Appendix K

Archaeological Sites Technical Study

Archaeological Sites

Technical Study

Prepared by

Texas Department of Transportation

U.S. Department of Transportation
Federal Railroad Administration

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Abbreviations and Acronyms

APE	Area of Potential Effect
CFR	Code of Federal Regulations
CONV	conventional rail
BTAS	*Bulletin of the Texas Archeological Society*
EIS	environmental impact statement
FR	Federal Register
FRA	Federal Railroad Administration
HrSR	higher-speed rail
HSR	high-speed rail
IH-35	Interstate Highway 35
ITC	Intermodal Transportation Center
KCS	Kansas City Southern
mph	miles per hour
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
OAS	Oklahoma Archeological Survey
ODOT	Oklahoma Department of Transportation
Program	Texas-Oklahoma Passenger Rail Program
SHPO	State Historic Preservation Officer
Study	Texas-Oklahoma Passenger Rail Study
TARL	Texas Archeological Research Laboratory
TCP	traditional cultural properties
THC	Texas Historical Commission
TxDOT	Texas Department of Transportation
U.S.C.	United States Code

1.0 Introduction

The Texas Department of Transportation (TxDOT), along with the Federal Railroad Administration (FRA), is preparing a service-level environmental impact statement (EIS) to evaluate intercity passenger rail service alternatives for the Texas-Oklahoma Passenger Rail Program (Program). 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 air travel. Preparation of the service-level EIS, in support of which this technical study has been prepared, is one of two primary objectives of the Texas-Oklahoma Passenger Rail Study (Study). In addition to the service-level EIS, TxDOT and FRA are preparing 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 is a partnering state agency for the Study and the EIS.

The 850-mile corridor analyzed for the Study runs north-south and roughly parallels Interstate Highway 35 (IH-35), with the northern point in Edmond, Oklahoma (i.e., 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, as shown on Figure 1-1. For this service-level analysis, a preliminary alignment was developed to represent each EIS alternative, based on conceptual engineering that considered and avoided obvious physical or environmental constraints. These alignments were 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. A broad corridor of study with a width of 500 feet has been identified along each route. Unless described differently, for each environmental resource being analyzed, this 500-foot EIS Study Area[1] is the area in which potentially affected environmental resources are identified in proximity to each alternative. This EIS Study Area provides an envelope that could accommodate areas for associated effects, including 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.

The area for which data were collected is identified as the Study Vicinity. Typically, county-wide data were collected for counties partially or completely within the Study Area.

The analysis provides quantitative information about archaeological sites 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 rail, higher-speed rail, or high-speed rail) relative to the environmental context. However, because the 500-foot EIS Study Area does not represent the actual footprint of operation

[1] Some environmental resource issues, such as transportation, air quality, and noise and vibration, use broader study areas to determine impacts.

