites, such as LUST sites, would occur during project-level analysis, when detailed alignment plans and profiles are developed. With the development of environmental health and safety plans and procedures, the use of existing track where feasible, and avoidance of known contamination sites, effects from hazardous materials would be negligible, as discussed in Section 3.16.4.1.

Station locations have not yet been determined, and it is possible that additional listed hazardous materials sites may be identified near the station locations. Stations would be either newly constructed or renovations of existing stations. If stations require renovation, effects would be the same as described for Alternative N4A Conventional. Newly constructed stations would require an additional project-level analysis to determine conditions related to hazardous materials contamination in the vicinity of the station location. Nonetheless, the effect would be negligible.

3.16.4.4.2 Alternative C4A High-Speed Rail

Public Safety

High-speed rail alternatives would operate on a fully grade-separated, dedicated track alignment. No at-grade crossings of high-speed rail corridors would be allowed, thus preventing conflicts with other modes of travel. Implementation of Alternative C4A High-Speed Rail would likely result in changes to existing crossings of rail lines located adjacent to the alternative, depending on the physical distance between the new passenger rail track and the existing rail track. Some crossings would be closed and others would be grade-separated. A large number of new grade-separated crossings would be required where the alternative follows a new alignment outside of existing rail corridors. Because Alternative C4A High-Speed Rail would be fully grade-separated, there would be no effects or safety risks associated with the potential for train collisions with other modes of travel, and crossing safety would be improved over existing conditions and the No Build Alternative.

Passenger rail tracks that parallel freight tracks would maintain adequate separation to prevent derailed trains from entering the adjacent rail trackway, or they would include physical barriers, such as crash walls, in areas where adequate physical separation cannot be attained. These types of design features would be determined during project-level design and analysis, and would follow the design and safety standards and recommended practices in the *2014 Manual for Railway Engineering* (AREMA 2014) and federal Track Safety Standards (49 CFR Part 213).

Modifications to roadways and existing crossings could affect emergency response times either by increasing them in the case of roadway or crossing closures or decreasing them when existing at-grade crossings are grade-separated. Subsequent project-level analysis would create a comprehensive grade crossing plan that addresses a full range of options, such as consolidating groups of roadways or crossings into a single crossing, closing selected roadways or crossings, and grade-separating remaining roadways and crossings. The crossing plan would adhere to the standards in the *Railroad–Highway Grade Crossing Handbook* (FHWA 2007).

Project design would include coordination with emergency responders to incorporate roadway modifications that maintain existing traffic patterns and fulfill response route needs. Because the crossing plan would adhere to national standards and coordination with emergency responders would occur during design, effects on emergency response times would be negligible.

Passenger safety at stations would be the same as for Alternative C4A Higher-Speed Rail, and would be negligible.

Hazardous Materials

While both service-types for C4A follow the same route, the effects of Alternative C4A High-Speed Rail would be greater than the effects under Alternative C4A Higher-Speed Rail because more construction would be necessary, making the possibility of encountering contamination moderate.

Although station locations might vary between the alternatives, the same considerations related to renovations of existing stations and additional analysis at new station locations would apply. Effects from hazardous materials would be negligible.

3.16.4.4.3 Alternative C4B Higher-Speed Rail

Public Safety

Effects on public safety would be the same as those described under Alternative C4A Higher-Speed Rail, because the same types of changes to existing crossings and needs for new crossings would occur and the same required safety measures, grade crossing plan, and coordination with emergency responders would be implemented. However, Alternative C4B Higher-Speed Rail would likely have fewer chances for collisions than any of the other Central Section higher-speed rail alternatives because it is shorter than the other alternatives and would likely have fewer at-grade crossings; therefore, the effect would be negligible.

Hazardous Materials

Alternative C4B Higher-Speed Rail has the potential to affect eight hazardous materials sites that were identified from the narrowed list of federal and state databases within the Central Section EIS Study Area; this is lowest number in all of the Central Section route alternatives. One of these sites, RSR Corp – Murph Metals, is a National Priorities List (NPL) site in the Dallas and Fort Worth area, and cleanup activities at the site have been ongoing since 2004 (EPA 2012). The location of the RSR Corp – Murph Metals NPL site is shown on Figure 3.16-4. More in-depth investigations would be required to determine the nature and severity of contamination at the eight hazardous materials sites in the Alternative C4B Higher-Speed Rail EIS Study Area. The project-level design would avoid the affected sites to the extent possible. Additionally, investigation of other smaller sites, such as LUST sites, would occur during the project-level analysis, when detailed alignment plans and profiles are developed. With the development of environmental health and safety plans and procedures, effects from hazardous materials would be negligible.

Station effects would be the same as discussed under Alternative C4A Higher-Speed Rail. Although station locations might vary between alternatives, the same considerations related to renovations of existing stations and additional analysis at new station locations would apply. The effect would be negligible.

3.16.4.4.4 Alternative C4B High-Speed Rail

Public Safety

Effects on public safety would be the same as those described under Alternative C4A High-Speed Rail because the same types of changes to existing crossings and needs for new crossings would occur, and the same required safety measures, grade crossing plan, and coordination with emergency responders would be implemented. The effects would be negligible.

Hazardous Materials

While both service types would follow the same alignment, the effects of Alternative C4B High-Speed Rail would be moderate because more construction would be needed for grade separation.

Although station locations might vary between alternatives, the same considerations related to renovations of existing stations and additional analysis at new station locations would apply. The effect would be negligible.

Figure 3.16-4: Hazardous Materials Sites, Dallas and Fort Worth to San Antonio, RSR Corp – Murph Metals, NPL Site

3.16.4.4.5 Alternative C4C Higher-Speed Rail

Public Safety

Effects on public safety would be the same as those described under Alternative C4A Higher-Speed Rail because the same types of changes to existing crossings and needs for new crossings would occur, and the same required safety measures, grade crossing plan, and coordination with emergency responders would be implemented. However, Alternative C4C Higher-Speed Rail would likely have more chances for collisions than any of the other Central Section higher-speed rail alternatives because it is longer than the other alternatives and would likely have more at-grade crossings. Nonetheless, the effect would be negligible.

Hazardous Materials

Alternative C4C Higher-Speed Rail has the potential to affect 12 hazardous materials sites within the Central Section EIS Study Area, the most of all of the Central Section route alternatives. More in-depth investigations would be required to determine the nature and severity of contamination at the sites. The project-level design would avoid the affected sites to the extent possible. Additionally, investigation of smaller sites, such as LUST sites, would occur during the project-level analysis, when detailed alignment plans and profiles are developed. With the development of environmental health and safety plans and procedures, effects from hazardous materials would be negligible.

Station effects would be the same as discussed under Alternative C4A Higher-Speed Rail. Although station locations might vary between alternatives, the same considerations related to renovations of existing stations and additional analysis at new station locations would apply. The effect would be negligible.

3.16.4.4.6 Alternative C4C High-Speed Rail

Public Safety

Effects on public safety would be the same as those described under Alternative C4A High-Speed Rail because the same types of changes to existing crossings and needs for new crossings would occur, and the same required safety measures, grade crossing plan, and coordination with emergency responders would be implemented. The effect would be negligible.

Hazardous Materials

The effects of Alternative C4C High-Speed Rail would be greater than the effects under Alternative C4C Higher-Speed Rail because, while both alternatives would follow the same alignment, more construction would be necessary for Alternative C4C High-Speed Rail; the effect would be moderate.

Although station locations might vary between alternatives, the same considerations related to renovations of existing stations and additional analysis at new station locations would apply. Effects from hazardous materials would be negligible.

3.16.4.5 Southern Section: San Antonio to South Texas

3.16.4.5.1 Alternative S4 Higher-Speed Rail

Public Safety

Effects on public safety would be the same as those described under Alternative C4A Higher-Speed Rail because the same types of changes to existing crossings and needs for new crossings would occur, and the same required safety measures, grade crossing plan, and coordination with emergency responders would be implemented. Though at-grade crossings would incorporate required crossing protection measures, Alternative S4 Higher-Speed Rail would have more chances for collisions than Alternative S6 High-Speed Rail because the latter would be fully grade-separated. Additionally, Alternative S4 Higher-Speed Rail is substantially longer than Alternative S6 Higher-Speed Rail, and therefore would have more at-grade crossings and associated chance of collisions. Nonetheless, the effect would be negligible.

Hazardous Materials

Alternative S4 Higher-Speed Rail has the potential to affect four hazardous materials sites identified from the narrowed list of federal and state databases within the Southern Section EIS Study Area, which is more than the S6 alternatives which would not affect any of the identified hazardous materials sites. Two of these sites located in the Alternative S4 Higher-Speed Rail EIS Study Area include R & H Oil, a Proposed NPL site, and Niagara Chemical, which is a former NPL site that was deleted from the NPL registry. The location of the R & H Oil NPL site is shown on Figure 3.16-5. In-depth investigations would be required to determine the nature and severity of contamination at the four hazardous materials sites in the Alternative S4 Higher-Speed Rail EIS Study Area. The project-level design would avoid the affected sites to the extent possible. Additionally, investigation of other smaller sites, such as LUST sites, would occur during the project-level analysis when detailed alignment plans and profiles are developed. With the development of environmental health and safety plans and procedures, effects from hazardous materials would be negligible.

Station locations have not yet been determined, and it is possible that additional hazardous materials sites may be identified near the station locations. Stations would be either newly constructed or renovations of existing stations. If stations require renovation, effects would be the same as described under Alternative N4A Conventional. Newly constructed stations would require additional project-level analysis to determine conditions related to hazardous material contamination in the vicinity of the station location. The effect would be negligible.

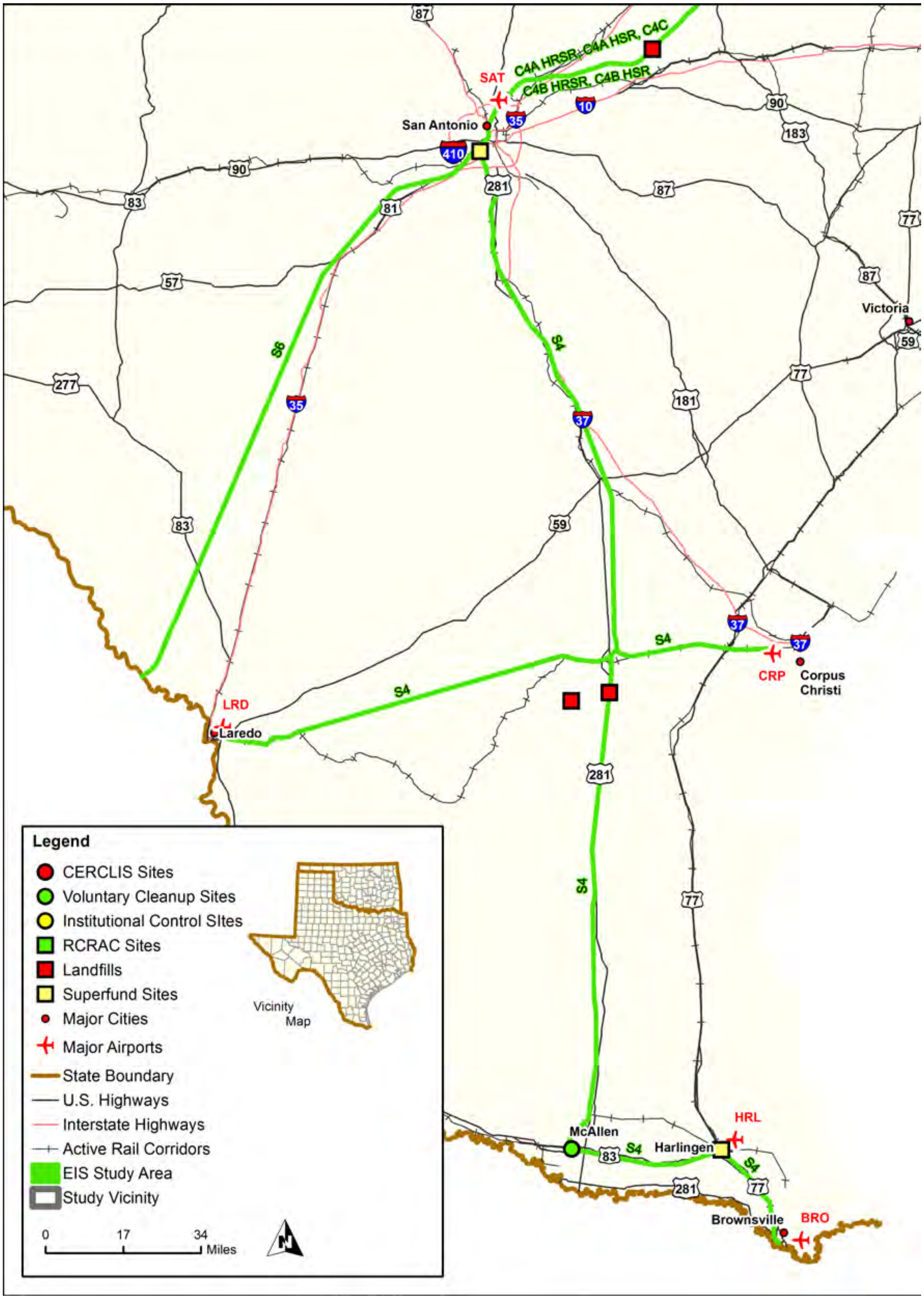

Figure 3.16-5: Hazardous Materials Sites, San Antonio to South Texas, R&H Oil, NPL Site

3.16.4.5.2 Alternative S6 Higher-Speed Rail

Public Safety

Effects on public safety would be the same as those described under Alternative C4A Higher-Speed Rail because the same types of changes to existing crossings and needs for new crossings would occur, and the same required safety measures, grade crossing plan, and coordination with emergency responders would be implemented. Though at-grade crossings would incorporate required crossing protection measures, Alternative S6 Higher-Speed Rail would have more chances for collisions than Alternative S6 High-Speed Rail because the latter would be fully grade-separated. Alternative S6 Higher-Speed Rail is substantially shorter than Alternative S4 Higher-Speed Rail and therefore would have fewer at-grade crossings and associated chance of collisions. The effect would be negligible.

Hazardous Materials

No hazardous materials sites identified from the narrowed list of federal and state databases are located within the Alternative S6 Higher-Speed Rail study area; therefore, no effects related to identified hazardous materials sites would occur. Investigation of other smaller sites that have not been identified for this service-level EIS, such as LUST sites, would occur during the project-level analysis, when detailed alignment plans and profiles are developed. Because no hazardous materials sites from the narrowed list of federal and state databases have been identified within the EIS Study Area for the S6 alternatives, and with the development of environmental health and safety plans and procedures, effects from hazardous materials would be negligible.

Station effects would be the same as discussed under Alternative S4 Higher-Speed Rail. Although station locations might vary between alternatives, the same considerations related to renovations of existing stations and additional analysis at new station locations would apply. The effect would be negligible.

3.16.4.5.3 Alternative S6 High-Speed Rail

Public Safety

Effects on public safety would be the same as those described under Alternative C4A High-Speed Rail because the same types of changes to existing crossings and needs for new crossings would occur, and the same required safety measures, grade crossing plan, and coordination with emergency responders would be implemented. The effect would be negligible.

Hazardous Materials

The effects of Alternative S6 High-Speed Rail would be the same as the effects of Alternative S6 Higher-Speed Rail because there are no hazardous materials sites identified from the narrowed list of federal and state databases and both alternatives would follow the same alignment. Therefore, effects would be negligible.

Although station locations might vary between alternatives, the same considerations related to renovations of existing stations and additional analysis at new station locations would apply. With the development of environmental health and safety plans and procedures, effects from hazardous materials would be negligible.

3.16.4.6 Summary of Potential Effects

Public Safety

The potential intensity of effects on public safety would be negligible for conventional rail and higher-speed rail alternatives and would be negligible for high-speed rail alternatives. High-speed rail alternatives would be fully grade separated, presenting no risk of collisions between trains and other travel modes. Among the higher-speed rail alternatives, those with the shortest routes (Alternative C4B Higher-Speed Rail in the Central Section and Alternative S6 Higher-Speed Rail in the Southern Section) would likely have the fewest at-grade crossings and associated chance of collisions. Inversely, higher-speed rail alternatives with the longest routes (Alternative C4C Higher-Speed Rail in the Central Section and Alternative S4 Higher-Speed Rail in the Southern Section) would likely have the most at-grade crossings and associated chance of collisions. Table 3.16-7 lists the potential intensity of effects associated with existing at-grade and grade-separated crossings within the EIS Study Area for each geographic section. All alternatives would improve crossing safety over existing conditions and the No Build Alternative.

Table 3.16-7: Summary of Effects on Public Safety by Alternative

Section	Alternative[a]	Total Existing At-Grade and Grade-Separated Crossings within the EIS Study Area	Potential Intensity of Effects
No Build Alternative[b]		0	None
Northern	N4A CONV	401	Negligible
Central	C4A HrSR	270	Negligible
	C4A HSR	270	Negligible
	C4B HrSR	176	Negligible
	C4B HSR	176	Negligible
	C4C HrSR	361	Negligible
	C4C HSR	361	Negligible
Southern	S4 HrSR	368	Negligible
	S6 HrSR	9	Negligible
	S6 HSR	9	Negligible

[a] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

[b] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area. However, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

Hazardous Materials

The potential intensity of effects related to hazardous materials would be negligible to moderate, depending on whether hazardous materials sites would be affected and the nature and extent of the contamination. Assuming that a larger number of identified hazardous materials sites within the study area for each alternative would increase the potential for hazardous materials effects, the extent of effects, cleanup, or remediation depends on the route alternative and station locations selected. Table 3.16-8 lists the number of known hazardous materials sites by alternative and the potential intensity of effects.

Table 3.16-8: Summary of Effects Related to Hazardous Materials by Alternative

Section	Alternative	Hazardous Material Sites within EIS Study Area	Potential Intensity of Effects
No Build Alternative[a]		0	None
Northern	N4A CONV	8	Negligible
Central	C4A HrSR	9	Negligible
	C4A HSR	9	Moderate
	C4B HrSR	8	Negligible
	C4B HSR	8	Moderate
	C4C HrSR	12	Negligible
	C4C HSR	12	Moderate
Southern	S4 HrSR	4	Negligible
	S6 HrSR and HSR	0	Negligible

[a] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area. However, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

3.16.5 Avoidance, Minimization, and Mitigation Strategies

Future project-level analyses will identify more specific effects on public safety and hazardous materials based on a more advanced understanding of the project design in the three geographic sections. Avoidance and minimization of effects will be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies will be implemented. Project design features and avoidance, minimization, and mitigation strategies to address public safety risks and risks associated with hazardous materials are described in the following subsections.

3.16.5.1 Public Safety

The following mitigation measures, BMPs, and project design features will be considered during project-level analysis to address public safety and security risks:

- Develop a construction health and safety plan to limit risks to human health.
- Implement a construction transportation plan that includes traffic control measures to address temporary road closures, provisions for detours, alternative routes, and procedures for coordination with emergency service providers.
- Implement construction site security measures, such as securing equipment and materials after hours in locked storage areas and use of security personnel.
- Implement operational security measures, such as access control and security monitoring systems.
- Follow safety design standards for track and roadway design.
- Comply with federal and state rules for vehicular movements, such as right-of-way fencing, use of contemporary signaling, Positive Train Control systems, and adequate clearance between parallel passenger and freight rail tracks.
- Incorporate engineering safety measures and BMPs for at-grade and grade-separated rail crossings in accordance with federal and state regulations.
- Implement standard safety precautions at stations, such as textured warning strips along platform edges, properly designed lighting, adequate platform depth to allow passengers to stand away from active tracks, and grade separated pedestrian crossings of rail tracks. Other station improvements that promote safety may include designating pedestrian and vehicle spaces and adding passenger pick-up and drop-off zones. The FRA Passenger Rail Division provides technical expertise and guidance in the development and implementation of rail safety programs applicable to commuter and passenger railroads as well as advice and oversight in system safety, emergency preparedness, and safety related to shared use with freight rail.
- Maintain adequate separation between adjacent passenger and freight rail tracks to prevent derailed trains from entering the adjacent rail trackway. Include physical barriers, such as crash walls, in areas where adequate physical separation cannot be attained. These types of design features would follow the design and safety standards and recommended practices in the *2014 Manual for Railway Engineering* (AREMA 2014) and federal Track Safety Standards (49 CFR Part 213).
- Coordinate with emergency responders to incorporate roadway modifications that maintain existing traffic patterns and fulfill response route needs.
- Develop and implement an emergency response plan in the event of an act of terrorism, natural disasters, and other emergencies.
- Develop and implement a safety and security plan for services in sealed corridors, such as high-speed rail, where access is limited by fencing or on viaducts (e.g., Dallas to Houston).

3.16.5.2 Hazardous Materials

Avoidance and minimization of effects will be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies will be implemented. The following mitigation measures and BMPs will be considered during project-level analysis to address construction effects related to hazardous materials:

- Use construction safety procedures, equipment stockpiling methods, material handling plans, and solid waste management procedures that protect human health and the environment and minimize hazardous materials releases during construction.
- Develop specific environmental health and safety plans and procedures that protect construction workers, surrounding communities, and the environment.
- Develop and implement a spill prevention, control, and countermeasure plan to handle potential hazardous material spills.
- Develop and implement a soil and material handling plan in the event that undocumented contamination is encountered.
- Use personal protection, workplace monitoring, alternative designs, and evaluation of construction methods that limit the effect from contaminated materials.
- Follow applicable federal and state regulations for removal and disposal of hazardous materials, such as asbestos or lead-based paint, if such materials are encountered during building or structure renovation or demolition.

To the extent feasible, the project design would avoid known hazardous materials sites. Where effects on hazardous material sites cannot be avoided, coordination with regulatory agencies and responsible parties would occur prior to construction activities to address remediation requirements. For locations where subsurface ground disturbance is required at hazardous material sites, further evaluation may be required to assess the level of contamination and the potential risks to human health and the environment, as well as the method of cleanup prior to the construction of the rail line. For construction activities at hazardous material sites, coordination would be required with the regulatory agencies and responsible parties.

3.16.6 Subsequent Analysis

3.16.6.1 Public Safety

The operational relationships between passenger and freight rail services will be assessed during the project-level analysis. Current and future freight operations will be considered such that freight and passenger rail services operate without conflicts.

Project-level analyses will include a comprehensive grade crossing plan that studies safety conditions at each existing crossing and addresses a full range of options, such as consolidating groups of crossings, grade separating heavily used crossings, closing selected crossings, and implementing proven techniques for reducing hazards at the remaining at-grade crossings. The grade crossing plan will adhere to the practices and standards in the *Railroad–Highway Grade Crossing Handbook* (FHWA 2007).

Specific emergency response routes, times, and service areas will be evaluated in the project-level analysis to determine the effects of Program operations on emergency services.

ADA compliance will be evaluated in the project-level analysis.

Because oil fields are potentially present in the EIS Study Area, potential safety concerns related to explosions or related safety issues will be addressed in the project-level analysis.

3.16.6.2 Hazardous Materials

Specific hazardous material site limits, contamination boundaries, and effects will be analyzed as part of the project-level analysis. Additionally, investigation of other smaller sites, such as LUST sites, will occur during the project-level analysis, when detailed alignment plans and profiles are developed. Subsequent analysis could include Phase I Environmental Site Assessments and Phase II Environmental Site Assessments if determined necessary, which include site reconnaissance, additional database searches and assessments, a review of historical land uses and agency records, and agency consultations. Additional design modification will be considered to avoid known contamination sites as part of project-level analysis.

Project-level analysis will include potential construction-related impacts that could result in increased risks to human health and the environment through disturbance of hazardous construction materials such as asbestos, lead-based paint, polychlorinated biphenyls (PCBs), and mercury switches/thermostats. Assessment of potential contaminants typically associated with railway corridors (e.g., creosote, arsenic, other heavy metals, PCBs, pesticides, and herbicides) will also be addressed, as will transportation, use, storage, or disposal of hazardous materials during construction.

3.17 Recreational Areas and Opportunities

This section discusses identified park and recreational areas within the 500-foot environmental impact statement (EIS) Study Area, including trails. Not only are recreational features important to a healthy and sustainable quality of life, park and recreational resources are protected under Section 4(f) of the U.S. Department of Transportation (USDOT) Act of 1966 (49 United States Code [U.S.C.] § 303) for all federally funded USDOT projects. Section 4(f) resources include “publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance” (23 Code of Federal Regulations [CFR] § 774.17). The introduction to Chapter 3 describes the EIS Study Area and use of terms such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.17.1 Laws, Regulations, and Orders

Applicable federal and state legislation and regulations pertaining to recreational areas and opportunities are discussed in the following sections. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.17.1.1 Federal

- **Section 4(f) of the USDOT Act of 1966 (49 U.S.C. § 303) and Section 6(f) of the Land and Water Conservation Fund (L&WCF) Act of 1965 (16 U.S.C. § 460).** If a publicly owned park or recreational resource is considered a significant resource, it is protected under Section 4(f) of the USDOT Act of 1966. If a park, trail, or recreation area receives funding under the L&WCF Act of 1965, it is protected under Section 6(f) of the L&WCF Act. The federal regulations that apply to impacts to parks, recreation areas, and wildlife and waterfowl refuges under Section 4(f) are found in 23 CFR 774. Federal regulations applicable to city parks, trails, and recreation areas that receive L&WCF monies are included in 36 CFR 59. Based on a review of the cities that received funding under the L&WCF Act, several of the recreational properties identified in this service-level EIS may have received Section 6(f) grants for city parks, trails, and recreation areas. However, their Section 6(f) protection status would be identified in the project-level analysis, when detailed evaluations and agency consultations can be conducted. Therefore, information on the Section 4(f) or Section 6(f) protection status of recreational properties identified in this service-level EIS is included for informational purposes only and is not a complete list of parks and recreational properties potentially protected under Section 4(f) or Section 6(f). Detailed descriptions of Section 4(f) and Section 6(f) regulations, applicability, and properties are included in Chapter 4, Section 4(f) and Section 6(f) Resources.

3.17.1.2 State

- **Texas Parks and Wildlife Code – Chapter 26 Protection of Public Parks and Recreational Lands**. Chapter 26 states that a department, agency, political subdivision, county, or municipality of Texas may not approve any program or project that requires the use or taking of any public land designated as a park, recreation area, scientific area, wildlife refuge, or historic site unless there is no feasible and prudent alternative to the use or taking of such land and that all reasonable planning to minimize harm to the public land has been undertaken (3PWC 26.003).

3.17.2 Methodology

This service-level EIS took a broad approach in determining the potential for effects on recreational areas along the proposed alternatives. Identified recreational areas within the 500-foot EIS study area included public parks, fields that appeared to be for recreational use, sport courts, wildlife refuges, school facilities (including playgrounds and interscholastic athletic fields), recreational open spaces, wildlife management areas, amphitheaters, venues, greenways, trails, museums, art spaces, amusement and water parks, and motorsports tracks. This service-level EIS is not intended to be a complete review of recreational areas; rather, it is a preliminary assessment and inventory of properties that would likely require evaluation and documentation in a subsequent project-level EIS. An assessment of private and public facilities or identification of specific recreational activities at each park resource was not conducted, and the significance of the park resources was not verified by the national, state, or local jurisdictions or ownership. When possible, current and historical aerial imagery and Google Streetview was used to confirm the location of the resources. All schools identified within the EIS Study Area were assumed to contain recreational facilities and are included in this EIS. For a complete list of recreational resources identified within the EIS Study Area, see Tables 3.17-1 through 3.17-3.

Information on potential recreational areas was obtained in September and October 2014 from the following electronic databases and online resources:

- Oklahoma public schools (ogi.state.ok.us 2014a)
- Oklahoma private schools (ogi.state.ok.us 2014b)
- Texas Schools Google Earth layer (http://www.tea.state.tx.us/School_District_Locator/Data_Download/)
- The Economic and Social Research Institute (ESRI) 2012 data, the Texas Strategic Mapping Program (http://www.arcgis.com/home/group.html?owner=esri&title=ESRI%20Data%20%26%20Maps&content=all&focus=layers&start=11&q)
- National maps (USGS 2014)
- U.S. Fish and Wildlife Service (USFWS) interactive maps (2014)
- Texas Parks and Wildlife Department websites for parks and wildlife management areas
- U.S. Army Corps of Engineers (USACE) websites
- U.S. Department of the Interior, National Park Service (NPS) Land and Water Conservation Fund (L&WCF) website (http://www.lwcfcoalition.org/)
- NPS Google Earth layer of National Register of Historic Places-listed resources in Texas and Oklahoma (http://nrhp.focus.nps.gov/natreg/docs/Download.html#spatial)

- Texas Independent School District websites (including Arlington, Ben Bolt-Palito Blanco, Brownsville, Bruceville-Eddy, Dallas, Donna, Eagle Mountain-Saginaw, Grand Prairie, Harlingen, La Vega, Los Fresnos, McAllen, Northwest [Tarrant County], Pharr-San Juan-Alamo, South Texas [Cameron County], Southwest [Bexar County], Troy, and West) (see Chapter 11, References, for a list of websites)
- City parks and recreation department websites (including Arlington, Dallas, Oklahoma City, Fort Worth, Grand Prairie, Nueces County, San Antonio-Bexar County, and Travis County) (see Chapter 11, References, for a list of websites)
- Websites for numerous public and private recreational areas, including Bryan McClain Park (Bexar County), Casa Blanca Golf Club (Webb County), International Museum of Art and Science (McAllen), River Legacy Foundation (Tarrant County), St. Mark Catholic Youth Organization (San Antonio), San Antonio Gun Club, and Southern Oklahoma Speedway (Ardmore) (see Chapter 11, References, for a list of websites)

Effects as a result of the route alternatives are characterized as negligible, moderate, or substantial compared to the No Build Alternative. For recreational areas and opportunities, these terms are defined as follows:

- Negligible intensity effects are those that would have a slight effect on (e.g., minor property acquisition, offsite construction disturbance), but would not interfere with, a recreational or intended use of the open space or park area and no property acquisition is necessary.
- Moderate intensity effects are those that would have a noticeable effect on park and recreational resources, temporarily affecting (e.g., noise or visual intrusion of construction) a recreational or intended use of the open space or park area, or resulting in a partial property acquisition or relocation of park or recreational resources.
- Substantial intensity effects are those that would have a noticeable, inevitable effect on park and recreational resources, permanently affecting a recreational or intended use of the open space or park area, or resulting in a substantial property acquisition that may bifurcate or substantially change the resource.

3.17.3 Affected Environment

3.17.3.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Alternative N4A Conventional follows the same general alignment within the Dallas and Fort Worth areas as several of the Central Section alternatives. As a result, some recreational resources identified within the EIS Study Area are located in both the Northern and Central sections. Overlapping resources are identified in Tables 3.17-1 and 3.17-2 (see table note “b”). The six Central Section alternatives are discussed in Section 3.17.3.2, Dallas and Fort Worth to San Antonio (Central Section).

3.17.3.1.1 Alternative N4A Conventional

There are 56 recreational resources identified within the EIS Study Area for Alternative N4A Conventional. Most of these resources are public parks and/or trails, baseball, softball and general athletic fields, playgrounds and fields associated with public, private and/or charter schools, and private and public golf courses. The resources are primarily in urban areas, especially the metropolitan areas of Norman, Oklahoma City, Dallas, and Fort Worth. Other resources in the Northern Section EIS Study Area include the YMCA of Greater Oklahoma City, two raceways in southern Oklahoma, a go-kart track in northern Texas, and the Ray Roberts Lake Wildlife Management Area (of which there is approximately 34.41 acres within the EIS Study Area).

Of the recreational resources within the EIS Study Area for Alternative N4A Conventional, three are also located within the EIS Study Area for the C4B alternatives, and 14 were also within the EIS Study Area for the C4A alternatives and C4C alternatives. A list of recreational resources in the Northern Section EIS Study Area is included in Table 3.17-1, and they are mapped on Figures 3.17-1 through 3.17-4.

Table 3.17-1: Recreational Resources – Northern Section

Site ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location[c] (Lat/Long)	Alternative[d]	Acreage within Study Area
1 3.17-2	Canyon Park	City park	City of Oklahoma City	Yes	35.5278/-97.51924	N4A CONV	3.37
2 3.17-2	Topping Park	City park	City of Oklahoma City	Yes	35.525646/-97.517796	N4A CONV	11.91
3 3.17-2	YMCA of Greater Oklahoma City	Private recreation	YMCA of Greater Oklahoma City	No	35.472351/-97.512692	N4A CONV	1.11
4 3.17-2	Bricktown Canal and Downtown Park	Urban park and art area	City of Oklahoma City	Yes	35.465048/-97.512146	N4A CONV	4.01
5 3.17-2	Riverside Walking and Bicycling Trail (north)	City trail	City of Oklahoma City	Yes	35.44946/-97.512823	N4A CONV	0.20
6 3.17-2	Riverside Walking and Bicycling Trail (south)	City trail	City of Oklahoma City	Yes	35.447799/-97.51298	N4A CONV	0.16
7 3.17-2	Bicycling and walking trail	City trail	City of Oklahoma City	Yes	35.428266/-97.504351	N4A CONV	0.11
8 3.17-2	Oklahoma City Educare	Private school	Oklahoma City Educare	No	35.427335/-97.503259	N4A CONV	2.08

Site ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location[c] (Lat/Long)	Alternative[d]	Acreage within Study Area
9 3.17-2	Santa Fe South Charter High School	Charter school	Oklahoma City School District	Yes	35.426868/-97.504211	N4A CONV	1.48
10 3.17-2	Bella Rose Academy	Private school	Bella Rose Academy	No	35.337939/-97.483826	N4A CONV	0.45
11 3.17-2	Pumpkin Shell School Playground (daycare)	Private school	Pumpkin Shell School	No	35.228213/-97.449336	N4A CONV	0.07
12 3.17-2	Bicycling and walking trail	City trail	City of Norman	Yes	35.5278/-97.51924	N4A CONV	0.75
13 3.17-2	Legacy Park	City park and trail	City of Norman	Yes	35.228936/-97.449165	N4A CONV	8.02
14 3.17-2	Andrews Park	City park	City of Norman	Yes	35.224441/-97.446605	N4A CONV	4.29
15 3.17-2	University of Oklahoma Brandt Park	City park	University of Oklahoma	Yes	35.21998/-97.442875	N4A CONV	9.76
16 3.17-2	Jimmie Austin University of Oklahoma Golf Course	University golf course	University of Oklahoma	Yes	35.205663/-97.434575	N4A CONV	15.43
17 3.17-2	Oak Tree Park South	City park	City of Norman	Yes	35.193544/-97.426991	N4A CONV	4.53
18 3.17-2	Thunder Valley Raceway Park	Drag racing track	Thunder Valley Raceway Park	Yes	35.187872/-97.423317	N4A CONV	9.68
19 3.17-2	Wacker Park	City park	City of Pauls Valley	Yes	35.091482/-97.384341	N4A CONV	9.75
20 3.17-2	Santa Fe Depot Museum and Park	City museum and park	City of Pauls Valley	Yes	34.749634/-97.227876	N4A CONV	0.93
21 3.17-3	Davis High School Football Stadium and Baseball Field	Public school	Davis Public Schools	Yes	34.741912/-97.218958	N4A CONV	4.16
22 3.17-3	Southern Oklahoma Speedway	Race track	Southern Oklahoma Speedway	Yes	34.497429/-97.119817	N4A CONV	1.84
23 3.17-3	Motorcycle Race Course	Race track	Unknown (private?)	Yes	34.109627/-97.143059	N4A CONV	15.84

Site ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location[c] (Lat/Long)	Alternative[d]	Acreage within Study Area
24 3.17-3	Thackerville Elementary School	Public school	Thackerville Public Schools	Yes	33.829092/-97.133153	N4A CONV	0.22
25 3.17-3	Heritage Park	City park	City of Gainesville	Yes	33.79637/-97.143174	N4A CONV	3.32
26 3.17-3	Jaycee Park	City park	City of Gainesville	Yes	33.624681/-97.140138	N4A CONV	4.54
27 3.17-3	Pecan Creek Park	City park	City of Gainesville	Yes	33.622278/-97.139605	N4A CONV	0.27
28 3.17-3	Forsythe Transportation Skate Park	City park	City of Gainesville	Yes	33.622638/-97.139289	N4A CONV	0.01
29 3.17-3	Home Grown Hero Walking Trail	City trail	City of Gainesville	Yes	33.62089/-97.138977	N4A CONV	0.49
30 3.17-4	Ray Roberts Lake Wildlife Management Area	Public wildlife management area	Texas Parks and Wildlife Department	Yes	33.620662/-97.139057	N4A CONV	34.41
31 3.17-4	Baseball and Softball Fields	Baseball and softball	City of Sanger	Yes	33.459994/-97.15505	N4A CONV	3.86
32 3.17-4	North Texas Karters	Go-kart track	North Texas Karters	Yes	33.351319/-97.168138	N4A CONV	2.90
33 3.17-4	Eddie Deussen Jr. Park	City park	City of Ponder	Yes	33.306957/-97.191264	N4A CONV	0.51
34 3.17-4	Bishop Park	City park	City of Justin	Yes	33.184533/-97.287363	N4A CONV	1.79
35 3.17-4	Northwest High School	Public school	Northwest Independent School District	Yes	33.076581/-97.296061	N4A CONV	3.22
36 3.17-4	Haslet Community Park	City park	City of Haslet	Yes	33.025423/-97.310695	N4A CONV	0.40
37 3.17-4	Northwest Community Park	City park	City of Fort Worth	Yes	32.972928/-97.349907	N4A CONV	7.95
38 3.17-4	Prairie Vista Middle School Running Track	Public school	Eagle Mountain-Saginaw Independent School District	Yes	32.892836/-97.36205	N4A CONV	2.33

Site ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location[c] (Lat/Long)	Alternative[d]	Acreage within Study Area
39 3.17-4	Knowles-Towery Kiwanis Park	City park	City of Saginaw	Yes	32.887891/-97.363409	N4A CONV	0.19
40 3.17-4	Trader Oak Park	City park	City of Fort Worth	Yes	32.855602/-97.36154	N4A CONV	1.03
41 3.17-4	Arnold Park	City park	City of Fort Worth	Yes	32.774595/-97.330768	N4A CONV	1.48
42 3.17-4	Elm Street Park	City park	City of Fort Worth	Yes	32.76831/-97.328741	N4A CONV	0.28
43[b] 3.17-4	Harmon Field Park and Trails	City park and trails	City of Fort Worth	Yes	32.757206/-97.326293	N4A CONV	7.54
44[b] 3.17-4	Riverside Trails	City trails	City of Fort Worth	Yes	32.758255/-97.314868	N4A CONV	0.25
45[b] 3.17-4	Texas Star Golf Course	Private golf course	Texas Star Golf Course	Yes	32.759051/-97.312246	N4A CONV	1.36
46[b] 3.17-4	River Legacy Park	Public park	Non-profit [503c(3)] organization	Yes	32.80783/-97.105762	N4A CONV	2.92
47[b] 3.17-4	Veterans Memorial Park	City park	City of Irving	Yes	32.816414/-97.06276	N4A CONV	1.01
48[b] 3.17-4	Sowers Pioneer Park	City park	City of Irving	Yes	32.814502/-96.95304	N4A CONV	0.49
49[b] 3.17-4	Trinity View Park	City park	City of Dallas	Yes	32.815449/-96.952377	N4A CONV	18.47
50[b] 3.17-4	Campion Trail	City park	City of Dallas	Yes	32.813919/-96.911518	N4A CONV	0.03
51[b] 3.17-4	River Hills Park	City park	City of Dallas	Yes	32.813637/-96.907025	N4A CONV	0.55
52[b] 3.17-4	Trinity River Greenbelt Park	City trail	City of Dallas	Yes	32.814734/-96.90655	N4A CONV	6.07
53[b] 3.17-4	Sleepy Hollow Park	City park	City of Dallas	Yes	32.814196/-96.905096	N4A CONV	0.15
54[b] 3.17-4	Hank Haney Golf Center	Golf practice center	Hank Haney Golf Center	No	32.813843/-96.862576	N4A CONV	1.30
55[b] 3.17-4	Stemmons Park	City park	City of Dallas	Yes	32.806383/-96.834228	N4A CONV	3.03

Site ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location[c] (Lat/Long)	Alternative[d]	Acreage within Study Area
70[b] 3.17-4	Martyr's Park	City park	City of Dallas	Yes	32.777792/-96.820677	N4A CONV	0.34

[a] Public Access is based on readily available information. No confirmation of access has been conducted.

[b] Recreational resources located in both the EIS Study Area for both the Northern and Central sections.

[c] Lat/Long = latitude/longitude

[d] CONV = conventional rail

Sources: Arlington Independent School District (2014); Arlington Parks and Recreation Department (2014); City of Dallas Parks and Recreation Department (2014); City of Oklahoma City (2014); Dallas Independent School District (2014); Eagle Mountain-Saginaw Independent School District (2014); Federal Highway Administration (FHWA) (1987); FHWA (2014); Fort Worth Parks and Community Services Department (2014); Google Earth (2014); Land and Water Conservation Fund Coalition (2014); NPS (2014); NPS (2013); Northwest Independent School District (2014); Oklahoma City Educare (2014); River Legacy Foundation (2014); Southern Oklahoma Speedway (2014); Texas Department of Transportation (TxDOT) (2014); TxDOT (2013); Texas Education Agency (2014); Texas Natural Resources Information System (2014); USFWS (2014); USGS (2014).

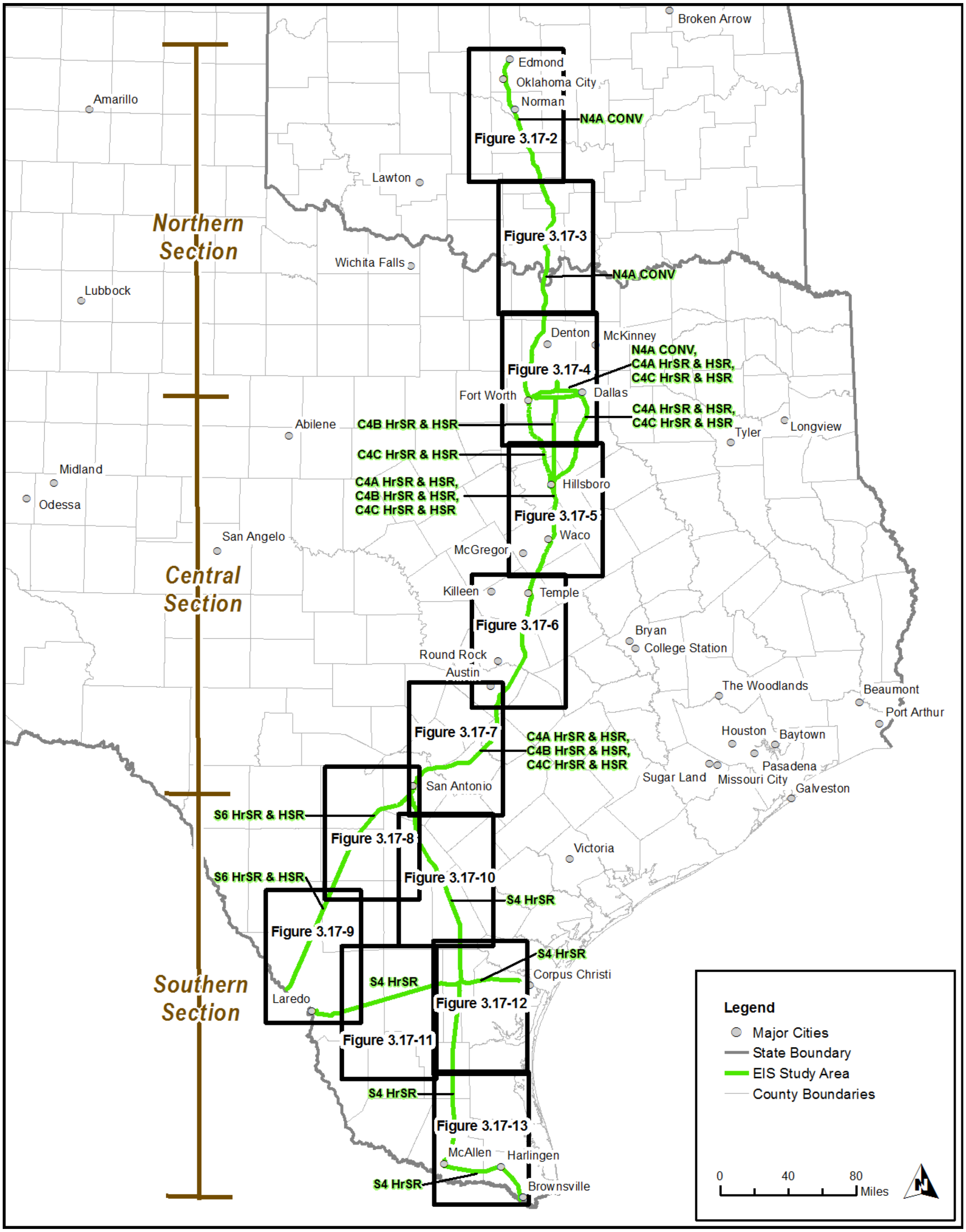

Figure 3.17-1: Index Map

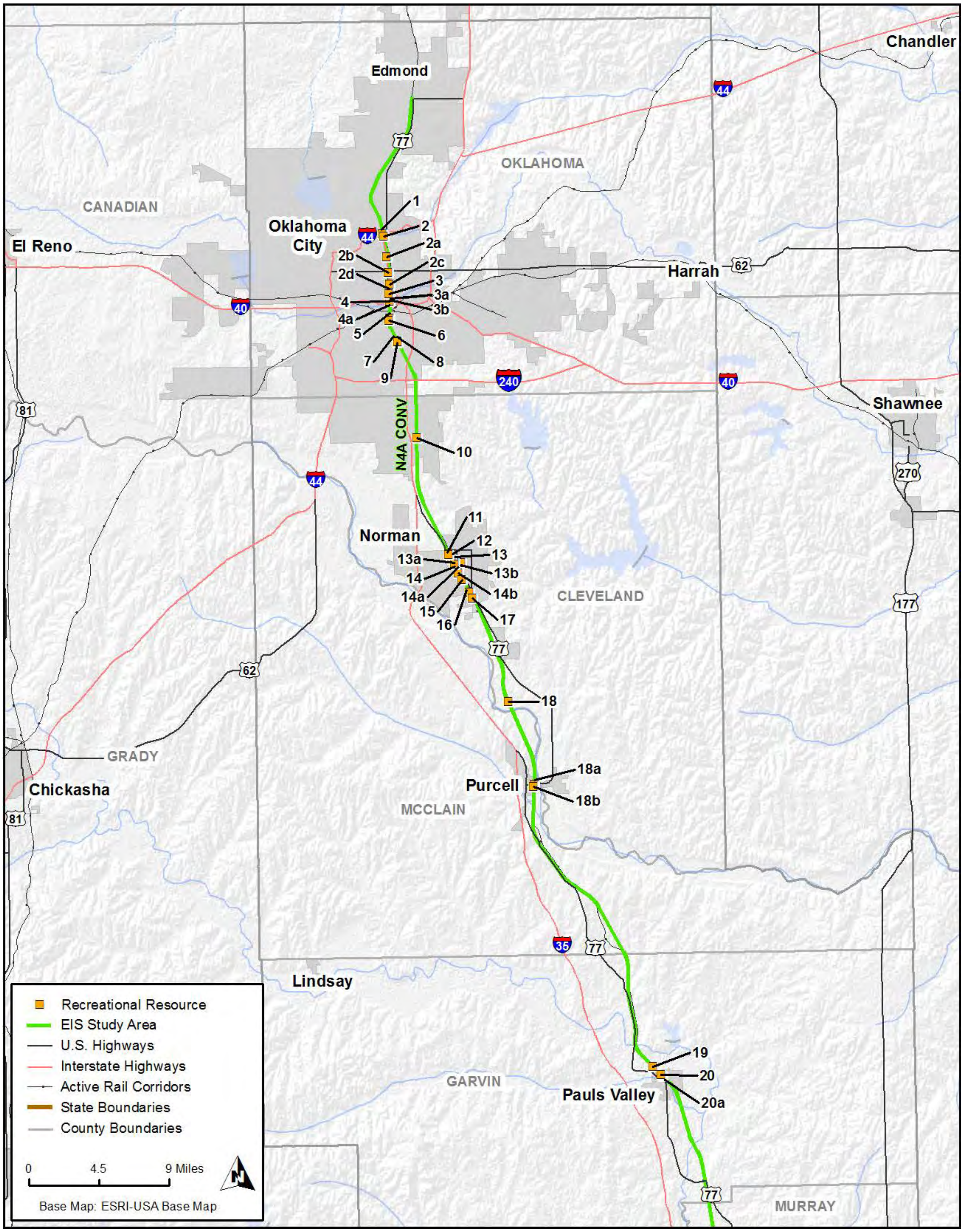

Figure 3.17-2: Recreational Resources within the EIS Study Area (Map 1)

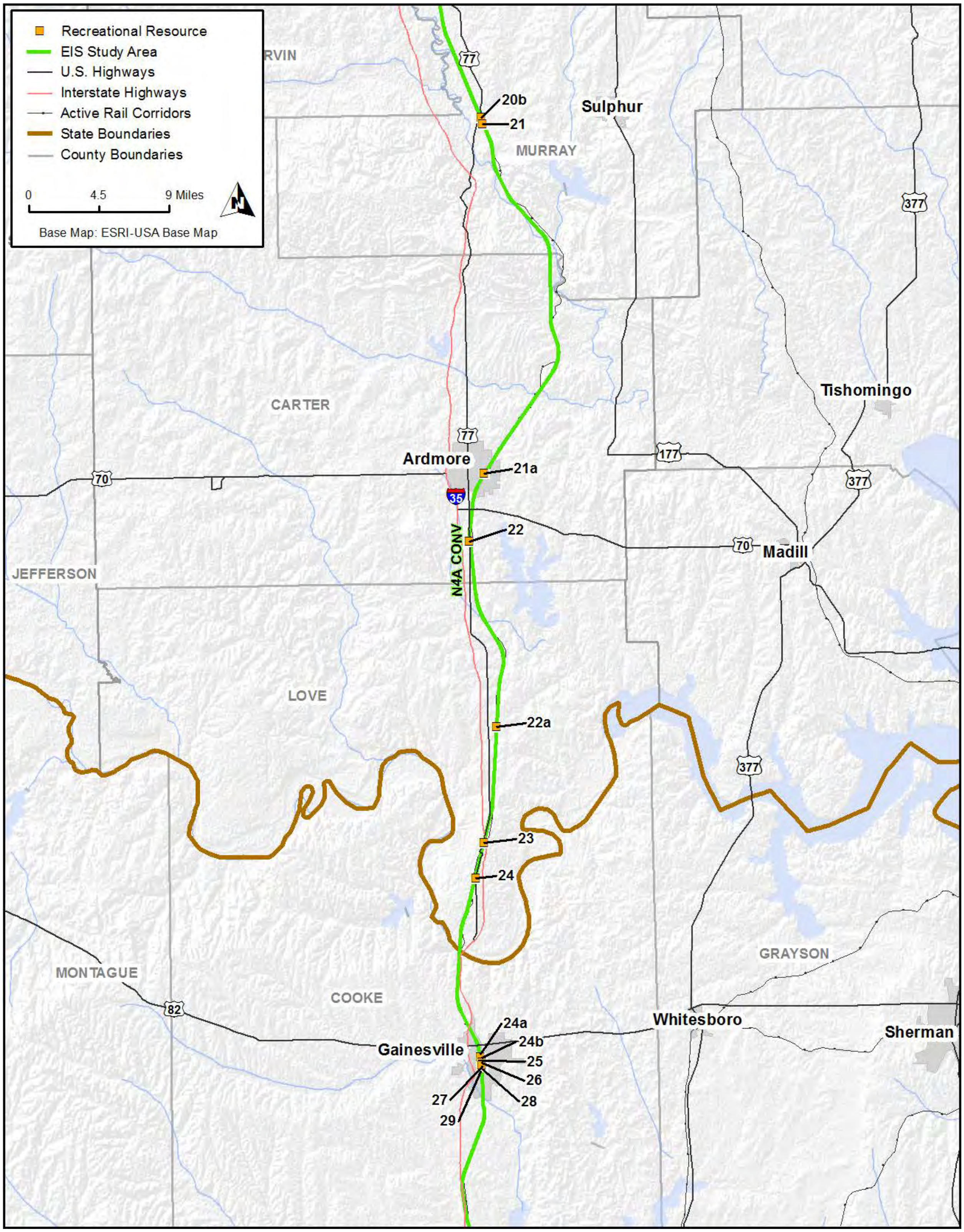

Figure 3.17-3: Recreational Resources within the EIS Study Area (Map 2)

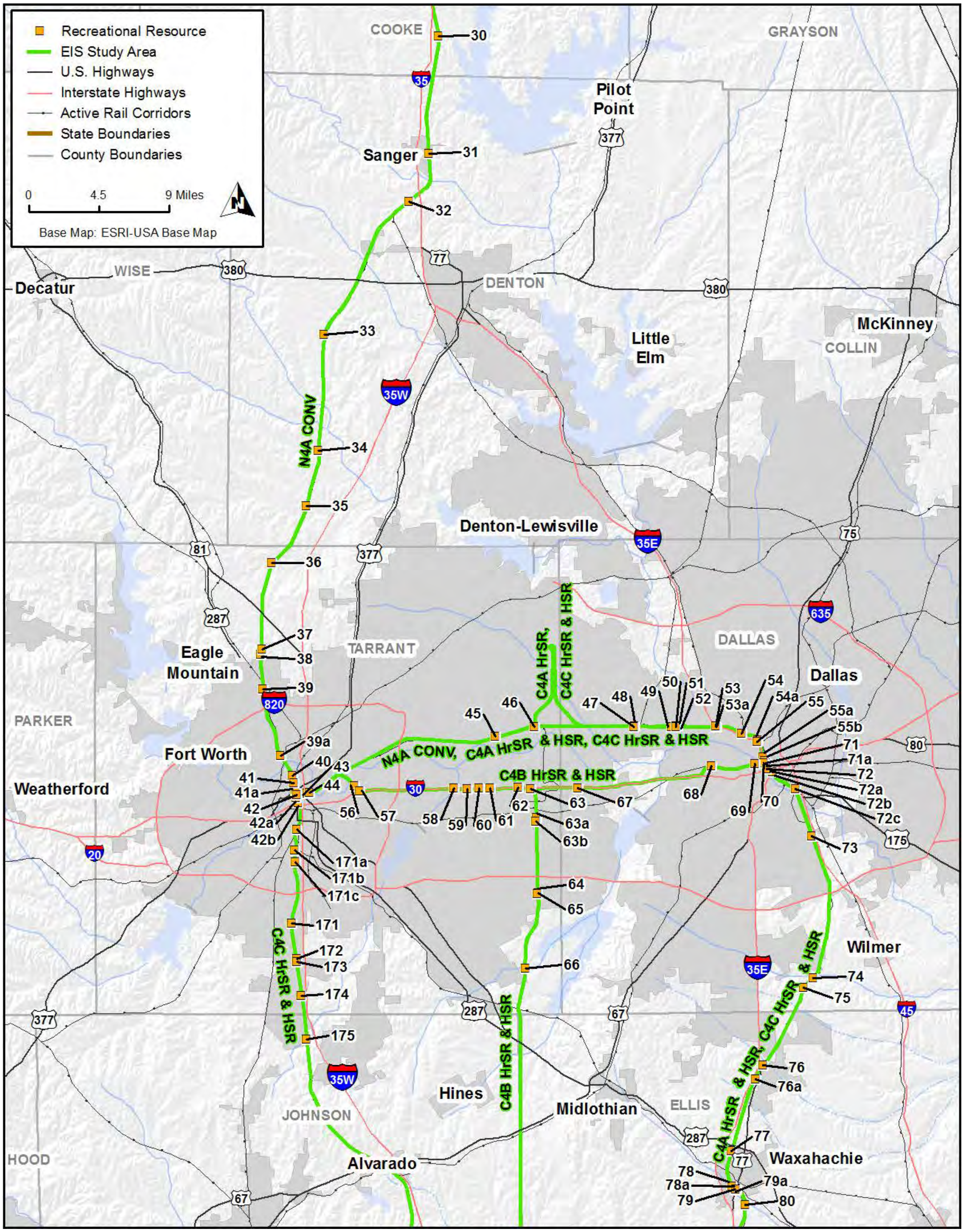

Figure 3.17-4: Recreational Resources within the EIS Study Area (Map 3)

3.17.3.2 Central Section: Dallas and Fort Worth to San Antonio

3.17.3.2.1 Alternative C4A Higher-Speed Rail and High-Speed Rail

There are 57 recreational resources identified within the EIS Study Area for Alternatives C4A Higher-Speed Rail and High-Speed Rail. The majority of these resources are public parks, trails, and/or playgrounds, baseball, softball, soccer and general athletic fields, playgrounds and fields associated with public and/or private schools, and both private and public golf courses. Recreational resources are primarily concentrated in urban areas, especially Dallas, Fort Worth, and San Antonio. Other resources in the EIS Study Area include a museum, a private campground, two college dormitories and/or campuses, a county park, and two USACE-owned public parks.

A list of recreational resources in the Central Section EIS Study Area is included in Table 3.17-2, and they are mapped on Figures 3.17-5 through 3.17-8.

3.17.3.2.2 Alternatives C4B Higher-Speed Rail and High-Speed Rail

There are 51 recreational resources identified within the EIS Study Area for Alternatives C4B Higher-Speed Rail and High-Speed Rail. The majority of these resources are public parks, trails, and/or playgrounds, baseball, softball, soccer and general athletic fields, playgrounds and fields associated with public and/or private schools, and both private and public golf courses. Recreational resources within the EIS Study Area for these alternatives are primarily concentrated in urban areas, especially Dallas, Fort Worth, and San Antonio. Other resources in the EIS Study Area include a museum, a private campground, two college dormitories and/or campuses, a county park, and two USACE-owned public parks.

A list of recreational resources in the Central Section EIS Study Area is included in Table 3.17-2, and they are mapped on Figures 3.17-5 through 3.17-8.

3.17.3.2.3 Alternatives C4C Higher-Speed Rail and High-Speed Rail

There were 62 recreational resources identified within the EIS Study Area for Alternatives C4C Higher-Speed Rail and High-Speed Rail. The majority of these resources are public parks; trails; playgrounds, baseball, softball, soccer, and general athletic fields; fields associated with public and private schools; and private and public golf courses. Recreational resources along the alternative are primarily concentrated in urban areas, especially Dallas, Fort Worth, and San Antonio. Other resources in the EIS Study Area include a museum, a private campground, two college dormitories and/or campuses, a county park, and two USACE-owned public parks.

A list of recreational resources in the Central Section EIS Study Area is included in Table 3.17-2, and they are they are mapped on Figures 3.17-5 through 3.17-8.

Table 3.17-2: Recreational Resources – Central Section

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
43[b] 3.17-4	Harmon Field Park and Trails	City park and trails	City of Fort Worth	Yes	32.757206/-97.326293	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	7.54
44[b] 3.17-4	Riverside Trails	City trails	City of Fort Worth	Yes	32.758255/-97.314868	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	0.25
45[b] 3.17-4	Texas Star Golf Course	Private golf course	Texas Star Golf Course	Yes	32.759051/-97.312246	C4A HrSR and HSR C4C HrSR and HSR	1.36
46[b] 3.17-4	River Legacy Park	Public park	Non-profit [503c(3)] organization	Yes	32.80783/-97.105762	C4A HrSR and HSR C4C HrSR and HSR	2.92
47[b] 3.17-4	Veterans Memorial Park	City park	City of Irving	Yes	32.816414/-97.06276	C4A HrSR and HSR C4C HrSR and HSR	1.01
48[b] 3.17-4	Sowers Pioneer Park	City park	City of Irving	Yes	32.814502/-96.95304	C4A HrSR and HSR C4C HrSR and HSR	0.49
49[b] 3.17-4	Trinity View Park	City Park	City of Dallas	Yes	32.815449/-96.952377	C4A HrSR and HSR C4C HrSR and HSR	18.47
50[b] 3.17-4	Campion Trail	City park	City of Dallas	Yes	32.813919/-96.911518	C4A HSR C4A HrSR C4C HrSR and HSR	0.03
51[b] 3.17-4	River Hills Park	City park	City of Dallas	Yes	32.813637/-96.907025	C4A HSR C4A HrSR C4C HrSR and HSR	0.55
52[b] 3.17-4	Trinity River Greenbelt Park	City trail	City of Dallas	Yes	32.814734/-96.90655	C4A HSR C4A HrSR C4C HrSR and HSR	6.07

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
53[b] 3.17-4	Sleepy Hollow Park	City park	City of Dallas	Yes	32.814196/-96.905096	C4A HrSR and HSR C4C HrSR and HSR	0.15
54[b] 3.17-4	Hank Haney Golf Center	Golf practice center	Hank Haney Golf Center	No	32.813843/-96.862576	C4A HrSR and HSR C4C HrSR and HSR	1.30
55[b] 3.17-4	Stemmons Park	City park	City of Dallas	Yes	32.806383/-96.834228	C4A HrSR and HSR C4C HrSR and HSR	3.03
56 3.17-4	Gateway Park	City park	City of Fort Worth	Yes	32.798784/-96.817144	C4B HSR C4B HrSR	22.88
57 3.17-4	Nolan Catholic High School	Private school	Nolan Catholic High School	No	32.764402/-97.262664	C4B HrSR and HSR	5.07
58 3.17-4	Waterchase Golf Course	Private golf course	Waterchase Golf Course	Yes	32.759691/-97.256851	C4B HrSR and HSR	10.05
59 3.17-4	Randol Mill Park	City park	City of Arlington	Yes	32.7606/-97.152959	C4B HrSR and HSR	15.45
60 3.17-4	Lamar High School Athletic Fields	Public school	Arlington Independent School District	Yes	32.759939/-97.138068	C4B HrSR and HSR	6.94
61 3.17-4	Rolling Hills Country Club	Golf course	Rolling Hills Country Club	No	32.760193/-97.125371	C4B HrSR and HSR	1.04
62 3.17-4	Six Flags Hurricane Harbor	Water park	Six Flags Hurricane Harbor	Yes	32.760382/-97.112752	C4B HrSR and HSR	3.79
63 3.17-4	Six Flags Over Texas	Amusement Park	Six Flags Over Texas	Yes	32.760242/-97.082033	C4B HrSR and HSR	0.66
64 3.17-4	Fish Creek Linear Park (east)	City park trail	City of Grand Prairie	Yes	32.758783/-97.067868	C4B HrSR and HSR	1.67
65 3.17-4	Fish Creek Linear Park (west)	City park trail	City of Arlington	Yes	32.661048/-97.062882	C4B HrSR and HSR	1.49
66 3.17-4	Lloyd Park	City park	City of Grand Prairie	Yes	32.661782/-97.062126	C4B HrSR and HSR	41.98
67 3.17-4	John Adams Middle School	Public school	Grand Prairie Independent School District	Yes	32.591584/-97.077784	C4B HrSR and HSR	1.71
68 3.17-4	Thomas A. Edison Middle School	Public school	Dallas Independent School District	Yes	32.758865/-97.016232	C4B HrSR and HSR	1.22

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
69 3.17-4	Trinity River Greenbelt Park	City park	City of Dallas	Yes	32.776803/-96.8682	C4B HrSR and HSR	19.94
70[a] 3.17-4	Martyr's Park	City park	City of Dallas	Yes	32.777792/-96.820677	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	0.34[c] 0.89 1.81
71 3.17-4	Dealey Plaza Park	City park	City of Dallas	Yes	32.778878/-96.810691	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	0.7[c] 0.1 0.7
72 3.17-4	Reunion Park	City park	City of Dallas	Yes	32.778177/-96.808544	C4A HrSR and HSR C4C HrSR and HSR	1.25
73 3.17-4	Fruitdale Park	City park	City of Dallas	Yes	32.77309/-96.807441	C4A HrSR and HSR C4C HrSR and HSR	1.46
74 3.17-4	Country View Golf Course	Golf course	Country View Golf Course	Yes	32.709506/-96.759119	C4A HrSR and HSR C4C HrSR and HSR	16.78
75 3.17-4	Bear Creek Nature Park	City park	City of Lancaster	Yes	32.577623/-96.761461	C4A HrSR and HSR C4C HrSR and HSR	26.84
76 3.17-4	Red Oak Valley Golf Club	Golf course	Red Oak Valley Golf Club	Yes	32.569244/-96.772134	C4A HrSR and HSR C4C HrSR and HSR	39.71
77 3.17-4	Navarro College at Waxahachie	Public junior college	State of Texas	Yes	32.49734/-96.818164	C4A HrSR and HSR C4C HrSR and HSR	7.08
78 3.17-4	Richards Park	City park	City of Waxahachie	Yes	32.418699/-96.855072	C4A HrSR and HSR C4C HrSR and HSR	3.88
79 3.17-4	Waxahachie Creek Hike and Bike Trail	City trail	City of Waxahachie	Yes	32.385806/-96.854972	C4A HrSR and HSR C4C HrSR and HSR	5.18

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
80 3.17-4	Lions Park	City park	City of Waxahachie	Yes	32.382484/-96.85065	C4A HrSR and HSR C4C HrSR and HSR	2.86
81 3.17-5	Playground	Playground and park	City of West	Yes	32.368438/-96.840974	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	2.05
82 3.17-5	West Intermediate School Athletic Fields	School athletic fields	West Independent School District	Yes	31.816967/-97.088907	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	3.84
83 3.17-5	Baseball fields	Baseball fields	City of West	Yes	31.813805/-97.089789	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	2.64
84 3.17-5	La Vega High School	Public School	La Vega Independent School District	Yes	31.788804/-97.097041	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	1.06
85 3.17-5	Lions Park	Baseball-softball fields	City of Bellmead	Yes	31.600162/-97.094003	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	1.01
86 3.17-5	BU Stadium	Football stadium	BU	Yes	31.598133/-97.093944	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	10.14
87 3.17-5	Riverwalk	Public trail	City of Waco	Yes	31.558662/-97.117195	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	0.17

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
88 3.17-5	Fort Fisher Park	City park	City of Waco	Yes	31.556447/-97.118737	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	9.20
89 3.17-5	Baylor University buildings	Dormitories and grounds	Baylor University	No	31.555049/-97.119244	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	27.52
90 3.17-5	Bruceville-Eddy High School and Junior High School	Public schools	Bruceville-Eddy Independent School District	Yes	31.550401/-97.122129	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	1.53
91 3.17-6	Raymond Mays Middle School	Public school	Troy Independent School District	Yes	31.306691/-97.247216	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	2.45
92 3.17-6	Jefferson Park	City park	City of Temple	Yes	31.21018/-97.312238	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	0.19
93 3.17-6	Optimist No. 1 Field	Soccer field	City of Temple	Yes	31.120739/-97.342771	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	2.15
94 3.17-6	Woodson Field	Soccer field	City of Temple	Yes	31.112342/-97.345396	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	1.52
95 3.17-6	Whistlestop Playground	Playground	City of Temple	Yes	31.103591/-97.347765	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	2.39

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
96 3.17-6	Santa Fe Gardens	Urban park	City of Temple	Yes	31.097609/-97.347606	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	6.31
97 3.17-6	Willis Creek Park	USACE park	USACE	Yes	31.095684/-97.345133	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	22.12
98 3.17-6	Wilson H. Fox Park	USACE park	USACE	Yes	30.649001/-97.432165	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	40.90
99 3.17-6	Southeast Burkett Street Park	City park	City of Taylor	Yes	30.642064/-97.429926	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	3.84
100 3.17-6, 3.17-7	Walter E. Long Metropolitan Park	City park	City of Austin	Yes	30.573323/-97.403554	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	30.29
101 3.17-6, 3.17-7	Richard Moya Park	County park	Travis County	Yes	30.292655/-97.577155	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	11.31
102 3.17-7	Lazy J Paradise	Private campground	Lazy J Paradise	No	30.170283/-97.667469	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	8.52
103 3.17-7	McClain Park	City park	City of San Antonio	Yes	29.908734/-97.704742	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	23.30

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
104 3.17-7, 3.17-8	Friensenhahn Park	City park	City of San Antonio	Yes	29.589338/-98.388303	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	5.02
105 3.17-7, 3.17-8	St. Mark Athletic Fields	Athletic fields	St. Mark Catholic Youth Organization	Yes	29.584274/-98.396811	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	1.14
106 3.17-7, 3.17-8	McAllister Park / Time Warner Cable Park	Baseball-softball fields	City of San Antonio	Yes	29.567232/-98.417327	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	7.98
107 3.17-7, 3.17-8	Texas Transportation Museum	Museum	Texas Transportation Museum [503c(3)]	Yes	29.548551/-98.433254	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	0.30
108 3.17-7, 3.17-8	Salado Creek Greenway	Public trail	City of San Antonio	Yes	29.547395/-98.434785	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	10.84
109 3.17-7, 3.17-8	Quarry Golf Club	Golf course	Quarry Golf Club	Yes	29.542548/-98.441155	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	12.16
110 3.17-7, 3.17-8	Olmos Basin Golf Course	Public golf course	City of San Antonio	Yes	29.502553/-98.479436	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	8.89
111 3.17-7, 3.17-8	Olmos Basin Baseball Fields	Athletic fields	City of San Antonio	Yes	29.496595/-98.482744	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	31.33

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
112 3.17-7, 3.17-8	San Antonio Gun Club	Public recreation	San Antonio Gun Club	Yes	29.491436/-98.486112	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	17.32
113 3.17-7, 3.17-8	Kenwood Park	City park	City of San Antonio	Yes	29.48614/-98.48898	C4A HrSR and HSR C4B HrSR and HSR C4C HrSR and HSR	4.23
171 3.17-4	Hallmark Park	City park	City of Fort Worth	Yes	32.63757/-97.33356	C4C HrSR and HSR	12.97
172 3.17-4	Parks of Deer Creek Park	City park and trails	City of Fort Worth	Yes	32.60456/-97.32922	C4C HrSR and HSR	0.65
173 3.17-4	Sidney H. Poynter Elementary School	Public school	Fort Worth Independent School District	Yes	32.60181/-97.32869	C4C HrSR and HSR	1.07
174 3.17-4	Mistletoe Hill Park	City park	City of Burleson	Yes	32.56968/-97.32425	C4C HrSR and HSR	1.70
175 3.17-4	Bailey Lake	City park and lake	City of Burleson	Yes	32.5292/-97.31995	C4C HrSR and HSR	6.64

[a] Public Access is based on readily available information. No confirmation of access has been conducted.

[b] Denotes recreational resources located in the EIS Study Area for both the Northern and Central sections.

[c.] Acreage within the EIS Study Area is different for the three alignments.

BU = Baylor University; HrSR = higher-speed rail; HSR = high-speed rail

Sources: Ben Bolt-Palito Blanco Independent School District (2014); Bruceville-Eddy Independent School District (2014); Bryan McClain Park (2014); FHWA (1987); FHWA (2014); Grand Prairie Independent School District (2014); Grand Prairie Parks and Recreation Department (2014); Land and Water Conservation Fund Coalition (2014); La Vega Independent School District (2014); NPS (2014); NPS (2013); River Legacy Foundation (2014); St. Mark Catholic Youth Organization (2014); San Antonio Gun Club (2014); San Antonio Parks and Recreation Department (2014); TxDOT (2014); TxDOT (2013); Texas Education Agency (2014); Texas Natural Resources Information System (2014); Travis County Parks (2014); Troy Independent School District (2014); USFWS (2014); USGS (2014).

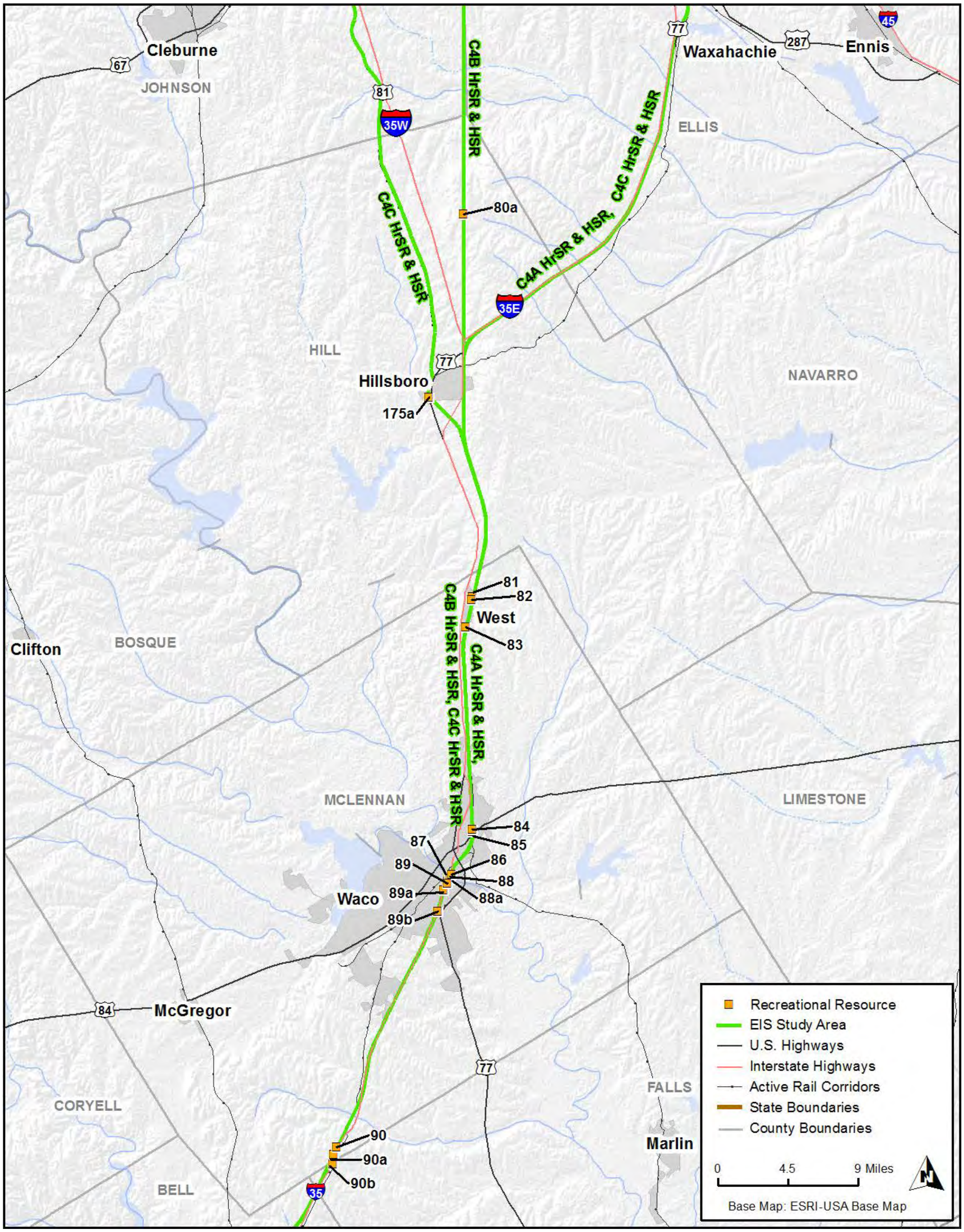

Figure 3.17-5: Recreational Resources within the EIS Study Area (Map 4)

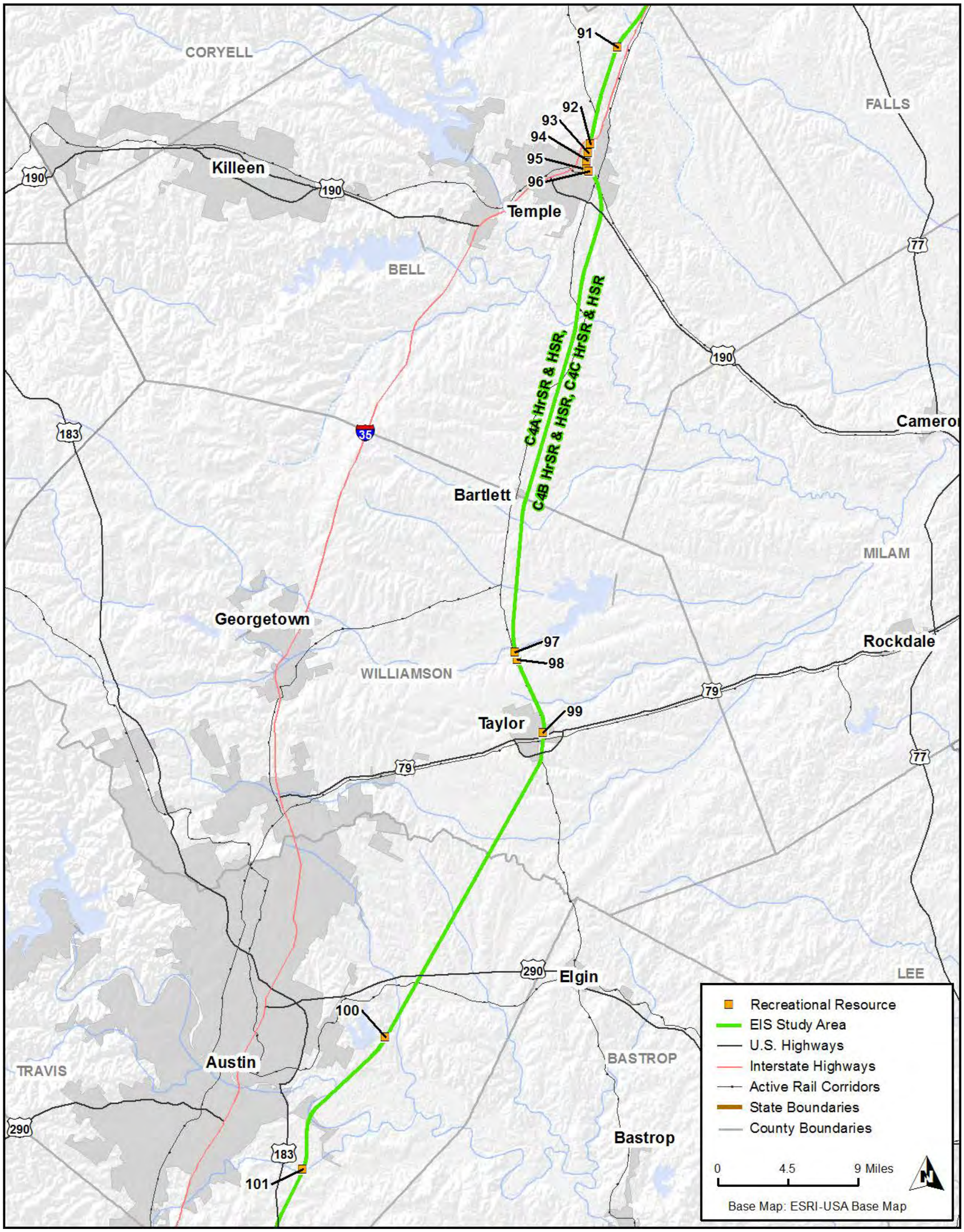

Figure 3.17-6: Recreational Resources within the EIS Study Area (Map 5)

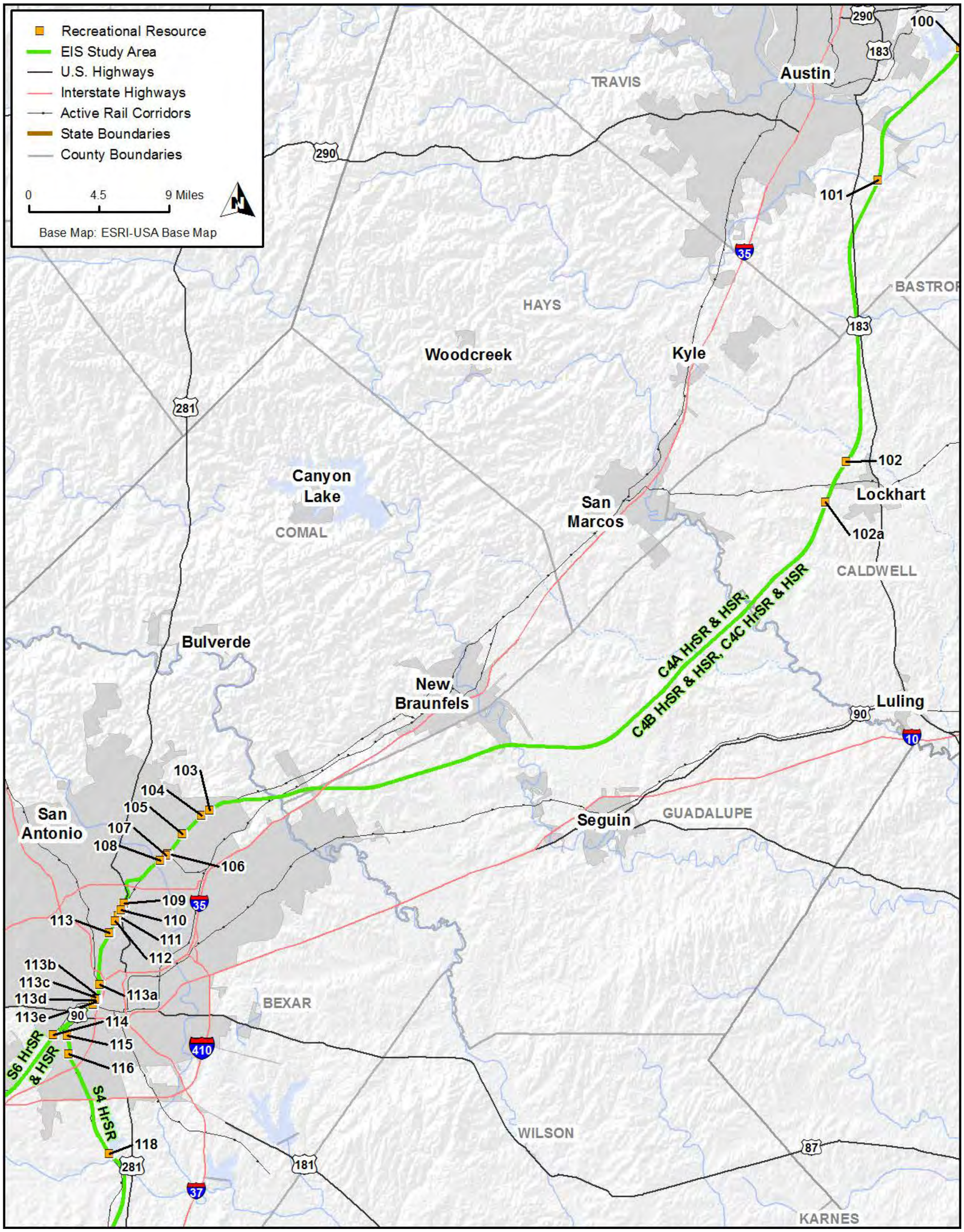

Figure 3.17-7: Recreational Resources within the EIS Study Area (Map 6)

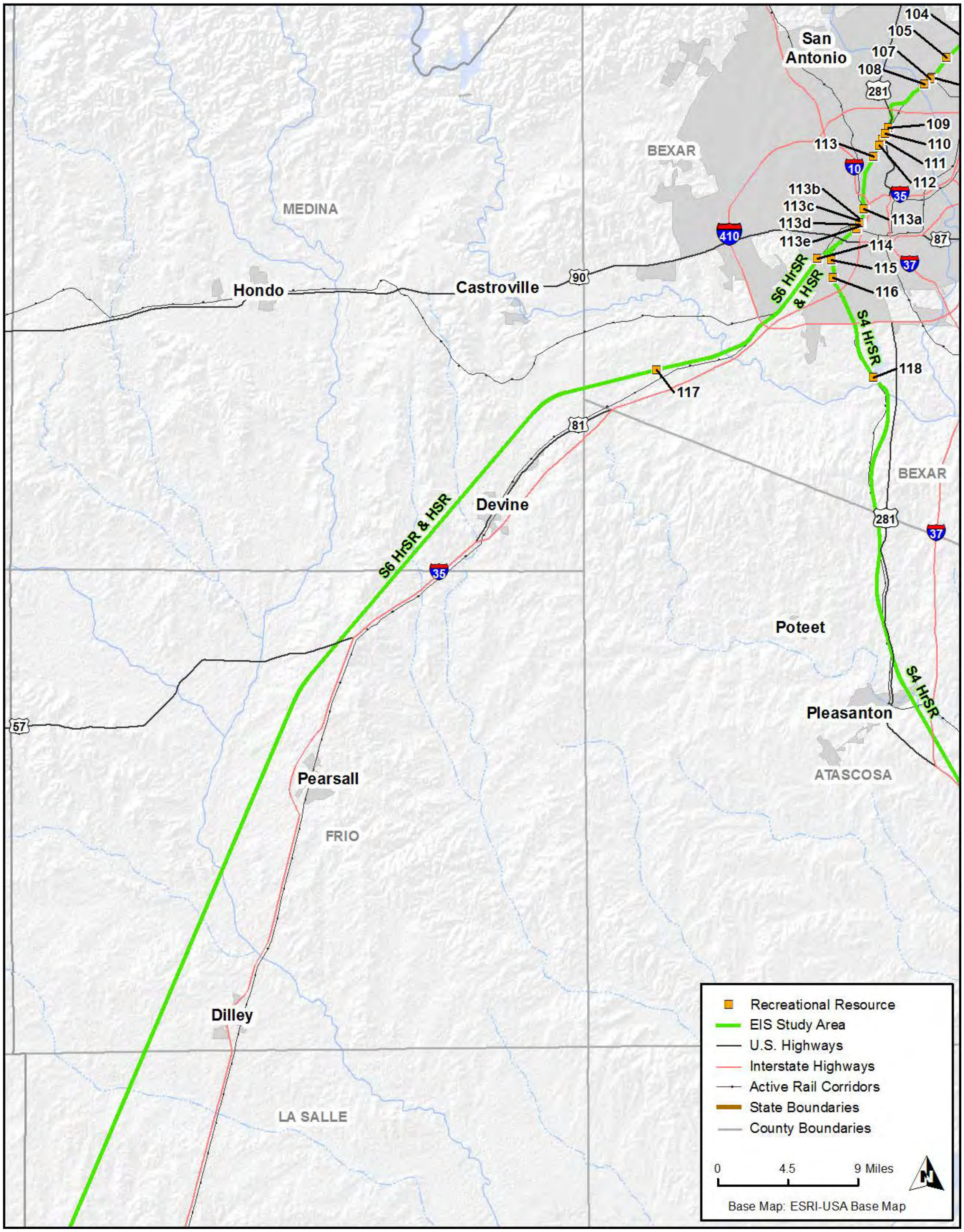

Figure 3.17-8: Recreational Resources within the EIS Study Area (Map 7)

3.17.3.3 Southern Section: San Antonio to South Texas

3.17.3.3.1 Alternative S4 Higher-Speed Rail

There are 54 recreational resources identified within the EIS Study Area for Alternative S4 Higher-Speed Rail. The majority of these resources are city parks, trails, courts, fields, public and private schools, or golf courses. Recreational resources along the alternative are primarily concentrated in urban areas, especially San Antonio, and the cities that line the southernmost stretch of the alternative near the border with Mexico (i.e., Edinburg, McAllen, Alamo, Mercedes, Harlingen, San Benito, Olmito, and Brownsville). There are two state parks along the alternative: La Casa Blanca International State Park in Laredo and Resaca de la Palma State Park in Bixby (Map ID #122 and 154). Approximately 40.67 acres of the Lower Rio Grande Valley National Wildlife Refuge are also located within the Alternative S4 Higher-Speed Rail EIS Study Area, along the southern branch of the alternative (Map ID #162). A list of recreational resources for Alternative S4 Higher-Speed Rail is included in Table 3.17-3, and they are mapped on Figures 3.17-9 through 3.17-13.

3.17.3.3.2 Alternatives S6 Higher-Speed Rail and High-Speed Rail

There are three recreational resources identified within the EIS Study Areas for Alternatives S6 Higher-Speed Rail and High-Speed Rail: Lindbergh Park in San Antonio (Map ID #114), Elm Creek Elementary School and McNair Middle School in Atascosa (Map ID #117), and the Chaparral Wildlife Management Area southwest of Cotulla (Map ID #119). A list of recreational resources for the S6 alternatives is included in Table 3.17-3, and they are mapped on Figures 3.17-8 and 3.17-9.

Table 3.17-3: Recreational Resources – Southern Section

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
114 3.17-7, 3.17-8	Lindbergh Park	City park	Unknown	Yes	29.380768/-98.555422	S6 HSR S6 HrSR	1.99
115 3.17-7, 3.17-8	Normoyle Park	City park	City of San Antonio	Yes	29.379631/-98.540743	S4 HrSR	9.93
116 3.17-7, 3.17-8	Al Forge Park	City park	City of San Antonio	Yes	29.362778/-98.53903	S4 HrSR	1.24
117 3.17-8	Elm Creek Elementary School and McNair Middle School	Public school	Southwest Independent School District	Yes	29.277432/-98.726771	S6 HSR S6 HrSR	0.15

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
118 3.17-7, 3.17-8	Medina River Greenway	City greenway park	City of San Antonio	Yes	29.269584/-98.496249	S4 HrSR	5.14
119 3.17-9	Chaparral Wildlife Manage-ment Area	State wildlife manage-ment area	Texas Parks and Wildlife Department	Yes	28.327495/-99.419841	S6 HSR S6 HrSR	217.32
120 3.17-10	Unnamed Park 1	City park	City of George West	Yes	28.342326/-98.099633	S4 HrSR	9.40
121 3.17-9	Casa Blanca Golf Course	County golf course	Webb County	Yes	27.536689/-99.45112	S4 HrSR	31.14
122 3.17-9	La Casa Blanca International State Park	State park	Texas Parks and Wildlife Department / Webb County	Yes	27.536094/-99.44979	S4 HrSR	11.76
123 3.17-12	Lake Findley Park	City park and lake	City of Alice	Yes	27.796567/-98.057485	S4 HrSR	29.58
124 3.17-12	Alice Country Club	Golf course	Alice Country Club	Yes	27.771512/-98.033563	S4 HrSR	2.58
125 3.17-12	Younts Park	City park	City of Agua Dulce	Yes	27.780929/-97.909541	S4 HrSR	1.12
126 3.17-12	John L. Sablatura County Park	County park	Nueces County	Yes	27.795694/-97.814204	S4 HrSR	86.42
127 3.17-12	Saint Anthony School	Private school	Saint Anthony School	No	27.789073/-97.675141	S4 HrSR	1.11
128 3.17-12	Robstown Memorial Park	City park	City of Robstown	Yes	27.788062/-97.663034	S4 HrSR	0.81
129 3.17-12	Charles Brazzell Sr. Park	City park	City of Alice	Yes	27.745213/-98.077557	S4 HrSR	0.75
130 3.17-12	Ben Bolt High School	Public school	Ben Bolt-Palito Blanco Independent School District	Yes	27.644327/-98.085525	S4 HrSR	0.12

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
131 3.17-12	Falfurrias Golfers, Inc.	Golf course	Falfurrias Golfers, Inc.	Yes	27.234552/-98.139027	S4 HrSR	5.32
132 3.17-13	Truman Elementary School	Public school	Edinburg Consolidated Independent School District	Yes	26.332708/-98.164428	S4 HrSR	6.71
133 3.17-13	Tennis Courts	City tennis courts	City of Edinburg	Yes	26.306664/-98.167024	S4 HrSR	0.42
134 3.17-13	University of Texas-Pan Am	Public university	University of Texas System	Yes	26.305375/-98.168599	S4 HrSR	3.58
135 3.17-13	Hike and Bike Trail	City trail	City of Edinburg	Yes	26.265073/-98.210354	S4 HrSR	0.25
136 3.17-13	Bill Schupp Park	City park	City of McAllen	Yes	26.251708/-98.227245	S4 HrSR	4.18
137 3.17-13	International Museum of Art and Science	Museum and playground	Non-profit [503c(3)] organization	Yes	26.24182/-98.23341	S4 HrSR	3.98
138 3.17-13	Hike and Bike Trail (north)	City trail	City of McAllen	Yes	26.231877/-98.234572	S4 HrSR	2.18
139 3.17-13	Hike and Bike Trail (south)	City trail	City of McAllen	Yes	26.232344/-98.235178	S4 HrSR	1.65
140 3.17-13	McAllen Bicentennial Soccer Fields	Athletic fields	City of McAllen	Yes	26.223748/-98.23664	S4 HrSR	2.40
141 3.17-13	McAllen High School	Public school	McAllen Independent School District	Yes	26.221657/-98.23707	S4 HrSR	1.28
142 3.17-13	Municipal Park	City park	City of McAllen	Yes	26.212548/-98.237799	S4 HrSR	2.08
143 3.17-13	Archer Park	City park	City of McAllen	Yes	26.204869/-98.233701	S4 HrSR	0.52
144 3.17-13	Myers Park	City park and trail	City of McAllen	Yes	26.202183/-98.220214	S4 HrSR	2.98

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
145 3.17-13	PSJA Thomas Jefferson Early College High School	Public school	Pharr-San Juan-Alamo Independent School District	Yes	26.193041/-98.17552	S4 HrSR	1.49
146 3.17-13	College, Career and Tech Academy	Public school	Pharr-San Juan-Alamo Independent School District	Yes	26.192185/-98.170735	S4 HrSR	0.78
147 3.17-13	Premier High School of San Juan	Private school	Premier High School of San Juan	No	26.186159/-98.138014	S4 HrSR	1.10
148 3.17-13	Alamo Middle School	Public school	Pharr-San Juan-Alamo Independent School District	Yes	26.185321/-98.133549	S4 HrSR	3.06
149 3.17-13	Central Park	City park	City of Alamo	Yes	26.182541/-98.117874	S4 HrSR	1.82
150 3.17-13	Captain Daniel Salinas II Elementary School	Public school	Donna Independent School District	Yes	26.180237/-98.105815	S4 HrSR	2.86
151 3.17-13	Truman Price Elementary School	Public school	Donna Independent School District	Yes	26.167834/-98.032776	S4 HrSR	2.95
152 3.17-13	South Texas College Mid-Valley Campus	Public college	State of Texas	Yes	26.161145/-97.996744	S4 HrSR	8.60
153 3.17-13	HEB Civic Center Park	City park	City of Mercedes	Yes	26.150447/-97.905243	S4 HrSR	0.83
154 3.17-13	Resaca de la Palma State Park	State park	Texas Parks and Wildlife Department	Yes	26.152162/-97.850569	S4 HrSR	2.90

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
155 3.17-13	Stuart Place Elementary School	Public school	Harlingen Consolidated Independent School District	Yes	26.178327/-97.756892	S4 HrSR	2.27
156 3.17-13	Sam Houston Park	City park	City of Harlingen	Yes	26.180714/-97.687183	S4 HrSR	6.39
157 3.17-13	Harlingen Thicket	City park	City of Harlingen	Yes	26.178049/-97.684237	S4 HrSR	3.43
158 3.17-13	Arroyo Park to McKelvey Park Trail	City trail	City of Harlingen	Yes	26.177238/-97.682474	S4 HrSR	0.22
159 3.17-13	Secondary Alternative Center	Public school	Harlingen Consolidated Independent School District	Yes	26.173065/-97.677437	S4 HrSR	3.13
160 3.17-13	South Texas Academy for Medical Professions	Public school	South Texas Independent School District	Yes	26.156571/-97.660002	S4 HrSR	4.04
161 3.17-13	Kennedy Park	City park	City of San Benito	Yes	26.134876/-97.635425	S4 HrSR	3.38
162 3.17-13	Lower Rio Grande Valley National Wildlife Refuge	National wildlife refuge	U.S. Fish and Wildlife Service	Yes	26.106602/-97.603301	S4 HrSR	40.67
163 3.17-13	Rancho Viejo Country Club	Golf and tennis club	Rancho Viejo Resort and Country Club	No	26.042118/-97.548028	S4 HrSR	17.27
164 3.17-13	Villareal Elementary School	Public school	Los Fresnos Consolidated Independent School District	Yes	26.023769/-97.533859	S4 HrSR	3.26
165 3.17-13	Unnamed Park 2	State land	State of Texas	Yes	25.98306/-97.526364	S4 HrSR	8.89

Map ID # Figure #	Resource Name	Resource Type	Ownership	Public Access[a]	Location (Lat/Long)	Alternative	Acreage within Study Area
166 3.17-13	Mattie A. Pullam Elementary School	Public school	Brownsville Independent School District	Yes	25.96925/-97.522885	S4 HrSR	2.62
167 3.17-13	Valley International Country Club	Golf course	Valley International Country Club	Yes	25.944365/-97.520126	S4 HrSR	16.31
168 3.17-13	Joe and Tony Oliveiro Park	City park	City of Brownsville	Yes	25.937954/-97.520918	S4 HrSR	7.91
169 3.17-13	Riverside Park	City park	City of Brownsville	Yes	25.910397/-97.515085	S4 HrSR	2.93
170 3.17-13	Lucille B. Skinner Elementary School	Public school	Brownsville Independent School District	Yes	25.909804/-97.513204	S4 HrSR	0.69

[a] Public Access is based on readily available information. No confirmation of access has been conducted.

Sources: Brownsville Independent School District (2014); Casa Blanca Golf Club (2014); Donna Independent School District (2014); FHWA (1987); FHWA (2014); Harlingen Consolidate Independent School District (2014); International Museum of Art and Science (2014); Land and Water Conservation Fund Coalition (2014); Los Fresnos Consolidated Independent School District (2014); NPS (2014); NPS (2013); Nueces County Parks and Recreation Department (2014); Pharr-San Juan Alamo Independent School District (2014); San Antonio Parks and Recreation Department (2014); South Texas Independent School District (2014); Southwest Independent School District (2014); TxDOT (2014); TxDOT (2013); Texas Education Agency (2014); Texas Natural Resources Information System (2014); USFWS (2014); USGS (2014).