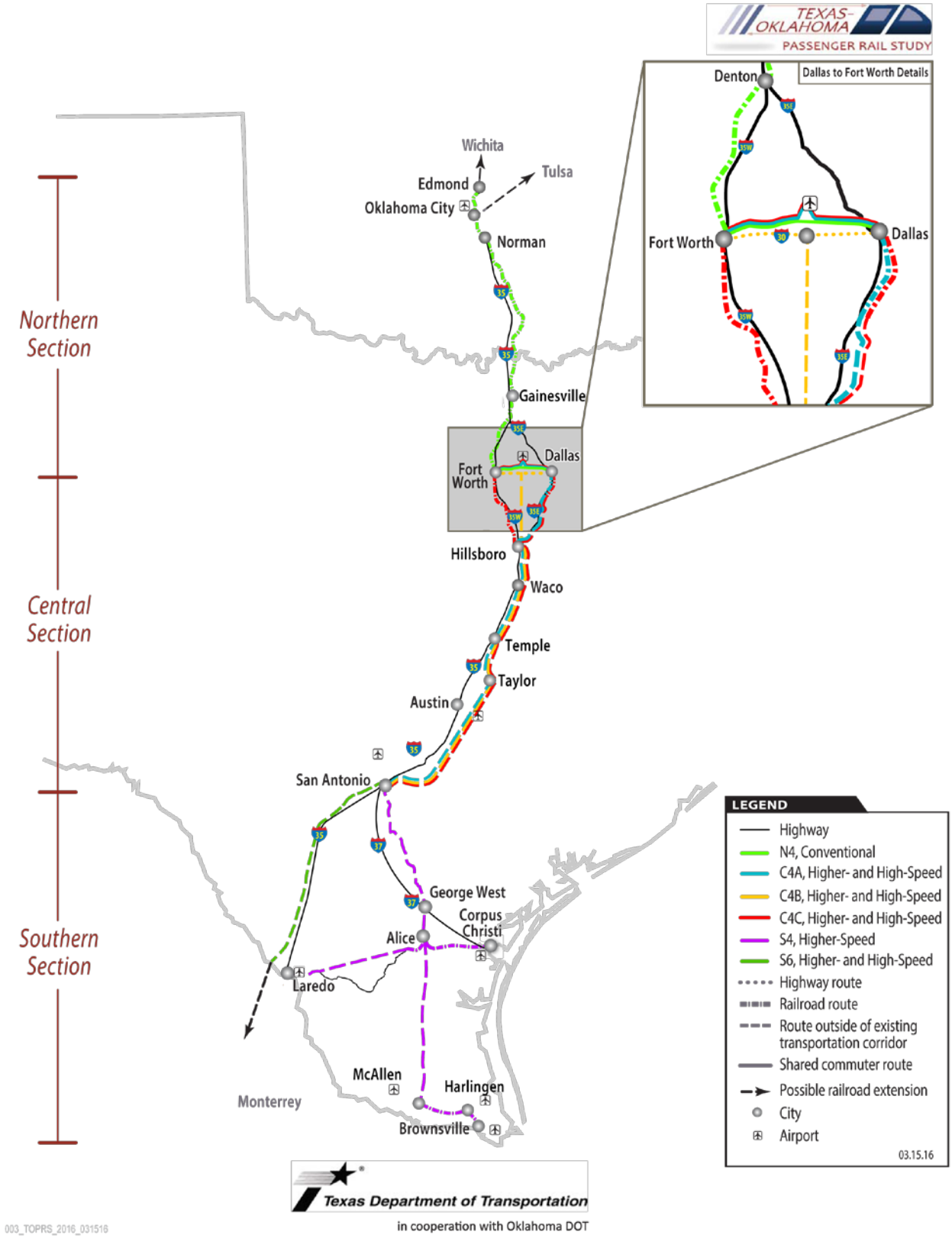


Figure 1-1: Build Alternatives

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 build alternatives are divided into the following three geographic sections based on the key regional markets that could be served by passenger rail improvements:

- 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

In addition, the 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 that have been carried forward for analysis in the EIS, including their geographic sections, routes, and service types, are listed in Table 1-1 and described in the following sections.

Table 1-1: Alternatives Carried Forward for Further Evaluation

Route	Service Type [a]
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 (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)

The route alternatives were based on the alignments of existing transportation networks with corridors potentially suitable for passenger rail operations (i.e., the existing railroad network and the existing interstate highway network) (the term “operations” includes maintenance of the facilities as well), 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 the existing transportation corridor could have greater indirect effects than those located in the existing transportation corridor; for example, alternatives outside existing corridors could divide neighborhoods or wildlife communities or create a potential new barrier.

1.1 Service Type Descriptions

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

1.1.1 Conventional Rail

Conventional rail 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 would be operated at speeds up to 79 to 90 mph and would mostly use existing railroad rights-of-way. For conventional rail alternatives, 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.

1.1.2 Higher-Speed Rail

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, but higher speeds can require improvements, such as upgrading wooden ties with concrete ties, improving signaling, and upgrading roadway crossings. In this case, higher-speed rail trains are assumed to be diesel-powered. 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. However, unlike high-speed rail, the design would not include electrification or a full double track, and some grade crossings would remain.

1.1.3 High-Speed Rail

High-speed rail 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 suspension and braking systems are designed for high-speed travel. 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. The alignment would be electrified and double-tracked. 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.

1.2 Alternative Descriptions

For this service-level analysis, a preliminary alignment was developed to represent each route alternative, based on conceptual engineering that considered obvious physical or environmental constraints. They are not detailed alignments that have been refined to optimize performance, reduce cost, avoid specific properties or individual environmental resources, or similar considerations, which would be assessed at the project-level phase for alternatives carried forward for further analysis.

The alternatives evaluated in the service-level EIS, shown on Figure 1-1, 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. When a route alternative is refined to include a service type (conventional, higher-speed, or high-speed rail), it is then referred to as an alternative. 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.

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, within an existing right-of-way or generally adjacent to existing tracks depending on the service type.

The Southern Section alternatives include a potential extension to Monterrey, Mexico. The EIS evaluates alignment corridors only within the United States; however, the potential extension to Monterrey has been included for ridership analysis purposes, and FRA and TxDOT have initiated coordination with the Mexican government about the potential extension.

1.2.1 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 and committed improvements to these systems. The No Build Alternative includes existing and planned roadway, passenger rail, and air travel in the Study Vicinity (including operation, maintenance, and expansion). Information was collected from current regional transportation plans within the Study Vicinity and websites describing services, such as train schedules. These improvements and their evaluation at this service-level stage would require

project-specific assessment. Conducting detailed project-specific assessments at this stage of the program development process is not feasible, except from a cumulative analysis perspective.

1.2.2 Northern Section: Oklahoma City to Dallas and Fort Worth

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

1.2.2.1 Alternative N4A Conventional Rail

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 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.