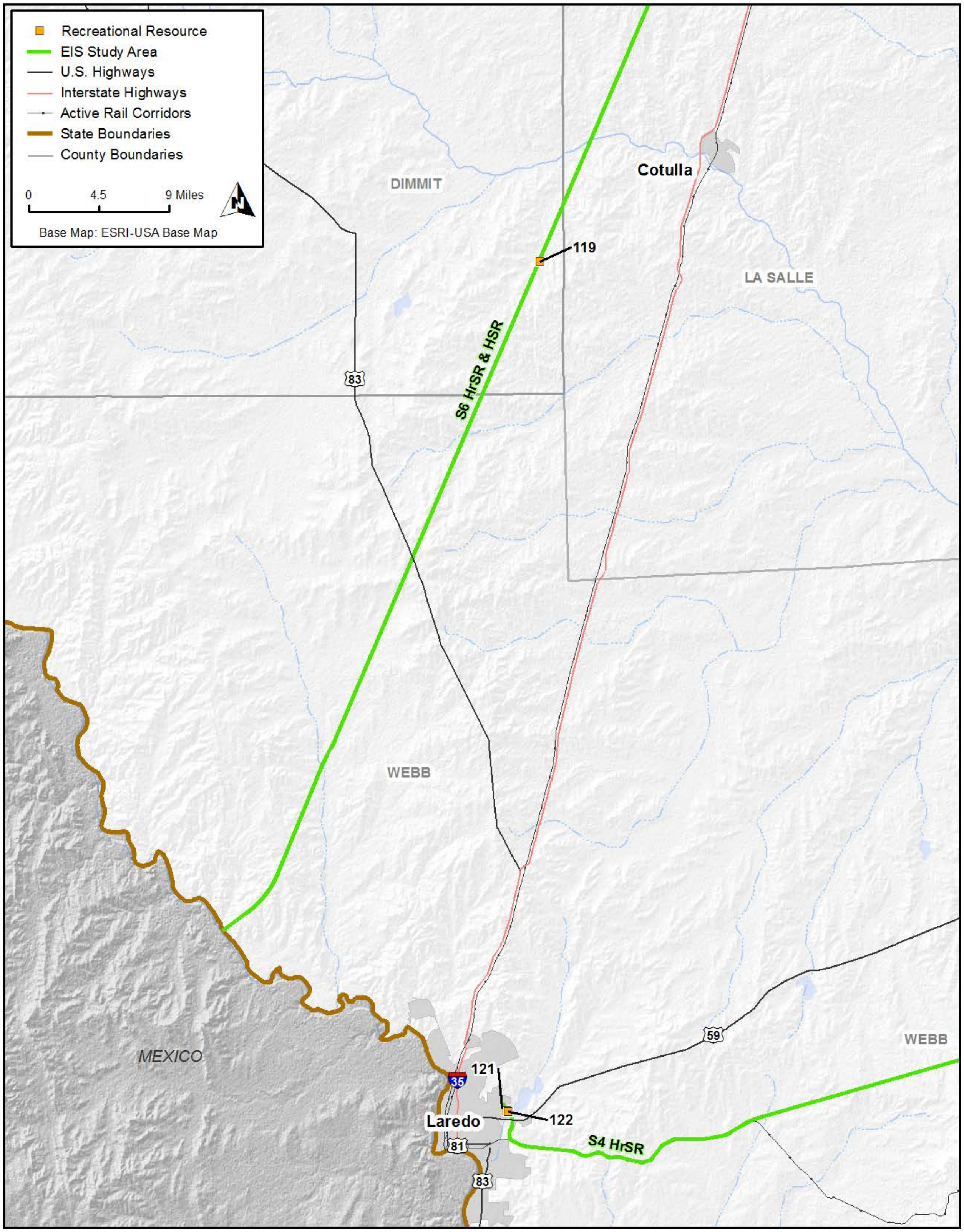

Figure 3.17-9: Recreational Resources within the EIS Study Area (Map 8)

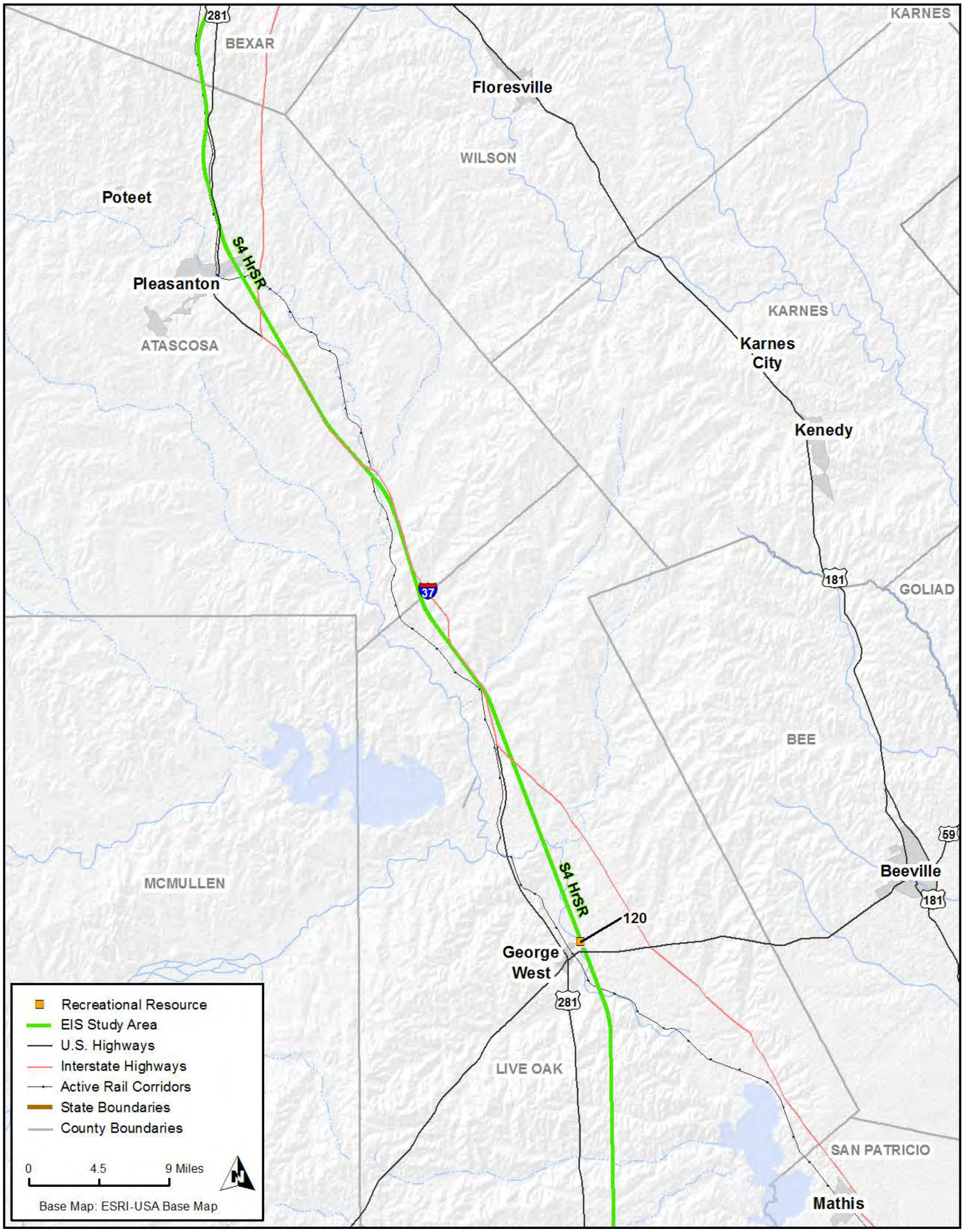

Figure 3.17-10: Recreational Resources within the EIS Study Area (Map 9)

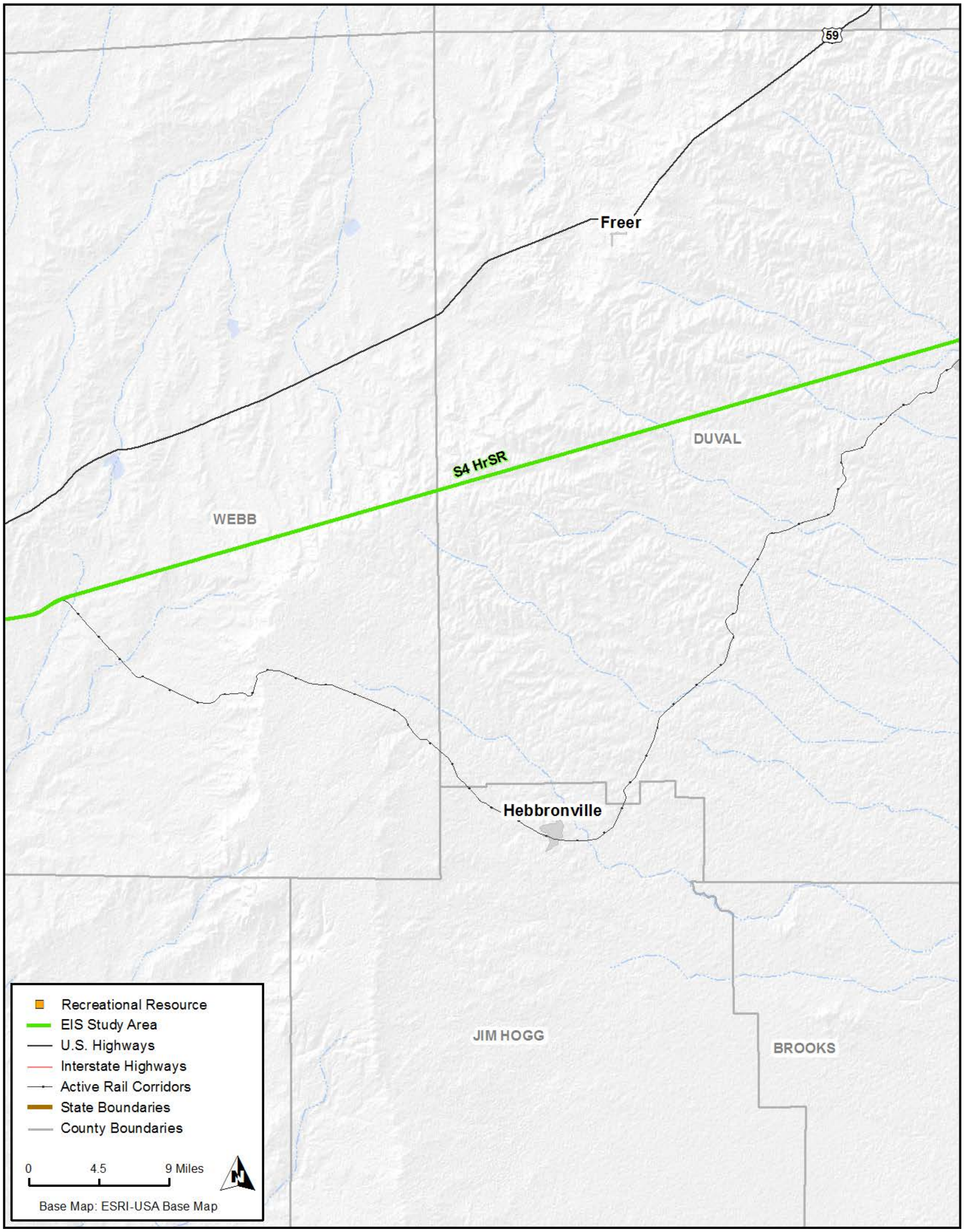

Figure 3.17-11: Recreational Resources within the EIS Study Area (Map 10)

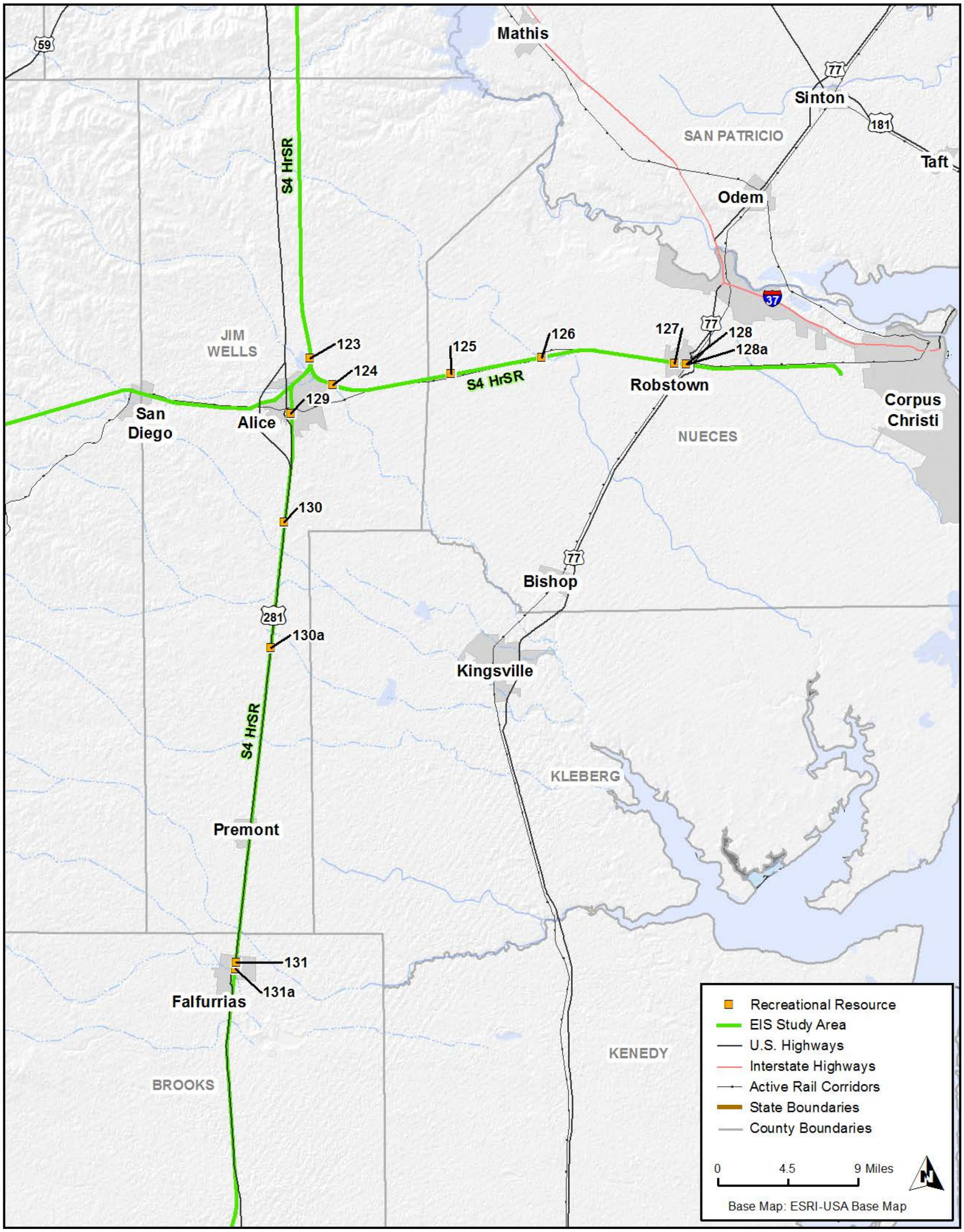

Figure 3.17-12: Recreational Resources within the EIS Study Area (Map 11)

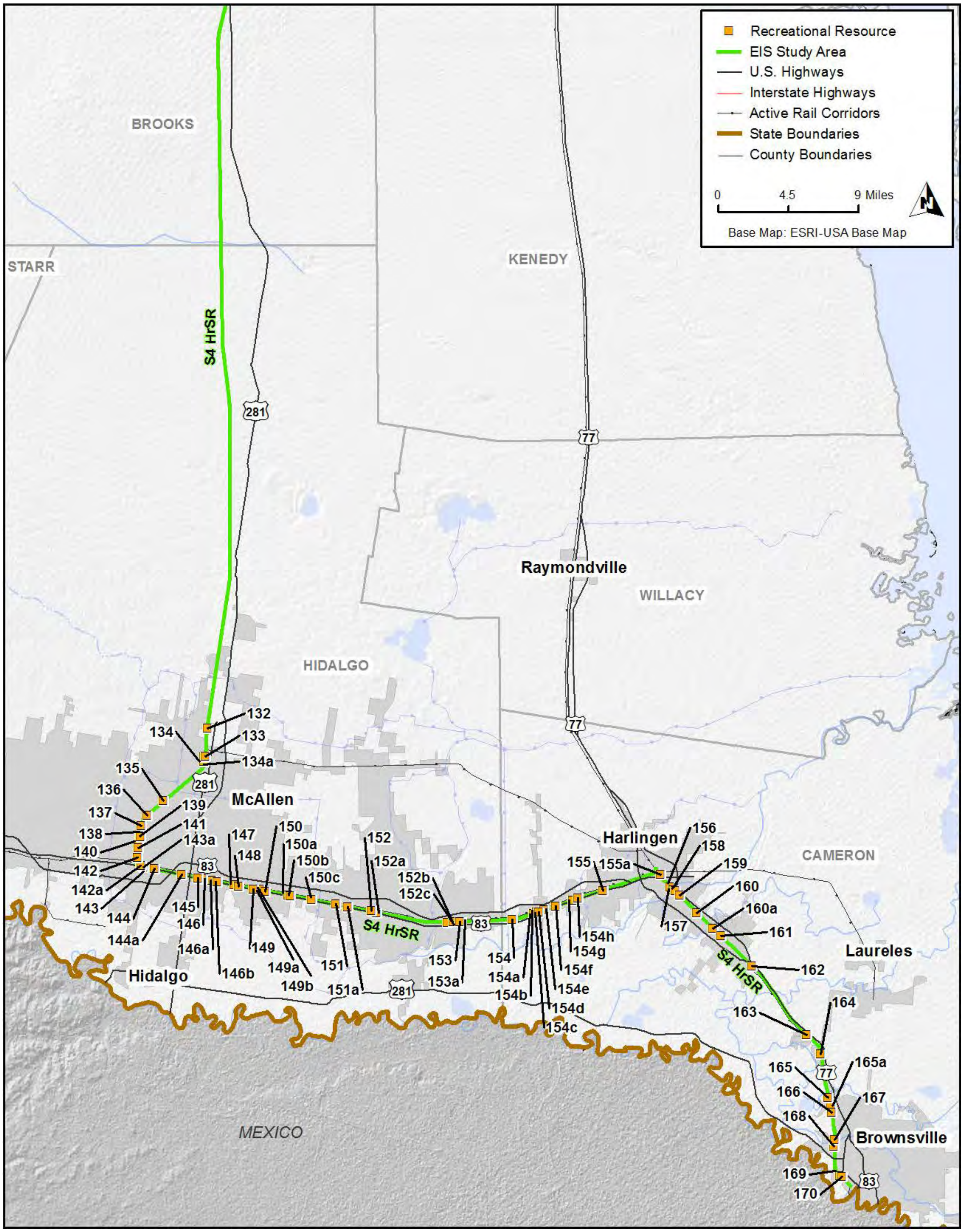

Figure 3.17-13: Recreational Resources within the EIS Study Area (Map 12)

3.17.4 Environmental Consequences

3.17.4.1 Overview

Alternatives could potentially have permanent effects on recreational uses through property acquisition, crossing park or trail facilities, or by affecting activities that require quiet. If scenic surroundings are important to the use of a resource, then the infrastructure may permanently affect the visual quality of the resource.

The alternatives would have temporary effects on recreational resources if construction requires easements that displace trails and recreational properties or block access to those resources. This service-level analysis determines the likelihood of effects on resources within the EIS Study Area, based on the type of rail service: conventional, higher-speed rail, or high-speed rail. The potential for operational effects is proportional to the type of rail service. Conventional rail has the potential to avoid most recreational resources and would not contribute noticeably higher noise effects or changes to the landscape because it would primarily use existing rail right-of-way. Higher-speed rail would have a greater potential effect on recreational resources because new rights-of-way and station areas would be needed in some areas. If a quiet condition and scenic surroundings are components of nearby open space resources, higher-speed may affect the use of those resources. High-speed rail may result in the greatest potential effects on recreational resources because high-speed rail facilities require large property acquisitions, and noise (short bursts at high volume) has the potential to be higher than with higher-speed rail. High-speed rail may also have more visual effects on the landscape because of the potential for elevated guideway over roadways or for roadways to cross over guideways. Given this context, the following discussion is only a comparative review of effects on recreational resources by alternative and type of rail service.

This analysis describes related recreational effects in terms of resources in urbanized, suburban, or rural areas to help represent the context of the effect. Urbanized areas include major cities, such as Oklahoma City, Dallas, Fort Worth, San Antonio, and cities such as Grand Prairie, Arlington, McAllen, and Harlingen. Examples of suburban cities include Gainesville, Norman, Temple, Waco, and Alice. Rural areas are generally unincorporated, smaller communities between urban and suburban cities.

3.17.4.2 No Build Alternative

Ongoing operation and maintenance of existing facilities is included in the No Build Alternative in addition to the potential expansion of existing facilities. Anticipated effects on recreational resources in the EIS Study Area under the No Build Alternative would be consistent with existing and planned transportation system uses and potential expansions, including incorporation of standard practices and best management practices (BMPs). Compared to the build alternatives and with the definition provided, the No Build Alternative is anticipated to have the least effect on recreational resources. However, as identified in Chapter 2 (Section 2.2) and the introduction to Chapter 3, the No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the

Program. The No Build Alternative is used as a basis for comparison for the build alternatives discussed in this EIS.

3.17.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.17.4.3.1 Alternative N4A Conventional

Alternative N4A Conventional has the potential to affect 56 recreational resources, of which 28 are in urban areas, 13 in suburban areas, and 15 in rural areas. Because Alternative N4A Conventional would predominantly use existing railroad infrastructure, it would have negligible effects on urban, suburban, and rural recreational resources. The main potential for effects on recreational resources would be the need for temporary construction easements; however, avoidance and minimization efforts in design refinement would reduce the total number of affected resources. Additionally, although Alternative N4A Conventional would likely be located within existing rights-of-way, temporary easements may be required during construction, resulting in temporary detours or closures of recreational resources. For example, several city trails are located within or cross existing railroad rights-of-way (Map ID #5, 6, 7, 12, 13, 29, 43, 44, and 52) in urban and suburban areas. Construction easements may also require the temporary closure of portions of public parks (Map ID #19, 27, and 33), golf courses (Map ID #16 and 45), and other recreation areas (Map ID #23, 30, and 32). Wherever possible, pedestrian detours would be provided for city trails and public parks in order to minimize these effects. Full access and usability of the recreational areas would be restored to their previous functions after construction is complete.

The expansion of existing stations or construction of new stations associated with Alternative N4A Conventional is expected to have negligible effects on recreational resources because existing railroad stations and depots would likely be used, and construction of new stations and additional parking facilities would avoid recreational resources during the project-level analysis.

Recreational resources within the EIS Study Area for Alternative N4A Conventional have historically been close to railroad facilities, and more frequent train noise and vibration are not likely to alter recreational activities. For more detailed information on changes in noise and vibration, see Section 3.3, Noise and Vibration. Delineations of specific increases in noise and vibration and the impacts on recreational resources would be addressed during the project-level analysis.

3.17.4.4 Central Section: Dallas and Fort Worth to San Antonio

3.17.4.4.1 Alternative C4A Higher-Speed Rail

Alternative C4A Higher-Speed Rail may affect 57 recreational resources, of which 28 are in urban areas, 17 in suburban areas, and 12 in rural areas. In the urban areas, Alternative C4A Higher-Speed Rail would use or be located adjacent to existing transportation corridors; therefore, avoidance and minimization of temporary construction easement effects would reduce the total affected resources during design refinement. These effects would be moderate compared to the No Build Alternative, which would not affect recreational resources.

The densest concentrations of urban development and recreational resources are located near the northern and southern termini of Alternative C4A Higher-Speed Rail, which are largely within the Fort Worth, Dallas, and San Antonio areas. Due to their location in relation to existing railroad infrastructure and Alternative C4A Higher-Speed Rail, city trails in the Dallas-Fort Worth area (Map ID #43, 44, and 52) and the Olmos Basin Golf Course and San Antonio Gun Club (Map ID #110 and 112) in San Antonio have the greatest potential to be affected by temporary easements. Construction easements may require the temporary closure of portions of urban trails and/or their access points; however, the closures would only be needed during construction and wherever possible, pedestrian detours would be provided in order to minimize these effects. Full access would be restored following construction. Construction easements may also require the temporary closure of portions of other urban recreation areas because of their locations (Map ID #49, 54, 103, and 111) and pedestrian detours would be provided wherever possible. Such areas would be restored to their previous functions after construction and result in negligible effects.

In suburban areas where alignments would be located outside existing rights-of-way (such as through downtown Waco and east of Austin), it is anticipated that Alternative C4A Higher-Speed Rail would have substantial effects on recreational resources during the construction and operational phases because of the need for temporary construction easements and new right-of-way acquisitions. For example, the Riverwalk Trail along the Brazos River in downtown Waco (Map ID #87) traverses an existing railroad right-of-way, and it may be temporarily affected, closed, or realigned during construction; new railroad infrastructure or acquisitions may have a permanent effect.

In rural areas where the alignments would be located outside existing rights-of-way, it is anticipated that Alternative C4A Higher-Speed Rail would have substantial effects on recreational resources. For example, Alternative C4A Higher-Speed Rail would pass through Red Oak Valley Golf Club in Red Oak, Texas (Map ID #76), and it would pass through the eastern portion of Walter E. Long Metropolitan Park, and the center of Richard Moya Park (Map ID #100 and 101), both of which are located outside Austin.

Two USACE-operated parks, Willis Creek Park and Wilson H. Fox Park (Map ID #97 and 98), are recreational resources identified within rural areas of the Alternative C4A Higher-Speed Rail EIS Study Area. Each park's recreational resources are primarily located along Granger Lake, east of the EIS Study Area. In addition, Alternative C4A Higher-Speed Rail passes through undeveloped areas of the parks, near places where existing rail infrastructure runs either through or adjacent to the parks. As previously stated, potential impacts on these resources would likely be avoided at the project level because higher-speed rail construction can accommodate relatively tight horizontal curves, and there is space in rural areas to avoid recreational resources; therefore, Alternative C4A Higher-Speed Rail would result in moderate effects on park resources.

In suburban and rural locations, where Alternative C4A Higher-Speed Rail would not be near existing railroad facilities, there may be additional effects on recreational resources that require quiet environments, such as the County View Golf Course in Lancaster (Map ID #74), the Red Oak

Valley Golf Club in Red Oak, Texas (Map ID #76) and the Lazy J Paradise campground (Map ID #102). For more detailed information on changes in noise and vibration, see Section 3.3, Noise and Vibration. Delineations of specific increases in noise and vibration and the impacts on recreational resources would be addressed during the project-level analysis.

The construction of new stations and expansion of existing stations within urban and suburban areas would potentially have moderate effects on recreational resources within the Alternative C4A Higher-Speed Rail EIS Study Area. Additionally, increased parking or additional parking facilities may be required; however, construction of parking facilities would likely avoid areas with recreational resources during the project-level analysis. Construction of new stations and associated parking lots in rural areas would likely be avoided, resulting in negligible effects on recreational resources.

3.17.4.4.2 Alternative C4A High-Speed Rail

The EIS Study Area for Alternative C4A High-Speed Rail is the same as Alternative C4A Higher-Speed Rail; therefore, this high-speed rail alternative may affect up to 57 recreational resources. The potential effects previously discussed for Alternative C4A Higher-Speed Rail would also be applicable to Alternative C4A High-Speed Rail. However, the high-speed rail facility poses additional effects on recreational resources because it must be constructed on new rights-of-way, it requires grade separation from other crossings (e.g., trails, roadways, railways, and wildlife corridors), and it requires rigid straights and large radii curvatures. Therefore, in densely developed urban and suburban areas, it may be difficult to avoid effects on recreational resources because existing railroad rights-of-way cannot be used and new railroad infrastructure would be required. It is anticipated that Alternative C4A High-Speed Rail would have substantial effects on recreational resources. Possible avoidance or minimization measures would include providing grade separations for trails under or over the guideway.

Alternative C4A High-Speed Rail may require that stations and grade crossings be elevated, which would impose new large-scale features on the surrounding landscape and may result in visual effects that would not be associated with effects potentially caused by Alternative C4A Higher-Speed Rail. It is anticipated that entirely new station facilities would need to be constructed in urban and suburban areas, even if there are existing stations, which could have moderate effects on recreational resources. However, recreational resources in urban and suburban areas may be avoided during station site selection. It is likely that effects on recreation resources in rural areas through the construction of new stations would be moderate because there is more available space than in dense urban areas.

3.17.4.4.3 Alternative C4B Higher-Speed Rail

Fifty-one recreational resources may be affected by Alternative C4B Higher-Speed Rail. It shares a similar EIS Study Area as Alternative C4A Higher-Speed Rail; however, it would avoid 20 resources that Alternative C4A Higher-Speed Rail may affect, while potentially affecting 14 other recreational resources. Because Alternative C4B Higher-Speed Rail shares a similar EIS Study Area as

Alternative C4A Higher-Speed Rail from approximately Hillsboro to San Antonio, the potential for effects are the same as previously discussed for Alternative C4A Higher-Speed Rail. Therefore, in the area from Hillsboro to San Antonio, it is anticipated that Alternative C4B Higher-Speed Rail would have substantial effects on recreational resources. The remaining discussion focuses on the urbanized areas in Dallas and Tarrant counties and the suburban and rural areas in Johnson, Ellis, and Hill counties.

Although Alternative C4B Higher-Speed Rail avoids 13 recreational resources in the Dallas and Fort Worth urban areas, it potentially affects 13 other urban recreational resources that Alternative C4A Higher-Speed Rail would not affect in Arlington, Fort Worth, Grand Prairie, and Dallas. Those potentially affected urban recreational resources include Nolan Catholic High School (Map ID #57) in Fort Worth, Randol Mill Park (Map ID #59), Lamar High School Athletic Field (Map ID #60), and Fish Creek Linear Park (west) (Map ID #65) in the city of Arlington. It also includes Fish Creek Linear Park (east) (Map ID #64) and John Adams Middle School (Map ID #67) in city of Grand Prairie. In Dallas, Alternative C4B Higher-Speed Rail may affect Thomas A. Edison Middle School (Map ID #68) and crosses the Trinity River Greenbelt Park (south) (Map ID #69). In addition, there are two large amusement parks in Fort Worth that could also potentially be affected by Alternative C4B Higher-Speed Rail: Six Flags Hurricane Harbor (Map ID #62) and Six Flags over Texas and Gateway Park (Map ID #63). Two golf courses, the Rolling Hills Country Club (Map ID #61) in Arlington and the Waterchase Golf Course in Fort Worth (Map ID #58), could potentially be affected by Alternative C4B Higher-Speed Rail.

In urban areas where Alternative C4B Higher-Speed Rail diverges from Alternative C4A Higher-Speed Rail, Alternative C4B Higher-Speed Rail is located within or directly adjacent to existing transportation corridors, Interstate Highway 30 (IH-30) and State Highway 360 (SH-360). Therefore, it is likely that temporary construction easements could lead to temporary closures and detours, and minimal right-of-way acquisition would be required. Effects from noise and vibrations on urban recreational resources are expected to be minimal because they are already located adjacent to major transportation corridors. For more detailed information on changes in noise and vibration, see Section 3.3, Noise and Vibration. Delineations of specific increases in noise and vibration and the impacts on recreational resources would be addressed during the project-level analysis. As a result, Alternative C4B Higher-Speed Rail (where it diverges from Alternative C4A Higher-Speed Rail) poses moderate effects on urban recreational resources.

Alternative C4B Higher-Speed Rail would affect the same suburban recreational resources as Alternative C4A Higher-Speed Rail, except Alternative C4B Higher-Speed Rail avoids the city of Waxahachie and, therefore, would not affect Navarro College (Map ID #77) or Richards Park (Map ID #78) in Waxahachie. It is anticipated that Alternative C4B Higher-Speed Rail would have substantial effects on suburban recreational resources.

In rural areas, Alternative C4B Higher-Speed Rail would affect the same rural recreational resources as Alternative C4A Higher-Speed Rail; however, Alternative C4B Higher-Speed Rail would affect one additional rural resource, Lloyd Park (Map ID #66), which is located outside Grand Prairie.

Alternative C4B Higher-Speed Rail would result in a moderate effect on rural recreational resources because Alternative C4B Higher-Speed Rail follows SH-360 through Lloyd Park, and the alternative would likely be built adjacent to or within existing transportation rights-of-way.

Alternative C4B Higher-Speed Rail and associated stations are expected to have moderate effects on urban recreational resources due to possible land acquisitions for new stations and parking facilities. The associated stations are expected to have the same effects on suburban and rural recreational resources as noted for Alternative C4A Higher-Speed Rail.

3.17.4.4.4 Alternative C4B High-Speed Rail

Alternative C4B High-Speed Rail shares the same EIS Study Area as Alternative C4B Higher-Speed Rail. Therefore, both C4B alternatives may potentially affect the same resources. The 51 recreational resources and the potential effects presented for Alternative C4B Higher-Speed Rail would also apply to Alternative C4B High-Speed Rail. However, Alternative C4B High-Speed Rail poses additional effects, particularly on urban recreational resources. The majority of the recreational resources within the EIS Study Areas for the C4B alternatives that are different from the C4A alternatives are urban recreational resources. In urban areas, high-speed rail facilities have the potential for substantial effects on recreational resources because they must be constructed on new rights-of-way, they require grade separation structures at all intersections, and they require straight alignments and large radii curvatures. As a result, it may be difficult to avoid effects on recreational resources because of the need to acquire new rights-of-way and the construction of new railroad infrastructure. It is anticipated that Alternative C4B High-Speed Rail would have substantial effects on recreational resources. Possible avoidance or minimization measures would include providing grade separations of trails, such as the Trinity River Greenbelt Park (south) (Map ID #69) under or over the guideway.

Alternative C4B High-Speed Rail may require that associated stations and grade crossings be elevated, which would impose new large-scale features on the surrounding landscape and may result in visual effects that would not be associated with Alternative C4B Higher-Speed Rail. It is anticipated that entirely new station facilities would need to be constructed in urban and suburban areas, even if existing stations are already present; this could have moderate effects on recreational resources. However, recreational resources in urban and suburban areas may be avoided during station site selection. It is likely that effects on recreation resources in rural areas caused by construction of new stations would be moderate because there is more available space than in more densely developed areas.

3.17.4.4.5 Alternative C4C Higher-Speed Rail

Alternative C4C Higher-Speed Rail shares the same EIS Study Area as Alternative C4A Higher-Speed Rail, except that there are five additional resources in urban areas that may be affected, for a total of 33 urban recreational resources potentially affected (62 recreational resources total). Alternative C4C Higher-Speed Rail has the potential to affect the most overall and the most urban recreational resources in the Central Section.

All urban recreational resources except the five noted herein have the same potential for effects, avoidance, and minimization as Alternative C4A Higher-Speed Rail. The five additional urban recreational resources include Hallmark Park (Map ID #171), Parks of Deer Creek Park (Map ID #172), and Sidney H. Poynter Elementary School (Map ID #173) in Fort Worth, and Mistletoe Hill Park (Map ID #174) and Bailey Lake (Map ID #175) in the city of Burleson. Where Alternative C4C Higher-Speed Rail does not follow Alternative C4A Higher-Speed Rail, it is located close to existing railroad rights-of-way; therefore, the urban recreational resources on this portion of Alternative C4C Higher-Speed Rail may be affected by temporary easements, temporary closures and detours, or minimal new right-of-way acquisitions. Effects from noise and vibrations are expected to be minimal because Alternative C4C Higher-Speed Rail follows an existing railroad and there are no known recreational areas that require quiet environments. For more details on changes in noise and vibration, see Section 3.3, Noise and Vibration. Delineations of specific increases in noise and vibration and the impacts on recreational resources would be addressed during the project-level analysis. As a result, Alternative C4C Higher-Speed Rail where it diverges from Alternative C4A Higher-Speed Rail would result in moderate effects.

Alternative C4C Higher-Speed Rail and associated stations are expected to have moderate effects on urban recreational resources because of the need to expand existing stations or construct new stations and parking facilities.

All resources in suburban and rural areas have the same potential for moderate effects, avoidance, and minimization as Alternative C4A Higher-Speed Rail.

3.17.4.4.6 Alternative C4C High-Speed Rail

Alternative C4C High-Speed Rail shares the same EIS Study Area as Alternative C4C Higher-Speed Rail. Therefore, both C4C alternatives may potentially affect the same recreational resources (62 recreational resources total). Alternative C4C High-Speed Rail may potentially result in substantial effects on the five urban recreational resources within the EIS Study Area. Because high-speed rail facilities must be constructed on new rights-of-way and because the facilities require grade separation structures at all intersections and large radii curvatures, the potential effects are greater in intensity than with higher-speed rail. It is anticipated that Alternative C4C High-Speed Rail would have substantial effects on recreational resources. Possible avoidance or minimization measures would include providing grade separations of trails at locations such as the walking trails at Parks of Deer Creek Park (Map ID #172) under or over the guideway.

Alternative C4C High-Speed Rail and the associated stations in the Fort Worth and Burleson areas may require that the stations and grade crossings be elevated, which would impose new large-scale features on the surrounding landscape and may result in visual effects that would not be associated with Alternative C4C Higher-Speed Rail. It is anticipated that entirely new station facilities would need to be constructed in urban areas, even if existing stations are already present; this could have moderate effects on recreational resources. However, recreational resources in urban areas may be avoided during station site selection.

All resources in suburban and rural areas have the same potential for moderate effects, avoidance, and minimization as Alternative C4A High-Speed Rail.

3.17.4.5 Southern Section: San Antonio to South Texas

3.17.4.5.1 Alternative S4 Higher-Speed Rail

Alternative S4 Higher-Speed Rail may affect 54 recreational resources, of which 38 are in urban areas, four are in suburban areas, and 12 are in rural areas. Recreational resources within the EIS Study Area for the alignment are located primarily in urban and suburban areas on the south side of San Antonio, in smaller communities along the alternative, and along the southern branch of Alternative S4 Higher-Speed Rail in the Lower Rio Grande Valley (extending south to McAllen and east to Brownsville). In urban and suburban areas, Alternative S4 Higher-Speed Rail would be mostly within existing railroad rights-of-way or directly adjacent to existing rights-of-way. In addition, existing railroad infrastructure, including at-grade railroad crossings and grade-separated crossings, are already in place in the urban and suburban areas along the alignment for Alternative S4 Higher-Speed Rail. A few hiking and bike trails are located within the existing railroad right-of-way along the alignment for Alternative S4 Higher-Speed Rail (Map ID #135, 138, and 139). Construction easements may require the temporary closure of these trails and/or their access points, as well as temporarily affect recreational resources within the EIS Study Area. Wherever possible, pedestrian detours would be provided in order to minimize these effects. Construction easement areas would be restored to their previous functions after construction activities. Consequently, there is lower potential in urban and suburban areas for effects on recreational resources under Alternative S4 Higher-Speed Rail, but due to the length of time for construction and the potential for adjacent parks to be affected, construction effects would be moderate.

In rural areas, most of Alternative S4 Higher-Speed Rail would require an alignment outside of existing rail infrastructure, although some of the alternative would use abandoned railroad alignments. Alternative S4 Higher-Speed Rail would potentially affect 12 recreational resources, such as an unnamed park near George West (Map ID #120), John L. Sablatura County Park (Map ID #126) near Banquette, Resaca de la Palma State Park (Map ID #154) in Bixby, and Lower Rio Grande Valley National Wildlife Refuge (Map ID #162). Rail through both Resaca de la Palma State Park and Lower Rio Grande Valley National Wildlife Refuge would be constructed on either existing or abandoned railroad alignments that already span those resources. Although a new alignment is proposed in the vicinity of the unnamed park near George West and John L. Sablatura County Park, the rural areas are on primarily undeveloped or inaccessible land. Therefore, it is anticipated that there would be negligible effects on recreational resources from Alternative S4 High-Speed Rail.

Potential effects caused by Alternative S4 Higher-Speed Rail and its associated stations are expected to have negligible effects on urban, suburban, and rural recreational resources. Alternative S4 Higher-Speed Rail would follow existing rail facilities in urban areas, and the potentially affected recreational resources are accustomed to passing trains; therefore, operational effects (e.g., noise and visual intrusion) are expected to be negligible. Station areas are expected to avoid park resources and therefore result in negligible effects. Delineations of specific increases in noise and vibration and the impacts on recreational resources would be addressed during the project-level analysis.

3.17.4.5.2 Alternatives S6 Higher-Speed Rail and High-Speed Rail

Only three recreational resources were identified within the EIS Study Area for Alternatives S6 Higher-Speed and High-Speed Rail, two urban recreational areas, and one rural recreational area: (1) Lindbergh Park in San Antonio (Map ID #114), (2) Elm Creek Elementary School and McNair Middle School in Atascosa (Map ID #117), and (3) the Chaparral Wildlife Management Area southwest of Cotulla (Map ID #119).

Alternative S6 Higher-Speed Rail may be located within or adjacent to existing railroad rights-of-way in the urban areas of San Antonio and south to Atascosa. Lindbergh Park and Elm Creek Elementary School and McNair Middle School are adjacent to existing railroad facilities where the S6 alternatives would be constructed (on or adjacent to the existing rail alignments). Alternative S6 High-Speed Rail would be constructed on a new location; however, it is anticipated that it would be located close to the existing railroad rights-of-way when possible, and recreational resources would be avoided if possible. Potential effects caused by Alternatives S6 Higher-Speed Rail and High-Speed Rail are expected to have negligible effects on urban recreational resources.

As Alternative S6 Higher-Speed Rail extends south, it would require a new alignment through rural areas of south Texas. It would bisect Chaparral Wildlife Management Area; however, impacts on that resource may be avoided at the project level. There are large areas nearby where the alignment could be routed to minimize potential impacts on the wildlife management area. If it can be avoided, the construction phase of Alternative S6 Higher-Speed Rail would have negligible effects on recreational resources.

Lindbergh Park and Elm Creek Elementary School and McNair Middle School have historically been close to railroad facilities; therefore, effects due to noise and vibrations from additional passing trains would be minimal. Noise and vibrations during construction and operation may have an effect on the Chaparral Wildlife Management Area if it keeps wildlife away from the property. For more details on changes in noise and vibration, see Section 3.3, Noise and Vibration. Delineations of specific increases in noise and vibration and the impacts on recreational resources would be addressed during the project-level analysis.

Alternatives S6 Higher-Speed Rail and High-Speed Rail associated stations are expected to have negligible effects on recreation resources because there are only three recreational resources and as a result it is anticipated that they can be avoided during site selection.

3.17.4.6 Summary of Potential Effects

Based on this service-level analysis of potential effects on recreational resources, it is anticipated that the highest intensity of effects during the construction and operational phases would occur in the Central Section, with potentially greater effects caused by high-speed rail because of the nature of high-speed rail (e.g., the need for grade-separated structures, potential elevated tracks and stations, and the need for new alignments outside of existing rights-of-way). The alternatives in the Central Section travel through major urban areas that have the densest concentration of recreational resources.

Although there are several recreational resources in the Northern and Southern sections, it is anticipated that effects on these resources would be negligible except for Alternative S4 Higher-Speed Rail, which would have moderate effects. Alternative N4A Conventional would use existing railroad facilities and infrastructure. Alternative S4 Higher-Speed Rail would also use existing railroad facilities or abandoned railroad rights-of-way, particularly in areas where the majority of the recreational resources are located. Due to the length of time for construction and the potential for adjacent parks to be affected, construction effects under Alternative S4 would be moderate in urban and suburban areas. Alternatives S6 Higher-Speed Rail and High-Speed Rail have relatively few recreational resources that would be affected. As a result, effects on recreational resources along the Northern and Southern section alignments would be minor and could be easily avoided or reduced. Table 3.17-4 lists the number of recreational resources by alternative and the potential intensity of effects for each alternative during construction and operation.

Table 3.17-4: Summary of Intensity of Effects on Recreational Resources

Section	Alternative	Total Recreational Resources	Potential Intensity of Effects[a]
No Build Alternative[b]		N/A	No effects
Northern	N4A CONV	56	Negligible
Central	C4A HrSR	57	Substantial
	C4A HSR	57	Substantial
	C4B HrSR	51	Substantial
	C4B HSR	51	Substantial
	C4C HrSR	62	Moderate
	C4C HSR	62	Substantial
Southern	S4 HrSR	54	Moderate
	S6 HrSR	3	Negligible
	S6 HSR	3	Negligible

[a] The most intense effect for each alternative is presented in the table; however, alternatives may include additional less intense effects depending on urban, suburban, or rural locations.
[b] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

3.17.5 Avoidance, Minimization, and Mitigation Strategies

Avoidance and minimization of effects at the project-level would be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies would be implemented at the project level. Avoidance, minimization, and mitigation strategies during construction would include, but not be limited to, minimizing generation of dust and debris, avoiding recreational resources, using detours (for pedestrians, bicycles, and vehicles) and providing partial access to recreational resources, recreational resource enhancements, and potential land replacement for long-term adverse effects. Proximity effects on parks could be reduced through context-sensitive design, plantings, vegetative screenings, and sound barriers. Other construction-phase mitigation would include, but not be limited to, preserving public access to and function of remaining park areas during construction. Resources, if temporarily affected, would be restored to pre-construction or better conditions after construction is complete. Where new rights-of-way would be required, shifting and narrowing of the new rights-of-way may minimize effects on recreational resources.

3.17.6 Subsequent Analysis

During the project-level analysis of the selected alternative, a detailed data gathering and analysis would occur, which will include, but is not limited to, research into the types of activities conducted at each resource, identification of the degree of public access and use of the resource, and delineation of exact property boundaries. This research will be conducted to determine the extent of potential impacts. The project-level analysis will include the following:

- Specific descriptions of the uses and functions of each resource.
- Identification of resource boundaries, the acreage of the resources, specific services and facilities, and access.
- Identification of specific potential impacts on each resource as a result of construction, operation, infrastructure, and improvement/maintenance of each passenger rail service alternative, including property acquisitions, permanent and temporary easements, and proximity and/or temporary impacts and the permanent or temporary impact on the functionality of the resource.
- Documentation of consultation with the affected federal, state, and local jurisdictions, as well as owners/operators of identified resources.
- Resource and impact-specific mitigation strategies.
- Public involvement and outreach to identify the local and regional importance of the resource and to notify the public if impacts would occur.

3.18 Historic, Architectural, and Non-Archaeological Cultural Resources

This section describes the historic, architectural, and non-archaeological cultural resources identified within the environmental impact statement (EIS) Study Area of the Program and outlines potential effects on these resources. These resources include visual landmarks of the communities' development and cultural history. Federal and state statutes recognize the value of preserving the historic structures for future generations. Archaeological sites, tribal resources, and traditional cultural properties are discussed in Section 3.19, Archaeological Resources. The introduction to Chapter 3 describes the EIS Study Area and use of terms, such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.18.1 Laws, Regulations, and Orders

Applicable federal and state legislation and regulations pertaining to historic, architectural, and non-archaeological cultural resources are discussed in the following sections. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in the project-level analysis.

3.18.1.1 Federal

- **National Historic Preservation Act (NHPA) of 1966 (16 United States Code [U.S.C.] 470) and Implementing Regulations for Section 106 NHPA (36 Code of Federal Regulations [CFR] Part 800).** Section 106 of the NHPA requires that federal agencies consider the effects of their undertakings on historic properties listed in or eligible for listing in the National Register of Historic Places (NRHP). Furthermore, it requires that federal agencies provide the Advisory Council on Historic Preservation, State Historic Preservation Officers (SHPOs), and other consulting parties the opportunity to comment on proposed federal undertaking(s). This document outlines potential effects on non-archaeological cultural resources at the service level. This service-level analysis does not comply with Section 106 because there is no proposed undertaking associated with this study. Compliance documentation in accordance with Section 106 would be completed after proposed undertakings are studied at the project level.
- **Section 4(f) of the U.S. Department of Transportation (USDOT) Act (49 U.S.C. § 303 and 23 U.S.C. § 138).** Compliance with Section 4(f) would be conducted at the project level. For more information on Section 4(f), see Chapter 4, Section 4(f) and Section 6(f) Resources.

3.18.1.2 State

- **Antiquities Code of Texas (Texas Natural Resource Code, Title 9, Chapter 191).** The Antiquities Code of Texas established the creation of State Antiquities Landmarks (SALs), which include archaeological sites and non-archaeological historic resources (e.g., buildings, structures). Non-archaeological historic resources designated as SALs must first be listed on the NRHP to be designated as a SAL. For non-archaeological historic resources, the Antiquities Code of Texas mandates that state agencies or any political subdivisions of the State of Texas, including cities, counties, municipal utilities, or school districts, may not alter, remove, damage, or destroy SALs (including non-archaeological SALs) without a contract with or permit from the Texas SHPO.

3.18.2 Methodology

The historic, architectural, and non-archaeological cultural resources analysis for this service-level EIS took a broad approach in determining the potential for effects on historic resources from the build alternatives.

The EIS Study Area for historic, architectural, and non-archaeological cultural resources is defined as a 500-foot buffer for each alternative. Using primary and secondary sources outlined below, a general historic context was prepared that presents the history of the areas surrounding the alternatives and provides a general overview with which to evaluate historic resources within the EIS Study Area (for more information on the historic context, see Appendix J).

Information on potential non-archaeological historic resources was obtained from electronic databases and online resources including the *Historic Sites Atlas* (Texas Historical Commission 2014); *Oklahoma's National Register Handbook* (Oklahoma Historical Society 2014); the National Park Service (NPS) Google Earth layer of NRHP-listed resources in Texas and Oklahoma; the Texas Department of Transportation (TxDOT) Environmental Affairs Division (ENV) internal database of resources with previous determinations of NRHP eligibility; *Irrigation District Engineering Assistance* (Texas A&M University 2014); and city planning and preservation department websites. These resources were used to identify known historic resources (i.e., those listed or determined eligible for listing in the NRHP, including non-archaeological historic resources like buildings, sites, structures, objects, and historic districts).

In addition to electronic resources from both Oklahoma and Texas, hard-copy files of previous surveys were reviewed at the Texas SHPO and TxDOT ENV offices. These files provided information on historic resources with previous determinations of NRHP eligibility within the EIS Study Area. Similar information was not available for Oklahoma. City preservation and planning departments with city preservation officers were contacted if information about locally designated historic resources was not available online.

This analysis also identified potential non-archaeological historic resources and potential historic districts within the EIS Study Area that have not been evaluated to date, but may meet the NRHP Criteria of Eligibility. Cemeteries not listed on the NRHP or previously determined NRHP-eligible were identified and noted as potentially NRHP-eligible resources. These resources were identified for further assessment and formal determinations of NRHP eligibility during the project-level analysis. Current and historic aerial imagery and Google Streetview were used to identify these previously un-evaluated but potentially NRHP-eligible historic resources within the EIS Study Area. From historic aerials, it was possible to identify potential historic districts from the post-World War II era and cemeteries more easily than other individual historic resources; however, local jurisdictions were called to acquire information on local historic resources to identify resources that should be evaluated for eligibility in future phases of project review.

Section 106 of the NHPA requires federal agencies to make a reasonable and good faith effort in identifying historic properties that are 50 years of age or older within the Area of Potential Effect (APE). As previously noted, this service-level analysis does not comply with Section 106 because there is no proposed undertaking associated with this study. However, Section 106 acted as guidance for this initial desktop service-level analysis of the 500-foot EIS Study Area. Cemeteries are included as properties that may be 50 years of age or older as part of the reasonable and good faith effort. As such, cemeteries appear as part of the findings when conducting this level of analysis of potential historic properties in the 500-foot EIS Study Area.

In accordance with the NRHP Criteria for Evaluation, a 50-year cutoff is typically used in the identification of potential historic resources. However, to allow for an expected period of time for Program planning, properties built in or before 1970 were evaluated as potentially NRHP-eligible historic districts within the EIS Study Area. This date may need to be modified during the project-level analysis, based on the actual date of construction of the Program. As a result, additional historic resources that were constructed after 1970 may be identified during the project-level analysis.

After NRHP-listed, NRHP-eligible, and potentially NRHP-eligible historic resources were identified for each alternative, the magnitude of potential effects on these resources was determined. The assessment was based on the data collected during the service-level analysis and may need to be reassessed at the project level, depending on changes to the Program and the actual date of construction. Formal determination of effects pursuant to the National Environmental Policy Act (NEPA) and NHPA would be made during the project-level analysis.

The intensity of an effect as a result of the route alternatives are characterized as negligible, moderate, or substantial compared with the No Build Alternative. In relation to historic, architectural, and non-archaeological cultural resources (which include buildings, structures, and districts), these terms are defined as follows:

- Negligible intensity effects are those that would result in no permanent change in the setting or character-defining features that make the historic resource eligible for, or listed in, the NRHP.
- Moderate intensity effects are those that would result in a change or alteration to the historic resource but would not diminish the setting or character-defining features that make the resource eligible for, or listed in, the NRHP.
- Substantial intensity effects are those that would result in a permanent alteration, relocation, or removal of the resource, which would result in a loss of character-defining features that make it eligible for, or listed in, the NRHP.

3.18.3 Affected Environment

Table 3.18-1 lists the number of known and potential historic resources by alternative within the EIS Study Area; the historic resources are discussed in further detail in the following sections.

Table 3.18-1: Historic Resources by Alternative within the EIS Study Area

Historic Resource	N4A CONV	C4A HrSR and HSR[a]	C4B HrSR and HSR[a]	C4C HrSR and HSR[a]	S4 HrSR	S6 HrSR and HSR
NRHP-Listed or NRHP-Eligible Historic Districts	9	4	4	3	7	0
Potentially NRHP-Eligible Historic Districts	5	4	6	6	3	0
NRHP-Listed or NRHP-Eligible Individual Resources	17	19	12	22	23	0
Potentially NRHP-Eligible Individual Resources	1	2	1	3	1	0
NRHP-Listed or NRHP-Eligible Cemeteries	0	1	1	1	0	0
Potentially NRHP-Eligible Cemeteries	3	15	14	17	2	0
Total Historic Resources	**35**	**45**	**38**	**52**	**36**	**0**

[a] These alternatives are listed together because the total number of historic resources within the EIS Study Area is the same for both.

CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

3.18.3.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Data revealed nine NRHP-listed or NRHP-eligible historic districts and five potentially NRHP-eligible historic districts within the Northern Section EIS Study Area. The historic districts are largely concentrated in Oklahoma City, Dallas, and Fort Worth, although several are in smaller towns and cities along the route. The analysis also revealed 17 individual NRHP-listed or previously determined NRHP-eligible resources and three potentially NRHP-eligible cemeteries within the Northern Section EIS Study Area.

Although detailed survey to identify potentially NRHP-eligible individual historic resources was not part of this analysis, the prevalence of historic Santa Fe Railroad Depots along the Alternative N4A route led to the identification of one previously unevaluated Santa Fe Railroad Depot (Map ID #15) in Pauls Valley, Oklahoma. This depot has been included as a potentially NRHP-eligible resource. Because of the prevalence of historically significant Santa Fe Railroad Depots along the Alternative N4A route, there is also potential for a discontinuous Santa Fe Railroad historic district.

Known and potential historic resources within the Northern Section EIS Study Area are listed in Table 3.18.2. Figure 3.18-1 is an index map for the Map ID numbers and figures identified in the table, and identified historic resources for all sections are shown on Figures 3.18-2 through 3.18-13.

Table 3.18-2: Historic Resources – Northern Section

Map ID # Figure #	Site Name	Location (Lat/Long)[b]	NRHP Status	Alternative
1 Figure 3.18-2	Edgemere Park Historic District	35.50639/ -97.514683	NRHP-Listed	N4A CONV
2 Figure 3.18-2	Mesta Park and Heritage Hills Historic Districts	35.491974/ -97.513299	NRHP-Listed	N4A CONV
3 Figure 3.18-2	Cain's Coffee Building	35.48141681/ -97.5122159	NRHP-Listed	N4A CONV
4 Figure 3.18-2	Automobile Alley Historic District	35.47801715/ -97.51249716	NRHP-Listed	N4A CONV
5 Figure 3.18-2	Sherman Machine and Iron Works Building	35.4678438/ -97.51156819	NRHP-Listed	N4A CONV
6 Figure 3.18-2	Stanford Furniture Company Building	35.46663246/ -97.51186181	NRHP-Listed	N4A CONV
7 Figure 3.18-2	J.I. Case Plow Works Building	35.4650558/ -97.5118831	NRHP-Listed	N4A CONV
8 Figure 3.18-2	Sooner Theater Building	35.22114837/ -97.4432098	NRHP-Listed	N4A CONV
9 Figure 3.18-2	Santa Fe Depot	35.21993512/ -97.4429154	NRHP-Listed	N4A CONV
10 Figure 3.18-2	Norman Historic District	35.219368/ -97.442376	NRHP-Listed	N4A CONV
11 Figure 3.18-2	Miller Historic District	35.217936/ -97.441167	Potentially NRHP-Eligible	N4A CONV
12 Figure 3.18-2	DeBarr Historic District	35.21183909/ -97.43882983	NRHP-Listed	N4A CONV
13 Figure 3.18-2	U.S. Highway 77 Bridge at Canadian River	35.01374298/ -97.35678374	NRHP-Listed	N4A CONV
14 Figure 3.18-2	Purcell Train Station	35.01191388/ -97.35728219	NRHP-Listed	N4A CONV
15 Figure 3.18-2	Santa Fe Depot	34.74137837/ -97.21791761	Potentially NRHP-Eligible	N4A CONV
16 Figure 3.18-2	Pauls Valley Historic District	34.74067683/ -97.21744851	NRHP-Listed	N4A CONV
17 Figure 3.18-3	Arbuckle Historical Museum/ Davis Santa Fe Depot	34.50361524/ -97.1217722	NRHP-Listed	N4A CONV

Map ID # Figure #	Site Name	Location (Lat/Long)[b]	NRHP Status	Alternative
18 Figure 3.18-3	Ardmore Commercial Historic District	34.1716344/ -97.12609074	NRHP-Listed	N4A CONV
19 Figure 3.18-3	Marietta Main Street Historic District	33.93723476/ -97.11732243	Potentially NRHP-Eligible	N4A CONV
20 Figure 3.18-3	Santa Fe Depot	33.93670828/ -97.11677581	NRHP-Listed	N4A CONV
21 Figure 3.18-3	Saint Paul's Church	33.62597124/ -97.14132663	NRHP-Eligible	N4A CONV
22 Figure 3.18-3	Santa Fe Passenger Depot	33.62501115/ -97.140706	NRHP-Listed	N4A CONV
23 Figure 3.18-3	Gainesville Commercial Historical District	33.624124/ -97.140743	Potentially NRHP-Eligible	N4A CONV
24 Figure 3.18-4	Krum Cemetery	33.244875/ -97.243899	Potentially NRHP-Eligible Cemetery	N4A CONV
25 Figure 3.18-4	Fort Worth Stockyards Historic District	32.793943/ -97.343368	NRHP-Listed	N4A CONV
26 Figure 3.18-4	Samuels Avenue Historical District	32.768609/ -97.328688	Potentially NRHP-Eligible	N4A CONV
27 Figure 3.18-4	Pioneers Rest Cemetery	32.765624/ -97.327955	Potentially NRHP-Eligible Cemetery	N4A CONV
28 Figure 3.18-4	Hampton-Peach Streets Historical District	32.763048/ -97.32699	Potentially NRHP-Eligible	N4A CONV
29 Figure 3.18-4	Allen Chapel AME Church	32.75897211/ -97.32752389	NRHP-Eligible	N4A CONV
30[a] Figure 3.18-4	Montgomery Ward and Company Building	32.75401418/ -97.32647395	NRHP-Listed	N4A CONV
31[a] Figure 3.18-4	Gulf, Colorado and Santa Fe Railroad Passenger Station	32.74916071/ -97.32410681	NRHP-Eligible	N4A CONV
32[a] Figure 3.18-4	Calloway Cemetery	32.810561/ -97.089142	Potentially NRHP-Eligible Cemetery	N4A CONV
33[a] Figure 3.18-4	Rock Island Railroad Bridge	32.81315531/ -96.86163747	NRHP-Eligible	N4A CONV

Map ID # Figure #	Site Name	Location (Lat/Long)[b]	NRHP Status	Alternative
34 [a] Figure 3.18-4	Turtle Creek Pump Station	32.80004162/ -96.81644069	NRHP-Listed	N4A CONV
35[a] Figure 3.18-4	West End Historic District	32.779764/ -96.809595	NRHP-Listed	N4A CONV

[a] Resource is also in the Central Section.

[b] Lat/Long = latitude/longitude

Sources: Baird and Goble (2008); Bamburg (2007); Beaumont et al. (no date [n.d.]); Crowder and Hoig (2008); Fite (2007); Fugate (2007); Google Maps (2014); Google Earth (1950–2014); Hager (2008), Hazel (1997); Hill (1996); Hoig (2007); Levy (2007); Long (2010a); Maxwell (2010); McElhaney and Hazel (2010); Moore et al(2013); NPS (2014); NPS (1995); NETROnline (2014); O'Dell (2007); Odom (2010); Oklahoma Historical Society (2014); Richardson (2005); Sanders and Tyler (1973); Schmelzer (2010); Selcer (2004); TxDOT (2014a); TxDOT (2014b); TxDOT (2014c); TxDOT (2014d); TxDOT (2014e); TxDOT and Federal Railroad Administration (FRA) (2014); Texas Historical Commission (2014); Wade (2010); Weaver (2007); Wilson (2007); Worcester (2010).

3.18.3.2 Central Section: Dallas and Fort Worth to San Antonio

Data collection revealed four NRHP-listed or NRHP-eligible historic districts and four potentially NRHP-eligible historic districts within the Alternative C4A EIS Study Area. The historic districts are largely concentrated in Dallas, Fort Worth, and San Antonio, although several are in smaller towns and cities along the build alternatives. The analysis also revealed 19 listed or previously determined NRHP-eligible resources, one previously identified NRHP-eligible cemetery, and 15 potentially NRHP-eligible cemeteries within the EIS Study Area. Two potentially NRHP-eligible railroad depots were identified: one in Waxahachie (Map ID #51) and one in Temple (Map ID #65).

Data collection revealed four NRHP-listed or NRHP-eligible historic districts and six potentially NRHP-eligible historic districts within the Alternative C4B EIS Study Area. The historic districts are largely concentrated in dense urban areas, including Dallas, Fort Worth, and San Antonio. The analysis also revealed 12 individual NRHP-listed or previously determined NRHP-eligible resources, one NRHP-eligible cemetery, and 14 potentially NRHP-eligible cemeteries within the EIS Study Area. One potentially NRHP-eligible railroad depot was identified, the Santa Fe Depot in Temple (Map ID #65).

Data collection revealed three NRHP-listed or NRHP-eligible historic districts and six potentially NRHP-eligible historic districts within the Alternative C4C EIS Study Area. The historic districts include residential neighborhoods, commercial cores, and large industrial complexes. The analysis also revealed 22 individual NRHP-listed or previously determined NRHP-eligible resources, one NRHP-eligible cemetery, and 17 potentially NRHP-eligible cemeteries within the EIS Study Area. Three potentially NRHP-eligible railroad-related resources were identified for this alternative: the

Santa Fe Depot in Temple (Map ID #65), the Waxahachie Train Depot (Map ID #51), and a Railroad Truss Bridge north of Grandview (Map ID #124).

Although identification of potentially NRHP-eligible individual historic resources was not part of this analysis, during data collection, potentially NRHP-eligible railroad depots were identified along the routes of the Central Section alternatives. Because of the proximity of the resources to the alternatives, the high potential for effects on these resources, and the potential for a discontinuous rail-related historic district, these resources were included in the assessment of effects.

Historic resources within the Central Section are listed in Table 3.18.3.

Table 3.18-3. Historic Resources – Central Section

Map ID # Figure #	Site Name	Location (Lat/Long)	NRHP Status	Alternative
30[a] Figure 3.18-4	Montgomery Ward and Company Building	32.75401418/ -97.32647395	NRHP-Listed	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
31[a] Figure 3.18-4	Gulf, Colorado and Santa Fe Railroad Passenger Station	32.74916071/ -97.32410681	NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
32[a] Figure 3.18-4	Calloway Cemetery	32.810561/ -97.089142	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4C HrSR C4C HSR
33[a] Figure 3.18-4	Rock Island Railroad Bridge	32.81315531/ -96.86163747	NRHP-Eligible	C4A HrSR C4A HSR C4C HrSR C4C HSR
34[a] Figure 3.18-4	Turtle Creek Pump Station	32.80004162/ -96.81644069	NRHP-Listed	C4A HrSR C4A HSR C4C HrSR C4C HSR
35[a] Figure 3.18-4	West End Historic District	32.779764/ -96.809595	NRHP-Listed	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR

Map ID # Figure #	Site Name	Location (Lat/Long)	NRHP Status	Alternative
36 Figure 3.18-4	White Lake Hills Historic District	32.759264/ -97.256597	Potentially NRHP-Eligible	C4B HrSR C4B HSR
37 Figure 3.18-4	Hollandale Historic District	32.729643/ -97.061774	NRHP-Eligible	C4B HrSR C4B HSR
38 Figure 3.18-4	Vought Manor Historic District	32.728696/ -97.063174	NRHP-Eligible	C4B HrSR C4B HSR
39 Figure 3.18-4	Grand Prairie Historic District	32.758908/ -96.976517	Potentially NRHP-Eligible	C4B HrSR C4B HSR
40 Figure 3.18-4	Scott Cemetery	32.776438/ -96.830282	Potentially NRHP-Eligible Cemetery	C4B HrSR C4B HSR
41 Figure 3.18-4	Dealey Plaza Historic District	32.777795/ -96.808461	NRHP-Listed	C4A HrSR C4A HSR C4C HrSR C4C HSR
42 Figure 3.18-4	Dallas Union Terminal	32.775551/ -96.807861	NRHP-Listed	C4A HrSR C4A HSR C4C HrSR C4C HSR
43 Figure 3.18-4	Houston Street Viaduct	32.772899/ -96.806363	NRHP-Listed	C4A HrSR C4A HSR C4C HrSR C4C HSR
44 Figure 3.18-4	Cadiz Street Overpasses and Underpasses	32.76992438/ -96.80142353	NRHP-Eligible	C4A HrSR C4A HSR C4C HrSR C4C HSR
45 Figure 3.18-4	Proctor & Gamble Manufacturing Complex	32.753842/ -96.776522	NRHP-Eligible	C4A HrSR C4A HSR C4C HrSR C4C HSR
46 Figure 3.18-4	Red Oak Cemetery	32.502635/ -96.812177	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4C HrSR C4C HSR
47 Figure 3.18-4	Ellis County Centennial Marker	32.48502864/ -96.82699143	NRHP-Eligible	C4A HrSR C4A HSR C4C HrSR C4C HSR

Map ID # Figure #	Site Name	Location (Lat/Long)	NRHP Status	Alternative
48 Figure 3.18-4	Waxahachie City Cemetery	32.3879/ -96.85707	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4C HrSR C4C HSR
49 Figure 3.18-4	Rogers Street Bridge	32.38304891/ -96.85079886	NRHP-Eligible	C4A HrSR C4A HSR C4C HrSR C4C HSR
50 Figure 3.18-4	Ellis County Courthouse Historic District	32.382978/ -96.85001	NRHP-Listed	C4A HrSR C4A HSR C4C HrSR C4C HSR
51 Figure 3.18-4	Waxahachie Train Depot	32.38288238/ -96.84953313	Potentially NRHP-Eligible	C4A HrSR C4A HSR C4C HrSR C4C HSR
52 Figure 3.18-5	Joe E. Turner House	32.17286616/ -97.09188122	NRHP-Listed	C4B HrSR C4B HSR
53 Figure 3.18-5	John Stubblefield Cemetery	32.17234802/ -97.09126114	Potentially NRHP-Eligible Cemetery	C4B HrSR C4B HSR
54 Figure 3.18-5	Abbott Cemetery	31.89251/ -97.072992	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
55 Figure 3.18-5	First Street Cemetery	31.55413275/ -97.1196492	NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
56 Figure 3.18-5	Baylor University Historic District	31.548335/ -97.123263	Potentially NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR

Map ID # Figure #	Site Name	Location (Lat/Long)	NRHP Status	Alternative
57 Figure 3.18-5	10th Street Bridge at Waco Creek	31.54413021/ -97.12581695	NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
58 Figure 3.18-5	Elite Café	31.52468786/ -97.13297609	NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
59 Figure 3.18-5	Waco Memorial Park Cemetery	31.474495/ -97.161357	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
60 Figure 3.18-5	Chapel Hill Memorial Park Cemetery	31.461623/ -97.169368	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
61 Figure 3.18-5	Cox Cemetery	31.336606/ -97.227864	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR
62 Figure 3.18-5	Eddy 3rd Street Historic District	31.29517312/ -97.2531277	NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR
63 Figure 3.18-5	1st National Bank	31.29511263/ -97.25298717	NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR

Map ID # Figure #	Site Name	Location (Lat/Long)	NRHP Status	Alternative
64 Figure 3.18-6	Jefferson Historic District	31.120135/ -97.343249	Potentially NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
65 Figure 3.18-6	Santa Fe Depot	31.09562772/ -97.34519641	Potentially NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
66 Figure 3.18-6	St Mary's Catholic Cemetery	30.579728/ -97.403508	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
67 Figure 3.18-6	Taylor Black Cemetery	30.577043/ -97.402118	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
68 Figure 3.18-6	Taylor City Cemetery	30.575672/ -97.402164	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
69 Figure 3.18-6	Rosehill Cemetery	30.372299/ -97.524404	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR

Map ID # Figure #	Site Name	Location (Lat/Long)	NRHP Status	Alternative
70 Figure 3.18-7	Withers House	29.87087726/ -97.72733176	NRHP-Listed	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
71 Figure 3.18-7	Guadalupe Valley Memorial Park Cemetery	29.647161/ -98.039395	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
72 Figure 3.18-7	Holy Cross Cemetery	29.599446/ -98.338229	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
73 Figure 3.18-7	Schulmeier Cemetery	29.55242338/ -98.42829685	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
74 Figure 3.18-7	Olmos Park Historic District	29.482189/ -98.490498	Potentially NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
75 Figure 3.18-7	Beacon Hill Historic District	29.451135/ -98.50622	Potentially NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
76 Figure 3.18-7	International & Great Northern Railroad Passenger Station	29.42704679/ -98.50563435	NRHP-Listed	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR

Map ID # Figure #	Site Name	Location (Lat/Long)	NRHP Status	Alternative
77 Figure 3.18-7	San Fernando #1 Cemetery	29.414107/ -98.510484	Potentially NRHP-Eligible Cemetery	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
78 Figure 3.18-7	Capt. Jose Antonio Menchaca Centennial Marker	29.41392268/ -98.51049747	NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
79 Figure 3.18-7	Jose Antonio Navarro Centennial Marker	29.41390188/ -98.51057822	NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
80 Figure 3.18-7	Col. Jose Francisco Ruiz Centennial Marker	29.41387101/ -98.51054135	NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
81 Figure 3.18-7	Don Juan Ximenes Centennial Marker	29.41385003/ -98.51063199	NRHP-Eligible	C4A HrSR C4A HSR C4B HrSR C4B HSR C4C HrSR C4C HSR
118 Figure 3.18-4	South Main Street Overpass	32.723962/ -97.32639	NRHP-Eligible	C4C HrSR C4C HSR
119 Figure 3.18-4	Kimbell Milling Company Historic District	32.723317/ -97.325975	Potentially NRHP-Eligible	C4C HrSR C4C HSR
120 Figure 3.18-4	J.W. Hall House	32.705324/ -97.32921	NRHP-Eligible	C4C HrSR C4C HSR
121 Figure 3.18-4	Ullman/Bungee Elevators	32.694673/ -97.329103	NRHP-Eligible	C4C HrSR C4C HSR
122 Figure 3.18-4	Burleson Main Street Historic District	32.542028/ -97.321191	Potentially NRHP-Eligible	C4C HrSR C4C HSR

Map ID # Figure #	Site Name	Location (Lat/Long)	NRHP Status	Alternative
123 Figure 3.18-5	Antioch Rest Cemetery	32.3090451/ -97.1933298	Potentially NRHP-Eligible Cemetery	C4C HrSR C4C HSR
124 Figure 3.18-5	Railroad Truss Bridge	32.291411/ -97.179735	Potentially NRHP-Eligible	C4C HrSR C4C HSR
125 Figure 3.18-5	Itasca City Cemetery	32.1490201/ -97.1481092	Potentially NRHP-Eligible Cemetery	C4C HrSR C4C HSR
126 Figure 3.18-5	Luke Tipton Cemetery	32.1475415/ -97.1473631	Potentially NRHP-Eligible Cemetery	C4C HrSR C4C HSR
127 Figure 3.18-5	609 Hawkins Street Residence	32.002807/ -97.132713	NRHP-Eligible	C4C HrSR C4C HSR

[a] Resource is also in the Northern Section.

Sources: Beaumont et al. (n.d); Everett (2010); Google Maps (2014); Google Earth (1950–2014); Humphrey (2010); Humphrey and Crawford (2001); Long (2010b); Manguso (2010); Moore et al. (2013); NPS (2014); NPS (2015); NETROnline (2014); Richardson (2005); TxDOT (2014c); TxDOT (2014d); TxDOT (2014e); TxDOT and FRA (2014); Texas Historical Commission (2014); Worcester (2010).

3.18.3.3 Southern Section: San Antonio to South Texas

Data collection revealed seven NRHP-listed or NRHP-eligible historic districts and three potentially NRHP-eligible historic districts within the Alternative S4 EIS Study Area. The historic districts include agricultural properties, residential neighborhoods, and irrigation districts. The analysis also revealed 23 individual NRHP-listed or previously determined NRHP-eligible resources and two potentially NRHP-eligible cemeteries within the EIS Study Area. Although identification of potentially NRHP-eligible individual resources was not part of this analysis, one potentially NRHP-eligible individual resource was identified: a Parker through-truss railroad bridge (Map ID #113).

Alternative S6 (higher-speed and high-speed rail) would primarily pass through rural and undeveloped areas; no historic resources were identified within the EIS Study Area for Alternative S6. Historic resources may be identified during project-level analysis; however, based on the existing topography and landscape, such historic resources would primarily be agricultural.

Historic resources within the Southern Section are listed in Table 3.18-4 and shown on Figures 3.18-12 and 3.18-13.

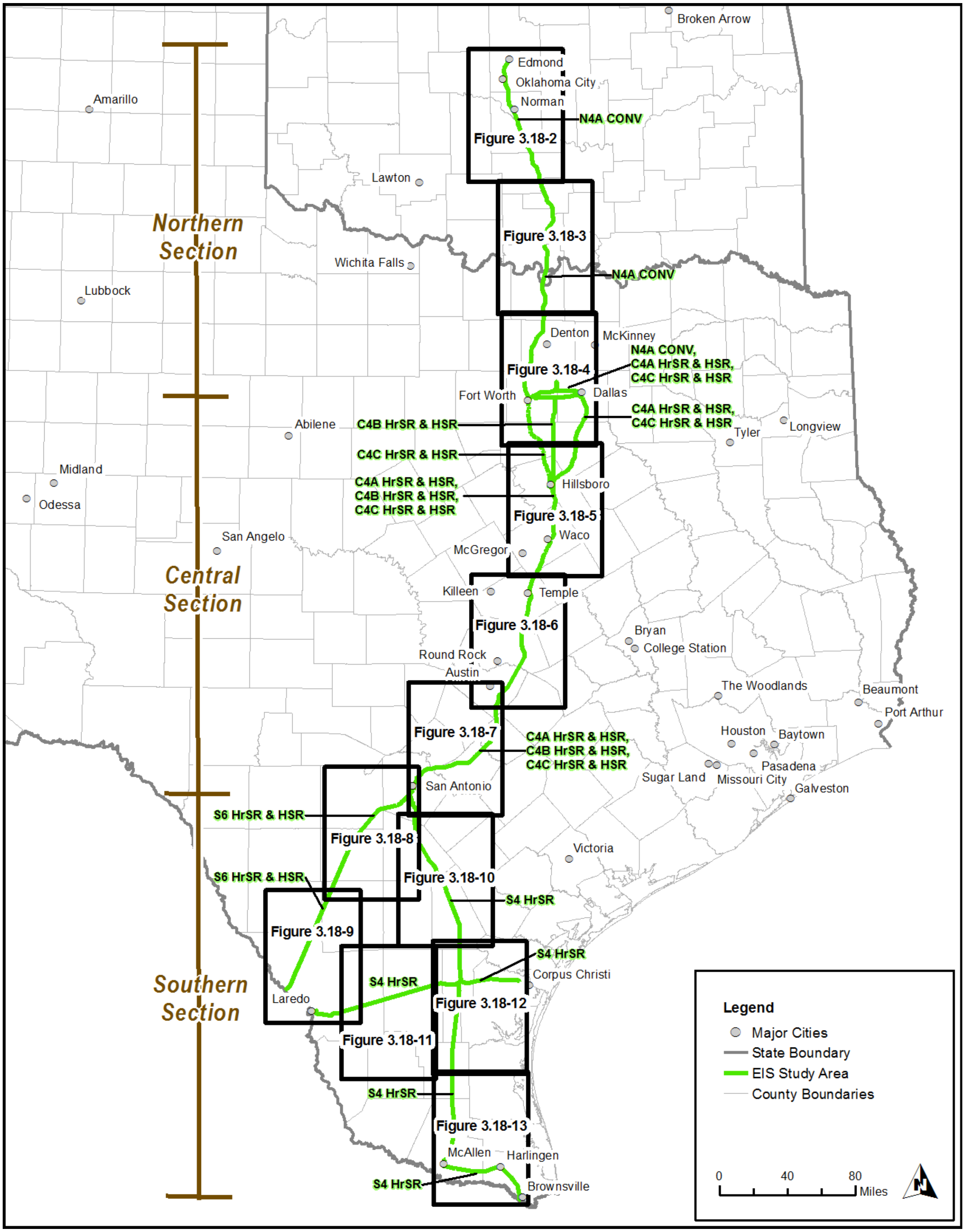

Figure 3.18-1: Index Map

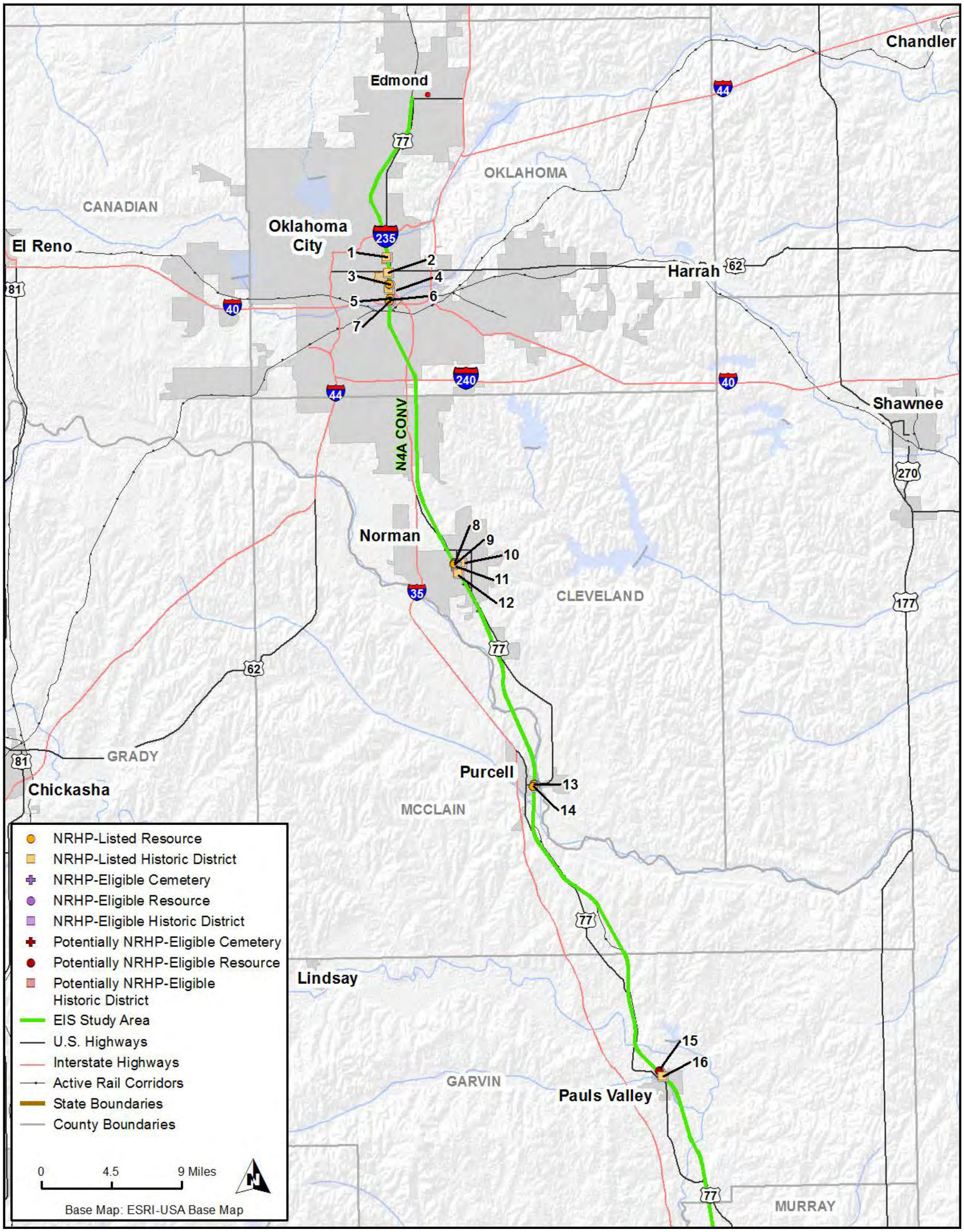

Figure 3.18-2: Historic Resources within the EIS Study Area (Map 1)

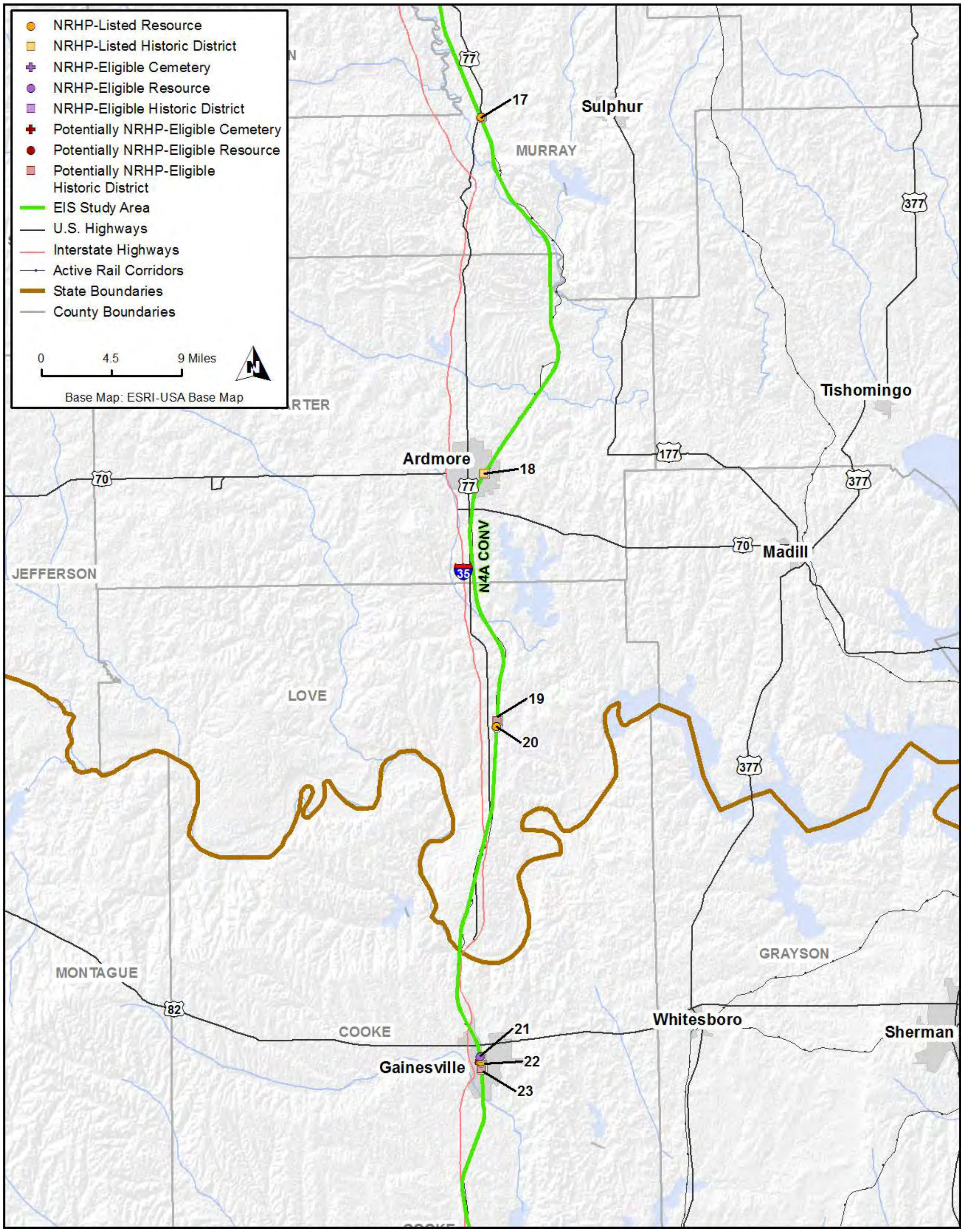

Figure 3.18-3: Historic Resources within the EIS Study Area (Map 2)

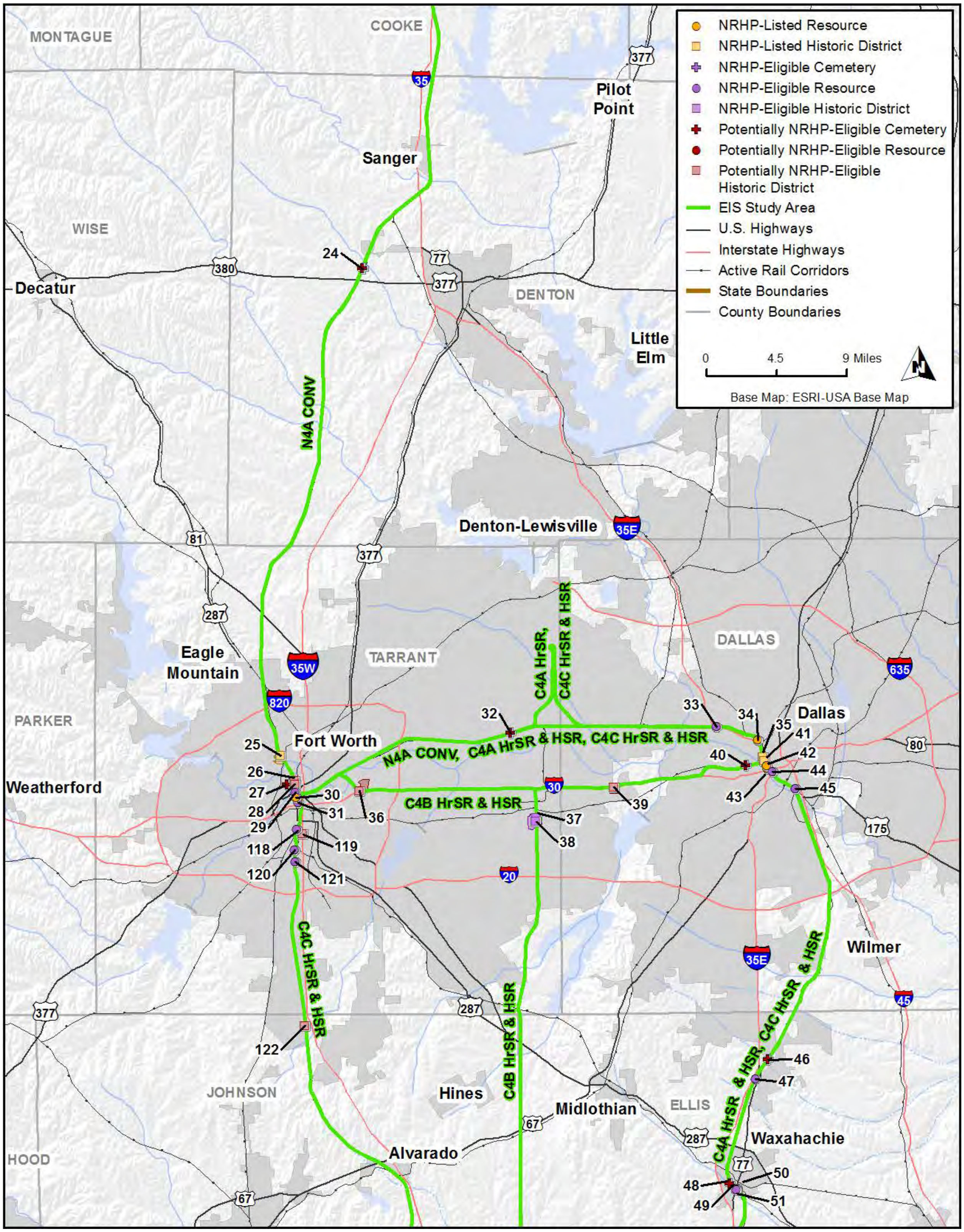

Figure 3.18-4: Historic Resources within the EIS Study Area (Map 3)

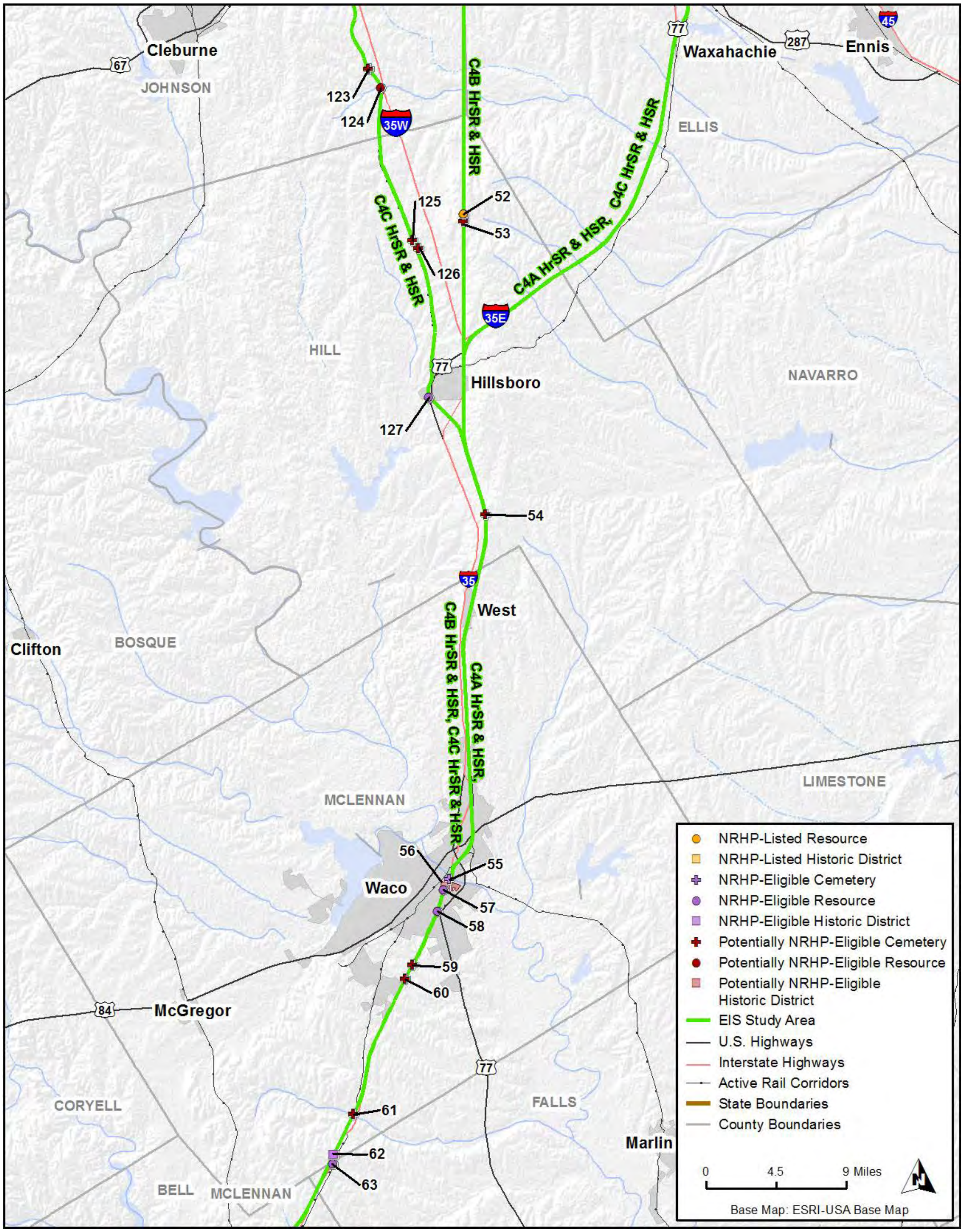

Figure 3.18-5: Historic Resources within the EIS Study Area (Map 4)

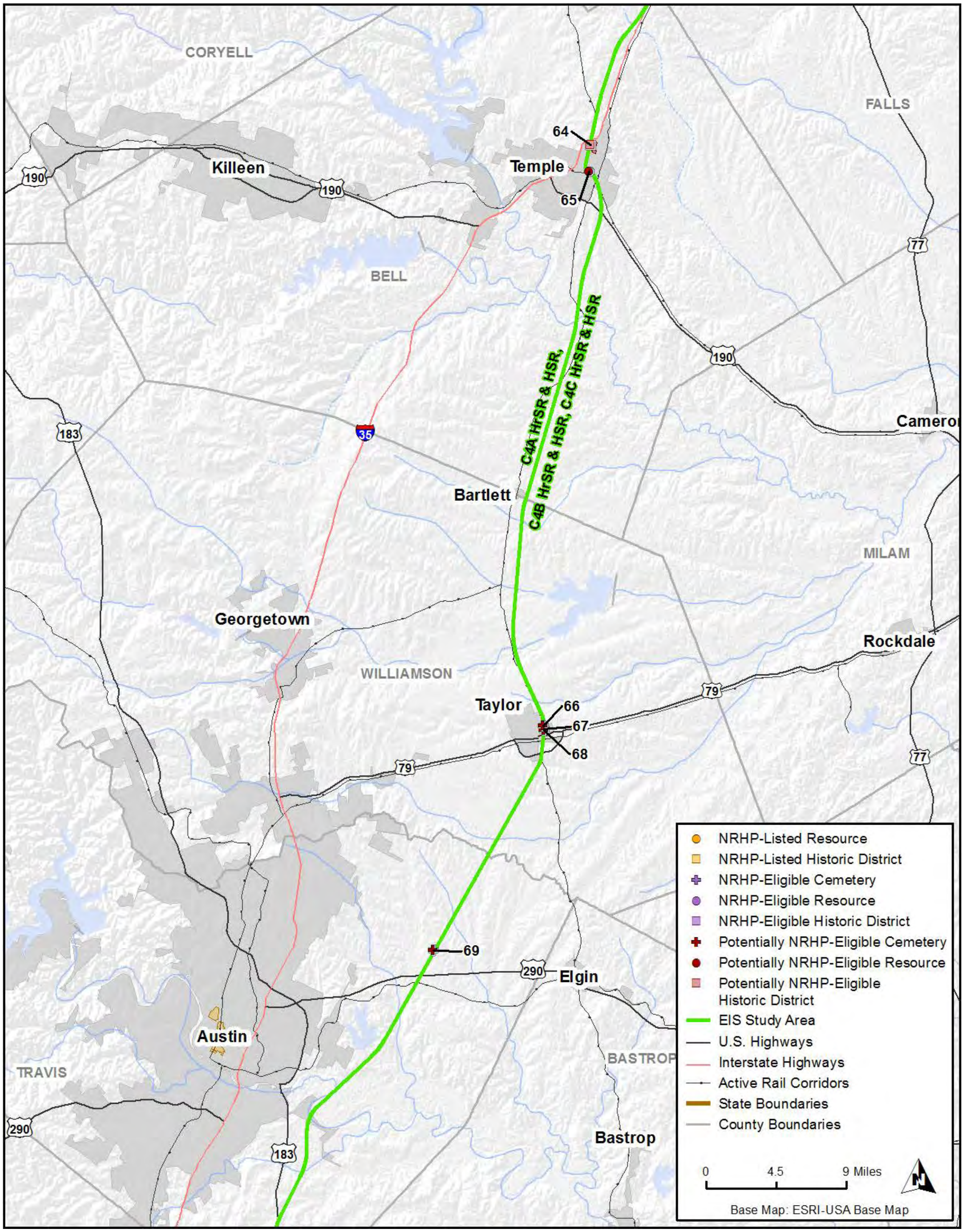

Figure 3.18-6: Historic Resources within the EIS Study Area (Map 5)

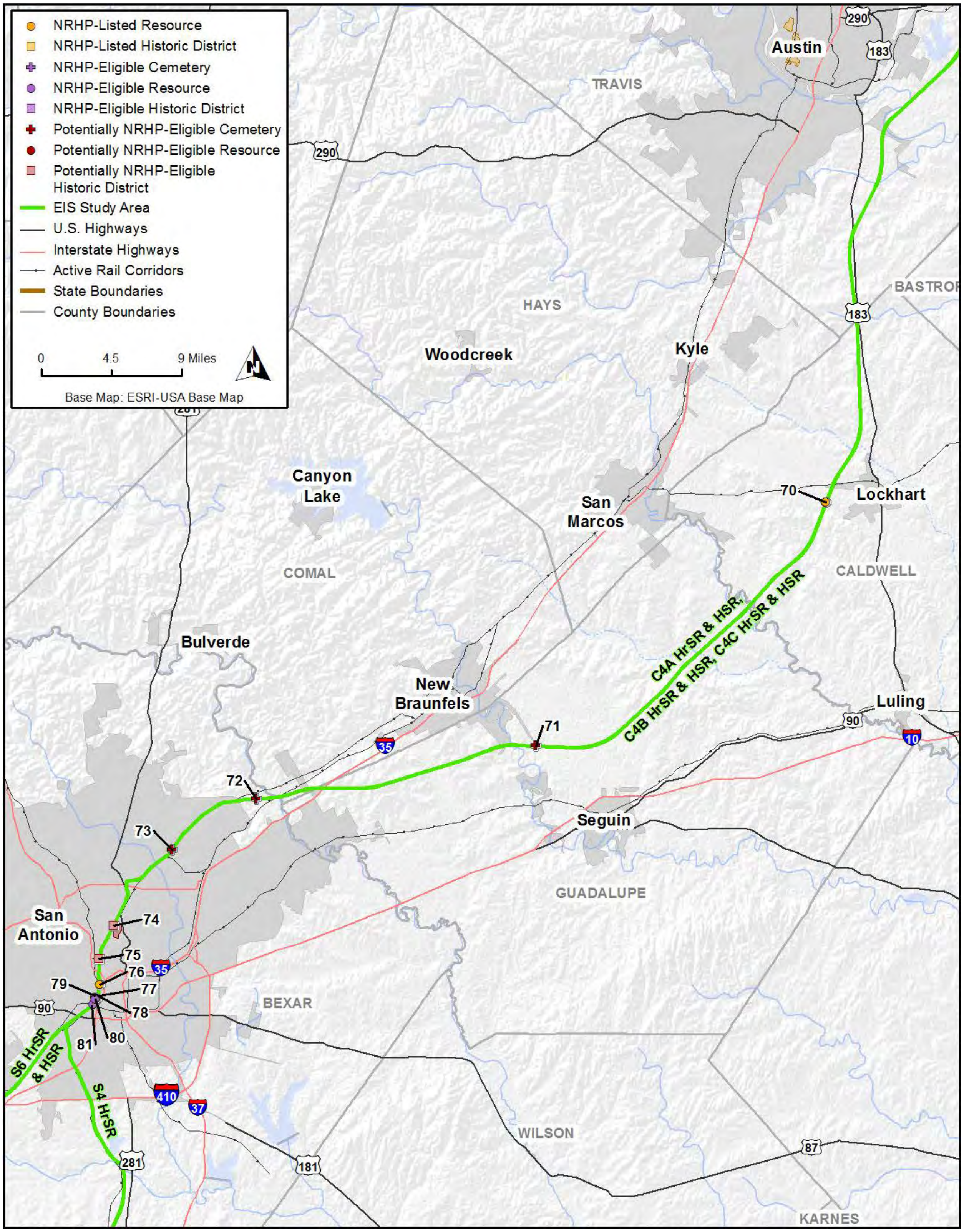

Figure 3.18-7: Historic Resources within the EIS Study Area (Map 6)