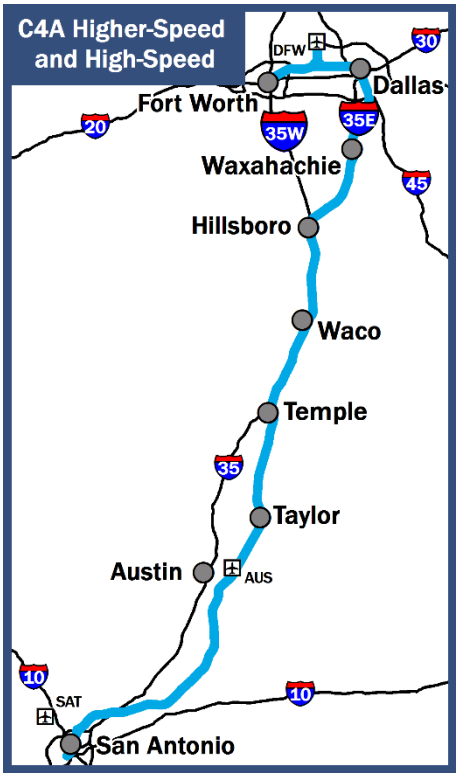
Alternative N4A would provide several improvements over the existing Heartland Flyer service. Alternative N4A would increase the number of daily round trips along this route (the Heartland Flyer currently offers one round trip per day), and the N4A route would extend from Fort Worth to Dallas without 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 the remaining local trains making up to 12 stops.

1.2.3 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 options would provide 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.

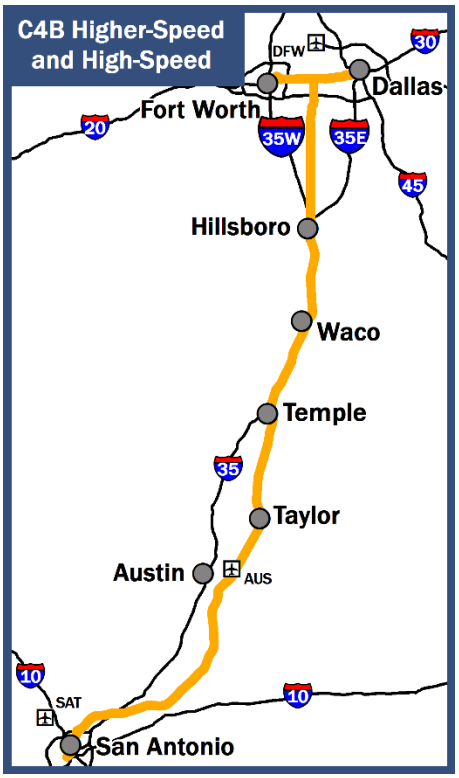


1.2.3.1 Alternative C4A Higher-Speed and High-Speed Rail

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, traveling south from Waxahachie through Hillsboro, Waco, Temple, Taylor, and Austin to San Antonio.

Alternative C4A Higher-Speed Rail assumes new high-performance 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 C4A High-Speed Rail assumes true 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 nine stops.

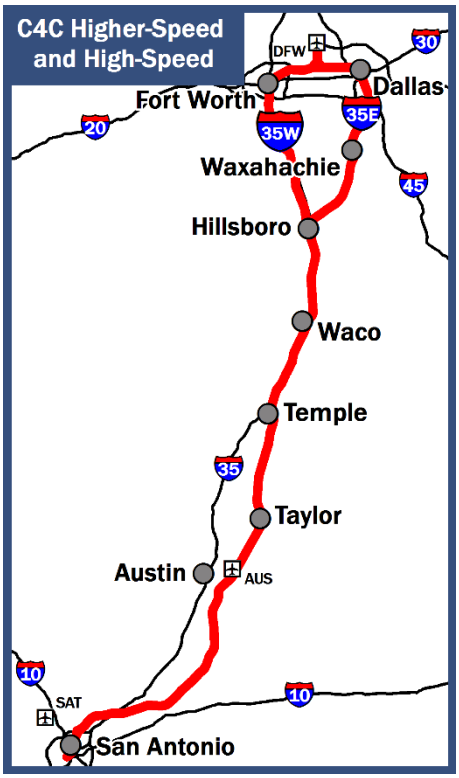


1.2.3.2 Alternative C4B Higher-Speed and High-Speed Rail

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 high-performance 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 true 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.



1.2.3.3 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 Alternative C4A).

Alternative C4C Higher-Speed Rail assumes new high-performance 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 true 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 nine stops.

1.2.4 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.

1.2.4.1 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 assumes new high-performance 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.

1.2.4.2 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 high-performance 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 is 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 true electric-powered, high-speed service running eight to 12 daily round trips between San Antonio and Laredo. If an extension from Laredo to Monterrey is added, the frequency of trips to Monterrey is assumed to be the same as those from San Antonio to Laredo.

1.2.5 Station Cities

The study 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 the alternatives analysis (TxDOT 2014), 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 1-2.

Table 1-2: 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

2.0 Regulatory Requirements

Applicable legislation and regulations pertaining to archaeological sites within the EIS Study Area include the following.

2.1.1 Federal Laws, Regulations, and Executive Orders

- **Section 106 of the National Historic Preservation Act (NHPA) of 1966 and implementing regulations 36 CFR 800**. 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 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). 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 (NHPA Section 101[d]). These regulations 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 United States Code [U.S.C.] §303 and 23 U.S.C. §138), compliance with which is anticipated at the project level. For more information on Section 4(f), see the Draft EIS, Chapter 4, Section 4(f) and Section 6(f) Resources.