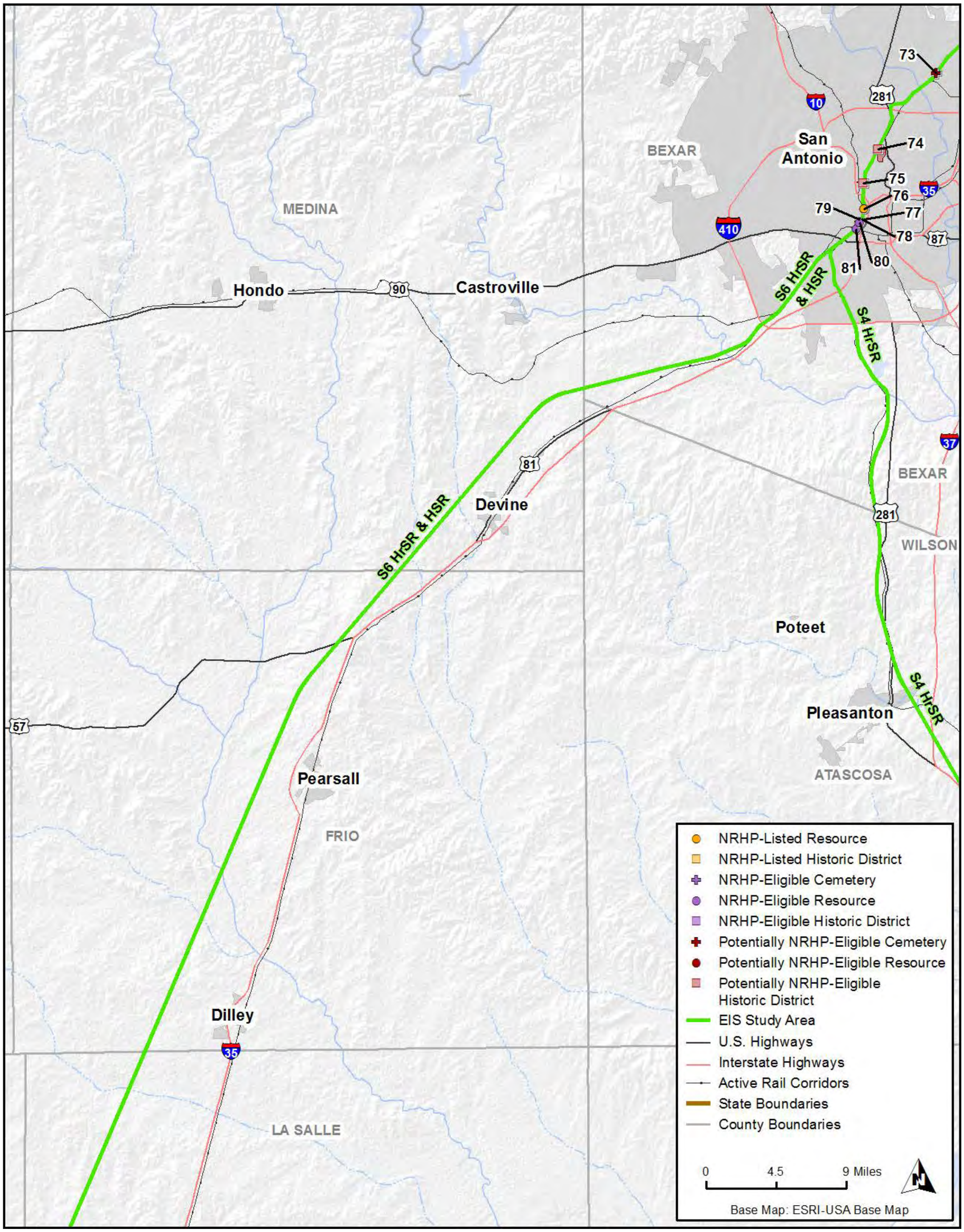

Figure 3.18-8: Historic Resources within the EIS Study Area (Map 7)

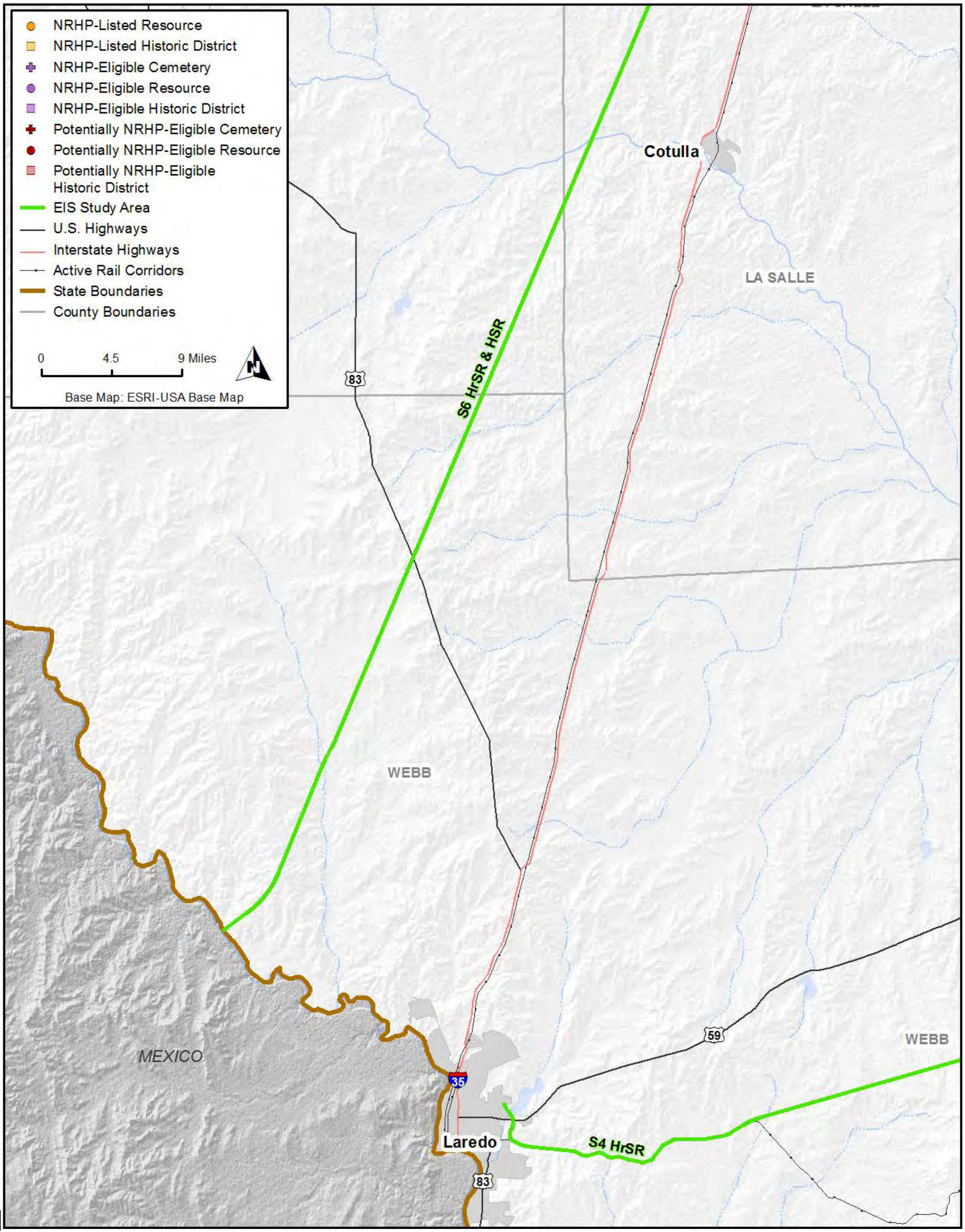

Figure 3.18-9: Historic Resources within the EIS Study Area (Map 8)

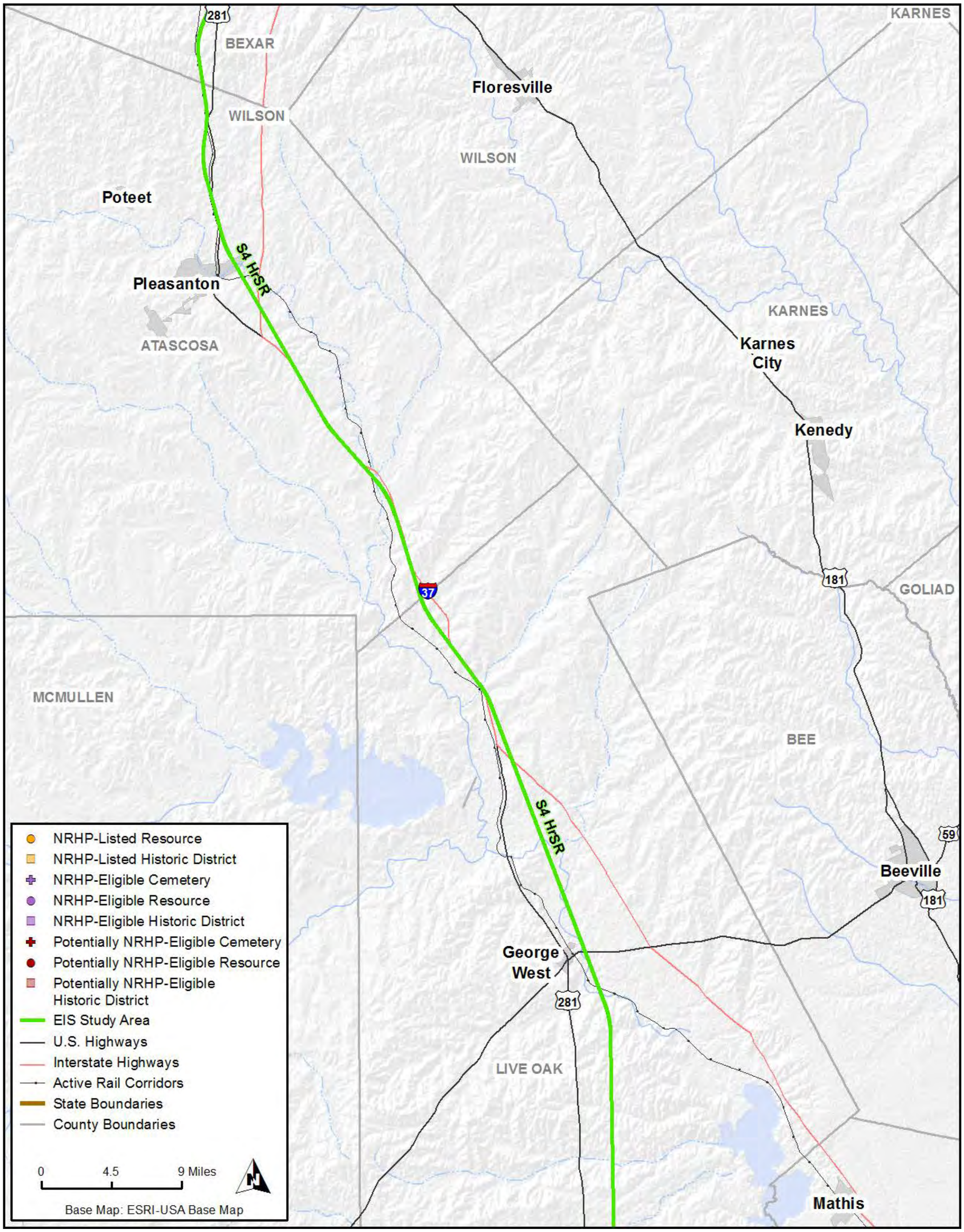

Figure 3.18-10: Historic Resources within the EIS Study Area (Map 9)

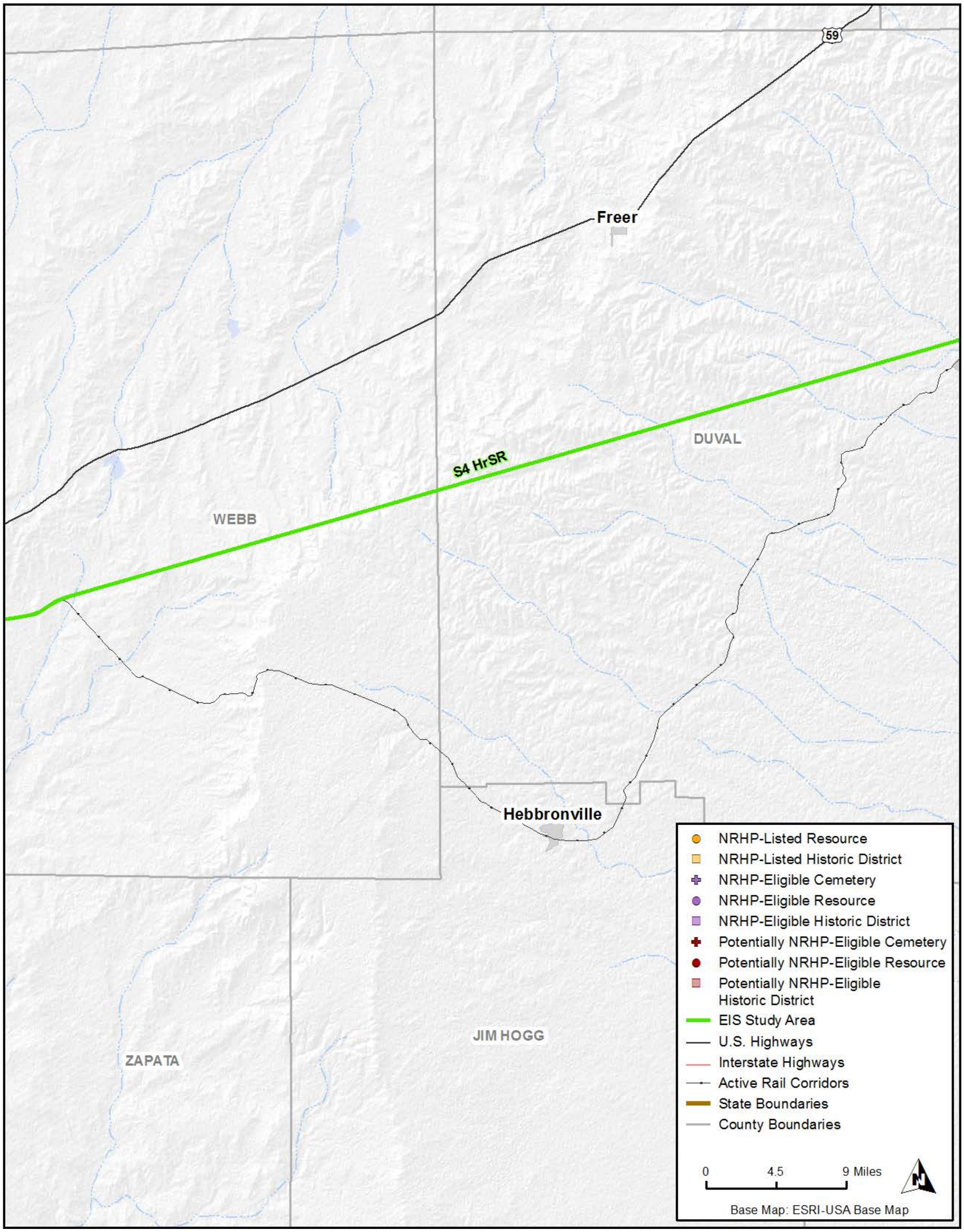

Figure 3.18-11: Historic Resources within the EIS Study Area (Map 10)

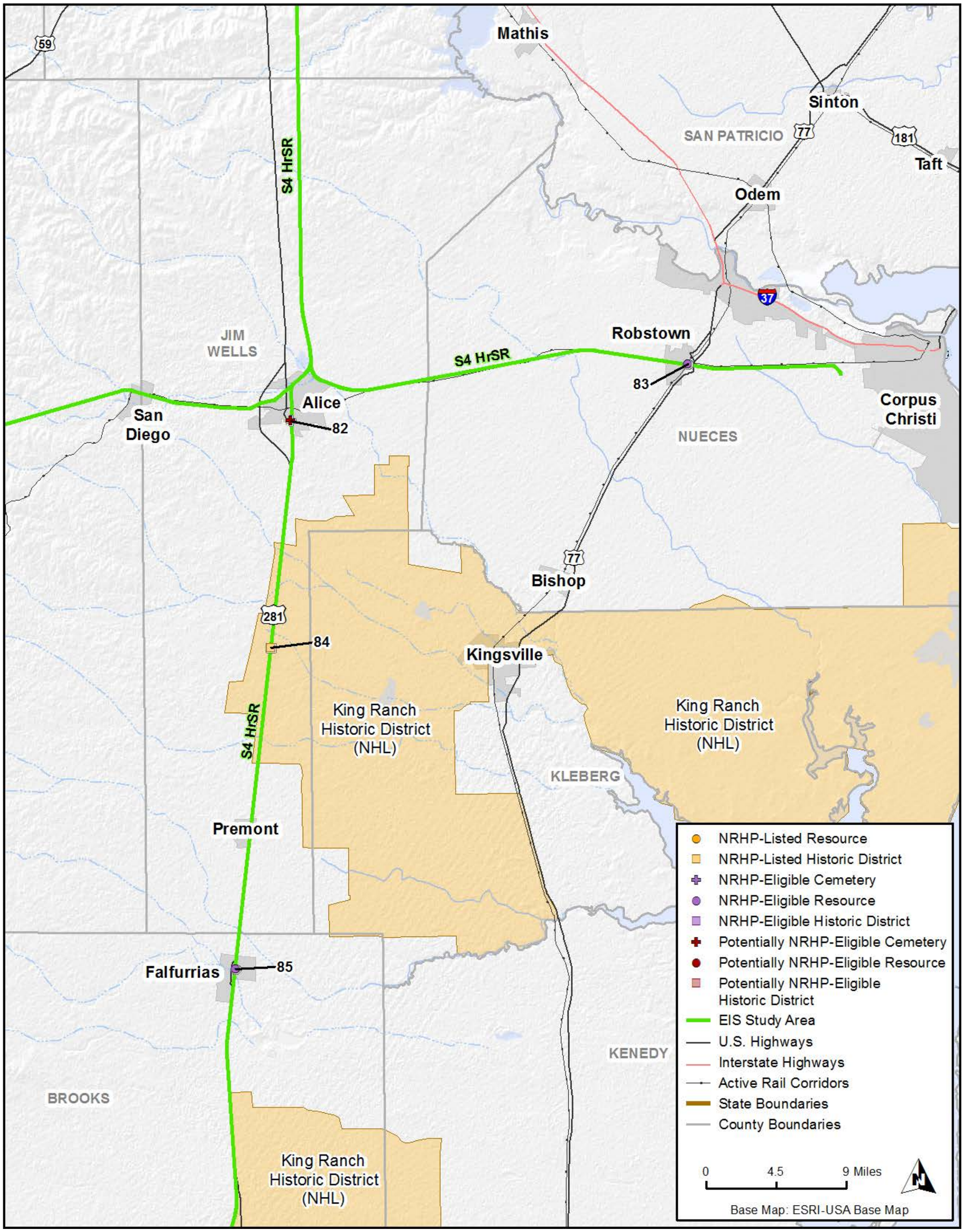

Figure 3.18-12: Historic Resources within the EIS Study Area (Map 11)

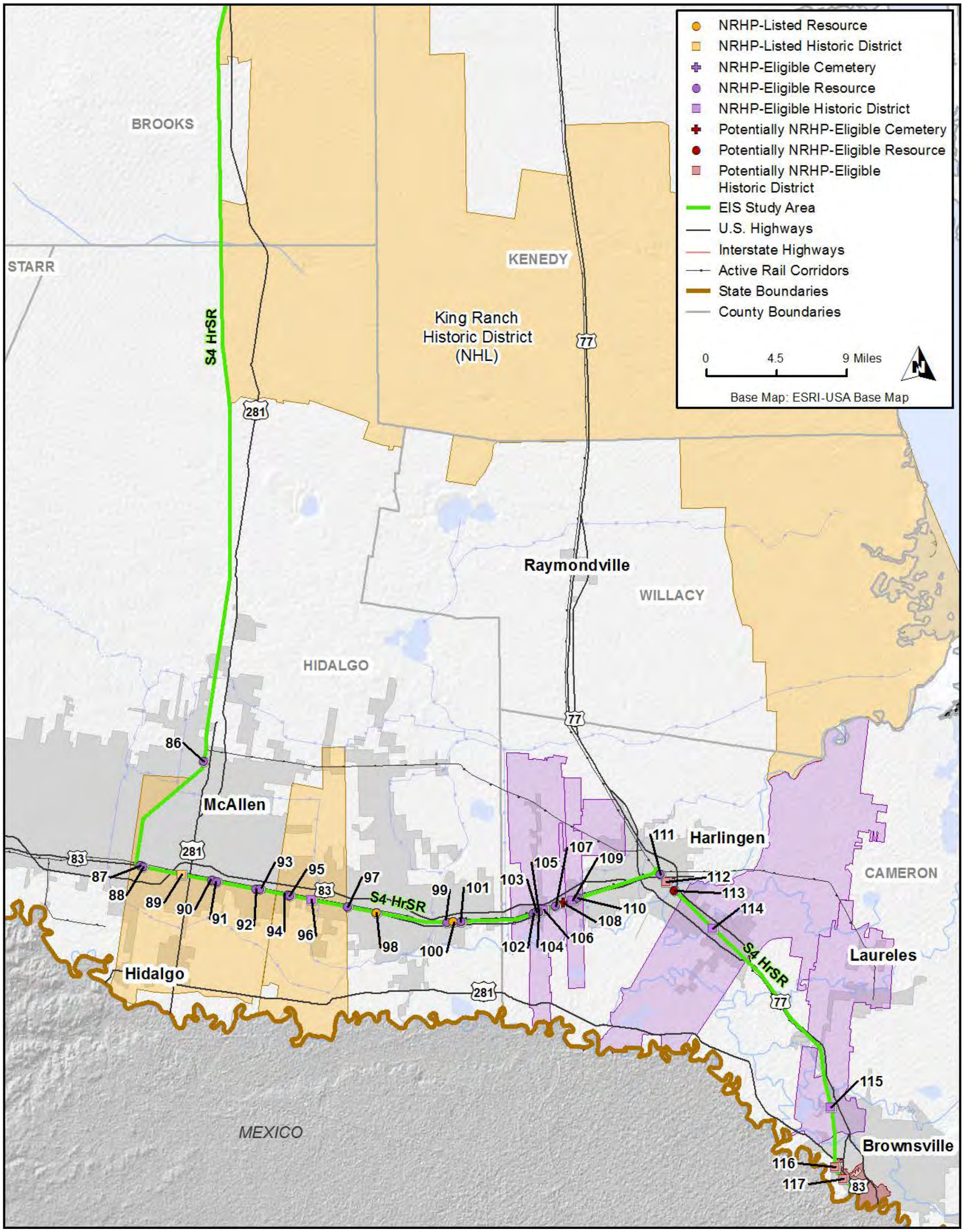

Figure 3.18-13: Historic Resources within the EIS Study Area (Map 12)

Table 3.18-4. Historic Resources – Southern Section

Map ID # Figure #	Site Name	Location (Lat/Long)	NRHP Status	Alternative
82 Figure 3.18-12	Alice Cemetery	27.738462/ -98.077518	Potentially NRHP-Eligible Cemetery	S4 HrSR
83 Figure 3.18-12	Hotel Brendel	27.7878792/ -97.66149443	NRHP-Eligible	S4 HrSR
84 Figure 3.18-12	King Ranch Historic District	27.527646/ -98.10017	NRHP-Listed	S4 HrSR
85 Figure 3.18-12	One-story Wood House	27.22840748/ -98.13982955	NRHP-Eligible	S4 HrSR
86 Figure 3.18-13	Southern Pacific Depot	26.30145346/ -98.16842767	NRHP-Eligible	S4 HrSR
87 Figure 3.18-13	Casa de Palmas	26.20511172/ -98.23488877	NRHP-Eligible	S4 HrSR
88 Figure 3.18-13	Restaurant	26.20341706/ -98.23139302	NRHP-Eligible	S4 HrSR
89 Figure 3.18-13	Louisiana--Rio Grande Canal Company Irrigation System Historic District	26.196429/ -98.191846	NRHP-Listed	S4 HrSR
90 Figure 3.18-13	San Juan Hotel	26.18945199/ -98.15687578	NRHP-Eligible	S4 HrSR
91 Figure 3.18-13	Early 20th Century Tile Decorated Storefront	26.18939291/ -98.15619621	NRHP-Eligible	S4 HrSR
92 Figure 3.18-13	Moderne Style Service Station/Muffler Shop	26.18201284/ -98.11508722	NRHP-Eligible	S4 HrSR
93 Figure 3.18-13	Crest Fruit Company Warehouse	26.18237037/ -98.11337202	NRHP-Eligible	S4 HrSR
94 Figure 3.18-13	Concrete Commercial Building	26.17662498/ -98.08187689	NRHP-Eligible	S4 HrSR
95 Figure 3.18-13	Hanson House	26.17562512/ -98.08117409	NRHP-Eligible	S4 HrSR
96 Figure 3.18-13	Donna Irrigation Historic District	26.172009/ -98.058142	NRHP-Eligible	S4 HrSR

Map ID # Figure #	Site Name	Location (Lat/Long)	NRHP Status	Alternative
97 Figure 3.18-13	Art Moderne Southern Mosaic Tile Factory	26.16488336/ -98.02111419	NRHP-Eligible	S4 HrSR
98 Figure 3.18-13	Cortez Hotel	26.15938574/ -97.99100852	NRHP-Listed	S4 HrSR
99 Figure 3.18-13	Commercial Building	26.15053982/ -97.91245295	NRHP-Eligible	S4 HrSR
100 Figure 3.18-13	Former Hidalgo County Irrigation District #5 Offices	26.15031853/ -97.91249016	NRHP-Eligible	S4 HrSR
101 Figure 3.18-13	Quonset Hut	26.15042375/ -97.90431001	NRHP-Eligible	S4 HrSR
102 Figure 3.18-13	Moderne Stucco Gas Station	26.15750842/ -97.82839521	NRHP-Eligible	S4 HrSR
103 Figure 3.18-13	Moderne Gas Station	26.15846407/ -97.8253208	NRHP-Eligible	S4 HrSR
104 Figure 3.18-13	La Feria Canning Co.	26.15886264/ -97.82343175	NRHP-Eligible	S4 HrSR
105 Figure 3.18-13	Texas Citrus Fruit Growers	26.15897524/ -97.82300438	NRHP-Eligible	S4 HrSR
106 Figure 3.18-13	La Feria Irrigation Historic District	26.160936/ -97.818269	NRHP-Eligible	S4 HrSR
107 Figure 3.18-13	International Style Cinder Block Fence	26.16414182/ -97.80606571	NRHP-Eligible	S4 HrSR
108 Figure 3.18-13	Restlawn Cemetery	26.166681/ -97.797061	Potentially NRHP-Eligible Cemetery	S4 HrSR
109 Figure 3.18-13	Adams Gardens Irrigation Historic District	26.169652/ -97.787909	NRHP-Eligible	S4 HrSR
110 Figure 3.18-13	Spanish Revival Petrified Stone Gates	26.17159694/ -97.7828932	NRHP-Eligible	S4 HrSR
111 Figure 3.18-13	Santos Lozano Building	26.1926212/ -97.69721701	NRHP-Eligible	S4 HrSR
112 Figure 3.18-13	Travis Historic District	26.185728/ -97.691487	Potentially NRHP-Eligible	S4 HrSR
113 Figure 3.18-13	RR Parker Through Truss Bridge	26.1773826/ -97.68292121	Potentially NRHP-Eligible	S4 HrSR

Map ID # Figure #	Site Name	Location (Lat/Long)	NRHP Status	Alternative
114 Figure 3.18-13	Cameron County Irrigation District #2 Historic District	26.14208/ -97.643964	NRHP-Eligible	S4 HrSR
115 Figure 3.18-13	CCWC Irrigation District #6 Historic District	25.974444/ -97.523804	NRHP-Eligible	S4 HrSR
116 Figure 3.18-13	West Brownsville Historic District	25.91883/ -97.519924	Potentially NRHP-Eligible	S4 HrSR
117 Figure 3.18-13	Brownsville Downtown Overlay Historic District	25.907635/ -97.511476	Potentially NRHP-Eligible	S4 HrSR
Sources: Alcott (2010); Ashton and Sneed (2010); Beaumont et al. (n.d); Conger (1964); Conger (2010); City of Laredo (2014); Cuéllar (2010); DaCamara (1949); Elliott (n.d.); Fehrenbach (2010); Ficker and Barron (2010); Garza (2010a); Garza (2010b); Garza and Long (2010); Gilbert (2010); Google Maps (2014); Google Earth (1950–2014); Harlingen Air Force Base (2010); Kearney (1989); Knight (2009); Long (2010c); Long (2010d); Manguso (2010); Munz (1966); NPS (2014); NPS (2015); NETROnline (2014); Parish (1989); “Port of Brownsville, Serving Two Nations.” (1955); Richardson (2005); Texas A&M University (2014); TxDOT (2014c); TxDOT (2014d); TxDOT (2014e); TxDOT (2014f); TxDOT and FRA (2014); Texas Historical Commission (2014); Worcester (2010).				

3.18.4 Environmental Consequences

3.18.4.1 Overview

According to Section 106, impacts on historic resources that result in adverse effects occur when an undertaking:

> “alters, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association (36 CFR 800.5 (a) (1)).”

These may include impacts such as physical destruction or damage; alterations that do not comply with the Secretary of the Interior’s *Standards for the Treatment of Historic Properties* (36 CFR 68); relocation of a historic resource; neglect; or changes in the physical features of a property’s setting, such as visual, atmospheric, or audible intrusions (36 CFR 800.5). Impacts on historic resources that result in adverse effects during both operation and construction would be permanent, as they would diminish a resource’s ability to convey its historical significance.

Effects that may be common to some or all of the build alternatives are summarized in the following sections.

3.18.4.1.1 Acquisition

Acquisition impacts on historic resources would occur when new rights-of-way or permanent easements are proposed through historic resources before or during construction. The acquisition of new rights-of-way or permanent easements from NRHP-listed or NRHP-eligible historic resources and the acquisition of new rights-of-way or permanent easements from contributing resources to historic districts could cause adverse direct effects on historic resources, as outlined in Section 106. Acquisition of historic resources for the construction of new rail facilities may result in the alteration, removal, or demolition of historically significant resources. In addition, acquisition of historic resources may result in a "use" under Section 4(f)[1]. Details on property acquisition impacts would be assessed at the project level, and compliance with Section 106 and Section 4(f) would be conducted during the project-level analysis. This assessment reports on the potential likelihood of property acquisition or relocations of historic resources, without identifying individual historic properties affected.

If new rights-of-way or permanent easements are required from historic resources and acquisition impacts on existing historically significant resources cannot be avoided, impacts would be mitigated as discussed in Section 3.18.5, Avoidance, Minimization, and Mitigation Strategies.

3.18.4.1.2 Rehabilitation, Restoration, or Expansion of Existing Railroad-Related Historic Resources

Numerous existing railroad stations and railroad-related, non-archaeological historic resources are located within the EIS Study Area, including many listed in or eligible for the NRHP. These are primarily located within urban and suburban areas. Possible rehabilitation, restoration, or expansion of historically significant railroad-related historic resources, such as train depots or railroad bridges, may be required to accommodate increased ridership. To avoid adverse effects under Section 106, such work would be completed using the *Secretary of the Interior's Standards for Rehabilitation* (36 CFR 67.7).

If adverse effects on existing historically significant depots or railroad-related resources cannot be avoided, such adverse effects would be mitigated as discussed in Section 3.18.5, Avoidance, Minimization, and Mitigation Strategies. Although increased or additional parking facilities may be required, acquisition of land for parking facilities would likely avoid significant historic resources. In addition, construction of new stations in urban and suburban areas could cause impacts on historic resources; these impacts would be assessed during the project-level analysis.

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[1] "Use" of a Section 4(f) property is defined as: (1) when land is permanently incorporated into a transportation facility; (2) when there is a temporary occupancy of land that is adverse in terms of the state's preservation purpose; (3) when there is a constructive use of a 4(f) property, which occurs when the transportation project does not incorporate land from a Section 4(f) property, but the project's proximity impacts are so severe that the protected activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired (23 CFR 774.15 and 774.17).

3.18.4.1.3 Noise and Vibration

Faster and more frequent rail service along the higher-speed or high-speed rail routes could cause noise or vibration impacts on historic resources within the EIS Study Area, and these effects would likely be permanent. Noise and vibration effects could also cause an indirect adverse effect on non-archaeological historic resources under Section 106 if the resource's setting and landscape are integral to its historical significance or are considered character-defining features. However, based on 36 CFR 800.5 and the project team's experiential insight, direct or indirect impacts from noise are only considered if a historic resource's quiet environment is considered a character-defining feature of its historic significance or if a historic resource's specific use or function is integral to its historic significance. For this service-level analysis, no known historic resources meet these criteria. Increased noise levels would not likely affect the continued use of historic properties within the EIS Study Area and, therefore, would not likely diminish the integrity of significant historic features.

Different rail service could cause indirect vibration impacts on historic resources. Table 3.18-5 lists the distance for assessing potential vibration impacts on residential and institutional resources by service type. However, vibration effects that might damage the building and diminish the historic significance is rare and dependent on building material types. Typically, vibration effects only occur during construction if avoidance measures are not incorporated into the construction planning.

Table 3.18-5: Screening Distance of Potential Vibration Effects

Land Use	CONV Service (Less than 100 mph)	HrSR Service (100 to 200 mph)	HSR Service (200 to 300 mph)
Residential	60 feet	100 feet	140 feet
Institutional	20 feet	70 feet	100 feet
Source: FRA (2012).			

A more detailed noise and vibration impact assessment would be completed on individual historic resources during the project-level analysis because detailed alignment, station locations, and grade separations have not yet been identified. Nevertheless, it is assumed that noise and vibration effects, which would be otherwise mitigated for sensitive receptors' (e.g., residential, libraries, and schools) uses, would not directly result in damage or indirectly result in diminishing the character-defining feature of its historic significance or altering the historic resource's specific use or function integral to its historic significance. Noise and vibration effects are not discussed further in this section.

3.18.4.1.4 Visual

Based on 36 CFR 800.5 and the project team's experiential insight, visual impacts on historic resources occur when new features are introduced to a landscape that may physically or visually affect the historic setting or the elements of the resource that make it eligible for the NRHP. These impacts may constitute an indirect effect under Section 106. The introduction of new visual features to the surrounding setting does not necessarily constitute an adverse effect on historic resources under Section 106, unless the resource's setting and landscape are integral to its historical significance or are considered character-defining features.

Visual impacts would most likely occur during the operational phase for higher-speed and high-speed rail service because of the potential for the construction of new railroad-related facilities and stations. Construction of high-speed rail service may require stations and grade crossings to be elevated, which would impose new large-scale features on the surrounding landscape and would result in substantial visual effects, potentially affecting the historic setting. In rural areas, these visual impacts would be mitigated using vegetative screening, as discussed in Section 3.18.5, Avoidance, Minimization, and Mitigation Strategies. A more detailed assessment of visual impacts on individual historic resources would occur during the project-level analysis because station locations and grade separations have not yet been identified. Nevertheless, it is assumed that conventional rail and higher-speed rail would result in negligible visual effects and high-speed rail would result in substantial visual effects on historic resources, specifically in urban and suburban areas near historic districts where grade separations are required. As these locations are not defined in this phase of engineering, visual impacts are not discussed further in this section.

3.18.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect historic resources.

3.18.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.18.4.3.1 Alternative N4A Conventional

Alternative N4A Conventional has the potential to affect nine NRHP-listed or NRHP-eligible historic districts and five potentially NRHP-eligible historic districts within the EIS Study Area. Because Alternative N4A Conventional would primarily use existing railroad infrastructure or would be located adjacent to existing railroad facilities and tracks, minimal new rights-of-way and easements would be required. As a result, acquisition effects would be minimal. Based on identified historic resources, Alternative N4A would have negligible acquisition effects on urban, suburban, and rural historic resources compared to the No Build Alternative. If new rights-of-way or easements are required from historic resources, acquisition effects and potential adverse direct effects under Section 106 of the NHPA would be assessed during the project-level analysis.

The expansion of existing stations and new stations within urban and suburban areas could result in moderate effects on historic resources within the EIS Study Area. Because several stations are NRHP-listed or NRHP-eligible, expansion and reconstruction of historically significant buildings and structures may be required to accommodate increased ridership. If effects on existing historically significant depots cannot be avoided, effects would be mitigated as discussed in Section 3.18.5, Avoidance, Minimization, and Mitigation Strategies. Although increased or additional parking facilities may be required, siting parking facilities would attempt to avoid significant historic resources. In addition, the construction of new stations in urban and suburban areas could result in effects on historic resources; such effects would be assessed during the project-level analysis.

Rehabilitation, restoration, or expansion of existing railroad-related historic resources within existing railroad rights-of-way, including the historic railroad depots, would have the greatest potential for effects. These railroad-related historic resources in the Alternative N4A EIS Study Area include six Santa Fe Depots (Map ID #9, 15, 17, 20, 22, and 31) and the Rock Island Railroad Bridge (Map ID #33). However, effects on these resources could be avoided at the project level, and, therefore, this alternative would have a negligible effect on historic resources. Alternative N4A would not affect other non-railroad-related historic resources or historic districts in urban and suburban areas during construction because these resources would be located outside the existing right-of-way.

3.18.4.4 Central Section: Dallas and Fort Worth to San Antonio

3.18.4.4.1 Alternative C4A Higher-Speed Rail

Alternative C4A Higher-Speed Rail and associated stations would potentially affect 45 NRHP, NRHP-eligible, or potentially NRHP-eligible unique resources. This alternative would potentially result in substantial acquisition effects on historic resources in urban areas because of the potential for removal of historic properties where new rights-of-way may be necessary. For example, the alternative may pass through portions of Baylor University (Map ID #56), which has been identified as a potentially NRHP-eligible historic district. Further evaluation would be required at the project level to determine if the property is eligible for the NRHP, and if so, if contributing features to the historic district would be directly affected by the acquisition, causing adverse effects under Section 106 of the NHPA.

The greatest potential for effects within suburban areas would result from acquisition of new rights-of-way or easements from previously designated or potentially eligible NRHP- historic districts, such as the Eddy 3rd Street Historic District (Map ID #62) and the Jefferson Historic District (Map ID #64).

In rural areas, Alternative C4A Higher-Speed Rail would have negligible acquisition effects on historic resources along existing and new alignments. Only one known historically significant agricultural property, the Withers House (Map ID #70), was identified within the EIS Study Area. Acquisition of this property could be avoided during the project-level analysis. Additional agricultural resources or rural historic landscapes may be identified within the EIS Study Area; however, these impacts would be assessed during the project-level analysis. Although increased or additional parking facilities may be required, acquisition of land for parking facilities would avoid significant historic resources.

Where existing railroad rights-of-way would be used, rehabilitation, restoration, or expansion of existing railroad-related historic resources would have substantial effects in urban and suburban areas along the route of Alternative C4A Higher-Speed Rail. The densest concentration of urban development is near the northern and southern termini of the alternative, largely within Dallas, Fort Worth, and San Antonio. In these areas, the route would be located within existing railroad right-of-way, and new construction would be adjacent to existing railroad facilities and tracks.

Some of the existing stations within urban and suburban areas are NRHP-listed, NRHP-eligible, or potentially NRHP-eligible, including the Gulf, Colorado, and Santa Fe Passenger Station (Map ID #31); the Dallas Union Terminal (Map ID #42); the International & Great Northern Passenger Station (Map ID #76); the Waxahachie Train Depot (Map ID #51); and the Santa Fe Depot in Temple (Map ID #65). As a result, possible rehabilitation, restoration, or expansion of historically significant railroad-related buildings and structures may be required to accommodate increased ridership.

3.18.4.4.2 Alternative C4A High-Speed Rail

Alternative C4A High-Speed Rail would have the potential to affect the same historic resources as Alternative C4A Higher-Speed Rail. However, Alternative C4A High-Speed Rail would be constructed on new alignment, and as a result, it would require the acquisition of large acreages for new rights-of-way or permanent easements. Alternative C4A High-Speed Rail may also require the alteration, relocation, or demolition of historic resources within the EIS Study Area. Because of dense development in Dallas, Fort Worth, and San Antonio, avoidance of historic resources within the EIS Study Area may be difficult, and the potential is high for acquisition effects and resultant adverse direct effects under Section 106. In particular, construction in areas either within or adjacent to historic districts would have the most potential for effects. Therefore, acquisition effects from Alternative C4A High-Speed Rail within urban and suburban areas are expected to be substantial. Construction of Alternative C4A High-Speed Rail in rural areas would result in the same negligible effects as Alternative C4A Higher-Speed Rail.

Because high-speed rail service typically requires either construction of new stations or extensive alterations to existing facilities, effects from rehabilitation, restoration, or expansion of existing railroad-related resources would be substantial in urban and suburban areas. Construction of Alternative C4A High-Speed Rail stations has the potential to affect the same historic resources as Alternative C4A Higher-Speed Rail; however, high-speed rail stations may require larger expansion than the higher-speed rail stations and, therefore, have a greater intensity of effects.

3.18.4.4.3 Alternative C4B Higher-Speed Rail

Alternative C4B Higher-Speed Rail would have the potential to affect 38 NRHP, NRHP-eligible, or potentially NRHP-eligible unique resources. This is the lowest number of historic resources among the Central Section alternatives. The effects would be the same historic resources as Alternative C4A Higher-Speed Rail and Alternative C4A Higher-Speed Rail in the portion of the route from the Arlington area south to Hillsboro. Alternative C4B Higher-Speed Rail would have substantial acquisition effects on historic resources in urban and suburban areas because of the potential for demolition or removal of historic properties along the route. The greatest potential for acquisition effects along this portion of the route would be if new rights-of-way or easements are required from NRHP-eligible suburban neighborhoods, such as Hollandale Historic District (Map ID #37) and Vought Manor Historic District (Map ID #38).

Construction of Alternative C4B Higher-Speed Rail in rural areas would likely have negligible acquisition effects on historic resources. Only two historically significant rural agricultural properties, the Joe E. Turner House (Map ID #52) and the Withers House (Map ID #70), were identified within the EIS Study Area. Because of higher-speed rail construction and the ability to construct the railroad line with relatively tight horizontal curves, acquisition of these agricultural resources could be avoided. Although additional agricultural resources or rural historic landscapes may be identified within the EIS Study Area, impacts on these resources would be assessed at the project level. Although increased or additional parking facilities may be required, acquisition of land for parking facilities would likely avoid significant historic resources.

Where existing railroad right-of-way would be used, rehabilitation, restoration, or expansion of existing railroad-related resources would result in moderate intensity effects in urban and suburban locations along the route of Alternative C4B Higher-Speed Rail. Some of the existing stations are NRHP-listed, NRHP-eligible, or potentially NRHP-eligible, including the Gulf, Colorado, and Santa Fe Passenger Station (Map ID #31); Santa Fe Depot in Temple (Map ID #65); and International & Great Northern Passenger Station (Map ID #76). As a result, possible expansion and rehabilitation of historically significant buildings and structures may be required to accommodate increased ridership. Such work would be completed in compliance with the *Secretary of the Interior Standards for Rehabilitation* to avoid adverse effects on the depots. If adverse effects on existing historically significant depots cannot be avoided, they would be mitigated, as discussed in Section 3.18.5, Avoidance, Minimization, and Mitigation Strategies.

No historically significant railroad-related resources were identified in rural areas for Alternative C4B Higher-Speed Rail. Although there is a potential that additional historic resources could be identified, the rural areas are not as constrained as urban and suburban areas; therefore, avoidance could be used to reduce effects from Alternative C4B Higher-Speed Rail to negligible.

3.18.4.4.4 Alternative C4B High-Speed Rail

Alternative C4B High-Speed Rail would potentially affect the same resources as Alternative C4B Higher-Speed Rail, although it may result in a greater intensity of effects on historic resources around proposed grade separations. Alternative C4B High-Speed Rail would result in the same types and intensity of effects as described for Alternative C4A High-Speed Rail for the trackway and station areas. Alternative C4B High-Speed Rail would likely have substantial acquisition effects on historic resources within suburban and urban areas.

Although Alternative C4B High-Speed Rail would require the construction of an entirely new rail facility, most of the alternative between Dallas and Fort Worth would be located within or adjacent to the existing Interstate Highway 30 corridor and would, therefore, potentially avoid historic resources. A small portion of this alternative would require the construction of an entirely new transportation corridor adjacent to the potentially NRHP-eligible White Lake Hills Historic District (Map ID #36), which may result in an adverse effect on the historic district resulting in a substantial intensity of effect. In rural areas, Alternative C4B High-Speed Rail could avoid resources, resulting in negligible effects.

3.18.4.4.5 Alternative C4C Higher-Speed Rail

Alternative C4C Higher-Speed Rail would have the potential to affect 52 identified NRHP-listed, NRHP-eligible, or potentially NRHP-eligible resources. The route for the Alternative C4C Higher-Speed Rail represents the longest alternative and has the most identified historic resources within the Central Section. Most of the C4C Higher-Speed Rail route follows the Alternative C4A Higher-Speed Rail route and, therefore, would result in the same substantial effects in those areas. In addition, Alternative C4C Higher-Speed Rail would travel farther south from Fort Worth through Burleson to Hillsboro and would split from Alternative C4A Higher-Speed Rail in Taylor to travel through downtown Austin. The differences occur in urban and suburban areas where a new alignment outside the existing right-of-way may be necessary. Although Alternative C4C Higher-Speed Rail would not affect three of the resources potentially affected by the C4A alternatives, it would potentially affect 10 additional resources. Alternative C4C Higher-Speed Rail would result in substantial effects in urban areas and moderate effects in suburban areas.

Alternative C4C Higher-Speed Rail would have negligible acquisition effects on historic resources in rural areas. Only one historically significant agricultural property, the Withers House (Map ID #70), was identified within the EIS Study Area. The higher-speed rail design refinements would avoid this agricultural resource. Although additional agricultural resources or rural historic landscapes may be identified within the EIS Study Area, impacts on these resources would be assessed during the project-level analysis. Although increased or additional parking facilities may be required, acquisition of land for parking facilities would avoid significant historic resources.

3.18.4.4.6 Alternative C4C High-Speed Rail

Alternative C4C High-Speed Rail would potentially affect the same resources as Alternative C4C Higher-Speed Rail, although it may result in a greater intensity of effects on historic resources around proposed grade separations and station areas. During construction, Alternative C4C High-Speed Rail would have a substantial acquisition effect on historic resources in urban and suburban areas. In particular, construction in areas either within or adjacent to historic districts would have the greatest potential for adverse effects.

3.18.4.5 Southern Section: San Antonio to South Texas

3.18.4.5.1 Alternative S4 Higher-Speed Rail

Alternative S4 Higher-Speed Rail and associated stations would potentially affect 36 NRHP, NRHP-eligible, or potentially NRHP-eligible unique resources. Alternative S4 Higher-Speed Rail would be located within or adjacent to existing rights-of-way in San Antonio and the Lower Rio Grande Valley area (from Edinburg to McAllen and from McAllen to Brownsville). In this case, acquisition effects on urban historic resources would be moderate. Because existing railroad infrastructure, including at-grade railroad crossings and grade-separated crossings, are already in place in the densely populated areas, Alternative S4 Higher-Speed Rail would have moderate effects on urban historic resources during construction.

Only one historic Southern Pacific railroad depot (Map ID #86) near Edinburg is within the existing railroad right-of-way along the route of Alternative S4 Higher-Speed Rail; therefore, minimal rehabilitation, restoration, or expansion of existing railroad-related resources would be required. Because of the limited number of suburban and urban historic resources identified for Alternative S4 Higher-Speed Rail, design refinements would reduce acquisition effects and avoid adverse effects under Section 106.

In the rural areas, Alternative S4 Higher Speed Rail would extend through and be adjacent to the 1-million-acre, NRHP-listed (and National Historic Landmark-designated) King Ranch within the abandoned Texas and New Orleans Railroad (later Southern Pacific Railroad) right-of-way. During construction, King Ranch operations would not be hindered, and access to gates would be maintained during phased construction. Because the numerous complexes on King Ranch are near U.S. Highway 77 and thus several miles from the construction areas associated with Alternative S4 High-Speed Rail, construction would have negligible acquisition effects and would not cause adverse effects on King Ranch or other rural historic resources.

No historically significant railroad-related resources were identified in rural areas within the EIS Study Area for Alternative S4 Higher-Speed Rail; therefore, there would be no effects from rehabilitation, restoration, or expansion of existing railroad-related historic resources in rural areas.

3.18.4.5.2 Alternative S6 Higher-Speed Rail

Alternative S6 Higher-Speed Rail would primarily pass through rural and undeveloped areas, and no historic resources were identified within the EIS Study Area. Therefore, it appears that Alternative S6 Higher-Speed Rail would have negligible acquisition effects on historic resources.

No historically significant railroad-related resources were identified with the EIS Study Area for Alternative S6 Higher-Speed Rail. As a result, negligible effects would be anticipated as a result of rehabilitation, restoration, or expansion of existing railroad-related historic resources.

3.18.4.5.3 Alternative S6 High-Speed Rail

Alternative S6 High-Speed Rail would travel within the same EIS Study Area as Alternative S6 Higher-Speed Rail and would result in similar effects, except that Alternative S6 High-Speed Rail may acquire more land area for grade separations and other transportation infrastructure. However, because of the low number of identified historic properties, this alternative would have negligible effects.

No historically significant railroad-related resources were identified with the EIS Study Area for Alternative S6 High-Speed Rail. As a result, no effects would be anticipated as a result of rehabilitation, restoration, or expansion of existing railroad-related historic resources.

3.18.4.6 Summary of Potential Effects

Potential effects on historic resources include acquisition effects and effects for the rehabilitation, restoration, or expansion of existing railroad-related historic resources. According to Section 106, these types of impacts are typically characterized as direct adverse effects. Based on this service-level analysis, the highest intensity of effects would occur within the Central Section. The alternatives in the Central Section would extend within major urban areas that feature the densest concentration of historic resources, including historic districts. In addition, because high-speed rail construction requires grade-separated structures and new alignments outside existing rights-of-way, this type of service would have the greatest potential for effects.

Visual, noise, and vibration impacts are typically characterized under Section 106 as indirect effects. These effects would be assessed during the project-level analysis; however, a preliminary assessment of the intensity of visual, noise, and vibration impacts can be made based on density of historic resources and service type and professional knowledge of how these impacts can affect the character-defining features or the historic resource's specific use or function in relation to its historic significance. High-speed rail alternatives would have the potential to result in substantial changes on the landscape, impacting the setting by changing the appearance of the area, particularly in an urbanized area where grade separations would be necessary. Neither higher-speed rail nor conventional rail is anticipated to alter the historic setting to the extent of diminishing the historic significance of the extant historic resources.

Additionally, since none of the historic resources identified were determined to have a quiet environment as a character-defining feature of its historic significance, and because noise and vibration are mitigated for effects on sensitive receptors, noise and vibration are determined not to result in adverse effects on historic resources.

Like the effects discussed previously, the highest intensity of effects would likely occur within the Central Section. The alternatives in the Central Section would extend within major urban areas that feature the densest concentration of historic resources, including historic districts. In addition, the need for grade-separated structures with high-speed rail service has the potential to alter the surrounding visual character. This may alter the setting of historic resources that would adversely affect the historic integrity of those resources. Consequently, alternatives with high-speed rail service would have the greatest potential for visual effects.

No non-archaeological historic resources were identified for the S6 alternatives; therefore, effects on historic resources for these alternatives would be negligible. Although historic resources are present along the route for Alternative N4A Conventional, effects on historic resources for this alternative would be negligible within the existing railroad right-of-way, and effects would be avoided or minimized because these services would require minimal new right-of-way and use of existing facilities. For Alternative N4A Conventional, the expansion of existing stations and new stations within urban and suburban areas could result in moderate effects on historic resources.

Table 3.18-6 lists the potential intensity of effects for each alternative.

Table 3.18-6. Potential Intensity of Effects on Historic Resources

Section	Alternatives	Number of NRHP-Listed, NRHP-Eligible, or Potentially NRHP-Eligible Historic Resources	Potential Intensity of Effects[a]
No Build Alternative[b]		Not applicable	No effect
Northern	N4A CONV	35	Moderate
Central	C4A HrSR	45	Substantial
	C4A HSR	45	Substantial
	C4B HrSR	38	Substantial
	C4B HSR	38	Substantial
	C4C HrSR	52	Substantial
	C4C HSR	52	Substantial
Southern	S4 HrSR	36	Moderate
	S6 HrSR	0	Negligible
	S6 HSR	0	Negligible

[a] The most intense effect for each alternative is presented in the table. However, alternatives may include additional less intense effects depending on urban, suburban, or rural locations.

[b] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

Source: See discussions in Sections 3.18.4.2 through 3.18.4.5.

3.18.5 Avoidance, Minimization, and Mitigation Strategies

Strategies would begin with avoidance, in accordance with Section 4(f) regulations. Properties that are eligible for listing in the NRHP are considered a Section 4(f) resource. The “use” of a Section 4(f)-protected property is prohibited for transportation purposes unless there are no prudent and feasible avoidance alternatives to that use. A project must also include all possible planning to minimize harm to Section 4(f) resources. For actions that would result in moderate or substantial effects on historic resources that cannot be avoided or minimized, Section 106 requires a more detailed evaluation and determination of specific impacts and proposed mitigation strategies. Similarly, for uses of historic resources, Section 4(f) requires a more detailed evaluation of prudent and feasible alternatives and determination of specific impacts and proposed mitigation strategies. Often these evaluations result in mitigation agreements among agencies that would be executed through a Memorandum of Agreement or Programmatic Agreement.

For this service-level analysis, a wide range of mitigation strategies could be used in cases where moderate or substantial effects cannot be avoided or minimized. One mitigation strategy would be to document the historic property before construction. This may include preparation of Historic American Building Survey or Historic American Engineering Record documentation, NRHP nominations, or historic property management and treatment plans. Sound barriers, vegetative screening, and landscaping would be appropriate mitigation strategies during construction. Another mitigation strategy could include development and dissemination of education materials throughout the project area.

3.18.6 Subsequent Analysis

During the project-level analysis, a reconnaissance-level historic resources survey will be conducted in accordance with the Secretary of the Interior's Standards for the Identification, Evaluation, and Documentation of Historic Resources (NPS 1995), as well as Oklahoma Department of Transportation and TxDOT guidelines. The survey will establish an APE through consultation with the Oklahoma and Texas SHPOs, and field investigations will be conducted to identify potential historic resources within the APE, including those that have not been evaluated for NRHP eligibility. This will include field investigations of cemeteries that were listed as potentially NRHP eligible because of the service level of analysis. The survey will include an evaluation of NRHP eligibility for identified historic resources and an assessment of adverse effects pursuant to Section 106 of the NHPA (36 CFR Part 800). At the project level, avoidance and minimization of potential impacts on historic resources will be conducted prior to mitigation.

3.19 Archaeological Sites

This section describes archaeological sites, including archaeological historic properties, within the environmental impact statement (EIS) Study Area and summarizes the potential effects on these resources. For this analysis, archaeological sites are defined as prehistoric or historic sites (generally 50 years of age or older) for which National Register of Historic Places (NRHP) eligibility may not yet have been formally determined. Archaeological historic properties, specifically, are defined as those archaeological sites already listed in the NRHP or that have been formally determined eligible for listing in the NRHP. Traditional cultural properties (TCPs) are a specific type of historic property associated with cultural beliefs or practices of a living community that are rooted in history and important to the continuing cultural identity of the community (Parker and King 1998). TCPs would not be identified until after tribal consultation and public scoping; therefore, specific TCPs were not included in this evaluation. The introduction to Chapter 3 describes the EIS Study Area and use of terms, such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.19.1 Laws, Regulations, and Orders

Federal and state legislation and regulations pertaining to archaeological sites are described below. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.19.1.1 Federal

- Section 106 of the National Historic Preservation Act (NHPA) of 1966 (16 United States Code [U.S.C.] § 470f). Section 106 requires that federal agencies consider the effects of their undertakings on historic properties listed in, or eligible for listing in, the NRHP. Furthermore, it requires that federal agencies afford the Advisory Council on Historic Preservation, respective State Historic Preservation Officers (SHPOs), and other consulting parties the opportunity to comment on the proposed federal undertaking(s).

  This analysis evaluates potential effects on archaeological historic properties at the service level. Therefore, this document does not require a Section 106 analysis because there is no proposed undertaking at the Program level. Documentation in accordance with Section 106 would be required during the project-level environmental review. The NHPA also provides for consultation with Native American tribes when proposed projects might affect cultural or traditional places or resources that have value to a tribe; this value is derived from the role the property plays in the community's historically rooted beliefs, customs, and practices (16 U.S.C. § 470a[d]). At the Program level, consultation with Native American tribes was limited to *informal* consultation, which included sending coordination letters to identified tribes in the EIS Study Area and meeting with tribes interested in receiving additional information. This coordination is further described in Chapter 8, Public Involvement. Additional tribal consultation would continue during project-level analysis, as required.

These laws also encourage coordination with the environmental review process required by other statutes, including Section 4(f) of the U.S. Department of Transportation Act of 1966 (49 U.S.C. § 303 and 23 U.S.C. § 138), for which compliance is anticipated during the project-level analysis. For more information on Section 4(f), see Chapter 4, Section 4(f) and Section 6(f) Resources.

At the project-level analysis, the investigation may require procedures to adhere to additional federal statutes, regulations, and executive orders, as necessary, which may include:

- American Indian Religious Freedom Act of 1978, as amended (U.S.C. Title 42, Chapter 21 [I], § 1996). Requires federal agencies to consult Native American tribes when undertakings have the potential to affect tribal rights to the free exercise of traditional religions, including effects on religious places and practices.
- Executive Order 13007 of 1996. Requires federal agencies to accommodate access to and ceremonial use of Native American sacred sites on federal land by Native American religious practitioners and avoid adverse effects on the physical integrity of such sites.
- Other Laws. Other federal statutes that may apply include the Archaeological Resources Protection Act of 1979 (16 U.S.C. § 470aa-mm), the Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001-3013), the Federal Antiquities Act of 1906 (16 U.S.C. § 430-433), the Federal Historic Sites Act of 1935 (16 U.S.C. § 461-467), the Abandoned Shipwreck Act of 1987 (43 U.S.C. § 2101-2106), and the Archeological and Historic Preservation Act of 1974, as amended (16 USC § 469-469c-2).

3.19.1.2 State

At the project-level analysis, the investigation may require procedures to adhere to the following state statutes and regulations:

- Oklahoma Antiquities Law of 1965, as amended in 1985 (Oklahoma Statute Title 53, Chapter 20 [§361]). Applies to projects that may affect cultural resources including archaeological sites on state-owned land. Under this act, site excavations on state land must be conducted by trained researchers under a permit issued by the State Archaeologist at the Oklahoma Archeological Survey (OAS), and collections resulting from such excavations must be deposited with a museum or other recognized repository in the state. The statute further states that it is illegal to intentionally deface American Indian or aboriginal paintings, pictographs, petroglyphs, or other marks that pertain to early American Indian or aboriginal habitation of the country and to willingly injure, disfigure, remove, or destroy archaeological resources without lawful authority according to provisions of the statute.
- Oklahoma Burial Desecration Law of 1987 (Oklahoma Statute Title 21, Chapter 47 [§1168.0-1168.6]). Protects human remains and associated burial goods in unmarked graves on both state and privately owned land by making it illegal to knowingly disturb, buy, sell, or barter human skeletal remains or associated items from unmarked graves. The statute further states that those who encounter or discover unmarked graves and their contents, including federal

and state agencies in performance of their duties, should stop further disturbance activities, report the find to appropriate law enforcement in the county of the find, and comply with other provisions of the statute.

- **Texas Antiquities Code of 1969, as amended (Texas Natural Resources Code Title 9, Chapter 191 [§191.001-191.174]),** and associated regulations (Texas Administrative Code [TAC] Title 13, Chapter 26). These regulations serve to locate, protect, and preserve State Antiquities Landmarks located in, on, or under lands owned or controlled by the State of Texas or a political subdivision thereof that may be affected by proposed projects. Such landmarks include sites, objects, buildings, structures and historic shipwrecks, and locations of historical, archaeological, educational, or scientific interest related to the inhabitants, prehistory, history, government, or culture of Texas. The code requires notice be provided to the Texas Historical Commission (THC) prior to breaking ground at a project location on state or local public land to ensure that the project effects on State Antiquities Landmarks, whether or not they have been identified, are appropriately considered.
- **Chapter 711 (Cemeteries) of the Texas Health and Safety Code of 1989, as amended 2009 (Texas Health and Safety Code Title 8, Subtitle C, Chapter 711),** and associated regulations (TAC Title 13 Part 2, Chapter 22). Chapter 711 of the Texas Health and Safety Code concerns the discovery, notification, permits for, and requirements related to the removal of unknown and abandoned cemeteries and graves including those over 100 years of age often found in conjunction with archaeological sites. Although this service-level analysis is not intended to comply with Chapter 711 because it does not include fieldwork-based identification of such cemeteries within the Area of Potential Effect (APE), the statute is referenced here for future informational purposes. It states that a railroad, street, road, alley, pipeline, telephone, telegraph, electric line, wind turbine, cellular telephone tower, or other public utility or thoroughfare may not be placed through, over, or across a part of a dedicated cemetery (that is, one or more intentional human graves) without consent and includes provisions for discovery, removal, and reburial of cemeteries, particularly those considered unidentified, abandoned, or otherwise non-perpetual care, within public or private property. Cases where newly discovered previously unidentified or abandoned cemeteries may be affected by proposed construction are prohibited from further disturbance of the cemetery unless and until the human remains are removed in accordance with provisions of the code and its associated regulations.

3.19.2 Methodology

This service-level analysis used a broad approach to determine the potential effects on archaeological sites within the EIS Study Areas for the build alternatives. The analysis consisted of an evaluation of reported sites within and in proximity to the EIS Study Area for each alternative, but did not include a detailed evaluation of all potential archaeological sites.

The EIS Study Area for archaeological sites was defined as a 500-foot buffer for each alternative. Using primary resources outlined below, a general prehistoric context was prepared that includes an overview of the prehistory and environmental setting of each alternative. Based on this context, archaeological sites identified in the EIS Study Area were evaluated (for more information on the prehistoric context, see the Archaeological Sites Technical Study, included as Appendix K).

Information regarding recorded archaeological sites within the EIS Study Area was obtained from electronic databases and physical records at research libraries and institutions including the THC's Texas Historic Sites Atlas online database, the THC/Texas SHPO restricted use library, the University of Texas Archeological Research Laboratory's site file repository and library, and the OAS site file repository. These resources were used to identify archaeological sites listed in the NRHP, archaeological sites determined NRHP-eligible by the Oklahoma or Texas SHPO, and archaeological sites with undetermined NRHP eligibility. Archaeological sites with undetermined NRHP eligibility are treated as NRHP-eligible sites because final eligibility determinations have not been made by the Oklahoma or Texas SHPO. Archaeological sites that have been determined ineligible for inclusion in the NRHP do not require further inquiry and are not addressed in the service-level analysis.

After potential historic resources were identified, the magnitude of potential effects on archaeological historic properties and sites with undetermined NRHP eligibility was determined for each alternative. The assessment was based on the data collected during the service-level analysis and may need to be reassessed during the project-level analysis depending on changes to the Program. Formal determination of effects pursuant to National Environmental Policy Act (NEPA) and the NHPA would be made during the project-level analysis.

Effects as a result of the route alternatives are characterized as negligible, moderate, or substantial compared with the No Build Alternative. Because this analysis did not include ground surveys, the presence of archaeological resources is only an indication of the types of resources that might be present. Additionally, effects on archaeological resources cannot be valued by the number of sites affected. Therefore, determination of effects for this service-level analysis is largely a professional judgement based on the probability to affect archaeological sites. In relation to archaeological sites, these terms are defined as follows:

- Negligible intensity effects are those that would result in low likelihood of disturbing new areas by improving existing railroad infrastructure.
- Moderate intensity effects are those where ground disturbance is minimal and have a low probability of containing archaeological resources. For instance, there would be a moderate intensity of effects where the alignment would be placed on fill rather than depressing the alignment, or there are areas of low probability of archaeological resources.
- Substantial intensity effects are those where ground disturbance is deep and occurs in areas with a high likelihood of archaeological resources. For example, this may occur for roadway undercrossings and pier structure foundations.

3.19.3 Affected Environment

An overview of identified archaeological sites within the EIS Study Area, including sites listed in the NRHP, sites determined NRHP-eligible, and sites with undetermined NRHP eligibility, is provided in Table 3.19-1 through 3.19-3. Table 3.19-4 summarizes the number of resources within the EIS Study Area for each alternative. Figure 3.19-1 is an index map, and the approximate locations of archaeological sites are shown on Figures 3.19-2 through 3.19-13.

Archaeological sites identified within the EIS Study Area include open camps, villages, lithic scatters, fire-cracked rock features, and lithic quarries/workshops that have been dated throughout the prehistoric period. Structural ruins and archaeological deposits associated with farmsteads, wells, railroad bridges, wagon trails, *acequias* (irrigation canals), military roads, a naval air station, and two cemeteries identified within the EIS Study Area have been dated to the historic period. Both cemeteries are within the Central Section of the EIS Study Area; interments at one cemetery date between AD 1860 and 1954, and the exact age of the other was not verified.

3.19.3.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Results of the data collection regarding identified archaeological sites within the EIS Study Area for Alternative N4A Conventional are detailed in Table 3.19-2, including six archaeological sites that are also located within the Central Section EIS Study Area. Data collection revealed one NRHP-eligible archaeological site and 14 archaeological sites with undetermined NRHP eligibility.

Table 3.19-1: Archaeological Sites—Northern Section

Site Trinomial	Description	NRHP Status	Notes/ Recommendations	Alternative[a]
34OK63 Figure 3.19-2	Prehistoric open camp; possibly Archaic period	Undetermined	Further work needed	N4A-CONV
34OK99 Figure 3.19-2	Late Prehistoric period open camp	Undetermined	NRHP testing needed	N4A-CONV
34CL179 Figure 3.19-2	Norman Historic Naval Air Station/archaeological deposits	NRHP-eligible	Further NRHP assessment needed	N4A-CONV
34CL57 Figure 3.19-2	Prehistoric open camp	Undetermined	Two site plots, one within the EIS Study Area needs further assessment	N4A-CONV
34GV291 Figure 3.19-2	Archaic period prehistoric open camp	Undetermined	Site may extend east of railroad	N4A-CONV
34GV295 Figure 3.19-2	Plains Village prehistoric open camp	Undetermined	Investigation of subsurface needed	N4A-CONV
34GV136 Figure 3.19-2	Washita River Phase prehistoric village	Undetermined	Investigation of subsurface needed	N4A-CONV

Site Trinomial	Description	NRHP Status	Notes/ Recommendations	Alternative[a]
34MR110 Figure 3.19-3	Prehistoric open camp and historic farmstead	Undetermined	Site inventory and full recording needed	N4A-CONV
34LV27 Figure 3.19-3	Archaic period prehistoric open camp	Undetermined	None	N4A-CONV
41TR235[b] Figure 3.19-4	1890s Historic Railroad Roundhouse	Undetermined; demolished structure ineligible	Possible associated buried artifacts	N4A-CONV
41TR226[b] Figure 3.19-4	Historic Walker Branch Railroad Bridge	Undetermined; railroad bridge-ineligible, cleared in past	Possible associated buried artifacts	N4A-CONV
41TR70[b] Figure 3.19-4	Early Archaic through Late Prehistoric open camp	Undetermined	NRHP testing recommended	N4A-CONV
41TR140[b] Figure 3.19-4	Prehistoric open camp	Undetermined	None	N4A-CONV
41TR3[b] Figure 3.19-4	Paleoindian period dart points, no additional data available	Undetermined	None	N4A-CONV
41DL54[b] Figure 3.19-4	Prehistoric open camp	Undetermined	Investigation of the subsurface and site inventory needed; two possible site locations; one within the EIS Study Area	N4A-CONV

[a] CONV = conventional rail

[b] Site is also in the Central Section.

Sources: THC (2014); University of Texas (2014); OAS (2014).

3.19.3.2 Central Section: Dallas and Fort Worth to San Antonio

Results of the data collection regarding identified archaeological sites within the EIS Study Area for the Central Section alternatives are detailed in Table 3.19-2, including six archaeological sites that are also within the Northern Section. Data collection revealed one NRHP-eligible site and 25 sites with undetermined NRHP eligibility within the EIS Study Area for Alternative C4A Higher-Speed and High-Speed Rail, and these sites are considered to have moderate to high potential for significant archaeological deposits. Data collection revealed two NRHP-eligible sites and 18 sites with undetermined NRHP eligibility within the EIS Study Area for Alternative C4B Higher-Speed and High-Speed Rail, and these sites have moderate to high potential for significant archaeological deposits.

Data collection revealed one NRHP-eligible site and 26 sites with undetermined NRHP eligibility within the EIS Study Area for Alternative C4C Higher-Speed and High-Speed Rail, and these sites have moderate to high potential for significant archaeological deposits.

Table 3.19-2: Archaeological Sites—Central Section

Site Trinomial	Description	NRHP Status	Notes/ Recommendations	Alternative[a]
41TR235[b] Figure 3.19-4	1890s Historic Railroad Roundhouse	Undetermined; demolished structure ineligible	Possible associated buried artifacts	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41TR226[b] Figure 3.19-4	Historic Walker Branch Railroad Bridge	Undetermined; railroad bridge-ineligible, cleared in past	Possible associated buried artifacts	C4A-HrSR, C4A-HSR, C4C-HrSR, C4C-HSR
41TR70[b] Figure 3.19-4	Early Archaic through Late Prehistoric open camp	Undetermined	NRHP testing recommended	C4A-HrSR, C4A-HSR, C4C-HrSR, C4C-HSR
41TR140[b] Figure 3.19-4	Prehistoric open camp	Undetermined	None	C4A-HrSR, C4A-HSR, C4C-HrSR, C4C-HSR
41TR3[b] Figure 3.19-4	Paleoindian period dart points, no additional data available	Undetermined	None	C4A-HrSR, C4A-HSR, C4C-HrSR, C4C-HSR
41DL54[b] Figure 3.19-4	Prehistoric open camp	Undetermined	Investigation of the subsurface and site inventory needed; two possible site locations; one within the EIS Study Area	C4A-HrSR, C4A-HSR, C4C-HrSR, C4C-HSR
41DL51 Figure 3.19-4	Caddoan period prehistoric open camp	Undetermined	None	C4B-HrSR, C4B-HSR
41TR48 Figure 3.19-4	1890-1940 Historic Mars Tenant Farm	NRHP-eligible	None	C4B-HrSR, C4B-HSR

Site Trinomial	Description	NRHP Status	Notes/ Recommendations	Alternative[a]
41TR244 Figure 3.19-4	Late 19th century historic farmstead with features	Undetermined; small portion ineligible	None	C4B-HrSR, C4B-HSR
41DL355 Figure 3.19-4	No data available	Undetermined	None	C4A-HrSR, C4A-HSR, C4C-HrSR, C4C-HSR
41DL356 Figure 3.19-4	Late Prehistoric period open camp with features	Undetermined	None	C4A-HrSR, C4A-HSR, C4C-HrSR, C4C-HSR
41DL273 Figure 3.19-4	Prehistoric lithic scatter and historic debris	Undetermined	None	C4A-HrSR, C4A-HSR, C4C-HrSR, C4C-HSR
41DL277 Figure 3.19-4	Historic wagon trail	Undetermined	Unlikely intact, later paved	C4A-HrSR, C4A-HSR, C4C-HrSR, C4C-HSR
41HI255 Figure 3.19-5	1890s historic recreational facility	Undetermined	Most structures destroyed; associated features intact	C4C-HrSR, C4C-HSR
41ML96 Figure 3.19-5	Prehistoric open camp and 1890s historic structure	Undetermined (contractor recommended eligible)	Good to excellent intact buried deposits	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41WM22 Figure 3.19-6	Lithic and fire-cracked rock scatter	Undetermined	Partly destroyed by highway, flooding, and illegal dumping	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41WM159 Figure 3.19-6	Prehistoric quarry and workshop	Undetermined	None	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41WM958 Figure 3.19-6	Late Prehistoric/Neo-American period campsite	Undetermined	Extensive site size, full boundary unidentified	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41TV1344 Cemetery No. TV-C058 Figure 3.19-6	Rose Hill Cemetery	Undetermined	None	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR

Site Trinomial	Description	NRHP Status	Notes/ Recommendations	Alternative[a]
41TV1221 Figure 3.19-6	Prehistoric open camp, Paleoindian – Late Prehistoric periods	Undetermined	NRHP testing recommended	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41TV1366 Figure 3.19-6	Prehistoric open camp with historic house debris	Undetermined	None	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41TV1262 Figure 3.19-6	Prehistoric lithic scatter with tools	Undetermined	None	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41TV1266 Figure 3.19-6	Prehistoric lithic scatter and procurement site	Undetermined	None	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41TV1267 Figure 3.19-6	Prehistoric lithic scatter	Undetermined	Site may not be intact	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41TV1642 Figure 3.19-6	Historic 20th century house	Undetermined	Further work needed	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41TV285 Figure 3.19-6	Archaic period prehistoric open camp	Undetermined, ineligible within previous survey boundary	Deeply buried with clusters of intact hearths	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41GU130 Figure 3.19-7	Prehistoric lithic scatter	Undetermined	None	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41BX910 Figure 3.19-7	Prehistoric open camp	Undetermined	None	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR

Site Trinomial	Description	NRHP Status	Notes/ Recommendations	Alternative[a]
BX-C084 (Cemetery Number) Schulmeier Cemetery Figure 3.19-7	1860-1954 historic Schaefer/ Schulmeier Family Cemetery, perimeter cast iron fence, granite gravestones, and landscaping	Undetermined	Preservation in place recommended	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR
41BX620 Figure 3.19-7	Alazan Acequia associated with San Pedro Springs	NRHP-eligible	None	C4A-HrSR, C4A-HSR, C4B-HrSR, C4B-HSR, C4C-HrSR, C4C-HSR

[a] HrSR = higher-speed rail; HSR = high-speed rail

[b] Site is also in the Northern Section.

Sources: THC (2014); University of Texas (2014).

3.19.3.3 Southern Section: San Antonio to South Texas

Results of the data collection regarding identified archaeological sites within the EIS Study Area for the Southern Section alternatives are detailed in Table 3.19-3. Data collection revealed one NRHP-eligible archaeological site and 20 sites with undetermined NRHP eligibility are within the EIS Study Area for Alternative S4 Higher-Speed Rail, and these sites have moderate to high potential for significant archaeological deposits. Almost half of these sites are at the terminus of the western branch in eastern Laredo and appear to have intact buried deposits; therefore, these sites may require NRHP-eligibility testing to determine their significance. Data collection revealed seven archaeological sites with undetermined NRHP eligibility within the EIS Study Area for Alternative S6 Higher-Speed and High-Speed Rail, and these sites have moderate to high potential for significant archaeological deposits.

Table 3.19-3: Archaeological Sites—Southern Section

Site Trinomial	Description	NRHP Status	Notes/ Recommendations	Alternatives
41FR94 Figure 3.19-8	Prehistoric open camp, possibly Early Archaic period	Undetermined; ineligible within the previous survey boundary	Not investigated beyond the pipeline boundary, but likely disturbed by plowing	S6-HrSR, S6-HSR
41DM95 Figure 3.19-9	Middle to Transitional Archaic period prehistoric open camp	Undetermined	High research potential, testing recommended	S6-HrSR, S6-HSR

Site Trinomial	Description	NRHP Status	Notes/ Recommendations	Alternatives
41DM99 Figure 3.19-9	Prehistoric open camp	Undetermined	High research potential	S6-HrSR, S6-HSR
41DM112 Figure 3.19-9	Prehistoric open camp	Undetermined	High research potential	S6-HrSR, S6-HSR
41WB726 Figure 3.19-9	Early-mid 20th century historic homestead, windmill, artifact scatter	Undetermined	None	S6-HrSR, S6-HSR
41WB343 Figure 3.19-9	Prehistoric lithic scatter	Undetermined	NRHP testing recommended	S6-HrSR, S6-HSR
41WB205 Figure 3.19-9	Prehistoric lithic scatter with tools, debitage, tested cobbles, cores, and biface fragments	Undetermined: prehistoric component; ineligible: historic component	None	S6-HrSR, S6-HSR
41BX629 Figure 3.19-8	Prehistoric open camp and early 20th century historic residence	NRHP-eligible (prehistoric component); State Antiquities Landmark	Boundary and depth have only been estimated	S4-HrSR
41AT19 Figure 3.19-10	Prehistoric open camp	Undetermined	None	S4-HrSR
41AT20 Figure 3.19-10	Prehistoric open camp	Undetermined	None	S4-HrSR
41LK83 Figure 3.19-10	Paleoindian through Late Prehistoric period open camp	Undetermined	None	S4-HrSR
41LK84 Figure 3.19-10	Archaic period prehistoric open camp	Undetermined	NRHP testing recommended	S4-HrSR
41LK339 Figure 3.19-10	Prehistoric open camp	Undetermined	The site may be deeply buried	S4-HrSR
41WB774 Figure 3.19-9	Prehistoric open camp	Undetermined	The site may be partially destroyed	S4-HrSR

Site Trinomial	Description	NRHP Status	Notes/ Recommendations	Alternatives
41WB380 Figure 3.19-9	No data available	Undetermined	None	S4-HrSR
41WB443 Figure 3.19-9	Prehistoric open camp	Undetermined	Possible buried intact deposits	S4-HrSR
41WB449 Figure 3.19-9	Prehistoric open camp	Undetermined	NRHP testing recommended	S4-HrSR
41WB452 Figure 3.19-9	Prehistoric open camp	Undetermined	Possible buried intact deposits	S4-HrSR
41WB450 Figure 3.19-9	Prehistoric open camp	Undetermined	Intact buried deposits, NRHP testing recommended	S4-HrSR
41WB448 Figure 3.19-9	Prehistoric open camp	Undetermined	One buried occupation	S4-HrSR
41WB463 Figure 3.19-9	Prehistoric open camp	Undetermined	None	S4-HrSR
41WB687 Figure 3.19-9	Prehistoric open camp	Undetermined	None	S4-HrSR
41DV134 Figure 3.19-11	Prehistoric quarry with lithic tools	Undetermined	None	S4-HrSR
41JW1 Figure 3.19-12	No data available	Undetermined	None	S4-HrSR
41BK5 Figure 3.19-12	Historic early 20th century Trosada Well and Ruins	Undetermined	Possible station for steam train; archival research and NRHP testing recommended	S4-HrSR
41CF208 Figure 3.19-13	Historic Old Military Road	Undetermined	Good research potential; most of the road has been paved	S4-HrSR
41NU12 Figure 3.19-12	No data available	Undetermined	None	S4-HrSR
41NU73 Figure 3.19-12	No data available	Undetermined	None	S4-HrSR
Sources: THC (2014); University of Texas (2014).				

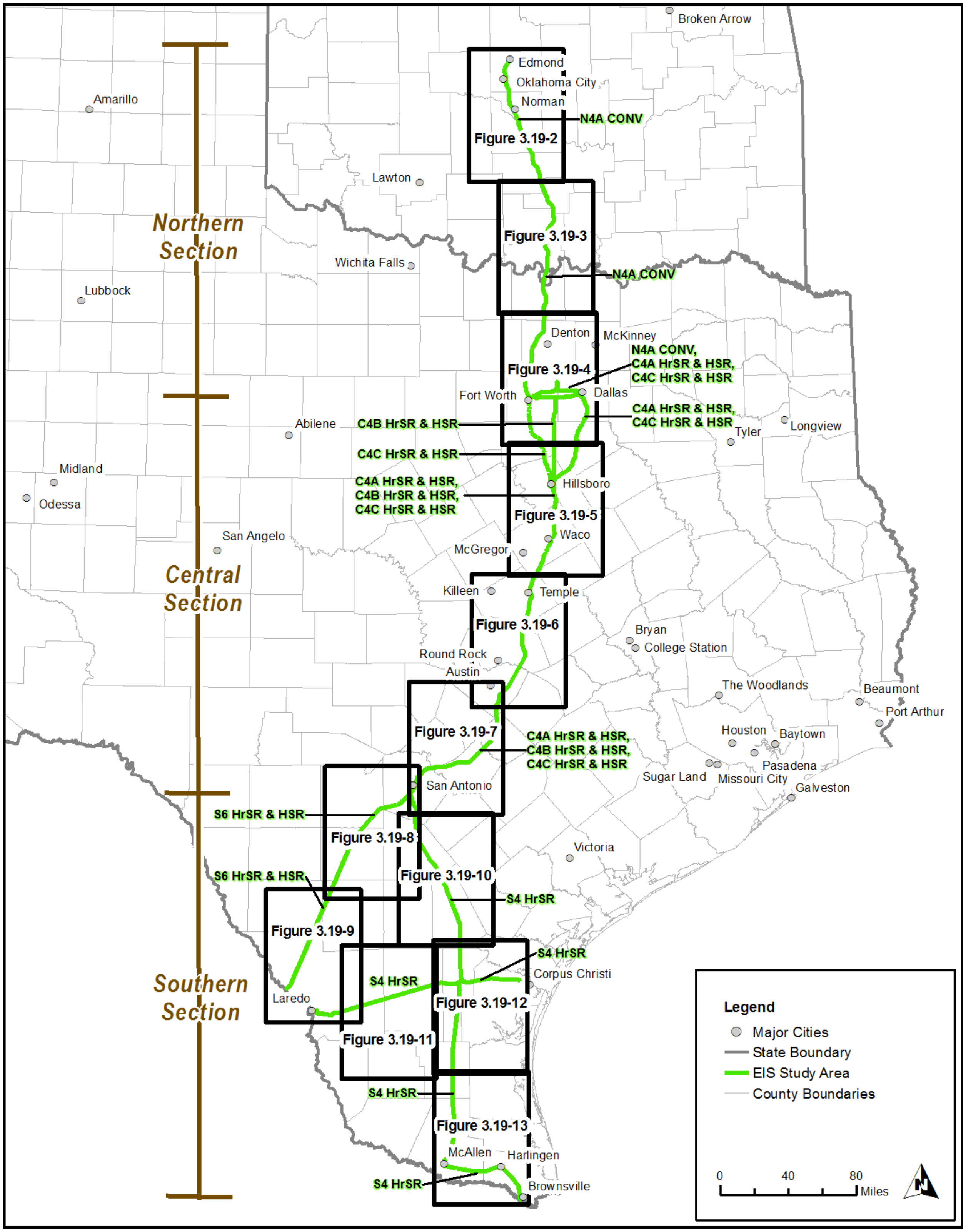

Figure 3.19-1: Archaeological Cultural Resources Index Map

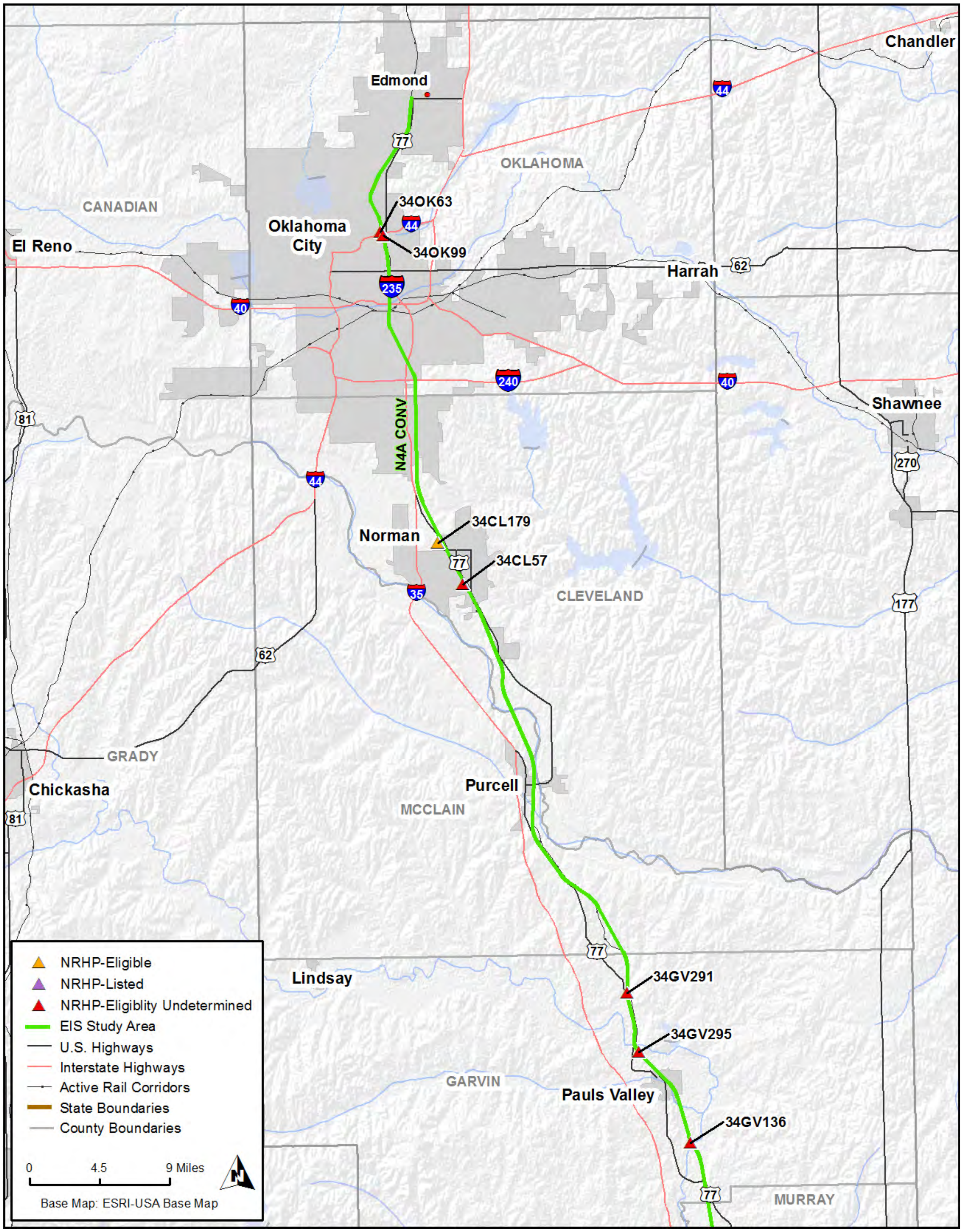

Figure 3.19-2: Archaeological Cultural Resources within the EIS Study Area (Map 1)

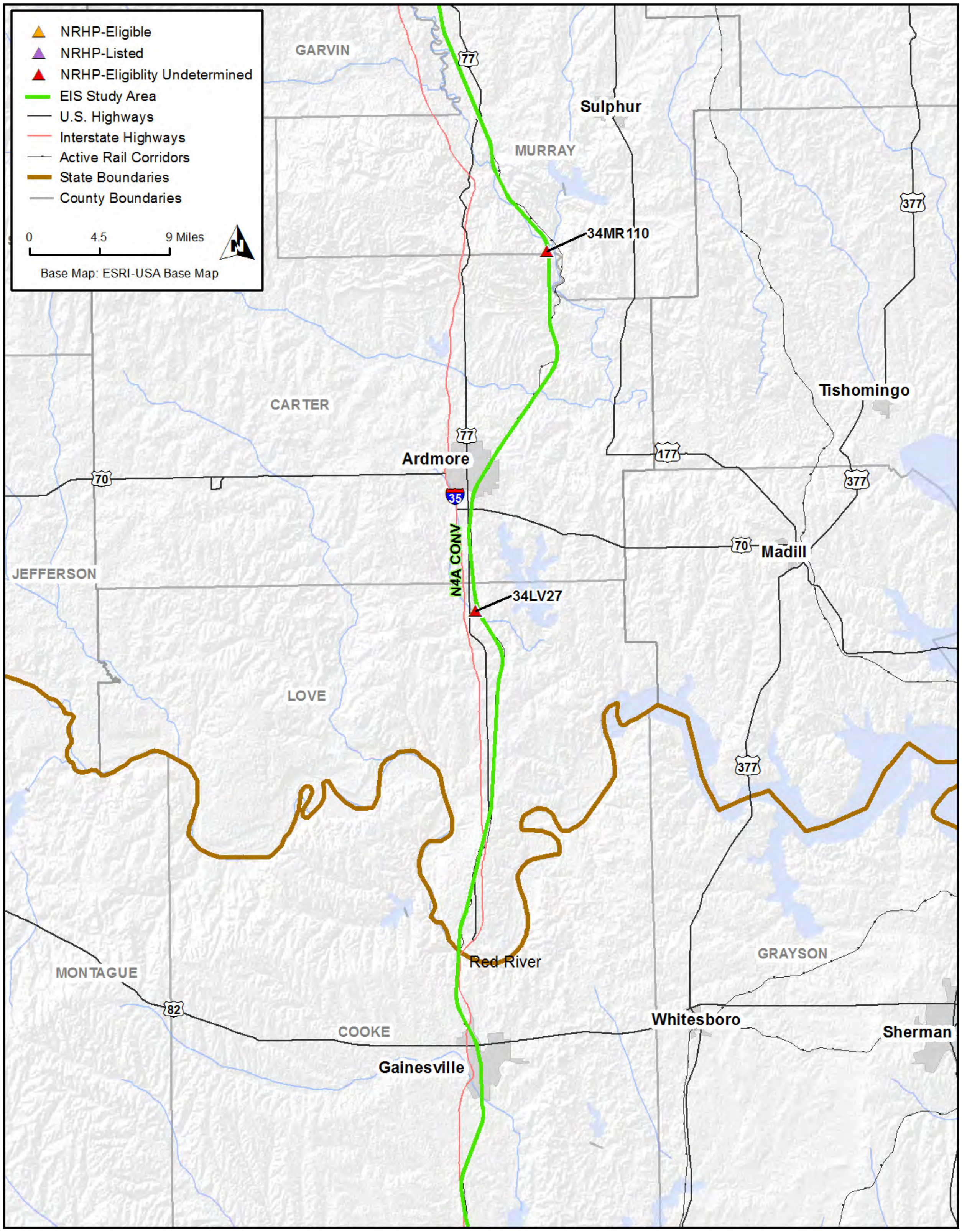

Figure 3.19-3: Archaeological Cultural Resources within the EIS Study Area (Map 2)

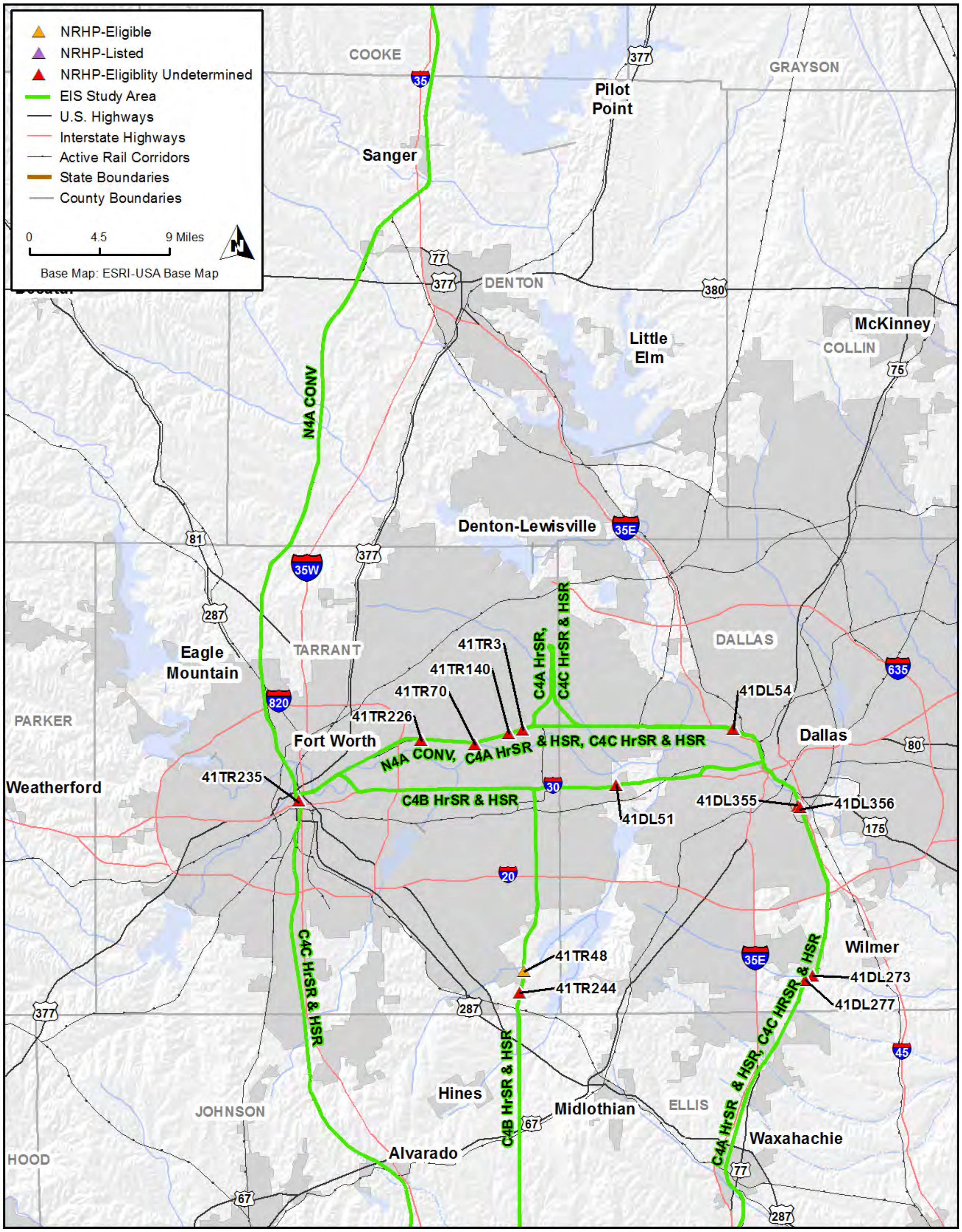

Figure 3.19-4: Archaeological Cultural Resources within the EIS Study Area (Map 3)

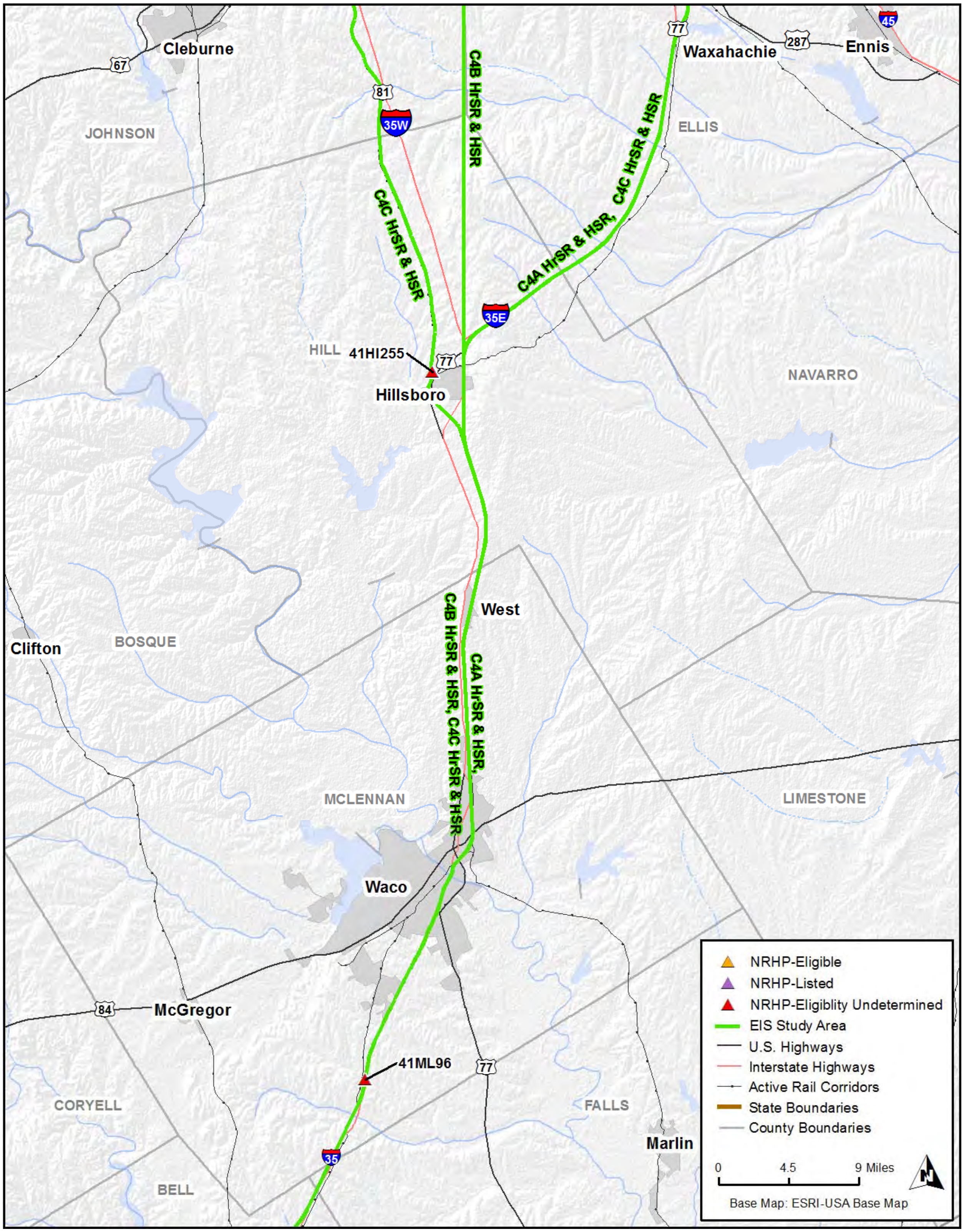

Figure3.19-5: Archaeological Cultural Resources within the EIS Study Area (Map 4)

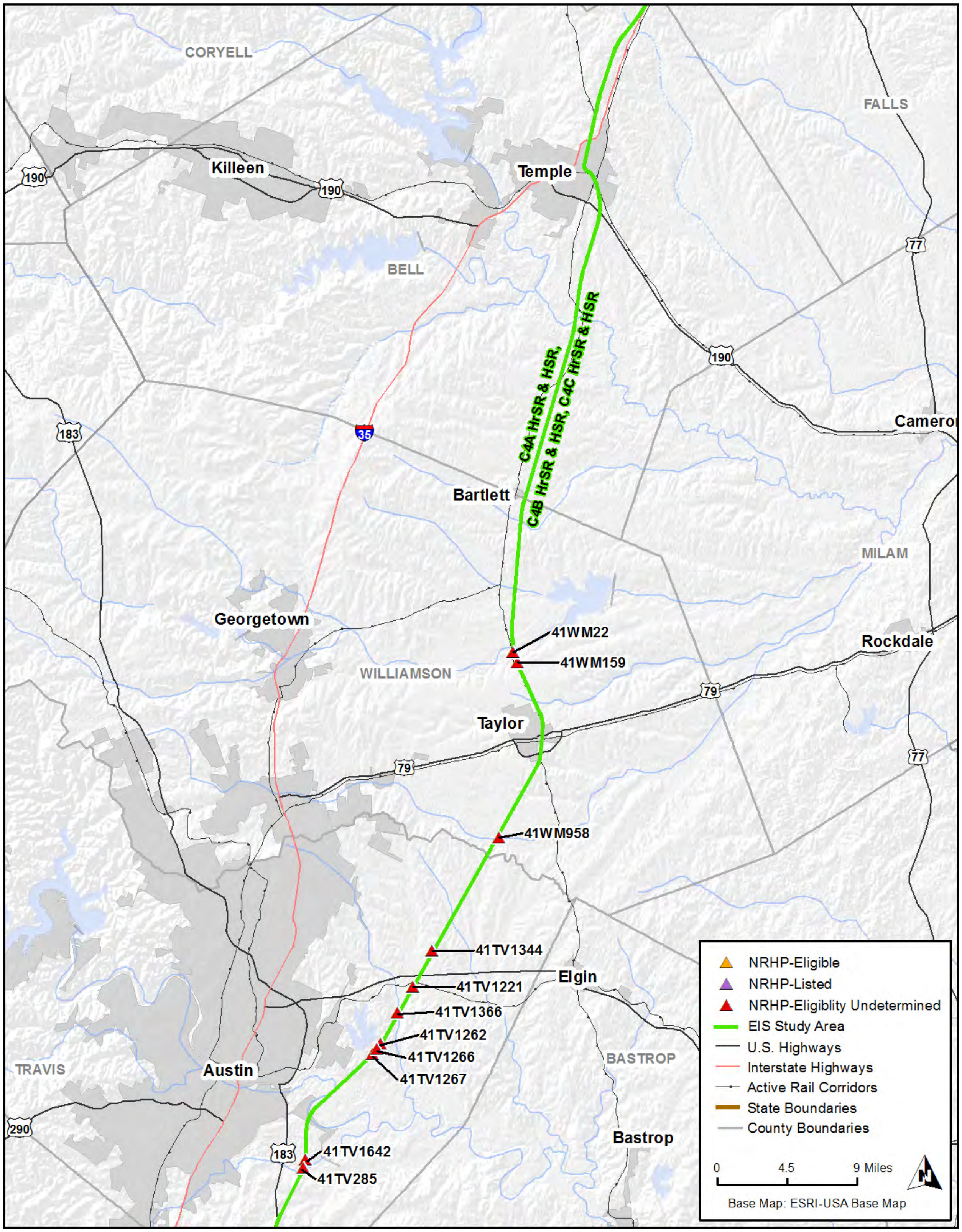

Figure 3.19-6: Archaeological Cultural Resources within the EIS Study Area (Map 5)

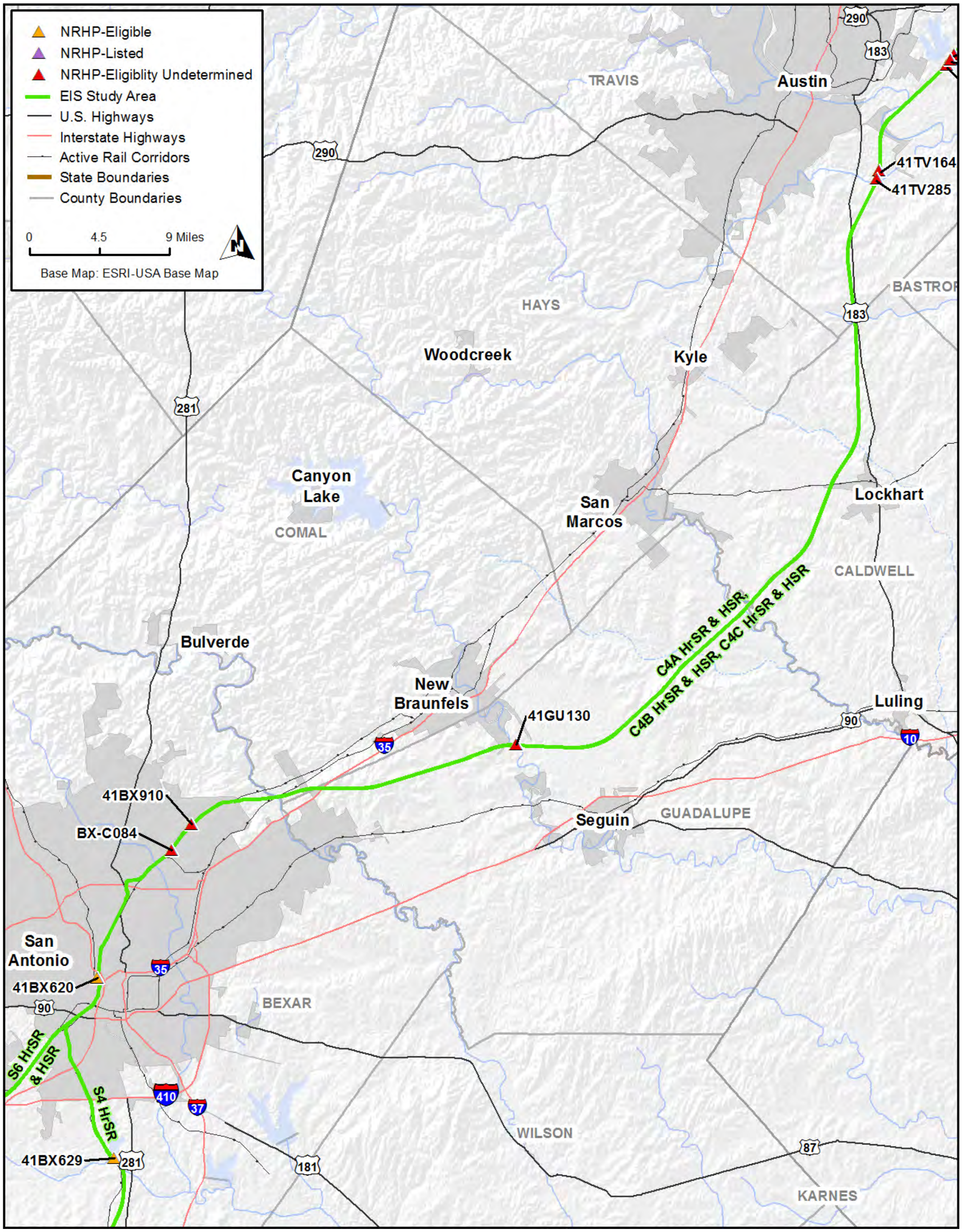

Figure 3.19-7: Archaeological Cultural Resources within the EIS Study Area (Map 6)

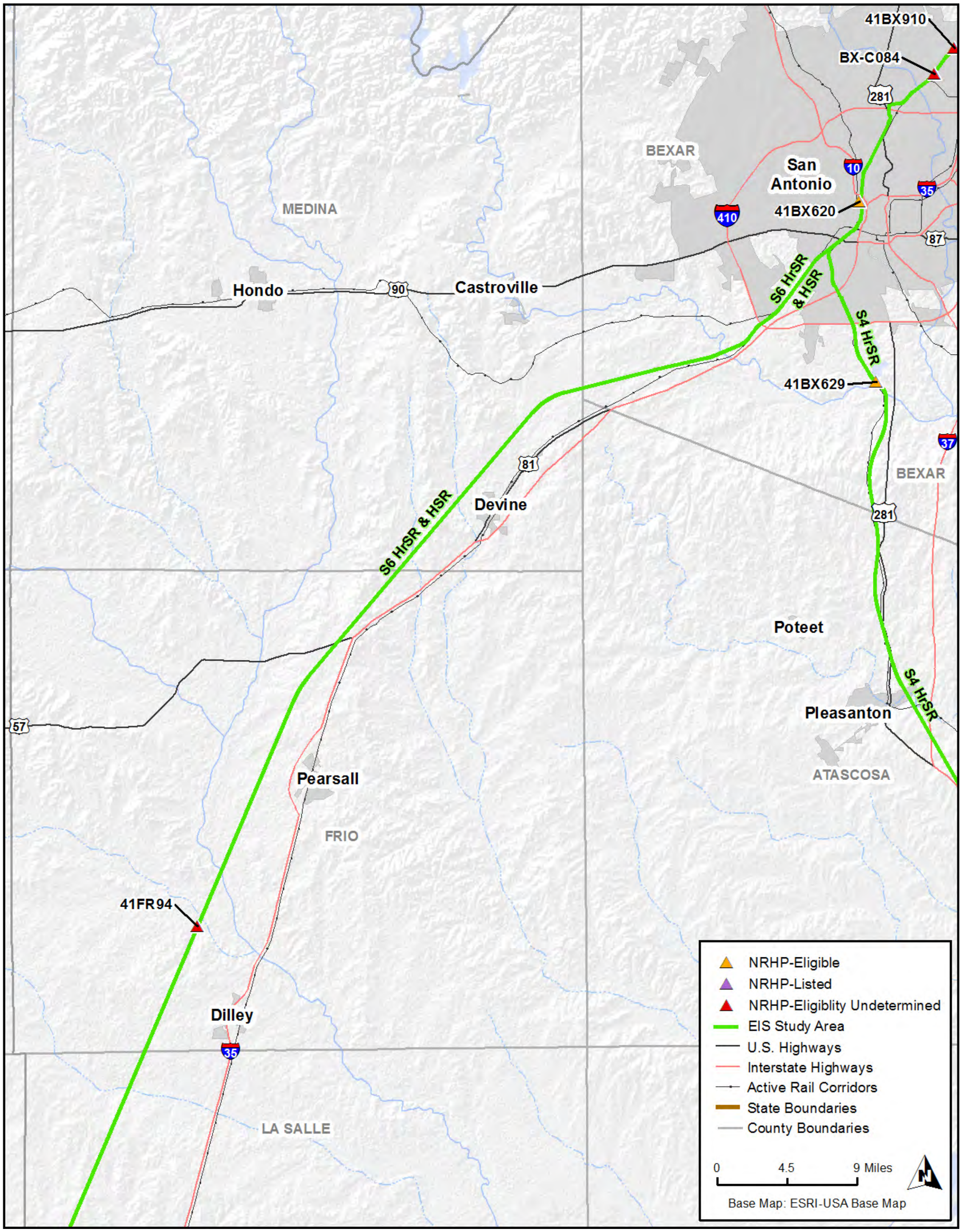

Figure 3.19-8: Archaeological Cultural Resources within the EIS Study Area (Map 7)

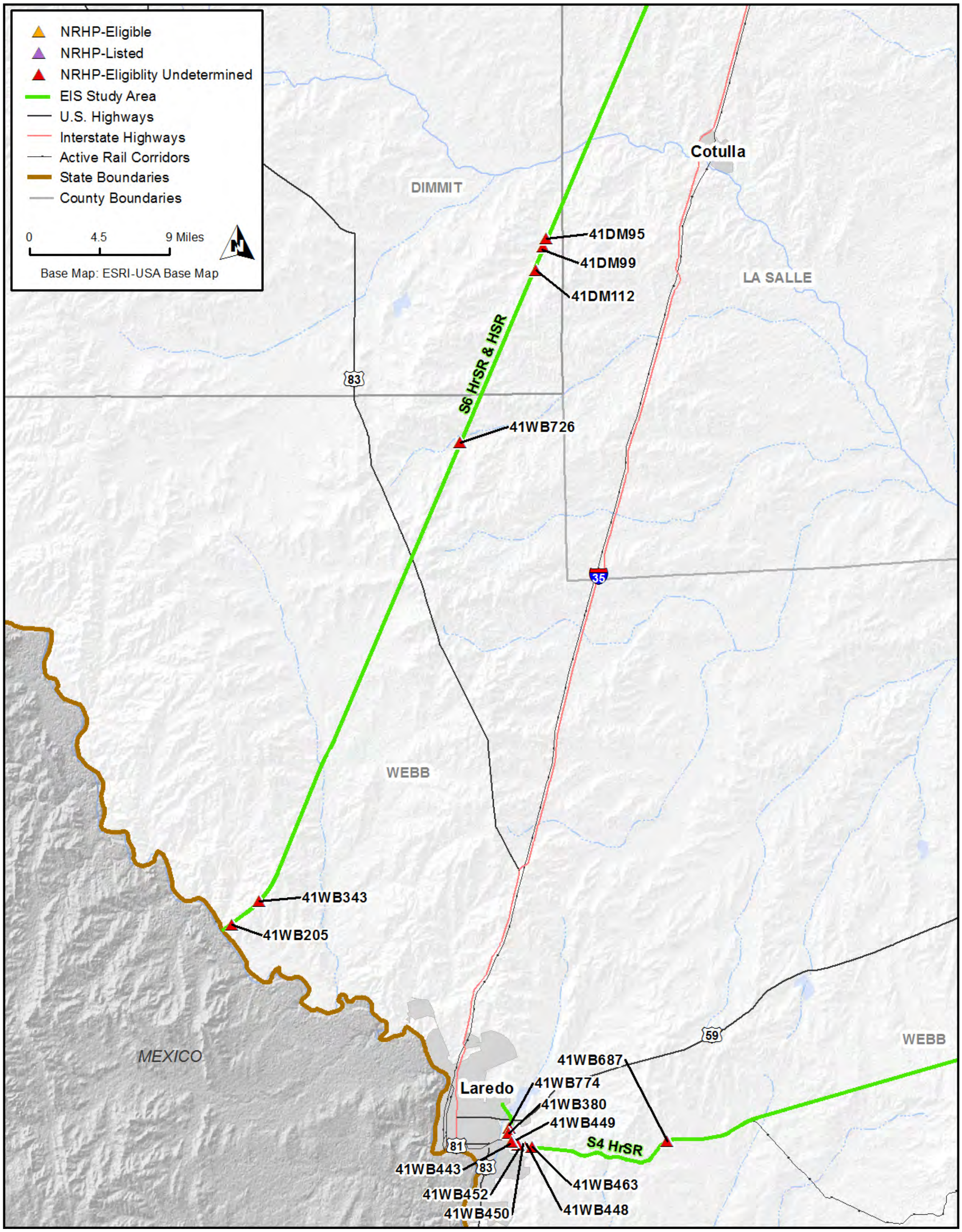

Figure 3.19-9: Archaeological Cultural Resources within the EIS Study Area (Map 8)

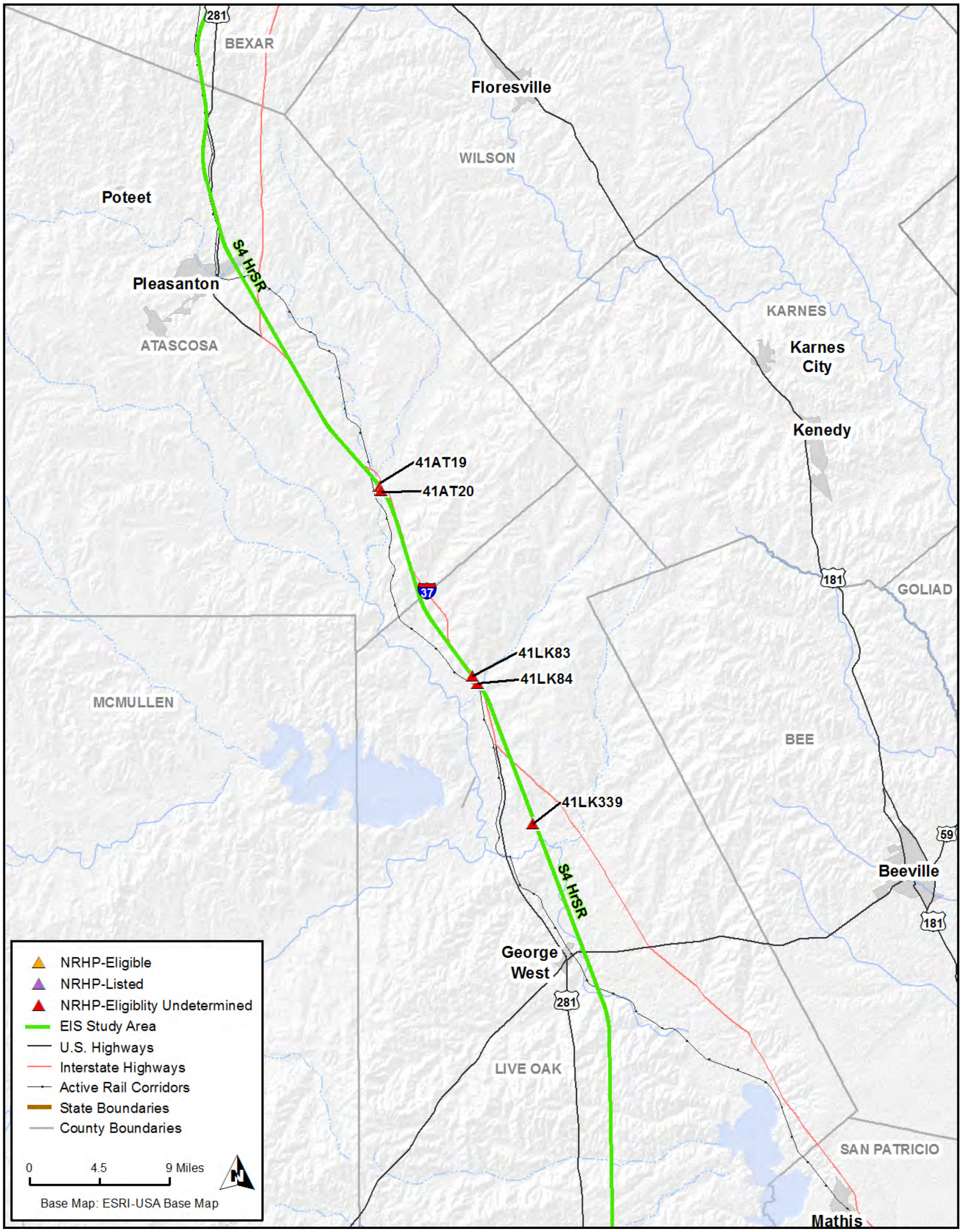

Figure 3.19-10: Archaeological Cultural Resources within the EIS Study Area (Map 9)

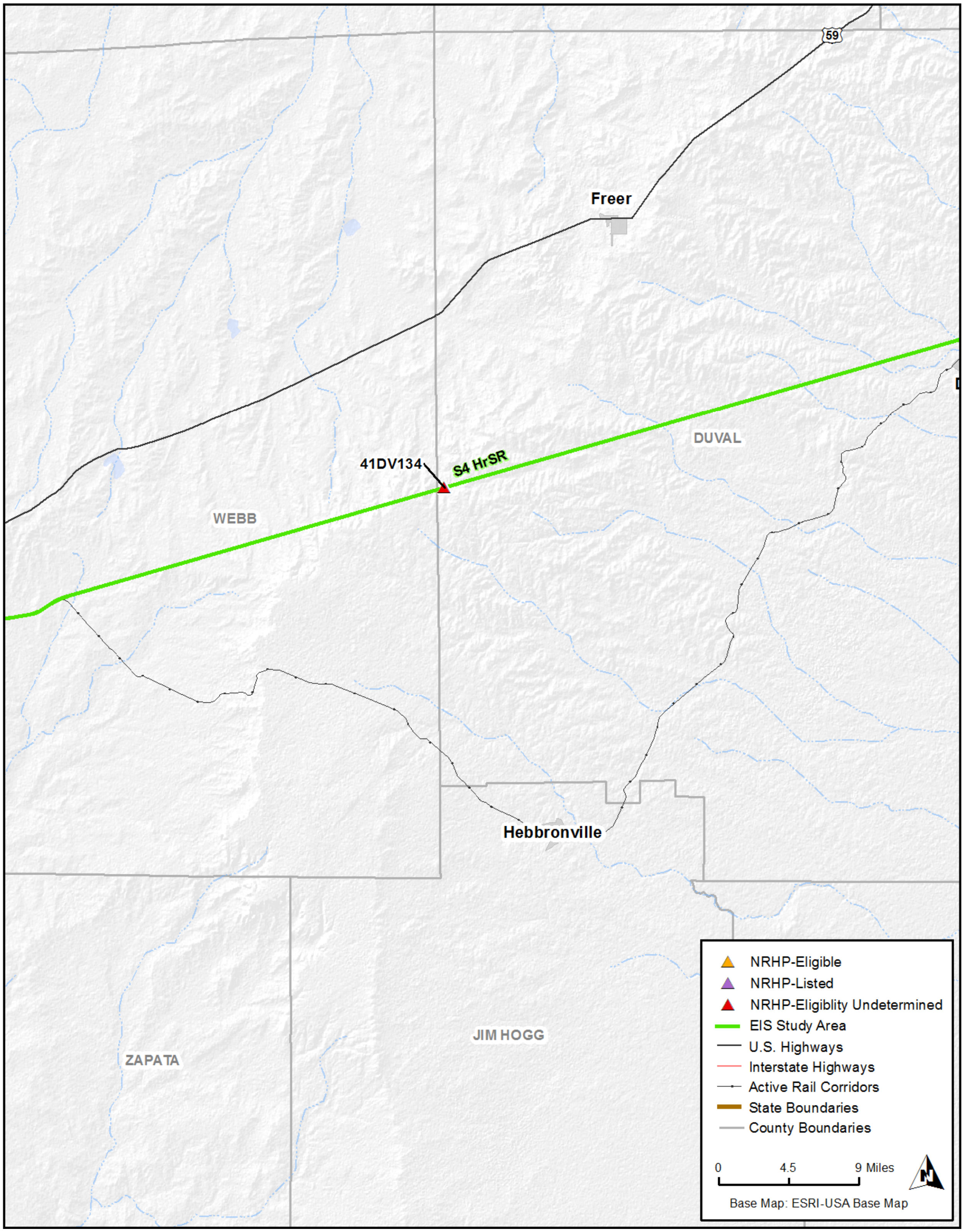

Figure 3.19-11: Archaeological Cultural Resources within the EIS Study Area (Map 10)

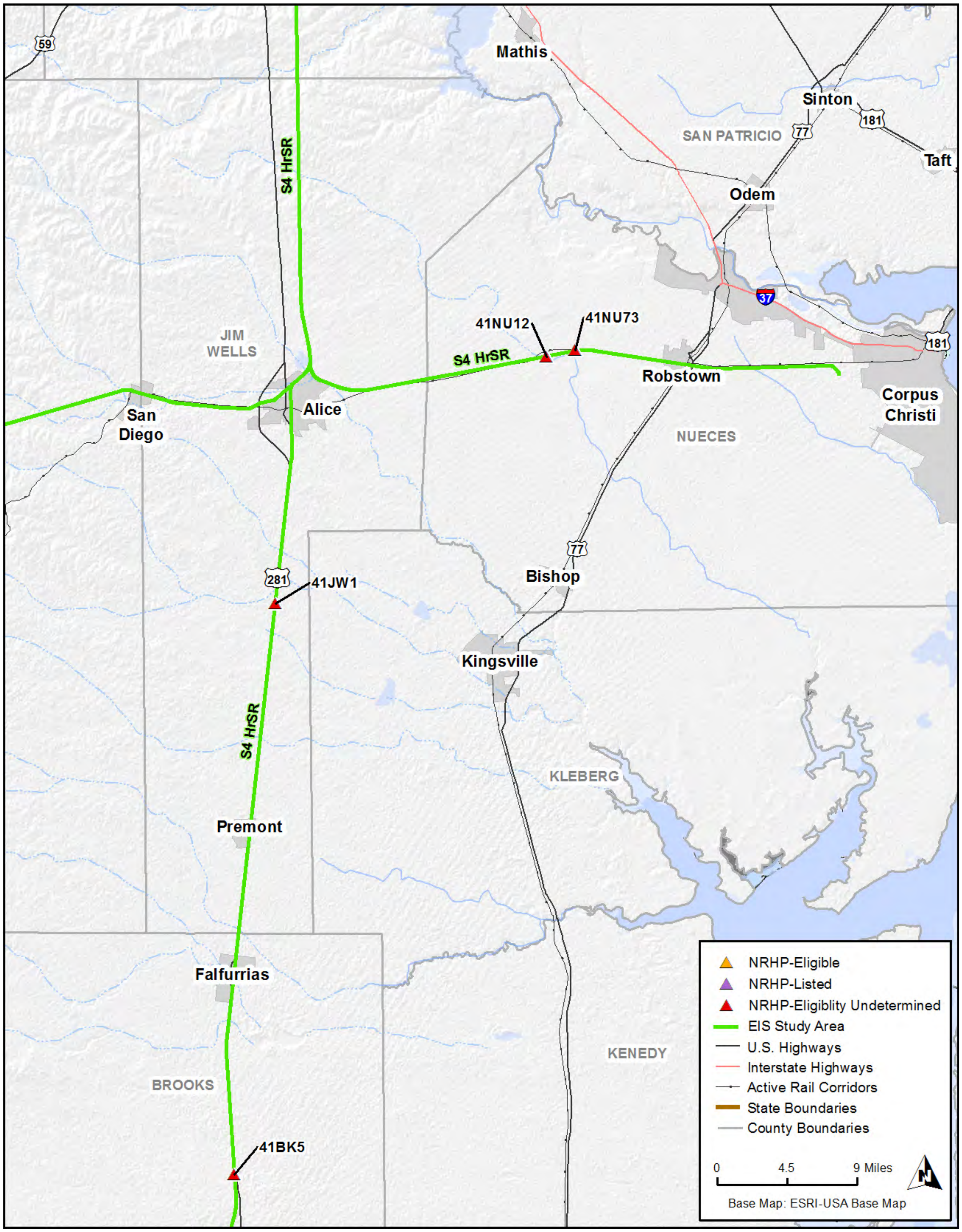

Figure 3.19-12: Archaeological Cultural Resources within the EIS Study Area (Map 11)

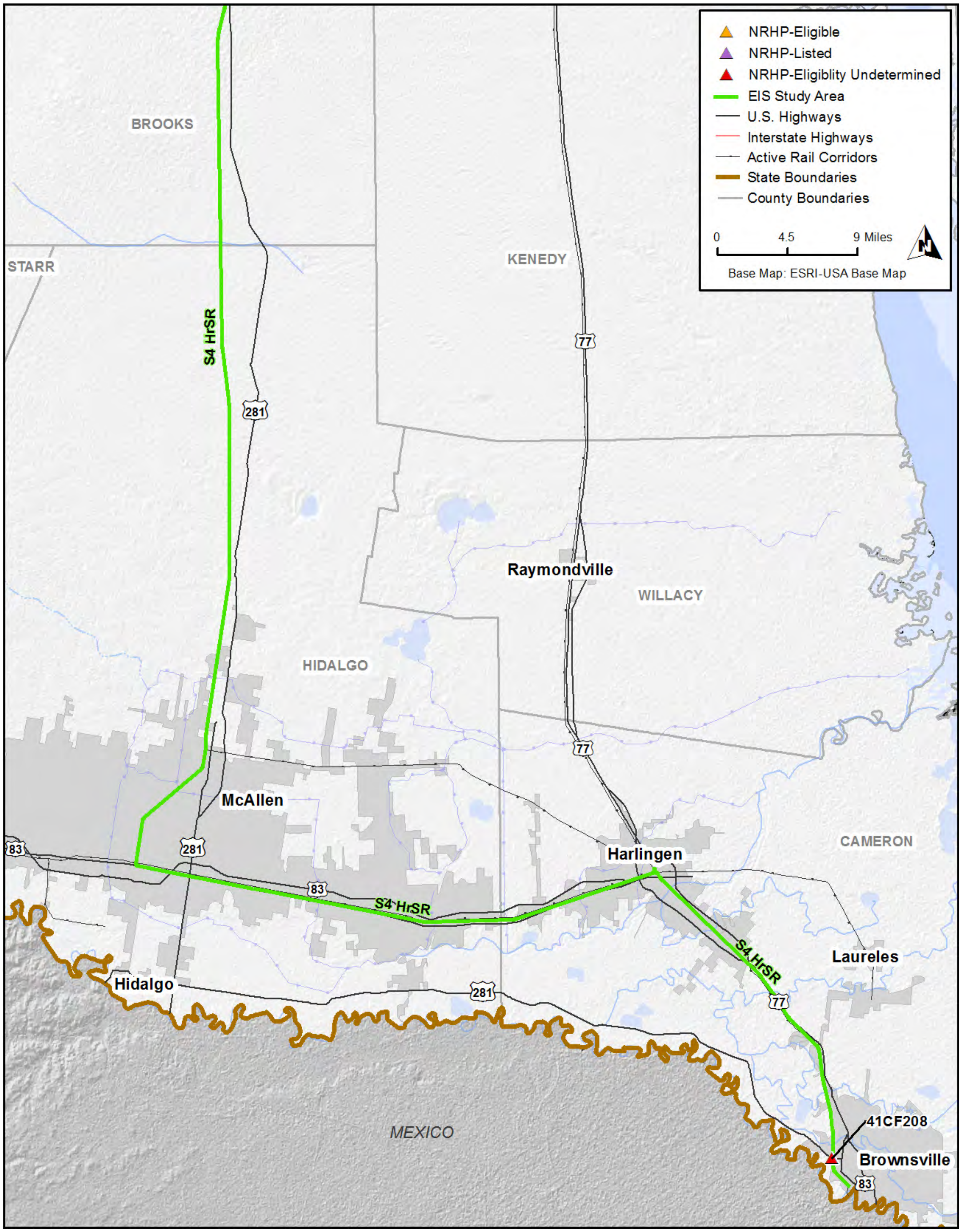

Figure 3.19-13: Archaeological Cultural Resources within the EIS Study Area (Map 12)

3.19.4 Environmental Consequences

3.19.4.1 Overview

Effects during the operations phase would primarily be indirect effects of inducing growth whereupon other development exposes disturbance to archaeological sites. The growth activities indirectly associated with this Program would likely be concentrated around station areas, which are identified to be located near or within urbanized areas, where archaeological sites may have already been disturbed. These effects are not foreseeable at this time and, therefore, are not discussed further.

Identified archaeological sites are presented by geographic section in Table 3.19- and by alternative in Table 3.19-. The number of identified archaeological historic properties does not reflect the significance of archaeological sites within each section. The greatest densities of sites occur where intensive archaeological investigations have been conducted; these include developed areas associated with urban expansion, utility, energy, and transportation projects, as well as park and recreational development and expansion. Archaeological sites are often associated with rivers, streams, and primary drainages and tributaries, as well as existing and former roads and paths; prior to reservoir inundation, intensive investigations of these high probability areas resulted in the recording of large clusters of archaeological sites. Other site types, such as lithic procurement sites and seasonal camps, generally occur farther away from these waterways. Specific areas of high sensitivity (high-probability areas for containing archaeological sites) have not been identified in this analysis; areas of high sensitivity would be further refined and assessed during project-level analyses.

For this service-level analysis, each alternative was evaluated as an independent alternative—even when overlapping other alternatives. Each alternative has termini within large cities, and each route has independent utility. Each alternative could be built alone or in combination with other alternatives. In addition, more than one alternative within the Central or Southern sections could be built because the alternatives provide different service types for different destinations.

Table 3.19-4: Summary of Archaeological Sites by Section

Section	NRHP-listed	NRHP-Eligible	NRHP Eligibility Undetermined	Total Sites
Northern	0	1	14	15[a]
Central	0	2	28	30[a]
Southern	0	1	27	28

Note: This table is a summary of the site tables and figures presented in this section.
[a] Includes six sites represented twice on overlapping Northern and Central sections.

Table 3.19-5: Summary of Archaeological Sites by Alternative

Alternative (Service Type)	Total NRHP-Listed Sites	Total NRHP-Eligible Sites	Total NRHP Eligibility Undetermined	Total Sites
No Build	NA	NA	NA	0
N4A (CONV)	0	1	14	15
C4A (HrSR and HSR)	0	1	25	26
C4B (HrSR and HSR)	0	2	18	20
C4C (HrSR and HSR)	0	1	26	27
S4 (HrSR)	0	1	20	21
S6 (HrSR and HSR)	0	0	7	7
Note: This table is a summary of the site tables and figures presented in this section.				

3.19.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect archaeological sites. However, as identified in Chapter 2 (Section 2.2) and the introduction to Chapter 3, the No Build Alternative does not meet the purpose and need for the Program. Without the Program, the opportunity to concentrate growth and development at central urban districts may not be as attractive because continued growth would worsen travel and accessibility. This could lead to other, more land-consuming transportation infrastructure, thus disturbing more land area and potentially affecting more archaeological sites.

3.19.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.19.4.3.1 Alternative N4A Conventional

There are known archaeological sites located in proximity to Alternative N4A Conventional. Alternative N4A Conventional would have a negligible effect on urban, suburban, and rural archaeological sites during the construction phase if it would involve improvement of existing railroad infrastructure and new track, sidings, and other facilities within the existing right-of-way. However, if improvements are built parallel and adjacent to existing railroad facilities and tracks, minimal new rights-of-way and easements may be required, resulting in the potential for moderate effects on archaeological sites. Renovation of existing stations within urban, suburban, and rural areas would pose negligible potential effects on archaeological sites. In addition, construction activities, including vehicular and heavy equipment access/egress, parking facilities, and staging areas, would pose moderate potential effects on archaeological sites compared with the No Build Alternative.

3.19.4.4 Central Section: Dallas and Fort Worth to San Antonio

Each of the Central Section alternatives has a similar number of identified archaeological sites. This may not be a true indication of the actual presence of archaeological resources, and therefore, the variation of effects among Central Section alternatives is the degree of potential ground disturbance in areas with high potential for dense archaeological resources. The Central Section high-speed rail alternatives would have a larger area of disturbance than higher-speed rail alternatives and, thus, have a higher probability of affecting archaeological sites.

3.19.4.4.1 Alternative C4A Higher-Speed Rail

Alternative C4A Higher-Speed Rail would have a moderate effect on archaeological sites during the construction phase as it would either be built parallel and adjacent to existing railroad facilities and tracks or in new alignments. Both of these scenarios would require new rights-of-way and easements and disturbance of large subsurface areas. Expansion of existing stations and construction of new stations within urban, suburban, and rural areas would pose moderate potential effects on archaeological sites. Construction activities, including vehicular and heavy equipment access/egress, parking facilities, and staging areas, would also pose moderate potential effects on archaeological sites compared with the No Build Alternative. Additionally, expansion of existing stations and construction of new stations within urban, suburban, and rural areas would pose moderate potential effects on archaeological sites.

3.19.4.4.2 Alternative C4A High-Speed Rail

In major urban areas, such as Fort Worth, Dallas, and San Antonio, Alternative C4A High-Speed Rail facilities would result in the construction of a new alignment. Archaeological sites may already have been substantially disturbed or covered and left intact in the urban areas. Conversely, the dense development in these areas may limit the ability to avoid identified archaeological sites; therefore, the potential for effects would be moderate for these areas. Likewise, new station facilities and construction activities in urban areas, including vehicular and heavy equipment access/egress, parking facilities, and staging areas, would potentially pose moderate effects on archaeological sites based on the same limitations.

In suburban and rural areas, effects on archaeological sites would be moderate during the construction phase because construction of a new alignment and stations would be required. Although suburban areas typically feature more open space than dense urban environments, which may enable more flexibility to minimize or avoid project effects, the high-speed rail alignment must remain straight or have gradual curvatures, which would limit the ability for avoidance. Additionally, high-speed rail service requires crossings to be grade-separated, which would require structural support or deep excavation. These factors have potential to result in substantial effects on deeply buried archaeological sites within urban, suburban, and rural settings. Conversely, the elevated portions of the trackway may be able to span archaeological historic properties. Minimization or avoidance of urban, suburban, and rural archaeological historic properties would be conducted at the project level to the extent possible to avoid known sites and properties.

3.19.4.4.3 Alternative C4B Higher-Speed Rail

Although Alternative C4B Higher-Speed Rail is different and slightly shorter than Alternative C4A Higher-Speed Rail, the same types of effects on archaeological sites would occur. The potential effect of Alternative C4B Higher-Speed Rail on known archaeological resources would be moderate.

3.19.4.4.4 Alternative C4B High-Speed Rail

Alternative C4B High-Speed Rail has the same EIS Study Area as Alternative C4B Higher-Speed Rail and, therefore, would potentially affect the same archaeological resources. As with Alternative C4A High-Speed Rail, in major urban and suburban areas, such as Fort Worth, Dallas, Waxahachie, Waco, Temple, Austin, and San Antonio, Alternative C4B High-Speed Rail facilities may include deep excavation for grade separations and pier installation. This alternative would represent the same substantial effects on archaeological resources as Alternative C4A High-Speed Rail.

3.19.4.4.5 Alternative C4C Higher-Speed Rail

Alternative C4C Higher-Speed Rail is the longest alternative in the Central Section and therefore may affect more archaeological sites. However, the treatment and avoidance measures would be the same as Alternative C4A Higher-Speed Rail. Therefore, this alternative would represent the same moderate effects on archaeological resources as the higher-speed rail service type for Alternatives C4A and C4B.

3.19.4.4.6 Alternative C4C High-Speed Rail

Alternative C4C High-Speed Rail has the same EIS Study Area as Alternative C4C Higher-Speed Rail and therefore would potentially affect similar archaeological resources. However, because of the service type, it would have similar characteristics and effect types as Alternative C4A High-Speed Rail. This alternative would represent the same substantial effects on archaeological resources. Minimization or avoidance of urban, suburban, and rural archaeological historic properties would be conducted at the project level to the extent possible to avoid known sites and properties.

3.19.4.5 Southern Section: San Antonio to South Texas

The EIS Study Area for Alternative S4 Higher-Speed Rail has a higher number of identified archaeological sites than the EIS Study Area for Alternative S6 (both service types). This may not be a true indication of the actual presence of archaeological resources, but instead is likely a result of intensive archaeological investigations associated with large-scale development projects within the Laredo area.

3.19.4.5.1 Alternative S4 Higher-Speed Rail

Compared with the No Build Alternative, Alternative S4 Higher-Speed Rail would have moderate effects on archaeological resources because the longer length of the alternative has the potential to result in disturbance of more identified and unidentified sites. In areas where Alternative S4

Higher-Speed Rail would parallel existing transportation corridors, minimization of soil disturbance may avoid some sensitive sites.

3.19.4.5.2 Alternative S6 Higher-Speed Rail

Alternative S6 Higher-Speed Rail has a low number of identified archaeological resources; however, the EIS Study Area does not parallel existing transportation facilities for much of the proposed route. Therefore, it still has the potential for moderate effects on identified and unidentified archaeological resources. Alternative S6 is substantially shorter in linear miles than Alternative S4 and, therefore, may result in overall lower effects on archaeological resources.

3.19.4.5.3 Alternative S6 High-Speed Rail

Alternative S6 High-Speed Rail would be constructed on a new alignment. Because design criteria for high-speed rail require straight and large radii curves, the ability to avoid effects on archaeological sites would be difficult. The potential for effects on archaeological sites would be moderate for these areas. Likewise, new station facilities and construction-related activities, including vehicular and heavy equipment access/egress, parking facilities, and staging areas, would pose moderate potential effects on archaeological sites. Additionally, high-speed rail service requires crossings to be grade-separated, which would require structural support or deep excavation. These factors have potential to result in substantial effects on deeply buried archaeological sites within urban, suburban, and rural settings.

3.19.4.6 Summary of Potential Effects

All alternatives, except the No Build Alternative, have the potential to disturb identified archaeological sites (Table 3.19-). Alternative N4A Conventional would have moderate effects on archaeological resources because it would primarily remain within the existing rail right-of-way, where sites may already have been removed or disturbed, but would still require some ground disturbance. Depending on the alternative, the Central Section alternatives could result in substantial effects on archaeological resources because of the potential for large areas of soil disturbance. Although both higher-speed and high-speed rail service types would likely result in the removal of archaeological resources, avoidance may be more difficult for the high-speed rail alternatives than the higher-speed rail alternatives because of the larger area of soil disturbance where grade separations would be necessary. Additionally, the high-speed rail alternatives have the potential for substantial effects where excavation and piers may destroy resources because pre-construction surveys may not be practical. In the Southern Section, the alternatives are likely to result in moderate effects on archaeological resources, except Alternative S6 High-Speed Rail, which may result in substantial effects for deep excavation or pier construction.

Table 3.19-6: Summary of Effects on Archaeological Sites

Section	Alternative	Context	Potential Intensity of Effects[a, b]
		No. of NRHP-listed or -eligible sites	
No Build Alternative[c]		NA	No effect
Northern	N4A-CONV	1	Moderate
Central	C4A-HrSR	1	Moderate
	C4A-HSR	1	Substantial
	C4B-HrSR	2	Moderate
	C4B-HSR	2	Substantial
	C4C-HrSR	1	Moderate
	C4C-HSR	1	Substantial
Southern	S4-HrSR	1	Moderate
	S6-HrSR	0	Moderate
	S6-HSR	0	Substantial

Note: This table is a summary of the effects documented in this section.

[a] Limited to construction-phase effects only.

[b] The most intense effect for each alternative is presented in the table; however, alternatives may include additional less intense effects depending on urban, suburban, or rural locations.

[c] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

3.19.5 Avoidance, Minimization, and Mitigation Strategies

Avoidance and minimization of effects at the project-level would be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies would be implemented. Mitigation strategies are conceptual measures that are often developed in the early stages of a project, but may be applied at various stages of design development. During the project-level analysis, avoidance and minimization of potential impacts on archaeological historic resources would be conducted, prior to mitigation. Mitigation strategies enable project planners to examine appropriate methods to avoid or minimize potential impacts on archaeological historic properties. These evaluations would result in agreements, such as a Memorandum of Agreement (MOA) or Programmatic Agreement, executed among agencies. An MOA would be coordinated with both Oklahoma and Texas SHPOs, Native American tribes, and other interested parties, as appropriate, to review the plan. A Programmatic Agreement would be coordinated with the Federal Railway Administration, TxDOT, Oklahoma Department of Transportation (ODOT), and Oklahoma and Texas SHPOs. Other agreement documents that could constitute mitigation strategies include an Archaeological Sites Monitoring and Treatment Plan or an Unanticipated Discovery Plan (UDP) that would guide archaeological monitoring work during construction. These agreements would likely propose that if significant archaeological sites are inadvertently discovered during construction in any portion of the project area, ground-disturbing activities would be halted and the procedures of the Archaeological Sites Monitoring and Treatment Plan or UDP would be followed.

Mitigation measures for archaeological historic properties would be further developed in consultation with Oklahoma and Texas SHPOs and in consultation with Indian tribes during project-level analyses once an archaeological site has been determined eligible for the NRHP. Project-level analysis would include a more detailed analysis of potentially moderate or substantial impacts and mitigation measures to reduce such impacts. For actions that would result in moderate or substantial impacts on archaeological historic properties that cannot be avoided or minimized, Section 106 of the NHPA would require a more detailed evaluation and determination of specific impacts and proposed mitigation measures at the project level.

3.19.6 Subsequent Analysis

Future project-level analyses will establish an APE for archaeological sites for each specific project. Once identified, archaeological surveys of portions of each APE not previously investigated will be conducted for individual projects when they are proposed. These surveys would be conducted to identify potential archaeological sites (including cemeteries) within the APE, including those that have not been evaluated for NRHP eligibility, in accordance with the Secretary of the Interior's standards for the identification, evaluation, and documentation of historic properties, as well as ODOT and TxDOT guidelines. The survey would include an evaluation of NRHP eligibility of identified archaeological sites and an assessment of adverse effects pursuant to 36 CFR Part 800 of the NHPA.

3.20 Travel Demand and Transportation

This section provides a preliminary assessment of potential effects on travel demand and transportation. This section is based on the findings of the Transportation Technical Study, which is presented in Appendix L. Preliminary avoidance, minimization, and mitigation strategies and further analyses needed in the project-level National Environmental Protection Act (NEPA) analysis are identified at the end of the section. The introduction to Chapter 3 describes the environmental impact statement (EIS) Study Area and the use of such terms as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.20.1 Laws, Regulations, and Orders

Applicable legislation, regulations, and orders pertaining to transportation are described below. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.20.1.1 Federal

3.20.1.1.1 Federal Railroad Administration

Section 14(n)(13) of the Federal Railroad Administration (FRA)'s *Procedures for Considering Environmental Impacts* states: "The EIS should assess the impacts on both passenger and freight transportation, by all modes, from local, regional, national and international perspectives. The EIS should include a discussion of both construction period and long-term impacts on vehicular traffic congestion."

3.20.1.1.2 Passenger Rail Investment and Improvement Act (PRIIA) (49 USC 22705).

In 2008, state rail plans took on an increased importance when Congress passed the Passenger Rail Investment and Improvement Act (PRIIA) (49 United States Code [U.S.C.] 22705). It laid the foundation for an expanded focus on rail planning. PRIIA requires each state to have an approved state rail plan as a condition of receiving rail funding in the future for either passenger or freight improvements. PRIIA requires each state rail plan to include the following:

- Inventory of the existing rail transportation network
- Review of proposed high-speed rail corridors in the state
- Statement of the state's objectives related to rail transportation
- General analysis of rail's economic, transportation, and environmental impacts
- Long-range investment program for current and future rail freight and passenger services
- Discussion of public financing issues for rail projects and listing of current and potential rail-related funding sources
- Discussion of stakeholder-identified rail infrastructure issues

- Review of freight and passenger multimodal rail connections and facilities
- Review of publicly funded rail projects that enhance rail-related safety
- Performance evaluation of passenger rail services
- Compilation of previous high-speed rail reports and studies
- Statement that the state's rail plan complies with PRIIA

3.20.1.2 State

To improve the coordination of the planning, construction, operation, and maintenance of a statewide passenger rail system in the State of Texas, S.B. 1382 (Section 201.6012-6013, Transportation Code), an act passed by the 81st Texas Legislature and approved by the governor on June 19, 2009, requires the Texas Department of Transportation (TxDOT) to prepare and update annually a long-term plan for a statewide passenger rail system. The plan must include the following information useful for the development of the vision, goals, and objectives for the passenger rail system for Texas:

- A description of existing and proposed passenger rail systems
- Information regarding the status of passenger rail systems under construction
- An analysis of potential interconnectivity difficulties
- Ridership projections for proposed passenger rail projects
- Ridership statistics for existing passenger systems

3.20.2 Methodology

To evaluate the potential effects of the demand for the new rail system, a travel demand model was developed to forecast existing and future conditions (Year 2035) by mode (auto, passenger rail, intercity bus, and air travel) within the EIS Study Area for each alternative. For the purpose of this transportation analysis, the EIS Study Area includes the primary routes of travel (e.g., major highway corridors) and sets of modeled city pairs within each geographic section. The model outputs were then used to compare the No Build Alternative against the rail alternatives. A general description of the travel demand model outputs is provided in Table 3.20-1.

Table 3.20-1: Travel Demand Model Outputs

Context	Description	Potential Effect Compared to the No Build Alternative	Evaluation of Intensity of Effects
Travel Demand/Mode Share	Number and percentage of intercity trips taken by mode.	A shift in mode share could be a beneficial or negative effect depending on the mode (e.g., a decrease in bus ridership could have a negative effect on transit service providers).	Negligible: <3% Moderate: 3%-20% Substantial: > 20%

Context	Description	Potential Effect Compared to the No Build Alternative	Evaluation of Intensity of Effects
Travel Time Savings	Travel times by mode between city pairs. For rail, bus, and air, travel time includes on-train/on-plane, or on-bus time and transfer time between city pairs.	Savings in travel time is a beneficial effect of the project.	Negligible: <30 mins. Moderate: 30 mins-60 mins. Substantial: > 60 mins.
Travel Time Reliability	Average variance in travel times between city pairs.	Travel time reliability is a beneficial effect of the project. Trains operate on a scheduled service within a dedicated right-of-way.	Negligible: <30 mins. Moderate: 30 mins-60 mins. Substantial: >60 mins.
Vehicle Miles Traveled (VMT)	Average annual VMT on the highways between city pairs (for auto travel only).	A reduction in VMT is a beneficial effect of the project.	Negligible: <2% Moderate: 2%-5% Substantial: > 5%
Level of Service (trains, buses, and air travel)	Daily number of trains, buses, or flights between city pairs.	Increased (or new) rail service is a beneficial effect of the project.	The intensity of the effect was not evaluated because the analysis assumes no change in level of service for the other modes.
Ridership	Ridership (passengers per year) by mode between city pairs.	Passenger rail travel demand is a beneficial effect of the project.	The intensity of the effect was not evaluated because it is captured in other measures (Travel Demand Mode Share).

Potential effects, including beneficial effects, were characterized using ratings of negligible, moderate, or substantial. These levels of effect determinations are further defined as follows:

- Negligible intensity effects from construction and operation of an alternative are those effects that result in minor changes to travel demand, mode share, travel time, and VMT.
- Moderate intensity effects from construction and operation of an alternative are those effects that result in noticeable changes to travel demand, mode share, travel time, and VMT.
- Substantial intensity effects from construction and operation of an alternative are those effects that result in significant changes to travel demand, mode share, travel time, and VMT, with a probability of a residual effect.

For this service-level analysis, each alternative was evaluated as an independent alternative—even when overlapping with other alternatives. Each alternative has termini within large cities and each alternative could be constructed alone or in combination with other alternatives. In addition, multiple alternatives could be constructed within each region because each alternative provides separate service-type options.

3.20.2.1 Travel Demand

Ridership travel demand measures the potential attractiveness of new passenger rail service investments to the traveling public. Travel demand includes the existing intercity travel demand for the EIS Study Area, by mode, and how this travel demand is expected to change due to the infrastructure and service improvements of each alternative.

The service-level analysis included the following tasks:

- Conducted existing and future-year intercity travel demand forecasts for the EIS Study Area, by mode and level of service.
- Compared the alternatives on their ability to meet the projected intercity travel demand.
- Assessed the impacts on intercity travel times, by mode, between key destinations, for each alternative.

The travel demand model rail forecasting methodology is based on an inter-urban travel mode choice model to predict what percentage of current travelers will divert to the proposed new or improved rail service for their trips. The mode choice models place sensitivities on key elements of travel, such as time and cost, based on survey respondents' answers to hypothetical scenarios about available travel choices. For this study, a new data collection effort to gather such data was undertaken and mode choice model(s) specific to the Program corridors were estimated.

To assess the attractiveness of proposed improvements in the rail mode relative to other existing modes, data about traveler responses to these improvements are needed. These data are often obtained from surveys called Stated Preference (SP) surveys. SP surveys are used to elicit traveler preferences and tradeoffs involving different modal attributes. Survey data can then be used to develop choice models involving the improved mode.

The survey response data were used to develop mode choice models that calculate traveler diversions from existing modes to the rail service with the proposed services. Model development also incorporated relevant information from other sources (e.g., U.S. Department of Transportation guidance on values of time for intercity travel), and professional judgment based on forecasting best practices.

3.20.2.2 Transportation Conditions

The evaluation also describes the current and projected traffic conditions in the EIS Study Area, including average annual VMT, travel times, level of service, and mode share. Changes to traffic conditions due to the infrastructure and service changes proposed by each alternative were assessed based on the projected travel demand (developed from the model). However, this service-level analysis does not include a detailed evaluation of potential impacts to specific roadways, intersections, or specific transportation service providers (bus or air).

The service-level analysis included the following tasks:

- Documented existing traffic conditions within the EIS Study Area, including a general analysis of existing primary travel routes and travel times by mode.
- Documented the anticipated changes to traffic conditions within the study area as a result of each alternative. Potential effects include changes to travel modes, average speeds, travel time, and travel time reliability for both passenger rail and autos.
- Broadly assessed existing and future freight use of the existing routes and impacts on freight travel times, reliability, and areas of conflict.
- Broadly assessed effects on air carriers.
- Broadly assessed effects on intercity transit service providers.
- Identified the likely short-term impacts of construction activities on vehicular traffic congestion.

With the exception of Table 3.20-33: Summary of Travel Demand and Transportation Effects by Alternative, which summarizes the potential intensity of effects, the information reported in all of the tables and figures is based on the travel demand model outputs developed as part of the *Service Development Plan: Initial Service Schedule and Operating Assumptions Texas-Oklahoma Passenger Rail Study – Service-Level EIS Phase* (TxDOT 2016). The model outputs are presented at either the corridor level or the city pair level depending on the context (e.g., travel time vs. mode share). The results at the city level are specific to the pair of cities that are modeled, and may not reflect the travel demand and transportation conditions occurring at the corridor level. Therefore, a comparison between the modeled results at the corridor level versus the city level should not be made. Furthermore, because each alternative was evaluated as an independent alternative, the travel demand model accounts for the individual market segment identified for each alternative. For example, the No Build Alternative would have a different number of total trips (for all modes) compared to the total number of trips for Alternative N4A because each alternative is drawing from a different market segment. Another example is the model results shown for VMT. For instance, Alternative C4A Higher-Speed Rail serves both Austin Downtown and Austin Airport, while Alternative C4A High-Speed Rail only serves Austin Airport. As a result, when computing existing VMTs, the Austin Downtown market is included for Alternative C4A Higher-Speed Rail, but not included for Alternative C4A High-Speed Rail, thus resulting in different VMTs overall. Therefore, due to the nuances in the model outputs, a direct comparison between every alternative is not always possible. Instead, the model provides a reasonable measure of future changes in travel demand, mode share, etc., based on the specific alternative being evaluated.

3.20.3 Affected Environment

3.20.3.1 Overview

The following section provides a general description of the existing transportation facilities (highway corridors, passenger rail, intercity bus, and airports) for each geographic section analyzed. The information within each geographic section is generally described from north to south. Please refer to the Transportation Technical Study in Appendix L for a detailed description of the existing transportation conditions (travel demand, mode share, travel times, level of service, and VMT). This information is not included in the Draft EIS chapter because the alternatives analysis was conducted for the 2035 horizon year only.

3.20.3.2 Northern Section: Oklahoma City to Dallas and Fort Worth

The Northern Section extends approximately 220 miles, beginning in the north in Edmond, Okla., and ending in the south in Dallas. From north to south, the route passes through the cities of Edmond, Oklahoma City, Moore, Norman, Purcell, Pauls Valley, Ardmore, and Marietta, Oklahoma; and Gainesville, Sanger, Denton, Fort Worth and Dallas, Texas. The Northern Section is served primarily by passenger and freight rail, highway, intercity bus, and air travel. The existing transportation modes and facilities are discussed below.

3.20.3.2.1 General Description of Transportation Facilities

Passenger and Freight Rail

Passenger rail service in Oklahoma and North Texas plays a limited role in its transportation system. The Heartland Flyer, operated by Amtrak, provides intercity passenger rail service between Oklahoma City and Fort Worth and is a 418-mile round-trip route. Amtrak operates one train per day in each direction, with station stops in Norman, Purcell, Pauls Valley, Ardmore, and Gainesville, in addition to Oklahoma City and Fort Worth. The train departs Oklahoma City in the morning, arrives in Fort Worth mid-day, and returns to Oklahoma City in the evening. The Heartland Flyer operates on tracks owned by BNSF (Amtrak 2016).

At the Fort Worth end of the Heartland Flyer route, connections can be made in Fort Worth to Amtrak's Texas Eagle, which operates between Chicago and Los Angeles via San Antonio. Connections can also be made to the Trinity Railway Express (TRE), a commuter rail line (described below) that provides a connection to Dallas and its public transportation network.

The TRE is a 35-mile regional commuter train service that operates between downtown Fort Worth and downtown Dallas. There are 10 stations between the cities, including the Texas and Pacific station in downtown Fort Worth, the Fort Worth Intermodal Transportation Center (ITC), Richland Hills, Bell, CentrePort/Dallas/Fort Worth International Airport (DFW), Downtown Irving Crossing, Medical Market Center, Victory Station, and Dallas Union Station. There are 17 weekday departures from Fort Worth. Reduced service is offered on Saturday and no service on Sunday. Connections between the Heartland Flyer and TRE are not coordinated at Fort Worth, resulting in significant time delays between these services.

Within the Northern Section, BNSF and UPRR operate north-south routes with significant freight traffic through central Oklahoma and Texas. The MidCon route, operated by BNSF, operates between Canada and the Gulf Coast and generally parallels the IH-35 corridor. This north-south route is vital in connecting ports on the Gulf Coast and markets in Mexico with the central United States (Oklahoma Department of Transportation [ODOT] 2012). The number of freight trains per day varies significantly depending on the route and segment and ranges from approximately 15 to 100 trains per day (Texas A&M Transportation Institute [TTI] 2010).

Regional Highway System

The highway system constitutes the foundation of the region's overall transportation infrastructure. Within the Northern Section, the primary highways, along the corridor, are Interstate Highway (IH)-35, IH-235, and U.S. Highway (US)-77.

IH-35 begins at the border with Mexico at Laredo, Texas, and terminates at Duluth, Minnesota, approximately 200 miles southwest of the Canadian border. Within the EIS Study Area, IH-35 runs north-south through central Texas and central Oklahoma. Within Oklahoma, IH-35 connects the cities of Blackwell, Perry, Guthrie, Oklahoma City, Moore, Norman, Purcell, Pauls Valley, Ardmore, and Thackerville. Within central Texas, IH-35 connects the cities of Denton, Argyle, Corral City, and the greater Fort Worth metropolitan area.

IH-235 is a north-south spur of IH-35 that connects IH-35 and IH-40 in downtown Oklahoma City to IH-44, north of downtown. It is also called the Centennial Expressway.

US-77 is a north-south highway that connects Brownsville, Texas in the south with Sioux City, Iowa in the north. Within the Northern Section, US-77 connects Edmond to Oklahoma City and generally parallels IH-35 to the east, connecting all of the major cities in the Northern Section.

Intercity Bus

The Northern Section is served by two traditional intercity motor coach operators—Jefferson Lines and Greyhound. Jefferson Lines provides a route that crosses Oklahoma diagonally from the northeast, originating in Kansas City, with stops in Bartlesville, Stillwater, Tulsa, Oklahoma City, Chickasha, Lawton, and terminating in Wichita Falls, Texas (Jefferson Lines 2016). Greyhound provides direct service from Oklahoma City to Dallas and from Norman to Dallas. Indirect service (e.g., transfers are required) is provided by Greyhound to all major cities in the area (Greyhound 2016).

The Central Oklahoma Transportation & Parking Authority operates Metro Transit, a public transit service concentrated into a service area of Oklahoma City and Midwest City with express bus service to Norman. The Oklahoma City system has fixed routes that originate from the Downtown Transit Center with generally 15-minute headways throughout the day. There are approximately 30 routes that serve all areas of the city. Included in these routes are four express routes to suburban areas (Central Oklahoma Transportation & Parking Authority 2016).

3.20.3.2.2 Air Service

The Northern Section is served by three commercial service airports: Will Rogers World Airport (OKC), Dallas-Fort Worth (DFW) Airport, and Dallas Love Field Airport (DAL).

OKC is located approximately 6 miles from downtown Oklahoma City, near the junctions of IH-35, IH-40, and IH-44. OKC handles an average of 150 commercial flights each day, carrying more than 3.5 million passengers annually. Five commercial carriers operate at OKC with service to 21 nonstop destinations. Regionally, direct service is provided to Dallas (DAL and DFW) and Houston George Bush Intercontinental Airport (IAH) and Houston Hobby Airport (HOU) (Will Rogers World Airport 2016; Oklahoma City Department of Airports 2016).

DFW is located within the cities of Irving, Euless, Grapevine, and Coppell, between the major cities of Dallas and Fort Worth. DFW is the primary international airport serving the Dallas and Fort Worth metropolitan area. DFW is ranked fourth in the world for operations (aircraft movements) and tenth in the world for number of passengers served. DFW has 24 passenger airlines and serves over 60.4 million passengers annually. Within the EIS Study Area, DFW provides direct service to Wichita, Tulsa, Oklahoma City, Waco, Killeen, Austin, San Antonio, Houston (IAH and HOU), Corpus Christi, and Laredo (DFW 2016).

DAL is located 7 miles northwest of the downtown central business district. DAL serves an average of over 7 million passengers annually. Within the EIS Study Area, DAL provides direct service to Kansas City, Tulsa, Oklahoma City, Austin, Houston (IAH and HOU), and San Antonio (Dallas Love Field 2016).

3.20.3.3 Central Section: Dallas and Fort Worth to San Antonio

The Central Section extends approximately 260 miles, beginning in the north in Dallas and Fort Worth and ending in the south in San Antonio. From north to south, the route passes through the cities of Fort Worth, Dallas, Arlington, Waxahachie, Hillsboro, Waco, Temple, Taylor, Austin, San Marcos, New Braunfels, Schertz, and San Antonio, Texas.

The Central Section EIS Study Area differs by alternative north of Hillsboro but is the same for all alternatives south of Hillsboro. The following section provides a general description of the primary transportation facilities/services in the Central Section. The section is served primarily by passenger and freight rail, highway, intercity bus, and air travel. Because the alternatives could be built as individual, stand-alone projects, there is some overlap in facilities/services between the Northern and Central sections.

3.20.3.3.1 General Description of Transportation Facilities

Passenger and Freight Rail

As previously described, Amtrak currently operates the Heartland Flyer and the Texas Eagle. The Texas Eagle operates between Chicago and San Antonio daily and between Chicago and Los Angeles three days per week. Within the Central Section, the Texas Eagle stops in Fort Worth, Dallas, Cleburne, McGregor, Temple, Taylor, Austin, San Marcos, and San Antonio. Thruway Amtrak Motorcoach connections are provided to Shreveport and Houston via Longview; Fort Hood and Killeen via Temple; Brownsville and Laredo via San Antonio; and Albuquerque via El Paso.

Regional/commuter rail service is provided on the TRE (Dallas to Fort Worth), as previously described, and Capital MetroRail in Austin. Capital MetroRail offers service Monday through Friday between Leander and downtown Austin and from Lakeline to downtown on Saturday.

TEX Rail is a 27-mile commuter rail project being constructed by the Fort Worth Transportation Authority ("The T"). The line begins in downtown Fort Worth at the existing Texas and Pacific Station (currently served by TRE commuter service) and travels through the ITC station, continuing across northeast Tarrant County to the cities of North Richland Hills and Grapevine and into DFW. At full build-out, the service is projected to have more than 13,600 daily riders using nine rail stations.

As previously described, BNSF and UPRR operate north-south routes with significant freight traffic through central Oklahoma and Texas. The MidCon route, operated by BNSF, operates between Canada and the Gulf Coast and generally parallels the IH-35 corridor. This north-south route is vital in connecting ports on the Gulf Coast and markets in Mexico with the central United States (ODOT 2012). The number of freight trains per day varies significantly depending on the route and segment and ranges from approximately 15 to 100 trains per day (TTI 2010).

Regional Highway System

IH-35 is the primary north-south highway running through the Central Section. IH-30 is the primary east-west highway between Dallas and Fort Worth.

Intercity Bus

Within the Central Section, Greyhound serves the Dallas/Fort Worth Metroplex, with four stops in Dallas, including Dallas Union Station, and two stops in Fort Worth. Additional Greyhound stations are located in Arlington, Dublin, Garland, Lewisville, Richardson, Stephenville, Terrell, Waxahachie, Hillsboro, Waco, Killeen, Temple, Weatherford, Round Rock, Austin, Bastrop, Kerrville, San Marcos, and San Antonio. Greyhound also provides coordinated schedules and through ticketing services for passengers along routes served by All Aboard America, Kerrville Bus Company, Inc., Valley Transit Company, Inc.; T.N.M. & O Coaches, Inc., Arrow Trailways (terminal in Round Rock), and Concho Coaches provide additional routes, although they do not coordinate with Greyhound and passengers wishing to travel on these carriers must obtain schedules and purchase tickets directly from the individual bus company (TTI 2010).

In addition to the U.S.-based intercity carriers, several Mexican intercity bus companies provide service in the state, particularly along the Laredo-Dallas corridor. El Conejo, El Expreso, Tornado, Autobus Adame, and Americanos USA are some of the carriers operating in the Central and Southern sections. However, finding route and schedule information for these carriers is more difficult than for the larger U.S.-based carriers; they advertise primarily in Spanish language newspapers and only some provide information online (TTI 2010).

Public transportation services are provided by small and large transit-focused organizations, as well as private bus companies. The three largest public agencies include Dallas Area Rapid Transit (DART), The T, and the Denton County Transportation Authority. Other local organizations provide complementary services that coordinate transit operations in less densely populated areas in north-central Texas. There are an additional 80 known public, private, and specialized transportation service providers in north-central Texas.

DART serves the cities of Addison, Carrollton, Cockrell Hill, Dallas, Farmers Branch, Garland, Glenn Heights, Highland Park, Irving, Richardson, Rowlett, Plano, and University Park. DART's services include 45 miles of light rail and 130 bus routes. DART light rail connects with the TRE for service to the DFW and to Fort Worth. DART's 2030 system plan includes an additional 43 miles of light rail service, 77 miles of enhanced bus service corridors, and 20 miles of rapid bus service corridors (TTI 2010).

The T offers fixed route and express bus service within Fort Worth, plus a "Rider Request" demand-response circulator service in Richland Hills. Many of The T's bus routes connect with the TRE at either the ITC or the Texas and Pacific Station.

The Denton County Transportation Authority provides fixed-route service in the cities of Denton, Lewisville, and Highland Village. The Denton County Transportation Authority's Commuter Express bus service travels from park-and-rides in Denton and Lewisville to downtown Dallas, the DART North Carrollton Transit Center, Texas Women's University, and the University of North Texas.

The Capital Metropolitan Transportation Authority (Capital Metro) provides urban transit service in the cities of Austin, Manor, San Leanna, Leander, Jonestown, Lago Vista, Point Venture, Volente, and some of the incorporated areas of Travis and Williamson counties. A variety of bus services serve different travel markets; options include local, limited-stop and "flyer," crosstown, and express bus routes; feeder routes that connect selected neighborhoods to Capital Metro Transit Centers, airport shuttles, downtown circulators; and a dial-a-ride route serving Lago Vista, Jonestown, and Leander.

The Hill Country Transit District provides demand-response transit service to Bell, Coryell, Hamilton, Lampasas, Llano, Mason, Milam, Mills, and San Saba counties and fixed-route service in the cities of Copperas Cove, Killeen, Harker Heights, Nolanville, and Temple. Waco Transit provides fixed-route service within Waco and connects to Greyhound at the Waco Intermodal Center. The Waco Streak bus line provides three roundtrips per day from Waco to DFW. The Waco Intermodal Transit Center serves Waco Transit as well as Greyhound.

VIA Metropolitan Transit (VIA) provides public transportation services to San Antonio, 13 suburban cities, and the unincorporated areas of Bexar County. Services currently include 85 fixed routes and four downtown circulator routes. VIA also sponsors commuter vanpools in partnership with Enterprise Rent-a-Car; some of these vanpools travel between San Antonio and Austin.

VIA has opened two new major transit centers connecting the region's largest employment centers—the Westside Multimodal Transit Center and the South Texas Medical Center Transit Center—and implemented the region's first high-capacity transit line, VIA Primo/BRT, on the Fredericksburg Road corridor.

Air Service

DFW and DAL, as described previously, provide commercial air service in the Central Section.

The Austin-Bergstrom International Airport serves the greater Austin metropolitan area and is located approximately 5 miles southeast of downtown Austin. The Austin-Bergstrom International Airport has two runways and three helipads. It served nearly 12 million passengers in 2015 and is the 35th busiest airport for total passengers in the United States.

San Antonio International Airport is located in northern San Antonio, approximately 8 miles from downtown. The airport provides commercial airline service for the south Texas region and approximately 8.5 million passengers fly into and out of San Antonio each year.

Regional airports in the Central Section include Waco Regional Airport/McGregor Executive Airport and Killeen/Fort Hood Regional Airport.

3.20.3.4 Southern Section: San Antonio to South Texas

The Southern Section includes two distinct alignments, and extends approximately 120 to 145 miles, depending on the alignment. The section begins in the north in San Antonio and ends in either Brownsville (Alternative S4) or Laredo (Alternative S6) in southern Texas. With the exception of the urban areas of San Antonio, Alice, Corpus Christi, Laredo, Kingsville, Raymondville, McAllen, Harlingen, and Brownsville, Texas, the Southern Section is predominately rural.

The following section provides a general description of the primary transportation facilities and services in the Southern Section. The section is served primarily by highway and intercity bus travel, with some local air service. There is some overlap in facilities and services between the Central and Southern sections.

3.20.3.4.1 General Description of Transportation Facilities

Passenger and Freight Rail

There is currently no passenger rail service in the Southern Section.

Regional Highway System

IH-35 is the major north-south highway between San Antonio and Laredo. To the west, IH-37 is the major north-south highway connecting San Antonio and Corpus Christi.

Intercity Bus

Valley Transit Company, a Greyhound affiliate company, connects the Lower Rio Grande Valley to Houston, San Antonio, and Laredo, with stops in the three primary cities (Brownsville, Harlingen, and McAllen). The Valley Transit "Main Line" through the Lower Rio Grande Valley also operates as express bus service along US-83 from Brownsville to McAllen.

The Harlingen Express, a flex-route bus service, provides local service in Harlingen. The Brownsville Urban System provides urban transit service within Brownsville and the McAllen Express Transit provides urban transit service within McAllen.

Air Service

As previously described, San Antonio International Airport provides commercial airline service for the south Texas region.

Brownsville/South Padre Island International Airport (BRO) is located approximately 4 miles east of downtown Brownsville. The airport is served by three commercial airlines and is a convenient airport for flying into the Rio Grande Valley and northern Mexico. The airport has scheduled nonstop passenger flights to DFW and IAH.

Corpus Christi International Airport is approximately 5.5 miles west of downtown Corpus Christi. The airport is served by three commercial airlines, with scheduled non-stop passenger flights to DFW and IAH, and HOU.

Valley International Airport is located 3 miles northeast of Harlingen. The airport is served by four commercial airlines, with scheduled non-stop passenger flights to HOU, IAH, and Austin. Non-stop service is also provided on a seasonal basis to Minneapolis/St. Paul and DFW.

Laredo International Airport is located approximately 4 miles northeast of downtown Laredo. The airport is served by three commercial airlines, with scheduled non-stop passenger flights to IAH and DFW.

McAllen Miller International Airport is located approximately 2.5 miles south of downtown McAllen. The airport is served by four commercial airlines, with scheduled non-stop passenger flights to IAH and DFW.

3.20.4 Environmental Consequences

3.20.4.1 Overview

This section compares the alternatives on their ability to meet the projected intercity travel demand and documents the anticipated changes to traffic patterns by alternative, including changes in mode share, travel time, travel time reliability (for passenger rail and autos), and VMT. A qualitative discussion of potential effects on air carriers, intercity transit service providers, and freight operations is also provided. The analysis presented is for the 2035 conditions only.

With all of the build alternatives, highway, bus, and air travel decreases as users are diverted from these modes to the new rail service. Based on the broad assessment conducted, increases in mode share to rail could provide both negative and beneficial effects across all mode choices. For highway travel, the decrease in mode share would be a beneficial effect, based on users being encouraged to use transit and reduce congestion on highways, which could also provide a secondary benefit to bus service providers. Likewise, the increase in mode share for passenger rail is considered a beneficial effect of the project.

The diversion of intercity bus and air travelers to the rail system may yield additional benefits by providing a mode choice for travelers, travel time savings, and increased schedule reliability. For air carriers, the potential benefits may include the opportunity to shift from short-haul to longer-haul flight operations, which may include more reliable scheduling and increased revenue.

There are also negative effects for bus and air travel carriers, since a reduction in their mode share would affect intercity bus service providers and air carrier operations (e.g., existing demand, schedule adjustments/reductions, and revenue). The shift in mode share and the corresponding effects are discussed further throughout the alternative sections, and the results vary from negligible to substantial, depending on the alternative.

For example, automobile drivers do not typically switch to transit without significant gains in travel time or reductions in cost. Compared with the No Build Alternative, the build alternatives save travelers time compared with highway travel in most cases (high-speed service providing the most time savings), with time savings generally increasing as the trip length increases or for urban areas where congestion levels are forecast to increase and highway travel time increases.

Travel time reliability is another beneficial effect of the project. Trains operate on a scheduled service within a dedicated right-of-way and are not subject to fluctuations in traffic congestion. Highway travel time reliability will vary from location to location, depending on future traffic conditions in the area. In general, the Build Alternatives provide travel time reliability for train travelers, compared with expected increases in highway drive times. A reduction in VMT is also a beneficial effect of the project. VMT changes vary by alternative, from negligible changes (less than 2 percent) to substantial changes (more than 5 percent).

The potential effects, beneficial or negative, from air carrier operations, which may include shifting their existing short-haul flights to longer-haul flights, have not been assessed as part of this service-level analysis (see Section 3.20.6, Subsequent Analysis).

3.20.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2 (Section 2.2) and the introduction to Chapter 3, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program. The No Build Alternative is carried forward as a baseline alternative and provides an alternative for comparative evaluation of the advantages and disadvantages of the build alternatives. The context of the No Build Alternative is the 2035 horizon year, which is the year when the project is projected to occur. Under the No Build Alternative, it is assumed that the level of service for rail, bus, and air would remain the same. There would be no increase in rail ridership because there would be no expanded rail service and there would be no diversion of bus ridership and air to rail. There would be no effect on these modes and no effect on intercity transit service providers and air carriers because operations would remain the same. The benefits of fewer VMT (lower congestion, increased transit use, etc.) would not be realized with the No Build Alternative. Under the No Build Alternative there would be no effects on local transportation (e.g., roadway and intersection operations, parking demand, etc.) because there would be no change in mode shift or demand.

3.20.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.20.4.3.1 Alternative N4A Conventional

Alternative N4A would increase the existing passenger rail service between Oklahoma City and Dallas and Fort Worth from one daily train to six daily trains, as well as provide an expanded route north to Edmond, Okla.

Travel Demand and Mode Share

Table 3.20-2 presents the projected yearly ridership and mode share for the No Build Alternative and Alternative N4A.

Table 3.20-2: 2035 Travel Demand and Mode Share – Alternative N4A

Mode	Travel Demand (Trips per Year)		Mode Share (Percentage by Mode)	
	No Build	N4A	No Build	N4A
	Oklahoma City – Dallas and Fort Worth			
Auto	38,115,278	37,875,193	99.0%	97.8%
Passenger Rail	109,028	702,034	0.3%	1.8%
Intercity Bus	130,272	65,711	0.3%	0.2%
Air	147,588	83,313	0.4%	0.2%

Under Alternative N4A, highway, bus, and air travel would decrease as users would be diverted from these modes to the new rail service. For highway travel, the decrease in mode share would be a beneficial effect. Users would be encouraged to use transit and reduce congestion on highways as a result of having a new mode choice. Likewise, the increase in mode share for passenger rail would be a beneficial effect for the Northern Section. For bus and air travel, a reduction in mode share would be a negative effect as this change would affect intercity bus service providers and air carriers' operations (e.g., demand, schedule, and revenue).

Under Alternative N4A, the reduction in mode share for highway travel would be less than 2 percent, which would be a negligible effect. The increase in mode share for passenger rail would be substantial. Passenger rail ridership is forecast to increase to over 700,000 passengers per year, which is a 500 percent increase in mode share over the 2035 No Build Alternative. For bus and air, the shift in mode share would also be substantial. The mode share for bus would decrease by 33 percent and the mode share for air would decrease by 50 percent. The ridership data (including diverted trips and induced demand) are described in further detail in the Passenger Rail Ridership section.

Travel Time Savings

Table 3.20-3 provides a comparison of the projected travel time for the different modes.

Table 3.20-3: 2035 Travel Time Comparison by Mode – Alternative N4A

Mode	Travel Time (minutes)[a]		
	Oklahoma City–Dallas	Oklahoma City–Fort Worth	Dallas–Fort Worth
Highways	225	219	40
Passenger Rail	418	238	60
With N4A[b]	266	217	41
Intercity Bus	391	473	72
Air	52	59	-

[a] Except for passenger rail, travel time is assumed to be the same for the No Build Alternative and Alternative N4A.

[b] Estimated passenger rail time with Alternative N4A.

It is assumed that there would be no significant difference in travel time between the No Build Alternative and Alternative N4A for autos, bus, and air because these modes would not see a significant change in their travel times after the rail service is introduced. While there would be travel times saved for those who elect to use the new passenger rail system, there would be no significant travel time savings for those users who continue to use their existing modes. For example, the removal of a few thousand cars per day on roads with 100,000 cars or more per day, such as IH-35, would not affect the congestion significantly enough to improve travel times on the road. Similarly, the few hundreds of air and bus travelers removed from the existing planes and buses would not affect plane frequency and bus frequency or their travel times, so the remaining air and bus travelers (who continue to use air or bus travel) will not see any reduction in their travel times.

Therefore, this analysis focuses on the travel time savings for rail users compared to the other modes. Under Alternative N4A, rail and highway travel times would be similar; therefore, Alternative N4A would have a negligible effect on travel time compared with highway travel. There would be improvements in passenger rail travel time under Alternative N4A due to increases in rail frequency, as well as better rail connections between the cities in the Northern Section. Passenger rail service between Oklahoma City and Dallas would take approximately 2.5 hours less than the No Build Alternative, approximately 20 minutes less between Oklahoma City and Fort Worth, and approximately 20 minutes less between Fort Worth and Dallas. Alternative N4A would have a beneficial effect on passenger rail travel time savings.

Alternative N4A would also provide significant travel time savings compared to intercity bus travel. Under Alternative N4A Conventional, passenger rail service would take approximately 3.5 to 4 hours (217 to 266 minutes) between Oklahoma City and the Dallas and Fort Worth area. However, it is predicted that future bus travel would take up to 8 hours (473 minutes).

Travel Time Reliability

Highway travel time is projected to increase over the next 20 years as a result of general increases in VMT and future highway congestion. By 2035, highway travel time between Oklahoma City and Dallas is projected to increase by 16 minutes, travel time between Oklahoma City and Fort Worth is projected to increase by 19 minutes, and travel time between Fort Worth and Dallas is projected to increase by 4 minutes. These increases in future highway travel time would be minor, so reliability for highway travel is expected to remain relatively good. Under Alternative N4A, there would be a negligible difference and corresponding effect in travel time reliability for train travelers, compared with highway travel.

Passenger Rail Ridership

Table 3.20-4 provides a summary of the projected rail ridership under Alternative N4Aat the corridor level, as well as for the Oklahoma City and Dallas urban markets. Figure 3.20-1 illustrates the projected rail ridership composition for Alternative N4A. It is assumed that the rail ridership will be a combination of trips that are diverted from other modes to rail and induced demand for the new service.

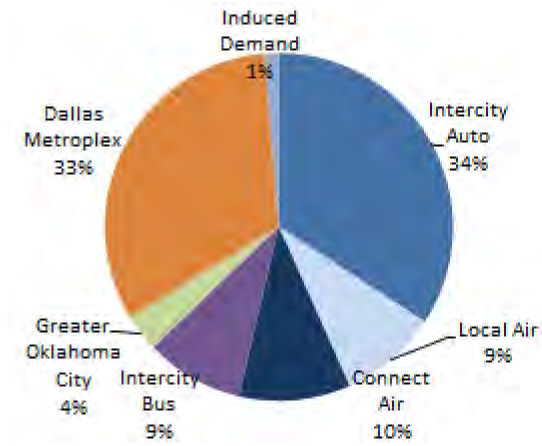

Figure 3.20-1: Alternative N4A Ridership Composition (2035)

The table presents the number of trips and the percentage of trips that would be diverted from other modes to rail. It also shows the composition of the total rail trips by mode. For example, there are 38,115,278 potential auto trips that could be diverted to rail. It is projected that 240,085 of these auto trips (approximately 1 percent) would be diverted to rail. In total, 702,033 new rail trips are projected. Of these new rail trips, 240,085 trips, or 34 percent, are trips that are diverted from auto trips or other modes.

Table 3.20-4: 2035 Intercity Rail Ridership – Alternative N4A

Ridership Composition by Mode	Divertible Market	N4A Rail Riders	Diversion Percentage	N4A Rail Ridership Composition
(Passengers per Year)				
Total Intercity Ridership	40,770,643	**441,407**	1%	
Auto	38,115,278	240,085	1%	34%
Local Air[a]	147,588	64,276	44%	9%
Connect Air[b]	2,377,505	72,485	3%	10%
Bus	130,272	64,561	50%	9%
Total Urban Ridership		**251,550**		
Greater Oklahoma City[c]		24,047		4%
Dallas Metroplex[d]		227,503		34%
Induced Demand[e]		**9,076**		1%
Total Intercity and Urban Ridership[f]		**702,033**		

[a] Air travelers whose entire trip is within the corridor area.

[b] Air travelers for whom only one end of their trip falls within the corridor area.

[c] Trips that begin and end within the Greater Oklahoma City area.

[d] Trips that begin and end within the Dallas Metroplex.

[e] HSR riders who would not have made the trip by another mode.

[f] The sum of diverted and induced demand for HSR.

For the new rail trips (over 700,000 riders), the highest percentage would be shifts from auto trips (34 percent), followed by connect air (10 percent), and local air and bus trips (9 percent). Intercity bus has the highest percentage of its trips diverted to rail (50 percent), followed by local air (44 percent), connect air (3 percent), and auto trips (1 percent).

Vehicle Miles Traveled

Regional and corridor effects on highway congestion can be measured through changes in VMT. The ability of the rail alternatives to alter travel patterns on a regional basis can also be evaluated through the number of auto trips taken and corresponding changes in VMT. Table 3.20-5 presents the estimated changes in annual VMT between the No Build Alternative and Alternative N4A.

Table 3.20-5: 2035 Vehicle Miles Traveled – Alternative N4A

	Vehicle Miles Traveled (per Year)		
	No Build	N4A	Change
Oklahoma City – Dallas and Fort Worth	2,047,593,985	2,035,630,281	-11,963,704 / -0.6%

The existing VMT in the Northern Section is projected to increase from 1.3 billion annual VMT to 2.0 billion annual VMT by 2035 under the No Build Alternative scenario. The increase in VMT by 2035 is primarily attributed to population growth in the region. The diversion of auto trips to rail under Alternative N4A would result in a 0.6 percent reduction in VMT compared with the No Build Alternative. This equates to nearly 12 million fewer miles traveled each year. The decrease in VMT is a beneficial, although negligible effect of Alternative N4A.

Local Effects on Transportation and Parking

Alternative N4A would primarily use the existing rail infrastructure and stations. It would not likely result in permanent grade crossing closures that could impact local circulation. Local traffic volumes and parking demand would increase around and at the stations due to increases in ridership and longer wait times would occur at grade-crossings. Based on this assessment, the qualitative evaluation is that the local effects on transportation and parking are moderate.

Effects on Intercity Transit Providers, Air Carriers, and Freight Operations

Under Alternative N4A, approximately 50 percent of existing bus riders and 44 percent of air passengers would be diverted to rail. While the new rail service would yield benefits for travelers by providing an alternative transportation option, transit operators and airlines themselves could be negatively affected by a reduction in passengers. This diversion could result in substantial effects on service provider operations (e.g., demand, schedule, etc.) and lost revenue as a result of fewer customers.

Alternative N4A would provide passenger rail service on the existing BNSF track, with potential improvements within the existing BNSF right-of-way. Once operational, there would be no change to the existing freight routes. Freight operations could be affected by the increase in passing trains, from one train per day to six trains per day. The long-term improvements to the rail system would offset any adverse effects on freight service. Based on this assessment, the qualitative evaluation is that the local effects on freight operations are negligible.

3.20.4.4 Central Section: Dallas and Fort Worth to San Antonio

In the Central Section, six build alternatives and the No Build Alternative were carried forward for further evaluation. All of the alternatives in the Central Section (Alternative C4A [both service types] and Alternative C4B [both service types] and Alternative C4C [both service types]) follow the same alignment from Hillsboro south to San Antonio (see Figures 3.20-2 through 3.20-4).

3.20.4.4.1 Alternative C4A Higher-Speed Rail

Travel Demand and Mode Share

Table 3.20-6 presents the projected travel demand and mode share for the No Build Alternative and Alternative C4A Higher-Speed Rail.

Table 3.20-6: 2035 Travel Demand and Mode Share – Alternative C4A Higher-Speed Rail

Mode	Travel Demand (Trips per Year)		Mode Share (Percentage by Mode)	
	No Build	C4A HrSR	No Build	C4A HrSR
	Dallas – Fort Worth – San Antonio			
Auto	36,912,196	35,679,819	92.18%	82.71%
Passenger Rail	77,575	5,271,829	0.19%	12.22%
Intercity Bus	1,238,394	1,061,409	3.09%	2.46%
Air	1,815,699	1,125,615	4.53%	2.61%

Under Alternative C4A Higher-Speed Rail, the reduction in mode share for highway travel would be 10 percent, which represents a moderate effect. The increase in mode share for passenger rail represents a substantial beneficial effect. Passenger rail ridership is forecast to increase to over 5 million passengers per year, an increase of more than 6,000 percent in mode share over the 2035 No Build Alternative. The shift in mode share represents a moderate effect for bus and a substantial effect for air. The mode share for bus would decrease by 20 percent and the mode share for air would decrease by 42 percent. The ridership data (including diverted trips and induced demand) are described in further detail in the Passenger Rail Ridership section.

Travel Time Savings

Table 3.20-7 provides a comparison of the projected travel time between modes. It is assumed that there would be no difference in travel time between the No Build Alternative and Alternative C4A Higher-Speed Rail for auto, bus, and air.

With the exception of air, Alternative C4A Higher-Speed Rail would provide significant travel time savings across all modes, although to a lesser extent than Alternative C4A High-Speed Rail. For example, the new passenger rail service would take approximately 3 hours (190 minutes) between Dallas and San Antonio, compared with over 5.5 hours (338 minutes) by car. The time savings associated with Alternative C4A Higher-Speed Rail would be a substantial beneficial effect compared with the No Build Alternative.

Table 3.20-7: 2035 Travel Time Comparison by Mode – Alternative C4A Higher-Speed Rail

Mode	Travel Time (minutes)[a]				
	Dallas – San Antonio	Fort Worth – San Antonio	Dallas – Austin	Fort Worth – Austin	Austin – San Antonio
Auto	338	332	238	232	103
Passenger Rail	605	465	392	252	143
With C4A HrSR[b]	190	238	131.	179	57
Intercity Bus	327	409	220	292	95
Air	62	68	55	62	-

[a] Except for passenger rail, travel time is assumed to be the same for the No Build Alternative and Alternative C4A HrSR.

[b] Estimated Passenger rail time with Alternative C4A HrSR.

Travel Time Reliability

As previously discussed, the Central Section will generally experience moderate increases in highway travel time by 2035, particularly between the larger metropolitan areas. By 2035, highway travel time between Dallas and San Antonio and Fort Worth and San Antonio is projected to increase by approximately 50 minutes as a result of general increases in congestion. Alternative C4A Higher-Speed Rail would provide travel time reliability between these areas for train travelers, compared to the expected increases in highway drive times and potential unexpected delays. Under Alternative C4A Higher-Speed Rail there would be a substantial difference and corresponding effect in travel time reliability compared to highway travel.

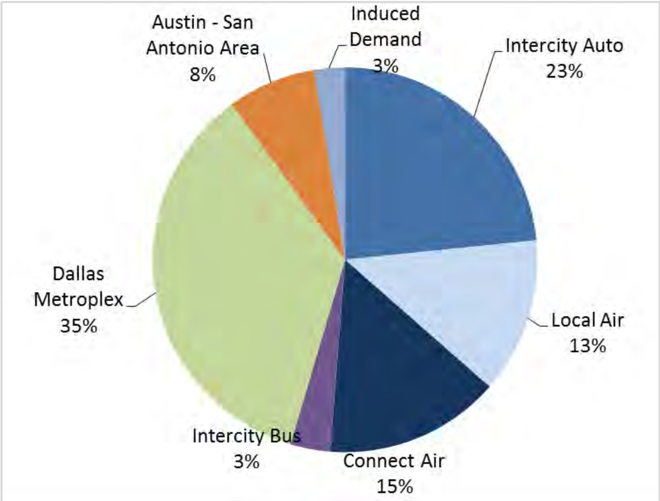

Figure 3.20-2: Alternative C4A HrSR Ridership Composition

Passenger Rail Ridership

Table 3.20-8 provides a summary of the projected rail ridership under Alternative C4A Higher-Speed Rail at both the corridor level, as well as for the Dallas and Austin/San Antonio urban markets. Figure 3.20-2 illustrates the anticipated ridership composition for this alternative.

For the new rail trips (approximately 5.3 million riders), the highest percentage would be shifts from auto trips (23 percent), followed by connect air (15 percent), local air (13 percent), and bus trips (3 percent). Local air would have the highest percentage of its trips diverted to rail (38 percent), followed by bus (14 percent), connect air (5 percent), and auto trips (3 percent).

Table 3.20-8: 2035 Intercity Rail Ridership – Alternative C4A Higher-Speed Rail

Ridership Composition by Mode	Divertible Market	C4A HrSR Riders	Diversion Percentage	C4A HrSR Ridership Composition
(Passengers per Year)				
Total Intercity Ridership	55,568,425	**2,877,995**	5%	
Auto	36,912,196	1,232,377	3%	23%
Local Air[a]	1,815,945	690,084	38%	13%
Connect Air[b]	15,601,890	778,549	5%	15%
Bus	1,238,394	176,985	14%	3%
Total Urban Ridership		**2,256,911**		
Dallas Metroplex[c]		1,865,274		35%
Austin-San Antonio Area[d]		391,637		8%
Induced Demand[e]		**136,923**		3%
Total Intercity and Urban Ridership[f]		**5,271,829**		

[a] Air travelers whose entire trip is within the corridor area.
[b] Air travelers for whom only one end of their trip falls within the corridor area.
[c] Trips that begin and end within the Dallas Metroplex.
[d] Trips that begin and end within the Austin-San Antonio area.
[e] HrSR riders who would not have made the trip by another mode.
[f] The sum of diverted and induced demand for HrSR.

Vehicle Miles Traveled

Table 3.20-9 summarizes the projected 2035 VMT under the No Build Alternative and Alternative C4A Higher-Speed Rail. Implementation of Alternative C4A Higher-Speed Rail would result in a 3.1 percent decrease in annual VMT in the Central Section, compared with the No Build Alternative. This would be a moderate beneficial effect on VMT.

Table 3.20-9: 2035 Vehicle Miles Traveled – Alternative C4A Higher-Speed Rail

	Vehicle Miles Traveled (per Year)		
	No Build	C4A HrSR	Change
Dallas – Fort Worth – San Antonio	2,811,060,425	2,722,809,840	-88,250,585/ -3.14%

Local Effects on Transportation and Parking

Alternative C4A Higher-Speed Rail would have similar effects on transportation and parking as those described for Alternative C4A High-Speed Rail. However, unlike high-speed rail, the higher-speed rail design would include some grade crossings, which would affect local traffic circulation. Local traffic volumes and parking demand would increase around and at the stations due to both increases and new demand in rail ridership and longer wait times would occur at grade crossings. Based on this assessment, the qualitative evaluation is that the local effects on transportation and parking are moderate.

Effects on Intercity Transit Providers, Air Carriers, and Freight Operations

Alternative C4A Higher-Speed Rail would have similar effects on intercity transit providers and air carriers as those described for Alternative C4A High-Speed Rail, but at a lesser intensity. Under Alternative C4A Higher-Speed Rail, approximately 14 percent of existing bus riders and 38 percent of air passengers would be diverted to rail. This diversion could result in moderate (for transit) to substantial (for air) effects on service provider operations (e.g., demand, schedule, etc.) and lost revenue as a result of fewer customers.

The design of the higher-speed rail alternative, within existing railroad rights-of-way, would allow for a shared right-of-way with separate tracks for freight and passenger services. The long-term improvements to the rail system would offset any adverse effects on freight service. Based on this assessment, the qualitative evaluation is that the local effects on freight operations are negligible.

3.20.4.4.2 Alternative C4A High-Speed Rail

Travel Demand and Mode Share

Table 3.20-10 presents the projected travel demand and mode share for the No Build Alternative and Alternative C4A High-Speed Rail.

Table 3.20-10: 2035 Travel Demand and Mode Share – Alternative C4 High-Speed Rail

Mode	Travel Demand (Trips per Year)		Mode Share (Percentage by Mode)	
	No Build	C4A HSR	No Build	C4A HSR
	Dallas and Fort Worth – San Antonio			
Auto	34,453,728	31,668,952	91.74%	76.52%
Passenger Rail	77,575	8,193,483	0.21%	19.80%
Intercity Bus	1,218,438	949,310	3.24%	2.29%
Air	1,806,931	575,327	4.81%	1.39%

Under Alternative C4A High-Speed Rail, highway, bus, and air travel would decrease as users are diverted from these modes to the new rail service. Under Alternative C4A High-Speed Rail, the reduction in mode share for highway travel would be 16 percent, which represents a moderate effect. The increase in mode share for passenger rail represents a substantial effect, with passenger rail ridership forecast to increase to over 8 million passengers per year, which is a 9,000 percent increase. For bus and air, the shift in mode share would also represent a substantial effect. The mode share for bus would decrease by 29 percent and the mode share for air would decrease by 71 percent. The ridership data (including diverted trips and induced demand) are described in further detail in the Passenger Rail Ridership section.

Travel Time Savings

Table 3.20-11 provides a comparison of the projected travel time between modes. It is assumed that there would be no difference in travel time between the No Build Alternative and Alternative C4A High-Speed Rail for auto, bus, and air.

With the exception of air, Alternative C4A High-Speed Rail would provide significant travel time savings across all modes. For example, the new passenger rail service would take approximately 2 hours (115 minutes) between Dallas and San Antonio, compared with over 5.5 hours (338 minutes) by car. The time savings associated with Alternative C4A High-Speed Rail is a substantial beneficial effect compared with the No Build Alternative.

Table 3.20-11: 2035 Travel Time Comparison by Mode – Alternative C4A High-Speed Rail

Mode	Travel Time (minutes)[a]				
	Dallas – San Antonio	Fort Worth – San Antonio	Dallas – Austin	Fort Worth – Austin	Austin – San Antonio
Auto	338	332	238	232	103
Passenger Rail	605	465	392	252	143
With C4A HSR[b]	115	163	74	122	39
Intercity Bus	327	409	220	292	95
Air	62	68	55	62	-

[a] Except for passenger rail, travel time is assumed to be the same for the No Build Alternative and Alternative C4A HSR.
[b] Estimated passenger rail time with Alternative C4A HSR.

Travel Time Reliability

The Central Section will generally experience moderate increases in highway travel time by 2035, particularly between the larger metropolitan areas. For instance, by 2035, highway travel time between Dallas and San Antonio and Fort Worth and San Antonio is projected to increase by approximately 50 minutes. Alternative C4A High-Speed Rail would provide travel time reliability between these areas for train travelers, compared to the expected increases in highway drive times and potential unexpected delays. Under Alternative C4A High-Speed Rail there would be a substantial difference and beneficial effect in travel time reliability compared with highway travel.

Passenger Rail Ridership

Table 3.20-12 provides a summary of the expected rail ridership under Alternative C4A High-Speed Rail at both the corridor level, as well as for the Dallas and Austin/San Antonio urban markets. Figure 3.20-3 illustrates the projected ridership composition for Alternative C4A High-Speed Rail.

For the new rail trips (over 8 million riders), the highest percentage would be shifts from auto trips (34 percent), followed by local air (15 percent), connect air (13 percent) and bus trips (3 percent). Local air would have the highest percentage of its trips diverted to rail (68 percent), followed by bus (22 percent), auto trips (8 percent), and connect air (7 percent).

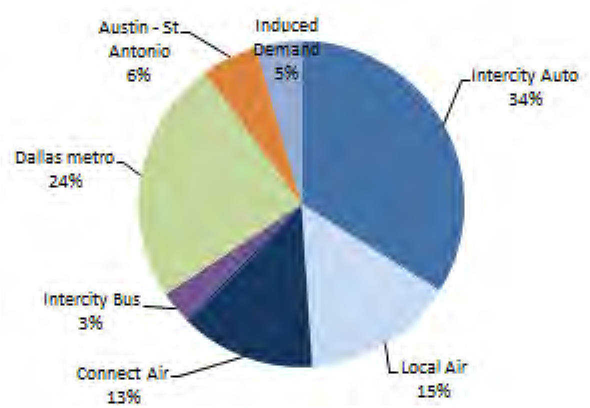

Figure 3.20-3: Alternative C4A HSR Ridership Composition

Table 3.20-12: 2035 Intercity Rail Ridership – Alternative C4A High-Speed Rail

Ridership Composition by Mode	Divertible Market	C4A HSR Riders	Diversion Percentage	C4A HSR Ridership Composition
(Passengers per Year)				
Total Intercity Ridership	53,076,654	**5,391,666**	10%	
Auto	34,453,728	2,784,776	8%	34%
Local Air[a]	1,806,931	1,231,604	68%	15%
Connect Air[b]	15,597,557	1,106,158	7%	13%
Bus	1,218,438	269,128	22%	3%
Total Urban Ridership		**2,449,206**		
Dallas Metroplex[c]		1,991,898		24%
Austin - San Antonio Area[d]		457,308		6%
Induced Demand[e]		**352,611**		5%
Total Intercity and Urban Ridership[f]		**8,193,484**		

[a] Air travelers whose entire trip is within the corridor area.
[b] Air travelers for whom only one end of their trip falls within the corridor area.
[c] Trips that begin and end within the Dallas Metroplex
[d] Trips that begin and end within the Austin-San Antonio area.
[e] HSR riders who would not have made the trip by another mode.
[f] The sum of diverted and induced demand for HSR.