  Regulations in 36 CFR 800 provide the following four-step-by-step process for satisfying the Section 106 requirements: (1) initiate consultation with regulatory agencies, concerned Native American tribes, and other interested parties; (2) identify historic properties; (3) assess adverse effects; and (4) resolve adverse effects. Significant properties are evaluated in consultation with the SHPO and must qualify for listing in the NRHP by being at least 50 years old, in most cases, and by meeting specific eligibility criteria and standards of integrity (36 CFR 60.4).

At the project level, the investigation may require procedures to adhere to additional federal statutes and regulations, as necessary, which may include the following:

- **American Indian Religious Freedom Act of 1978, as amended (Public Law No. 95-341, 92 Stat. 469) and implementing regulations (U.S.C. Title 42, Chapter 21 [I], §1996).** State that federal agencies should consult tribes regarding potential impacts from agency actions or undertakings that may affect tribal rights to the free exercise of traditional religions including effects on religious places and practices to the extent practicable and not inconsistent with the agency's essential functions. This consultation may occur in conjunction with NHPA Section 106 consultation.
- **Executive Order 13007 of 1996.** Applies to federal lands and requires federal agencies to accommodate access to and ceremonial use of Indian sacred sites by Native American religious practitioners; avoid adverse effect on the physical integrity of such sites; maintain the confidentiality of information on such sites, where appropriate; and implement procedures to

carry out provisions of the order, including provisions to provide notice to Indian tribes of actions that might affect sacred sites or access to or ceremonial use of such sites in a manner consistent with government-to-government relations.

Additional federal statutes may include the Archaeological Resources Protection Act, the Native American Grave Protection and Repatriation Act, the Federal Antiquities Act, the Federal Historic Sites Act, the Abandoned Shipwreck Act, and the Archaeological and Historic Preservation Act.

2.1.2 State Laws 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 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 unlawful to intentionally and knowingly deface American Indian or aboriginal paintings, pictographs, petroglyphs, or other marks or carvings on rock or elsewhere that are of archaeological interest and pertain to early American Indian or aboriginal habitation of the country and to willingly injure, disfigure, remove, or destroy archaeological resources including a prehistoric or historic structure, site, monument, marker, medallion, burial, burial marker, or artifact 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 and 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 Title 13, Chapter 26).** Serves 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 including prehistoric American Indian or aboriginal campsites, dwellings and habitation sites, aboriginal paintings, petroglyphs, and other marks or carvings on rock or elsewhere that pertain to early American Indian or other archaeological sites of every character, treasure imbedded in the earth, sunken or abandoned ships and wrecks of the sea or any part of their contents, maps, records, documents, books, artifacts, and implements of culture 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 project effects on 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 in 2009 (Texas Health and Safety Code Title 8, Subtitle C, Chapter 711) and associated regulations (Texas Administrative Code 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 (i.e., one or more intentional human graves) without consent and include provisions for discovery, removal, and reburial of cemeteries, particularly those considered unknown, abandoned, or otherwise non-perpetual care, within public or private property. Cases where newly discovered previously unknown 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.

FRA's *Procedures for Considering Environmental Impacts* states: "In accordance with Section 106 of the National Historic Preservation Act (NHPA), 16 U.S.C. 470(f), the EIS shall identify all properties which may be affected by the alternatives that are included in or eligible for inclusion in the National Register of Historic Places (NRHP)." This technical study outlines potential effects on archaeological historic properties at the service level. Therefore, this technical study does not require a Section 106 analysis of the NHPA or the Texas Antiquities Code because there is no proposed undertaking associated at the Program level. Documentation in accordance with Section 106 and the Texas Antiquities Code would be required at the project level.

With regard to regulations in 36 CFR 800, because of the service level of this evaluation, consultation with Indian tribes was limited to *informal* consultation, which included sending coordination letters to known tribes in the EIS Study Area and meeting with tribes interested in receiving additional information. This coordination is further described in the Texas-Oklahoma Passenger Rail Study Agency and Tribal Coordination Plan. Additional tribal consultation would continue at the project level, as required.

3.0 Evaluation Methods

This section describes the method to identify archaeological sites listed on the NRHP, archaeological sites determined NRHP-eligible by the Texas or Oklahoma SHPO, and archaeological sites with undetermined NRHP eligibility within the EIS Study Area. NRHP-listed archaeological sites are sites that have already been formally listed in the NRHP. NRHP-eligible archaeological sites are those that have been previously determined eligible for the NRHP by the Texas or Oklahoma SHPO. Archaeological sites with undetermined NRHP eligibility have not yet been sufficiently assessed, and therefore no determination of NRHP eligibility has yet been made by the Texas or Oklahoma SHPO. Archaeological sites with undetermined NRHP eligibility are included in this service-level analysis because such sites should be treated as NRHP-eligible sites until final eligibility determinations have been made by the Texas or Oklahoma SHPO. Archaeological sites that have been determined ineligible for inclusion in the NRHP do not require further inquiry and have not been included in this service-level analysis.