Vehicle Miles Traveled

Table 3.20-13 summarizes the projected 2035 VMT under the No Build Alternative and Alternative C4A High-Speed Rail. Implementation of Alternative C4A High-Speed Rail would result in an 8.6 percent decrease in VMT in the Central Section, compared with the No Build Alternative. This would be a substantial beneficial effect on VMT.

Table 3.20-13: 2035 Vehicle Miles Traveled – Alternative C4A High-Speed Rail

	Vehicle Miles Traveled (per Year)		
	No Build	C4A HSR	Change
Dallas – Fort Worth – San Antonio	2,742,367,985	2,507,423,895	-234,944,090/ -8.57%

Local Effects on Transportation and Parking

Alternative C4A High-Speed Rail would begin in Fort Worth and follow the TRE tracks east to Dallas. From Dallas, it would follow the BNSF alignment south toward Waxahachie where it would enter a new alignment outside existing highway and rail corridors. The entire right-of-way would be fenced and fully grade-separated. Once constructed, there would be no effect on local traffic circulation because of the grade-separated tracks. Local traffic volumes and parking demand would increase around and at the stations due to both increases and new demand in rail ridership and longer wait times would occur at grade crossings. Based on this assessment, the qualitative evaluation is that the local effects on transportation and parking are moderate.

Effects on Intercity Transit Providers, Air Carriers, and Freight Operations

Under Alternative C4A High-Speed Rail, approximately 20 percent of existing bus riders and 70 percent of air passengers would be diverted to rail. While the diversion of intercity bus and air travelers to the rail system will yield benefits for travelers by providing an alternative transportation option, transit operators and airlines themselves could be negatively affected by a reduction in passengers. This diversion could result in moderate (for transit) to substantial (for air) effects on service provider operations (e.g., demand and schedule) and lost revenue as a result of fewer customers.

Within existing transportation corridors, the high-speed rail alternative would not have the required space for separation of freight and passenger rail and freight operations could be affected by an increase in the number of passing trains. Effects on freight operations within these existing transportation corridors will be determined at the project level. The long-term improvements to the rail system would offset any adverse effects on freight service. Based on this assessment, the qualitative evaluation is that the local effects on freight operations are negligible. Within proposed new transportation corridors, passenger rail tracks would be constructed within a separate right-of-way and there would be no effect on freight operations.

3.20.4.4.3 Alternative C4B Higher-Speed Rail

For this service-level analysis the travel demand modeling for Alternative C4B Higher-Speed Rail was not conducted to the same level of detail, but instead relied upon a proportional relationship based on full travel demand modeling conducted for the C4A High-Speed Rail and C4A Higher-Speed Rail alternatives. This appropriate level of detail applied for Alternative C4B Higher-Speed Rail is supported by a linear proportional adjustment in ridership and demand, which is based on the relationship between the C4A High-Speed Rail and C4A Higher-Speed Rail alternatives, thereby producing reasonably accurate estimates for Alternative C4B Higher-Speed Rail. Further, the observed relationship between the C4A Higher-Speed Rail and C4A High-Speed Rail alternatives was used to produce a forecast of Alternative C4B Higher-Speed Rail based on Alternative C4B High-Speed Rail. An identical methodology was utilized for the observed relationship between Alternative C4C Higher-Speed Rail based on Alternative C4C High-Speed Rail.

Travel Demand and Mode Share

Alternative C4B Higher-Speed Rail would see decreases in ridership demand proportionally similar to the decrease in ridership demand between the C4A High-Speed Rail and C4A Higher-Speed Rail alternatives. The shift in mode share would also be proportionally similar. For example, the ridership demand would be approximately 36 percent less for Alternative C4A Higher-Speed Rail than Alternative C4A High-Speed Rail. Alternative C4B would see a similar difference between ridership demand between the high-speed rail alternative and higher-speed rail alternative.

Travel Time Savings

Travel time information was prepared for Alternative C4B Higher-Speed Rail and is summarized in Table 3.20-14. Alternative C4B Higher-Speed Rail would result in similar changes to travel time savings as Alternative C4A Higher-Speed Rail. Both alternatives would provide significant travel time savings across all modes, although to a lesser extent than the high-speed rail alternatives. The new passenger rail service would take approximately 3 hours (195 minutes) between Dallas and San Antonio, compared with over 5.5 hours (338 minutes) by car. The time savings associated with Alternative C4B Higher-Speed Rail would be a substantial beneficial effect compared with the No Build Alternative.

Table 3.20-14: 2035 Travel Time Comparison by Mode – Alternative C4B Higher-Speed Rail

Mode	Travel Time (minutes)[a]				
	Dallas – San Antonio	Fort Worth – San Antonio	Dallas – Austin	Fort Worth – Austin	Austin – San Antonio
Auto	338	332	238	232	103
Passenger Rail	605	465	392	252	143
With C4B HrSR[b]	195	202	136	143	57
Intercity Bus	327	409	220	292	95
Air	62	68	55	62	-

[a] Except for passenger rail, travel time is assumed to be the same for the No Build Alternative and Alternative C4B HrSR.
[b] Estimated passenger rail time with Alternative C4B HrSR.

Travel Time Reliability

As previously discussed, the Central Section will generally experience moderate increases in highway travel time by 2035, particularly between the larger metropolitan areas, as a result of general increases in congestion. By 2035, highway travel time between Dallas and San Antonio and Fort Worth and San Antonio is projected to increase by approximately 50 minutes. Alternative C4B Higher-Speed Rail would provide travel time reliability between these areas for train travelers, compared with the expected increases in highway drive times and potential unexpected delays. Under Alternative C4B Higher-Speed Rail there would be a substantial difference and corresponding effect in travel time reliability compared with highway travel.

Vehicle Miles Traveled

Alternative C4B Higher-Speed Rail would see a reduction in VMT proportionally similar to the reduction in VMT between the C4A High-Speed Rail and the C4A Higher-Speed Rail alternatives. The reduction in VMT would be approximately 64 percent less for Alternative C4A Higher-Speed Rail than Alternative C4A High-Speed Rail. Alternative C4B would see a similar difference between VMT changes between the high-speed rail alternative and higher-speed rail alternative.

Local Effects on Transportation and Parking

Alternative C4B Higher-Speed Rail would have similar effects on transportation and parking as those described for Alternative C4A High-Speed Rail. However, unlike high-speed rail, the higher-speed rail design would include some grade crossings, which would affect local traffic circulation. Local traffic volumes and parking demand would increase around and at the stations due to both increases and new demand in rail ridership and longer wait times would occur at grade crossings. Based on this assessment, the qualitative evaluation is that the local effects on transportation and parking are moderate.

Effects on Intercity Transit Providers, Air Carriers, and Freight Operations

Alternative C4B Higher-Speed Rail would have similar effects on intercity transit providers and air carriers as those described for Alternative C4B High-Speed Rail, but at a lesser intensity. Under Alternative C4B Higher-Speed Rail, existing bus riders and air passengers would be diverted to rail. However, the percentage of diverted trips would be less with Alternative C4B Higher-Speed Rail than Alternative C4B High-Speed Rail.

The design of the higher-speed rail alternative, within existing railroad rights-of-way, would allow for a shared right-of-way with separate tracks for freight and passenger services. The long-term improvements to the rail system would offset any adverse effects on freight service. Based on this assessment, the qualitative evaluation is that the local effects on freight operations are negligible.

3.20.4.4.4 Alternative C4B High-Speed Rail

Travel Demand and Mode Share

Table 3.20-15 presents the projected travel demand and mode share for the No Build Alternative and Alternative C4B High-Speed Rail.

Table 3.20-15: 2035 Travel Demand and Mode Share – Alternative C4B High-Speed Rail

Mode	Travel Demand (Trips per Year)		Mode Share (Percentage by Mode)	
	No Build	C4B HSR	No Build	C4B HSR
	Dallas/Fort Worth – San Antonio			
Auto	34,486,594	31,528,524	91.75%	78.74%
Passenger Rail	77,575	7,039,557	0.21%	17.58%
Intercity Bus	1,218,248	932,764	3.24%	2.33%
Air	1,805,925	538,644	4.80%	1.35%

Under Alternative C4B High-Speed Rail, the reduction in mode share for highway travel would be 14 percent, which represents a moderate effect. The increase in mode share for passenger rail would be substantial. Passenger rail ridership is forecast to increase to over 7 million passengers per year, an over 8,000 percent increase. For bus and air, the shift in mode share would be substantial. The mode share for bus would decrease by 28 percent and the mode share for air would decrease by 72 percent. The ridership data (including diverted trips and induced demand) are described in further detail in the Passenger Rail Ridership section.

Travel Time Savings

Table 3.20-16 provides a comparison of the projected travel time between modes. It is assumed that there will no difference in travel time between the No Build Alternative and Alternative C4B High-Speed Rail for auto, bus, and air.

With the exception of air, Alternative C4B High-Speed Rail would provide significant travel time savings across all modes. For example, the new passenger rail service would take approximately 2 hours (127 minutes) between Dallas and San Antonio, compared with over 5.5 hours (338 minutes) by car. The time savings associated with Alternative C4B High-Speed Rail would be a substantial beneficial effect compared with the No Build Alternative.

Table 3.20-16: 2035 Travel Time Comparison by Mode – Alternative C4B High-Speed Rail

Mode	Travel Time (minutes)[a]				
	Dallas – San Antonio	Fort Worth – San Antonio	Dallas – Austin	Fort Worth – Austin	Austin – San Antonio
Auto	338	332	238	232	103
Passenger Rail	605	465	392	252	143
With C4B HSR[b]	127	134	86	93	39
Intercity Bus	327	409	220	292	95
Air	62	68	55	62	-

[a] Except for passenger rail, travel time is assumed to be the same for the No Build Alternative and Alternative C4B HSR.
[b] Estimated passenger rail time with Alternative C4B HSR.

Travel Time Reliability

As previously discussed, the Central Section will generally experience moderate increases in highway travel time by 2035, particularly between the larger metropolitan areas as a result of general increases in congestion. By 2035, highway travel time between Dallas and San Antonio and Fort Worth and San Antonio is projected to increase by approximately 50 minutes. Alternative C4B High-Speed Rail would provide travel time reliability between these areas for train travelers, compared with the expected increases in highway drive times and potential unexpected delays. Under Alternative C4B High-Speed Rail there would be a substantial difference and corresponding effect in travel time reliability compared with highway travel.

Passenger Rail Ridership

Table 3.20-17 provides a summary of the projected rail ridership with Alternative C4B High-Speed Rail at the corridor level, as well as for the Dallas and San Antonio urban markets. Figure 3.20-4 illustrates the projected ridership composition for this alternative.

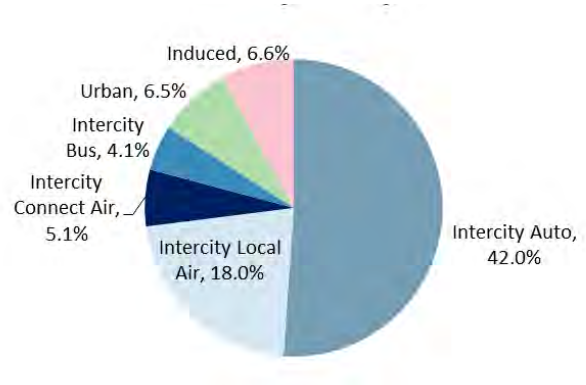

Figure 3.20-4: Alternative C4B HSR Ridership Composition

For the new rail trips (over 7 million riders), the highest percentage would be shifts from auto trips (42 percent), followed by local air (18 percent), connect air (5 percent) and bus trips (4 percent). Local air would have the highest percentage of its trips diverted to rail (70 percent), followed by bus (23 percent), auto trips (9 percent), and connect air (2 percent).

Table 3.20-17: 2035 Intercity Rail Ridership – Alternative C4B High-Speed Rail

Ridership Composition by Mode	Divertible Market	C4B HSR Riders	Diversion Percentage	C4B HSR Ridership Composition
(Passengers per Year)				
Total Intercity Ridership	53,116,035	**4,867,251**	9%	
Auto	34,486,594	2,958,069	9%	42%
Local Air[a]	1,805,925	1,267,281	70%	18%
Connect Air[b]	15,605,268	356,415	2%	5%
Bus	1,218,248	285,484	23%	4%
Total Urban Ridership		**1,709,043**		
Dallas Metroplex[d]		1,251,735		18%
Austin - San Antonio Area[d]		457,308		6%
Induced Demand[e]		463,263		7%
Total Intercity and Urban Ridership[f]		**7,039,557**		

[a] Air travelers whose entire trip is within the corridor area.

[b] Air travelers for whom only one end of their trip falls within the corridor area.

[c] Trips that begin and end within the Dallas Metroplex.

[d] Trips that begin and end within the Austin-San Antonio area.

[e] HSR riders who would not have made the trip by another mode.

[f] The sum of diverted and induced demand for HSR.

Vehicle Miles Traveled

Table 3.20-18 summarizes the projected 2035 VMT with the No Build Alternative and Alternative C4B High-Speed Rail. Implementation of Alternative C4B High-Speed Rail would result in a 9 percent decrease in VMT in the Central Section, compared with the No Build Alternative. This would be a substantial beneficial effect on VMT.

Table 3.20-18: 2035 Vehicle Miles Traveled – Alternative C4B High-Speed Rail

	Vehicle Miles Traveled (per Year)		
	No Build	C4B HSR	Change
Dallas-Fort Worth-San Antonio	2,748,517,876	2,496,018,505	-252,499,371/ -9.19%

Local Effects on Transportation and Parking

Alternative C4B High-Speed Rail would have similar effects on transportation and parking as those described for Alternative C4A High-Speed Rail. As a high-speed rail alternative, the entire right-of-way would be fenced and fully grade-separated. Once constructed, there would be no effect on local traffic circulation because of the grade-separated tracks. Local traffic volumes and parking demand would increase around and at the stations due to both increases and new demand in rail ridership and longer wait times would occur at grade crossings. Based on this assessment, the qualitative evaluation is that the local effects on transportation and parking are moderate.

Effects on Intercity Transit Providers, Air Carriers, and Freight Operations

Under Alternative C4B High-Speed Rail, approximately 23 percent of existing bus riders and 70 percent of air passengers would be diverted to rail. This diversion could result in moderate (for transit) to substantial (for air) effects on service provider operations (e.g., demand, schedule, etc.) and lost revenue as a result of fewer customers.

Within existing transportation corridors, the high-speed rail alternative would not have the required space for separation of freight and passenger rail and freight operations could be affected by an increase in the number of passing trains. The long-term improvements to the rail system would offset any adverse effects on freight service. Based on this assessment, the qualitative evaluation is that the local effects on freight operations are negligible. Within proposed new transportation corridors, passenger rail tracks would be constructed within a separate right-of-way and there would be no effect on freight operations.

3.20.4.4.5 Alternative C4C Higher-Speed Rail

For this service-level analysis, the travel demand modeling for Alternative C4C Higher-Speed Rail was not conducted to the same level of detail, but instead relied upon a proportional relationship based on full travel demand modeling conducted for the C4A High-Speed Rail and C4A Higher-Speed Rail alternatives. This appropriate level of detail applied for Alternative C4C Higher-Speed Rail is supported by a linear proportional adjustment in ridership and demand, which is based on the relationship between the C4A High-Speed Rail and C4A Higher-Speed Rail alternatives, thereby producing reasonably accurate estimates for Alternative C4C Higher-Speed Rail. Further, the observed relationship between the C4A Higher-Speed Rail and C4A High-Speed Rail alternatives was used to produce a forecast of Alternative C4C Higher-Speed Rail based on Alternative C4C High-Speed Rail.

Travel Demand and Mode Share

Alternative C4C Higher-Speed Rail would result in decreases in ridership demand proportionally similar to the decrease in ridership demand between the C4A High-Speed Rail and the C4A Higher-Speed Rail alternatives. The shift in mode share would also be proportionally similar. For example, the ridership demand would be approximately 36 percent less for Alternative C4A Higher-Speed Rail than Alternative C4A High-Speed Rail. Alternative C4B would see a similar difference between ridership demand between the high-speed rail and higher-speed rail alternatives.

Travel Time Savings

Travel time information was not prepared for Alternative C4C Higher-Speed Rail; however, this alternative would result in similar changes to travel time savings as Alternative C4C High-Speed Rail, although to a lesser extent. This is because the higher-speed rail alternative would be operated at speeds of up to 110 to 125 miles per hour (mph), compared with the faster high speed rail alternatives, which would be operated at speeds of up to 220 to 250 mph. Both alternatives are expected to provide substantial travel time savings across all modes.

Travel Time Reliability

As previously discussed, the Central Section would generally experience moderate increases in highway travel time by 2035, particularly between the larger metropolitan areas. By 2035, highway travel time between Dallas and San Antonio and Fort Worth and San Antonio is projected to increase by approximately 50 minutes. Alternative C4C Higher-Speed Rail would provide travel time reliability between these areas for train travelers, compared to the expected increases in highway drive times and potential unexpected delays. Under Alternative C4C Higher-Speed Rail there would be a substantial difference and corresponding effect in travel time reliability compared with highway travel.

Vehicle Miles Traveled

Alternative C4C Higher-Speed Rail would see a reduction in VMT proportionally similar to the reduction in VMT between the C4A High-Speed Rail and the C4A Higher-Speed Rail alternatives. The reduction in VMT would be approximately 64 percent less for Alternative C4A Higher-Speed Rail than Alternative C4A High-Speed Rail. Alternative C4C would see a similar difference between VMT changes between the high-speed rail and higher-speed rail alternatives.

Local Effects on Transportation and Parking

Alternative C4C Higher-Speed Rail would have similar effects on transportation and parking as those described for Alternative C4A High-Speed Rail. However, unlike high-speed rail, the higher-speed rail design would include some grade crossings, which would affect local traffic circulation. Local traffic volumes and parking demand would increase around and at the stations due to both increases and new demand in rail ridership and longer wait times would occur at grade-crossings. Based on this assessment, the qualitative evaluation is that the local effects on transportation and parking are moderate.

Effects on Intercity Transit Providers, Air Carriers, and Freight Operations

Alternative C4C Higher-Speed Rail would have similar effects on intercity transit providers and air carriers as those described for Alternative C4C High-Speed Rail, but at a lesser intensity. Under Alternative C4C Higher-Speed Rail, existing bus riders and air passengers would be diverted to rail. However, the percentage of diverted trips would be less with Alternative C4C Higher-Speed Rail than with Alternative C4C High-Speed Rail.

The design of the higher-speed rail alternative, within existing railroad rights-of-way, would allow for a shared right-of-way with separate tracks for freight and passenger services. The long-term improvements to the rail system would offset any adverse effects on freight service. Based on this assessment, the qualitative evaluation is that the local effects on freight operations are negligible.

3.20.4.4.6 Alternative C4C High-Speed Rail

Travel Demand and Mode Share

Table 3.20-19 presents the projected travel demand and mode share for the No Build Alternative and Alternative C4C High-Speed Rail.

Table 3.20-19: 2035 Travel Demand and Mode Share – Alternative C4C High-Speed Rail

Mode	Travel Demand (Trips per Year)		Mode Share (Percentage by Mode)	
	No Build	C4C HSR	No Build	C4C HSR
	Dallas and Fort Worth – San Antonio			
Auto	34,355,278	31,986,136	91.72%	81.17%
Passenger Rail	77,575	5,754,286	0.21%	14.60%
Intercity Bus	1,218,378	980,645	3.25%	2.49%
Air	1,804,336	684,830	4.82%	1.74%

Under Alternative C4C High-Speed Rail, the reduction in mode share for highway travel would be 11 percent, which represents a moderate effect. The increase in mode share for passenger rail is substantial. Passenger rail ridership is forecast to increase to over 5 million passengers per year, a nearly 7,000 percent increase. For bus the shift in mode share would be moderate and for air the shift in mode share would be substantial. The mode share for bus would decrease by 23 percent and the mode share for air would decrease by 64 percent. The ridership data (including diverted trips and induced demand) are described in further detail in the Passenger Rail Ridership section.

Travel Time Savings

Table 3.20-20 provides a comparison of the projected travel time between modes. It is assumed that there will no difference in travel time between the No Build Alternative and Alternative C4C High-Speed Rail for auto, bus, and air.

With the exception of air, Alternative C4C High-Speed Rail would provide significant travel time savings across all modes. Under this alternative, the new passenger rail service would take less than 2.5 hours (140 minutes) between Dallas and San Antonio, compared to over 5.5 hours (338 minutes) by car. The time savings associated with Alternative C4C High-Speed Rail would be a substantial beneficial effect compared with the No Build Alternative.

Table 3.20-20: 2035 Travel Time Comparison by Mode – Alternative C4C High-Speed Rail

Mode	Travel Time (minutes)[a]				
	Dallas – San Antonio	Fort Worth – San Antonio	Dallas – Austin	Fort Worth – Austin	Austin – San Antonio
Auto	338	332	238	232	103
Passenger Rail	605	465	392	252	143
With C4C HSR[b]	140	140	99	99	39
Intercity Bus	327	409	220	292	95
Air	62	68	55	62	-

[a] Except for passenger rail, travel time is assumed to be the same for the No Build Alternative and Alternative C4C HSR.

[b] Estimated Passenger rail time with Alternative C4C HSR.

Travel Time Reliability

As previously discussed, the Central Section will generally experience moderate increases in highway travel time by 2035, particularly between the larger metropolitan areas. By 2035, highway travel time between Dallas and San Antonio and Fort Worth and San Antonio is projected to increase by approximately 50 minutes as a result of general increase in congestion. Alternative C4C High-Speed Rail would provide travel time reliability between these areas for train travelers, compared to the expected increases in highway drive times and potential unexpected delays. Under Alternative C4C High-Speed Rail there would be a substantial difference and corresponding effect in travel time reliability compared with highway travel.

Passenger Rail Ridership

Table 3.20-21 provides a summary of the projected rail ridership with Alternative C4C High-Speed Rail at the corridor level, as well as for the Dallas and San Antonio urban markets. Figure 3.20-5 illustrates the projected ridership composition for this alternative.

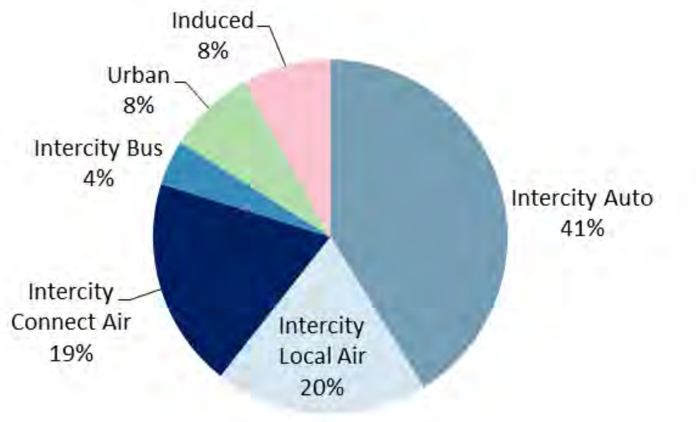

Figure 3.20-5: Alternative C4C HSR Ridership Composition

For the new rail trips (approximately 5.8 million riders), the highest percentage would be shifted from auto trips (41 percent), followed by local and connect air (20 and 19 percent, respectively), and bus trips (4 percent). Local air would have the highest percentage of its trips diverted to rail (62 percent), followed by bus (21 percent), connect air (7 percent), and auto trips (6 percent).

Table 3.20-21: 2035 Intercity Rail Ridership – Alternative C4C High-Speed Rail

Ridership Composition by Mode	Divertible Market	C4C HSR Riders	Diversion Percentage	C4C HSR Ridership Composition
(Passengers per Year)				
Total Intercity Ridership	52,980,507	**4,830,777**	9%	
Auto	34,355,278	2,369,141	6%	41%
Local Air[a]	1,804,336	1,119,506	62%	20%
Connect Air[b]	15,602,515	1,104,397	7%	19%
Bus	1,218,378	237,733	21%	4%
Total Urban Ridership		**457,308**		
Dallas Metroplex[c]				0%
Austin-San Antonio Area[d]		457,308		8%
Induced Demand[e]		**466,202**		8%
Total Intercity and Urban Ridership[f]		**5,754,286**		

[a] Air travelers whose entire trip is within the corridor area.

[b] Air travelers for whom only one end of their trip falls within the corridor area.

[c] Trips that begin and end within the Dallas Metroplex.

[d] Trips that begin and end within the Austin-San Antonio area.

[e] HSR riders who would not have made the trip by another mode.

[f] The sum of diverted and induced demand for HSR.

Vehicle Miles Traveled

Table 3.20-22 summarizes the projected 2035 VMT with the No Build Alternative and Alternative C4C High-Speed Rail. Implementation of Alternative C4C High-Speed Rail would result in a 7.2 percent decrease in annual VMT in the Central Section, compared with the No Build Alternative. This would be a substantial beneficial effect on VMT.

Table 3.20-22: 2035 Vehicle Miles Traveled – Alternative C4C High-Speed Rail

	Vehicle Miles Traveled (per Year)		
	No Build	C4C HSR	Change
Dallas – Fort Worth – San Antonio	2,731,030,269	2,533,463,242	197,567,027/ -7.23%

Local Effects on Transportation and Parking

Alternative C4C High-Speed Rail would have similar effects on transportation and parking as those described for Alternative C4A High-Speed Rail. As a high-speed rail alternative, the entire right-of-way would be fenced and fully grade-separated. Once constructed, there would be no effect on local traffic circulation because of the grade-separated tracks. Local traffic volumes and parking demand would increase around and at the stations due to both increases and new demand in rail ridership and longer wait times would occur at grade crossings. Based on this assessment, the qualitative evaluation is that the local effects on transportation and parking are moderate.

Effects on Intercity Transit Providers, Air Carriers, and Freight Operations

Under Alternative C4C High-Speed Rail, approximately 21 percent of existing bus riders and 62 percent of air passengers would be diverted to rail. This diversion could result in moderate (for transit) to substantial (for air) effects on service provider operations (e.g., demand, schedule, etc.) and lost revenue as a result of fewer customers.

Within existing transportation corridors, the high-speed rail alternative would not have the required space for separation of freight and passenger rail and freight operations could be affected by an increase in the number of passing trains. The long-term improvements to the rail system would offset any adverse effects on freight service. Based on this assessment, the qualitative evaluation is that the local effects on freight operations are negligible. Within proposed new transportation corridors, passenger rail tracks would be constructed within a separate right-of-way and there would be no effect on freight operations.

3.20.4.5 Southern Section: San Antonio to South Texas

In the Southern Section, three alternatives and the No Build Alternative were carried forward for further evaluation. Alternative S4 Higher-Speed Rail serves different destinations than Alternative S6 (both service types). Alternative S6 (both service types) would follow an alignment that does not follow existing transportation corridors and is considerably shorter than Alternative S4 Higher-Speed Rail.

3.20.4.5.1 Alternative S4 Higher-Speed Rail

Alternative S4 Higher-Speed Rail would introduce a new passenger rail service between San Antonio and southern Texas. It is assumed that there would be no changes in the level of service for all other modes.

Travel Demand and Mode Share

Table 3.20-23 presents the projected travel demand and mode share for the No Build Alternative and Alternative S4 Higher-Speed Rail.

Table 3.20-23: 2035 Travel Demand and Mode Share – Alternative S4 Higher-Speed Rail

Mode	Travel Demand (Trips per Year)		Mode Share (Percentage by Mode)	
	No Build	S4 HrSR	No Build	S4 HrSR
	San Antonio - Brownsville			
Auto	139,815,235	139,560,919	99.25%	99.03%
Passenger Rail	0	611,106	0.00%	0.43%
Intercity Bus	920,291	713,133	0.65%	0.51%
Air	129,309	46,568	0.09%	0.03%

With Alternative S4 Higher-Speed Rail, the reduction in mode share for highway travel would be less than 1 percent, which represents a negligible effect. Passenger rail service does not currently exist in the Southern Section and there would be a substantial demand for this new service. Passenger rail ridership is forecast at 611,100 passengers per year. For bus the shift in mode share would be moderate and for air the shift in mode share would be substantial. The mode share for bus would decrease by 14 percent and the mode share for air would decrease by 67 percent. The ridership data (including diverted trips and induced demand) are described in further detail in the Passenger Rail Ridership section.

Travel Time Savings

Table 3.20-24 provides a comparison of the projected travel time between modes. It is assumed that there will no difference in travel time between the No Build Alternative and Alternative S4 Higher-Speed Rail for auto and bus (direct air service between the modeled city-pairs does not exist).

For most of the city pairs, Alternative S4 Higher-Speed Rail would provide substantial travel time savings compared to highway and intercity bus travel. For example, between Laredo and Brownsville, Alternative S4 Higher-Speed Rail would be nearly 2 hours faster than driving.

Table 3.20-24: 2035 Travel Time Comparison by Mode – Alternative S4 Higher-Speed Rail

Mode	Travel Time (minutes)[a]				
	San Antonio – Laredo	San Antonio – Corpus Christi	Laredo – Brownsville	Corpus Christi – Brownsville	Austin – San Antonio
Auto	157	151	320	211	103
Passenger Rail[b]	151	113	213	175	-
Intercity Bus	160	157	285	231	95
Air[c]	-	-	-	-	-

[a] Except for passenger rail, travel time is assumed to be the same for the No Build Alternative and Alternative S4 HrSR.

[b] Passenger rail times shown for the build alternative only. Except for Austin to San Antonio, rail service does not currently exist. No new service is proposed between Austin and San Antonio.

[c] There is no direct air (non-stop) service between these city pairs.

Travel Time Reliability

The Southern Section will generally experience moderate increases in highway travel time by 2035, particularly between the larger cities. For instance, by 2035, highway travel time between Brownsville and Laredo is projected to increase by approximately 1 hour and 25 minutes. Alternative S4 Higher-Speed Rail would provide travel time reliability between these areas for train travelers, compared to the expected increases in highway drive times and potential unexpected delays. With Alternative S4 Higher-Speed Rail there would be a substantial difference and corresponding effect in travel time reliability compared with highway travel.

Passenger Rail Ridership

Table 3.20-25 provides a summary of the expected rail ridership with Alternative S4 Higher-Speed Rail at the corridor level and for the urban market (McAllen–Brownsville area). Figure 3.20-6 illustrates the anticipated ridership composition for Alternative S4 Higher-Speed Rail.

For the new rail trips (approximately 611,000 riders), the highest percentage would be shifted from auto trips (42 percent), followed by bus (34 percent), and local air (13 percent). Local air has the highest percentage of its trips diverted to rail (64 percent), followed by bus (23 percent).
Less than 1 percent of auto trips would be diverted to rail.

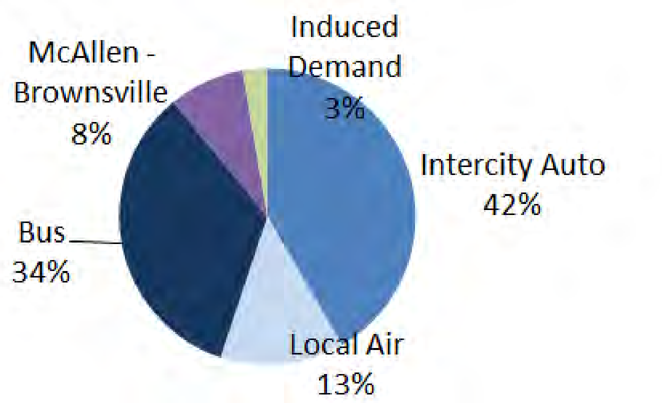

Figure 3.20-6: Alternative S4 HrSR Ridership Composition

Table 3.20-25: 2035 Intercity Ridership – Alternative S4 Higher-Speed Rail

Ridership Composition by Mode	Divertible Market	S4 HrSR Rail Riders	Diversion Percentage	S4 HrSR Rail Ridership Composition
(Passengers per Year)				
Total Intercity Ridership	140,864,835	**544,215**	<1%	
Auto	139,815,235	254,316	<1%	42%
Local Air[a]	129,309	82,741	64%	13%
Connect Air	-	-	-	-
Bus	920,291	207,159	23%	34%
Total Urban Ridership		**50,514**		
McAllen – Brownsville[b]		50,514		8%
Induced Demand[c]		**16,377**		3%
Total Intercity and Urban Ridership[d]		**611,106**		

[a] Air travelers whose entire trip is within the corridor area.

[b] Trips that begin and end within the McAllen-Weslaco-Harlingen-Brownsville triangle.

[c] HrSR riders who would not have made the trip by another mode.

[d] The sum of diverted and induced demand for HrSR.

Vehicle Miles Traveled

Table 3.20-26 presents the estimated changes in VMT with the No Build Alternative and Alternative S4 Higher-Speed Rail. The existing VMT in the Southern Section is projected to increase from 2.9 billion annual VMT to 9.3 billion annual VMT by 2035, under the No Build Alternative. The increase in VMT by 2035 is primarily attributed to population growth in the region. Implementation of Alternative S4 Higher-Speed Rail would result in a 0.2 percent decrease in VMT compared with the No Build Alternative. This equates to nearly 18.5 million fewer miles traveled each year. The decrease in VMT is a beneficial, although negligible, effect of the project, compared with the No Build Alternative.

Table 3.20-26: 2035 Vehicle Miles Traveled – Alternative S4 Higher-Speed Rail

	Vehicle Miles Traveled (per Year)		
	No Build	S4 HrSR	Change
San Antonio-Brownsville	9,364,781,443	9,346,313,854	-18,467,589/ -0.2%

Local Effects on Transportation and Parking

Alternative S4 Higher-Speed Rail would have similar effects on local transportation and parking as previously described for the build alternatives in the Central Section. This alternative generally traverses through less developed areas and as a higher-speed rail option would be designed with some at-grade crossings, which would affect local traffic circulation. New stations would be constructed in some locations and would alter traffic patterns in these locations. Based on this assessment, the qualitative evaluation is that the local effects on transportation and parking are moderate.

Effects on Intercity Transit Providers, Air Carriers, and Freight Operations

With Alternative S4 Higher-Speed Rail, approximately 23 percent of existing bus riders and 64 percent of air passengers would be diverted to rail. This diversion could result in moderate (for transit) to substantial (for air) effects on service provider operations (e.g., demand, schedule, etc.) and lost revenue as a result of fewer customers.

The design of the higher-speed rail alternative, within existing railroad rights-of-way, would allow for a shared right-of-way with separate tracks for freight and passenger services. The long-term improvements to the rail system would offset any adverse effects on freight service. Based on this assessment, the qualitative evaluation is that the local effects on freight operations are negligible.

3.20.4.5.2 Alternative S6 Higher-Speed Rail

Travel Demand and Mode Share

Table 3.20-27 presents the projected travel demand and mode share for the No Build Alternative and Alternative S6 Higher-Speed Rail.

Table 3.20-27: 2035 Travel Demand and Mode Share – Alternative S6 Higher-Speed Rail

Mode	Travel Demand (Trips per Year)		Mode Share (Percentage by Mode)	
	No Build	S6 HrSR	No Build	S6 HrSR
	San Antonio - Laredo			
Auto	11,745,072	11,700,826	98.88%	98.48%
Passenger Rail	0	59,440	0.00%	0.50%
Intercity Bus	132,860	120,956	1.12%	1.02%
Air	0	0	0.00%	0.0%

With Alternative S6 Higher-Speed Rail, the reduction in mode share for highway travel is less than 1 percent, which represents a negligible effect. Passenger rail service does not currently exist in the Southern Section and there would be a substantial demand for this new service. Passenger rail ridership is forecast at 59,440 passengers per year. For bus, the shift in mode share is moderate. The mode share for bus will decrease by 9 percent. Direct air service does not exist and there would be no effect on this mode. The ridership data (including diverted trips and induced demand) are described in further detail in the Passenger Rail Ridership section.

Travel Time Savings

Table 3.20-28 provides a comparison of the projected travel time between modes. Alternative S6 Higher-Speed Rail would provide service between San Antonio and Laredo. This alternative would save travelers approximately 1 hour compared with driving or intercity bus travel. This is a moderate beneficial effect of the project.

Table 3.20-28: 2035 Travel Time Comparison by Mode – Alternative S6 Higher-Speed Rail

Mode	Travel Time (minutes)[a]				
	San Antonio – Laredo	San Antonio – Corpus Christi	Laredo – Brownsville	Corpus Christi – Brownsville	Austin - San Antonio
Auto	157	151	320	211	103
Passenger Rail[b]	101	-	-	-	-
Intercity Bus	160	157	285	231	95
Air	-	-	-	-	-

[a] Except for passenger rail, travel time is assumed to be the same for the No Build Alternative and Alternative S6 HrSR.
[b] Passenger rail is for the build alternative only. This service does not currently exist. Service is only proposed between San Antonio and Laredo.

Travel Time Reliability

By 2035, highway travel time between San Antonio and Laredo is projected to increase by approximately 8 minutes. These increases in future highway travel time are minor, so reliability for highway travel is expected to remain relatively good. With Alternative S6 Higher-Speed Rail, there would be a negligible difference and corresponding effect in travel time reliability for train travelers, compared with highway travel.

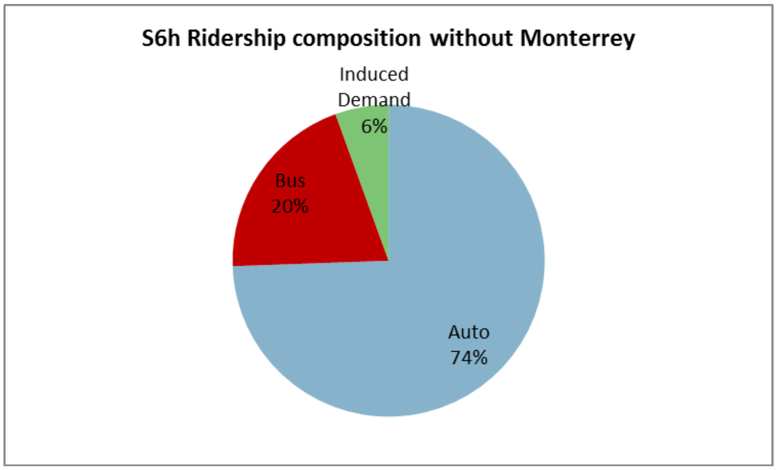

Figure 3.20-7: Alternative S6 HrSR Ridership Composition

Passenger Rail Ridership

Table 3.20-29 provides a summary of the projected rail ridership with Alternative S6 Higher-Speed Rail and Figure 3.20-7 illustrates the projected ridership composition.

For the new rail trips (approximately 59,440 riders), the highest percentage is from auto trips (74 percent), followed by bus trips (20 percent). Bus has the highest percentage of its trips diverted to rail (9 percent).

Table 3.20-29: 2035 Intercity Rail Ridership – Alternative S6 Higher-Speed Rail

Ridership Composition by Mode	Divertible Market	S6 HrSR Rail Riders	Diversion Percentage	S6 HrSR Rail Ridership Composition
(Passengers per Year)				
Total Intercity Ridership	11,877,933	**56,150**	0%	
Auto	11,745,073	44,246	0%	74%
Local Air[a]	< 40,000	< 10,000		
Connect Air	-	-	-	
Bus	132,860	11,909	9%	20%
Induced Demand[b]		**3,289**		6%
Total Ridership[c]		**59,439**		

[a] Air travelers whose entire trip is within the corridor area.

[b] HSR riders who would not have made the trip by another mode.

[c] The sum of diverted and induced demand for HSR.

Vehicle Miles Traveled

Table 3.20-30 presents the estimated changes in VMT with the No Build Alternative and Alternative S6 Higher-Speed Rail. Implementation of Alternative S6 Higher-Speed Rail would result in a 0.4 percent reduction in VMT compared with the No Build Alternative. This equates to nearly 3 million fewer miles traveled each year. The decrease in VMT is a beneficial, although negligible, effect of the project, compared with the No Build Alternative.

Table 3.20-30: 2035 Changes in Vehicle Miles Traveled

	Vehicle Miles Traveled (per Year)		
	No Build	S6 HrSR	Change
San Antonio - Laredo	745,641,562	742,832,570	-2,808,992/ -0.4%

Local Effects on Transportation and Parking

Alternative S6 Higher-Speed Rail would have similar effects on local transportation and parking as previously described for the build alternatives in the Central Section. This alternative generally traverses through less developed areas and as a higher-speed rail option would be designed with some at-grade crossings, which would affect local traffic circulation. New stations would be constructed in some locations and would alter traffic patterns in these locations. Based on this assessment, the qualitative evaluation is that the local effects on transportation and parking are moderate.

Effects on Intercity Transit Providers, Air Carriers, and Freight Operations

With Alternative S6 Higher-Speed Rail, approximately 9 percent of existing bus riders would be diverted to rail. This diversion could result in moderate effects on transit service provider operations (e.g., demand and schedule) and lost revenue as a result of fewer customers.

The design of the higher-speed rail alternative would allow for a shared right-of-way with separate tracks for freight and passenger services. The long-term improvements to the rail system would offset any adverse effects on freight service. Based on this assessment, the qualitative evaluation is that the local effects on freight operations are negligible.

3.20.4.5.3 Alternative S6 High-Speed Rail

Travel Demand and Mode Share

Table 3.20-31 presents the projected travel demand and mode share for the No Build Alternative and Alternative S6 High-Speed Rail.

Table 3.20-31: 2035 Travel Demand and Mode Share – Alternative S6 High-Speed Rail

Mode	Travel Demand (Trips per Year)		Mode Share (Percentage by Mode)	
	No Build	S6 HSR	No Build	S6 HSR
	San Antonio – Laredo			
Auto	11,745,072	11,638,144	98.88%	97.88%
Passenger Rail	0	138,500	0.00%	1.17%
Intercity Bus	132,860	113,302	1.12%	0.95%
Air	0	0	0.00%	0.00%

With Alternative S6 High-Speed Rail, the reduction in mode share for highway travel is 1 percent, which represents a negligible effect. Passenger rail service does not currently exist in the Southern Section and there would be a substantial demand for this new service. Passenger rail ridership is forecast at 138,500 passengers per year. For bus, the shift in mode share is moderate. The mode share for bus would decrease by 15 percent. Direct air service does not exist and there would be no effect on this mode. The ridership data (including diverted trips and induced demand) are described in further detail in the Passenger Rail Ridership section.

Travel Time Savings

Table 3.20-32 provides a comparison of the projected travel time between modes. It is assumed that there will no difference in travel time between the No Build Alternative and Alternative S6 High-Speed Rail for auto and bus (direct air service does not exist).

Alternative S6 High-Speed Rail would provide service between San Antonio and Laredo. This alternative would provide significant travel time savings compared with highway and intercity bus travel between these city pairs. Alternative S6 High-Speed Rail would save travelers 1 hour and 40 minutes compared with driving or intercity bus travel, between San Antonio and Laredo. This is a substantial beneficial effect of the project.

Table 3.20-32: 2035 Travel Time Comparison by Mode – Alternative S6 High-Speed Rail

Mode	Travel Time (minutes)[a]				
	San Antonio – Laredo	San Antonio – Corpus Christi	Laredo – Brownsville	Corpus Christi – Brownsville	Austin - San Antonio
Auto	157	151	320	211	103
Passenger Rail[b]	56	-	-	-	-
Intercity Bus	160	157	285	231	95
Air	-	-	-	-	-

[a] Except for passenger rail, travel time is assumed to be the same for the No Build Alternative and Alternative S6 HSR.

[b] Passenger rail is for the build alternative only. Rail service does not currently exist. Service is only proposed between San Antonio and Laredo.

Travel Time Reliability

By 2035, highway travel time between San Antonio and Laredo is projected to increase by approximately 8 minutes. These increases in future highway travel time are minor, so reliability for highway travel is expected to remain relatively good. With Alternative S6 High-Speed Rail, there would be a negligible difference and corresponding effect in travel time reliability for train travelers, compared with highway travel (because of an increase of only 8 minutes in highway travel).

Passenger Rail Ridership

Table 3.20-33 provides a summary of the projected rail ridership with Alternative S6 High-Speed Rail and Figure 3.20-8 illustrates the projected ridership composition.

For the new rail trips (approximately 138,500 riders), the highest percentage would be shifted from auto trips (77 percent), followed by bus (14 percent). Bus travel has the highest percentage of its trips diverted to rail (15 percent).

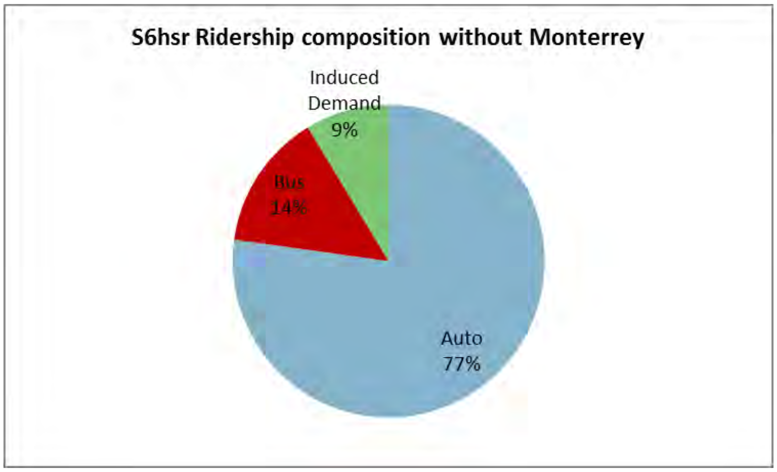

Figure 3.20-8: Alternative S6 HSR Ridership Composition

Table 3.20-33: Summary of Travel Demand and Transportation Effects by Alternative

Context	Potential Intensity of Effects					
	Northern	Central		Southern		
	N4A CONV	C4A/B/C SR	C4A HrSR	S4 HrSR	S6 HSR	S6 HrSR
Travel Demand and Mode Share[a]						
Auto	Negligible (positive)	Moderate (positive)	Moderate (positive)	Negligible (positive)	Negligible (positive)	Negligible (positive)
Transit	Substantial (negative)	Substantial (negative)	Moderate (negative)	Moderate (negative)	Moderate (negative)	Moderate (negative)
Air	Substantial (negative)	Substantial (negative)	Substantial (negative)	Substantial (negative)	No effect	No effect
Travel Time Savings[b]						
Auto	Negligible (positive)	Substantial (positive)	Substantial (positive)	Substantial (positive)	Substantial (positive)	Moderate (positive)
Transit	Substantial (positive)	Substantial (positive)	Substantial (positive)	Substantial (positive)	Substantial (positive)	Moderate (positive)
Air	Negligible (positive)	Negligible (positive)	Negligible (positive)	No effect	No effect	No effect
Travel Time Reliability[c]						
Auto	Negligible (positive)	Substantial (positive)	Substantial (positive)	Substantial (positive)	Negligible (positive)	Negligible (positive)

Context	Potential Intensity of Effects					
	Northern	Central		Southern		
	N4A CONV	C4A/B/C SR	C4A HrSR	S4 HrSR	S6 HSR	S6 HrSR
Change in VMT[d]						
Auto	Negligible (positive)	Substantial (positive)	Moderate (positive)	Negligible (positive)	Negligible (positive)	Negligible (positive)
Local Transportation[e]						
Transportation/Parking	Moderate (negative)	Moderate (negative)	Moderate (negative)	Moderate (negative)	Moderate (negative)	Moderate (negative)
Service Providers[f] and Freight Operations[g]						
Transit	Substantial (negative)	Moderate (negative)	Moderate (negative)	Moderate (negative)	Moderate (negative)	Moderate (negative)
Air	Substantial (negative)	Substantial (negative)	Substantial (negative)	Substantial (negative)	No effect	No effect
Freight	Negligible (negative)	Negligible (negative)	Negligible (negative)	Negligible (negative)	Negligible (negative)	No effect

[a] Shift in mode share as a result of the project. This could be a beneficial or negative effect depending on mode.

[b] Travel time savings compared to all modes. Savings in travel time is a beneficial effect of the project.

[c] Travel time reliability compared to highway travel. This is a beneficial effect of the project (e.g., as highway travel speeds slow, highway travel time reliability decreases).

[d] A reduction in VMT is a beneficial effect of the project.

[e] Potential effects on local traffic circulation and parking were assessed qualitatively.

[f] Potential effects on transit providers and air carriers.

[g] Effects on freight operations were assessed qualitatively.

3.20.5 Avoidance, Minimization, and Mitigation Strategies

Avoidance and minimization of effects at the project level will be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies will be implemented. Avoidance, minimization, and mitigation strategies will also be further developed in consultation with affected agencies and providers during the project-level analysis.

At the project level, measures to minimize transportation effects may include, but would not be limited to, preparation and implementation of a Traffic Management Plan (TMP) during construction. The implementation of any of the build alternatives should include a TMP that would minimize effects on existing local traffic as a result of construction activities. The TMP would be prepared in accordance with the *Manual on Uniform Traffic Control Devices* (Federal Highway Administration 2009) and all applicable requirements of the local reviewing agency, as appropriate. The TMP could include, but would not be limited to, the following measures:

- Prepare temporary traffic control plans for each construction area. The temporary traffic control plans will identify the need for full or partial lane closures, detours, flaggers for directing traffic, temporary signage, lighting, traffic control devices, and other measures, if required.

- Identify oversize and overweight load haul routes. Transporters will comply with state and county regulations for transportation of oversized and overweight loads on all state, county, and city roads. Such regulations typically include provisions for time of day, pilot cars, law enforcement escorts, speed limits, flaggers, and warning lights. All material hauling activities shall comply with applicable state and local regulations.
- Schedule deliveries of heavy equipment and construction materials during periods of minimum traffic flow and determine the need for construction work hours and arrival and departure times outside peak traffic periods.
- Post the approved hours of construction activity at the construction site in a place and manner that can be easily viewed by any interested member of the public.
- Identify vehicle safety procedures for entering and exiting site access roads.
- Notify and coordinate with emergency responders regarding potential road closures prior to construction.
- Provide access for emergency vehicles to and around the project sites.
- Maintain access to adjacent properties, transit, bicycle, and pedestrian facilities along project routes.
- Notify residential and commercial occupants of property adjacent to the construction sites of the hours of construction activity which may impact the area.
- Notify and coordinate with transit operators regarding potential road closures prior to construction. Notify and coordinate with mail service and waste haulers regarding potential road closures prior to construction.
- Provide a construction-parking plan that minimizes the effect of construction worker parking in the area. Include an estimate of the number of workers that will be present on the site during the various phases of construction, indicate where sufficient off-street parking will be used, and identify all locations for offsite material deliveries.
- Distribute public information using local news television and radio broadcasts, informational flyers and mailers, Web sites, and other outreach options. Signs should be installed and public notices should be distributed regarding construction work before disruptions occur; the notifications would identify detours to maintain access.

3.20.6 Subsequent Analysis

Future studies conducted at the project level would likely define a specific Area of Potential Effects through the development of a Programmatic Agreement among FRA, TxDOT, and ODOT. At the local level, the project-level analysis will include identifying local effects on circulation (roadway and intersection level of service), access (vehicular, transit, pedestrian, and bicycle access), and parking demand in the vicinity of station locations and grade crossings. Additional project-level analysis will include an assessment of air carrier operations and any potential operational shifts that may be realized based on changes in mode share to rail. The analysis will include an assessment of potential benefits and/or impacts that may result with a shift from short-haul to longer-haul flight operations. During construction, transportation effects will also be analyzed in the vicinity of new station locations, and where new rail infrastructure is proposed.

Updated travel market data, demographic data, and forecasts should be included in the travel demand model. The update should include the latest metropolitan planning organization (MPO) base year and future year highway networks; the latest MPO and statewide socioeconomic data and forecasts; and the latest rail, intercity bus and air travel market data. Subsequent analysis related to the travel demand model will also include refined intercity travel demand forecasts by section or subsequent project and detailed assessment of potential frequency, costs, travel market data, using project-level demographic data and forecasts, and more detailed information on future/planned regional and local transportation systems.

Detailed information about how the alternatives could connect would be analyzed at the project-level EIS phase. Due to the degree of variability in possibilities and the lack of detail, the Study does not provide a summary of effects for the entire route traveling between Oklahoma to South Texas. Rather, this analysis provides information about each individual alternative compared against the No Build Alternative and in some instances compared with another alternative for that same section.

Review of potential site-specific indirect and cumulative effects would be included during the project-level analysis. These actions are not covered in this analysis and therefore are not discussed further.

3.21 Public Health

This section describes the anticipated overall direct and indirect public health effects within the environmental impact statement (EIS) Study Area, including applicable information from the other relevant individual discussions such as air quality, groundwater quality, and hazardous materials. Public safety is addressed in Section 3.16 of the EIS. The introduction to Chapter 3 describes the EIS Study Area and use of terms such as Study Vicinity and transportation corridor, along with the standard organization of each analysis.

3.21.1 Laws, Regulations, and Orders

Applicable federal laws, regulations and orders pertaining to public health effects relating to air emissions, groundwater quality, and hazardous materials within the EIS Study Area are described in Section 3.1, Air Quality, Section 3.2, Water Quality, and Section 3.16, Public Safety and Hazardous Materials. Additional state, local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

3.21.2 Methodology

The public health effect evaluation consists of a qualitative assessment of the public health effects of the alternatives in relation to air quality, groundwater quality, and hazardous materials. Groundwater is the primary source of potable drinking water in the EIS Study Area and therefore the public health evaluation focuses on potential health effects associated with the use of groundwater. For each route alternative, sources of air pollution, groundwater aquifers which supply drinking water, and known hazardous materials sites located within the potential right-of-way were identified. The No Build Alternative is the primary basis of comparison to the build alternatives.

Effects of the route alternatives are characterized as negligible, moderate, or substantial compared with the No Build Alternative. For this service-level analysis the definition of negligible, moderate, or substantial effects for air quality, water quality, and hazardous materials were used as the basis for characterizing potential public health effects. Refer to Section 3.1, Air Quality, Section 3.2, Water Quality, and Section 3.16, Public Safety and Hazardous Materials, for the resource-specific definitions of negligible, moderate, and substantial. For example, where an alternative would have a negligible effect on groundwater it is reasonable to determine that the public health effects associated with the use of groundwater for drinking would also be negligible. For air quality, for example, where an alternative would have long-term regional effects or benefits, a more conservative approach was taken to determine public health effects because of the level of detail available at the service level.

3.21.3 Affected Environment

The National Environmental Policy Act regulations do not require quantitative analysis regarding public health; however, environmental, social, demographic, and economic conditions drive the health and well-being of communities. As defined above, the range of issues that can affect human health include exposures to air pollution, groundwater contamination where the water is used for drinking, waste disposal, and hazardous substances. Specific discussions regarding air quality, groundwater quality, and hazardous materials may be found in Sections 3.1, 3.2, and 3.16, respectively; however, aspects within these issue areas pertaining to public health are qualitatively assessed in this section.

3.21.3.1 Overview

Air pollutants, individually and in combination, degrade the atmosphere and harm human health with high concentrations of pollutants, particularly when exceeding acceptable and regulated thresholds, thereby creating poor air quality conditions. Pollutants and sources of airborne pollutions affecting air quality and attainment status of an area are identified in Section 3.1. The U.S. Environmental Protection Agency designates areas that are not in compliance with the National Ambient Air Quality Standards (NAAQS) as “nonattainment”. Areas once classified as nonattainment that have since demonstrated attainment of the NAAQS are classified as “maintenance areas.” Groundwater aquifers that occur within the EIS Study Area are identified and discussed in greater detail in Section 3.2. Groundwater is a significant resource for freshwater throughout the EIS Study Area, including major sourcing of potable and irrigation water in the region. Existing and known hazardous sites have the potential to be disturbed or released, including the introduction of hazardous materials during construction. As stated in Section 3.16, Public Safety and Hazardous Materials, known recorded hazardous materials sites were identified within the EIS Study Area.

3.21.3.2 Northern Section: Oklahoma City to Dallas and Fort Worth

3.21.3.2.1 Air Quality

Oklahoma is designated as in attainment/unclassified for all criteria pollutants under NAAQS (see Section 3.1, Air Quality, for detailed discussions on the affected environment). The main contributors to air pollution in Oklahoma are point sources including power plants and industrial facilities. Mobile emissions from cars and trucks are a minor contributor to pollutants in Oklahoma. In northern Texas, the Dallas and Fort Worth counties are designated as nonattainment for ozone; portions of Collins County are nonattainment for the 2008 lead standard), and in maintenance for the 1978 lead standard. Mobile emissions from cars and trucks are contributors to pollutants in Texas.

3.21.3.2.2 Groundwater Quality

The groundwater contained in aquifers is one of the most important sources of water. An aquifer is a geologic formation, group of formations, or part of a formation which contains sufficient saturated, permeable material to yield significant quantities of water to wells and springs. Eight major aquifers and two minor aquifers occur within the Northern Section EIS Study Area and overlap with Alternative N4A Conventional, as shown on Figures 3.2-3 and 3.2-4 (Section 3.2 provides detailed discussions on the affected environment). Specifically, there are seven major aquifers in Oklahoma, one major aquifer in Texas and one minor aquifer in both Oklahoma and

Texas. A major aquifer is generally defined as supplying large quantities of water in large areas. Minor aquifers typically supply large quantities of water in small areas or relatively small quantities in large areas. Only one of the major aquifers in the Northern Section is designated as a Sole Source Aquifer (Arbuckle-Simpson Aquifer), which is defined as an aquifer that supplies at least 50 percent of the drinking water consumed in the overlying area.

Aquifers in Oklahoma contain an estimated 320 million acre-feet of fresh water, of which approximately half is considered recoverable for use. The aquifers supply more than 60 percent of the water used in the state, particularly where less surface water is available. Aquifers in Texas provide about 60 percent of the 16.1 million acre-feet of water used annually within the state.

3.21.3.2.3 Hazardous Materials

Areas where new right-of-way may be developed or where significant earth-disturbing activities would occur have an increased potential to disturb contaminated or potentially contaminated hazardous materials sites. The exposure to, and potential release of, hazardous materials associated with Alternative N4A Conventional has the potential to affect eight known hazardous materials sites within the Northern Section EIS Study Area. Section 3.16, Public Safety and Hazardous Materials, provides a detailed discussion on the affected environment.

3.21.3.3 Central Section: Dallas and Fort Worth to San Antonio

3.21.3.3.1 Air Quality

The Dallas and Fort Worth area to the Austin-Round Rock air basin is in attainment or unclassified for all criteria pollutants. The main contributors to air pollution include agricultural dust and soil disturbances, point sources including power plants and industrial facilities, and mobile emissions (both onroad and offroad).

3.21.3.3.2 Groundwater Quality

As mentioned above, aquifers in Texas provide approximately 60 percent of the 16.1 million acre-feet of water used annually within the state. Two major aquifers and three minor aquifers occur within the Central Section EIS Study Area and overlap with all the Central Section alternatives as shown on Figures 3.2-7 and 3.2-8. Only one of the major aquifers, the Edwards Aquifer, is designated as a Sole Source Aquifer. The aquifer is considered one of the most prolific artesian aquifers in the world and provides water to approximately 2 million people (San Antonio Water System 2014). Major springs produced by the Edwards Aquifer include San Pedro, San Antonio, Comal, San Marcos, and Hueco Springs (Eckhardt 2014).

3.21.3.3.3 Hazardous Materials

Nine known hazardous materials sites were identified for Alternative C4A Higher-Speed Rail and Alternative C4A High-Speed Rail. Eight known hazardous materials sites were identified for Alternative C4B Higher-Speed Rail and Alternative C4B High-Speed Rail. Twelve known hazardous materials sites were identified for Alternative C4C Higher-Speed Rail and Alternative C4C High-Speed Rail (Section 3.16 provides a detailed discussion of the affected environment).

3.21.3.4 Southern Section: San Antonio to South Texas

3.21.3.4.1 Air Quality

For areas south of San Antonio, all criteria pollutants are in attainment or unclassified under NAAQS. In the rural regions outside of the San Antonio air basin and Corpus Christi air basin, the predominant contributors to air pollution are area sources including agricultural dust and soil disturbances. In the San Antonio air basin and Corpus Christi air basin, the predominant contributors to air pollution are point sources, including power plants, industrial facilities, and mobile emissions (both onroad and offroad).

3.21.3.4.2 Groundwater Quality

Four major aquifers and three minor aquifers occur within the Southern Section EIS Study Area and overlap with the Southern Section alternatives, as shown on Figures 3.2-11 and 3.2-12. Only one of the major aquifers, the Edwards Aquifer, is designated as a Sole Source Aquifer.

3.21.3.4.3 Hazardous Materials

Alternative S4 Higher-Speed Rail has the potential to affect four known hazardous materials sites within the Northern Section EIS Study Area. No known hazardous materials sites were identified for Alternative S6 Higher-Speed Rail and Alternative S6 High-Speed Rail (Section 3.16 provides a detailed discussion of the affected environment).

3.21.4 Environmental Consequences

3.21.4.1 Overview

Construction activities, such as the use of construction equipment, site ingress and egress, staging areas, and site grading, could potentially result in an increase in pollutants affecting air quality and groundwater quality. These activities may also create safety hazards and hazardous conditions for construction workers, and result in a release or disturbance of hazardous materials. Potential operations effects would be long-term and would include air pollution, groundwater contamination, and exposure to hazardous material sites or operations. Operation of the Program would affect air quality and can have adverse effect on human health if air pollutants emissions would increase. However, operation of the build alternatives would generally result in a long-term net benefit to regional air quality by reducing emissions of criteria pollutants and air toxics. Localized public health effects would occur if large amount of diesel vehicles or diesel trains idle at a particular location. An increase in impervious surface area would increase stormwater runoff and in areas of groundwater recharge may affect groundwater quality. Known hazardous material sites are not anticipated to be disturbed during operation; however, additional hazardous materials sites may be discovered during construction. Because oil fields, including pipelines and wells (see Section 3.16, Public Safety and Hazardous Materials), are potentially present in the EIS Study Area, there would be potential public health concerns related to passenger rail service operating in close proximity to these areas.

Routine maintenance and operation of passenger trains also create opportunities for unintended releases and spills of hazardous materials.

All of the alternatives would result in a net long-term regional benefit to air quality by reducing vehicle miles traveled.

Support and ancillary operations at stations could also result in local air quality effects. Increases in traffic congestion, especially at high-speed stations, could result in greater health-related effects than other alternatives. The type of station may also influence the level of potential health-related air quality effects.

3.21.4.2 No Build Alternative

The No Build Alternative, as described in Chapter 2, Section 2.2, and Chapter 3, Introduction, is used as the baseline for comparison. The No Build Alternative would not implement the Program of rail improvements associated with this service-level evaluation and would not meet the purpose and need of the Program; therefore, the No Build Alternative would not affect public health.

3.21.4.3 Northern Section: Oklahoma City to Dallas and Fort Worth

3.21.4.3.1 Alternative N4A Conventional

Air Quality

Construction of Alternative N4A Conventional would have the potential to expose nearby populations to short-term air pollution emissions. However, Alternative N4A would primarily use existing rail infrastructure and would require minimal construction activities to implement. Due to the limited construction emissions associated with construction activities, short-term health effects would be negligible for Alternative N4A.

At a regional level, operation emissions associated with Alternative N4A would be similar or slightly lower compared to No Build Alternative, as detailed in Section 3.1, Air Quality. Due to the minor change in regional emissions, the long-term regional benefits to public health would be negligible.

Alternative N4A would reduce localized traffic congestion at some of the locations in the region by removing passenger vehicles from roadways and reducing vehicle emissions. Therefore, the alternative would have beneficial effects of reducing public exposure to air pollutants at locations with improved traffic conditions. On the other hand, the alternative would have the potential to cause adverse health effects if it causes a large number of diesel vehicles or diesel trains to idle for long periods of time, especially at locations near sensitive populations such as children, the elderly, and those with existing health concerns.

As discussed above, Alternative N4A would be beneficial in reducing localized effects in some cases but would have the potential to cause localized adverse effects in other cases. For this service-level analysis there is not sufficient information to determine potential local health effects. Localized health effects of Alternative N4A would be evaluated at the project level when project-specific information becomes available. As such, localized health effects from Alternative N4A will be analyzed in subsequent analysis and are not further discussed in this study.

Groundwater Quality

There are two types of aquifers: confined and unconfined. Confined aquifers generally occur at significant depth below the ground surface and are bounded above and below by confining beds. The Arbuckle-Simpson Aquifer, which is a Sole Source aquifer, is a confined aquifer.
An unconfined aquifer, also called a water-table aquifer, is an aquifer which has the water table as its upper boundary and occurs near the ground surface.

Construction-related activities are most likely to affect unconfined and sole source aquifers because they have a direct connection to the ground surface and are the primary source of water for adjacent populations. Alternative N4A Conventional would be located in the recharge area for the Arbuckle-Simpson Aquifer, which is an unconfined area (primary recharge is from precipitation infiltration with very little vertical leakage) of the otherwise confined aquifer; therefore, there is very little potential for groundwater to be affected by surface water runoff during construction. During construction activities, effects would be minimized by implementing standard best management practices (BMPs) that would address runoff as identified in Section 3.2, Water Quality. In general, these construction BMPs may include phasing and construction sequencing, temporary seeding of cleared areas, mulching, erosion control blankets, reinforced matting, stabilized construction access, controlled temporary stockpile areas, hay bales, silt fences, dikes, baffles, runoff diversion, level spreaders and subsurface drains. For new construction related to stations, stormwater treatment measures and BMPs would also be implemented during construction and operation. Short-term effects on groundwater resources caused by construction and operations activities would be negligible.

Long-term effects may include groundwater contamination caused by rainfall runoff from created impervious surfaces and spills of construction materials such as hydraulic fluids, fuel, paint, and solvents. During operation activities, effects would primarily be minimized by adhering to the required stormwater management regulations and BMPs as identified in Section 3.2, Water Quality. In general, these operational BMPs may include wet and dry detention ponds, vegetate conveyance systems, maintaining stream and wetland buffers, and porous surfacing. Long-term effects on groundwater resources caused by operations activities would be negligible.

Hazardous Materials

Construction vehicles and equipment have the potential to release hazardous materials (primarily petroleum products) or encounter contaminated sites or materials. Dewatering activities during construction could potentially alter existing groundwater contamination plumes. Heavy truck traffic may also increase during construction, creating an increased potential for hazardous material spills. Appropriate construction safety procedures, equipment stockpiling methods, material handling plans, and solid waste management procedures would be implemented to protect human health and the environment and minimize releases. With these procedures in place, public health effects related to hazardous materials during construction of Alternative N4A Conventional would be negligible.

Alternative N4A Conventional could potentially cause accidental hazardous material releases during train refueling, maintenance activities, or spills during operation of the trains. Environmental health and safety plans and procedures to address spills, accidental release, and exposure to hazardous materials would be developed and implemented during operation and maintenance of the passenger rail service. With the environmental health and safety plans and procedures, public health effects related to hazardous materials would be negligible.

3.21.4.4 Central Section: Dallas and Fort Worth to San Antonio

3.21.4.4.1 Alternative C4A Higher Speed Rail

Air Quality

Construction of Alternative C4A Higher-Speed Rail would be a major infrastructure project. Section 3.1, Air Quality, indicates that construction of Alternative C4A Higher-Speed Rail would generate substantial air emissions in the region. However, construction emissions would be spread throughout the construction period and along the rail alignment. Residents and workers would only be temporarily exposed to a small portion of the total construction emissions. Therefore, long-term exposure to criteria pollutants and air toxics, especially diesel particulate matter from construction equipment and vehicles that cause cancer from long-term exposure, would not occur. Therefore, Alternative C4A Higher-Speed Rail would have the potential to cause temporary and moderate health effects from construction.

At a regional level, operation emissions associated with Alternative C4A Higher-Speed Rail would be greatly reduced compared to No Build Alternative, as detailed in Section 3.1, Air Quality. Conservatively, it is anticipated that the air pollution emissions reduction would have long-term negligible (benefit) effects to public health in the region.

Similar to localized health effects discussed under Alternative N4A, Alternative C4A Higher-Speed Rail would be beneficial in reducing localized effects at locations where traffic conditions would improve. However, it would also have the potential to cause localized adverse effects at added at-grade crossings, near the stations, and at other locations where a large number of diesel vehicles and trains idle. Localized health effects of Alternative C4A Higher-Speed Rail would be evaluated at the project level when project-specific information becomes available.

Groundwater Quality

Alternative C4A Higher-Speed Rail does not cross the Sole Source Aquifer recharge areas of the Edwards Aquifer where groundwater would be more susceptible to surface disturbances and potential effects from construction and operation activities. Therefore, construction and operations activities would have negligible effects on the aquifer, and public health effects relating to groundwater would also be negligible.

Hazardous Materials

Construction effects related to potential releases of hazardous materials and encounters of contaminated sites or materials for Alternative C4A Higher-Speed Rail would be the same as the effects identified for Alternative N4A Conventional. Appropriate construction safety procedures as described under Alternative N4A Conventional would be implemented to protect human health and the environment and minimize releases. With these procedures in place, public health effects related to hazardous materials during construction of Alternative C4A Higher-Speed Rail would likely be negligible.

Operation of Alternative C4A Higher-Speed Rail could potentially result in accidental hazardous material releases during train refueling, maintenance activities, or spills during operation of the trains. Environmental health and safety plans and procedures identified under Alternative N4A Conventional would also be developed and implemented during operation and maintenance of the passenger rail service under this alternative. With these environmental health and safety plans and procedures, public health effects related to hazardous materials would be negligible.

The locations of potential stations have not been fully defined for Alternative C4A Higher-Speed Rail; however, it is possible that additional listed hazardous materials sites may be identified near the stations depending on their ultimate locations. Stations would be either newly constructed or renovations of existing stations. If stations require renovations, the effects would be the same as described for Alternative N4A Conventional. Newly constructed stations would require an additional analysis to determine conditions related to hazardous materials contamination in the vicinity of the station location.

3.21.4.4.2 Alternative C4A High-Speed Rail

Air Quality

Construction of Alternative C4A High-Speed Rail would potentially cause more emissions than Alternative C4A Higher-Speed Rail due to the additional grade-separated crossings. Section 3.1, Air Quality, indicates that construction of Alternative C4A High-Speed Rail would generate substantial air emissions in the region. Similar to Alternative C4A Higher-Speed Rail, long-term exposure to pollutants and air toxics, especially the diesel particulate matter from construction equipment and vehicles that cause cancer, would not occur. Therefore, Alternative C4A High-Speed Rail would have the potential to cause temporary and moderate health effects from construction.

At a regional level, operation emissions associated with Alternative C4A High-Speed Rail would be greatly reduced compared to No Build Alternative, as evaluated in Section 3.1, Air Quality. Alternative C4A High-Speed Rail would have a greater emission reduction than Alternative C4A Higher-Speed Rail due to the use of electric-powered trains and anticipated higher ridership. Conservatively, it is anticipated that Alternative C4A High-Speed Rail would have long-term negligible (benefit) effects to public health in the region.

Similar to localized health effects discussed under Alternative N4A, Alternative C4A High-Speed Rail would be beneficial in reducing localized effects at locations with improved traffic conditions. In addition, because Alternative C4A High Speed Rail would not have direct emissions from the trains (trains would be electric rather than diesel), localized health effects from train travel or train idling would not occur. However, Alternative C4A High-Speed Rail would have the potential to cause localized adverse effects near the stations where vehicles travel to and from and also idle at the stations. Detailed localized health effects of Alternative C4A High-Speed Rail would be evaluated at the project level when project specific information becomes available.

Groundwater Quality

Potential effects on groundwater resources for Alternative C4A High-Speed Rail would be the same Alternative C4A Higher-Speed Rail because both service types would follow the same or similar route. The public health effects relating to groundwater would be negligible.

Hazardous Materials

Potential construction and operations effects associated with hazardous materials and known hazardous materials sites for Alternative C4A High-Speed Rail would be the same as Alternative C4A Higher-Speed Rail because both service types would follow the same or similar routes. Although station locations might vary, the same considerations related to renovations of existing stations and potential new stations identified for Alternative C4A Higher-Speed Rail would apply for Alternative C4A High-Speed Rail. BMPs used during construction and operation of Alternative C4A High-Speed Rail would be the same as Alternative C4A Higher-Speed Rail and would provide the same mitigation functions with regard to hazardous materials. With implementation of BMPs, including environmental health and safety plans and procedures, public health effects related to hazardous materials would be negligible.

3.21.4.4.3 Alternative C4B Higher Speed Rail

Air Quality

Potential construction health effects associated with air quality for Alternative C4B Higher-Speed Rail would be similar to Alternative C4A Higher-Speed Rail because the construction requirements and potential for exposure of sensitive populations to increased levels of air pollutants and air toxics would be similar. As such, health effects for Alternative C4B Higher-Speed Rail during construction would be temporary and moderate.

Long-term health effects during operation of Alternative C4B Higher-Speed Rail would be similar to Alternative C4A Higher-Speed Rail due to the use diesel powered trains but at a lower level due to the shorter alignment length and the anticipated lower ridership. Conservatively, it is anticipated that Alternative C4B Higher-Speed Rail would have long-term negligible (benefit) effects to public health in the region.

As detailed for Alternative C4A Higher-Speed Rail, Alternative C4B Higher-Speed Rail would utilize diesel locomotive engines and there is potential for local health effects to occur where vehicles and diesel trains idle for long periods of time near high concentrations of sensitive populations. For this service-level analysis, there is insufficient information to determine potential local health effects. Detailed localized health effects of Alternative C4B Higher-Speed Rail would be evaluated at the project level when project-specific information becomes available.

Groundwater Quality

Alternative C4B Higher-Speed Rail does not cross the Sole Source Aquifer recharge areas of the Edwards Aquifer. Therefore, construction and operations activities would have negligible effects on the aquifer, and public health effects relating to groundwater also would be negligible.

Hazardous Materials

Potential construction and operations effects associated with hazardous materials and known hazardous materials sites for Alternative C4B Higher-Speed Rail would be the same as for Alternative C4A Higher-Speed Rail. BMPs and health and safety plans used during construction and operation of Alternative C4B Higher-Speed Rail would be the same as for Alternative C4A Higher-Speed Rail and would provide the same mitigation functions with regard to potential effects associated with hazardous materials. With implementation of environmental health and safety plans and BMPs, public health effects related to hazardous materials would be negligible.

3.21.4.4.4 Alternative C4B High-Speed Rail

Air Quality

Potential construction effects to public health associated Alternative C4B High-Speed Rail would be similar to Alternative C4A High-Speed Rail because the construction requirements and potential for exposure of sensitive populations to increased levels of air pollutants and air toxics would be similar. Health effects of Alternative C4B High-Speed Rail would be temporary and moderate.

Section 3.1, Air Quality, indicates that air pollution emissions from Alternative C4B High-Speed Rail would be greatly reduced compared to No Build Alternative. Health effects anticipated with Alternative C4B High-Speed Rail would be the similar to Alternative C4A High-Speed Rail, conservatively having long-term negligible (benefit) effects to the public health of the region.

Alternative C4B High-Speed Rail would utilize electric trains and be grade-separated; therefore, local health effects associated with train idling or vehicle idling at crossings would not occur.

However, Alternative C4B High-Speed Rail would have the potential to cause localized effects near the stations. For this service-level analysis, there is insufficient information to determine potential local health effects. Detailed localized health effects of Alternative C4B High-Speed Rail would be evaluated at the project level when project- specific information becomes available.

Groundwater Quality

Potential effects on groundwater resources for Alternative C4B High-Speed Rail would be the same as for Alternative C4B Higher-Speed Rail because both service types would follow the same or similar route. The public health effects relating to groundwater would be negligible.

Hazardous Materials

Potential construction and operations effects associated with hazardous materials and known hazardous materials sites for Alternative C4B High-Speed Rail would be the same as for Alternative C4B Higher-Speed Rail because both service types would follow the same or similar route. BMPs used during construction and operation of Alternative C4B High-Speed Rail would be the same as Alternative C4A High-Speed Rail and would provide the same mitigation functions with regard to potential effects associated with hazardous materials. With implementation of BMPs and environmental health and safety plans and procedures, public health effects related to hazardous materials would be negligible.

3.21.4.4.5 Alternative C4C Higher-Speed Rail

Air Quality

Potential health effects associated with Alternative C4C Higher-Speed Rail during construction would be similar to Alternative C4A Higher-Speed Rail because the construction requirements and potential for exposure of sensitive populations to increased levels of criteria pollutants and air toxics would be similar. Alternative C4C Higher-Speed Rail also has the same types of changes to existing crossings and the need for new crossings, as well as the ability to utilize some existing track as Alternative C4A Higher-Speed Rail. Therefore, health effects associated with Alternative C4C Higher-Speed Rail during construction would be temporary and moderate.

Alternative C4C Higher-Speed Rail would have similar health benefits to the region as Alternative C4A Higher-Speed Rail, but with a slightly greater benefit due to the longer alignment and greater ridership. Conservatively, Alternative C4C Higher-Speed Rail would have long-term regional negligible (benefit) effects to public health due to the reduced regional emissions.

Alternative C4C Higher-Speed Rail would utilize diesel locomotive engines. There is potential for local health effects to occur where vehicles and diesel trains idle for long periods of time near high concentrations of sensitive populations. For this service-level analysis, there is insufficient information to determine potential local health effects. Detailed localized health effects of Alternative C4C-Higher-Speed Rail would be evaluated at the project level when project- specific information becomes available.

Groundwater Quality

Alternative C4C Higher-Speed Rail does not cross the Sole Source Aquifer recharge areas of the Edwards Aquifer. Therefore, construction and operation activities would have negligible effects on the aquifer, and public health effects relating to groundwater would also be negligible.

Hazardous Materials

Potential construction and operations effects associated with hazardous materials and known hazardous materials sites for Alternative C4C Higher-Speed Rail would be the same as for Alternative C4A Higher-Speed Rail. Although station locations might vary, the same considerations related to renovations of existing stations and potential new stations identified for Alternative C4A Higher-Speed Rail would apply for Alternative C4C Higher-Speed Rail. BMPs and health and safety plans used during construction and operation of Alternative C4C Higher-Speed Rail would be the same as for Alternative C4A Higher-Speed Rail and would provide the same mitigation functions with regard to potential effects associated with hazardous materials. With these environmental health and safety plans and procedures, public health effects related to hazardous materials would be negligible.

3.21.4.4.6 Alternative C4C High-Speed Rail

Air Quality

Potential construction effects associated with air quality for Alternative C4C High-Speed Rail would be similar to Alternative C4A High-Speed Rail because the construction requirements and potential for exposure of sensitive populations to increased levels of particulate matter and air toxics would be similar. Alternative C4C High-Speed Rail also has the need for new crossings, new tracks, and related infrastructure as Alternative C4A High-Speed Rail. Therefore, regional health effects associated with Alternative C4C High-Speed Rail during construction would be temporary and moderate.

Operation of Alternative C4C High-Speed Rail would result in substantial emission reduction compared to the No Build Alternative. Conservatively, it is anticipated that Alternative C4C High-Speed Rail would have long-term regional negligible (benefit) during operation.

Alternative C4C High-Speed Rail would utilize electric trains and be grade-separated; therefore, localized health effects associated with train or vehicle idling at crossings would not occur. However, Alternative C4C High-Speed Rail would have the potential to cause localized effects near the stations. For this service-level analysis, there is insufficient information to determine potential local health effects. Detailed localized health effects of Alternative C4C High-Speed Rail would be evaluated at the project level when project-specific information becomes available.

Groundwater Quality

Potential effects on groundwater resources for Alternative C4C High-Speed Rail would be the same as for Alternative C4C Higher-Speed Rail because both service types would follow the same route. The public health effects relating to groundwater would be negligible.

Hazardous Materials

Potential construction and operations effects associated with hazardous materials and known hazardous materials sites for Alternative C4C High-Speed Rail would be the same as Alternative C4C Higher-Speed Rail because both service types would follow the same route. BMPs used during construction and operation of Alternative C4C High-Speed Rail would be the same as Alternative C4A Higher-Speed Rail and would provide the same mitigation functions in regards to potential effects associated with hazardous materials. With these environmental health and safety plans and procedures, public health effects related to hazardous materials would be negligible.

3.21.4.5 Southern Section: San Antonio to South Texas

3.21.4.5.1 Alternative S4 Higher-Speed Rail

Air Quality

Alternative S4 Higher-Speed Rail would utilize existing railroad corridors (Alice to Corpus Christi), but also require construction of some new track and related infrastructure. Potential construction effects associated with air quality for Alternative S4 Higher-Speed Rail would be the similar to the effects described for Alternative C4A Higher-Speed Rail because of the similar construction requirements and potential for exposure of sensitive populations to increased levels of particulate matter and air toxics. Alternative S4 Higher-Speed Rail would have temporary and moderate effects.

As discussed in Section 3.1, Air Quality, during operation, Alternative S4 Higher-Speed Rail is expected to cause an increase in regional criteria pollutant emissions compared to the No Build Alternative. Because the operational emissions increase would primarily be from diesel train travel along the alignment, people who live near the rail corridors would only be exposed to limited emissions when trains are passing by. People who live farther away from the rail corridor would have minimal exposure to emissions from the trains. Therefore, it is anticipated that Alternative S4 Higher-Speed Rail would have the potential to cause long-term moderate effects.

Alternative S4 Higher-Speed Rail would utilize diesel locomotive engines. There is potential for localized health effects at locations where diesel trains idle for long periods of time near high concentrations of sensitive populations. For this service-level analysis there is insufficient information to determine potential local health effects. Detailed localized health effects of Alternative S4 Higher-Speed Rail would be evaluated at the project level when project-specific information becomes available.

Groundwater Quality

Alternative S4 Higher-Speed Rail does not cross the Sole Source Aquifer recharge areas of the Edwards Aquifer. Therefore, construction and operations activities would have negligible effects on the aquifer, and public health effects relating to groundwater would also be negligible.

Hazardous Materials

Potential construction and operations effects associated with hazardous materials and known hazardous materials sites for Alternative S4 Higher-Speed Rail would be the same as Alternative C4A Higher-Speed Rail. BMPs used during construction and operation of Alternative S4 Higher-Speed Rail would be the same as for Alternative C4A Higher-Speed Rail and would provide the same mitigation functions with regard to potential effects associated with hazardous materials. With implementation of BMPs and environmental health and safety plans and procedures, public health effects related to hazardous materials would be negligible.

3.21.4.5.2 Alternative S6 Higher-Speed Rail

Air Quality

The length of the Alternative S6 Higher-Speed Rail alignment is approximately one-third the length of the S4 Higher-Speed Rail and S6 High-Speed Rail alignments. Therefore, Alternative S6 Higher-Speed Rail would have lower construction emissions than the other Southern Section alternatives. Construction of Alternative S6 Higher-Speed Rail would have the potential to cause moderate health effects.

Alternative S6 Higher-Speed Rail would have a negligible reduction in emissions of particulate matter and carbon monoxide and slight increase of nitrogen oxides, as discussed in Section 3.1, Air Quality. Increases of nitrogen oxide emissions are mostly due to the use of diesel-powered trains and the extremely low baseline emissions of the No Build Alternative. As the emission increases would be spread along the rail alignment, exposure of people to air pollutants at any given location would be minimal. Therefore, negligible long-term health effects are anticipated to occur during operation.

Alternative S6 Higher-Speed Rail would utilize diesel locomotive engines. There is potential for localized health effects at locations where diesel trains idle for long periods of time near high concentrations of sensitive populations. For this service-level analysis there is insufficient information to determine potential local health effects. Detailed localized health effects of Alternative S6- Higher-Speed Rail would be evaluated at the project level when project-specific information becomes available.

Groundwater Quality

Alternative S6 Higher-Speed Rail does not cross the Sole Source Aquifer recharge areas of the Edwards Aquifer. Therefore, construction and operation activities would have negligible effects on the aquifer, and public health effects relating to groundwater would also be negligible.

Hazardous Materials

No effects to known hazardous materials sites would occur with Alternative S6 Higher-Speed Rail since hazardous materials sites were not identified within the associated EIS Study Area. Potential construction and operations effects associated with the handling, storage, and the use of hazardous materials for Alternative S6 Higher-Speed Rail would be the same as for Alternative C4A Higher-Speed Rail. Should a hazardous materials site be encountered during the construction of Alternative S6 Higher-Speed Rail, the removal and disposal of hazardous materials would follow applicable federal and state regulations and effects would be negligible. Although station locations have not been identified for Alternative S6 Higher-Speed Rail, the same considerations related to renovations of existing stations and potential new stations identified for Alternative C4A Higher-Speed Rail would apply for Alternative S6 Higher-Speed Rail. BMPs used during construction and operation of Alternative S6 Higher-Speed Rail would be the same as Alternative C4A Higher-Speed Rail and would provide the same mitigation functions with regard to potential effects from hazardous materials. Public health effects as a result of hazardous materials would be negligible.

3.21.4.5.3 Alternative S6 High-Speed Rail

Air Quality

Alternative S6 High-Speed Rail would require construction of new track and related infrastructure. Potential construction effects associated with air quality for Alternative S6 High-Speed Rail would be the similar to those described for Alternative C4A High-Speed Rail because the construction requirements and potential for exposure of sensitive populations to increased levels of particulate matter and air toxics. Alternative S6 High-Speed Rail would have the potential to result in temporary and moderate health effects in the region.

As discussed in Section 3.1, Air Quality, operation of Alternative S6 High-Speed Rail would reduce regional emissions at negligible to moderate levels. Therefore, it is anticipated that regional health benefits for Alternative S6 High-Speed Rail would be negligible.

Groundwater Quality

Potential effects on groundwater resources for Alternative S6 High-Speed Rail would be the same as for Alternative S6 Higher-Speed Rail because both service types would follow the same route. The public health effects relating to groundwater would be negligible.

Hazardous Materials

Similar to Alternative S6 Higher-Speed Rail, no effects to known hazardous materials sites would occur with Alternative S6 High-Speed Rail since hazardous materials sites were not identified within the associated EIS Study Area because both service types would follow the same route. BMPs used during construction and operation of Alternative S6 High-Speed Rail would be the same as for Alternative C4A Higher-Speed Rail and would provide the same mitigation functions with regard to potential effects from hazardous materials. Public health effects as a result of hazardous materials would be negligible.

3.21.4.6 Summary of Potential Effects

Table 3.21-1 provides a summary of the potential intensity of effects by alternative.

Table 3.21-1. Summary of Public Health Effects by Alternative

Section	Alternative[a]	Potential Intensity of Effects - Air Quality (Short-Term Effects)	Potential Intensity of Effects – Air Quality (Long-Term Regional Effects)	Potential Intensity of Effects - Groundwater	Potential Intensity of Effects - Hazardous Materials
Northern	N4A CONV	Negligible	Negligible (benefit)	Negligible	Negligible
Central	C4A HrSR	Moderate	Negligible (benefit)	Negligible	Negligible
	C4A HSR	Moderate	Negligible (benefit)	Negligible	Negligible
	C4B HrSR	Moderate	Negligible (benefit)	Negligible	Negligible
	C4B HSR	Moderate	Negligible (benefit)	Negligible	Negligible
	C4C HrSR	Moderate	Negligible (benefit)	Negligible	Negligible
	C4C HSR	Moderate	Negligible (benefit)	Negligible	Negligible
Southern	S4 HrSR	Moderate	Moderate	Negligible	Negligible
	S6 HrSR	Moderate	Moderate	Negligible	Negligible
	S6 HSR	Moderate	Negligible (benefit)	Negligible	Negligible

Note:

Localized effects to public health associated with air quality would be evaluated in subsequent project-level analyses.

[a] CONV = conventional rail; HrSR = higher-speed rail; HSR = high-speed rail

3.21.5 Avoidance, Minimization, and Mitigation Strategies

Future project-level analysis will identify more specific potential effects on public health based on a more advanced understanding of the project design in the three geographic sections. Avoidance and minimization of effects will be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies will be implemented.

Measures to avoid and minimize public health effects related to air quality during construction will be considered during project-level analysis and will include, but not be limited to, use of low-emissions vehicles during construction, use of newer and well-maintained equipment, and reducing traffic congestion emissions such as by using site-specific traffic management plans. Strategies for managing emissions from diesel trains during operation could include using Tier 4 locomotive engines and implementing additional measures to reduce diesel locomotive idling times. Locating the tracks, stations, and other supporting facilities away from populated areas and sensitive receptors would also minimize and reduce the potential exposure to air toxics from diesel combustion.

Measures to avoid and minimize public health effects related to groundwater contamination require the use of surface water runoff BMPs. Construction BMPs will be considered during project-level analysis and will include, but not be limited to, runoff diversion measures, level spreaders, and subsurface drains. Operation BMPs will include, but not be limited to, the use of wet and dry retention/detention ponds, vegetated swales and conveyance systems, adequate buffers around or adjacent to groundwater recharge areas, and the use of most up-to-date industry standards for addressing water quality (e.g., porous surfacing and pavement).

The following mitigation measures and BMPs will be considered during project-level analysis to address public health effects related to hazardous materials:

- Use construction safety procedures, equipment stockpiling methods, material handling plans, and solid waste management procedures that protect human health and minimize hazardous materials releases during construction.
- Develop specific environmental health and safety plans and procedures that protect construction workers and surrounding communities.
- Use personal protection, workplace monitoring, alternative designs, and evaluation of construction methods that limit the effect from contaminated materials.
- Follow applicable federal and state regulations for removal and disposal of hazardous materials, such as asbestos or lead-based paint, if such materials are encountered during building or structure renovation or demolition.

3.21.6 Subsequent Analysis

Localized health impacts of air toxics associated with the Build Alternatives will be performed during project-level analysis when project-specific information is available and will likely only be conducted where operations are determined to have the potential to substantially increase localized air toxic emissions.

3.22 Irreversible and Irretrievable Commitments of Resources

The National Environmental Policy Act (NEPA) Section 102 (2)(C)(v) requires the analysis of irreversible and irretrievable commitments of resources under Title 40 Code of Federal Regulations (CFR) Section 1502.16, Environmental Consequences. A resource commitment is considered irreversible when direct and indirect impacts from its use limit future use options. Irreversible commitments apply primarily to nonrenewable resources, such as cultural resources, and to resources that are renewable only over long periods of time, such as soil productivity, forest health, and energy resources such as fossil fuels. A resource commitment is considered irretrievable when the use or consumption of the resource is neither renewable nor recoverable for future use. Irretrievable commitments apply to loss of production and harvest.

Irreversible and irretrievable commitments of resources could result from development of specific future projects within the Program. Each of the alternatives would require the commitment of material and energy for construction and operation, and the commitment of land for facilities and transportation infrastructure. As described in Chapter 2, Alternatives, the Program would require the dedication of land area and an investment in construction materials including rock, aggregate, and steel. This section describes the implications on land-based resources, construction materials, and energy used.

3.22.1 Laws, Regulations, and Orders

Irreversible and irretrievable impacts were evaluated in accordance with NEPA [42 United States Code § 4332(C)(v)] guidelines published by the White House Council on Environmental Quality regarding implementation of NEPA (40 CFR 1502.16) and the Federal Railroad Administration's *Procedures for Considering Environmental Impacts*, Section 14(n)(10) Consumption of Energy, (11) Use of Natural Resources, and (22) Construction Impacts (64 Federal Register 28545, May 26, 1999).

3.22.2 Methodology

For this service-level analysis, design of the alternatives is conceptual; therefore, the amount of material or the land area needed to construct and operate the alternatives is not quantifiable. Although there are average dimensions and material quantification by typical guideway profiles (e.g., at-grade, elevated, retained-cut/trench), this service-level design phase does not yet define the profile. Therefore, the irretrievable and irreversible commitment of resources to construct each alternative is best understood by discussing the different lengths of each alternative in combination with the different resources necessary by the rail service type (i.e., conventional, higher-speed rail, high-speed rail). Similarly, the details of irreversible impacts on environmental resources cannot be reported because this service-level evaluation does not determine the specific impact area, rather it reviews the presence of environmental resources within a 500-foot-wide environmental impact statement (EIS) Study Area for each alternative and determines the potential effects of the alternatives within the EIS Study Area. In reality, the right-of-way for each alternative could be as narrow as 50 feet in some areas of the trackway and require 500 feet or more around station areas. This evaluation is, therefore, a comparative discussion of likely environmental resources that would be irretrievably and irreversibly committed for conventional, higher-speed, and high-speed rail service types for each route alternative. Based on the commitment of these resources and the length of each alternative, the comparative use of irreversible and irretrievable resources is categorized as low, medium, or high for each alternative. For the reasons explained above, the low, medium, and high rankings are not defined in quantifiable terms for this service-level analysis.

3.22.3 Affected Environment

Section 3.1, Air Quality, through Section 3.20, Transportation, provide information on resources that may be disturbed or eliminated within the EIS Study Area, including farmland, wetlands, and wildlife habitat. Other resources would likely need to be acquired from outside the EIS Study Area, including material resources like steel, petroleum, natural gas, concrete materials, ballast rock, and wood. The locations of these resources are not ascertainable at this time, but would be considered during a subsequent project-level analysis.

3.22.4 Environmental Consequences

3.22.4.1 No Build Alternative

Under the No Build Alternative, the Program would not be implemented, and new commitments of resources would not occur other than those that would occur for other projects in the EIS Study Area. Future energy resources would be consumed at a slightly higher rate by automobiles, buses, and airplanes under the No Build Alternative than under the build alternatives.

3.22.4.2 Build Alternatives

3.22.4.2.1 Commitment of Land and Resources

The permanent use of land area is proportional to the length of the alternative. Permanent use of land would lead to the incremental displacement of critical habitat areas, farmland, historic resources, community, and residential uses. Some critical habitats, such as wetlands, can be mitigated with replacement, while others are more difficult to replace and could incrementally affect wildlife species sustainability. Effects on residential and community buildings can be mitigated by relocation or reconstruction elsewhere, whereas historic structures and farmland cannot be replaced. Additionally, new rail infrastructure would increase the amount of impervious surface area, which could incrementally affect water percolation into the groundwater.

Use of electric power or diesel fuel would be an irreversible commitment of resources to construct and/or operate the rail system. Construction would require the use of equipment and construction personnel who drive to the site. Most materials would be provided and delivered by truck or rail. These modes require use of nonrenewable fuels. In addition, diesel and electric-powered rail system alternatives would require the use of nonrenewable fuels. Texas and Oklahoma electric power generation predominantly uses natural gas or coal, but both Texas and Oklahoma have increased the use of renewable power sources to approximately 16 and 29 percent, respectively (see Section 3.10, Use of Energy Resources, for details) (U.S. Energy Information Administration 2015). As detailed in Section 3.10, operation of all the build alternatives would result in reduced demand for nonrenewable resources because of change in ridership from high-energy consumption modes of travel (i.e., automobile) to the lower energy mode – passenger rail. Electric rail service would result in the greatest benefits due to the switch from diesel to more efficient electricity.

3.22.4.2.2 Use of Resources by Service Type

Conventional Rail: Conventional rail is proposed only in existing rail corridors where passenger rail service can use existing rail lines or, in some cases, modifications (i.e., double-tracking) can be built within the existing right-of-way to accommodate additional trains. Because conventional rail would primarily use existing rail lines, the land area and materials required for implementation of this service type are expected to be minimal. Improvements could include straightening rail alignments, replacing existing rails, constructing a second track in some locations, improving communication systems, and upgrades to station areas. Nonrenewable materials needed to construct the improvements would include steel rail, ballast rock, and power for communication lines. Minor expansion of rights-of-way may be required in some areas. Because the objective of this service type is to use an existing rail line, conventional rail alternatives would not restrict access to other resources.

Higher-Speed Rail: Higher-speed rail could operate within existing railroad rights-of-way with separate tracks for freight and passenger services, or within new alignments outside of existing transportation corridors. This service type could operate on a single track with passing locations and would not require double-tracking. Construction would require typical rail line development materials: engineered soil stabilizing subsurface, ballast rock, railroad ties, steel rail, communication lines, and materials typical for building station and parking areas (e.g., asphalt). The land area for the right-of-way is a nonrenewable resource that would be removed from development or farming activities. In some areas along the alignments, creation of right-of-way would affect other resources that are difficult to replace or cannot be replaced including wetlands, critical habitat, and historic resources. However, because the higher-speed rail alternatives would employ only a diesel option, these alternatives could interconnect with existing rail lines through urbanized areas to minimize new right-of-way acquisitions.

High-Speed Rail: High-speed rail would use the largest amount of materials per mile of construction because these alternatives require fully access-controlled alignments, along with double-tracking for the entire corridor. In addition, safety requirements for trains operating at speeds of up to 220 to 250 miles per hour would necessitate grade separation from roadway crossings. This would result in modifications to existing infrastructure, in addition to constructing the rail system. The high-speed rail alternatives would involve the construction of multiple structures either to elevate or trench the track or to construct grade-separated roadway crossings. These structures require considerable amounts of aggregate, concrete, rebar, and steel materials. In addition, these structures require conversion of land uses to transportation rights-of-way. In some areas along the alignments, creation of right-of-way would affect resources that are difficult to replace or cannot be replaced including wetlands, historic resources, and farmlands. Because high-speed rail can best compete with air service, its rail stations are expected to attract high ridership and require large land areas for station-related services (e.g., parking areas and passenger ticketing processing), which would also affect resources such as wetlands, farmlands, and historic structures. High-speed rail alignments must be as straight as possible and with only large-radii curves. The high-speed rail alignments may not be able to closely follow existing transportation corridors and, therefore, would require more land area than the other build alternatives.

On a per-mile basis, conventional rail would require the least amount of irretrievable and irreversible commitment of resources, followed by higher-speed rail; high-speed rail would require the most resources. Table 3.22-1 provides a comparative summary of the use of irretrievable and irreversible commitment of resources based on the discussion above and considering the linear miles of each alternative.

Table 3.22-1: Comparative Summary of Resource Use by Alternative

Alternative and Service Type		Distance (miles)	Comparative use of Resources
Northern Section			
N4A	Conventional Rail	280	Low
Central Section			
C4A	Higher-Speed Rail	368	Medium
C4A	High-Speed Rail	368	High
C4B	Higher-Speed Rail	317	Medium
C4B	High-Speed Rail	317	High
C4C	Higher-Speed Rail	428	High
C4C	High-Speed Rail	428	High[a]
Southern Section			
S4	Higher-Speed Rail	416	High
S6	Higher-Speed Rail	143	Medium
S6	High-Speed Rail	143	Medium[b]

[a] Considering Alternative C4C Higher-Speed Rail covers more distance and also has greater effects on some irretrievable resources (such as historic resources and prime farmland) compared with the other higher-speed rail alternatives in the Central Section, the comparative use of resources is ranked higher for this alternative than for the other higher-speed rail alternatives in the Central Section.