This technical study includes a service-level evaluation of reported archaeological sites in proximity to the build alternatives. As such, it identifies recorded prehistoric and historic archaeological sites using an online database of sites maintained by the Texas SHPO, site file repositories in both states, and reconnaissance-level data. It does not include a detailed evaluation of potential archaeological sites.

This study used a broad approach to determine the potential effects on archaeological sites along the alternatives. This study does not discuss historic, architectural, and non-archaeological cultural resources. Those property types are discussed in the Historic, Architectural, and Non-Archaeological Cultural Resources Technical Study (see Appendix J of the Draft EIS).

Another type of cultural resource that should be considered for effects from the build alternatives are traditional cultural properties (TCPs). TCPs are a specific type of historic property included or eligible for inclusion in the NRHP that are associated with cultural beliefs or practices of a living community, which are rooted in history and important to the continuing cultural identity of the community (Parker and King 1998). TCPs would not be identified until tribal consultation and public scoping take place; therefore, specific TCPs were not included in this evaluation.

3.1 Data Sources

Information on archaeological sites was obtained from electronic databases and physical records at research libraries and institutions including the following sources:

- THC's Texas Historic Sites Atlas online database
- THC/Texas SHPO's restricted use library
- University of Texas Archeological Research Laboratory's (TARL) site file repository and library
- OAS site file repository

In addition to the electronic resources listed above, hard-copy files of site forms, topographic maps, and cultural resource reports were reviewed at OAS, TARL, and THC/Texas SHPO offices. These files

provided information on archaeological sites within the EIS Study Area, their locations, and previous determinations of NRHP eligibility. Sources used in the preparation of this technical study are listed in Section 8.0, References.

3.2 Data Collection

Data were collected to identify the location, description, and significance of each previously identified archaeological site within the EIS Study Area, which is defined as a 500-foot-wide corridor for each alternative regardless of whether it travels through urban or rural areas. The NRHP-listed, NRHP-eligible, and unknown NRHP-eligible archaeological sites identified during data collection are listed in Section 4, Baseline/Affected Environment.

3.3 NRHP Significance Criteria

Historic properties are prehistoric or historic archaeological sites, TCPs, and districts and buildings, structures, objects, or landscapes that are listed or eligible for listing on the NRHP. To be eligible, a property must be at least 50 years old or be exceptionally important and meet one or more of the following criteria for evaluation, as outlined in 36 CFR 60.4:

- Criterion A: The property is associated with events that have made a significant contribution to the broad patterns of history.
- Criterion B: The property is associated with the lives of persons significant in the past.
- Criterion C: The property embodies the distinctive characteristics of a type, period, or method of construction; represents the work of a master; possesses high artistic values; or represents a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D: The property has yielded, or may be likely to yield, information important to prehistory or history.

In addition to meeting one of these four criteria, archaeological historic properties must retain their stratigraphic or locational integrity, preservation of and sufficient amounts of interpretable materials, and cultural association in order to convey their significance.

For this technical study, archaeological sites are defined as any prehistoric or historic site (generally 50 years of age or older) for which NRHP eligibility may not yet have been formally determined. Archaeological historic properties, specifically, are defined as those archaeological sites already listed on the NRHP or that have been formally determined eligible for listing on the NRHP. Archaeological sites that have not yet been sufficiently assessed for NRHP listing have been treated as historic properties until final eligibility determinations have been made.

3.4 Service-Level Analysis

The Advisory Council on Historic Preservation's regulations implementing Section 106 of the NHPA have created a process by which federally assisted undertakings are reviewed for their impacts on properties listed or eligible for listing on the NRHP. After the property is identified and evaluated,

the next step is to apply the Criteria of Adverse Effect. These criteria are used to determine whether the undertaking could change the characteristics that qualify the property for NRHP inclusion. An adverse effect (or impact) is found when an undertaking may alter, directly or indirectly, the characteristics of a historic property that qualify the property for inclusion in the NRHP. Adverse effects on an archaeological historic property consist of the physical encroachment upon an archaeological site. In addition to the criteria above, 36 CFR 800.5(b) allows the agency official to propose a finding of no adverse effect if the undertaking is modified or conditions are imposed to avoid impacts.

Most impacts on archaeological sites occur during construction when ground is disturbed. These effects are considered direct effects. Impacts during the operations phase are primarily the indirect effects of inducing growth whereupon other development exposes disturbance to archaeological sites. This service-level analysis focused primarily on potential effects during construction.