[b] Considering Alternative S6 High-Speed Rail covers less distance and also has less effect on some irretrievable resources (such as historic resources) compared with the other high-speed rail alternatives, the comparative use of resources is ranked lower for this alternative than for the other high-speed rail alternatives.

3.22.5 Subsequent Analysis

Future project-level analyses for the Program would identify irretrievable and irreversible commitments of resources, including, but not limited to, wetlands and water resources, materials used to build transportation facilities, right-of-way, energy resources, natural habitats, cultural resources, and land use.

4.0 Section 4(f) and Section 6(f) Resources

This chapter discusses properties protected under Section 4(f) of the U.S. Department of Transportation (USDOT) Act and Section 6(f) of the Land and Water Conservation Fund (L&WCF) Act.

A service-level environmental impact statement (EIS) may not have the level of detail available that is necessary to make final approvals on uses of protected Section 4(f) or 6(f) resources. Therefore, this discussion focuses on the potential use of these properties. Final decisions on specific location and design will be made at the project level, when more detailed information is available and specific properties can be evaluated.

Data collection and analysis used a 500-foot-wide EIS Study Area (as described in the introduction to Chapter 3). Resources identified in the EIS Study Area are potentially eligible for protection under Section 4(f) of the USDOT Act of 1966 (49 United States Code [U.S.C.] 303) and/or Section 6(f) of the L&WCF Act of 1965. Section 3.17, Recreational Areas and Opportunities, and Section 3.18, Historic, Architectural, and Non-Archaeological Cultural Resources, document the methods and data sources used to identify the Section 4(f) and Section 6(f) resources.

4.1 Section 4(f) of the U.S. Department of Transportation Act

Section 4(f) of the USDOT Act of 1966, as amended, protects publicly owned park and recreation areas that are open to the general public, publicly owned wildlife and waterfowl refuges, and publicly or privately owned historic sites of national, state, or local significance from acquisition and conversion to transportation use. The term “historic sites” includes prehistoric and historic districts, sites, buildings, structures or objects listed in, or eligible for, the National Register of Historic Places (NRHP). This may also include places of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization that meet the National Register criteria.

4.1.1 Section 4(f) Criteria

Section 4(f) of the USDOT Act of 1966 protects parks, recreation areas, and refuges that meet the following criteria:

- **Publicly owned:** Public ownership, in relation to protected parks, recreation areas and refuges, refers to ownership by a local, state, or federal government agency. There are three types of public ownership:
  - **Fee simple ownership:** The land is solely owned by a government entity for park, recreation, or refuge purposes.
  - **Permanent easement for Section 4(f) purposes:** The land is not necessarily owned by a government agency, but the agency possesses an easement for Section 4(f) activities.
  - **Lease agreement for Section 4(f) purposes:** Similar to a public easement but with a lease agreement typically intended to be long term.

- **Open to the public:** A property that is open to the public is one where access is permitted to the entire public during normal hours of operation. A property would not be considered open to the public if access were permitted only to select groups. Wildlife and waterfowl refuges are an exception to this rule, as they may restrict public access either to sensitive areas or during certain times of the year for the protection of refuge habitat and/or species. Therefore, a publicly owned refuge would not have to provide unrestricted access to the public to be considered a Section 4(f) property.
- **Purposed primarily for park, recreation, or refuge activities:** The major purpose is related to the property's primary function and how it is intended to be managed. Parks and recreation areas typically offer a wide range of activities such as walking, hiking, or camping, as well as organized sports like soccer, softball or tennis. Parks can also be fairly passive in nature and may be designated open space without a specified recreational purpose. Refuges refer to properties that are formally part of the National Wildlife Refuge System or other publicly owned land (including waters), where the major purpose of such land is the conservation, restoration, or management of endangered species, their habitat, and other wildlife and waterfowl resources and their habitat.
- **Parks, recreation areas, and refuges must be significant:** The term "significant" means that in comparing the availability and function of the park, recreation area, or refuge with the park, recreation or refuge objectives of the agency, community, or authority, the property in question plays an important role in meeting those objectives at the national, state, or local level, except for certain multiple-use land holdings. Significance determinations are applicable to the entire property, not just to the portion of the property proposed for use by a project. A determination of significance is made in coordination with the official with jurisdiction, which is most commonly the agency that owns the property. Properties would be presumed significant in the absence of a determination by the official with jurisdiction. All determinations of significance are ultimately made by the federal lead agency, in this case, the Federal Railroad Administration (FRA).

Unlike the other Section 4(f) property categories (parks, recreation areas, and refuges), historic sites (also called cultural resources) can be privately or publicly owned to qualify as a Section 4(f) property. A historic site is considered a Section 4(f) property if it is listed in or determined eligible for listing in the NRHP. Determinations of NRHP eligibility are typically completed through Section 106 or Section 110 of the National Historic Preservation Act (NHPA).

Examples of types of Section 4(f)-protected cultural resources include historic buildings, historic transportation facilities, archaeological sites, traditional cultural places, historic and archaeological districts, and historic trails. However, Section 4(f) applies to archaeological sites that are on or eligible for inclusion on the NRHP and that warrant preservation in place, but does not apply to those that are chiefly important because of what can be learned by data recovery. For purposes of this service-level evaluation, archaeological resources are not included because it is unknown which sites would warrant preservation in place.

4.1.2 Use of Section 4(f) Resource

The "use" of a Section 4(f)-protected property is prohibited for transportation purposes unless there are no prudent and feasible avoidance alternatives to that use. A project must also include all possible planning to minimize harm to Section 4(f) resources. Section 4(f) applies when a use of a protected property occurs. To determine whether Section 4(f) applies to the proposed project alternatives, Section 4(f) properties must be assessed to determine whether a use of the property is anticipated. The "use" of a protected Section 4(f) property, as defined in 23 Code of Federal Regulations (CFR) 774.17, occurs when any of the conditions discussed in the subsections below are met:

- **Permanent/Direct Use:** A permanent use of a Section 4(f) resource occurs when the property is permanently incorporated into a proposed transportation facility. This use may occur as a result of partial or full acquisition or a permanent easement allowing permanent access onto the property for maintenance or other transportation-related purposes.
- **Constructive Use:** A constructive use of a Section 4(f) resource occurs when a transportation project does not permanently incorporate land from the resource, but the project's proximity results in impacts so severe that the protected activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired. Substantial impairment occurs only if the protected activities, features, or attributes of the resource are substantially diminished.
- **Temporary Occupancy:** A temporary use of a Section 4(f) resource results when the Section 4(f) property is required for project construction-related activities, the property is not permanently incorporated into a transportation facility, and the activity is considered adverse by the agency with jurisdiction in terms of the preservation purpose of Section 4(f).

4.1.3 Determination of *De Minimis* Use

When impacts to a Section 4(f) property are minor, as agreed to by the agency with jurisdiction over that property, Section 4(f) regulations can be satisfied through a *de minimis* determination. 23 CFR 774.17 defines a *de minimis* impact as follows:

- For parks, recreational areas, and wildlife and waterfowl refuges, a *de minimis* impact is one that would not adversely affect the activities, features, or attributes qualifying the property for protection under Section 4(f).
- For historical sites, *de minimis* impact means that the FRA has determined, in accordance with 36 CFR 800, that no historical property would be affected by the project or the project would have "no adverse effect" on the property in question. The State Historic Preservation Office (SHPO) and Advisory Council on Historic Preservation, if involved, must be notified that the FRA intends to enter a *de minimis* finding for properties where the project would result in no adverse effect.

- The officials with jurisdiction must concur in writing with a *de minimis* determination. For recreational or refuge properties, concurrence from the officials having jurisdiction over the properties is required. For historical sites, concurrence from the SHPO is required.

4.1.4 Service-Level EIS Evaluation of Section 4(f) Potential Use

The term Section 4(f) "potential use" acknowledges that the detail available at the service-level EIS phase is not adequate for a "use" determination for two reasons:

1. The design level is not detailed enough to determine property acquisition needs.
2. Surveys to validate parks, recreation resources, and properties eligible for Section 106 protection are not complete to verify that all section 4(f) properties have been considered in this evaluation. As with "potential Section 4(f) properties," the term "potential uses" reflects an inclusive approach at this level. Any publicly available recreational resource, or any property identified as eligible or potentially eligible for the NRHP within the 500-foot EIS Study Area, is considered protected under Section 4(f) and may result in a "potential use" for that alternative.

4.2 Section 6(f) of the Land and Water Conservation Fund Act

Section 6(f) of the L&WCF Act of 1965 preserves, develops, and assures the quality and quantity of outdoor recreation resources through purchase and improvement of recreation lands, wildlife and waterfowl refuges, and similar resources. The L&WCF Act provides funding for the federal acquisition of park and recreation lands and matching grants for state and local governments. Once a property is purchased using these funds, these lands are protected from conversion to land uses other than public outdoor recreation uses.

A conversion of a Section 6(f)-protected property occurs when the property is converted to anything other than outdoor recreation. A conversion of use must be in accordance with an existing statewide outdoor recreation plan and must be approved by the U.S. Department of the Interior. If a conversion occurs, the land must be replaced with a property of equivalent value and usefulness. The only type of use recognized by Section 6(f) is a permanent incorporation. Constructive use or adverse impacts are not considered under Section 6(f), and temporary occupancy during construction is not considered a conversion if the property is restored to its original condition after construction.

Typically, an incorporation of Section 6(f) property for project purposes would be considered a conversion or change in use; however, if the incorporation is necessary as part of a project that would directly enhance the recreational use of Section 6(f) property, such as improving access for visitors or emergency personnel, then the incorporation of land may not require a conversion because the incorporation would not change or diminish the recreational use of the property.

4.3 Potential Use by Alternative

The Section 4(f) and 6(f) properties located within the EIS Study Area for each of the route alternatives are also identified in Section 3.17, Recreational Areas and Opportunities (see Tables 3.17-1 through 3.17-3), and Section 3.18, Historic, Architectural, and Non-Archaeological Cultural Resources (see Tables 3.18-2 through 3.18-4). The only difference between what is listed in Section 3.17 and the locations listed in this chapter, is that Section 4(f) is limited to resources that are open to the public. Figures 4-1 through 4-17 show the Section 4(f) and 6(f) properties within the EIS Study Area for the build alternatives.

FRA cannot make a Section 4(f) determination at the service-level analysis because the information available at this time is not sufficiently detailed. This evaluation only indicates those resources where there may be a Section 4(f) use; however, in many situations, where the alternative's alignment is removed from an existing railway, there is not enough design development to determine whether the use would be permanent, temporary, or constructive, and the evaluation does not identify uses that may be classified as *de minimis* impacts. Under Section 6(f), discussions of impacts address conversion of Section 6(f) properties from recreational use to non-outdoor recreational use, which would occur through right-of-way acquisition or creation of permanent easements. Additional Section 4(f) and Section 6(f) properties would likely be identified at the project-level when detailed field surveys and evaluations would be conducted. Therefore, the following analysis presents potential uses of readily available Section 4(f) resources in the urban, suburban, and rural settings for each alternative. Where applicable, mitigation measures, such as those described in Section 4.7, Potential Mitigation Strategies, would be followed when avoidance and minimization of right-of-way acquisition or permanent easements are not prudent or feasible.

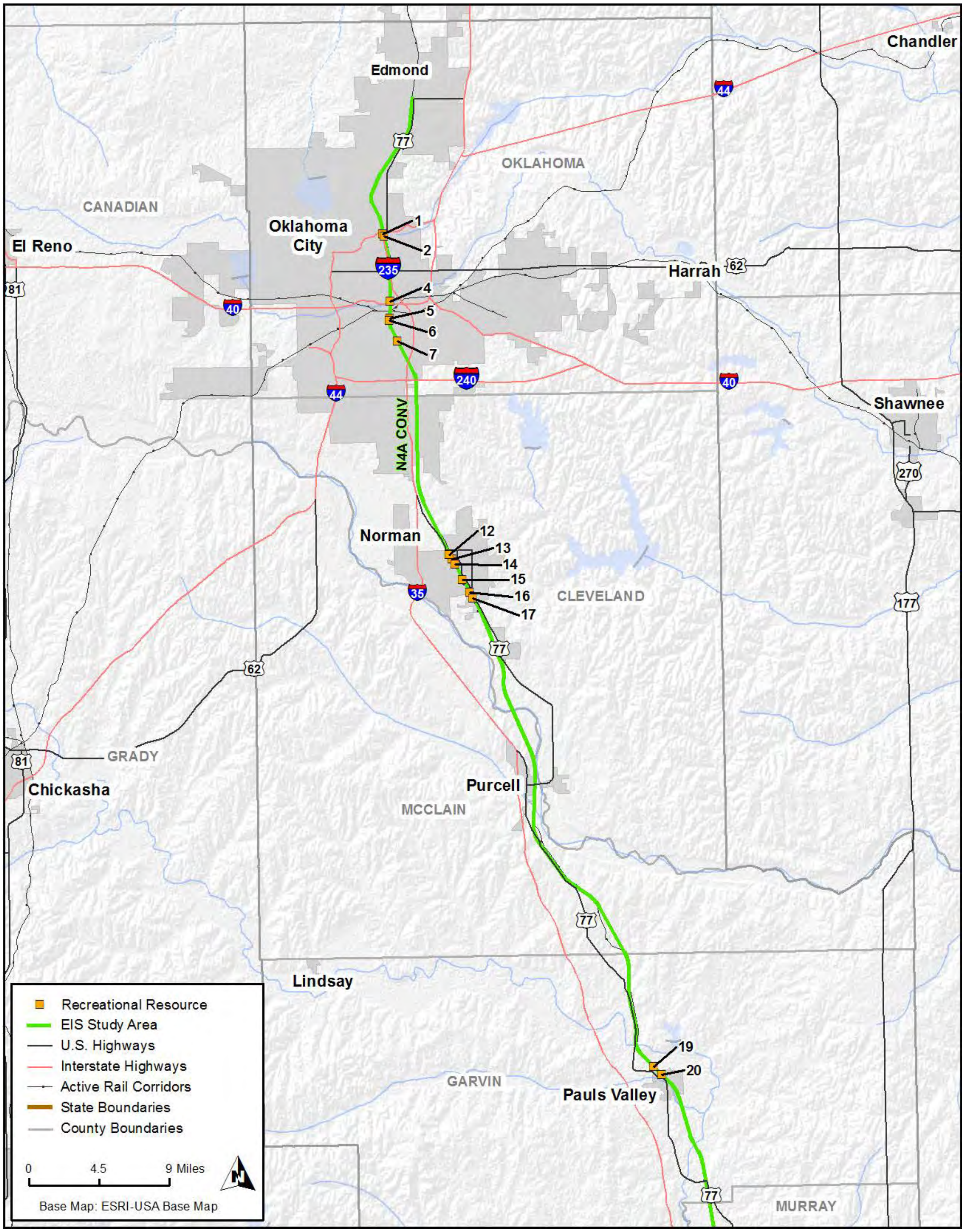

Figure 4-1: Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas (Map 1)

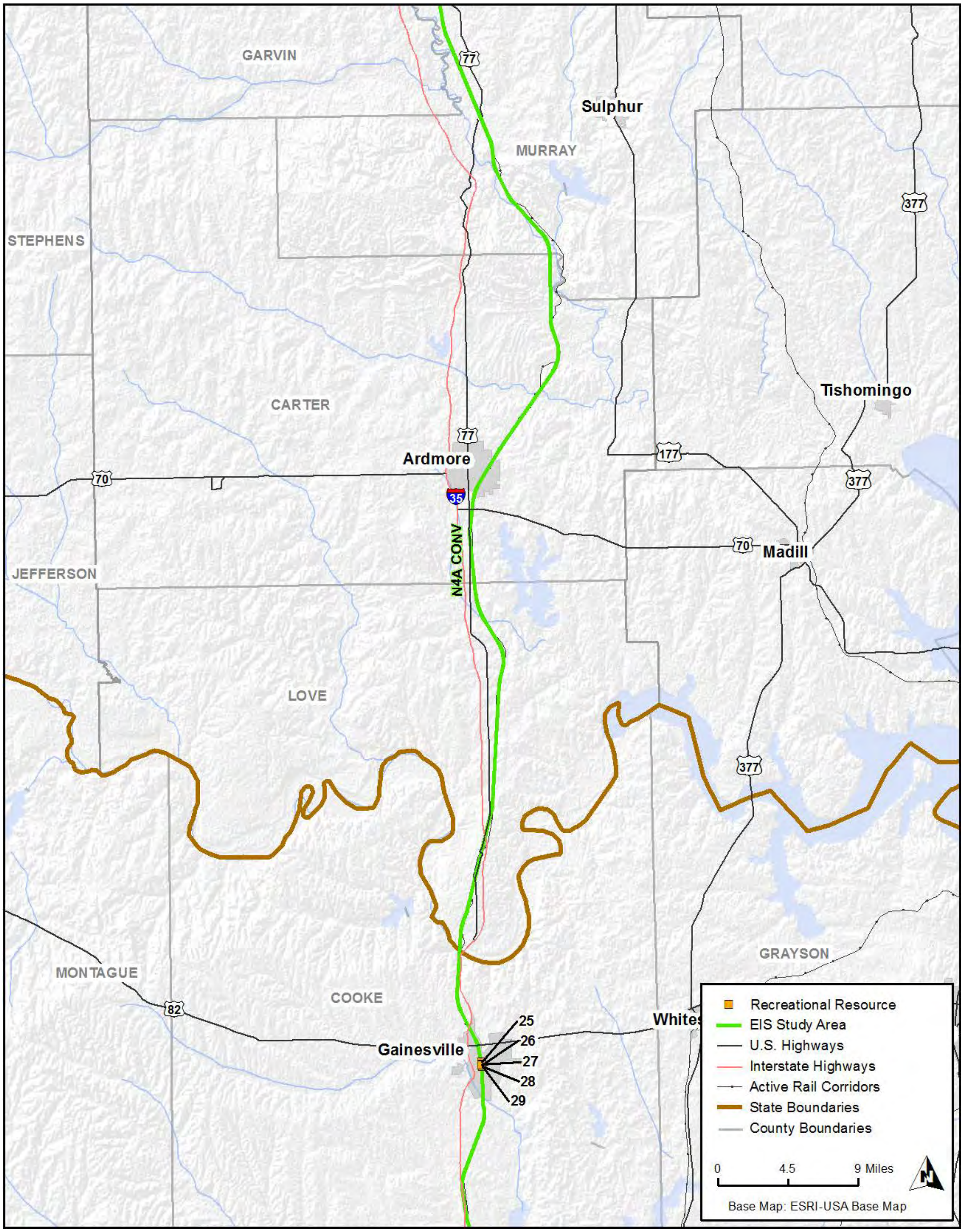

Figure 4-2: Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas (Map 2)

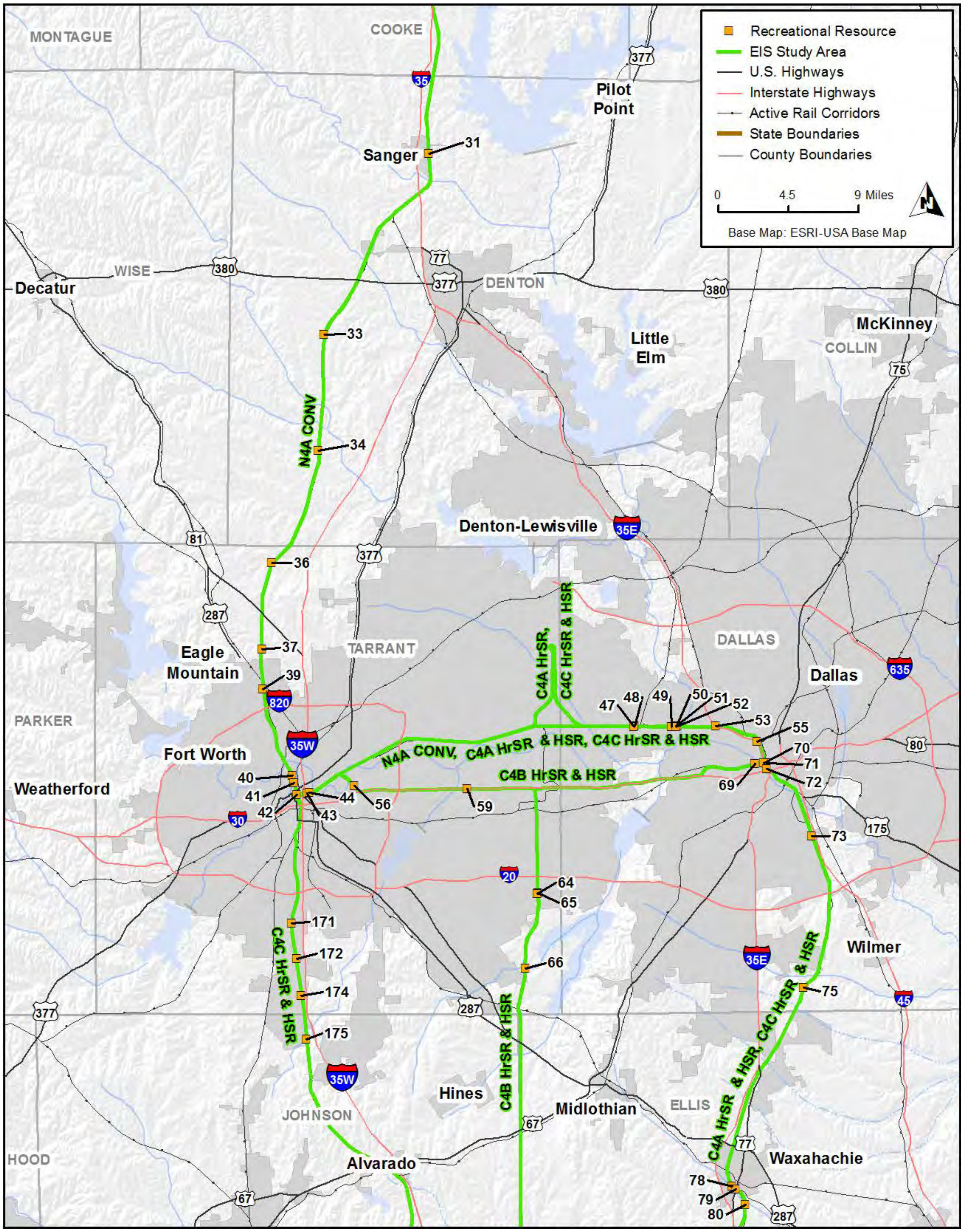

Figure 4-3: Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas (Map 3)

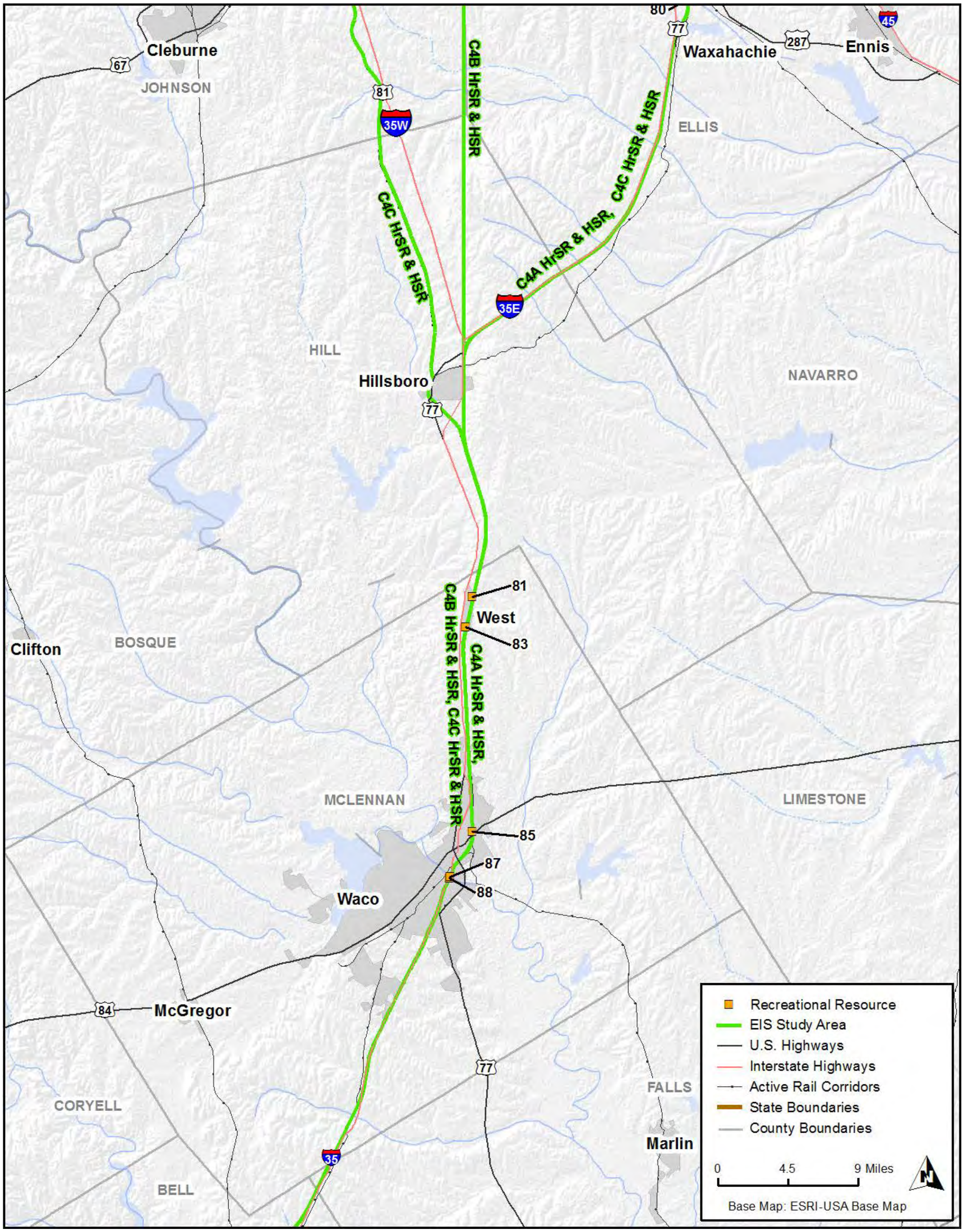

Figure 4-4: Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas (Map 4)

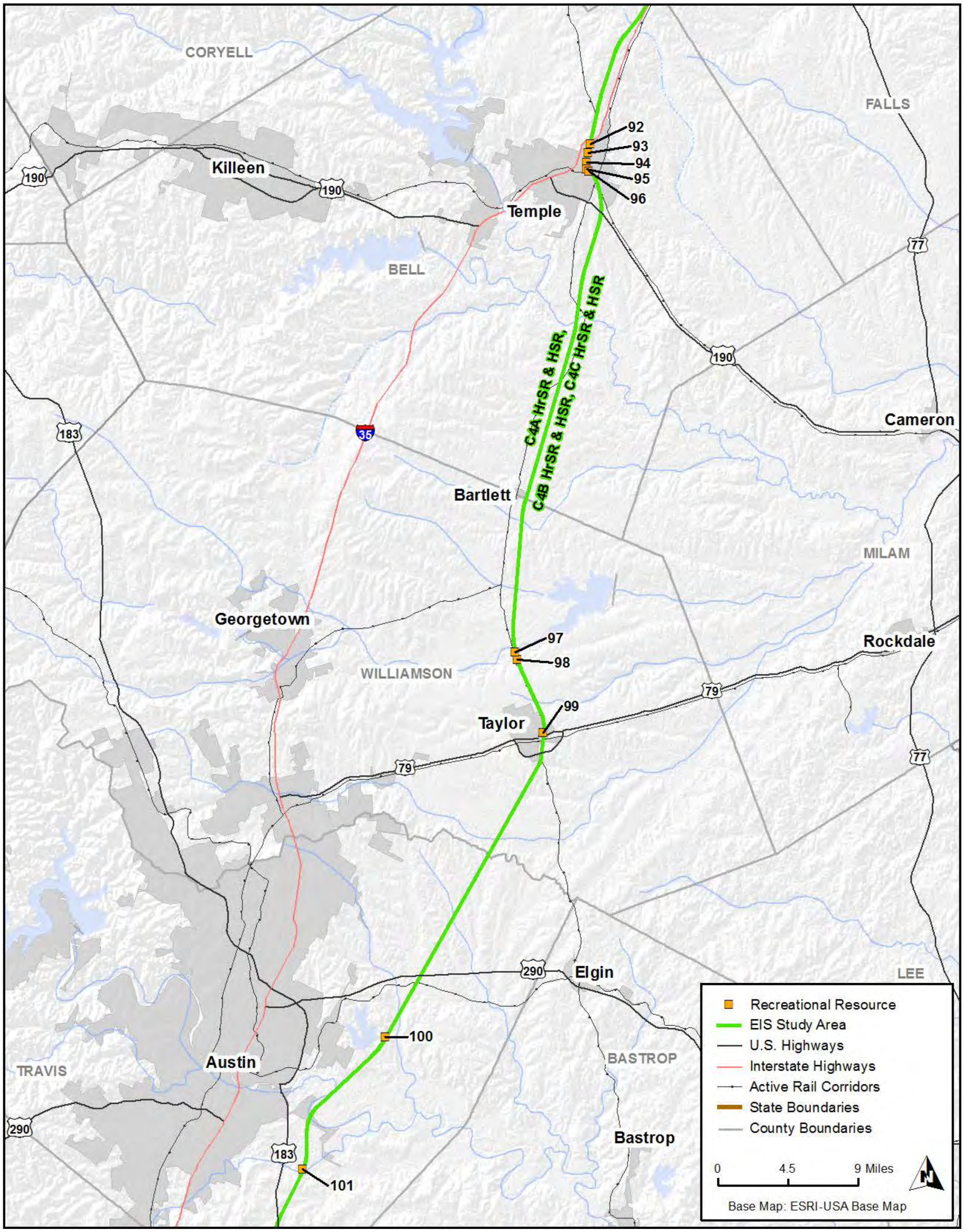

Figure 4-5: Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas (Map 5)

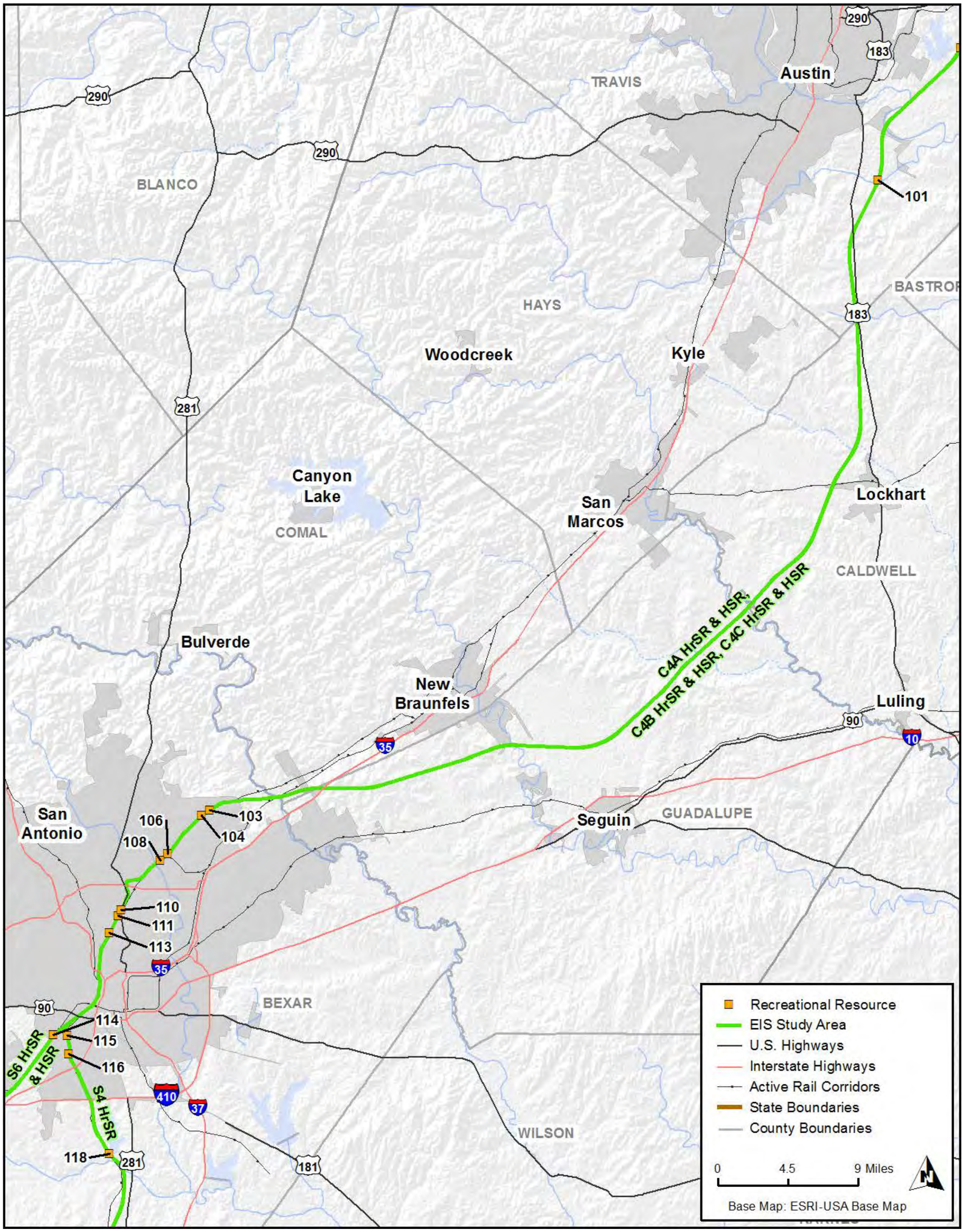

Figure 4-6: Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas (Map 6)

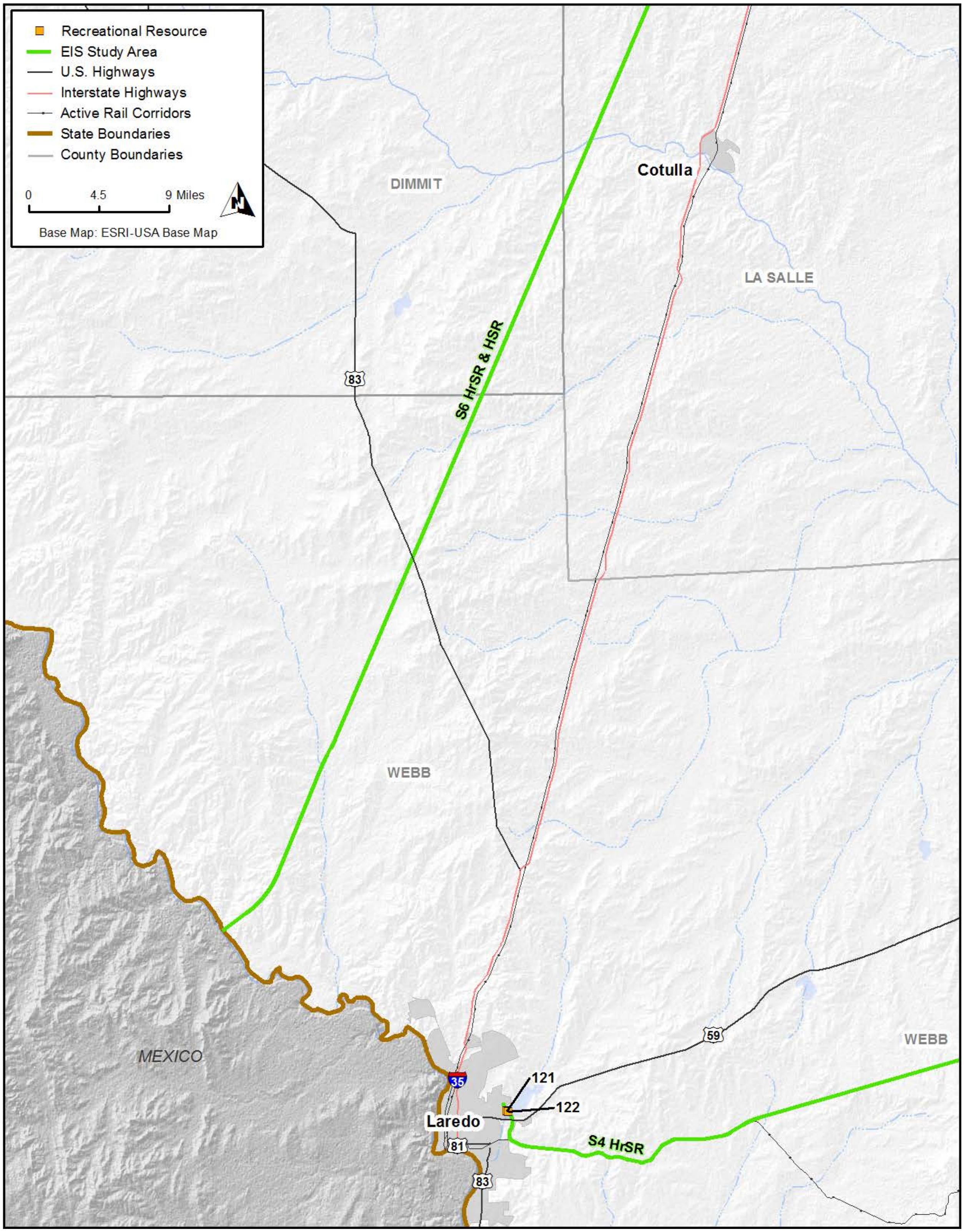

Figure 4-7: Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas (Map 7)

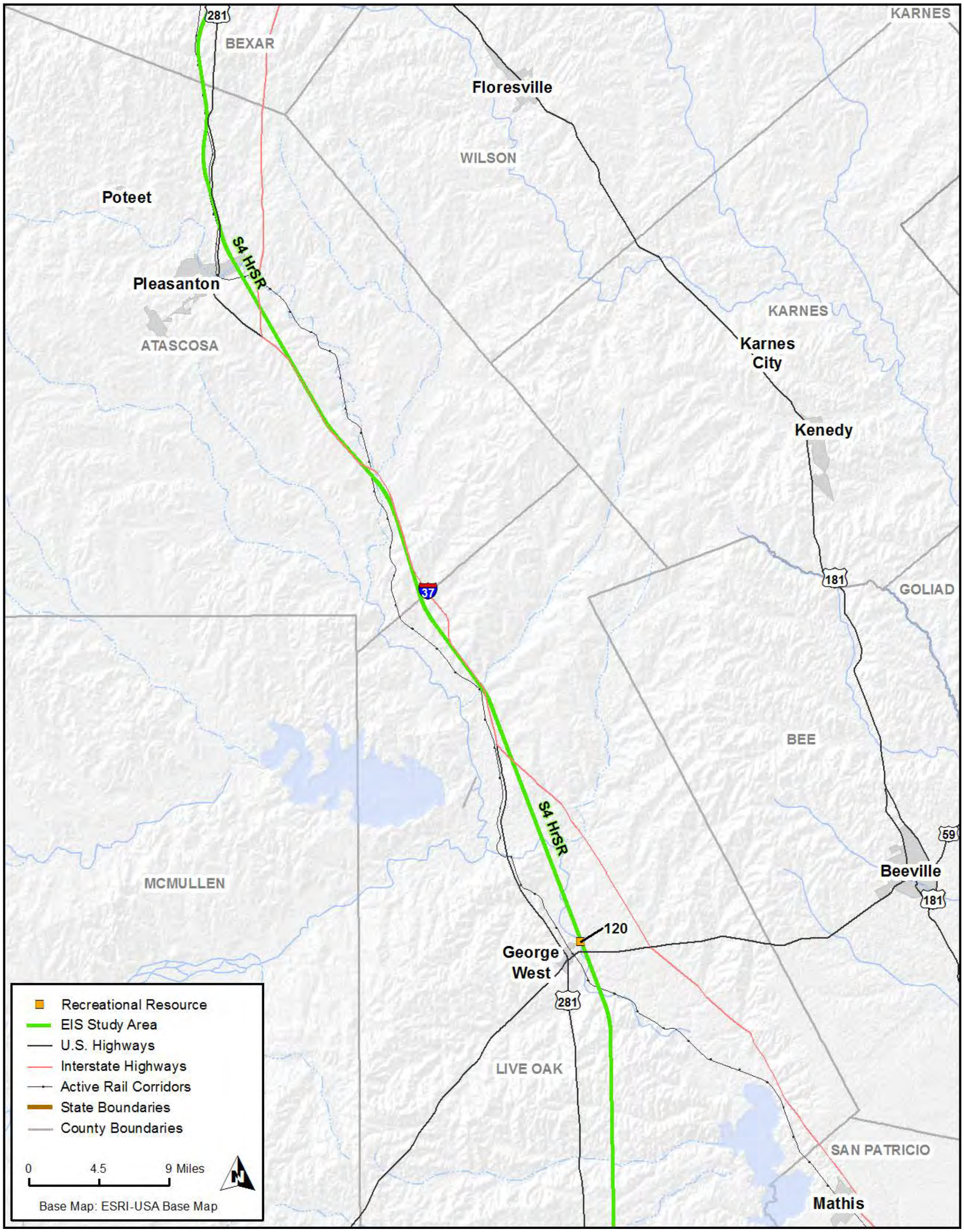

Figure 4-8: Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas (Map 8)

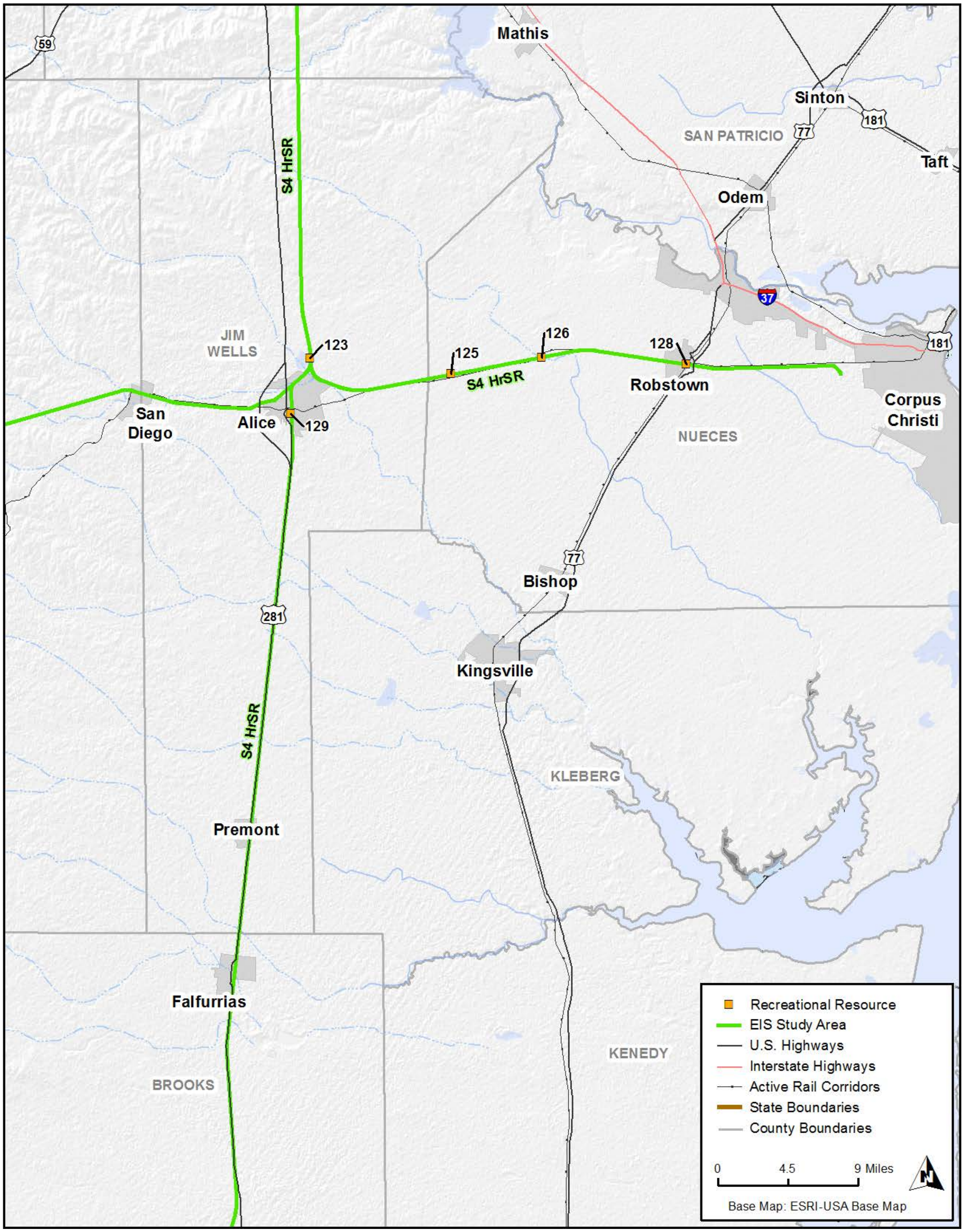

Figure 4-9: Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas (Map 9)

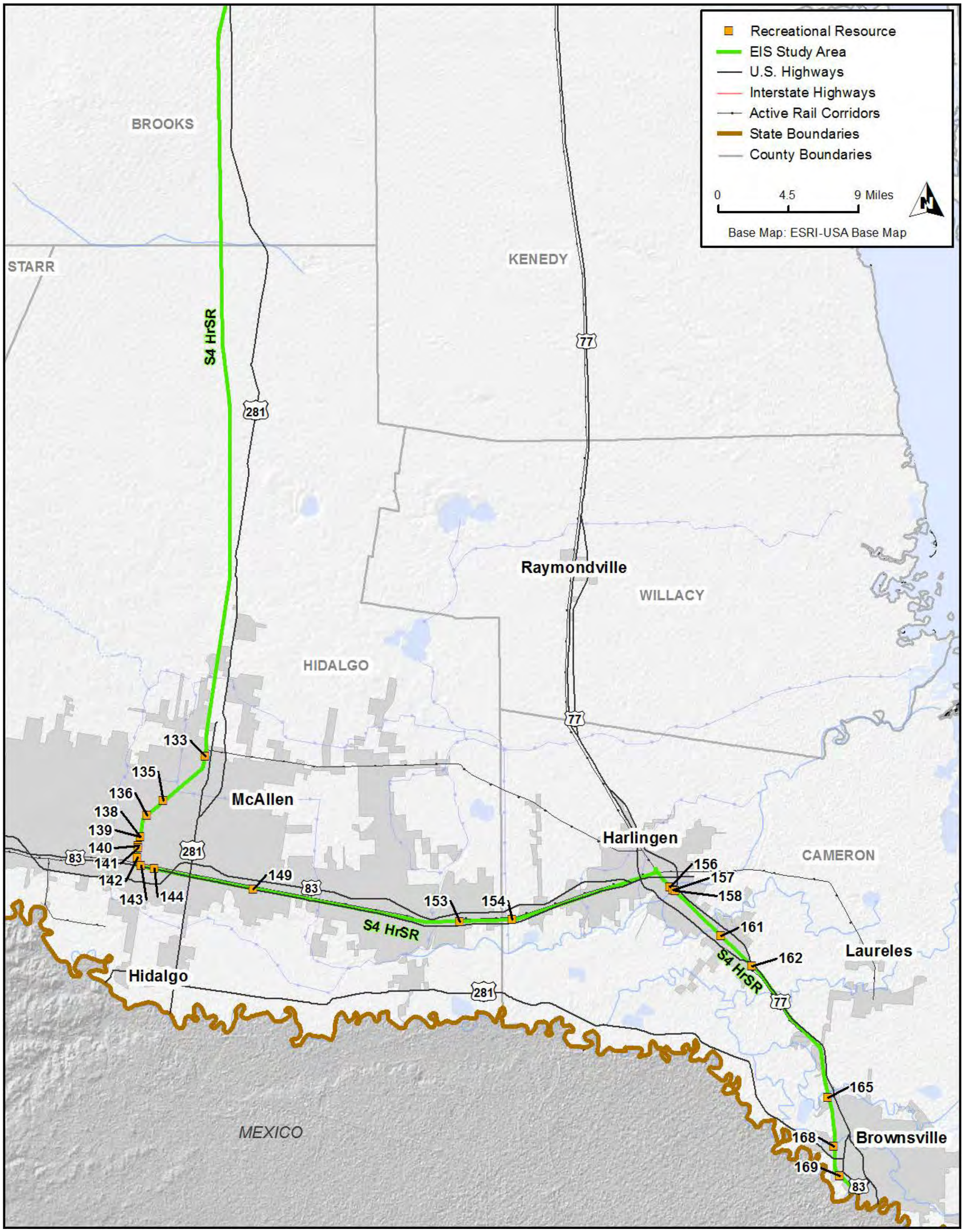

Figure 4-10: Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas (Map 10)

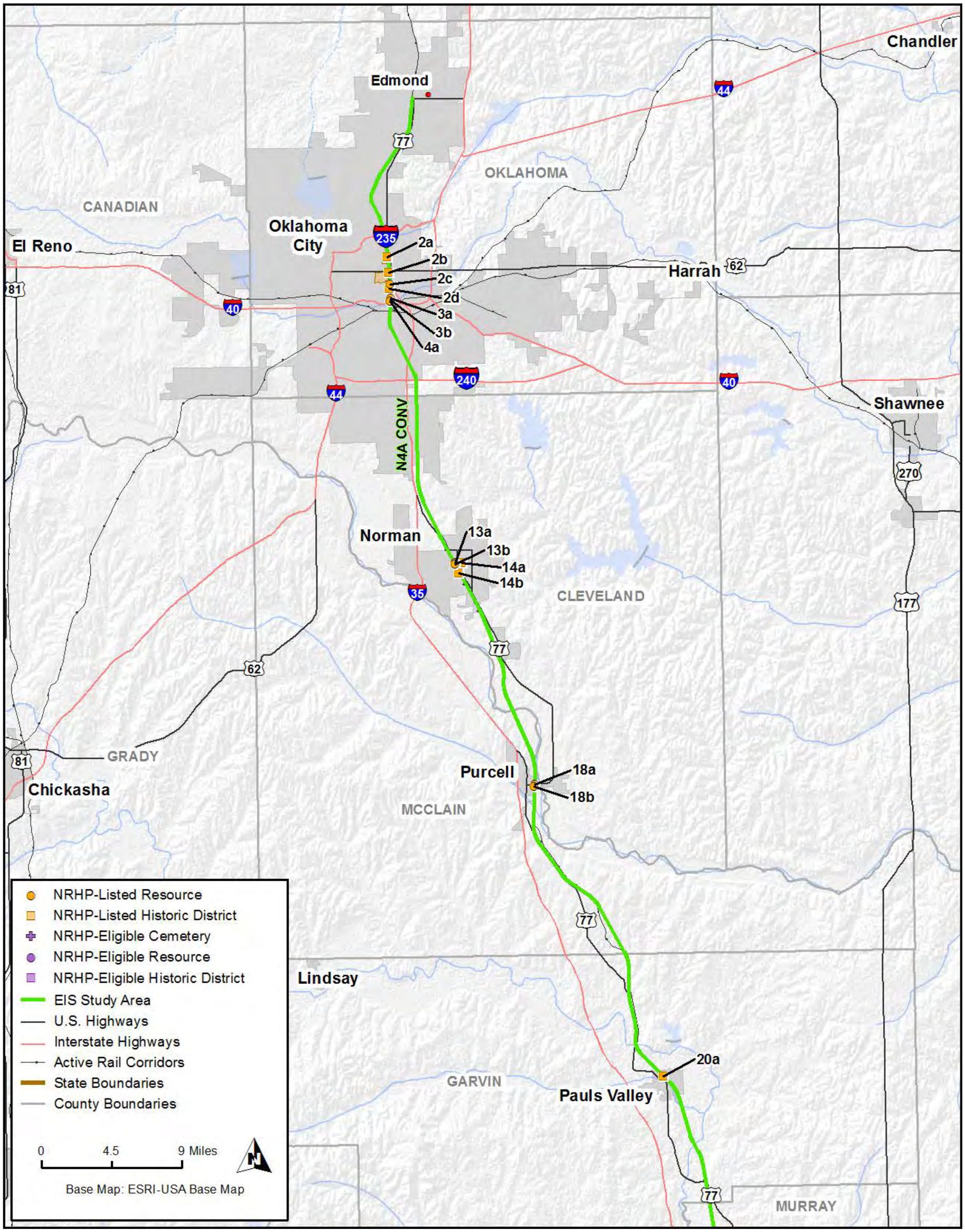

Figure 4-11: Section 4(f) Cultural Resources (Map 1)

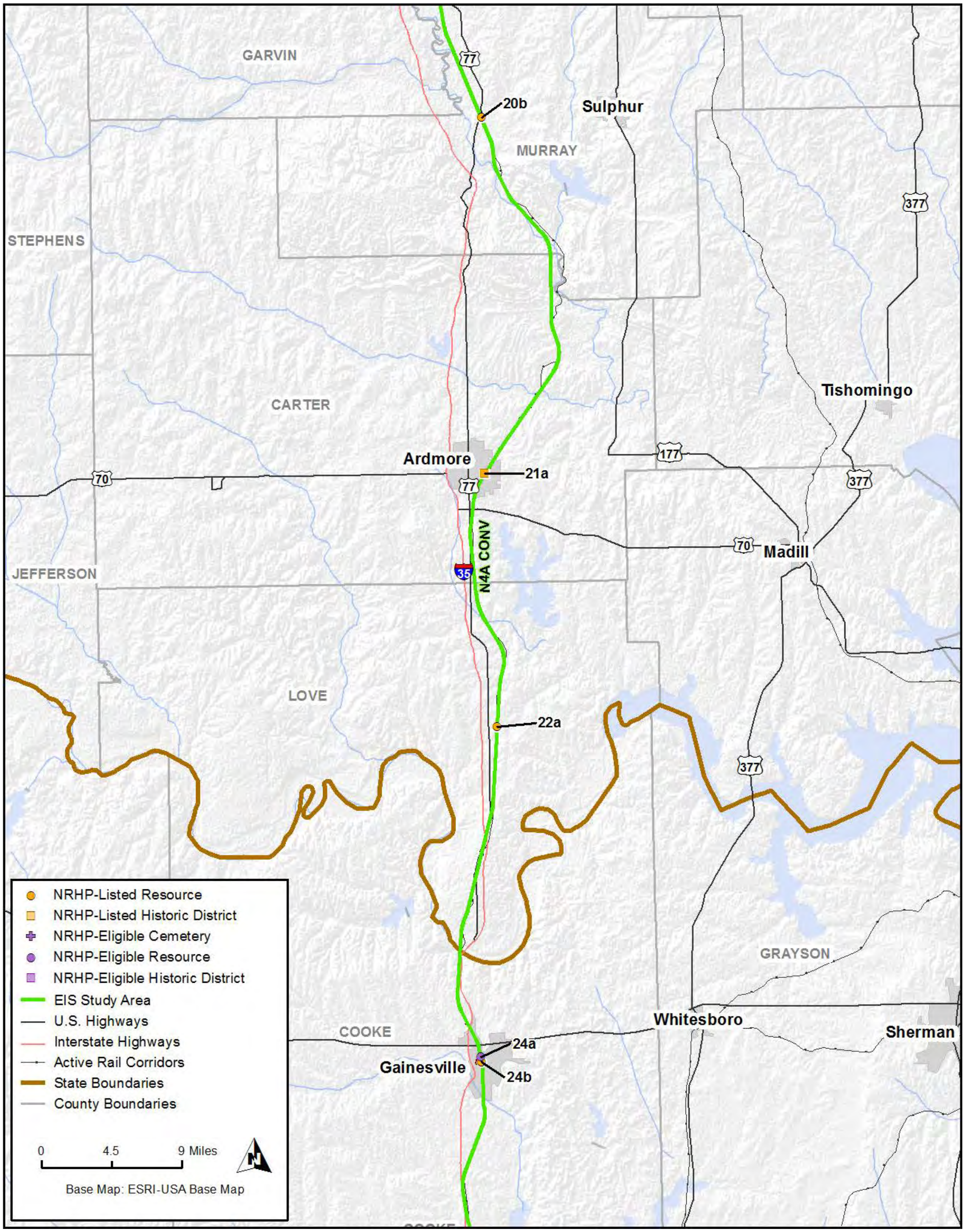

Figure 4-12: Section 4(f) Cultural Resources (Map 2)

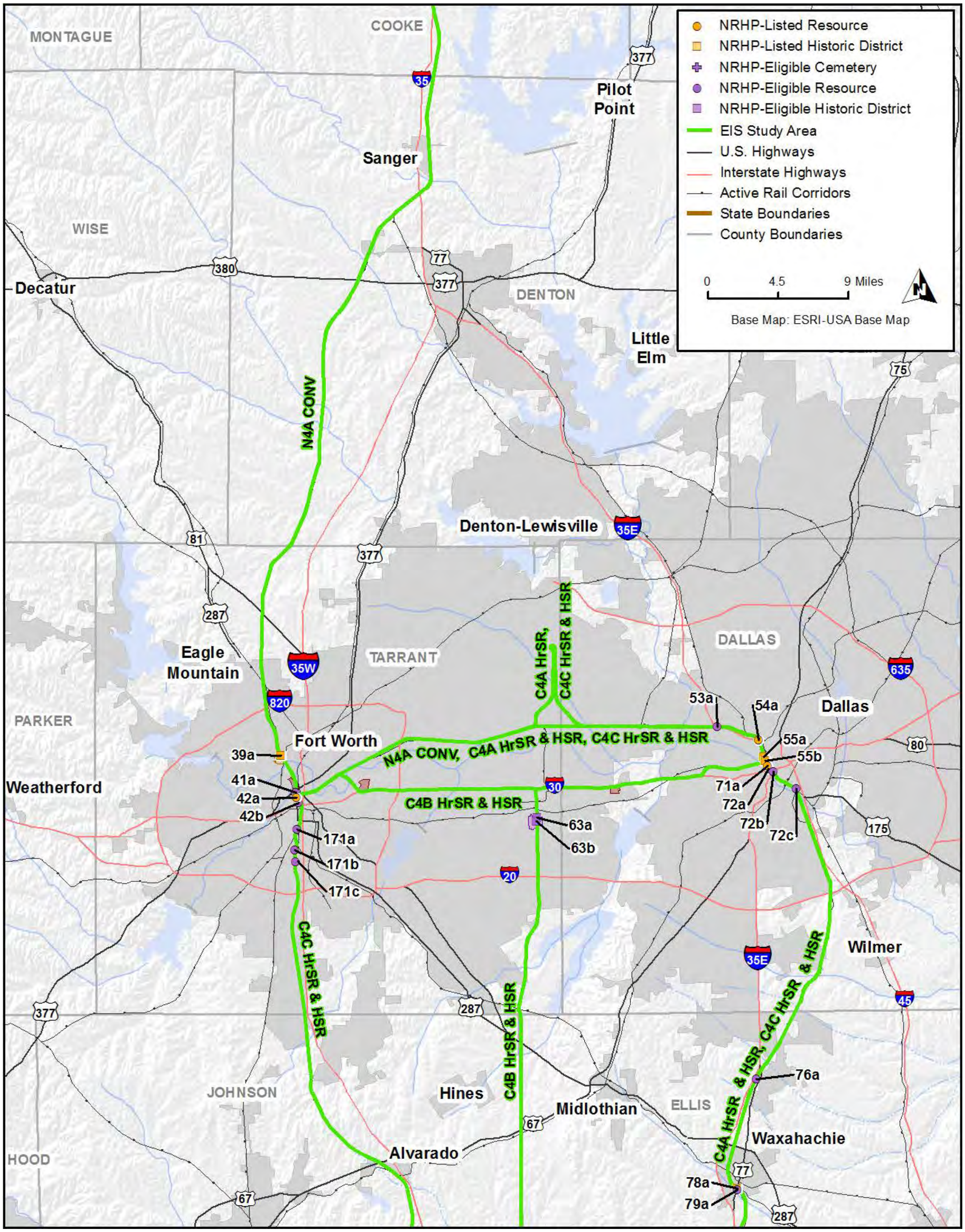

Figure 4-13: Section 4(f) Cultural Resources (Map 3)

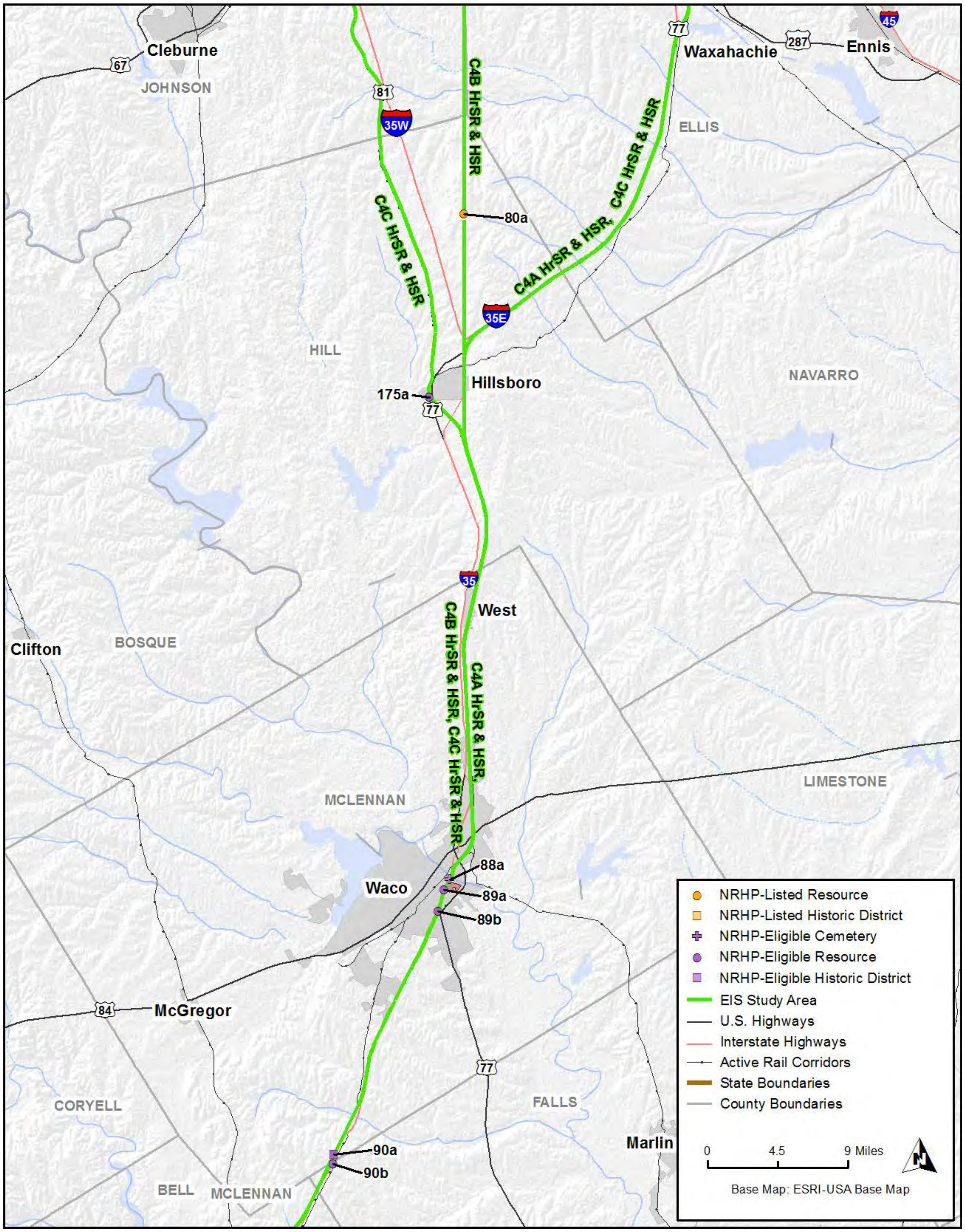

Figure 4-14: Section 4(f) Cultural Resources (Map 4)

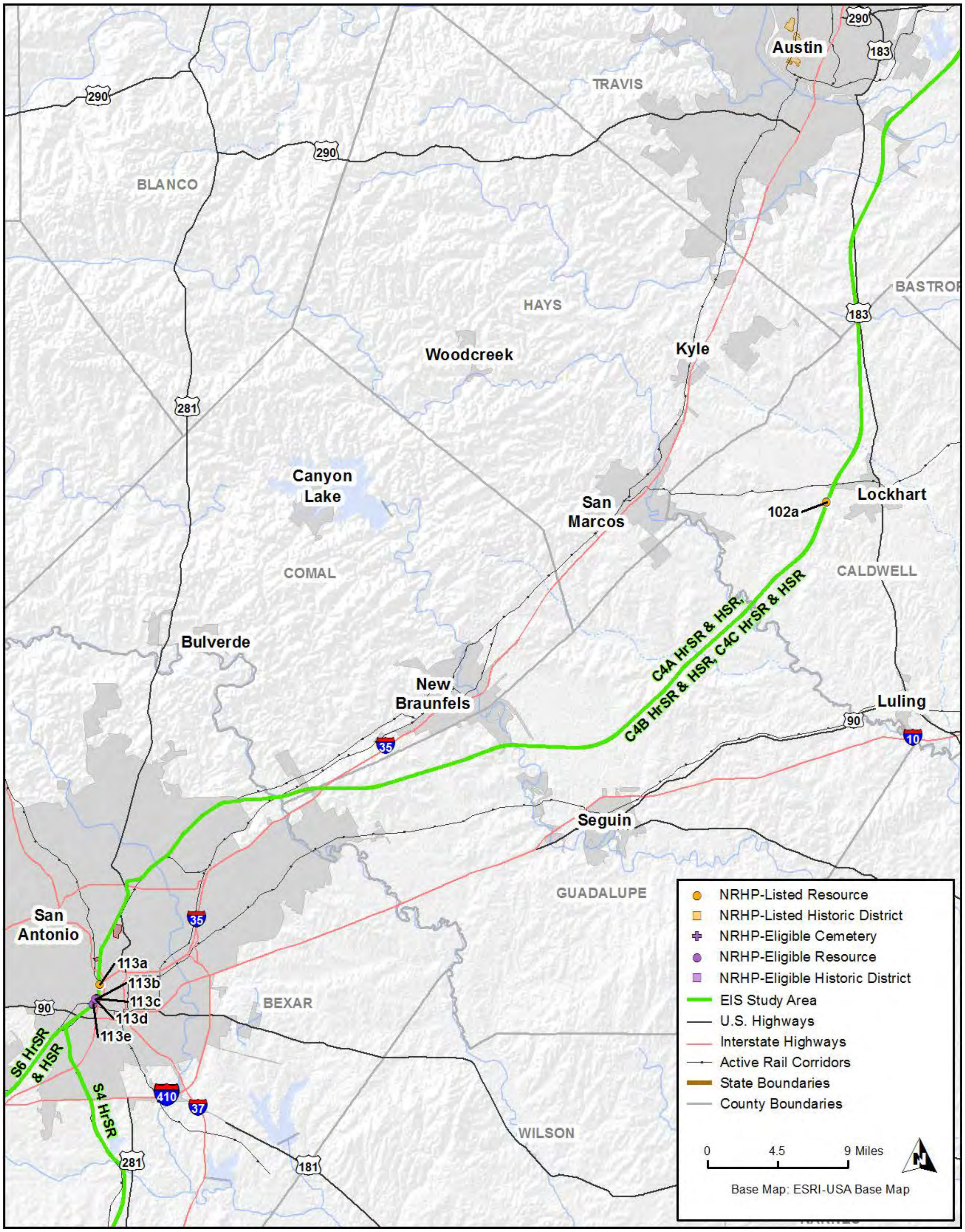

Figure 4-15: Section 4(f) Cultural Resources (Map 5)

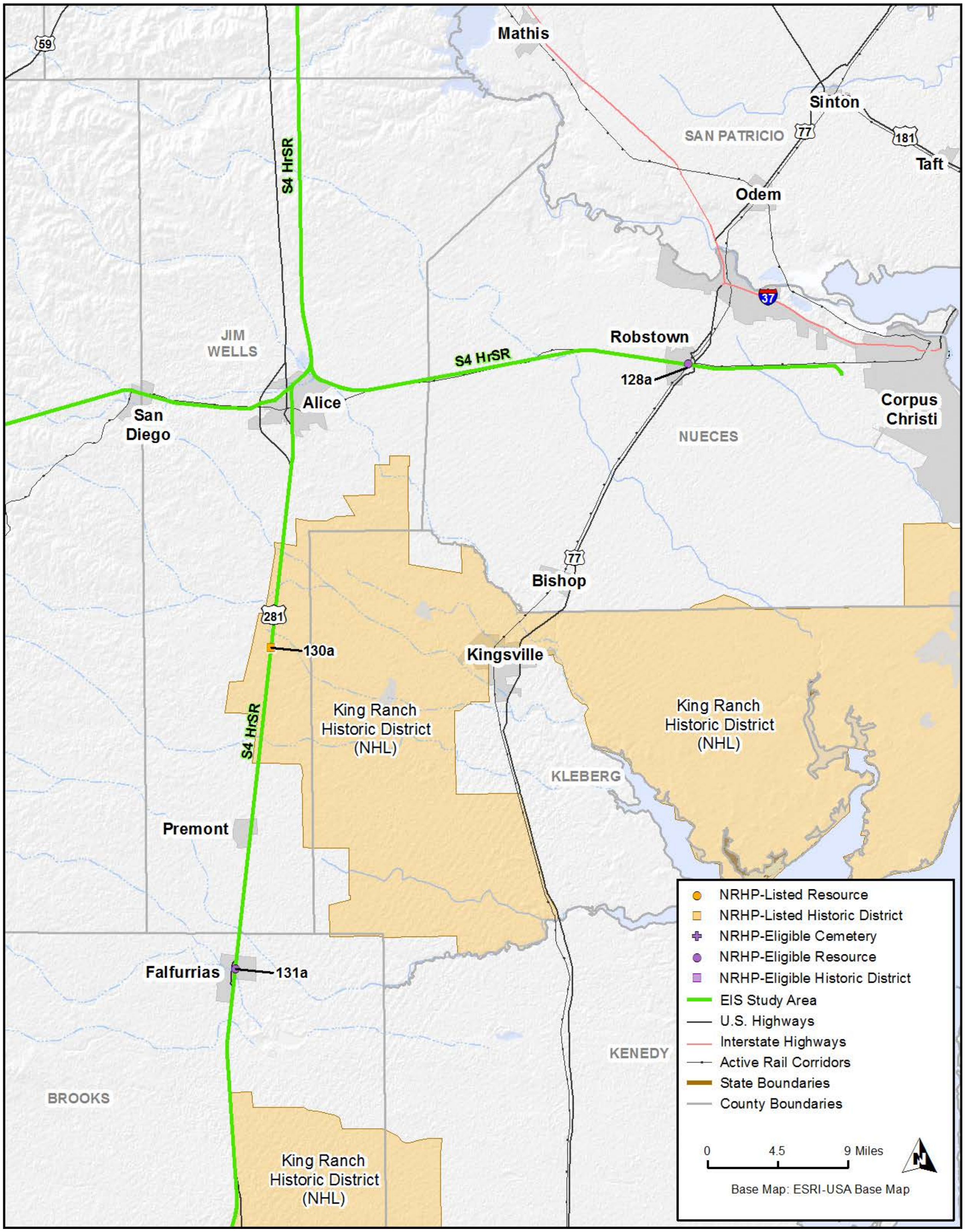

Figure 4-16: Section 4(f) Cultural Resources (Map 6)

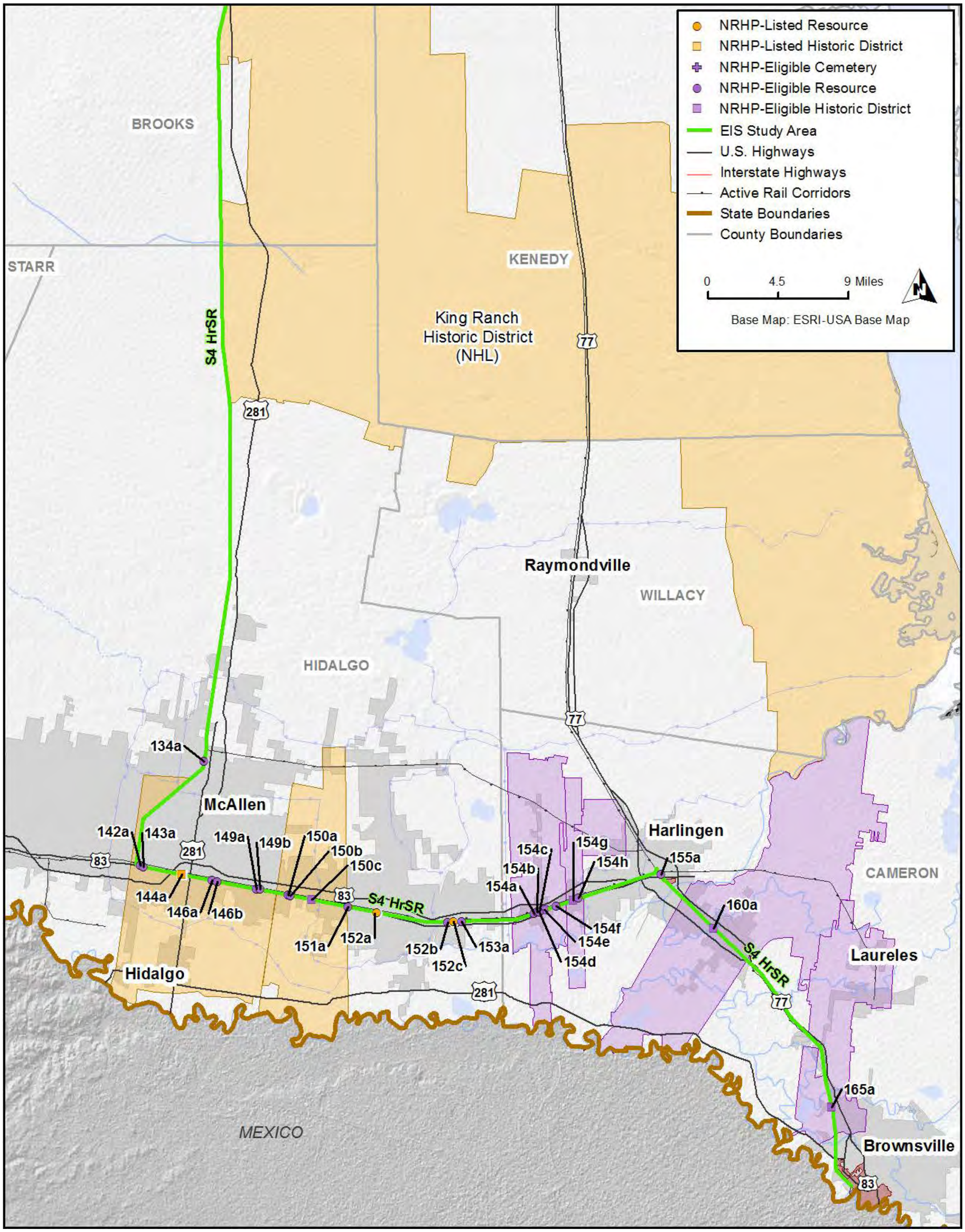

Figure 4-17: Section 4(f) Cultural Resources (Map 7)

4.3.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Tables 4-1 and 4-2 list the Section 4(f) and 6(f) park, refuge, and recreational resources and the Section 4(f) cultural resources identified, respectively, for Alternative N4A.

Table 4-1: Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas – Northern Section

Map ID # (Figures 4-1 to 4-3)	Resource Name	Resource Type	4(f)[a]	6(f)[a]	Ownership	Location (Lat/Long)[b]	Alternative	Acreage in EIS Study Area
1	Canyon Park	City Park	X	XX	Oklahoma City	35.527614/-97.522212	N4A CONV	3.37
2	Topping Park	City Park	X	XX	Oklahoma City	35.526386/-97.516755	N4A CONV	11.91
4	Bricktown Canal and Downtown Park	Urban Park and Art Area	X	XX	Oklahoma City	35.465113/-97.511767	N4A CONV	4.01
5	Riverside Walking and Bicycling Trail (north)	City Trail	X	XX	Oklahoma City	35.449672/-97.512624	N4A CONV	0.20
6	Riverside Walking and Bicycling Trail (south)	City Trail	X	XX	Oklahoma City	35.447811/-97.512944	N4A CONV	0.16
7	Bicycling and Walking Trail	City Trail	X	XX	Oklahoma City	35.228972/-97.449197	N4A CONV	0.11
12	Bicycling and Walking Trail	City Trail	X		City of Norman	35.42827/-97.504311	N4A CONV	0.75
13	Legacy Park	City Park and Trail	X		City of Norman	35.21998/-97.442875	N4A CONV	8.02
14	Andrews Park	City Park	X		City of Norman	35.22398/-97.447841	N4A CONV	4.29
15	University of Oklahoma Brandt Park	City Park	X		University of Oklahoma	35.196319/-97.443662	N4A CONV	9.76
16	Jimmie Austin OU Golf Course	University Golf Course	X	X	University of Oklahoma	35.190076/-97.429396	N4A CONV	15.43
17	Oak Tree Park South	City Park	X		City of Norman	35.187735/-97.423314	N4A CONV	4.53
19	Wacker Park	City Park	X		City of Pauls Valley	34.748672/-97.229205	N4A CONV	9.75
20	Santa Fe Depot Museum and Park	City Museum and Park	X		City of Pauls Valley	34.741912/-97.218958	N4A CONV	0.93
25	Heritage Park	City Park	X		City of Gainesville	33.624681/-97.140138	N4A CONV	3.32

Map ID # (Figures 4-1 to 4-3)	Resource Name	Resource Type	4(f)[a]	6(f)[a]	Ownership	Location (Lat/Long)[b]	Alternative	Acreage in EIS Study Area
26	Jaycee Park	City Park	X		City of Gainesville	33.622199/-97.139449	N4A CONV	4.54
27	Pecan Creek Park	City Park	X		City of Gainesville	33.622609/-97.138943	N4A CONV	0.27
28	Forsythe Transportation Skate Park	City Park	X		City of Gainesville	33.620795/-97.138608	N4A CONV	0.01
29	Home Grown Hero Walking Trail	City Trail	X		City of Gainesville	33.616274/-97.134062	N4A CONV	0.49
31	Baseball and Softball Fields	Baseball and Softball	X		City of Sanger	33.351165/-97.166942	N4A CONV	3.86
33	Eddie Deussen Jr. Park	City Park	X		City of Ponder	33.20457/-97.287657	N4A CONV	0.51
34	Bishop Park	City Park	X		City of Justin	33.076447/-97.296318	N4A CONV	1.79
36	Haslet Community Park	City Park	X	X	City of Haslet	32.973517/-97.35198	N4A CONV	0.40
37	Northwest Community Park	City Park	X	XX	City of Fort Worth	32.892697/-97.355036	N4A CONV	7.95
39	Knowles-Towery Kiwanis Park	City Park	X		City of Saginaw	32.855598/-97.361576	N4A CONV	0.19
40	Trader Oak Park	City Park	X	XX	City of Fort Worth	32.774533/-97.331604	N4A CONV	1.03
41	Arnold Park	City Park	X	XX	City of Fort Worth	32.767855/-97.329034	N4A CONV	1.48
42	Elm Street Park	City Park	X	XX	City of Fort Worth	32.757206/-97.326293	N4A CONV	0.28
43*	Harmon Field Park and Trails	City Park and Trails	X	X	City of Fort Worth	32.755582/-97.314229	N4A CONV	7.54
44*	Riverside Trails	City Trails	X	XX	City of Fort Worth	32.758938/-97.312293	N4A CONV	0.25
47*	Veterans Memorial Park	City Park	X		City of Irving	32.81429/-96.953049	N4A CONV	1.01
48*	Sowers Pioneer Park	City Park	X		City of Irving	32.81729/-96.95297	N4A CONV	0.49
49*	Trinity View Park	City Park	X	XX	City of Dallas	32.810382/-96.909802	N4A CONV	18.47
50*	Campion Trail	City Park	X	XX	City of Dallas	32.80922/-96.90684	N4A CONV	0.03

Map ID # (Figures 4-1 to 4-3)	Resource Name	Resource Type	4(f)[a]	6(f)[a]	Ownership	Location (Lat/Long)[b]	Alternative	Acreage in EIS Study Area
51*	River Hills Park	City Park	X	XX	City of Dallas	32.81944/-96.90552	N4A CONV	0.55
52*	Trinity River Greenbelt Park	City Trail	X	XX	City of Dallas	32.802729/-96.892373	N4A CONV	6.07
53*	Sleepy Hollow Park	City Park	X	XX	City of Dallas	32.81399/-96.86254	N4A CONV	0.15
55*	Stemmons Park	City Park	X	XX	City of Dallas	32.813988/-96.862538	N4A CONV	3.03
70*	Martyr's Park	City Park	X	XX	City of Dallas	32.777792/-96.820677	N4A CONV	0.34

* A resource that is also located within the EIS Study Area of an alternative in the Central Section.
[a] "X" indicates that a property has been identified as a potential Section 4(f) or Section 6(f) property.
"XX" indicates that the city has L&WCF monies for its city parks, trails, and/or recreation areas, but there is no indication of where the funding was used; therefore, additional research is required.
[b] Lat/Long = latitude/longitude
CONV = conventional rail
Sources: Arlington Independent School District (2014); Arlington Parks and Recreation Department (2014); City of Dallas Parks and Recreation Department (2014); City of Oklahoma City (2014); Dallas Independent School District (2014); Eagle Mountain-Saginaw Independent School District (2014); Federal Highway Administration (FHWA) (1987); FHWA (2014); Fort Worth Parks and Community Services Department (2014); GoogleEarth (1950 – 2014); Land and Water Conservation Fund Coalition (2014); National Park Service (NPS) (2014); NPS (2013); Northwest Independent School District (2014); Oklahoma City Educare (2014); River Legacy Foundation (2014); Southern Oklahoma Speedway (2014); Texas Department of Transportation (TxDOT) (2014a); TxDOT (2013); Texas Education Agency (2014); Texas Natural Resources Information System (2014); U.S. Fish and Wildlife Service (USFWS) (2014); U.S. Geological Survey (USGS) (2014).
Note: Map ID #s are discontinuous to remain consistent with resources listed in Section 3.17, Recreational Areas and Opportunities.

Table 4-2: Section 4(f) Cultural Resources – Northern Section

Map ID # (Figures 4-11 to 4-13)	Resource Name	Location (Lat/Long)	NRHP Status	Alternative	Acreage in EIS Study Area
2a	Edgemere Park Historic District Boundary	35.506391/-97.514683	NRHP-Listed	N4A CONV	0.08
2b	Mesta Park and Heritage Hills Historic Districts	35.491974/-97.513299	NRHP-Listed	N4A CONV	0.02
2c	Cain's Coffee Building	35.481417/-97.512216	NRHP-Listed	N4A CONV	Building

Map ID # (Figures 4-11 to 4-13)	Resource Name	Location (Lat/Long)	NRHP Status	Alternative	Acreage in EIS Study Area
2d	Automobile Alley Historic District	35.478017/-97.512497	NRHP-Listed	N4A CONV	0
3a	Sherman Machine and Iron Works Building	35.467844/-97.511568	NRHP-Listed	N4A CONV	Building
3b	Stanford Furniture Company Building	35.466632/-97.511862	NRHP-Listed	N4A CONV	Building
4a	J.I. Case Plow Works Building	35.465056/-97.511883	NRHP-Listed	N4A CONV	Building
13a	Sooner Theater Building	35.221148/-97.44321	NRHP-Listed	N4A CONV	Building
13b	Santa Fe Depot	35.219935/-97.442915	NRHP-Listed	N4A CONV	Building
14a	Norman Historic District	35.219368/-97.442376	NRHP-Listed	N4A CONV	2.32
14b	DeBarr Historic District	35.211839/-97.43883	NRHP-Listed	N4A CONV	8.05
18a	US-77 Bridge at Canadian River	35.013743/-97.356784	NRHP-Listed	N4A CONV	Building
18b	Purcell Train Station	35.011914/-97.357282	NRHP-Listed	N4A CONV	Building
20a	Pauls Valley Historic District	34.740677/-97.217449	NRHP-Listed	N4A CONV	7.45
20b	Arbuckle Historical Museum/Davis Santa Fe Depot	34.503615/-97.121772	NRHP-Listed	N4A CONV	Building
21a	Ardmore Commercial District	34.171634/-97.126091	NRHP-Listed	N4A CONV	0.50
22a	Santa Fe Depot	33.936708/-97.116776	NRHP-Listed	N4A CONV	Building
24a	Saint Paul's Church	33.625971/-97.141327	NRHP-Eligible	N4A CONV	Building
24b	Santa Fe Passenger Depot	33.625011/-97.140706	NRHP-Listed	N4A CONV	Building
39a	Fort Worth Stockyards Historic District	32.793943/-97.343368	NRHP-Listed	N4A CONV	0.46
41a	Allen Chapel AME Church	32.758972/-97.327524	NRHP-Eligible	N4A CONV	Building
42a*	Montgomery Ward and Company Building	32.754014/-97.326474	NRHP-Listed	N4A CONV	Building

Map ID # (Figures 4-11 to 4-13)	Resource Name	Location (Lat/Long)	NRHP Status	Alternative	Acreage in EIS Study Area
42b*	Gulf, Colorado and Santa Fe Railroad Passenger Station	32.749161/-97.324107	NRHP-Eligible	N4A CONV	Building
53a*	Rock Island Railroad Bridge	32.81315531/ -96.86163747	NRHP-Eligible	N4A CONV	Building
54a*	Turtle Creek Pump Station	32.80004162/ -96.81644069	NRHP-Listed	N4A CONV	Building
55a*	West End Historic District	32.779764/ -96.809595	NRHP-Listed	N4A CONV	6.62

* A property that is also located within the EIS Study Area of an alternative in the Central Section.

Sources: Baird and Goble (2008); Bamburg (2007); Beaumont et al. (n.d.); Crowder and Hoig (2008); Fite (2007); Fugate (2007); Google Maps (2014); GoogleEarth (1950–2014); Hager (2008), Hazel (1997); Hill (1996); Hoig (2007); Levy (2007); Long (2010a); Maxwell (2010); McElhaney and Hazel (2010); Moore et al. (2013); NPS (2014); NPS (1995); NETROnline (2014); O'Dell (2007); Odom (2010); Oklahoma Historical Society (2014); Richardson et al. (2005); Sanders and Tyler (1973); Schmelzer (2010); Selcer (2004); TxDOT (2014b); TxDOT (2014c); TxDOT (2014d); TxDOT (2014e); TxDOT (2014f); TxDOT and FRA (2014); Texas Historical Commission (2014); Wade (2010); Weaver (2007); Wilson (2007); Worcester (2010).

There are 65 Section 4(f) properties within the Alternative N4A EIS Study Area, including 39 parks or recreational properties (see Table 4-1) and 26 historic resources (see Table 4-2). The Section 4(f) properties are located largely in urban and suburban areas such as Oklahoma City, Dallas, and Fort Worth, although several are located in rural areas and smaller towns. Because Alternative N4A would be predominantly located within existing railroad right-of-way, there is little potential for permanent use of Section 4(f) properties, especially public parks and recreation areas such as the following: Map ID #13, 15, 16, 31, and 42, and cultural resources properties such as Map ID #2a, 3a, 14a, and 42a (see Figures 4-1, 4-3, 4-11, and 4-13). Where limited new right-of-way and/or easements would be required, it is anticipated that Section 4(f) properties would be avoided.

While most Section 4(f) properties along Alternative N4A would likely not be susceptible to use under Section 4(f), there is the potential for uses of transportation-related Section 4(f) properties, such as historic railroad depots (Figures 4-11, 4-12, and 4-13: Map ID #13b, 18b, 20b, 22a, 24b, and 42b) and historic bridges (Figures 4-11 and 4-13: Map ID #18a and 53a) within the EIS Study Area. Possible expansion and reconstruction of railroad Section 4(f) depots and bridges may be required to accommodate increased ridership and new tracks. It is anticipated that potential uses of these railroad Section 4(f) properties could be avoided or minimized during the project-level design. If uses of Section 4(f) properties cannot be avoided or minimized, it is anticipated that mitigation measures, as described in Section 4.7, Potential Mitigation Strategies, would be followed.

Construction of Alternative N4A may require temporary detours or short-term closures of Section 4(f) properties, including trails that are within or traverse existing railroad right-of-way (see Figures 4-1, 4-2, and 4-3: Map ID #5, 6, 7, 12, 13, 29, 43, 44, and 52), parks that are outside the railroad right-of-way but within the EIS Study Area (Figures 4-1, 4-2, and 4-3: Map ID #19, 27, 33), or a public golf course (Figure 4-1: Map ID #16). The project-level EIS and further design refinement would be needed to determine if a potential temporary occupancy would occur for these properties.

There are three identified Section 6(f) properties in the EIS Study Area of Alternative N4A: a golf course (Map ID #16) and two city parks (Map ID #36 and 43), as shown on Figures 4-1 and 4-3. These three properties are not located within existing railroad right-of-way, and limited right-of-way or easements may be required for Alternative N4A such that these Section 6(f) properties would be avoided. As a result, it is unlikely that the acquisition of land from these Section 6(f) properties would be required.

4.3.2 Central Section: Dallas and Fort Worth to San Antonio

Tables 4-3 and 4-4 list the Section 4(f) and 6(f) park, refuge, and recreational resources and the Section 4(f) cultural resources identified, respectively, in the Central Section. Potential uses in the Central Section between Hillsboro and San Antonio are the same for all of the alternatives because they would follow the same alignment in this area.

Table 4-3. Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas – Central Section

Map ID # (Figures 4-3 to 4-6)	Resource Name	Resource Type	4(f)[a]	6(f)[a]	Ownership	Location (Lat/Long)	Alternative	Acreage in EIS Study Area
43*	Harmon Field Park and Trails	City Park and Trails	X	X	City of Fort Worth	32.755582/-97.314229	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	7.54
44*	Riverside Trails	City Trails	X	XX	City of Fort Worth	32.758938/-97.312293	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	0.25
47*	Veterans Memorial Park	City Park	X		City of Irving	32.81429/-96.953049	C4A HSR C4A HrSR C4C HSR C4C HrSR	1.01
48*	Sowers Pioneer Park	City Park	X		City of Irving	32.81729/-96.95297	C4A HSR C4A HrSR C4C HSR C4C HrSR	0.49
49*	Trinity View Park	City Park	X	XX	City of Dallas	32.810382/-96.909802	C4A HSR C4A HrSR C4C HSR C4C HrSR	18.47

Map ID # (Figures 4-3 to 4-6)	Resource Name	Resource Type	4(f)[a]	6(f)[a]	Ownership	Location (Lat/Long)	Alternative	Acreage in EIS Study Area
50*	Campion Trail	City Park	X	XX	City of Dallas	32.80922/-96.90684	C4A HSR C4A HrSR C4C HSR C4C HrSR	0.03
51*	River Hills Park	City Park	X	XX	City of Dallas	32.81944/-96.90552	C4A HSR C4A HrSR C4C HSR C4C HrSR	0.55
52*	Trinity River Greenbelt Park	City Trail	X	XX	City of Dallas	32.802729/-96.892373	C4A HSR C4A HrSR C4C HSR C4C HrSR	6.07
53*	Sleepy Hollow Park	City Park	X	XX	City of Dallas	32.81399/-96.86254	C4A HSR C4A HrSR C4C HSR C4C HrSR	0.15
55*	Stemmons Park	City Park	X	XX	City of Dallas	32.813988/-96.862538	C4A HSR C4A HrSR C4C HSR C4C HrSR	3.03
56	Gateway Park	City Park	X	XX	City of Fort Worth	32.798784/-96.817144	C4B HSR C4B HrSR	22.88
59	Randol Mill Park	City Park	X		City of Arlington	32.7606/-97.152959	C4B HSR C4B HrSR	15.45
64	Fish Creek Linear Park (East)	City Park Trail	X		City of Grand Prairie	32.758783/-97.067868	C4B HSR C4B HrSR	1.67
65	Fish Creek Linear Park (West)	City Park Trail	X		City of Arlington	32.661048/-97.062882	C4B HSR C4B HrSR	1.49
66	Loyd Park	City Park	X		City of Grand Prairie	32.661782/-97.062126	C4B HSR C4B HrSR	41.98
69	Trinity River Greenbelt Park	City Park	X	XX	City of Dallas	32.776803/-96.8682	C4B HSR C4B HrSR	19.94
70*	Martyr's Park	City Park	X	XX	City of Dallas	32.777792/-96.820677	C4A HSR and C4A HrSR C4B HSR and C4B HrSR C4C HSR and C4C HrSR	0.34 0.89 1.81
71	Dealey Plaza Park	City Park	X	XX	City of Dallas	32.778878/-96.810691	C4A HSR and C4A HrSR C4B HSR and C4B HrSR C4C HSR and C4C HrSR	0.70 0.1 0.7

Map ID # (Figures 4-3 to 4-6)	Resource Name	Resource Type	4(f)[a]	6(f)[a]	Ownership	Location (Lat/Long)	Alternative	Acreage in EIS Study Area
72	Reunion Park	City Park	X	XX	City of Dallas	32.778177/-96.808544	C4A HSR C4A HrSR C4C HSR C4C HrSR	1.25
73	Fruitdale Park	City Park	X	XX	City of Dallas	32.77309/-96.807441	C4A HSR C4A HrSR C4C HSR C4C HrSR	1.46
75	Bear Creek Nature Park	City Park	X		City of Lancaster	32.577623/-96.761461	C4A HSR C4A HrSR C4C HSR C4C HrSR	26.84
78	Richards Park	City Park	X		City of Waxahachie	32.418699/-96.855072	C4A HSR C4A HrSR C4C HSR C4C HrSR	3.88
79	Waxahachie Creek Hike and Bike Trail	City Trail	X		City of Waxahachie	32.385806/-96.854972	C4A HSR C4A HrSR C4C HSR C4C HrSR	5.18
80	Lions Park	City Park	X		City of Waxahachie	32.382484/-96.85065	C4A HSR C4A HrSR C4C HSR C4C HrSR	2.86
81	Playground	Playground and Park	X		City of West	32.368438/-96.840974	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	2.05
83	Baseball fields	Baseball fields	X		City of West	31.813805/-97.089789	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	2.64
85	Lions Park	Baseball-softball fields	X		City of Bellmead	31.600162/-97.094003	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	1.01
87	Riverwalk	Public trail	X		City of Waco	31.558662/-97.117195	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	0.17
88	Fort Fisher Park	City Park	X		City of Waco	31.556447/-97.118737	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	9.20

Map ID # (Figures 4-3 to 4-6)	Resource Name	Resource Type	4(f)[a]	6(f)[a]	Ownership	Location (Lat/Long)	Alternative	Acreage in EIS Study Area
92	Jefferson Park	City Park	X		City of Temple	31.21018/-97.312238	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	0.19
93	Optimist No. 1 Field	Soccer Field	X		City of Temple	31.120739/-97.342771	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	2.15
94	Woodson Field	Soccer Field	X		City of Temple	31.112342/-97.345396	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	1.52
95	Whistle-stop Playground	Playground	X		City of Temple	31.103591/-97.347765	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	2.39
96	Santa Fe Gardens	Urban Park	X		City of Temple	31.097609/-97.347606	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	6.31
97	Willis Creek Park	USACE Park	X		USACE	31.095684/-97.345133	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	22.12
98	Wilson H. Fox Park	USACE Park	X		USACE	30.649001/-97.432165	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	40.90
99	Southeast Burkett Street Park	City Park	X		City of Taylor	30.642064/-97.429926	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	3.84
100	Walter E. Long Metro-politan Park	City Park	X		City of Austin	30.573323/-97.403554	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	30.29

Map ID # (Figures 4-3 to 4-6)	Resource Name	Resource Type	4(f)[a]	6(f)[a]	Ownership	Location (Lat/Long)	Alternative	Acreage in EIS Study Area
101	Richard Moya Park	County Park	X	X	Travis County	30.292655/-97.577155	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	11.31
103	McClain Park	City Park	X	XX	City of San Antonio	29.908734/-97.704742	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	23.30
104	Friensen-hahn Park	City Park	X	XX	City of San Antonio	29.589338/-98.388303	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	5.02
106	McAllister Park/Time Warner Cable Park	Baseball-softball fields	X	X	City of San Antonio	29.567232/-98.417327	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	7.98
108	Salado Creek Greenway	Public trail	X	X	City of San Antonio	29.547395/-98.434785	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	10.84
110	Olmos Basin Golf Course	Public golf course	X		City of San Antonio	29.502553/-98.479436	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	8.89
111	Olmos Basin Baseball Fields	Athletic fields	X	XX	City of San Antonio	29.496595/-98.482744	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	31.33
113	Kenwood Park	City Park	X	XX	City of San Antonio	29.48614/-98.48898	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	4.23
171	Hallmark Park	City Park	X	XX	City of Fort Worth	32.63757/-97.33356	C4C HSR C4C HrSR	12.97
172	Parks of Deer Creek Park	City Park and Trails	X	XX	City of Fort Worth	32.60456/-97.32922	C4C HSR C4C HrSR	0.65

Map ID # (Figures 4-3 to 4-6)	Resource Name	Resource Type	4(f)[a]	6(f)[a]	Ownership	Location (Lat/Long)	Alternative	Acreage in EIS Study Area
174	Mistletoe Hill Park	City Park	X		City of Burleson	32.56968/-97.32425	C4C HSR C4C HrSR	1.70
175	Bailey Lake	City Park and Lake	X		City of Burleson	32.5292/-97.31995	C4C HSR C4C HrSR	6.64

* A resource that is also located within the EIS Study Area of an alternative in the Northern Section.

[a] "X" indicates that a property has been identified as a potential Section 4(f) or Section 6(f) property.
"XX" indicates that the city has L&WCF Act monies for its city parks, trails, and/or recreation areas, but there is no indication of where the funding was used; therefore, additional research is required.

Note: Map ID #s are discontinuous to remain consistent with resources listed in Section 3.17, Recreational Areas and Opportunities.

HrSR = higher-speed rail; HSR = high-speed rail

Sources: Ben Bolt-Palito Blanco Independent School District (2014); Bruceville-Eddy Independent School District (2014); Bryan McClain Park (2014); FHWA (1987); FHWA (2014); Grand Prairie Independent School District (2014); Grand Prairie Parks and Recreation Department (2014); Land and Water Conservation Fund Coalition (2014); La Vega Independent School District (2014); NPS (2014); NPS (2013); River Legacy Foundation (2014); St. Mark Catholic Youth Organization (2014); San Antonio Gun Club (2014); San Antonio Parks and Recreation Department (2014a); San Antonio Parks and Recreation Department (2014b); TxDOT (2014a); TxDOT (2013); Texas Education Agency (2014); Texas Natural Resources Information System (2014); Travis County Parks (2014); Troy Independent School District (2014); USFWS (2014); USGS (2014).