The likelihood for adverse effects on archaeological sites differs slightly between rail service types as follows:

- Conventional rail would include only existing railroad rights-of-way, typically using existing railroad tracks or modifying existing tracks within the existing right-of-way to accommodate additional trains. At-grade railroad crossings and the use of existing stations would be required.
- Higher-speed rail alternatives could be either diesel or electrified. This technology can include both new right-of-way, as well as shared right-of-way with existing railroad tracks. Stations may be adapted from existing buildings or railroad stations. This potential for reuse of existing facilities may reduce the amount of disturbance to areas otherwise left untouched.
- High-speed rail alternatives would be electrified, double tracked, and grade-separated. High-speed rail service would require a separated right-of-way for the alignment and stations. In addition, high-speed rail service would require gradual vertical and large horizontal curve changes, making avoidance of specific archaeological sites more difficult than the higher-speed rail option. Although the exact locations of new stations are not delineated for this service-level analysis, they would likely be located within or adjacent to primarily urban and suburban communities, such as Fort Worth, Dallas, Waxahachie, Waco, Temple, Austin, and San Antonio. Areas subject to intensive development, such as these, may display substantial ground surface disturbance depending on soil characteristics and age, topography, geology, and intensity and nature of development. This intensive development may affect the integrity of archaeological sites. Elevated portions of the high-speed rail service type may help avoid some archaeological sites.

The following activities were conducted during this service-level analysis:

- Delineated an EIS Study Area for each alternative to evaluate archaeological sites. The EIS Study Area for each alternative is a 500-foot-wide corridor within which the rail alignment would be positioned during further design development phases.

- Prepared a general prehistoric context using the cumulative and interpretive results of archaeological research in the subject areas to date. Presented the prehistory and environmental setting of the alternatives to provide the general context to evaluate archaeological sites identified in the EIS Study Area. Historic cultural background for the EIS Study Area is presented in Section 4.2 of the Historic, Architectural, and Non-Archaeological Cultural Resources Technical Study, included as Appendix J of the Draft EIS.
- Identified known archaeological historic properties (those that are included in or eligible for inclusion in the NRHP) 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's restricted use library, TARL's site file repository and library, and the OAS site file repository. 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. As appropriate for a service-level evaluation, a literature search and a review of previous archaeological surveys were not conducted.
- Plotted previously recorded and registered archaeological sites within the EIS Study Area that have undetermined eligibility but may meet NRHP eligibility (to be further assessed and formal determinations of NRHP eligibility to be completed at the project level). As appropriate for a service-level evaluation, no subsurface archaeological investigations were undertaken to locate previously unidentified archaeological sites or assess the integrity of previously recorded sites, and areas of archaeological sensitivity were not formally delineated.
- Conducted a preliminary assessment of the potential effects on known archaeological historic properties and on previously recorded and registered archaeological sites with undetermined NRHP eligibility within the EIS Study Area for each alternative. The assessment of potential effects was based on preliminary information and research conducted at the service level; potential effects may need to be reassessed based on changes to the proposed Program. Formal determination of effects pursuant to NEPA and NHPA would be made during the project-level NEPA process.

4.0 Baseline/Affected Environment

4.1 EIS Study Area

The EIS Study Area for archaeological sites was defined in consultation with FRA. As previously stated, this service-level analysis of archaeological sites was conducted at a corridor level. Future studies conducted at the project level would likely define a specific APE through the development of a Programmatic Agreement among FRA, TxDOT, Oklahoma Department of Transportation (ODOT), and Texas and Oklahoma SHPOs. Project-specific research, including archaeological surveys in areas of the APE not previously investigated and site significance assessments of archaeological sites with unknown NRHP-eligibility, would be conducted for individual projects when they are proposed.

This service-level analysis did not identify the locations of potential easements and construction-related facilities, such as equipment staging areas, access roads, and utilities. The locations of these facilities would likely be identified during project-level analysis, and a specific APE would be defined during development of a Programmatic Agreement.

4.2 Brief Prehistoric Cultural Background of Region

The archaeological cultural background is divided into three geographic sections as shown on Figure 1-1. Archaeological site types vary, and often these are partly based on an area's ecology. Five physiographic natural regions compose the EIS Study Area; these regions and their typical archaeological associations are identified in Table 4-1. This is not an inclusive list of all types of archaeological sites, but is presented as a general guideline for the range of prehistoric site types that might be present in the EIS Study Area.

Table 4-1: Prehistoric Archaeological Site Types by Natural Region

Natural Region	Typical Prehistoric Archaeological Site Types
Central Great Plains/High Plains	Paleoindian and Archaic lithic scatters, lithic procurement sites, rock shelters, open camps, and mammoth or bison kill sites; Archaic and Late Prehistoric lithic scatters, lithic procurement sites, open camps, rock shelters, and bison kill or hunting sites; Late Prehistoric lithic scatters, open camps, workshops, and plains villages.
Cross Timbers and Blackland Prairie	Paleoindian lithic scatters, open camps, and bison kill or processing sites; Archaic, Plains Woodland, Late Prehistoric, and Protohistoric lithic scatters, lithic procurement sites, open camps, burned rock middens, rock shelters, bison kill or hunting sites; Archaic and Late Prehistoric cemeteries and open camps, including Caddo open camps, hamlets, villages, and cemeteries.
Edwards Plateau	Paleoindian to Late Prehistoric lithic scatters, open camps, lithic procurements sites, rock shelters, and burned rock middens.
Gulf Coast Prairies	Paleoindian to Late Prehistoric lithic scatters, open camps, lithic procurement sites, and burned rock middens; Archaic to historic cemeteries, open camps, and shell middens.

Natural Region	Typical Prehistoric Archaeological Site Types
South Texas Plains and Coastal Sand Plains	Paleoindian to Late Prehistoric lithic scatters, shell middens, and open camps; Archaic to historic Indian lithic scatters, lithic procurement sites, shell middens, open camps, lithic procurement sites, and cemeteries.
Source: Perttula (2004).	

Each natural region is described below for each of the three geographic sections.

4.2.1 Northern Section: Oklahoma City to Dallas and Fort Worth

4.2.1.1 Edmond, Oklahoma, to the Oklahoma/Texas Border

Central and south-central Oklahoma compose the southern extension of the Osage Savanna or Great Plains. This mix of scrub forest uplands and mixed prairie grasslands, interspersed with meadows and heavily wooded stream valleys, has a greater diversity of bedrock and topography than found to the north (Drass and Martin 2010). The EIS Study Area is characterized north to south by the hills and rolling uplands of Permian or Pennsylvania sandstone and shale; the folded remnants of the Arbuckle Mountains; and sands, clays, and limestone deposited by Cretaceous streams and seas (Wyckoff and Brooks 1983). This transitional or ecotonal zone, between the eastern woodlands and mixed grass prairies farther to the west, supported diverse plant and animal communities available to the prehistoric peoples of south-central Oklahoma. The native vegetation in south-central Oklahoma and north-central Texas is known as the Cross Timbers.

4.2.1.2 Oklahoma Cultural Background

The overview of prehistoric south-central Oklahoma is derived mainly from the cultural history prepared by Wyckoff and Brooks (1983). Additionally, the culture history provided below draws heavily on available summaries of the region, particularly those prepared by Drass and Martin (2010), Drass and Clanahan (2008), and Brooks and Bowman (2005).

In contrast to other areas of Oklahoma, fewer archaeological investigations have been conducted in the south-central part of the state, and these have generally been limited in scope. This may have a direct correlation with the low number of documented archaeological sites in this portion of the state. The earliest investigations were conducted by H. R. Antle. Between 1930 and 1942, Antle excavated two prehistoric villages and a rock shelter, tested an open camp, and reported pictographs, unusual artifacts, and site locations (Wyckoff and Brooks 1983). Between 1937 and 1942, Works Progress Administration funds supported the University of Oklahoma's archaeological excavations at numerous endangered sites. These included two major Plains Village settlements eroding into the Washita River (the Grant [34GV1] and Braden [34GV2] sites), a prehistoric ceremonial center near the North Canadian River (the Eufaula or Groseclose Mound [34MI145]), and three prehistoric sites and four 19th-century Chickasaw farmsteads later flooded by Lake Texoma (Wyckoff and Brooks 1983).

The era of reservoir development, beginning after World War II, resulted in numerous archaeological surveys and excavations. Within the general EIS Study Area, investigations were conducted at the Norman (later renamed Thunderbird) Reservoir (1955), Lake of the Arbuckles (1964), Arcadia Reservoir (1973), and the Seaward Reservoir in the 1980s (OAS 2014; THC 2014). Numerous sites were studied prior to their inundation; Archaic, Woodland, and Plains Village middens were sampled at Lake Texoma, and a large Woodland period settlement was excavated at the Lake of the Arbuckles. During this same period, investigations were conducted by the University of Oklahoma faculty and students, East Central State College, Oklahoma Geological Survey members, and the Highway Salvage Project archaeologists. Investigations were conducted at a Woodland hamlet (Brewer site [34ML3]), Plains Village settlements (Lee I [34GV3] and Lee II [34GV4] sites), a burned Woodland period house containing burials (Pickett Switch site [34PN1]), flint workshops and outcrops, a Plains Village Cemetery (Nagle site [34OK4]), an Archaic open camp (Evers site [state trinomial not available]), and a Plains Village (Montgomery site [state trinomial not available]) (Wyckoff and Brooks 1983).

Following the establishment of legislation to preserve significant cultural resources (NHPA of 1966 and NEPA in 1969) including archaeological sites, archaeological investigations increased significantly to fulfill environmental assessment requirements related to federally funded, licensed, or permitted projects with the potential to have an effect on significant cultural resources. Surveys related to utility corridors (water lines, natural gas pipelines, electric transmission lines) and transportation construction projects resulted in a better understanding of the types and numbers of archaeological sites, as well as insight into site settings and diverse habitats. The first evidence of a Caddoan village settlement in the general EIS Study Area was found by ODOT during excavations at the Plantation Site [state trinomial not available] in McIntosh County. Numerous upland hunting camps and lithic workshops, rock shelters, open camps, and prehistoric farmsteads were documented during surveys for the Soil Conservation Service impoundments projects. In addition, the Oklahoma Anthropological Society, OAS, and Oklahoma River Basin Survey archaeologists tested and excavated significant sites within the EIS Study Area. These include an 8,000-year-old open camp in Love County, a stratified Archaic-Woodland camp in Seminole County, a Plains Village camp in Murray County, and a 12th-century burned house in Garvin County (Wyckoff and Brooks 1983).