Table 4-4: Section 4(f) Cultural Resources – Central Section

Map ID # (Figures 4-13 to 4-15)	Resource Name	Location (Lat/Long)	NRHP Status	Alternative	Acreage in EIS Study Area
42a*	Montgomery Ward and Company Building	32.754014/-97.326474	NRHP-Listed	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	Building
42b*	Gulf, Colorado and Santa Fe Railroad Passenger Station	32.749161/-97.324107	NRHP-Eligible	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	Building
53a*	Rock Island Railroad Bridge	32.813155/ -96.86163747	NRHP-Eligible	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	Building
54a*	Turtle Creek Pump Station	32.80004162/ -96.81644069	NRHP-Listed	C4A HSR C4A HrSR C4C HSR C4C HrSR	Building

Map ID # (Figures 4-13 to 4-15)	Resource Name	Location (Lat/Long)	NRHP Status	Alternative	Acreage in EIS Study Area
55a*	West End Historic District	32.779764/ -96.809595	NRHP-Listed	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	6.62
55b	Dealey Plaza Historic District	32.777795/ -96.808461	NRHP-Listed	C4A HSR C4A HrSR C4C HSR C4C HrSR	0.01
63a	Hollandale Historic District	32.729643/ -97.061774	NRHP-Eligible	C4B HSR C4B HrSR	5.14
63b	Vought Manor Historic District	32.728696/ -97.063174	NRHP-Eligible	C4B HSR C4B HrSR	5.49
71a	Dallas Union Terminal	32.775551/-96.807861	NRHP-Listed	C4A HSR C4A HrSR C4C HSR C4C HrSR	0.01
72a	Houston Street Viaduct	32.772899/-96.806363	NRHP-Listed	C4A HSR C4A HrSR C4C HSR C4C HrSR	0.73
72b	Cadiz Street Overpasses and Underpasses	32.769924/-96.801424	NRHP-Eligible	C4A HSR C4A HrSR C4C HSR C4C HrSR	Building
72c	Proctor & Gamble Manufacturing Complex	32.753842/-96.776522	NRHP-Eligible	C4A HSR C4A HrSR C4C HSR C4C HrSR	2.82
76a	Ellis County Centennial Marker	32.485029/-96.826991	NRHP-Eligible	C4A HSR C4A HrSR C4C HSR C4C HrSR	Building
78a	Ellis County Courthouse Historic District	32.382978/-96.85001	NRHP-Listed	C4A HSR C4A HrSR C4C HSR C4C HrSR	8.35
79a	Rogers Street Bridge	32.383049/-96.850799	NRHP-Eligible	C4A HSR C4A HrSR C4C HSR C4C HrSR	Building
80a	Joe E. Turner House	32.172866/-97.091881	NRHP-Listed	C4B HSR C4B HrSR	Building
88a	First Street Cemetery	31.554133/-97.119649	NRHP-Eligible	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	Building

Map ID # (Figures 4-13 to 4-15)	Resource Name	Location (Lat/Long)	NRHP Status	Alternative	Acreage in EIS Study Area
89a	10th Street Bridge at Waco Creek	31.54413/-97.125817	NRHP-Eligible	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	Building
89b	Elite Café	31.524688/-97.132976	NRHP-Eligible	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	Building
90a	Eddy 3rd Street Historic District	31.295173/-97.253128	NRHP-Eligible	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	1.21
90b	1st National Bank	31.295113/-97.252987	NRHP-Eligible	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	Building
102a	Withers House	29.870877/-97.727332	NRHP-Listed	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	Building
113a	International & Great Northern Railroad Passenger Station	29.427047/-98.505634	NRHP-Listed	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	Building
113b	Capt. Jose Antonio Menchaca Centennial Marker	29.413923/-98.510497	NRHP-Eligible	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	Building
113c	Jose Antonio Navarro Centennial Marker	29.413902/-98.510578	NRHP-Eligible	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	Building
113d	Col. Jose Francisco Ruiz Centennial Marker	29.413871/-98.510541	NRHP-Listed/RTHL	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR	Building

Map ID # (Figures 4-13 to 4-15)	Resource Name	Location (Lat/Long)	NRHP Status	Alternative	Acreage in EIS Study Area
				C4C HrSR	
113e	Don Juan Ximenes Centennial Marker	29.41385/-98.510632	NRHP-Eligible	C4A HSR C4A HrSR C4B HSR C4B HrSR C4C HSR C4C HrSR	Building
171a	South Main Street Overpass	32.723962/-97.32639	NRHP-Eligible	C4C HSR C4C HrSR	Building
171b	J.W. Hall House	32.705324/-97.329210	NRHP-Eligible	C4C HSR C4C HrSR	Building
171c	Ullman/Bungee Elevators	32.694673/-97.329103	NRHP-Eligible	C4C HSR C4C HrSR	Building
175a	609 Hawkins Street Resident	32.002807/-97.132713	NRHP-Eligible	C4C HSR C4C HrSR	Building

* Resource is also located within the EIS Study Area of an alternative in the Northern Section.
Sources: Beaumont et al. (n.d); Everett (2010); Google Maps (2014); GoogleEarth (1950–2014); Humphrey (2010); Humphrey and Crawford (2001); Long (2010b); Manguso (2010); Moore et al. (2013); NPS (2014); NPS (2015); NETROnline (2014); Richardson et al. (2005); TxDOT (2014b); TxDOT (2014e); TxDOT (2014f); TxDOT and FRA (2014); Texas Historical Commission (2014); Worcester (2010).

4.3.2.1 Alternative C4A Higher-Speed Rail

There are 64 Section 4(f) properties within the EIS Study Area of Alternative C4A Higher-Speed Rail, including 40 parks or recreational properties (Table 4-3) and 24 historic resources (Table 4-4). The densest concentration of Section 4(f) properties is located in the urban and suburban development near the northern and southern termini of this alternative, largely within the Fort Worth, Dallas, and San Antonio metropolitan areas and suburbs. In these urban and suburban areas, Alternative C4A would be located within existing railroad right-of-way and new construction outside the existing right-of-way would likely be directly adjacent to existing railroad facilities and tracks. Therefore, Alternative C4A Higher-Speed Rail would require limited new right-of-way or easements in the Fort Worth, Dallas, and San Antonio metropolitan areas and suburbs. While most of the Section 4(f) properties in the Alternative C4A Higher-Speed Rail EIS Study Area would likely not be susceptible to use under Section 4(f), there is the potential for impacts on railroad Section 4(f) properties including historic railroad depots (Map ID #42b, 71a, 113a) and bridges (Map ID #79a, 89a), as shown on Figures 4-13, 4-14, and 4-15. It is anticipated that, in most cases, right-of-way acquisition or permanent easements from Section 4(f) properties could be avoided or minimized, making a *de minimis* determination possible.

In rural areas and small towns in the EIS Study Area for Alternative C4A Higher-Speed Rail, the alignment would be outside the existing right-of-way, and due to the potential need for right-of-way and/or permanent and temporary construction easements, there is potential for use of Section 4(f) properties. The Section 4(f) properties in these areas include publicly owned parks (Map ID #75, 78, 80, 81, and 97), playing fields (Map ID #85, 93, and 94), trails (Map ID #79), individual historic properties (such as Map ID #88a and 102a), and historic districts (Map ID #90a), as shown on Figures 4-3, 4-4, 4-5, 4-14, and 4-15. Because there is more space in rural areas to avoid properties, it is anticipated that acquisitions and easements would be avoided or minimized at the project-level, resulting in a Section 4(f) *de minimis* determination.

Stations and their associated parking facilities along Alternative C4A Higher-Speed Rail have the potential for use of Section 4(f) properties within urban areas due to possible alteration, relocation, and demolition of existing historically significant Section 4(f) railroad depots. Several existing stations, including the Gulf, Colorado, and Santa Fe Passenger Station (Map ID #42b), the Dallas Union Terminal (Map ID #71a), and International & Great Northern Passenger Station (Map ID #113a), shown on Figures 4-13 and 4-15, have the potential for use. Construction techniques would include the Secretary of Interior's standards for rehabilitation. If use of Section 4(f) depots cannot be avoided, mitigation measures, as discussed in Section 4.7, Potential Mitigation Strategies, would be implemented. It is anticipated that use of other types of Section 4(f) properties in urban areas could be avoided or minimized during station site selection and as part of project-level design. While increased or additional parking facilities may also be required, it is anticipated that parking facilities would be designed to avoid railroad and other Section 4(f) properties. In suburban and rural areas, it is anticipated that locations where new stations would be constructed would not likely require use of Section 4(f) properties. Suburban and rural areas feature more available space than dense urban areas; as a result, Section 4(f) properties would likely be avoided or use would be minimized during site selection.

There are three Section 6(f) properties in this EIS Study Area that are also considered Section 4(f) properties: Harmon Field Park and Trails in Fort Worth (Map ID #43), Richard Moya Park in Travis County (Map ID# 101), and McAllister Park/Time Warner Cable Park in San Antonio (Map ID #106), as shown on Figures 4-3, 4-5, and 4-6. Use of the two urban parks in Fort Worth and San Antonio could likely be avoided or minimized because the alternative in these areas would be within or directly adjacent to existing transportation alignments. However, Alternative C4A would be outside existing transportation alignments in Travis County and would bisect Richard Moya Park (Figure 4-5: Map ID #101). It is anticipated that the project-level design of Alternative C4A would avoid use of this property, but if Richard Moya Park cannot be avoided, the amount of right-of-way acquisition from this property would be minimized, and the minimization efforts would be documented during Section 6(f) coordination with the Department of Interior.

4.3.2.2 Alternative C4A High-Speed Rail

There are 64 Section 4(f) properties in the EIS Study Area of Alternative C4A High-Speed Rail: 40 parks or recreational properties (Table 4-3) and 24 historic resources (Table 4-4). Because it is a high-speed rail service type, this alternative would be constructed on new alignment and as a result may require new right-of-way acquisition, permanent easements, temporary easements, and possible demolition of buildings and structures on Section 4(f) properties.

Due to dense development in the metropolitan areas of Fort Worth, Dallas, and San Antonio, avoidance of Section 4(f) properties in the EIS Study Area may be difficult at the project level. For example, use of portions of the Olmos Basin Golf Course (Map ID #110) in San Antonio would likely be required where the alternative traverses the golf course. Use of portions of Fort Fisher Park (Map ID #88) in Waco would likely be required where the alternative passes through downtown Waco (see Figures 4-4 and 4-6). Areas within or directly adjacent to historic districts, such as the West End Historic District (Map ID #55a) in Dallas, Dealey Plaza Park (Map ID #71) in Dallas, and the Ellis County Courthouse Historic District (Map ID #78a) in Waxahachie, as shown on Figure 4-13, have a high potential for use through acquisition, permanent easements, and/or temporary easements. If avoidance of Section 4(f) properties in urban areas is not possible, it is anticipated that right-of-way acquisitions, permanent easements, and temporary easements would be minimized where possible, creating only *de minimis* use of Section 4(f) properties.

The potential for use of Section 4(f) properties in suburban areas exists due to the need for new right-of-way, easements, and grade-separated structures associated with this alternative. Several school playgrounds, public parks, city trails, and historic properties are located within the EIS Study Area for Alternative C4A High-Speed Rail (Map ID #75, 76a, 79, 80, 81, and 95, as shown on Figures 4-3, 4-4, 4-5, and 4-13). Suburban areas typically feature more open space than dense urban environments do, which may enable more flexibility to avoid these Section 4(f) properties at the project level. However, because the high-speed rail service type requires gradual vertical and very large horizontal curve changes, avoidance of use in suburban areas may not be possible.

Because few rural Section 4(f) properties were identified at the service level, construction of Alternative C4A High-Speed Rail would not be likely to require use of Section 4(f) properties, such as the Wilson H. Fox Park (Map ID #98) and the historic Withers House (Map ID #102a) in Caldwell (see Figures 4-5 and 4-15). If use of these properties is required at the project level, it is anticipated that the alternative would be modified to avoid or minimize right-of-way acquisition, permanent easements, and temporary easements. Although high-speed rail construction requires large horizontal curves, the availability of large areas of undeveloped land in rural areas would allow the possibility of avoidance and minimization at the project level.

Stations and their associated parking facilities along Alternative C4A HSR have the potential for use of Section 4(f) properties within urban areas. Because the high-speed rail service type typically requires the construction of new station facilities or extensive alterations to existing facilities, it is possible that construction of this alternative could result in the use of Section 4(f) historic properties within the EIS Study Area. It is anticipated that these stations would be located in dense urban areas, where land availability is typically limited. As a result, several existing stations, including the Gulf, Colorado, and Santa Fe Passenger Station (Map ID #42b), the Dallas Union Terminal (Map ID #71a), and International & Great Northern Passenger Station (Map ID #113a), shown on Figures 4-13 and 4-15, have the potential for use. It is possible that construction of stations along this alternative would result in the alteration, relocation, or demolition of these historic Section 4(f) properties. In suburban areas, it is anticipated that locations where new stations would be constructed would not be likely to require use of Section 4(f) properties due to the availability of other land. While increased or additional parking facilities may also be required in urban and suburban areas, it is anticipated that construction of parking facilities would avoid Section 4(f) properties during the project-level design. Finally, it is likely that use of Section 4(f) properties in rural areas for construction of new stations would be unlikely because there is available vacant land, and Section 4(f) properties would likely be avoided during site selection.

There are three Section 6(f) properties within the EIS Study Area of Alternative C4A High-Speed Rail that are also considered Section 4(f) properties: Harmon Field Park and Trails in Fort Worth (Map ID #43), Richard Moya Park in Travis County (Map ID #101), and McAllister Park/Time Warner Cable Park in San Antonio (Map ID #106), as shown on Figures 4-3, 4-5, and 4-6. Use of the two urban parks in Fort Worth and San Antonio may be difficult to avoid because they would be located in dense urban environments where there is limited available space for a railroad corridor on new alignment. As shown on Figure 4-5, the alternative would bisect Richard Moya Park (Map ID #101). Because of its location in a rural part of Travis County, it is anticipated the alternative would be refined at the project level to avoid right-of-way acquisition from this park. However, it is possible that avoidance of Richard Moya Park may not be feasible because high-speed rail alternatives require gradual vertical curve changes.

Because there are so few Section 6(f) properties in the EIS Study Area of Alternative C4A High-Speed Rail, construction of new stations in urban, suburban, and rural areas is unlikely to require conversion of Section 6(f) properties. It is anticipated that Section 6(f) properties would be avoided during the selection of sites for new stations and associated parking lots.

4.3.2.3 Alternative C4B Higher-Speed Rail

There are 50 Section 4(f) properties in the EIS Study Area of Alternative C4B Higher-Speed Rail: 32 parks or recreational properties (Table 4-3) and 18 historic resources (Table 4-4). In the urban areas of Fort Worth, Dallas, and San Antonio Metropolitan areas, most of the alternative alignment would follow existing railroad or roadway rights-of-way, such as IH-30 and SH-360. The only exception is a short, new portion of the alternative east of downtown Fort Worth. Otherwise, within urban and suburban locations, new construction would likely be within or directly adjacent to existing transportation corridors, requiring less new right-of-way or fewer easements than new alignment segments. 4(f) properties have the greatest potential for use, specifically in Fort Worth and Dallas, if new right-of-way or easements are required, such as from the West End Historic District (Map ID #55a) and Dallas Union Terminal (Map ID #71a), shown on Figure 4-13. Furthermore, where existing railroad right-of-way would be used, railroad-related historic properties, including historic railroad depots and bridges (Map ID #42b, 53a, 71a, and 72a, shown on Figure 4-13), would have potential for use under Section 4(f).

In suburban areas where new alignments may be necessary, it is anticipated that there would be potential use of Section 4(f) properties. The greatest potential for use would be if new right-of-way or permanent and/or temporary easements are required from Section 4(f) properties in suburban areas such as Arlington and Grand Prairie in the Dallas and Fort Worth metropolitan area; resources in these areas include Randol Mill Park (Map ID #59), Hollandale Historic District (Map ID #63a), Vought Manor Historic District (Map ID #63b), and West Fish Creek Linear Park (Map ID #65), as shown on Figures 4-3 and 4-13. There is also potential for use when the alternative would be constructed within existing railroad right-of-way where there are railroad- Section 4(f) properties, such as the Gulf, Colorado, and Santa Fe Depot (Map ID #42b, shown on Figure 4-13).

In rural areas and small towns, Alternative C4B Higher-Speed Rail would generally be constructed on new alignment outside of existing transportation corridors. In such areas there is more space available to avoid properties, making use of Section 4(f) properties unlikely. As shown on Figures 4-4, 4-5, 4-14, and 4-15, Section 4(f) properties in rural areas and small towns include publicly owned parks (Map ID #97 and 101), playing fields (Map ID #85, 93, and 94), individual historic properties (Map ID #80a, 88a, and 102a), and historic districts (Map ID #90a). The permanent use of Section 4(f) properties in these areas could occur through the acquisition of new right-of-way and permanent easements; however, it is anticipated that the alternative could be modified at the project level to avoid or minimize use of these Section 4(f) properties, resulting in a determination of *de minimis* use. Potential use and avoidance of Section 4(f) properties related to stations and associated parking facilities for this alternative would be the same as described above for Alternative C4A Higher-Speed Rail.

The potential impacts on and avoidance of the three 6(f) properties in the EIS Study Area for this alternative are identical to those described for Alternative C4A Higher-Speed Rail. Because there are so few Section 6(f) properties in the EIS Study Area of Alternative C4B Higher-Speed Rail, it is anticipated that the properties would be avoided during project-level design.

4.3.2.4 Alternative C4B High-Speed Rail

There are 50 Section 4(f) properties in the EIS Study Area of Alternative C4B High-Speed Rail: 32 parks or recreational properties (Table 4-3) and 18 historic resources (Table 4-4). Because it is a high-speed rail service type, this alternative would be constructed on new alignment and as a result may require new right-of-way acquisition, permanent easements, temporary easements, and possible demolition of buildings and structures on Section 4(f) properties.

Potential use and avoidance of Section 4(f) properties primarily adjacent to existing transportation right-of-way within the major metropolitan areas of Fort Worth, Dallas, and San Antonio, including Map ID #110, 88, 55a, 71, and 78a, shown on Figures 4-3, 4-4, 4-6, and 4-13, would be the same as described for Alternative C4A High-Speed Rail.

Use of Section 4(f) properties in suburban areas could include school playgrounds, public parks, city trails, and historic properties (Map ID #63a, 63b, 64, 65, and 66, shown on Figures 4-3 and 4-13). Suburban areas typically feature more open space than dense urban environments do, which may enable more flexibility at the project level to avoid these Section 4(f) properties. Potential use and avoidance of rural Section 4(f) properties and of Section 4(f) properties related to stations and associated parking facilities in urban and suburban areas for this alternative would be the same as described above Alternative C4A High-Speed Rail.

The potential impacts on, avoidance of, and documentation of the three Section 6(f) properties in the EIS Study Area for this alternative are identical to those described for Alternative C4A High-Speed Rail. It is anticipated that construction of new stations in urban, suburban, and rural areas would not be likely to use Section 6(f) properties in the EIS Study Area because they would be avoided during site selection. If the conversion of Section 6(f) park land associated with the construction of new stations and parking facilities cannot be avoided, the amount of right-of-way required from this property would be minimized, and minimization efforts would be documented for the Department of Interior.

4.3.2.5 Alternative C4C Higher-Speed Rail

There are 72 Section 4(f) properties within the EIS Study Area of Alternative C4C Higher-Speed Rail: 44 parks or recreational properties (Table 4-3) and 28 historic resources (Table 4-4). The densest concentration of urban and suburban development and Section 4(f) properties is located near the northern and southern termini of this alternative, largely within the Fort Worth, Dallas, and San Antonio metropolitan areas and suburbs. In these areas, the alternative would be located within existing railroad right-of-way and new construction outside the existing right-of-way would likely be directly adjacent to existing railroad facilities and tracks. Therefore, the alternative would require limited new right-of-way or easements in the Fort Worth, Dallas, and San Antonio metropolitan areas and suburbs. It is anticipated that right-of-way acquisition or permanent easements from Section 4(f) properties could be avoided or minimized, making a *de minimis* determination possible.

In urban and suburban areas where existing railroad right-of-way would be used, there is the potential for use of railroad-related Section 4(f) properties, including historic railroad depots (Map ID #42b, 71a, and 113a) and bridges (Map ID #79a and 89a), as shown on Figures 4-13, 4-14, and 4-15. Possible expansion and reconstruction of railroad Section 4(f) depots and bridges may be required. It is anticipated that uses of these railroad Section 4(f) properties could be avoided or minimized at the project level, making a *de minimis* determination possible.

Because there are so few Section 6(f) properties in the EIS Study Area for Alterative C4B, it is anticipated that Section 6(f) properties would be avoided during project-level design.

4.3.2.6 Alternative C4C High-Speed Rail

There are 72 Section 4(f) properties in the EIS Study Area of Alternative C4C High-Speed Rail: 44 parks or recreational properties (Table 4-3) and 28 historic resources (Table 4-4). Because it is a high-speed rail service type, this alternative would be constructed on new alignment and as a result may require new right-of-way acquisition, permanent easements, temporary easements, and possible demolition of buildings and structures on Section 4(f) properties.

Potential use and avoidance of Section 4(f) properties primarily adjacent to existing transportation right-of-way within the major metropolitan areas of Fort Worth, Dallas, and San Antonio, including Map ID #110, 88, 55a, 71, and 78a, shown on Figures 4-3, 4-4, 4-6, and 4-13, would be the same as described for Alternative C4A High-Speed Rail.

Use of Section 4(f) properties in suburban areas is possible due to the need for new right-of-way, easements, and grade-separated structures. Several school playgrounds, public parks, city trails, and historic properties are located within the EIS Study Area (Map ID #75, 76a, 79, 80, 81, and 95, shown on Figures 4-3, 4-4, 4-5, and 4-13). Suburban areas typically feature more open space than dense urban environments, which may enable more flexibility at the project level to avoid these Section 4(f) properties. Potential use and avoidance of rural Section 4(f) properties and of Section 4(f) properties related to stations and associated parking facilities in urban and suburban areas for this alternative would be the same as described above Alternative C4A High-Speed Rail.

The potential impacts on, avoidance of, and documentation of the three Section 6(f) properties in the EIS Study Area for this alternative would be identical to those described for Alternative C4A High-Speed Rail. Because there are so few Section 6(f) properties in the EIS Study Area for Alternative C4C High-Speed Rail, it is anticipated that construction of new stations in urban, suburban, and rural areas would not be likely to require conversion of Section 6(f) properties. It is anticipated that Section 6(f) properties would be avoided during site selection of new stations and associated parking lots. If the conversion of Section 6(f) park land associated with the construction of new stations and parking facilities cannot be avoided, the amount of right-of-way required from this property would be minimized, and minimization efforts would be document for coordination with the Department of Interior.

4.3.3 Southern Section: San Antonio to South Texas

Tables 4-5 and 4-6 list the Section 4(f) and 6(f) park, refuge, and recreational resources and the Section 4(f) cultural resources identified, respectively, in the Southern Section.

Table 4-5. Section 4(f) and 6(f) Parks, Refuges, and Recreation Areas – Southern Section

Map ID # (Figures 4-6 to 4-10)	Resource Name	Resource Type	4(f)[a]	6(f)[a]	Ownership	Location (Lat/Long)	Alternative	Acreage in EIS Study Area
114	Lindbergh Park	City Park	X	XX	City of San Antonio	29.380768/-98.555422	S6 HSR S6 HrSR	1.99
115	Normoyle Park	City Park	X	X	City of San Antonio	29.379631/-98.540743	S4 HrSR	9.93
116	Al Forge Park	City Park	X	XX	City of San Antonio	29.362778/-98.53903	S4 HrSR	1.24
118	Medina River Greenway	City Greenway Park	X	XX	City of San Antonio	29.269584/-98.496249	S4 HrSR	5.14
120	Unnamed Park 1	City Park	X		City of George West	28.342326/-98.099633	S4 HrSR	9.40

Map ID # (Figures 4-6 to 4-10)	Resource Name	Resource Type	4(f)[a]	6(f)[a]	Ownership	Location (Lat/Long)	Alternative	Acreage in EIS Study Area
121	Casa Blanca Golf Course	County Golf Course	X		Webb County	27.536689/-99.45112	S4 HrSR	31.14
122	La Casa Blanca International State Park	State Park	X	X	Texas Parks and Wildlife Department/Webb County	27.536094/-99.44979	S4 HrSR	11.76
123	Lake Findley Park	City Park and Lake	X		City of Alice	27.796567/-98.057485	S4 HrSR	29.58
125	Younts Park	City Park	X		City of Agua Dulce	27.780929/-97.909541	S4 HrSR	1.12
126	John L. Sablatura County Park	County Park	X		Nueces County	27.795694/-97.814204	S4 HrSR	86.42
128	Robstown Memorial Park	City Park	X		City of Robstown	27.788062/-97.663034	S4 HrSR	0.81
129	Charles Brazzell Sr. Park	City Park	X		City of Alice	27.745213/-98.077557	S4 HrSR	0.75
133	Tennis Courts	City Courts	X		City of Edinburg	26.306664/-98.167024	S4 HrSR	0.42
135	Hike and Bike Trail	City Trail	X		City of Edinburg	26.265073/-98.210354	S4 HrSR	0.25
136	Bill Schupp Park	City Park	X	XX	City of McAllen	26.251708/-98.227245	S4 HrSR	4.18
138	Hike and Bike Trail (north)	City Trail	X	XX	City of McAllen	26.231877/-98.234572	S4 HrSR	2.18
139	Mcallen Bicentennial Soccer Fields	City Athletic Fields	X		City of McAllen	26.223748/-98.23664	S4 HrSR	2.40
140	McAllen High School	Public School	X	XX	McAllen Independent School District	26.221657/-98.23707	S4 HrSR	1.28
141	Municipal Park	City Park	X	XX	City of McAllen	26.212548/-98.237799	S4 HrSR	2.08
142	Hike and Bike Trail (south)	City Trail	X	XX	City of McAllen	26.232344/-98.235178	S4 HrSR	1.65
143	Archer Park	City Park	X	XX	City of McAllen	26.204869/-98.233701	S4 HrSR	0.52
144	Myers Park	City Park and Trail	X	XX	City of McAllen	26.202183/-98.220214	S4 HrSR	2.98
149	Central Park	City Park	X		City of Alamo	26.182541/-98.117874	S4 HrSR	1.82
153	HEB Civic Center Park	City Park	X		City of Mercedes	26.150447/-97.905243	S4 HrSR	0.83
154	Resaca de la Palma State Park	State Park	X		Texas Parks and Wildlife Department	26.152162/-97.850569	S4 HrSR	2.90
156	Sam Houston Park	City Park	X		City of Harlingen	26.180714/-97.687183	S4 HrSR	6.39
157	Harlingen Thicket	City Park	X		City of Harlingen	26.178049/-97.684237	S4 HrSR	3.43

Map ID # (Figures 4-6 to 4-10)	Resource Name	Resource Type	4(f)[a]	6(f)[a]	Ownership	Location (Lat/Long)	Alternative	Acreage in EIS Study Area
158	Arroyo Park to McKelvey Park Trail	City Trail	X		City of Harlingen	26.177238/-97.682474	S4 HrSR	0.22
161	Kennedy Park	City Park	X		City of San Benito	26.134876/-97.635425	S4 HrSR	3.38
162	Lower Rio Grande Valley National Wildlife Refuge	National Wildlife Refuge	X		U.S. Fish and Wildlife Service	26.106602/-97.603301	S4 HrSR	40.67
165	Unnamed Park 2	State Land	X	XX	State of Texas	25.98306/-97.526364	S4 HrSR	8.89
168	Joe and Tony Oliveiro Park	City Park	X	XX	City of Brownsville	25.937954/-97.520918	S4 HrSR	7.91
169	Riverside Park	City Park	X	XX	City of Brownsville	25.910397/-97.515085	S4 HrSR	2.93

* A resource that is also located within the EIS Study Area of an alternative in the Central Section.
[a] "X" indicates that a property has been identified as a potential Section 4(f) or Section 6(f) property.
"XX" indicates that the city has L&WCF monies for its city parks, trails, and/or recreation areas, but there is no indication of where the funding was used; therefore, additional research is required.
Note: Map ID #s are discontinuous to remain consistent with 4(f)/6(f) resources listed in Section 3.17, Recreational Areas and Opportunities.
Sources: Brownsville Independent School District (2014); Casa Blanca Golf Club (2014); Donna Independent School District (2014); FHWA (2014); Harlingen Consolidate Independent School District (2014); International Museum of Art and Science (2014); Land and Water Conservation Fund Coalition (2014); Los Fresnos Consolidated Independent School District (2014); NPS (2014); NPS (2013); Nueces County Parks and Recreation Department (2014); Pharr-San Juan Alamo Independent School District (2014); San Antonio Parks and Recreation Department (2014a); San Antonio Parks and Recreation Department (2014b); South Texas Independent School District (2014); Southwest Independent School District (2014); TxDOT (2014a); TxDOT (2013); Texas Education Agency (2014); Texas Natural Resources Information System (2014); USFWS (2014); USGS (2014).

Table 4-6: Section 4(f) Cultural Resources – Southern Section

Map ID # (Figures 4-15 to 4-17)	Resource Name	Location (Lat/Long)	NRHP Status	Alternative	Acreage in EIS Study Area
128a	Hotel Brendel	27.7878792/ -97.66149443	NRHP-Eligible	S4 HrSR	Building
130a	King Ranch Historic District	27.527646/-98.10017	NRHP-Listed	S4 HrSR	890.35
131a	One story wood house	27.228407/-98.13983	NRHP-Eligible	S4 HrSR	Building
134a	Southern Pacific Depot	26.301453/-98.168428	NRHP-Eligible	S4 HrSR	Building
142a	Casa de Palmas	26.205112/-98.234889	NRHP-Eligible	S4 HrSR	Building

Map ID # (Figures 4-15 to 4-17)	Resource Name	Location (Lat/Long)	NRHP Status	Alternative	Acreage in EIS Study Area
143a	Restaurant	26.203417/-98.231393	NRHP-Eligible	S4 HrSR	Building
144a	Louisiana–Rio Grande Canal Company Irrigation System Historic District	26.196429/-98.191846	NRHP-Listed	S4 HrSR	979.75
146a	San Juan Hotel	26.189452/-98.156876	NRHP-Listed	S4 HrSR	Building
146b	Early 20th century tile decorated storefront	26.189393/-98.156196	NRHP-Eligible	S4 HrSR	Building
149a	Moderne style service station/muffler shop	26.182013/-98.115087	NRHP-Eligible	S4 HrSR	Building
149b	Crest Fruit Company warehouse	26.18237/-98.113372	NRHP-Eligible	S4 HrSR	Building
150a	Concrete commercial building	26.176625/-98.081877	NRHP-Eligible	S4 HrSR	Building
150b	Hanson House	26.175625/-98.081174	NRHP-Eligible	S4 HrSR	Building
150c	Donna Irrigation District	26.172009/-98.058142	NRHP-Eligible	S4 HrSR	280.02
151a	Art Moderne Southern Mosaic Tile Factory	26.164883/-98.021114	NRHP-Eligible	S4 HrSR	Building
152a	Cortez hotel	26.159386/-97.991009	NRHP-Listed	S4 HrSR	Building
152b	Commercial building	26.150319/-97.91249	NRHP-Eligible	S4 HrSR	Building
152c	Hidalgo County Irrigation District #5 Offices	26.150243/-97.912504	NRHP-Eligible	S4 HrSR	Building
153a	Quonset Hut	26.150424/-97.90431	NRHP-Eligible	S4 HrSR	Building
154a	Moderne stucco gas station	26.157508/-97.828395	NRHP-Eligible	S4 HrSR	Building
154b	Moderne gas station	26.158464/-97.825321	NRHP-Eligible	S4 HrSR	Building
154c	La Feria Canning Co.	26.158863/-97.823432	NRHP-Eligible	S4 HrSR	Building
154d	Texas Citrus Fruit Growers	26.158975/-97.823004	NRHP-Eligible	S4 HrSR	Building

Map ID # (Figures 4-15 to 4-17)	Resource Name	Location (Lat/Long)	NRHP Status	Alternative	Acreage in EIS Study Area
154e	La Feria Irrigation District	26.160936/-97.818269	NRHP-Eligible	S4 HrSR	212.63
154f	International Style cinder block fence	26.164142/-97.806066	NRHP-Eligible	S4 HrSR	Building
154g	Adams Gardens Irrigation District	26.169652/-97.787909	NRHP-Eligible	S4 HrSR	70.53
154h	Spanish Revival Petrified Stone Gates	26.171597/-97.782893	NRHP-Eligible	S4 HrSR	Building
155a	Santos Lozano Building	26.192621/-97.697217	NRHP-Eligible	S4 HrSR	Building
160a	Cameron County Irrigation District #2	26.14208/-97.643964	NRHP-Eligible	S4 HrSR	347.24
165a	CCWC Irrigation District #6	25.974444/-97.523804	NRHP-Eligible	S4 HrSR	312.19

Note: Map ID #s are discontinuous to remain consistent with 4(f)/6(f) resources listed in Section 3.18, Historic, Architectural, and Non-Archaeological Cultural Resources.

Sources: Alcott (2010); Ashton and Sneed (2010); Beaumont et al. (n.d.); Conger (1964); Conger (2010); City of Laredo (2014); Cuéllar (2010); DaCamara (1949); Elliott (n.d.); Fehrenbach (2010); Ficker and Barron (2010); Garza (2010a); Garza (2010b); Garza and Long (2010); Gilbert (2010); Google Maps (2014); GoogleEarth (1950 – 2014); Harlingen Air Force Base (2010); Kearney (1989); Knight (2009); Long (2010c); Long (2010d); Manguso (2010); Munz (1966); NPS (2014); NPS (2015); NETROnline (2014); Parish (1989); "Port of Brownsville, Serving Two Nations" (1955); Richardson et al. (2005); Texas A&M University (2014); TxDOT (2014b); TxDOT (2014e); TxDOT (2014f); TxDOT (2014g); TxDOT and FRA (2014); Texas Historical Commission (2014); Worcester (2010).

4.3.3.1 Alternative S4 Higher-Speed Rail

There are 62 Section 4(f) properties in the EIS Study Area of Alternative S4 Higher-Speed Rail: 32 parks or recreational properties (Table 4-5) and 30 historic resources (Table 4-6). The Section 4(f) properties are located primarily in urban and suburban areas on the south side of San Antonio and along the southern leg of the alternative in the Lower Rio Grande Valley, extending south to McAllen then east to Brownsville. In these urban areas, the alternative would mostly be within existing railroad right-of-way or directly adjacent to existing right-of-way. Existing railroad infrastructure, including at-grade railroad crossings and grade-separated crossings, are already in place in the urban and suburban areas in the EIS Study Area, and as a result, there is little potential in urban areas for use of most of the Section 4(f) properties. The urban and suburban Section 4(f) properties with the highest potential for use would be railroad-related resources located within the existing railroad right-of-way. At the service-level of analysis, the only railroad Section 4(f) property located in the existing railroad right-of-way in the Study Area for this alternative is the Southern Pacific Depot

(Map ID #134a, shown on Figure 4-17). If use of this or any other Section 4(f) property is likely, it is anticipated that it could be avoided at the project level or minimized to a degree that may result in a determination of *de minimis* use.

There are also Section 4(f) properties located in rural areas and smaller towns along this alternative, including public parks (Map ID #122, 123, 125, 128), a wildlife refuge (Map ID #162), and the 1-million-acre NRHP-listed (and National Historic Landmark-designated) King Ranch (Map ID #130a), shown on Figures 4-7, 4-9, 4-10, and 4-16. Because there are a limited number of Section 4(f) parks in the numerous complexes on the King Ranch (Figure 4-16: Map ID #130a) that are located near US-77 and are several miles from the EIS Study Area, it is expected that any potential use of King Ranch would be considered *de minimis*. A portion of this alternative would be located within the abandoned Southern Pacific Railroad (formerly the Texas and New Orleans Railroad) right-of-way; as a result, it is equally likely that the alignment may help in avoiding Section 4(f) resources or encounter historic resources eligible for Section 4(f) protection.

Several of the Section 4(f) properties along Alternative S4 Higher-Speed Rail are trails that are within or that traverse existing railroad right-of-way in the EIS Study Area (Map ID #135, 138, and 139, shown on Figure 4-10). Although construction easements may require the temporary closure of trails and access points, such closure would likely only be needed for a short time during construction, after which trails and access points would be restored. Similarly, a use may be required on of portion of a public parks (Map ID #116, 123, 144, and 156) or a public golf course (Map ID #121), shown on Figures 4-6, 4-9, and 4-10. If the use of these facilities is shorter than the construction periods and areas are restored to their previous functions after the construction activities, it is possible that a determination of temporary occupancy would be possible. Use of cultural resource Section 4(f) properties may also be required (Map ID #144a, 154e, and 165a, shown on Figure 4-17); however, it is anticipated that project development could avoid the properties entirely or avoid adversely affecting their character-defining historic features.

Two Section 6(f) properties have been identified within the EIS Study Area of Alternative S4 Higher-Speed Rail: Normoyle Park (Map ID #115) in San Antonio and La Casa Blanca International State Park (Map ID #122) in Webb County, shown Figures 4-6 and 4-7. This alternative would be located within existing railroad right-of-way near these Section 6(f) properties, but the parks are not located within existing railroad right-of-way. As a result, the conversion of these Section 6(f) properties may be avoided, and it is unlikely that the acquisition and conversion of land from these Section 6(f) properties would be required.

4.3.3.2 Alternative S6 Higher-Speed Rail

There is one Section 4(f) park property and no historic or Section 6(f) properties identified in the EIS Study Area of Alternative S6 Higher-Speed Rail (Table 4-5). Lindbergh Park (Map ID #114) was identified as a Section 4(f) property and is located southwest of San Antonio and adjacent to an existing railroad, as shown on Figure 4-6. This alternative would use existing railroad infrastructure or would be within or directly adjacent to existing railroad right-of-way. As a result, there is little potential for a Section 4(f) use of Lindbergh Park. If new right-of-way or permanent or temporary easements would be required from this Section 4(f) property, it is anticipated that such use could be avoided or minimized at the project level.

4.3.3.3 Alternative S6 High-Speed Rail

Lindbergh Park (Map ID #114, shown on Figure 4-6) is the only Section 4(f) property identified along this alternative, and no Section 6(f) properties were identified (Table 4-5). Because high-speed rail alternatives would be constructed on new alignment, there is a potential for use of Lindbergh Park.

4.3.4 Summary of Potential 4(f) and 6(f) Use Analysis

Table 4-7 demonstrates how many resources are within the EIS Study Area for each alternative of the Northern, Central and Southern sections.

Table 4-7: Number of Section 4(f)- and Section 6(f)-Protected Properties by Alternative (in the 500-foot EIS Study Area)

	Alternative					
	N4A CONV	C4A HrSR/ C4A HSR	C4B HrSR/ C4B HSR	C4C HrSR/ C4C HSR	S4 HrSR	S6 HrSR/ S6 HSR
Section 4(f)-Protected Parks	27	24	16	27	20	1
Section 4(f)-Protected Refuges	0	0	0	0	1	0
Section 4(f)-Protected Recreation Areas	12	16	16	17	11	0
Section 4(f)-Protected Cultural Resources	26	24	18	28	30	0
Section 6(f)-Protected Properties	3	3	3	3	2	0
Total Section 4(f)- and/or 6(f)-Protected Properties[a]	65	64	50	72	62	1

[a] Because all Section 6(f) properties are also protected under Section 4(f), the Section 6(f) properties were not included in the *Total Section 4(f) and/or Section 6(f) Protected Properties* row to avoid counting the Section 6(f) properties twice.

Although several Section 4(f)-protected properties were identified within the EIS Study Area in both the Northern and Southern sections, new facilities associated with alternatives in these sections would likely use existing railroad infrastructure, be built directly adjacent to existing railroad facilities and tracks, or in the case of the Southern Section, be constructed in rural areas with limited 4(f) and 6(f) properties. Even expansion of existing stations and new stations within urban and suburban areas can avoid an adverse effect under Section 106, by adhering to the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (NPS 1995) and when possible to avoid effects on the depots all together. Avoiding an adverse effect on historic resources allows some "use" but can result in a *de minimis* use classification. However, all of the Central Section alternatives are likely to result in a potential use of Section 4(f) resources.

4.4 Avoidance Alternatives

The requirement of Section 4(f) is to avoid use of these properties unless there is no feasible and prudent alternative to the use of such land. Therefore, the first step is to determine whether there are feasible and prudent alternatives that would avoid these properties. According to 23 CFR 774.17, an alternative is not feasible if it cannot be built as a matter of sound engineering judgment. An alternative is not prudent if the following apply:

- It would compromise the project to a degree that it is unreasonable to proceed with the project in light of its stated purpose and need.
- It would result in unacceptable safety or operational problems.
- After reasonable mitigation, it would still cause:
  - Severe social, economic, or environmental impacts,
  - Severe disruption to established communities,
  - Severe disproportionate impacts on minority or low-income populations, or
  - Severe impacts on environmental resources protected under other federal statutes.
- It would result in additional construction, maintenance, or operational costs of an extraordinary magnitude.
- It would cause other unique problems or unusual factors.
- It would involve multiple factors (listed above) that, while individually minor, cumulatively would cause unique problems or impacts of extraordinary magnitude.

If there is an avoidance alternative that is prudent and feasible, it must be selected. The Section 4(f) discussion does not further consider an alternative if it is not feasible and prudent. Though detailed design information is not yet available to fully characterize the type of use or the extent or size of the use of 4(f) properties for the build alternatives, screening has been done as part of this service-level EIS to eliminate alternatives deemed not feasible in light of project objectives, which include minimization of impacts on cultural and recreational resources. While the FRA cannot make a Section 4(f) approval at the service level, steps taken to date that contribute to the selection of feasible and prudent alternatives have been evaluated throughout the screening process. The sections below describe these avoidance alternatives, as well as their feasibility and prudence, for the different National Environmental Policy Act (NEPA) screening levels.

4.4.1 Avoidance Alternatives Evaluation

Avoidance alternatives will continue to be refined throughout the environmental process. Because the Northern, Central, and Southern sections of the Program could be built as individual, standalone projects or in combination with other sections, the Section 4(f) and 6(f) analysis considers each geographic section independently.

Based on the evaluation in Section 4.3, each of the build alternatives has the potential to use 4(f) resources, including historic or potentially historic properties, parks, recreation areas, and wildlife refuges. Table 4-7 in Section 4.3.4 demonstrates how many resources are within the EIS Study Area for each alternative.

As described above, the Northern and Southern sections may avoid Section 4(f) resources; however, all of the Central Section alternatives are likely to result in a potential use of Section 4(f) resources. Therefore, this avoidance alternatives discussion focuses on the Central Section.

4.4.2 Avoidance Alternatives for the Central Section

Chapter 2, Alternatives, documents the alternatives screening process carried out for this service-level EIS and describes the full range of alternatives considered in its preparation. For the Central Section, Table 4-8 lists and Figure 4-18 conceptually illustrates the range of route alternatives screened during the alternatives analysis with their respective service types.

Table 4-8: Route Alternatives Considered in Study Screenings

Geographical Section	Endpoints	Initial Route Alternative	Service Types
Central	Dallas and Fort Worth to San Antonio	C1	CONV, HrSR
		C2	HrSR, HSR
		C3	CONV
Metroplex	Dallas and Fort Worth	M1	CONV, HrSR
		M2	HrSR, HSR
		M3	CONV, HrSR

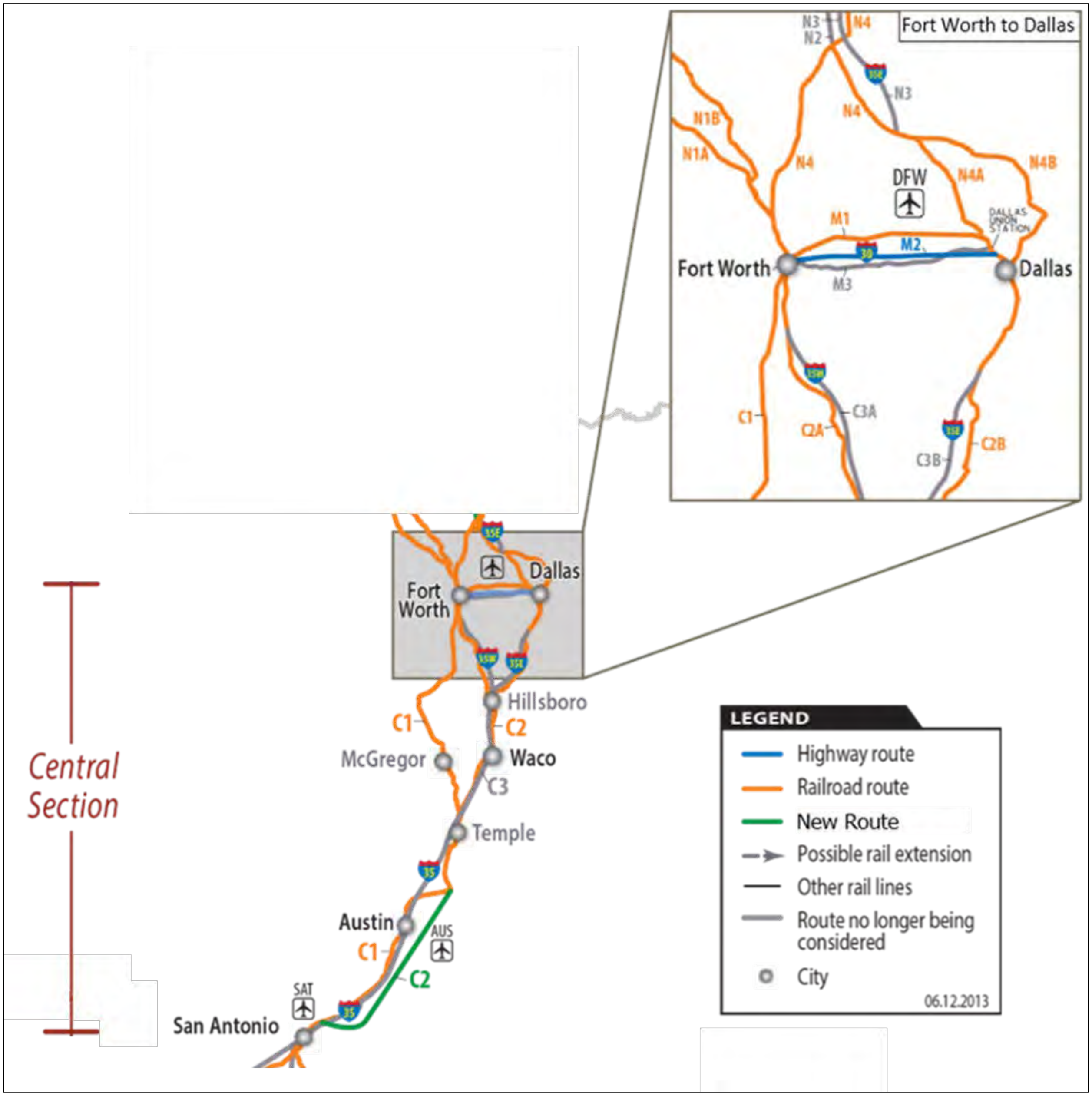

Figure 4-18: Screened Initial Route Alternatives in the Central Section

The route alternatives were explored to remain within existing freeway right-of-way or freight right-of-way or in some cases be placed in areas beyond existing urbanized developed areas. Each initial route alternative was developed to avoid impacts on existing Section 4(f) resources as well as other social, environmental, and economic resources. Initial screening efforts determined feasibility by considering two sources of information. The first source of information was the *Oklahoma City to South Texas Infrastructure Analysis* (TxDOT 2013), which evaluated the possibility of operating higher- or high-speed rail in the rights-of-way of interstate highways in the Study Vicinity. The findings of that report established that interstate highways are designed with curve radii too small for higher- or high-speed rail operation, that railroad vertical clearance needs are often higher than highway clearances at existing overpasses, and that many operational limitations of both highways and railroads make shared rights-of-way problematic for all but short stretches of a new rail alignment. The second source was information provided by Class 1 railroads (owners of the existing major operating rail lines in the EIS Study Area) regarding the level of existing and potential future freight rail traffic and how that freight traffic might affect the feasibility of adding or expanding passenger rail service on these rail lines. In light of this review, conventional rail was eliminated because additional passenger rail on existing rail would not be feasible over time. Therefore, this section considers only higher- and high-speed rail. In addition, freight usage needs restricted some opportunities for shared right-of-way. For these reasons, the following Central Section route alternatives were eliminated:

- Conventional passenger rail because it would not be feasible to use existing railroad tracks in the Central Section
- C3 because it would not be feasible to use the IH-35 corridor
- M3 because it would not be feasible to use railroad right-of-way

Other alternatives, including C1 and C2A, would not be prudent due to overriding cost. In the case of C1, the alternative would circumvent the urban development areas. While this would effectively avoid many Section 4(f) resources, the alternative would not support the purpose and need of the Program to enhance rail service for high-density population centers as efficiently as other alternatives.

The remaining alternatives, specifically C2, M1, and M2, were further refined into a new series of alternatives, resulting in Alternatives C4A, C4B, and C4C, which primarily differ in their connections between Fort Worth and Dallas and to the south, where they join at Hillsboro to take the same route to San Antonio. Alternatives C4A, C4B, and C4C would substantially follow the original C2 alignment for the southern portion of their routes. These are effectively the alternatives under review in this service-level EIS.

4.4.3 Avoidance in the EIS Study Area for the Central Section

This evaluation considers that most Section 4(f) resources in the EIS Study Area would have a potential use. The EIS Study Area is a 500-foot-wide corridor within which the alignments can shift to avoid Section 4(f) resources. The build alternatives are anticipated to require between 50 and

100 feet of right-of-way. Therefore, there is room to shift alignments within the 500-foot EIS Study Area in the case of Alternative N4A, and this design capability is already assumed for much of the qualitative discussions in the Section 4(f) evaluation. However, this may not be possible for the Central Section higher- and high-speed rail service types. High-speed rail alternatives must remain straight and require grade-separation from other transportation networks; therefore, the flexibility for alignment adjustments may be minimal.

Design refinements to avoid specific Section 4(f) properties and/or to minimize harm will be addressed at the project level. In addition, project-level processes will complete the Section 106 process, which requires formal identification of the APE, a survey of historic resources within the APE, and determination of effects, including visual and noise effects. These determinations of effect would constitute a use, upon which a Section 4(f) evaluation would be developed. Avoidance and minimization efforts would engage the SHPO and jurisdictions with authority.

4.5 Least Harm Analysis

Because there is a high likelihood that Section 4(f) resources cannot be avoided and impacts may be too great to determine a *de minimis* use through minimization and mitigation measures, a least harm analysis would be conducted for the Central Section alternatives during the project-level EIS.

When there is no prudent and feasible alternative to avoid Section 4(f) resources, pursuant to 23 CFR 774.3(c), a least harm analysis is required. Pursuant to 23 CFR 774.3(c), the FRA may approve only the alternative that causes the "least overall harm" in light of the purposes of Section 4(f). The regulations require that determining which alternative causes the least overall harm be based upon an assessment and balancing of seven factors:

1. The ability of the alternative to mitigate adverse impacts on each Section 4(f) property (including any measures that result in benefits to the property)
2. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that quality each Section 4(f) property for protection
3. The relative significance of each Section 4(f) property
4. The views of the official(s) with jurisdiction over each Section 4(f) property
5. The degree to which each alternative meets the purpose and need for the project
6. After reasonable mitigation, the magnitude of any adverse impacts on resources not protected by Section 4(f)
7. Substantial differences in costs among the alternatives

This level of detail is not available at the service-level EIS phase. In addition, it is possible that not all Section 4(f) resources have been identified, and therefore this service-level evaluation is comparative.

This analysis would likely be equally applicable to Section 6(f) resources that require a full review of avoidance and minimization alternatives. Based on the analysis of potential impacts on identified

Section 6(f)-protected properties, it is anticipated that the highest intensity of impacts would occur along alternatives in the Central Section, which travel through major urban areas that feature the densest concentration of Section 6(f) properties.

4.6 Agency Coordination

As part of the Study, and pursuant to the requirements of NEPA, TxDOT and FRA have conducted a public and agency involvement program in support of the service-level environmental review process. Chapter 8, Public Involvement, contains a detailed description of the activities included in this effort. Several of these activities involved opportunities for agencies and groups with an interest in Section 4(f) properties to provide input on Study alternatives under consideration during the different stages of the screening process.

Prior to the formal scoping period, an agency pre-scoping meeting was held to introduce the Study, including an overview of the purpose and need and preliminary information about the Study scope and general corridors under consideration. Among the attendees of this meeting were representatives from the U.S. Fish and Wildlife Service, Texas Department of Parks and Wildlife, and the Texas Historical Commission. Agency scoping meetings held in Oklahoma City, Austin, and Dallas in March and April 2013 were part of the formal scoping process. Agencies were encouraged to submit verbal or written comments during the meetings and throughout the scoping period.

Tribal coordination has also been initiated for the Study. FRA worked with TxDOT, Oklahoma Department of Transportation, and FHWA to develop a list of Native American Tribes that could potentially have interest in the Study because of current or historic presence or treaty interest in the Study Vicinity. Tribes on the list received letters during the scoping period inviting them to participate in public scoping meetings and encouraging comments. In addition, FRA sent letters inviting the Tribes to participate in government-to-government consultation pursuant to Section 106 of the NHPA.

4.7 Potential Mitigation Strategies

Project-level review would include a more detailed analysis of any potential temporary, permanent, or constructive uses under Section 4(f) or conversion of use under Section 6(f). Project-level review would also include an evaluation and determination of proposed mitigation measures and strategies to minimize these uses. Often these evaluations would result in mitigation agreements between agencies executed through a memorandum of agreement or programmatic agreement.

Where mitigation measures can eliminate the effect of the use, an agreement with the official with jurisdiction could result in FRA determining a *de minimis* effect, meaning no further Section 4(f) evaluation is necessary. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users amended Section 4(f) to allow the FHWA, Federal Transit Administration (FTA), and FRA to determine that certain uses would have a *de minimis* impact, or no adverse effect, on a protected resource provided that the responsible party with jurisdiction over the affected property agrees in writing. In this context, a *de minimis* impact is a minor impact that does not adversely affect the activities, features, or attributes of the Section 4(f) property.

When a federally funded transportation project requires the use of a Section 4(f) property, a Section 4(f) approval by the FHWA, FTA, or FRA is required. If the use of the property would result in impacts more substantial than *de minimis*, a written evaluation must be prepared and submitted to the FHWA, FTA, or FRA for approval. There are two types of Section 4(f) evaluations: an individual evaluation and a programmatic evaluation. At the project level, each individual evaluation would be submitted as part of the environmental process. A programmatic evaluation may be used only for projects that meet the application criteria for one of the five following nationwide programmatic evaluations that have been approved by FHWA, FTA, and FRA:

1. Independent Bikeway or Walkway Construction Projects (approved May 23, 1977)
2. Use of Historic Bridges (approved July 5, 1983)
3. Minor Involvement with Public Parks, Recreation Lands, and Wildlife and Waterfowl Refuges (approved December 23, 1986)
4. Minor Involvement with Historic Sites (approved December 23, 1986)
5. Transportation Projects that have a Net Benefit to Section 4(f) Property (approved April 20, 2005)

Individual and programmatic Section 4(f) evaluations describe the Section 4(f) property and the proposed Section 4(f) use of the property, include a detailed engineering description of avoidance alternatives, provide environmental and engineering considerations associated with all avoidance alternatives, summarize coordination with official(s) with jurisdiction, and outline the measures to minimize harm and mitigation.

In addition, a wide range of mitigation strategies could be used in cases where a Section 4(f) use cannot be avoided or minimized. Mitigation for the use of Section 4(f) properties would be commensurate with and correspond directly to the type of Section 4(f) use that would occur at the construction or operational phases.

For a use of a cultural resource Section 4(f) property, mitigation options for permanent and temporary uses include tangible, beneficial modifications to the Section 4(f) property or documentation of the cultural resource Section 4(f) property prior to construction. For example, mitigation could include erecting sound barriers, creating vegetative screening, or planting other landscaping elements. Documentation may take the form of the preparation of Historic American Building Survey or Historic American Engineering Record documentation, NRHP nominations, historic property management and treatment plans, and data recovery reports. Developing educational materials as part of public outreach is also a mitigation option and could include brochures, displays, websites, and public presentations. Development of these educational mitigation materials would likely occur in consultation with local historical societies and county historical commissions.

For a noncultural resource Section 4(f) property (such as public parks, recreational areas, and wildlife and waterfowl refuges), mitigation could also include sound barriers, vegetative screening, landscaping, or replacement of lands where the use would occur with lands of at least comparable value and reasonably equivalent usefulness and location. Additional mitigation options could include improved parking, access, and trail facilities or construction of improved or new emergency entry points for a large Section 4(f) property to allow emergency responders faster access to certain areas of the property. In addition, educational material and displays such as brochures and kiosks could be created to inform the public about the types of flora and fauna found in parks, trails, wildlife refuges, and waterfowl refuges.

Mitigation options for a Section 6(f) property are more limited than for a Section 4(f) property due to the substantive requirement of Section 6(f) regulations: mitigation for the conversion of use of a Section 6(f) property is restricted to replacement of converted lands with replacement lands of equal fair market value, usefulness, size, and location.

4.8 Subsequent Analysis

Section 4(f) and Section 6(f) evaluations for specific projects will be completed during project-level processes when sufficient design and operational information about improvements are developed to determine Section 4(f) use. During project-level analysis of the selected alternatives, more detailed research on the types of activities conducted at each resource, the degree of public access and use, and the exact property boundaries would be conducted to determine the potential options for avoidance and the extent of any potential impacts. For Section 4(f) and Section 6(f) compliance during project-level processes, further study of feasible and prudent avoidance alternatives and if no alternative for that section can avoid all Section 4(f) and Section 6(f) resources, a least overall harm assessment according to 23 CFR 774.3(c)(1)[1] will be required. This would include the following steps:

- **Step 1:** Conduct continued coordination with the officials with jurisdiction. This will be done to confirm the properties, confirm property boundaries, and obtain input on the effects of the project and proposed mitigation. If a *de minimis* impact is anticipated, obtain concurrence from officials with jurisdiction that the impact is indeed *de minimis*. Coordination with the SHPO will also be done to obtain concurrence with eligibility of a property, determination of effects, and proposed mitigation. If a "no adverse effect" determination is proposed that will be used to determine a *de minimis* impact, the SHPO will be notified of this intention on the part of TxDOT and FRA.
- **Step 2:** Conduct a more detailed evaluation to determine if additional Section 4(f) or 6(f) properties are located in the Study Area (that were not identified at the service level). Project-level processes will also include a step to confirm the eligibility of assumed Section 4(f) properties, including ownership details, property boundaries, and NRHP eligibility if the property

[1] While this regulation was written for Section 4(f), the analysis equally applies to Section 6(f) resources as well.

is a historic property. In addition, property management practice details from resource management plans for refuges, parks, and recreational properties will be reviewed.

- **Step 3:** Collect information needed to determine detailed use by alternative. This step will include laying the edges of physical disturbance and future right-of-way over the mapping of the property boundaries. This information will then be used to determine whether or not the anticipated use could be avoided or evaluated as a *de minimis* impact. This information, along with the findings of the noise analysis, access analysis, and visual analysis, will be used to determine whether or not an alternative could result in a constructive use. Analysis of temporary impacts will be conducted as well to determine if the conditions for temporary occupancy are met, as defined in 23 CFR 774.13 (d).
- **Step 4:** Conduct Section 4(f) evaluations to determine if a prudent and feasible alternative that avoids the Section 4(f) properties exists. Uses of the properties will be considered and compared to the service-level alternatives and this evaluation. If there is a substantial change in properties used or in the significance of the use, a determination will be made of the need to revisit the service-level decision. This evaluation will review additional alignment possibilities building upon this service-level EIS.
- **Step 5:** Identification of all possible planning to minimize harm. This step will include development of full mitigation measures, as well as other measures to minimize harm.
- **Step 6:** Development of least harm analysis. If no prudent and feasible avoidance alternative exists, and more than one alternative is developed at the project level that use Section 4(f) properties, a least harm analysis will be conducted to determine which alternative would cause the least overall harm in light of the preservation purpose contained in 23 CFR 774.3(c)(1).

5.0 Unavoidable Adverse Effects

This chapter describes potentially unavoidable adverse environmental effects identifiable at the service level of environmental review that cannot be avoided if specific alternatives are implemented.

This service-level environmental impact statement analyzes the environmental effects of route and service type options at the conceptual planning stage. At this service level, it was assumed that those adverse environmental effects characterized as substantial would be more likely to also be unavoidable (compared to moderate and negligible effects) and therefore this section focuses on substantial adverse effects. Many potentially substantial adverse effects described in Chapter 3, Affected Environment and Environmental Consequences, would likely be avoided or minimized through design refinement or mitigation measures. However, design refinement and mitigation measures would not avoid or minimize all adverse effects, and some unavoidable potentially substantial adverse effects would be expected to result from implementation of the alternatives.

The ability of the alternatives to avoid or minimize adverse effects varies by service type. The higher the design speed, the more difficult it is to avoid sensitive resources since higher design speeds require straighter, longer sections of track and larger radius curves. Moving or curving the alignment at higher design speeds may have ripple effects on the alignment for miles, may not always be feasible, and may result in equally severe adverse effects on other resources or in other locations. The unavoidable adverse effects of the three service types are summarized as follows:

- Conventional rail would have the fewest unavoidable adverse effects because conventional rail would typically operate within an existing rail corridor. If right-of-way is needed outside existing rail corridors, design speeds are low enough that small alignment shifts are often feasible.
- Higher-speed rail would have more unavoidable adverse effects because it would operate on new alignments outside existing transportation corridors in many locations, and the higher design speed provides fewer opportunities to shift the alignment to avoid sensitive resources.
- High-speed rail would have the most unavoidable adverse effects because, in addition to operating on new alignments outside existing transportation corridors in many locations, its design speeds are so high that few opportunities are available to shift the alignment to avoid sensitive resources.

Potential adverse effects can only be generalized at this service level of review because field studies were not conducted, and in most instances the buffer area used for the analysis is many times larger than the actual right-of-way that would be needed for the alternatives. Potential adverse effects would be studied and clarified during project-level studies, when more specific information would be available on the right-of-way needed for the alternatives and on specific properties potentially affected. The objective at the project level would be to identify design options (plans and profiles) that would avoid sensitive resources to the greatest extent possible.

5.1 *Northern Section: Oklahoma City to Dallas and Fort Worth*

Travel Demand and Transportation. Alternative N4A Conventional would have substantial adverse effects on bus and air travel, resulting in a reduction in mode share of 33 and 50 percent, respectively, as passengers are diverted to rail. This alternative would also have substantial adverse effects on bus and air service provider operations, resulting in a reduction in ridership of 50 and 44 percent, respectively, and potential lost revenue as a result of fewer customers.

5.2 *Central Section: Dallas and Fort Worth to San Antonio*

Air Quality. Construction of all of the Central Section alternatives would be a major infrastructure project and would occur in an area currently designated as serious nonattainment for ozone. Even with mitigation, all of the Central Section alternatives except for Alternative C4B High-Speed Rail would likely result in substantial short-term adverse effects on air quality during construction. The C4A and C4C high-speed rail alternatives would result in higher short-term construction emissions than the higher-speed rail alternatives, as they would require more grade-separation segments, a larger construction footprint, and more mobilization effort due to the high-speed rail segment and station design requirements.

Natural Ecosystems and Wildlife. Construction of the portions of all of the Central Section alternatives located on new alignments outside existing transportation corridors would affect a large amount of land and would have a substantial adverse effect, even with mitigation, on the following:

- Non-developed lands that support natural ecosystems
- Lands that support animal assemblages and terrestrial communities
- Land coverage of high ecological importance

Threatened and Endangered Species. Construction of the portions of all of the Central Section alternatives located on new alignments outside existing transportation corridors would affect a large amount of land and would have a substantial adverse effect, even with mitigation, on state-listed and federally listed sensitive wildlife species.

Energy. The Central Section high-speed rail alternatives would require significantly more structures to be built and transported for the new rail alignment and would all have substantial adverse effects during construction. However, the high-speed rail alternatives would also have substantial beneficial effects during operation, saving between an estimated 1,413,391 and 2,264,999 million British thermal units (MBTUs) annually for Alternative C4C High-Speed Rail and Alternative C4B High-Speed Rail, respectively.

Utilities. The Central Section high-speed rail alternatives would require new track along their entire alignments, and all would pass through urban areas with high density of utilities and fixed utilities, thereby resulting in the potential for substantial adverse effects. Within the Central Section, Alternatives C4B and C4C Higher-Speed Rail also have the potential for substantial adverse effects because of the high density of utility crossings and the magnitude of construction. Alternative C4C

Higher-Speed Rail has significantly more utility crossings than the other higher-speed rail alternatives in the Central Section.

Aesthetics and Visual Quality. All of the Central Section alternatives would have substantial adverse effects along portions of the alignment. Substantial adverse effects would occur where new rail alignments would be required outside of existing transportation corridors. Therefore, the high-speed rail alternatives have greater substantial effects on sensitive viewers than the higher-speed alternatives. However, when considering the overall intensity of effects, only the high-speed rail alternatives would have substantial adverse effects.

Land Use and Prime Farmland. Alternatives C4B and C4C for both the higher-speed rail and high-speed rail service types would have substantial adverse effects by isolating areas of prime farmland. Alternatives C4C Higher-Speed Rail and High-Speed Rail would also have substantial adverse effects on land use because they require new transportation corridors to be constructed outside of existing transportation corridors and would require conversion of larger areas of land compared with the other alternatives in the Central Section.

Recreation. All of the Central Section alternatives (with the exception of Alternative C4C Higher-Speed Rail) would have substantial adverse effects on recreational resources in both urban and suburban areas as a result of temporary interruption from construction activities, permanent property acquisition, and visual effects of the infrastructure. These adverse effects would likely be more intense and more difficult to fully mitigate for high-speed rail than higher-speed rail because of the larger footprint needed for stations and more potential for elevated guideways and roadway overpasses or underpasses.

Historic Resources. All of the Central Section alternatives would have substantial adverse effects on National Register of Historic Places (NRHP)-listed, NRHP-eligible, or potentially NRHP-eligible historic resources because of the potential for acquisition during construction, which may result in the alteration, removal, or demolition of historic resources along the alternatives. Although both higher-speed and high-speed rail would result in the removal of historic properties, avoidance may be more difficult for high-speed rail than higher-speed rail because of the larger footprint needed for stations (some existing railway stations are historic resources) and more potential roadway overpasses or underpasses, which would result in more property acquisition.

Archaeological Resources. The Central Section high-speed rail alternatives would have substantial adverse effects on archaeological resources because of the potential for large areas of soil disturbance, which may lead to disturbance or destruction of archaeological resources. Although both higher-speed and high-speed rail would likely result in the removal of archaeological resources, avoidance may be more difficult for high-speed rail than higher-speed rail because of the larger area of soil disturbance where grade separations would be necessary. Elevated portions of the guideway may result in avoidance of some sites. The higher-speed rail alternatives in the Central Section would not have substantial effects.

Travel Demand and Transportation. The Central Section Alternatives C4A Higher-Speed Rail and High-Speed Rail, Alternative C4B High-Speed Rail, and Alternative C4C High-Speed Rail would have substantial adverse effects on air travel, resulting in a reduction in mode share ranging from 42 percent for Alternative C4A Higher-Speed Rail to 72 percent for Alternative C4B High-Speed Rail as passengers are diverted to rail. The Central Section high-speed rail alternatives would have substantial adverse effects on bus travel, resulting in a reduction in mode share ranging from 23 percent for Alternative C4C High-Speed Rail to 29 percent for Alternative C4A High-Speed Rail. Alternative C4A Higher-Speed Rail, C4A High-Speed Rail, C4B High-Speed Rail, and C4C High-Speed Rail would have a substantial adverse effect on air service provider operations, resulting in a reduction in ridership of 38, 70, 70, and 62 percent, respectively, and potential lost revenue as a result of fewer customers.

5.3 Southern Section: San Antonio to South Texas

Air Quality. Construction of Alternative S4 Higher-Speed Rail and Alternative S6 High-Speed Rail would be a major infrastructure project. Even with mitigation, these alternatives would likely result in substantial short-term adverse effects on air quality during construction. Alternative S4 Higher-Speed Rail would also have substantial adverse long-term regional effects on air quality during operation. This is because although there would be a reduction in personnel vehicle miles traveled, the traffic modeling evaluation projected no change in bus or air miles traveled, and there is no future rail travel included in the No Build Alterative. Therefore, while Alternative S4 Higher-Speed Rail would provide additional modes of transport in the region, the use of diesel-powered trains would increase emissions from Alternative S4 Higher-Speed Rail compared with the No Build Alternative for all pollutants evaluated.

Natural Ecosystems and Wildlife. Construction of the portions of the Southern Section alternatives on new alignments outside existing transportation corridors would likely have a substantial adverse effect, even with mitigation, on the following:

- Non-developed lands that support natural ecosystems (Alternative S6 Higher-Speed Rail and Alternative S6 High-Speed Rail)
- Land coverage of high ecological importance (all Southern Section alternatives)

Threatened and Endangered Species. Construction of portions of Alternative S4 Higher-Speed Rail would affect a large amount of land and would have a substantial adverse effect, even with mitigation, on federally listed and sensitive plant and wildlife species.

Energy. Alternative S6 High-Speed Rail would require significantly more structures to be built and transported for the new rail alignment compared with the other alternatives in the Southern Section, and would have substantial adverse effects on energy use during construction. However, the alternative would also have substantial beneficial effects during operation, saving an estimated 398,509 MBTUs annually.

Aesthetics and Visual Quality. All of the Southern Section alternatives would have substantial adverse effects along portions of the alignment. Substantial adverse effects would occur where new rail alignments would be required outside of existing transportation corridors. Therefore, Alternative S6 High-Speed Rail has greater substantial adverse effects on sensitive viewers than the higher-speed alternatives. When considering the overall intensity of effects, only Alternative S6 High-Speed Rail would have substantial adverse effects.

Land Use and Prime Farmland. Alternatives S6 Higher-Speed Rail and High-Speed Rail would be located entirely outside of existing transportation corridors and land use compatibility would be low; therefore, these alternatives would have substantial effects on land use. All of the Southern Section alternatives would have substantial effects on prime farmland, either converting, bisecting, or isolating areas of prime farmland.

Socioeconomics and Environmental Justice. All of the Southern Section alternatives would have substantial effects on environmental justice populations. The new transportation corridors associated with these alternatives would pass through rural areas with higher concentrations of environmental justice populations.

Archaeological Resources. Alternative S6 High-Speed Rail would have substantial effects on archaeological resources because of the potential for large areas of soil disturbance, which may lead to the disturbance or destruction of buried or previously unidentified archaeological resources along the alternatives. In addition, although both higher-speed and high-speed rail would likely result in the removal of archaeological resources, avoidance may be more difficult for high-speed rail than higher-speed rail because of the larger area of soil disturbance where grade separations would be necessary. Elevated portions of the guideway may result in avoidance of some archaeological resources. The higher-speed rail alternatives would not have substantial effects.

Travel Demand and Transportation. Alternative S4 Higher-Speed Rail would have substantial adverse effects on air travel, resulting in a reduction in mode share of approximately 67 percent as passengers are diverted to rail. With Alternative S4 Higher-Speed Rail, approximately 64 percent of air passengers would be diverted to rail. This diversion could result in substantial adverse effects on air carrier operations (e.g., demand, schedule, etc.) and potential lost revenue as a result of fewer customers.

6.0 Cumulative Effects

This section presents an analysis of the potential cumulative effects of implementing the Program in combination with other past, present, and reasonably foreseeable future projects that may result in environmental impacts. The focus of this service-level cumulative effects assessment is (1) to evaluate the interrelationships among the transportation network, community resources, and environmental resources within the cumulative effects study area; and (2) to identify possible cumulative effects that may result from reasonably foreseeable future actions (called the "cumulative condition") and the incremental contribution, if any, of the build alternatives to cumulative effects.

6.1 Laws, Regulations, and Orders

National Environmental Policy Act. This regulation (40 Code of Federal Regulations 1508.7 and 1508.25) requires the analysis of cumulative impacts for federally funded projects. Cumulative impacts as those that:

- Result from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions.
- Can result regardless of what agency (federal or non-federal) or person undertakes such other actions.
- Can result from individually minor but collectively significant actions taking place over a period of time.

6.2 Methodology

The cumulative effects analysis identifies the possible cumulative effects of the build alternatives in combination with the cumulative condition. The analysis considers whether the Program as a whole would contribute to cumulative effects and evaluates any apparent differences in effects among corridors or service types.

Reasonably foreseeable future actions consist of the committed transportation projects included in the No Build Alternative and projected population and employment growth throughout the environmental impact statement (EIS) Study Area (described in the introduction to Chapter 3) that will result in increased commercial, industrial, and residential land development and a proportional increase in parks, roadways, and civil infrastructure. Growth forecasts and reasonably foreseeable future actions through 2035 were used to develop a baseline description of resource health, called the "cumulative condition."

Information regarding planned future growth within the cumulative effects study area (defined in Section 6.2.1, Geographic Scope of Cumulative Analysis) was developed using future population growth forecasts coupled with existing population, household, and land use data. Year 2035 population projections were derived for Oklahoma from the *2012 Demographic State of the State Report: Oklahoma State and County Population Projections through* 2075 (Oklahoma Department of Commerce 2012) and for Texas from the *2014 Population Projections for the State of Texas and Counties for 2010-2050* (Texas Data Center 2014). Populations and household data were gathered from 2010 U.S. Census data (U.S. Census Bureau 2010). Developed land area was gathered from the 2011 National Land Cover Database from the Multi-Resolution Land Characteristics Consortium, and total land area was gathered from the *National Atlas* (Multi-Resolution Land Characteristics Consortium 2011; U.S. Geological Survey no date [n.d.]).

A conservative estimate of future land development was identified. The projected acreage of new land development needed to accommodate the 2035 population growth was determined, assuming the number of people per household remains constant between 2010 and 2035:

1. Existing (2010) Households per Acre was calculated by dividing 2010 Households by Land Area (acres).
2. Existing (2010) People per Household was calculated by dividing 2010 Population by 2010 Households; 2035 projections assume the same number of people per household as 2010.
3. Change in Population (2010–2035) was calculated as the difference between 2035 and 2010 Population.
4. The number of 2035 New Households was calculated by dividing the Change in Population (2010–2035) by People per Household.
5. The acreage of 2035 New Developed Land needed was calculated by dividing 2035 New Households by 2010 Households per Acre; 2035 projections assume the consumption of land (homes, roads, civic businesses, and commercial businesses to support population expansion) remains the same in 2035 as in 2010.

Regional plans were also reviewed to determine future planned density increases and growth plans that could influence land development patterns.

Refer to the methodology sections in Chapter 3 for descriptions of the methodologies used to determine the effects of the build alternatives.

6.2.1 Geographic Scope of Cumulative Effects Analysis

The geographic scope of the cumulative effects analysis encompasses the counties within which the build alternatives are located, as shown on Figures 6-1 through 6-6.

6.2.2 Time Frame for Cumulative Effects Analysis

The time frame for the cumulative effects analysis begins with the completion of construction of Interstate Highway 35 (IH-35) through the Study Vicinity in the late 1950s and extends to 2035, which was the horizon year used in most relevant county and metropolitan planning organization (MPO) planning documents when preparation of this EIS commenced. The context for the cumulative analyses is generalized through the population growth and infrastructure development up through today. These changes on the landscape have a cumulative effect on the natural, built, and social environments.

6.2.3 Resources

This cumulative effects analysis evaluates those resources that would experience potential effects from the build alternatives. As demonstrated in Chapter 3, the build alternatives would have negligible effects on solid waste, floodplains, coastal resources, and public safety. Therefore, these resources are not included in the cumulative effects analysis. The resources are presented in the same order in this analysis as they are in Chapter 3.

6.3 Projected Growth Trends and Reasonably Foreseeable Future Actions

Population growth within the cumulative effects study area is projected to be highest, based on total increase in population, in the Dallas and Fort Worth area. The population is projected to increase by more than 1 million people (around a 20 percent increase) in Dallas, Tarrant, and Denton counties alone between 2010 and 2035. The two south Texas border counties, Hidalgo and Cameron, are expected to grow by approximately 500,000 people combined (around a 40 percent increase), and the metropolitan areas of San Antonio, Austin, and Oklahoma City are each expected to grow by approximately 300,000 people (around a 20 percent increase for each metropolitan area) between 2010 and 2035. Figures 6-1, 6-2, and 6-3 illustrate the projected 2035 populations by county (U.S. Census Bureau 2010).

New land development and infrastructure would be needed throughout the cumulative effects study area to accommodate the additional population. Using the methodology described in Section 6.2, Methodology, the acreage of required new land development was calculated, assuming that current development density would remain the same through 2035. Figures 6-4, 6-5, and 6-6 illustrate projected new acres of land development by 2035 using current densities. However, many cities and metropolitan areas are planning for higher densities in the future than currently exist, and total land development therefore would likely be lower than estimated in this analysis. The Association of Central Oklahoma Governments (ACOG) anticipates a 36 percent increase in population density by 2035 (ACOG 2012). The North Central Texas Council of Governments (NCTCOG) anticipates a 30 percent increase in density in central Tarrant and Dallas counties and a portion of Collin County and a 9 percent increase in density in outer suburbs and separate communities throughout the NCTCOG planning areas (NCTCOG 2010).

Reasonably foreseeable future transportation projects are described in detail in Chapter 2 (Section 2.2). Projects considered in the cumulative effects analysis are summarized by geographic section below.

6.3.1 Northern Section: Oklahoma City to Dallas and Fort Worth

The Oklahoma City metropolitan area is located within the ACOG planning area. The *Encompass 2035 Plan Report* (ACOG 2012) is the current long-range transportation plan for central Oklahoma, and it forecasts that both population and employment will see growth between 2005 and 2035, with approximately 390,000 new residents (36 percent growth) and 222,000 new jobs (39 percent

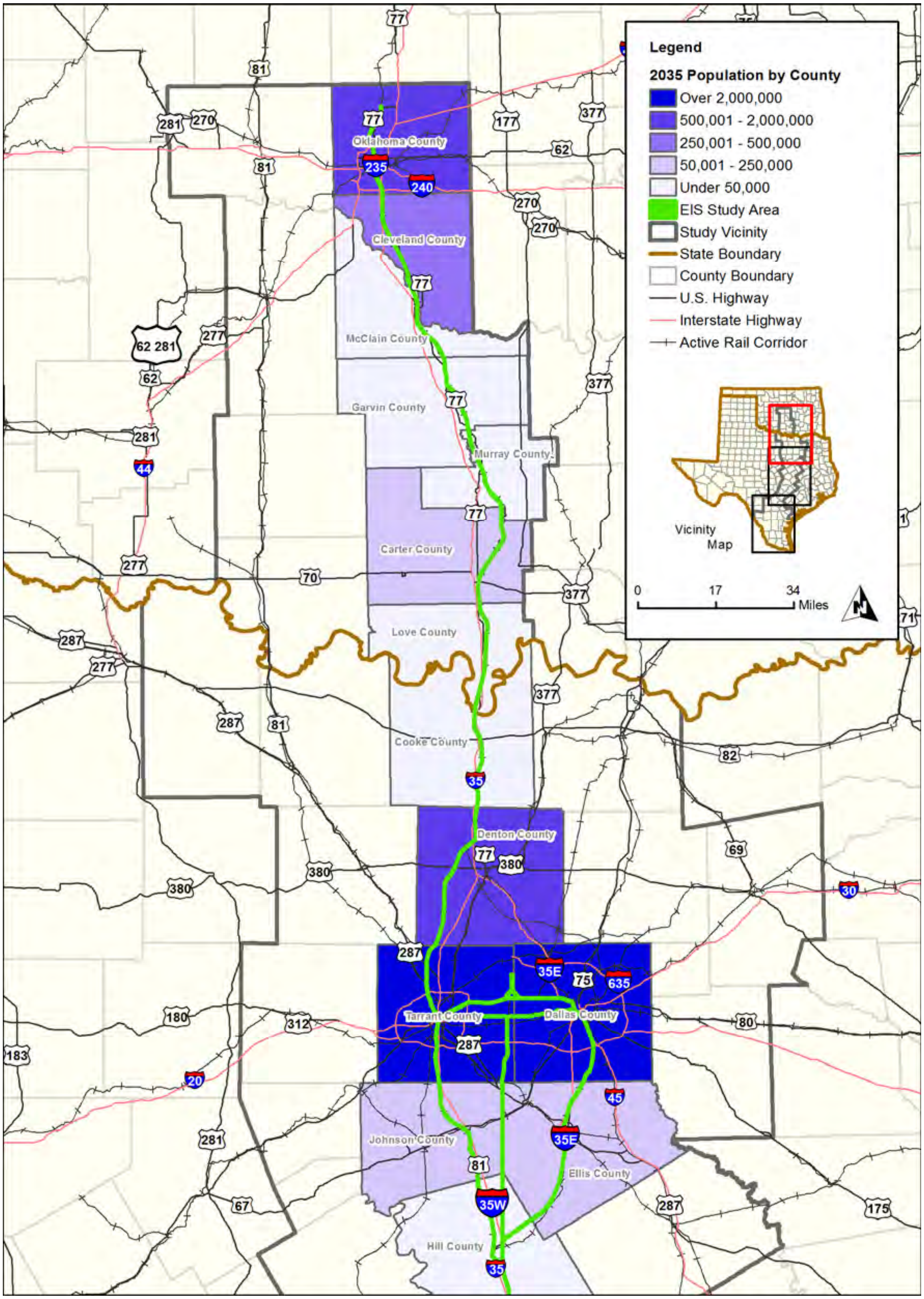

Figure 6-1: Northern Section Projected 2035 Population

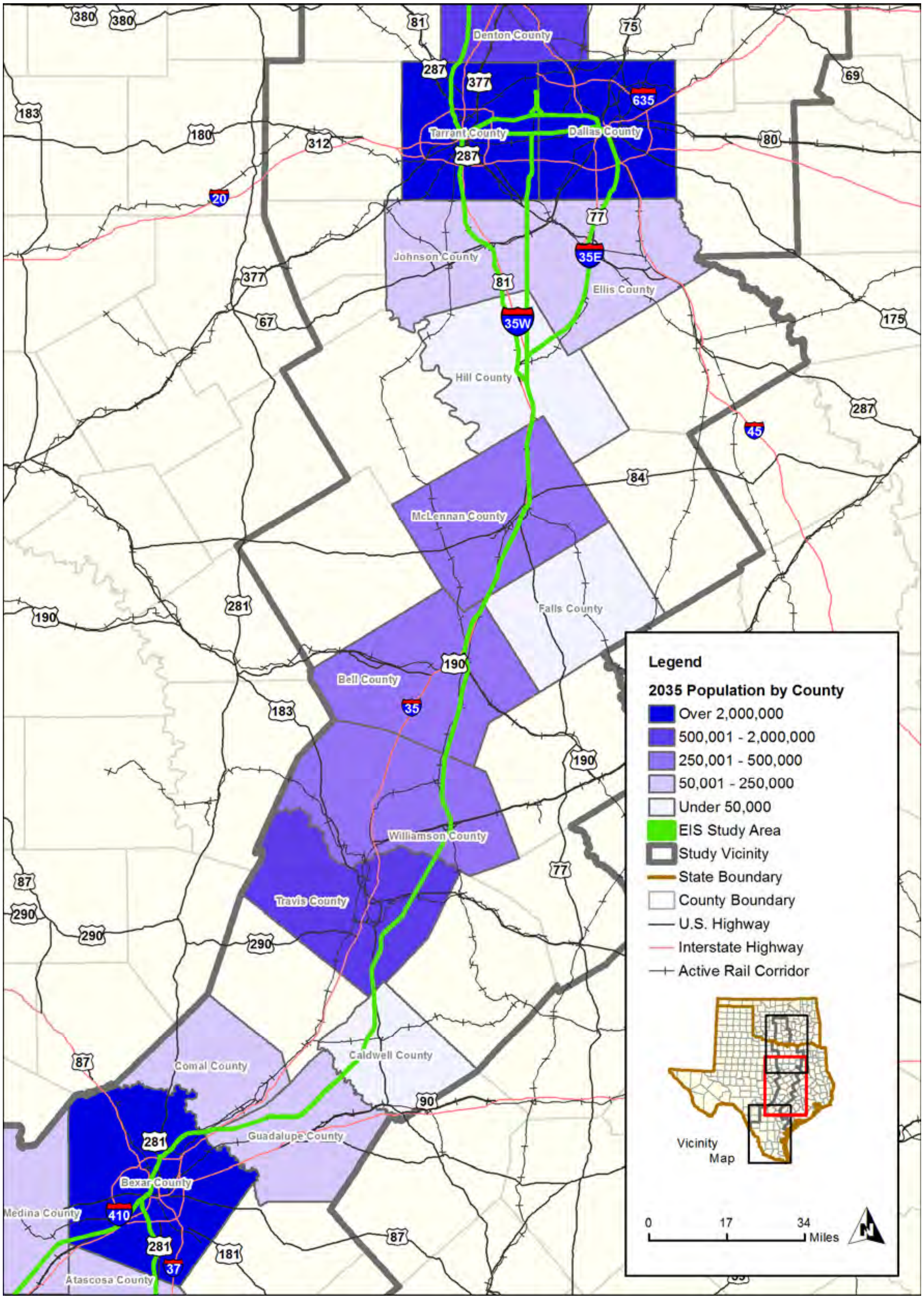

Figure 6-2: Central Section Projected 2035 Population

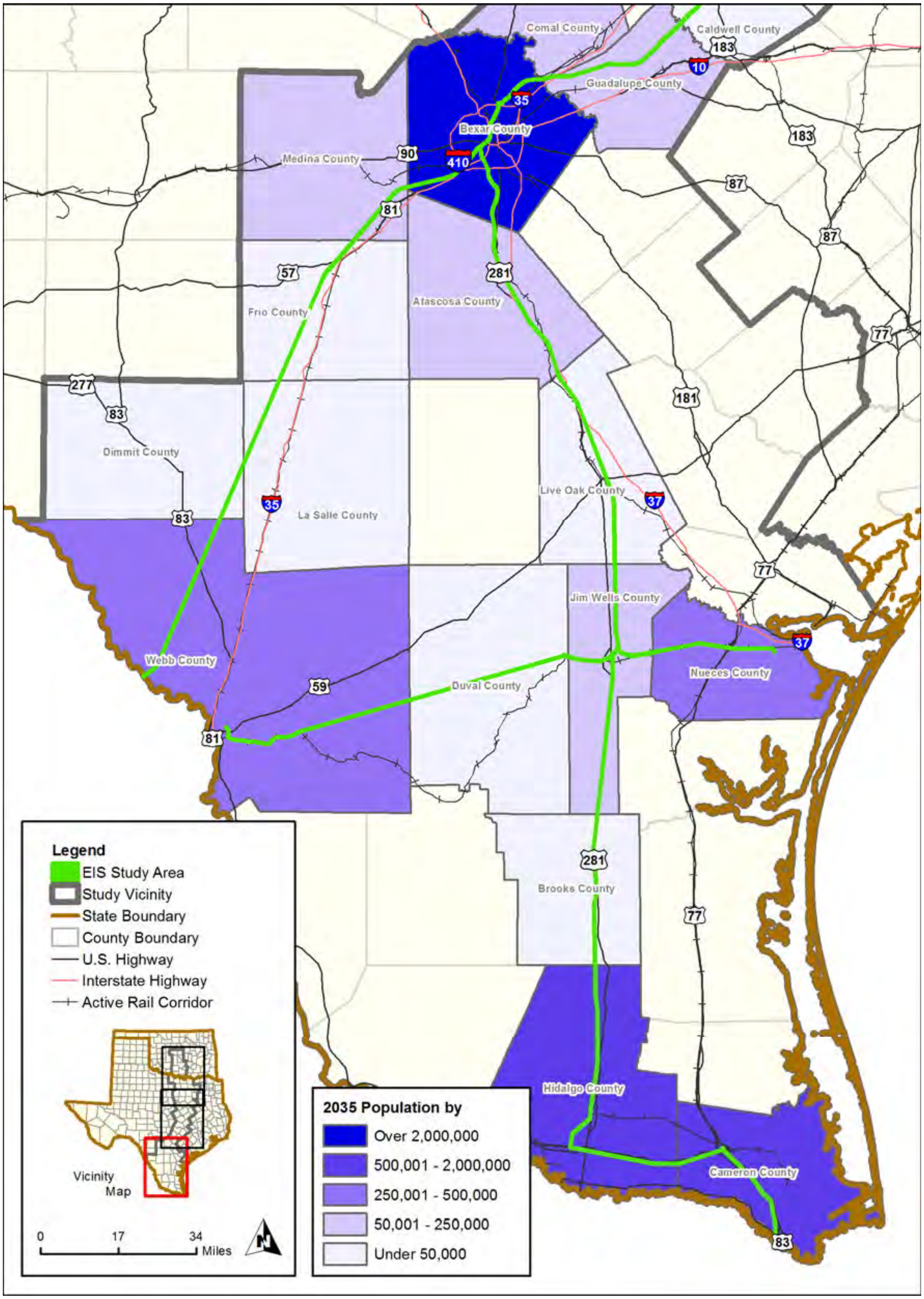

Figure 6-3: Southern Section Projected 2035 Population

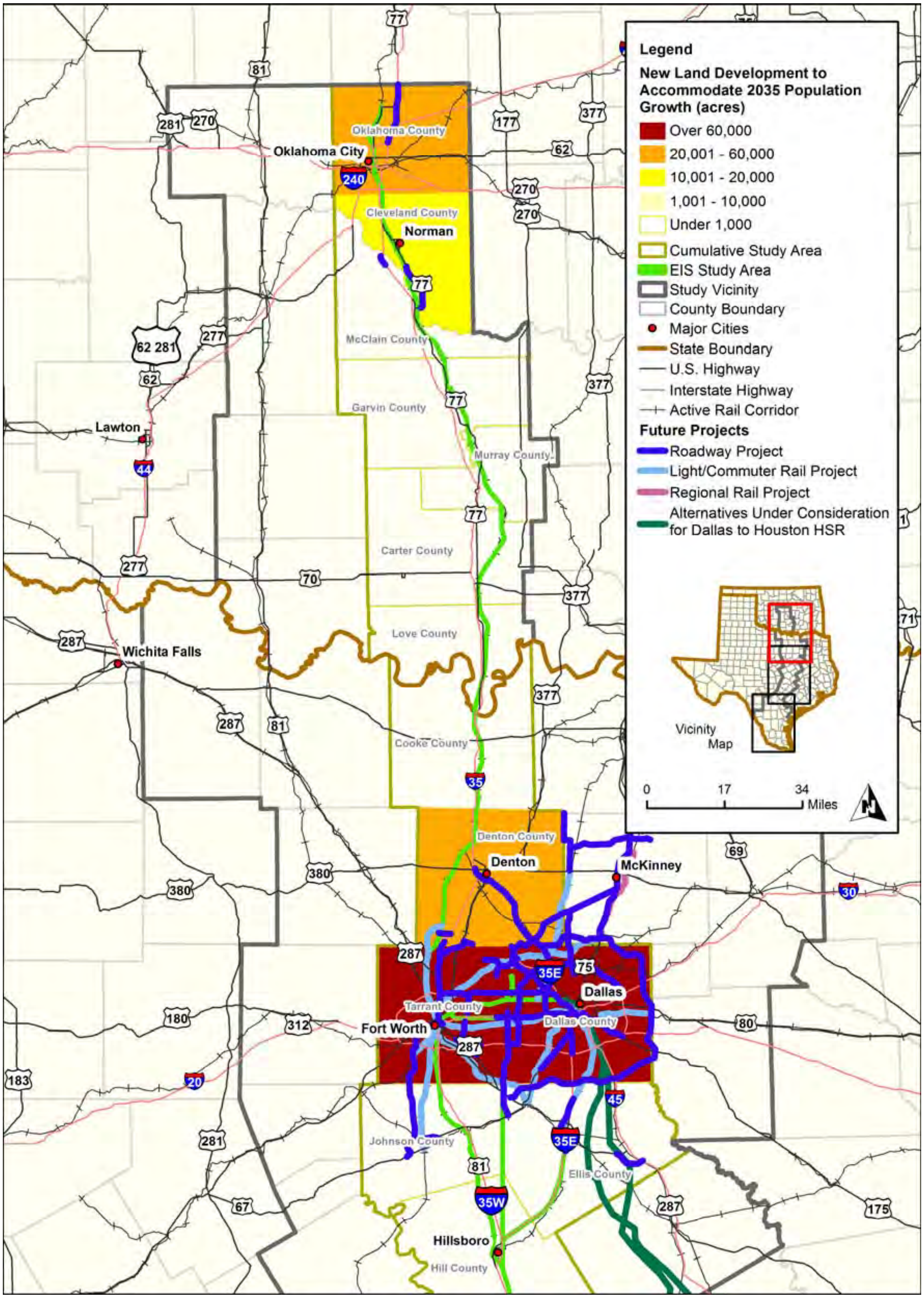

Figure 6-4: Northern Section Projected 2035 Land Development

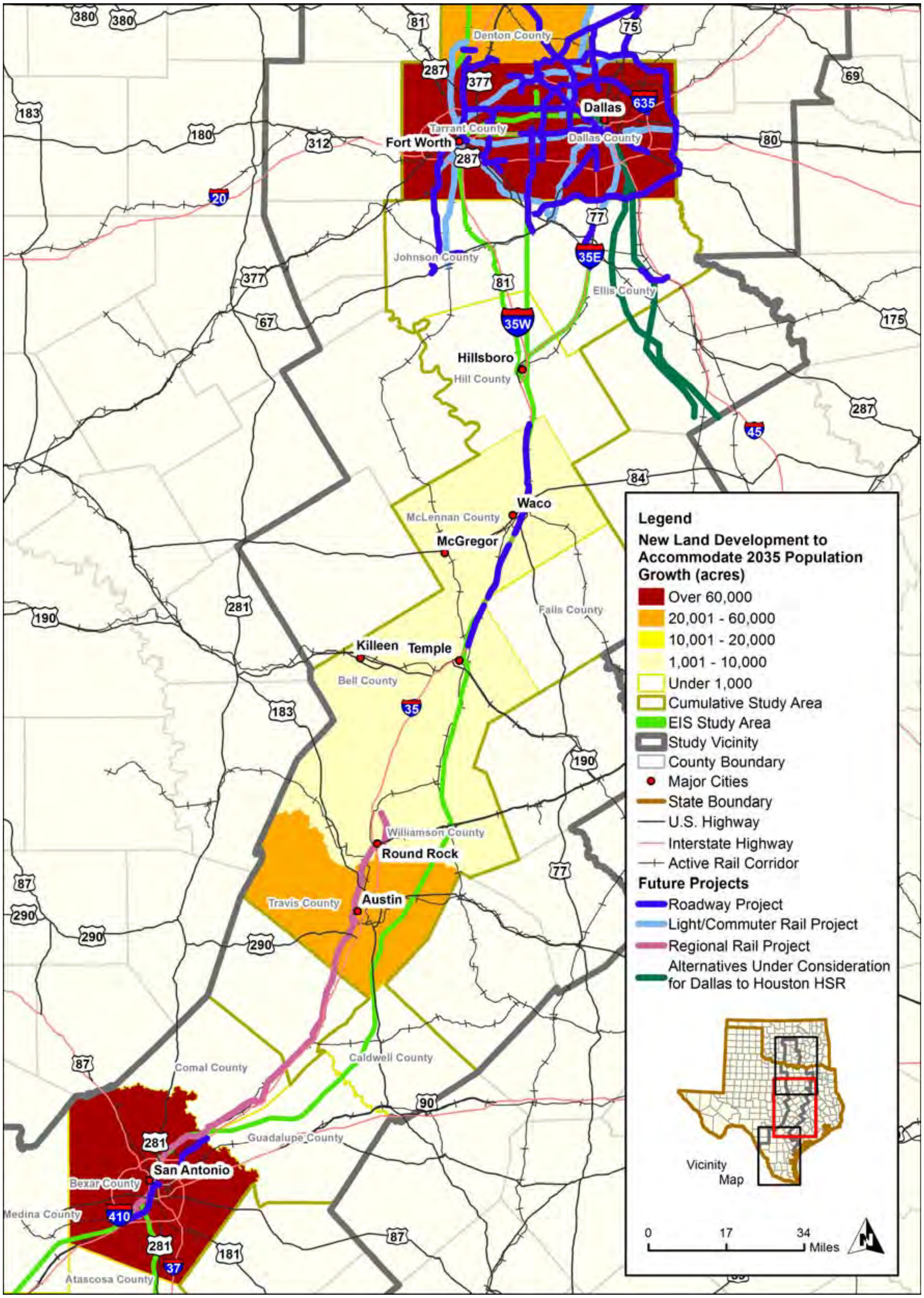

Figure 6-5: Central Section Projected 2035 Land Development

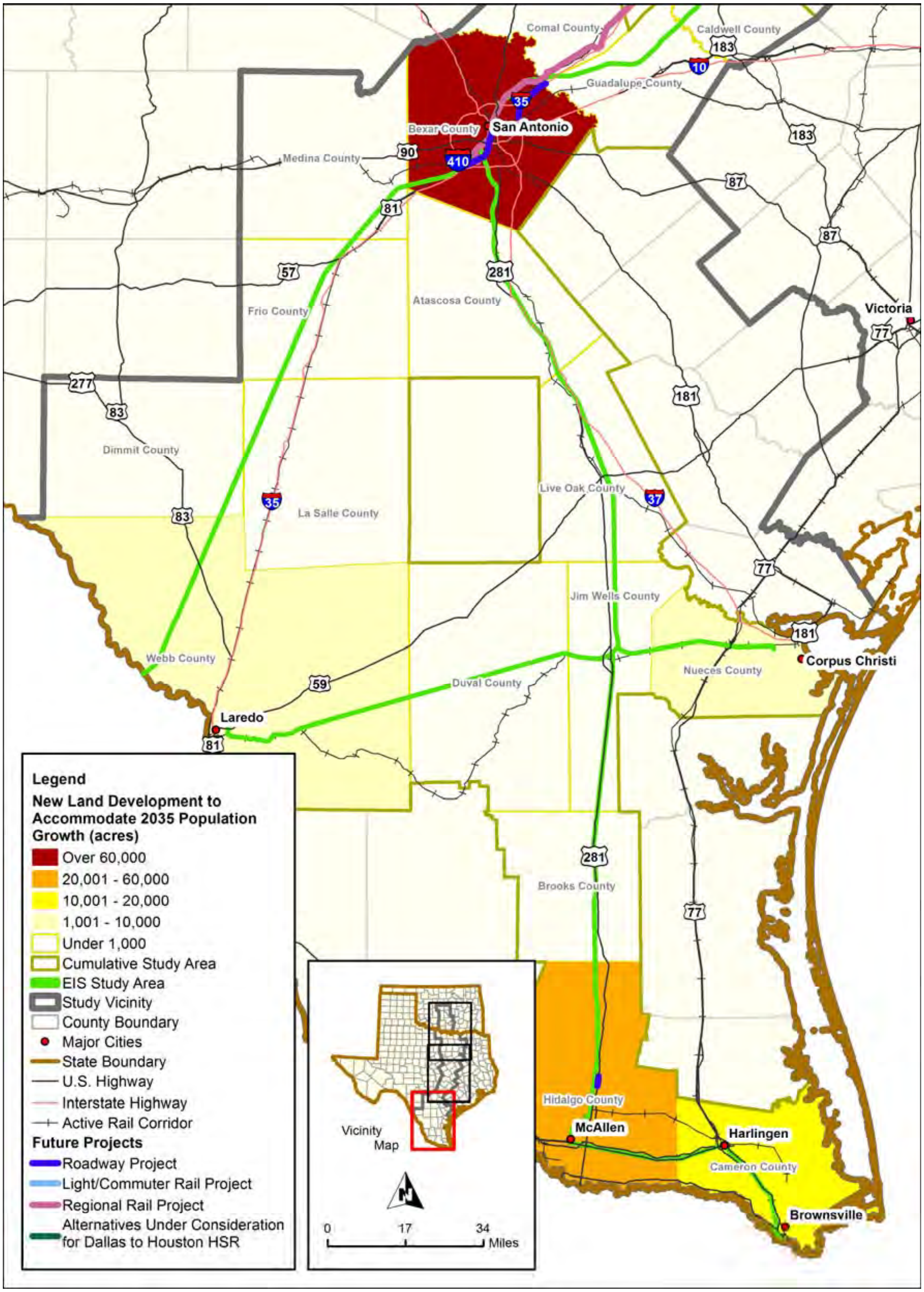

Figure 6-6: Southern Section Projected 2035 Land Development

growth) within the ACOG planning area. Density is anticipated to increase from 516 to 703 persons per square mile. Most of the growth (75 percent) will occur in Oklahoma and Cleveland counties.

With the overall level of densification within the ACOG planning area, most new growth could be accommodated within existing developed areas.

Tarrant, Denton, Dallas, Johnson, and Ellis counties are located in the NCTCOG planning area. Vision North Texas, a public-private planning partnership that includes NCTCOG, describes areas of higher-density development throughout the region to accommodate future growth more effectively (NCTCOG 2010). Within the cumulative effects study area, inner tier areas in Tarrant and Dallas counties are anticipated to have the most intense development, with a 30 percent increase in density compared with existing conditions, to 5.6 people per acre. Outer tier areas in Tarrant, Denton, and Dallas counties and separate communities throughout the NCTCOG planning area are anticipated to increase in density by approximately 9 percent to 4.7 persons per acre. The remaining land area within the NCTCOG boundaries consist of rural land uses, with an average of one household per 10 acres, and natural areas. Vision North Texas anticipates that with these planned land uses and densities, population growth will occupy 93 percent of the land area within the NCTCOG boundaries by 2050 (NCTCOG 2010).

The following major transportation projects are planned within the Northern Section cumulative effects study area:

- One highway project is planned to widen 4 miles of U.S. Highway (US)-77 from South 329th Street (Etowah Road) in Norman, Oklahoma, south to Banner Road in Lexington, Oklahoma, by 2030 (ACOG 2012).
- Two interstate projects are planned to widen IH-35 from four to six lanes in areas of Edmond, Oklahoma City, and Goldsby, Oklahoma, by 2035 (ACOG 2012).
- Four major interstate projects are planned to add capacity to IH-35 from Denton to Dallas (IH-35 East) and from the Denton-Tarrant County line to Fort Worth (IH-35 West) by 2035 (NCTCOG 2013).
- There is a total of 11 new rail line projects within the Dallas and Fort Worth area that are planned to open by 2035. One of these rail line projects would open by 2020, five would open by 2030, and the remaining five would open by 2035. The projects range in their level of service; nine of the projects are commuter rail, one is light rail, and one is regional rail (NCTCOG 2013).

6.3.2 Central Section: Dallas and Fort Worth to San Antonio

The Capital Area Metropolitan Planning Organization (CAMPO) encompasses the counties in the Austin region. The *CAMPO 2035 Regional Transportation Plan* (CAMPO 2010) envisions a 2035 growth scenario where growth and densification occur around major attraction areas, including transportation corridors in Travis County. CAMPO forecasts a population increase of 1.8 million residents (122 percent growth) and an employment increase of 944,000 jobs (135 percent growth) between 2005 and 2035 (CAMPO 2010). CAMPO estimates 31 percent of the regional population and 38 percent of regional employment will be located within designated activity centers, the largest in the central Austin area (CAMPO 2010).

The San Antonio-Bexar County MPO document, *Mobility 2035 Metropolitan Transportation Plan* (San Antonio-Bexar County MPO 2009), describes a combination of infill development and transit-oriented development to address future growth in the San Antonio region. The area is expected to see an increase in population of approximately 600,000 residents and an increase in employment of 450,000 jobs (60 percent increase) by 2035. The plan anticipates that with the planned development scenarios in place, most of the population will be located within the boundaries of IH-410 and the area between IH-410 and Loop 1604 (San Antonio-Bexar County MPO 2009).

The following major transportation projects are planned within the Central Section cumulative effects study area:

- In addition to the projects listed in Section 6.3.1, Northern Section: Oklahoma City to Dallas and Fort Worth, two major projects are planned to add lanes to IH-35 from 8th Street in Dallas to IH-20, and from US-77 north of Waxahachie to Bigham Road south of Waxahachie in Ellis County by 2035 (NCTCOG 2013).
- One new interstate project with three parts is planned to widen and reconstruct portions of IH-35 within McLennan County starting in 2015. Parts one and two would increase the number of lanes from four to six from the Falls County Line to Farm-to-Market Road (FM) 2063/FM 2113 and from North Loop 340 to the Hill County line. Part three would further increase the number of lanes from six to eight from State Highway 6 (SH-6)/West Loop 340 to North Loop 340 (Waco MPO 2010).
- Two interstate projects are planned to widen IH-35 to six lanes from North Loop 363 to North of Troy and FM 2843 to FM 2484 in Salado (Central Texas Council of Governments [CTCOG], Killeen-Temple MPO 2009).
- Three interstate projects are planned to add from four to six new lanes to existing six-lane and eight-lane portions of IH-35 from the Guadalupe-Comal County lines through Bexar County to IH-410 by 2020. One project would add four lanes to an existing six-lane portion of IH-35 from US-281/IH-37 East to IH-410 South. A second project would add four new lanes to IH-35 from IH-410 South to IH-410 North. A third project would add four new lanes to an existing portion of IH-35 from IH-410 North to the Guadalupe-Bexar County Line (Alamo Area MPO 2014).
- In addition to the rail lines listed in Section 6.3.1, Northern Section: Oklahoma City to Dallas and Fort Worth, one high-speed rail line from Dallas to Houston is planned to open by 2021 (Federal Railroad Administration [FRA] and Texas Department of Transportation [TxDOT] n.d.).

6.3.3 Southern Section: San Antonio to South Texas

With the exception of Webb County and Nueces County, much of the Laredo and Corpus Christi MPOs are projected to have less than 1,000 acres of new land development in 2035 (see Figure 6-6). The Corpus Christi *Metropolitan Transportation Plan (MTP) Fiscal Year 2010-2035* addresses growth within areas of the city of Corpus Christi and parts of Nueces County (Corpus

Christie MPO 2011). Several large-scale industrial projects are anticipated to add jobs, particularly within La Quinta Container Port, which is projected to add approximately 14,000 jobs by 2035 (Corpus Christie MPO 2011).

The Laredo 2010-2035 MTP estimates the Laredo MPO/Webb County will add approximately 257,000 new residents (110 percent increase) and approximately 110,900 jobs from 2008 to 2035 (Laredo MPO 2009). The Laredo MTP anticipates higher land use densities along Loop 20, SH-359, and US-83 through planned developments that are expected to support approximately 121,300 new residents and 67,000 new jobs (Laredo MPO 2009).

The Hidalgo County Metropolitan Planning Organization (HCMPO) 2010-2035 MTP describes areas of increased densities in Hidalgo County to balance transportation and land use needs. The county is anticipated to add approximately 444,000 residents (71 percent increase) and 134,000 new jobs (85 percent increase) between 2005 and 2035 (HCMPO 2009). Much of this growth would be accommodated by increasing density in planned growth areas along US-83 to address future transportation and land use needs.

Cameron County is located in both the Brownsville MPO and Harlingen-San Benito MPO. The Brownsville 2035 MTP addresses future growth and associated needs within Cameron County through land use policies that promote a compact urban environment and use of transit systems (Brownsville MPO 2009). The Harlingen-San Benito 2035 MTP envisions growth within the southern area of Cameron County, which has a current population of approximately 422,000 residents. Although population and associated growth is projected within Cameron County, population within this area fluctuates due to its proximity to the Mexico border and associated migration of farm workers, as well as tourists and second home owners visiting the area (Harlingen-San Benito MPO 2009).

Only one major transportation project is planned in the cumulative effects study area: the state plans to add four lanes to US-281 from FM 2812 to FM 162 (El Cibolo Road) in Hidalgo County (HCMPO 2009).

6.4 Cumulative Effects Analysis

Because the Northern, Central, and Southern sections could be built as standalone projects or in combination with other section(s), the cumulative analysis considers each geographic section independently. It is important to note that the detail presented in the cumulative effects analysis is at a level consistent with the information and Program detail available at the service level of analysis. A more comprehensive cumulative analysis will be performed during project-level studies.

In general, cumulative effects are expected in counties where the cumulative effects study area includes planned roadway and rail projects and/or population growth. For many resources, cumulative effects are most likely to occur in areas where these conditions intersect with a build alternative with a new alignment outside of existing transportation corridors (including in the Central Section between Hillsboro and San Antonio, and in portions of the Southern Section). For some resources (such as air quality and historic resources) cumulative effects are more likely to occur in areas where planned transportation projects and population growth in urban areas intersect with the cumulative effects study area.

Alternatives that include conventional rail service type would be expected to contribute least to cumulative effects because their alignment would remain within existing railroad corridors, predominantly using existing railroad tracks and portions of existing infrastructure. Alternatives with higher- or high-speed rail service types would be expected to contribute more to cumulative effects because they would include construction of new facilities such as stations, grade separations, and roadway modifications, and would be constructed in new alignments outside of existing transportation corridors.

In the Northern Section, under the cumulative condition, future IH-35 highway expansion projects in Oklahoma City, its southern suburbs, McClain County, and in Dallas between SH-183 and IH-30, and future US-77 expansion in Norman, would be near Alternative N4A Conventional. An estimated 20 percent population growth and accompanying development in the Oklahoma City and Dallas and Fort Worth metropolitan areas would also likely contribute to cumulative effects.

In the Central Section, under the cumulative condition, future IH-35 expansion projects in Dallas between SH-183 and IH-30, in Ellis County, throughout McLennan County, and in Temple would be near the build alternatives. Planned transit and rail lines in the Dallas and Fort Worth metropolitan area and in San Antonio also would be adjacent to the build alternatives. Within the Study Vicinity of the build alternatives, it is estimated that population will grow by 14 percent in McLennan County, 26 percent in Bell County, and 15 percent in Williamson County (see Section 6.2, Methodology). The Study Vicinity is shown on Figure 6-5. The accompanying development associated with growth in these counties, which do not currently contain major urban centers, is likely to contribute to cumulative effects.

In the Southern Section, under the cumulative condition, a future US-281 expansion project in Hidalgo County north of Edinburg and McAllen would be adjacent to Alternative S4. A planned rail line in San Antonio also would be adjacent to the build alternatives. Several counties within the Study Vicinity in the Southern Section are projected to experience population growth. It is estimated that the population of Webb County will increase by 45 percent, Nueces County will increase by 14 percent, Hidalgo County will increase by 41 percent, and Cameron County will increase by 39 percent (see Section 6.2, Methodology). The accompanying development associated with this planned growth is also likely to contribute to cumulative effects. Several portions of the build alternatives in the Southern Section would be constructed on a new alignment outside of existing transportation corridors, including all of Alternative S6 and parts of Alternative S4.

6.4.1 Air Quality

The following sections identify the geographic areas where cumulative air quality effects would be most likely to occur with the incremental effects of each build alternative.

6.4.1.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Construction of Alternative N4A Conventional would have negligible air quality effects during construction and therefore is not anticipated to have cumulative effects. Based on current ridership projections, it is expected that during operation, Alternative N4A Conventional would result in slightly lower regional air emissions relative to the No Build Alternative, and the overall benefit in regional air quality would be negligible. Therefore, the alternative would result in beneficial cumulative effects during operation when combined with other planned rail projects in the Dallas and Fort Worth area.

6.4.1.2 Central Section: Dallas and Fort Worth to San Antonio

Future planned projects and development, such as the planned transit and rail lines in the Dallas and Fort Worth area and in San Antonio, which are adjacent to the build alternatives, would have the potential to cause cumulative air quality effects during construction if the timing of the projects overlap.

Under the cumulative condition in the Central Section, planned highway expansion projects in Dallas, Ellis, and McLennan counties and near Temple would result in more vehicles on the roadway and increased emissions of air pollutants. However, as population growth occurs in the Dallas and Fort Worth, Austin, and San Antonio metropolitan areas, there will also be a greater number of transportation users, and a potentially greater cumulative shift in mode share as rail becomes an effective alternative transportation mode within the corridor. Therefore, the cumulative effect of the build alternatives with the planned transit and rail lines in the Dallas and Fort Worth metropolitan area and in San Antonio would be to promote decreased reliance on highway travel, thus reducing regional emissions of air pollutants. The high-speed rail alternatives relative to the higher-speed rail alternatives are anticipated to have larger regional beneficial effects on air quality due to the higher ridership and use of electric trains, and therefore would have greater beneficial cumulative effects.

6.4.1.3 Southern Section: San Antonio to South Texas

Similar to the Central Section, where future planned transportation projects and development are adjacent to the build alternatives, there is potential for cumulative air quality effects during construction if the timing of the projects overlap. For example, cumulative effects could occur along the existing US-281 corridor; existing rail corridors in Webb, Jim Wells, and Nueces counties; and in Webb, Hidalgo, and Cameron counties where future transportation projects and new development would combine with Alternative S4.

Similar to the Central Section, under the cumulative condition in the Southern Section, highway expansion projects in Hidalgo County would result in more vehicles on the roadway and increased emissions of air pollutants. Also similar to the Central Section, population growth and accompanying development in San Antonio and in Hidalgo and Cameron counties would result in a greater number of transportation users, but also a potentially greater cumulative shift in mode share as rail becomes an effective alternative transportation mode within the corridor. Because

Alternative S6 High-Speed Rail would result in a negligible reduction in emissions, the alternative may potentially result in minor beneficial cumulative air quality effects. Alternative S4 Higher-Speed Rail is much longer than the S6 alternatives, is projected to have a lower level of ridership, and is diesel-powered. Alternative S6 Higher-Speed Rail would also use diesel-powered trains. These alternatives would have adverse air quality effects during operation. When these alternatives are combined with projected population growth and the highway expansion projects in the area, they would have cumulative effects on air quality, the degree to which would depend on the cumulative shift in mode share to rail as population growth and development occurs.

6.4.2 Water Quality

The following sections identify the geographic areas where cumulative effects on water quality and water resources would be most likely to occur with the incremental effects of each build alternative.

6.4.2.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Under the cumulative condition in the Northern Section, highway expansion projects would result in an increase in impervious surfaces, which increases the potential for runoff and pollution impacts on water quality and the potential for erosion during construction. Population growth and accompanying development in the Oklahoma City and Dallas and Fort Worth metropolitan areas would also likely contribute to an increase in impervious surfaces and runoff. However, Alternative N4A Conventional is a conventional rail alternative that would remain within the existing railroad right-of-way, sometimes using existing railroad tracks and portions of existing infrastructure. As a result, runoff would have a negligible effect on surface and groundwater quality and water resources, and it is unlikely that Alternative N4A Conventional would contribute to cumulative water quality effects. Alternative N4A Conventional would have moderate erosion effects and would have cumulative erosion effects with other highway transportation projects in the Northern Section. Cumulative effects would be minimized with use of construction best management practices (BMPs).

6.4.2.2 Central Section: Dallas and Fort Worth to San Antonio

Under the cumulative condition in the Central Section, highway expansion projects in Dallas, Ellis, and McLennan counties and near Temple would result in an increase in impervious surfaces causing the potential for runoff and pollution impacts on water quality. Planned transit and rail lines in the Dallas and Fort Worth metropolitan area and in San Antonio would be adjacent to the build alternatives; however, the construction of rail projects in these urbanized areas is not likely to contribute to substantial additional impacts on water quality because they would not likely result in an increase in impervious surfaces and runoff. Because appropriate construction BMPs (required by the Clean Water Act) would be expected to be incorporated, erosion effects would be minimal. Development associated with growth in several counties including Bell, Williamson, and McLennan counties, in the Central Section that do not currently contain major urban centers is likely to contribute to an increase in impervious surfaces and runoff which could affect surface water quality. Construction BMPs (required by the Clean Water Act) would minimize erosion effects.

Under the build alternatives, the proposed alignment between Hillsboro and San Antonio would be constructed on a new alignment outside of existing transportation corridors. Because appropriate design features and construction BMPs (required by the Clean Water Act) would be incorporated, effects on surface water bodies and erosion effects are expected to be moderate. Cumulative effect on water quality would be expected primarily between Hillsboro and San Antonio, where future transportation projects and new development would combine with the build alternatives to result in greater potential effects. Effects associated with the build alternatives, in combination with development associated with growth and planned highway expansion projects, would likely contribute to cumulative erosion effects and effects on surface waterbodies in the Central Section. Cumulative effects would be minimized with use of design features and construction BMPs. As detailed in Section 3.2, the build alternatives would have negligible effects on groundwater resources and on runoff, and therefore would not have cumulative effects.

6.4.2.3 Southern Section: San Antonio to South Texas

Under the cumulative condition in the Southern Section, planned highway projects in Hidalgo County would result in an increase in impervious surfaces that would cause the potential for runoff and pollution effects on water quality. A planned rail line in San Antonio would be adjacent to the build alternatives; however, the construction of a rail project in this urbanized area is not likely to contribute to substantial additional effects on water quality because it would not likely result in an increase in impervious surfaces and runoff. The accompanying development associated with planned growth, for example in Webb, Nueces, Hidalgo, and Cameron counties, is also likely to contribute to an increase in impervious surfaces and runoff. Because appropriate construction BMPs (required by the Clean Water Act) would be expected to be incorporated, erosion effects would be minimal.

Because several portions of the build alternatives in the Southern Section would be constructed on a new alignment outside of existing transportation corridors, effects on surface waterbodies in this section are expected to be moderate. Cumulative effects would be expected primarily in these areas, particularly in Hidalgo and Cameron counties, where future transportation projects and new development would combine with the build alternatives to result in greater potential effects. Effects associated with the build alternatives in combination with development associated with growth and planned highway expansion projects would likely contribute to a cumulative effect on surface waterbodies in the Southern Section. As detailed in Section 3.2, the build alternatives would have negligible effects on groundwater resources, runoff and erosion, and therefore would not have cumulative effects.

6.4.3 Noise and Vibration

The following sections identify the geographic areas where cumulative noise and vibration effects would be most likely to occur with the incremental effects of each build alternative.

6.4.3.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Under the cumulative condition in the Northern Section, highway expansion projects would result in more vehicles on the roadway and higher noise levels. Population growth and accompanying development in the Oklahoma City and the Dallas and Fort Worth metropolitan areas would also contribute to increased noise and vibration levels. During operation, Alternative N4A Conventional would have moderate noise and vibration effects on surrounding sensitive land uses. Alternative N4A Conventional would result in potential cumulative noise and vibration effects with other development in the Northern Section. However, as detailed in Section 3.3.5, noise and vibration effects of Alternative N4A Conventional would be avoided, minimized, and mitigated at the project level, which would reduce the potential for cumulative effects.

Under the cumulative condition in the Northern Section there is potential for cumulative noise and vibration effects during construction, particularly where an alternative and future projects would be constructed adjacent to sensitive land uses. However, the temporary nature of the construction activities, adherence to local noise ordinances, and use of construction BMPs would likely minimize the potential for cumulative effects.

6.4.3.2 Central Section: Dallas and Fort Worth to San Antonio

Under the cumulative condition in the Central Section, planned highway expansion projects in Dallas, Ellis, and McLennan counties and near Temple would result in more vehicles on the roadway and higher noise levels. Planned transit and rail lines in the Dallas and Fort Worth metropolitan area and in San Antonio would be adjacent to the build alternatives and would result in higher noise and vibration levels. Population growth and accompanying development in the Dallas and Fort Worth, Austin, and San Antonio metropolitan areas would also contribute to an increase in noise and vibration levels.

Under the build alternatives, there would be greater change in noise and vibration levels along the proposed new alignment between Hillsboro and San Antonio where the build alternatives would be constructed on a new alignment outside of existing transportation corridors. Cumulative noise and vibration effects would be expected primarily in the Dallas and Fort Worth and the San Antonio metropolitan areas, particularly adjacent to the IH-35 corridor and new rail and transit corridors; in Austin; and in the existing transportation corridor of IH-35 through Ellis and McLennan counties, where future transportation projects and new development would combine with the build alternatives to generate higher noise and vibration levels along existing and proposed rail corridors. The high-speed rail alternatives for Alternatives C4A and C4C would have a higher incremental effect than the higher-speed rail alternatives because high-speed rail generates more noise and vibration during operation and would therefore affect a larger number of sensitive receptors. However, because of the high number of noise- and vibration-sensitive land uses along the alignments for both the high-speed and higher-speed alternatives, Alternatives C4A and C4C would have moderate noise and vibration effects and potential cumulative effects with other development in the Central Section. However, as detailed in Section 3.3.5, noise and vibration effects of Alternatives C4A and C4C would be avoided, minimized, and mitigated at the project level, which would reduce the potential for cumulative effects. As detailed in Section 3.3, Alternative C4B Higher-Speed Rail and Alternative C4B High-Speed Rail would have negligible noise and vibration effects and therefore would not result in cumulative effects during operation.

There is potential for cumulative noise and vibration effects during construction in the Central Section, particularly where an alternative and future projects would be constructed adjacent to sensitive land uses. Because of the higher number of noise- and vibration-sensitive land uses along the alignments of Alternatives C4A and C4C, they would have greater potential for noise and vibration effects and potential cumulative effects with other development in the Central Section compared to Alternative C4B. However, the temporary nature of the construction activities, adherence to local noise ordinances, and use of construction BMPs would likely minimize the potential for cumulative effects.

6.4.3.3 Southern Section: San Antonio to South Texas

Under the cumulative condition in the Southern Section, highway expansion projects in Hidalgo County would result in more vehicles on the roadway and higher noise levels. A planned rail line in San Antonio would be adjacent to the build alternatives and would result in higher noise and vibration levels. Population growth and accompanying development in San Antonio and in Hidalgo and Cameron counties would also contribute to increased noise and vibration levels.

Alternative S4 has a high number of noise and vibration sensitive land uses along its alignment and would have moderate effects. Cumulative noise and vibration effects would be expected primarily along the existing US-281 corridor, existing rail corridors in Webb, Jim Wells, and Nueces counties, and in Webb, Hidalgo, and Cameron counties where future transportation projects and new development would combine with Alternative S4 to generate higher noise and vibration levels along existing and proposed rail corridors during operation. However, as detailed in Section 3.3.5, noise and vibration effects of Alternatives C4A and C4C would be avoided, minimized, and mitigated at the project level, which would reduce the potential for cumulative effects. As detailed in Section 3.3, Alternative S6 Higher-Speed Rail and Alternative S6 High-Speed Rail would have negligible noise and vibration effects and are not anticipated to have cumulative effects during operation.

There is potential for cumulative noise and vibration effects during construction in the Southern Section, particularly where an alternative and future projects would be constructed adjacent to sensitive land uses. Because of the higher number of noise- and vibration-sensitive land uses along the alignment of Alternative S4, it would have greater potential for noise and vibration effects and potential cumulative effects with other development in the Southern Section compared to the other alternatives. However, the temporary nature of the construction activities, adherence to local noise ordinances, and use of construction BMPs would likely minimize the potential for cumulative effects.

6.4.4 Natural Ecological Systems and Wildlife

As described in detail in Section 3.5, Natural and Ecological Systems and Wildlife, lands with higher ecological value were determined using U.S. Environmental Protection Agency (EPA) Regional

Ecological Assessment Protocol (REAP) data, which identify the optimum ecological areas for protection and mitigation based on composite scores of diversity, rarity, and sustainability (EPA 2011). This cumulative analysis focuses on where cumulative effects may affect lands with Higher Ecological Importance REAP ranks. The following sections identify the geographic areas where cumulative natural ecological systems and wildlife effects would be most likely to occur with the incremental effects of each build alternative.

6.4.4.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Under the cumulative condition in the Northern Section, highway expansion projects would result in more vehicles on the roadway and higher noise levels, an increase in air pollution, wildlife dispersal, and vehicular wildlife strikes, as well as vegetation clearing during construction.

Within the Study Vicinity of Alternative N4A Conventional, population growth and accompanying development would absorb more land area. Such increases in land development would not contribute to a substantial effect on high ecological value lands and wildlife because the areas surrounding these urban centers consist predominantly of land types with low ecological value. Most lands with high ecological importance are in areas just south of Norman, Oklahoma, near Cleveland County, and where Alternative N4A Conventional would pass through Love and Murray counties. Future highway and rail projects are not projected for these areas, nor are these areas anticipated to see a large increase in population growth. Therefore, Alternative N4A Conventional, which would be constructed in existing transportation corridors, would not result in cumulative natural ecological systems and wildlife effects on lands with high ecological importance.

6.4.4.2 Central Section: Dallas and Fort Worth to San Antonio

Under the cumulative condition in the Central Section, highway expansion projects would result in more vehicles on the roadway and higher noise levels and would contribute to an increase in air pollution, wildlife dispersal, and vehicular wildlife strikes, as well as vegetation clearing during construction. Most lands with high ecological importance coincide with areas outside existing transportation corridors, in the same areas where the highway expansion projects and the build alternatives are planned.

Planned transit and rail lines in the Dallas and Fort Worth area and in San Antonio are also adjacent to the build alternatives. However, the rail projects in these urban centers would not likely contribute to a substantial effect on natural ecological systems and wildlife because the area consists predominantly of land types with low ecological value, as defined by REAP data.

However, within the Study Vicinity of the build alternatives, land with high ecological importance are located just south and southeast of Waco and McGregor, in McLennan County, and just west of Temple, in Bell County, where it is estimated that there will also be an increase in population growth within the counties. The development associated with this growth, in addition to the build alternatives, planned highway expansion projects in these counties, and preponderance of land types with high ecological value would contribute to a substantial effect on natural ecological systems and wildlife. Therefore, the build alternatives would result in a potential cumulative effect on ecological systems in these areas. As detailed in Section 3.5.4, the effects of the alternatives on natural ecosystems and wildlife would be avoided, minimized, and mitigated at the project level when feasible, which would reduce the potential for cumulative effects.

6.4.4.3 Southern Section: San Antonio to South Texas

Under the cumulative condition, planned transportation projects in the Southern Section would result in more vehicles on the roadway and higher noise levels and would contribute to an increase in air pollution, wildlife dispersal, and vehicular wildlife strikes, as well as vegetation clearing during construction. A planned rail line in San Antonio would be adjacent to the build alternatives; however, the rail project in this urban center would not likely contribute to a substantial effect on natural ecological systems and wildlife because this area consists predominantly of land types with low ecological value, as defined by REAP data.

Most lands with high ecological importance in Alternative S4 EIS Study Area are in Brooks, Live Oak, Duval, and Webb counties. The portions of Alternative S4 that would cross Brooks and Live Oak counties would be constructed on existing rights-of-way and would have a negligible effect on natural ecological systems and wildlife. However, construction of the portions of Alternative S4 outside existing transportation corridors, especially in Webb County, where an estimated population growth of 45 percent (see Section 6.2, Methodology) is anticipated and where there is a preponderance of lands with high ecological value, would result in a potential cumulative effect on natural ecological systems and wildlife. Most lands with high ecological importance in the EIS Study Area of Alternative S6 (both service types) are also in areas of Webb County. Although no highway or rail projects are planned for this area, the S6 alternatives alone would have a substantial effect on lands with high ecological importance and would result in a potential cumulative effect on natural ecological systems and wildlife due to the anticipated population growth and associated development in the county. As detailed in Section 3.5.4, the effects of the alternatives on natural ecosystems and wildlife would be avoided, minimized, and mitigated at the project level when feasible, which would reduce the potential for cumulative effects.

6.4.5 Wetlands

The following sections identify the geographic areas where cumulative effects on wetlands would be most likely to occur with the incremental effects of each build alternative.

6.4.5.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Under the cumulative condition in the Northern Section, highway expansion projects would result in an increase in impervious surfaces that would have the potential to cause additional runoff and pollution effects on wetlands. In some areas, such as Oklahoma City and its suburbs and McClain County, expansion projects would likely result in permanent removal of wetland area or function. Population growth and accompanying development in the Oklahoma City and the Dallas and Fort Worth metropolitan areas would also likely contribute to an increase in impervious surfaces, runoff pollution, and removal of wetland area. However, Alternative N4A is a conventional rail alternative that would remain within the existing railroad right-of-way, predominantly using existing railroad tracks and portions of existing infrastructure. As a result, wetlands effects from this build alternative are expected to be negligible, and it is unlikely that Alternative N4A would contribute to cumulative wetlands effects.

6.4.5.2 Central Section: Dallas and Fort Worth to San Antonio

Under the cumulative condition in the Central Section, highway expansion projects in Dallas, Ellis, and McLennan counties and near Temple would result in an increase in impervious surfaces that have the potential to cause additional runoff and pollution effects on wetlands. In some areas, expansion projects would likely result in permanent removal of wetland area or function. Planned transit and rail lines in the Dallas and Fort Worth metropolitan area and in San Antonio would also be adjacent to the build alternatives; however, the construction of rail projects in these urban centers is not likely to contribute to substantial additional effects on wetlands because the land is already densely developed. Within the cumulative effects study area, development associated with population growth in several counties that do not currently contain major urban centers, including Bell, Williamson, and McLennan, is likely to contribute to an increase in impervious surfaces, runoff pollution, and removal of wetland area.

The proposed build alternatives between Hillsboro and San Antonio would be constructed on a new alignment outside of existing transportation corridors in areas where there are likely to be undisturbed wetlands; therefore, effects on wetlands in the Central Section are expected to be moderate. Cumulative effects on wetlands would also be expected primarily in this area, particularly in McLennan, Bell, and Travis counties, where future transportation projects and new development would combine with the build alternatives to cause greater potential effects on wetlands. Effects associated with the build alternatives in combination with development associated with growth and planned highway expansion projects would contribute to a cumulative effect on wetlands in the Central Section. However, as detailed in Section 3.6.5, the effects of the alternatives on wetlands would be avoided, minimized, and mitigated at the project level when feasible, which would reduce the potential for cumulative effects.

6.4.5.3 Southern Section: San Antonio to South Texas

Under the cumulative condition in the Southern Section, planned highway expansion projects in Hidalgo County would result in an increase in impervious surfaces that have the potential to cause runoff and pollution effects on wetlands. A planned rail line in San Antonio would be adjacent to the build alternatives; however, the construction of rail projects in this urban center is not likely to contribute to substantial additional effects on wetlands because the land is already densely developed. Several counties within the Study Vicinity in the Southern Section are projected to experience population growth, for example in Webb, Nueces, Hidalgo, and Cameron counties. The accompanying development associated with this growth is also likely to contribute to an increase in impervious surfaces, runoff pollution, and removal of wetland area.

Several portions of the build alternatives in the Southern Section would be constructed on a new alignment outside of existing transportation corridors in areas where there are likely to be undisturbed wetlands. Therefore, effects on wetlands in the Southern Section are expected to be moderate. Cumulative effects on wetlands would also be expected primarily in these areas, particularly in Hidalgo and Cameron counties, where future transportation projects and new development would combine with the build alternatives to result in greater potential effects on wetlands. Effects associated with the build alternatives in combination with development associated with growth and planned highway expansion projects would contribute to a cumulative effect on wetlands in the Southern Section. However, as detailed in Section 3.6.5, the effects of the alternatives on wetlands would be avoided, minimized, and mitigated at the project level when feasible, which would reduce the potential for cumulative effects.

6.4.6 Threatened and Endangered Species

The following sections identify the geographic areas where cumulative effects on threatened and endangered species would be most likely to occur with the incremental effects of each build alternative.

6.4.6.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Under the cumulative condition in the Northern Section, highway expansion projects could result in cumulative effects on threatened and endangered species due to more vehicles on the roadway causing higher noise levels and increased air pollution, wildlife dispersal, and vehicular wildlife strikes, and vegetation clearing during construction. These effects are particularly important because federally listed wildlife species are known to occur in Oklahoma, Cleveland, and McClain counties in Oklahoma.

The construction of Alternative N4A Conventional would have a negligible effect on sensitive plants, wildlife, and critical habitat because the majority of the alternative would be constructed within existing transportation corridors, in areas already disturbed by development. However, from an operations standpoint, the build alternative would have a moderate effect on wildlife species. The alternative would not likely be fenced, making wildlife (including listed species known to occur in the area) vulnerable to an increased risk for strikes from the additional rail traffic that would occur. Additionally, within the Study Vicinity of the build alternative, it is estimated that there will be a 20 percent population increase in the Oklahoma City and Dallas and Fort Worth metropolitan areas (see Section 6.2, Methodology). The development associated with this growth, in addition to the operation of the build alternative and construction and operation of the planned highway expansion projects in these counties, would contribute to an effect on threatened and endangered species. Therefore, Alternative N4A Conventional would result in a potential cumulative effect on these resources. However, as detailed in Section 3.7.5, the effects of the alternatives on threatened and endangered species would be avoided, minimized, and mitigated at the project level when feasible, which would reduce the potential for cumulative effects.

6.4.6.2 Central Section: Dallas and Fort Worth to San Antonio

Under the cumulative condition in the Central Section, highway expansion projects would result in more vehicles on the roadway and higher noise levels and in increased air pollution, wildlife dispersal, and vehicular wildlife strikes, as well as vegetation clearing during construction. Planned transit and rail lines in the Dallas and Fort Worth metropolitan area and in San Antonio would also be adjacent to the build alternatives. The rail projects in the Dallas and Fort Worth area would not likely contribute to a substantial effect on threatened and endangered species because there are no known occurrences within these areas. However, there are occurrences of listed plant and animal species in Bexar County, in the vicinity of San Antonio. The accompanying development associated with the population growth in Bexar County, in addition to construction and operation of the build alternatives, the planned highway, and rail expansion projects in the county, may contribute to a cumulative effect on identified threatened and endangered species.

Within the Study Vicinity of the build alternatives, growth is also expected in McLennan and Travis counties. Within each of these counties, the state-ranked Texas garter snake (*Thamnophis sirtalis annectens*) and the proposed federally threatened and state-ranked mountain plover (*Charadrius montanus*) are known to occur. The accompanying development associated with this growth and the planned highway expansion projects in these counties, in addition to the build alternatives, would contribute to a substantial effect on threatened and endangered species, especially because the alternatives would likely result in a cumulative effect on these important state-listed and federally listed species.

As detailed in Section 3.7.5, the effects of the alternatives on threatened and endangered species would be avoided, minimized, and mitigated at the project level when feasible, which would reduce the potential for cumulative effects.

6.4.6.3 Southern Section: San Antonio to South Texas

Under the cumulative condition in the Southern Section, highway expansion projects would result in more vehicles on the roadway and higher noise levels and increased air pollution, wildlife dispersal, and vehicular wildlife strikes, as well as vegetation clearing during construction. A planned rail line in San Antonio would be adjacent to the build alternatives. Although these rail projects would be located in the urban center of San Antonio, there are listed plant and animal species occurrences in Bexar County that could also be present in remnant lands among the urbanized areas. Bexar County is projected to increase its population 21 percent over the planning horizon, and estimated population growth in Webb, Hidalgo, Cameron, and Nueces counties is 45, 42, 39 and 14 percent, respectively (see Section 6.2, Methodology). This growth, considered with Alternative S4, may contribute to cumulative effects on the seven federally listed and 24 other sensitive plant and wildlife species that have the potential to occur in these areas. Therefore, Alternative S4 is likely to result in a potential cumulative effect on threatened and endangered species. However, as detailed in Section 3.7.5, the effects of the alternatives on threatened and endangered species would be avoided, minimized, and mitigated at the project level when feasible, which would reduce the potential for cumulative effects.

Alternative S6 (both service types) would be constructed in a new, direct route, outside existing transportation corridors. However, effects related to the construction of Alternative S6 would be considered negligible because only 3 acres of one sensitive wildlife species habitat and no plant species or critical habitat are known to occur within its EIS Study Area. Although there is an anticipated population growth of 45 percent within one county (Webb County; see Section 6.2, Methodology) that would be crossed by Alternative S6, no other highway or rail projects are planned for this area. Therefore, Alternative S6 would have a low likelihood of resulting in cumulative effects on threatened and endangered species.

6.4.7 Energy

Under the cumulative condition in the Northern, Central, and Southern sections, future transportation projects and new development to accommodate population growth would result in consumption of energy during construction. The build alternatives combined with these future projects would cumulatively contribute to the consumption of energy during construction. However, operation of all build alternatives would result in a long-term net energy benefit because of changes in ridership from high-energy consumption modes of travel to the lower-energy mode of passenger rail. The build alternatives combined with other future rail projects in the area would have a beneficial cumulative effect on energy consumption and would contribute toward offsetting increased energy consumption that would result from future road transportation projects and new development to accommodate population growth.

6.4.8 Utilities

Under the cumulative condition in the Northern, Central, and Southern sections, future transportation projects and new development to accommodate population growth have the potential to affect existing utilities. All of the build alternatives, but particularly those in the Central Section, have the potential to affect existing utilities such as electrical transmission lines, electrical substations, and natural gas pipelines during construction (particularly in urban areas where there is a high density of utility lines and where new alignments or tracks are required). Therefore, the build alternatives would contribute to potential cumulative effects on utilities. However, as detailed in Section 3.11.5, the effects of the alternatives on utilities would be avoided, minimized, and mitigated at the project level when feasible, which would reduce the potential for cumulative effects.

6.4.9 Geologic Resources

Geologic resources can both affect and be affected by a project. Effects on a project by geologic resources can include risk due to potential seismic activity and soil hazards (in the case of the cumulative effects study area, this includes potential effects on structures from swell/shrink capacity of clay soils). Effects on geologic resources by a project could include cut and fill activities that cause slope instability and landslides, and loss of availability of known mineral, petroleum, or natural gas resources. Effects on projects by geologic resources would not be considered cumulative because the effects are not incrementally affected by additional projects (for example, the effect on a single project by an earthquake or the shrink/swell of clay soils would not be affected by other projects in the area). Effects on geologic resources, however, could be incrementally affected by multiple projects. Cumulative effects on geologic resources would be expected if construction of multiple projects resulted in slope instability in a given area, or if use of mineral resources for construction (such as limestone, sand, and gravel) caused a substantial overall depletion of these resources. Cumulative effects related to soil erodibility are discussed in Section 6.4.2, Water Quality.

Within the Study Vicinity of the Northern, Central, and Southern sections, slope topography is generally low, so potential effects due to slope instability (such as landslides or earthquake-induced liquefaction) would be easily addressed during final design. Limestone, sand, and gravel would be needed for construction of the build alternatives, but because reserves are plentiful throughout the Study Vicinity, none of the alternatives would be expected to contribute to limiting availability or access to these resources. Therefore, the build alternatives would be unlikely to result in cumulative effects related to geologic resources.

6.4.10 Aesthetics and Visual Quality

The following sections identify the geographic areas where cumulative visual effects would be most likely to occur with the incremental effects of each build alternative.

6.4.10.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Future rail projects planned in this section would follow existing transportation corridors past sensitive viewers. These planned projects would produce minor changes to the landscape viewed by sensitive viewers and would have minimal to no cumulative effects on aesthetics and visual quality. Future highway expansion projects in this section would also generally follow existing transportation corridors past sensitive viewers. These projects would result in minor changes to the landscape viewed by sensitive viewers and would have minimal cumulative effects on aesthetics and visual quality.

The majority of the Alternative N4A Conventional alignment that would pass next to sensitive viewers would use existing railroad rights-of-way. Required modifications along existing railroad rights-of-way would result in relatively minor physical changes to the landscape seen by sensitive viewers. These changes would likely be unnoticeable, or barely noticeable, to sensitive viewers, and it is not anticipated that there would be cumulative effects on aesthetics and visual quality. In the few locations in urban, suburban, and rural areas were new rail would be required next to sensitive viewers, Alternative N4A Conventional would create changes to the viewed landscape that would produce negligible to substantial effects, but would have little influence on the overall aesthetics and visual quality of this section. The overall cumulative effects of Alternative N4A Conventional on aesthetics and visual quality would be minor. The alternative would potentially contribute to cumulative effects associated with population growth and related development, particularly in suburban and rural areas.

6.4.10.2 Central Section: Dallas and Fort Worth to San Antonio

Under the cumulative condition in the Central Section, highway expansion projects would result in additional highways being built as well as transit and rail lines in the Dallas and Fort Worth metropolitan area and in San Antonio. Where these new projects would be built along existing transportation corridors near sensitive viewers, they would result in minor changes to the viewed landscape and may have minor cumulative effects on aesthetics and visual quality. Where the highway projects would be built along new alignments near sensitive viewers there would be a likelihood that they would produce changes to the viewed landscape. These changes would produce cumulative effects on aesthetics and visual quality. Where higher-speed rail alternatives are proposed to be located in, or parallel to, existing rail and highway corridors, the new tracks would have a low likelihood of changing the landscape seen by sensitive viewers, and it is not anticipated that there would be cumulative effects on aesthetics and visual quality. The portions of the higher-speed build alternatives in this section that would have the greatest effect on aesthetics and visual quality would occur along portions of routes that would require new rail alignments outside of existing transportation corridors that would be adjacent to sensitive viewers. Most of these locations would be in suburban and rural areas, particularly between Hillsboro and San Antonio. Where new tracks (and support features such bridges and fencing) outside of existing transportation corridors would be constructed near sensitive viewers, there would be changes to the viewed landscape that would result in cumulative effects on aesthetics and visual quality.

High-speed alternatives would require greater radii, more elevated structures to maintain grade separations than the other service types, possibly longer bridges, and would result in more alteration of the landscape beyond existing rail corridors that would be viewed by sensitive viewers than would be required for the higher-speed rail alternatives. Most of these locations would be in suburban and rural areas, particularly between Hillsboro and San Antonio. New high-speed rail alternatives near sensitive viewers that would be located outside of existing transportation corridors would alter the viewed landscape and could be noticeable to sensitive viewers. In these situations, the build alternatives would potentially contribute to cumulative effects on aesthetics and visual quality associated with population growth and related development, particularly in suburban and rural areas.

6.4.10.3 Southern Section: San Antonio to South Texas

The cumulative effects from higher-speed and high-speed rail described for the Central Section would apply to the Southern Section. However, the build alternatives in this section would require relatively few miles of new rail alignment outside of existing transportation corridors adjacent to sensitive viewers. The greatest changes to the landscape viewed by sensitive viewers from the build alternatives would occur in suburban and rural areas and small communities, particularly in areas southwest of San Antonio. The effects on aesthetics and visual quality from higher-speed rail in these areas would range from negligible to moderate. The effects from high-speed rail in these areas would range from moderate to substantial. These build alternatives would potentially contribute to cumulative effects associated with population growth and related development, particularly in suburban and rural areas.

6.4.11 Land Use and Prime Farmland

Of the build alternatives, only Alternative N4A Conventional would have negligible effects and therefore would not have the potential for cumulative effects with planned future transportation projects and population growth.

For the other build alternatives, cumulative effects on land use and farmlands could occur if future development and transportation projects result in additional land use conversions. Future transportation projects could have cumulative effects with the build alternatives depending on whether the projects are located within or outside of existing transportation corridor rights-of-way. Where planned projects are within existing transportation corridors, it is not anticipated that there would be cumulative effects. However, if existing land uses and areas of prime farmland are converted to transportation-related use, there would be cumulative effects with the build alternatives if the conversions are adjacent to or outside the existing transportation corridor and result in areas being bisected or isolated.

6.4.12 Socioeconomics and Environmental Justice

For all of the alternatives, the Program in conjunction with the future transportation projects could result in a number of beneficial socioeconomic and environmental justice cumulative effects. The station areas could encourage redevelopment in the surrounding area and the potential for transit oriented development. These additional developments could provide additional employment opportunities and new housing opportunities to address the projected employment and population growth. The potential for development around each station would depend on the type of station planned, which would be determined during the project-level analysis. Any new development in the station areas would also result in the potential for additional property tax and sales tax revenues, which would benefit the counties where the stations are located. The Program and the future transportation projects would also improve regional access and reduce travel times, allowing goods, services, and people to move more efficiently through the region.

The potential for new employment opportunities and the improvements in regional access would provide cumulative benefits to all populations including environmental justice populations. Depending on the existing uses in the station areas there is the potential for adverse effects on environmental justice populations as a result of acquisitions and displacements, especially in areas where there are high concentrations of these populations. Future transportation projects following existing transportation corridors would not create any new barriers or disruptions that would result in cumulative effects. However, cumulative effects may result where future transportation projects do not follow existing alignments and create new barriers or disruptions.

6.4.13 Hazardous Materials

Cumulative effects related to hazardous materials would occur in metropolitan areas and in counties where population growth, land development, and associated transportation and other infrastructure projects would increase the transport, storage, use, and disposal of hazardous materials and would affect contaminated sites. The build alternatives would contribute incrementally to effects on contaminated sites, depending on how many sites would be affected and the nature and extent of the contamination. Because environmental health and safety plans and procedures would be followed during site cleanup, the incremental contribution of the build alternatives to cumulative effects would likely be minor.

6.4.14 Recreational Areas and Opportunities

The following sections discuss areas where cumulative effects on recreational resources may occur when considering the growth projections and foreseeable projects in addition to the build alternatives.

6.4.14.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Under the cumulative condition, future highway expansion projects in the Northern Section would not affect parks and recreational resources in the neighborhoods the build alternative would travel near. The growth projected in the Oklahoma City area, Norman, and Denton communities should include adequate open space opportunities. Denser development in the cities of Dallas and Fort Worth, required to absorb the projected increase in population, may place added pressures on existing park resources. However, Alternative N4A Conventional would not result in property acquisition of nearby parks and recreational areas. Additionally, none of the 56 park and recreational resources in the EIS Study Area in the Northern Section are dependent on a quiet atmosphere for enjoyment of the resource; they are currently located near an active railroad. Therefore, it is not anticipated that the build alternative would result in cumulative effects on park or recreational resources in the Northern Section.

6.4.14.2 Central Section: Dallas and Fort Worth to San Antonio

Future expansion of IH-35 East and IH-35 West may affect park resources in urbanized areas of Dallas and Fort Worth in locations similar to those where the build alternatives in the Central Section are likely to have effects. Combined with projected population growth and associated development in the Dallas and Fort Worth urban centers, there is a high probability of cumulative effects on park resources. In metropolitan areas, available right-of-way is scarce and therefore avoiding park resources is often not prudent and feasible. While federally funded projects would be required to provide mitigation, available lands that could replace affected parklands may be in short supply in these metropolitan areas.

The communities of Waco and Temple, where build alternatives share a common EIS Study Area, are expected to incrementally add park resources according to their development plans, appropriate for the projected rate of growth. However, expansion of IH-35 is planned in the same area as the build alternatives near Waco and Temple. A combination of substantial roadway and rail projects in the same general area may result in cumulative effects on local neighborhood park resources. As part of these projects, prudent and reasonable avoidance alternatives would need to be developed. However, if none exists, then mitigation of the effects may be possible to minimize cumulative effects.

The build alternatives would not contribute to a cumulative effect on community recreational resources in Austin. In San Antonio, the build alternatives would be in the same corridor as a planned increase in commuter rail service. If the higher-speed alternatives can remain within existing rail right-of-way, then park effects may be limited. If the higher-speed alternatives do not follow existing rail right-of way, or if a high-speed service type is selected, there may be a cumulative effect on San Antonio park resources. Bexar County, which contains the San Antonio metropolitan area, is projected to grow by 21 percent by 2035 (see Section 6.2, Methodology), and park resources in downtown areas have high value. If any of the build alternatives were constructed, mitigation would be required for any loss of parks. However, the ability to replace resources for the same users may be limited, which could result in cumulative effects on recreational resources.

6.4.14.3 Southern Section: San Antonio to South Texas

The build alternatives in the Southern Section would have fewer cumulative effects on park resources in San Antonio than those identified for the Central Section because avoidance of park resources would be more feasible in the Southern Section EIS Study Area. Foreseeable transportation projects would not affect the same community parks as the build alternatives. Park resources are likely to increase proportionately to population-driven development, which would result in a net increase in park resources. With avoidance of existing park resources, and an increase in park resources proportional to development, there is a low likelihood for the build alternatives to contribute to a cumulative effect on park and recreational resources.

6.4.15 Historic and Archaeological Resources

This section reviews cumulative effects on historic and archaeological resources that are listed, eligible, or potentially eligible for the National Register of Historic Places (NRHP).

6.4.15.1 Northern Section: Oklahoma City to Dallas and Fort Worth

6.4.15.1.1 Archaeological Resources

In the Northern Section, the build alternative is conventional rail service rail that would remain within the existing rail corridor. The only exceptions would be locations where additional parking or staging areas could disturb archaeological resources, but these areas would adhere to Section 106 requirements to avoid or mitigate effects (refer to Section 3.19.5). There could be minor incremental disturbance of archaeological resources in urbanized areas, such as Oklahoma City, where other projects and development have already disturbed archeological resources. Therefore, the build alternative in the Northern Section would have a low likelihood of contributing to cumulative effects on archeological resources.

6.4.15.1.2 Historic Properties

Alternative N4A would primarily use existing railroad infrastructure or would be located adjacent to existing railroad facilities and tracks, and minimal new rights-of-way and easements would be required. As a result, acquisition effects on historic resources would be minimal. The expansion of existing stations and new stations within urban and suburban areas could potentially result in moderate effects on historic resources within the EIS Study Area. Because several stations are NRHP-listed or NRHP-eligible, expansion and reconstruction of historically significant buildings and structures may be required to accommodate increased ridership. If this is the case, the build alternative could result in cumulative effects on historic resources with the future rail projects planned in the Dallas and Fort Worth area.

6.4.15.2 Central Section: Dallas and Fort Worth to San Antonio

6.4.15.2.1 Archaeological Resources

There is a higher probability for disturbance of archaeological resources in the areas where ground disturbance has not already occurred. While growth may have incrementally disturbed archaeological resources on the fringe of the Dallas and Fort Worth metropolitan area, the cumulative effects of the build alternatives would be greater in combination with expanding transportation projects in rural areas, such as where the C4A and C4C alternatives would travel south of Dallas in parallel with US-77. In this corridor, expanding commuter rail is planned between Dallas and Waxahachie, along with expansion of US-77 south and through Waxahachie. These transportation projects could also influence the areas where development is planned to accommodate growth along the corridor, thus resulting in a high probability of cumulative effects on clusters of archaeological resources. There are only four previously identified archaeological resources in this corridor. IH-35 is projected to expand in McLennan County through Waco. However, this project is fairly distant from the build alternatives; while both may disturb archeological resources, it is unlikely they would affect a similar cluster of resources.

Cumulative effects could also occur at the Guadalupe River crossing where the build alternatives enter San Antonio. There is high probability for archaeological sites to occur near waterways, and at this river, a planned commuter rail expansion, a widening of IH-35, and the build alternatives would expand or build new crossings, which could lead to cumulative effects on common archaeological resources. However, no sites have been identified in this area.

6.4.15.2.2 Historic Properties

The build alternatives could contribute to a cumulative effect on historic properties in Dallas and Fort Worth because they would enter the city centers, where there are and will continue to be growth pressures. In addition, both cities have plans to expand commuter rail and highways (IH-35 East and IH-35 West, respectively) that would affect the city core areas, where there is a high number of historic properties. Route Alternative C4C has the highest potential for cumulative effects because it would travel the longest distance in parallel with planned highway improvements, and Route Alternative C4B would have the lowest contribution to cumulative effects because it has the shortest route.

The C4A and C4C alternatives would contribute to cumulative effects on historic resources in Waxahachie with the expansion of US-77 through the center of town. All Central Section build alternatives would similarly contribute to cumulative effects on historic resources in Waco, with the expansion of IH-35 parallel to the EIS Study Area. Historic resources in Temple may be able to be avoided, thereby preventing cumulative effects with the expansion of IH-35 at this location. Finally, all build alternatives, in combination with the planned increase in commuter rail service, would result in cumulative effects on the collection of historic resources in downtown San Antonio.

6.4.15.3 Southern Section: San Antonio to South Texas

6.4.15.3.1 Archaeological Resources

There are relatively few previously identified archaeological resources in the Southern Section. Moderate to high growth is projected in McAllen and moderate to low growth is projected in Brownsville and Corpus Christi. There are no archaeological resources identified in the areas around the S6 alternatives and very low potential for growth or other planned improvements; therefore, no cumulative effects are expected. Alternative S4 may result in cumulative effects in the area north of McAllen where expansion US-281 is planned. In combination with the growth in this area, they may be cumulative effects related to clusters of similar archaeological resources. However, no archaeological sites have been identified in this area.

6.4.15.3.2 Historic Properties

The only area where Alternative S4 may result in cumulative effects on historic resources is in McAllen, where moderate growth is projected and the Alternative S4 EIS Study Area would travel through NRHP-listed or eligible historic districts. The S6 alternatives would not affect any identified historic properties and would not travel in areas with strong growth pressures. The S6 alternatives would likely be able to avoid historic properties that might be identified at the project level and are not anticipated to have cumulative effects.

6.4.16 Transportation

The following sections identify the geographic areas where cumulative transportation effects would be most likely to occur with the incremental effects of each build alternative.

The transportation analysis in Section 3.20 evaluates the alternatives on their ability to meet the projected intercity travel demand; and documents the anticipated changes to traffic patterns by alternative, including changes in mode share, travel time, travel time reliability (for passenger rail and autos), and vehicle miles traveled (VMT). A qualitative analysis of potential effects on air carriers, intercity transit service providers, and freight operations, has also been conducted. The potential cumulative effects of the build alternatives are described below for each of these categories.

6.4.16.1 Northern Section: Oklahoma City to Dallas and Fort Worth

Cumulative traffic effects may occur when more than one project has an overlapping construction schedule that generates excessive construction-related traffic. Alternative N4A is proposed to use existing infrastructure and stations and is not anticipated to have cumulative transportation effects during construction.

During operation, local traffic volumes and parking demand would increase around and at the stations due to increases in ridership, which could combine with cumulative traffic generated by other local development projects. An estimated 20 percent population growth and accompanying development in the Oklahoma City and Dallas and Fort Worth metropolitan areas would likely contribute to the cumulative local transportation effects. However, as population growth occurs in these urban areas of the Northern Section, there will be a greater number of transportation users and a potentially greater cumulative shift in mode share as rail becomes an effective alternative transportation mode within the corridor. This could result in a cumulative reduction in VMT and highway congestion.

6.4.16.2 Central Section: Dallas and Fort Worth to San Antonio

In the Central Section, future planned projects and development, such as the planned transit and rail lines in the Dallas and Fort Worth area and in San Antonio, which are adjacent to the build alternatives, would have the potential to cause cumulative local transportation effects during construction if the timing of the projects overlap. Potential increases in vehicle trip generation would vary based on the project type, location, schedule, size of workforce, equipment needs, and other factors. The distribution of construction trips on the road network will also depend on the location of individual projects and the project staging areas. While construction activities for the build alternatives would be temporary, they would be cumulatively long term given that construction would be ongoing for many years, and could combine with other nearby construction projects.

During operations, cumulative effects on local traffic conditions and parking could occur in areas where new development is proposed, combined with the increases in local traffic and parking demand around and at the stations due to increases in rail ridership. However, as population growth occurs in the Dallas and Fort Worth, Austin, and San Antonio metropolitan areas, there will also be a greater number of transportation users, and a potentially greater cumulative shift in mode share as rail becomes an effective alternative transportation mode within the corridor. Therefore, cumulatively, the build alternatives combined with the planned transit and rail lines in the Dallas and Fort Worth metropolitan area and in San Antonio would decrease reliance on highway travel, thus contributing to a cumulative reduction in VMT and highway congestion.

6.4.16.3 Southern Section: San Antonio to South Texas

Similar to the Central Section, where future planned transportation projects and development are adjacent to the build alternatives, there is potential for cumulative local transportation effects during construction if the timing of the projects overlap. For example, cumulative effects could occur along the existing US-281 corridor; existing rail corridors in Webb, Jim Wells, and Nueces counties; and in Webb, Hidalgo, and Cameron counties where future transportation projects and new development would combine with Alternative S4.

Similar to the Central Section, under the cumulative condition in the Southern Section, population growth and accompanying development in San Antonio and in Hidalgo and Cameron counties would result in a greater number of transportation users, but also a potentially greater cumulative shift in mode share as rail becomes an effective alternative transportation mode within the corridor. This would result in a cumulative reduction in VMT and highway congestion.

6.4.17 Public Health

During construction, all of the build alternatives, but particularly those in the Central and Southern sections where construction would be more intensive, have potential to temporarily expose sensitive populations, such as children, the elderly, and those with existing health concerns, to increased levels of particulate matter and air toxics. Where future planned transportation projects and development are adjacent to the build alternatives, there is potential for cumulative public health effects during construction if the timing of the projects overlap.

During operation of the build alternatives, there is potential for local health effects to occur where vehicles and diesel trains (except for the high-speed rail alternatives, which use electric trains) idle for long periods of time near high concentrations of sensitive populations. As discussed further in Section 3.21, Public Health, for this service-level analysis, there is insufficient information to determine potential local health effects. Therefore, there is insufficient information to determine the potential for cumulative local public health effects. The detailed analysis necessary to determine these potential effects will be conducted at the project level.

All of the build alternatives, with the exception of Alternative S4 Higher-Speed Rail, would result in negligible long-term regional benefits to public health associated with air pollutant emissions during operation. These build alternatives, combined with the planned transit and rail lines in the area and the potential shift in mode share toward rail as development occurs and rail becomes a more effective mode of transportation, may cumulatively result in regional benefits to public health. Alternative S4 Higher-Speed Rail would have the potential to cause long-term regional effects on public health and may potentially result in cumulative effects.

The build alternatives are not anticipated to have cumulative public health effects associated with hazardous materials or groundwater aquifers that supply drinking water.

7.0 Permits

Transportation projects must comply with federal, state, and local environmental laws and regulations, permits, reviews, notifications, consultation, and other approvals. Table 7-1 lists the permits, notifications, or concurrences that may be required for construction of the Texas-Oklahoma Passenger Rail Program.

Table 7-1: Permits Potentially Required for Construction of the Texas-Oklahoma Passenger Rail Program

Agency	Permit
FEDERAL	
Bureau of Land Management	▪ Right-of-Way Permit
Department of the Interior – Bureau of Indian Affairs	▪ Consultation and Coordination with Indian Tribal Governments (Executive Order 11375)
Federal Aviation Administration	▪ Airport Layout Plan Modification Approval
Federal Emergency Management Agency	▪ Conditional Letter of Map Revision or Letter of Map Revision for changes in flood elevation
Federal Highway Administration	▪ Concurrence for Highway Right-of-Way Occupancy and/or Disposal ▪ Access Justification Report or Access Modification Report ▪ Concurrence on Project Design Elements Related to Highway Operations
National Marine Fisheries Service	▪ Section 7 Consultation and Biological Opinion
National Surface Transportation Board	▪ NEPA Consultation
Surface Transportation Board	▪ Authority to Construct and Operate Railroad
U.S. Advisory Council on Historic Preservation	▪ National Historic Preservation Act Section 106 consultation, administered by the Texas State Historic Preservation Officer and Oklahoma State Historic Preservation Officer

Agency	Permit
U.S. Army Corps of Engineers	▪ Clean Water Act Section 404 Permit for discharge of dredge or fill materials into waters of the U.S., including wetlands ▪ Clean Water Act Section 401 Certification – Water Quality, administered by the Texas Commission on Environmental Quality and the Oklahoma Department of Environmental Quality ▪ Rivers and Harbors Act Section 10 Permit for construction of any structure in or over any navigable waters of the U.S. ▪ Rivers and Harbors Act Section 408 Permit for construction of new levee crossings
U.S. Coast Guard	▪ General Bridge Act Section 9 Permit for construction of new bridge structures over waterways considered navigable by the U.S. Coast Guard
U.S. Department of Transportation/Federal Railroad Administration	▪ U.S. Department of Transportation Act Section 4(f) evaluation and approval
U.S. Environmental Protection Agency	▪ Review of Environmental Justice conclusions ▪ General Air Quality Conformity Determination ▪ Clean Water Act Section 402 National Pollutant Discharge Elimination System (NPDES) Permit, administered by the Texas Commission on Environmental Quality and the Oklahoma Department of Environmental Quality
U.S. Fish and Wildlife Service	▪ Section 7 Consultation and Biological Opinion
STATE	
Texas Commission on Environmental Quality	▪ Clean Water Act Section 401 Certification – Water Quality ▪ Clean Water Act Section 402 NPDES Permit, implemented by the Texas Pollutant Discharge Elimination System Program ▪ Notice of Intent to use General Permit TXR150000 for Stormwater Discharges Associated with Construction Activity ▪ Surface Water Use Permit ▪ Transportation Conformity Determination

Agency	Permit
Texas Department of Transportation	▪ Occupancy and Use Permit ▪ Right-of-Way Permit
Texas General Land Office	▪ Texas Coastal Management Program Coastal Coordination Council Consistency Determination
Texas Parks and Wildlife Department	▪ Scientific Collecting Permit for relocation of state-listed threatened and endangered species ▪ Marl, Sand, Gravel, Shell, or Mudshell Permit for disturbance or take of streambed materials
Texas State Historic Preservation Office	▪ National Historic Preservation Act Section 106 Consultation
Oklahoma Department of Environmental Quality	▪ Clean Water Act Section 401 Certification – Water Quality ▪ Clean Water Act Section 402 NPDES Permit, implemented by the Oklahoma Pollutant Discharge Elimination System Program ▪ Notice of Intent to use General Permit OKR10 for Stormwater Discharges from Construction Activities
Oklahoma Department of Transportation	▪ Occupancy and Use Permit ▪ Right-of-Way Permit
Oklahoma State Historic Preservation Office	▪ National Historic Preservation Act Section 106 Consultation
LOCAL	
Local agencies	▪ Construction Noise Permit (if construction violates city or county noise ordinance)

8.0 Public Involvement

As part of the Texas-Oklahoma Passenger Rail Study (Study), and pursuant to the requirements of the National Environmental Policy Act (NEPA), the Texas Department of Transportation (TxDOT) and the Federal Railroad Administration (FRA) have conducted a public and agency involvement program in support of the service-level environmental review process. This chapter describes the public and agency involvement efforts conducted in preparation of this service-level environmental impact statement (EIS). The public and agency involvement program included the following efforts:

- Agency involvement: Agency pre-scoping and scoping meetings; Cooperating Agency invitation letters.
- Tribal coordination: Invitation letters and meetings.
- Public involvement and outreach: Informational materials, including a Study website; scoping and alternatives analysis open house meetings; meetings with individual stakeholders, including presentations and briefings.

8.1 Agency Involvement

As part of the Study, TxDOT and FRA have engaged federal, state, and local agencies, as well as Native American Tribes, to obtain initial feedback on the Study and the scope of the environmental document, and to determine if the federal agencies would like to be Cooperating Agencies under NEPA. The elements developed to facilitate and document agency coordination for the Study are outlined in the *Texas-Oklahoma Passenger Rail Study Agency and Tribal Coordination Plan* (TxDOT 2013a).

To introduce agencies to the Study, TxDOT hosted a pre-scoping agency meeting on February 26, 2013. The meeting featured a presentation that included the background to the Study and an outline of the draft Purpose and Need Statement. In addition, the presentation included preliminary information about the Study scope and general corridors under consideration, as well as a draft version of the evaluation criteria. The EIS timeline was reviewed, along with next steps. After the presentation, agencies were invited to ask questions and to comment on the range of issues to be investigated in the environmental document, the adequacy of the draft Purpose and Need Statement, and the Study methods and evaluation criteria for resources under the agencies' purview.

As part of the formal scoping process, agency scoping meetings were held in Oklahoma City (March 25, 2013), Austin (March 27, 2013), and Dallas (April 3, 2013). These three agency meetings were held from 2:00 to 4:00 p.m. on the same day as public scoping open house meetings in their respective locations. Agency interest in the Study during the pre-scoping meeting was documented using a form that asked for contact information and a statement of interest. The agencies were encouraged to submit comments during the scoping process and were invited to attend the public scoping meetings. Agencies were also invited to provide written scoping comments during the scoping period. Transit districts, counties, cities, Metropolitan Planning Organizations, and state and federal regulatory agencies were invited to the agency scoping meetings.

After the *Texas-Oklahoma Passenger Rail Study Route Alternatives Analysis* (see Appendix C; TxDOT 2014) was completed, FRA and TxDOT invited federal, state, and local agencies and Native American Tribes to a series of public open house meetings that presented the results of the analysis. The meetings are described in more detail below in Section 8.2.2, Alternatives Analysis Public Meetings.

8.1.1 Federal Agency Coordination

The following federal agencies were identified in the *Texas-Oklahoma Passenger Rail Study Agency and Tribal Coordination Plan* (TxDOT 2013a) and received an invitation to the Study's pre-scoping and scoping meetings:

- Advisory Council on Historic Preservation
- Bureau of Land Management
- Federal Aviation Administration (FAA)
- Federal Emergency Management Agency
- Federal Highway Administration (FHWA)
- Federal Transit Administration
- International Boundary and Water Commission National Marine Fisheries Service
- Natural Resources Conservation Service
- U.S. Army Corps of Engineers (USACE)
- U.S. Bureau of Indian Affairs
- U.S. Coast Guard
- U.S. Department of Energy
- U.S. Department of Homeland Security
- U.S. Environmental Protection Agency (EPA)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Forest Service

Two federal agencies submitted scoping comment letters, EPA and U.S. Customs and Border Protection. EPA provided recommendations for continued interagency and community coordination, information sources, and guidance for analysis in the Study. U.S. Customs and Border Protection (an agency within the U.S. Department of Homeland Security), Laredo Sector, is interested in intercity passenger rail service as an alternative mode of transportation for its employees and requested additional information on the proposed routes, station locations, hours of operation, and fares. A more complete summary of the agencies' comments, as well as the original comment letters, can be found in the *Texas-Oklahoma Passenger Rail Program Scoping Report* (see Appendix A; TxDOT 2013b).

In September 2014, FRA sent letters to five federal agencies to invite them to take part in the Study NEPA process as Cooperating Agencies. The role of a Cooperating Agency is to participate in coordination meetings; identify issues, concerns, and studies that the EIS should address; assist in determining appropriate service-level mitigation strategies; and provide review and comment on environmental documents that reflect the views and concerns of the agency and the adequacy of the document. The following agencies were invited to participate in the Study as Cooperating Agencies:

- FAA, Southwest Region
- FHWA

- Surface Transportation Board, Office of Environmental Analysis
- USFWS
- USACE

Of the agencies invited, USACE (Fort Worth, Galveston, and Tulsa Districts) replied by letter to accept the invitation, and the FAA and the Surface Transportation Board replied by letter to decline the invitation, but will consider participating at the project level (USACE, Fort Worth District 2014; USACE, Galveston District 2014; USACE, Tulsa District 2014; FAA 2014; STB 2014).

8.1.2 State Agency Coordination

The following state agencies identified in the *Texas-Oklahoma Passenger Rail Study Agency and Tribal Coordination Plan* (TxDOT 2013a) received an invitation to the Study's pre-scoping and scoping meetings:

Texas

- Coastal Coordination Council
- General Land Office
- Texas Commission on Environmental Quality
- Texas Historical Commission
- Texas Parks and Wildlife Department (TPWD)

Oklahoma

- Oklahoma Department of Environmental Quality
- Oklahoma Department of Transportation (ODOT)
- Oklahoma Conservation Commission
- Oklahoma Department of Wildlife Conservation
- Oklahoma State Historic Preservation Office
- Oklahoma Water Resources Board

Two state agencies submitted scoping comment letters: TPWD and the Oklahoma Tourism and Recreation Department.[1] TPWD requested ongoing communication with the Program team during the early planning phase of the Study to provide guidance on avoidance and minimization of impacts on natural resources, and its letter listed applicable state and federal regulations that would pertain to the Program. It also recommended maintaining the proposed rail alignments within existing railroad right-of-way whenever possible.

The Oklahoma Tourism and Recreation Department expressed concerns regarding current passenger service not meeting the needs of travelers between Oklahoma and Texas and emphasized improving this service. It also stated that identifying and providing service to major and critical destinations for travelers is important. Connectivity and station amenities and services were identified as priorities that should be supportive of all passengers.

A more complete summary of the agencies' comments, as well as the original comment letters, can be found in the *Texas-Oklahoma Passenger Rail Program Scoping Report* (see Appendix A; TxDOT 2013b).

[1] While it was not among the agencies invited to comment, as identified on the list above, the Oklahoma Tourism and Recreation Department submitted a scoping comment letter. Comment was welcomed from all agencies.

8.1.3 Tribal Coordination

FRA worked with TxDOT, ODOT, and FHWA to develop a list of Native American Tribes that could potentially have interest in the Study because of current or historic presence or treaty interest in the study area. FRA has led all Tribal coordination and outreach activities, in conjunction with TxDOT, including the following actions:

- Sending letters inviting the Tribes to participate in scoping.
- Sending letters inviting the Tribes to participate in government-to-government consultation pursuant to Section 106 of the National Historic Preservation Act (NHPA).
- Holding consultation meetings with Tribes that responded to the invitation letters and agreed to participate in consultation.
- Providing additional Study documentation pertaining to potential Tribal interests.

The list of Tribes to be contacted was reassessed throughout the Study. Tribal groups that are not federally recognized were not included in the formal consultation process, but were invited to provide input by attending public scoping and stakeholder meetings and through ongoing Study coordination.

Federally recognized tribes with interests in the Texas and Oklahoma counties included in the EIS Study Area include the following:

- Absentee-Shawnee Tribe (Okla., Texas)
- Alabama-Coushatta Tribe of Texas (Texas)
- Alabama-Quassarte Tribal Town (Okla.)
- Apache Tribe of Oklahoma (Okla., Texas)
- Caddo Nation of Oklahoma (Texas)
- Cheyenne and Arapaho Tribes (Okla.)
- Chickasaw Nation (Okla.)
- Choctaw Nation (Texas)
- Citizen Potawatomi Nation (Okla.)
- Comanche Nation (Okla., Texas)
- Delaware Nation (Okla., Texas)
- Fort Sill Apache Tribe (Okla.)
- Iowa Tribe of Oklahoma (Okla.)
- Kialegee Tribal Town (Texas)
- Kickapoo Tribe of Oklahoma (Okla., Texas)
- Kickapoo Traditional Tribe of Texas (Texas)
- Kiowa Tribe (Okla., Texas)
- Mescalero Apache Tribe (Texas)
- Muscogee (Creek) Nation (Texas)
- Osage Nation (Okla.)
- Poarch Band of Creek Indians (Texas)
- Quapaw Tribe of Indians (Texas)
- Seminole Nation (Okla., Texas)
- Thlopthlocco Tribal Town (Texas)
- Tonkawa Tribe of Indians of Oklahoma (Texas)
- Wichita and Affiliated Tribes (Okla., Texas)

On April 11, 2013, FRA mailed invitation letters to the 26 federally recognized Tribes identified in Oklahoma and Texas to initiate government-to-government contact, alert them of the Study, and invite them to participate in the scoping process. FRA received three responses to the letters. The Delaware Nation expressed interest in the Study and the Study area and confirmed they will be a consulting party. The Chickasaw Nation expressed interest in the Study and accepted the invitation to consult. The Choctaw Nation of Oklahoma requested additional information to more thoroughly evaluate their interest in the Study relative to NHPA Section 106 review.

FRA held meetings with the Delaware Nation on February 12, 2014, and with the Chickasaw Nation on March 12, 2014. Each meeting included a presentation by staff to provide Study background, work completed to date, and route alternatives being carried forward into the EIS. The meetings included discussion of the geographic area of interest for each Tribe, as well as a process for communication and working together as the Study moves forward. Additional Study information was provided to the Choctaw Nation who subsequently determined that the Study area is outside of their area of historic interest, and consultation would not be necessary.

8.1.4 Regional/Local Coordination

An invitation letter to attend one of the three agency-specific scoping meetings was sent to representatives of metropolitan planning organizations, counties, cities, and transit districts. FRA and TxDOT also held focused stakeholder meetings at which local resource agencies, elected officials, Tribal representatives, transit agencies, railroads, and environmental interest groups could provide comments. In addition to these focused meetings, organization representatives were encouraged to attend public open house meetings and to invite their constituents and members to attend.

FRA and TxDOT assessed local and regional agency interest in the Study by using (1) a form requesting the agency's contact information and indication of interest in the Study; and (2) comments submitted by the agency during the scoping process. Post-scoping meeting actions by FRA and TxDOT for participating local and regional agencies included the following:

- Interactions and communications with local and regional agencies were documented in a tracking log; and agency status and contact information were updated as needed.
- For local and regional agencies that requested to be kept apprised of the Study, regular Study updates were distributed, along with an opportunity for comment at key milestones, such as the preliminary analysis of alternatives and identification of alternatives to be evaluated in the EIS.

Periodic informational teleconferences were conducted for local and regional agencies that requested to be kept apprised of the Study. Several local agencies, municipalities, and organizations submitted scoping comments, including Arlington, Brownsville (and the Brownsville Chamber of Commerce), Laredo, South Padre Island, and the Greater Waco Chamber of Commerce. These comments indicated their general support for passenger rail and listed the benefits of extending passenger rail to their cities.

8.2 Public Coordination and Outreach

The activities and outreach developed to involve the public in the different stages of the Study is described in detail in the *Texas-Oklahoma Passenger Rail Study Public Involvement Plan* (TxDOT 2013c), which was developed by TxDOT in coordination with ODOT and FRA. The public involvement process has the following goals:

- Deliver a “transparent” environmental review process that provides ongoing, inclusive, and meaningful two-way communication between the Study and the public.
- Meet the regulatory requirements and intent associated with NEPA, federal Executive Order 12898 on Environmental Justice, and Title VI requirements in the following ways:
  - Use a variety of information and outreach activities to solicit public and agency input
  - Provide ample notification and access to public and agency involvement opportunities
  - Assess public values and preferences then integrate those into Study planning and documentation

  Section 3.15, Socioeconomics and Environmental Justice, provides further information on the involvement of minority and low-income populations in the public outreach efforts associated with the Program.
- Encourage active participation by agencies, interest groups, and individuals with particular interest in the outcome of the Study.

8.2.1 Public Scoping Meetings

To solicit public feedback on the corridors under consideration for Study alternatives, 12 public scoping meetings were held throughout Oklahoma and Texas in March and April 2013. Meeting locations and dates included:

- Oklahoma City, Oklahoma: March 25, 2013
- Waco, Texas: March 25, 2013
- Ardmore, Oklahoma: March 26, 2013
- Austin, Texas: March 27, 2013
- Fort Worth, Texas: March 28, 2013
- Belton, Texas: April 1, 2013
- San Antonio, Texas: April 1, 2013
- Sherman, Texas: April 1, 2013
- Corpus Christi, Texas: April 2, 2013
- Dallas, Texas: April 3, 2013
- Laredo, Texas: April 3, 2013
- Harlingen, Texas: April 4, 2013

In addition, an “Online Open House,” described in greater detail below, was offered to allow individuals an opportunity to provide comments via computer.

A Notice of Intent to prepare a service-level EIS for the Program was issued on March 7, 2013, and published in the Federal Register on March 13, 2013. The Notice of Intent included dates and times of each public scoping meeting, as well as a link to the Study website. Additional notification and promotion of scoping activities included distribution of press releases, placement of paid newspaper ads, publication of the events using Facebook and Twitter, and release of emails to individuals on the Study mailing list. TxDOT and FRA also distributed posters and newsletters to metropolitan planning and other local organizations for them to send to their respective constituents. The Study received thorough media coverage in local newspapers and on local television (TV), including *Valley Morning Star*, my SanAntonio.com (MySA), *The Monitor*, *Dallas Morning News*, *Tulsa World*, News9 (in Oklahoma), NBC (in Dallas and Fort Worth), *Killeen Daily Herald*, *Progressive Railroading*, *San Marcos Mercury*, *Waco Tribune*, KXXV News Channel 25 (in Waco), *Waco Tribune*, and the *Hillsboro Reporter*.

Twelve in-person public scoping meetings, listed above, were held along the Study corridor between March 25 and April 4, 2013. A total of 340 people attended the meetings and 43 submitted comment forms. All meetings included time for participants to review displays and speak with staff, as well as a formal presentation with a question and answer period. The same materials and information were presented at each meeting.

The open house included display boards about the purpose and need of the Study, graphics illustrating potential route corridors, and information about the decision-making process. Meeting attendees received Study newsletters and comment forms that could be returned at the meeting or mailed in later.

A PowerPoint presentation showing all of the display boards translated into Spanish and including a Spanish narration of the slides was available to meeting attendees. TxDOT, ODOT, and consultant staff answered questions about the Study.

The team also created an online open house that replicated key elements of the in-person meeting format. It allowed community members to review materials online and provide comments until the scoping period closing date of April 26, 2013. Approximately 4,500 unique visitors viewed the online open house during the scoping period. Visitors were mostly driven to the site by media coverage (newspaper or TV). TxDOT's Facebook and Twitter accounts were also directed a large numbers of visitors to the online open house.

A total of approximately 12,000 comments were received during the scoping period, including in-person comments turned in at meetings, comments received through the online open house, and comments mailed in. General issues frequently identified as a result of public scoping are listed below:

- Agriculture, including impacts on farmland and productivity/viability of agricultural activities
- Benefits of passenger rail service, including but not limited to air quality, congestion relief, and economic development
- Connections to local transit and promotion of mass transit
- Cost and financing of the passenger rail system
- Employment opportunities
- Energy consumption and technology used for the trains

- Freight and passenger rail compatibility
- General support for the Study
- Health
- Impacts on plant and animal species, including associated habitats
- Impacts on wildlife corridor movement
- Integration of the system with existing and planned regional and local transportation and transit efforts
- Location of rail corridor
- Location of stations
- Noise impacts
- Open space impacts
- Parks and recreation impacts
- Potential devaluation of property
- Regional and local economic growth
- Ridership
- Right-of-way
- Safety and hazards
- Water quality and runoff impacts

8.2.2 Alternatives Analysis Public Meetings

After the *Texas-Oklahoma Passenger Rail Study Route Alternatives Analysis* (see Appendix C; TxDOT 2014) for the Study was completed, eight in-person public open house meetings were held between January 27 and February 6, 2014, in Oklahoma and Texas to present the results of the analysis. Meeting locations and dates included:

- Waco, Texas: January 27, 2014
- Austin, Texas: January 28, 2014
- McAllen, Texas: January 29, 2014
- Laredo, Texas: January 30, 2014
- Oklahoma City, Okla.: February 3, 2014
- Ardmore, Okla.: February 4, 2014
- Arlington, Texas: February 5, 2014
- San Antonio, Texas: February 6, 2014

Open house meetings were promoted through newspaper and TV news advertisements, and posters and newsletters listing the meeting times and locations were distributed to local metropolitan planning organizations, councils of governments, and the Study mailing list.

The open house format included display boards about the purpose and need of the Study, graphics illustrating the alternatives to be carried forward into the EIS, and information about the decision-making process. Meeting attendees received Study newsletters and comment forms that could be returned at the meeting or mailed in later.

A PowerPoint presentation showing all of the display boards translated into Spanish and including a Spanish narration of the slides was available to meeting attendees. Meeting attendees were also informed that the entire presentation, as well as all display boards in both English and Spanish, could be found on the Study website.

TxDOT, ODOT, and consultant staff were available to answer questions about the Study throughout the open house. The meetings included time for participants to review the displays and speak with staff, as well as a formal presentation with a question and answer period.

8.3 Future Agency Coordination and Public Involvement Activities

When the Draft EIS is released for comment, TxDOT will accept comments for at least 45 days at public hearings, by mail and email, and through the website. TxDOT will host open houses immediately prior to the public hearings at which Draft EIS findings can be reviewed. The Draft EIS will be available at TxDOT and ODOT district offices, study meetings, municipal buildings, and libraries. In addition, the Draft EIS will be available on the Study website hosted by TxDOT and FRA's project website.[2] After the public comment period concludes, and after careful consideration of all input, TxDOT and FRA will identify a preferred alternative.

After a preferred alternative is identified, a Final EIS will be prepared that responds to public comments made about the Draft EIS. The Final EIS will include an appendix containing public and agency comments received on the Draft EIS, along with responses from TxDOT and FRA. The body of the Final EIS will include corrections and edits based on comments received. Once the Final EIS is complete, FRA will issue a Record of Decision selecting an alternative for implementation.

[2] Available at http://www.txdot.gov/inside-txdot/projects/studies/statewide/texas-oklahoma-rail.html (TxDOT) and https://www.fra.dot.gov/Page/P0716 (FRA).

9.0 List of Preparers

9.1 Texas Department of Transportation

Name, Registration	Project Role	Years of Experience, Qualifications
Mark Werner	Rail Planning Section Manager	17 years of experience B.S., Civil Engineering, University of Texas, Austin
Melissa Neeley	Rail Project Manager, Environmental Affairs Division	35 years of experience M.S., Urban Planning, Texas A&M University B.A., Political Science, Texas A&M University

9.2 List of Consultants

Name, Registration	Project Role	Years of Experience, Qualifications
Trevor Allen	Recreational Resources and Section 4(f)/6(f) Resources	2 years of experience B.A., Integrative Biology, University of California, Berkeley
Debra Beene	Archaeological Resources	27 years of experience M.A. Anthropology, minor in Archaeology University of Texas, Austin
Rebecca Birtley	Geographic Information Systems	16 years of experience B.A. Geography, University of California, Fullerton
Lyna Black	Geographic Information Systems Coordination	17 years of experience M.S., Geosciences, California State University, Chico B.S., Biology (minor in Chemistry), California State University, Chico
Courtney Blechle	Energy Resources Construction Effects	9 years of experience B.A. Environmental Studies, Southwestern University, Georgetown, Texas
Loren Bloomberg	Reviewer	20 years of experience M.E., Civil Engineering, University of California, Berkeley M.S., Civil Engineering, University of California, Berkeley B.S., Systems Engineering, University of Virginia
Andrea Burden	Archaeological Resources	20 years of experience M.A. Anthropology; Certificate in Historic Preservation, Texas A&M University
Shawn Clayward, CGIS	Geographic Information Systems	22 years of experience B.F.A., Visual Communications, Indiana University

Name, Registration	Project Role	Years of Experience, Qualifications
Jeff Crisafulli	Technical Editing	19 years of experience B.A., English, Virginia Polytechnic Institute and State University
Steven Eakin	Water Quality	20 years of experience M.S., Aquatic Ecology, University of Florida, Gainesville B.S., Environmental Science, Virginia Polytechnic Institute and State University
Manomi Fernando	Document Publishing	11 years of experience B.A., Communications Studies, California State University, Sacramento
Melissa Fowler	Natural Ecosystems and Wildlife	10 years of experience M.S., Environmental Studies, Emphasis: Environmental Science, California State University, Fullerton B.S., Biological Science, California State University, Fullerton
Julie Froelich	Community Effects: Land Use and Agriculture Construction Effects Cumulative Effects Elderly and Handicapped Public Safety and Hazardous Materials	14 years of experience B.S., Physiology and Neurosciences, University of California at San Diego B.A., History, University of California at San Diego
Dave Golles	Solid Waste Disposal	23 years of experience B.S., Environmental Science, California State University of San Bernardino, California
Mark Greenig, AICP	Aesthetics and Visual Quality	29 years of experience M.U.P., Urban Planning, Texas A&M University B.S., Landscape Architecture, California Polytechnic State University, San Luis Obispo
Timothy Griffith	Archaeological Resources	20 years of experience Ph.D. Anthropology. University of Kansas (ABD)
Brian Hausknecht,	Tier 1 Project Manager EIS Manager	30 years of experience M.S., Environmental Engineering, University of Florida B.A., Biology, Jacksonville University
Kristin Hull	Public Involvement	15 years of experience Master of Public Affairs, University of Texas at Austin B.S., Politics, Willamette University
Kim Johnson	Archaeological Resources; Historic, Archaeological, Architectural and Cultural Resources; and Section 4(f)/6(f) Resources	23 years of experience B.A. Zoology, University of Texas at Austin

Name, Registration	Project Role	Years of Experience, Qualifications
Jodi Ketelsen, AICP	Senior Reviewer	20 years of experience M.C.P., Urban and Regional Planning, University of California, Berkeley M.L.A., Landscape Architecture, University of California, Berkeley B.S.L.A., Landscape Architecture, University of California, Davis
Estee Lafrenz, P.E.	Air Quality	17 years of experience B.S. Chemical Engineering, Arizona State University
Duane McClelland, P.E., Risk Assessment Methodology for Dams (RAM-D) Certified	Coastal Zone Management Flood Hazards and Floodplain Management	13 years of experience M.S., Civil Engineering, Utah State University B.S., Civil and Environmental Engineering, Washington State University B.A., Communication, Washington State University
Frank Orr, GISP, PMP	Geographic Information Systems	18 years of experience M.S., Geographic Information Systems, University of Denver B.A., Mathematics, Colorado College
Greg Parrent, P.E. (Texas)	Coastal Zone Management	20 years of experience B.S., Civil Engineering, Texas A&M University at College Station
Julie Petersen	Utilities	11 years of experience B.S. Biology, Austin Peay State University, Tennessee
Christopher Powers	Natural Ecosystems and Wildlife, Threatened and Endangered Species	12 years of experience M.A., Science Education, Union College, Schenectady, New York B.S., Biology, Union College, Schenectady, New York
Robert Price	Natural Ecosystems and Wildlife, Threatened and Endangered Species	17 years of experience Master of Public Affairs, Aquatic Ecosystems Management, Indiana University M.S., Environmental Science, Indiana University B.S., Zoology, History, Miami University, Ohio
Alexis Reynolds	Historic, Architectural, and Non-archaeological Cultural Resources	8 years of experience M.S., Historic Preservation, Eastern Michigan University B.A., American Studies, Skidmore College
Jason Reynolds	Reviewer	19 years of experience B.S., City and Regional Planning, Minor, Public Administration, California Polytechnic State University - San Luis Obispo
Colleen Roberts, AICP	Reviewer	13 years of experience B.A., Art History, Yale University

Name, Registration	Project Role	Years of Experience, Qualifications
Robert Rodland, AICP	Community Impacts: Land Use and Agriculture Community Impacts: Socioeconomic and Environmental Justice	13 years of experience B.A., Geography, University of Washington
Maryellen Russo	Historic, Architectural, and Non-Archaeological Cultural Resources; and Section 4(f)/6(f) Resources	14 years of experience M.A., Public History, Appalachian State University B.A., History, Appalachian State University
Sheila Rygwelski, P.E.	Air Quality	5 years of experience B.S., Environmental Engineering, Oregon State University
Kirstin Skadberg, Ph.D.	Alternatives Analysis	8 years of experience Ph.D., Ecology, San Diego State University/University of California, Davis B.S., Physiology, Michigan State University
Jason Speights	Water Quality	7 years of experience M.S., Forestry: Emphasis Avian Ecology, Stephen F. Austin State University B.S., Biology, Stephen F. Austin State University
Sarah Townsend	Reviewer	17 years of experience B.E.Sc (Hons): Geography, University of Wollongong, Australia MEL: University of Sydney, Australia
Jacob Trahan	Wetlands	8 years of experience B.S., Environmental and Sustainable Resource, University of Louisiana, Lafayette
Mark Twede, P.E. (California, Oregon, Nevada, Idaho), G.E. (California)	Geologic Resources	22 years of experience M.S. Civil Engineering (Geotechnical Group), University of Texas at Austin B.S. Civil Engineering, Brigham Young University at Provo
Lisa Valdez	Transportation	18 years of experience M.C.R.P, City and Regional Planning, California State University, San Luis Obispo B.A., Environmental Studies, University of California, Santa Cruz
Eddie Vasser	Recreational Resources and Section 4(f)/6(f) Resources	29 years of experience Master of Agriculture, Soil Science, North Carolina State University
Sara Vivas	Technical Editing	16 years of experience M.A.L.A.S., Tropical Conservation and Development, University of Florida, Gainesville B.A., Spanish Literature, Vanderbilt University

Name, Registration	Project Role	Years of Experience, Qualifications
Mark Walbrun, P.E. (Illinois, Texas)	Tier 1 Project Management	43 years of experience B.S. Engineering, University of Illinois Railroad Engineering, Penn State University Transportation Planning, Virginia Tech
Allison Wallen	Technical Editing	30 years of experience B.A., Communications, University of the Pacific, Stockton
Rebecca Wallisch	Historic, Architectural, and Non-Archaeological Cultural Resources	4 years of experience M.S., Historic Preservation, University of Texas, Austin B.A., European Studies and History, Scripps College
Brett Weiland, CFM, TECS	Noise and Vibration	15 years of experience B.S., Environmental Science, Iowa State University
Andrea White	Air Quality	8 years of experience B.S., Chemical Engineering, University of California, Davis
George Woolley	Flood Hazards and Floodplain Management	7 years of experience Master of Applied Science, Environmental Policy and Management, University of Denver B.A., Earth Science, Minor in Geology, University of Colorado at Denver
Fatuma Yusuf, Ph.D.	Community Effects: Socioeconomic and Environmental Justice	14 years of experience Ph.D., Agricultural Economics, Washington State University M.S., Statistics, Washington State University M.A., Agricultural Economics, Washington State University B.S., Range Management, University of Nairobi

10.0 Distribution List

The distribution of the Texas-Oklahoma Passenger Rail Study service-level Draft environmental impact statement (EIS) emphasizes the use of electronic media to ensure cost-effective, broad availability to the public and interested parties. The entire service-level Draft EIS, appendixes, and supporting reports are available on the internet on the Texas-Oklahoma Passenger Rail Study Federal Railroad Administration and the Texas Department of Transportation websites (http://www.fra.dot.gov/Page/P0716 and http://www.txdot.gov/inside-txdot/projects/studies/statewide/texas-oklahoma-rail.html). The service-level Draft EIS is also available at the repositories listed below.

All persons, agencies, and organizations listed in this chapter have been informed of the availability of, and locations to obtain, the service-level Draft EIS, as well as the timing of the 45-day formal comment period. Notices of availability of the Draft EIS have been included in the Federal Register. Repositories and cooperating federal agencies were sent both hard and electronic copies of the Draft EIS and appendixes. Other federal agencies, state agencies, and the selected interested parties listed below were sent summary chapters and electronic copies of the Draft EIS. Federal, state, and county elected officials, mayors of cities with possible stations, and potentially affected local agencies listed below were mailed instructions about how to obtain a copy of the Draft EIS. Additional local elected officials and agency representatives, along with others on the mailing list (approximately 187 contacts), have been mailed a notification that includes information about how to access the Draft EIS, timing for the formal comment period, and public hearing dates, times, and locations.

10.1 Repository Locations

Federal Railroad Administration
1200 New Jersey Ave. SE
Washington, D.C. 20590

Oklahoma Department of Transportation
200 NE 21st Street
Oklahoma City, Oklahoma 73105

Texas Department of Transportation
125 E. 11th Street
Austin, Texas 78701

Federal Railroad Administration
1200 New Jersey Ave. SE
Washington, D.C. 20590

10.2 Federal Agencies

Advisory Council on Historic Preservation
Sarah T. Bridges
Federal Preservation Officer
P.O. Box 2890
Washington, D.C. 20013-2890

Bureau of Indian Affairs
Director, Southern Plains Regional Office
Dan Deerinwater
WCD Office Complex

Bureau of Land Management
Richard Fields
Assistant Field Office Manager
7906 E. 33rd Street, Suite 101
Tulsa, Oklahoma 74145-1352

Bureau of Reclamation
Regional Director
Michael Ryan
P.O. Box 36900
Billings, Montana 59107

Federal Aviation Administration
Aeronautical Center
6500 South MacArthur Blvd.
Oklahoma City, Oklahoma 73169

Federal Emergency Management Agency
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Federal Highway Administration
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Federal Highway Administration
Gary Corino
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Federal Transit Administration
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Regional Administrator for Region 6
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Health and Human Services Region 6
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International Boundary and Water Commission
John Merino
Principal Engineer, US Section
4171 N. Mesa, Suite C-100
El Paso, Texas 79902-1441

National Marine Fisheries Service
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263 13th Avenue South
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National Resources Conservation Service
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Regional Conservationist, Southeast
1400 Independence Ave., SW, Room 5105-A
Washington, D.C. 20250

U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

U.S. Bureau of Indian Affairs
Bill Walker
Regional Director
South West Regional Office
1001 Indian School Road, NW
Albuquerque, New Mexico 87104

U.S. Coast Guard
David Frank
Commander DPB, Eight Coast Guard District
500 Poydras Street
New Orleans, Louisiana 70130-3310

U.S. Department of Energy
Scott Hine
Director
Office of National Environmental Policy Act
1000 Independence Ave.
Washington, D.C. 20585

U.S. Department of Homeland Security
The Honorable Jeh Johnson
Secretary of Homeland Security
Washington, D.C. 20528

U.S. Environmental Protection Agency
Rhonda Smith
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EPA Region 6 Main Office
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202

U.S. Fish and Wildlife Service
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Southwest Region, P.O. Box 1306
Albuquerque, New Mexico 87103-1306

U.S. Forest Service
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Southern Region
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10.3 State Agencies

Texas Coastal Coordination Council
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Austin, Texas 78711-2873

Texas General Land Office
Hal Croft
Asset Management Deputy Commissioner
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Austin, Texas 78711-2873

Texas Commission on Environmental Quality
Zac Covar
Executive Director
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Austin, Texas 78711-3087

Texas Historical Commission
Mark Wolfe
Executive Director
P.O. Box 12276
Austin, Texas 78711

Texas Parks and Wildlife Department
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Austin, Texas 78744

Oklahoma Department of Environmental Quality
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2800 North Lincoln Blvd.

Oklahoma Department of Transportation
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Oklahoma City, Oklahoma 73105-3204

Oklahoma Conservation Commission
Mike Thralls
Executive Director
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Oklahoma City, Oklahoma 73105

Oklahoma Tourism and Recreation Department
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Oklahoma City, Oklahoma 73104

Oklahoma Department of Wildlife Conservation
Richard Hatcher
Director
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Oklahoma City, Oklahoma 73152-8804

Oklahoma State Historic Preservation Office
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Oklahoma City, Oklahoma 73105

Oklahoma Water Resources Board
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Oklahoma Conservation Commission
Mike Thralls
Executive Director
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10.4 Elected Officials

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City Commission Chambers
Ardmore, Oklahoma 73402

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Norman, Oklahoma 73070

Charles Lamb
Mayor, City of Edmond
24 E. First St.
P.O. Box 2970
Edmond, Oklahoma 73083

Mick Cornett
Mayor, City of Oklahoma City
200 N Walker, 3rd Floor
Oklahoma City, OK 73102

Jim Goldsworthy
Mayor, City of Gainesville
200 South Rusk
Gainesville, Texas 76240

Mike Rawlings
Mayor, City of Dallas
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Betsey Price
Mayor, City of Fort Worth
1000 Throckmorton St.
Fort Worth, Texas 76102

Edith Turner Omberg
Mayor, City of Hillsboro
1048 Park Drive
Hillsboro, TX 76645

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Mayor, City of Temple
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Temple, Texas 76501

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Nelda Martinez
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David Lee
Mayor, City of Purcell
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Benjamin Gomez
Mayor, City of Nuevo Laredo
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10.4.1 Federal Elected Officials

U.S. Senators

The Honorable Jim Inhofe
1924 S. Utica Ave #530
Tulsa, Oklahoma 74104

The Honorable Ted Cruz
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Suite 961
Austin, Texas 78701

U.S. House of Representatives

The Honorable Filemon Vela
437 Cannon HOB
Washington, D.C. 20515

The Honorable Ruben Hinojosa
2262 Rayburn, HOB
Washington, D.C. 20515

The Honorable Henry Cuellar
2209 Rayburn, HOB
Washington, D.C. 20515

The Honorable Will Hurd
317 Cannon HOB
Washington, D.C. 20515

The Honorable Lamar Smith
2409 Rayburn, HOB
Washington, D.C. 20515

The Honorable Lloyd Doggett
2307 Rayburn HOB
Washington, D.C. 20515

The Honorable Michael T. McCaul
131 Cannon HOB
Washington, DC 20515

The Honorable John Carter
2110 Rayburn HOB
Washington, D.C. 20515

The Honorable Roger Williams
1323 Longworth HOB
Washington, D.C. 20515

The Honorable Bill Flores
1030 Longworth HOB
Washington, D.C. 20515

The Honorable Joe Barton
2107 Rayburn HOB
Washington, D.C. 20515

The Honorable Marc Veasey
414 Cannon HOB
Washington, DC 20151

The Honorable Eddie Bernice Johnson
2468 Rayburn HOB
Washington, D.C. 20515

The Honorable Michael Burgess
2336 Rayburn HOB
Washington, D.C. 20515

The Honorable Sam Johnson
2304 Rayburn HOB
Washington, D.C. 20515

The Honorable Mac Thornberry
2208 Rayburn HOB
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3.1 Air Quality

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3.2 Water Quality

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3.3 Noise and Vibration

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5.0 Unavoidable Adverse Effects

None.

6.0 Cumulative Effects

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7.0 Permits

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8.0 Public Involvement

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