4.2.1.2.1 Paleoindian Period

The Paleoindian period is generally associated with high mobility; distinctive lanceolate, unnotched fluted dart points; and the hunting of extinct Pleistocene mammals, including Columbian mammoth (*Mammuthus columbi*), bison (*Bison antiquus*), camel (*Camelops* sp.), and horse (*Equus*). The earliest well-documented evidence of the first peopling of North America is the Clovis culture; it has been well documented across the continent (Drass and Clanahan 2008). Although the conventional view shows the Clovis people arriving about 12,000 years before the present (BP, meaning AD 1950), there is debate among archaeologists regarding the earliest peopling of North America. The bones of a Columbian mammoth found at the Cooperton site (state trinomial not available) in Kiowa County were radiocarbon dated from 21,000 to 17,000 BP. The cultural association has

been questioned at this site and other early sites considered pre-Clovis (Wyckoff and Brooks 1983); more research is needed to definitively document pre-Clovis occupations.

According to Wyckoff and Brooks (1983), the Paleoindian period in Oklahoma generally dates from approximately 17,000 to 9000 BP; it can be divided into the Early Paleoindian period (approximately 17,000 to 10,000 BP: pre-Clovis, Clovis, Hell Gap, and Folsom complexes) and the Late Paleoindian period (approximately 10,000 to 9000 BP: Plainview, Plano, Milnesand, and Portales complexes). Typical for many parts of Oklahoma and Texas, the Paleoindian record for south-central Oklahoma derives mainly from surface contexts or mixed with later cultural materials (Hofman 1989; Wyckoff and Brooks 1983). However, an Imperial mammoth (*Mammuthus imperator*) was found in clear association with three Clovis type dart points at the Domebo site (34CD50) in Caddo County; it was radiocarbon dated to approximately 11,800 BP. The typical tool kit includes the distinctive fluted Clovis dart point and associated hunting-related tools (flake scraper/graver, flake shaft plane, wedge shaped flake knife, and a pebble scraper).

Toward the end of the Pleistocene, changing climate and possibly human hunting pressure caused the abrupt extinction of the Pleistocene megafauna with the exception of *Bison antiquus*. This change is evident in the faunal assemblages of three Folsom complex kill and camp sites (Cooper [34HP45], Jake Bluff [34HP60], and Waugh [34HP42] sites) in northwestern Oklahoma dating around 11,000 BP (Drass and Clanahan 2008). Folsom groups primarily hunted *Bison antiquus*; their lithic assemblage included distinctive fluted Folsom dart points and unfluted lanceolate dart points along with tools oriented toward hunting-related tasks.

Late Paleoindian (approximately 10,000 to 9000 BP) people of the Plainview, Plano, Milnesand, and Portales complexes were hunter and gatherers who tracked bison over great distances exploiting diverse plants and animals (Drass and Clanahan 2008; Wyckoff and Brooks 1983). Suggesting population increase, sites and artifacts associated with this period are more numerous than in previous periods. The tool assemblages included grinding stones, knives and scrapers, and distinctive unfluted dart points, such as Plainview, Merserve, Milnesand, Golondrina, Angostura, Agate Basin, Hell Gap, Eden, Cody, and Scottsbluff. Two sites dating to this period were recorded near the EIS Study Area; these include a Plainview bison kill site (Perry Ranch [34JK81]) and a late Paleoindian or Early Archaic open camp/workshop (Pumpkin Creek [34LV49]).

4.2.1.2.2 Archaic Period

Few discrete Archaic period (approximately 9000 to 2000 BP) sites have been investigated in south-central Oklahoma (Wyckoff and Brooks 1983); however, the period is generally associated with the warm, dry Hypsithermal period that led to the extinction of large Pleistocene animals (Drass and Clanahan 2008). Because of these changing climatic conditions, new technologies and subsistence evolved as people became more dependent on hunting smaller game and gathering plants. The period is commonly divided into Early, Middle, and Late Archaic (Wyckoff and Brooks 1983) and is characterized by diversified hunting and gathering groups living in larger groups and maintaining seasonal rounds of camps.

Early and Middle Archaic (approximately 9000 to 4000 BP) sites are particularly scarce (Drass and Clanahan 2008). The Gore Pit site (34CM131) is the best documented Early Archaic site (approximately 6000 BP) in the region; emergency salvage work at this open camp recovered numerous features such as burned rock roasting ovens, shell middens, hearths, and one of the oldest human burials in Oklahoma (Drass and Clanahan 2008; Wyckoff and Brooks 1983). Diagnostic tools include side and corner notched dart points (Trinity, Ensor, Darl, Ellis, and Frio) and triangular Meserve dart points. The material assemblage from Early Archaic sites includes grinding basins, manos, scrapers, Clear Fork gouges, drills, knives, flake scrapers, hammerstones, bone awls, and bird bone beads. Local Ogallala quartzite dominates the lithic raw material type; however, some materials came from areas to the west and northeast. Faunal remains at Early Archaic sites indicate a diversification in resources that included small mammals, turtles, frogs, fish, and mussels. Best known and studied of the known Middle Archaic (approximately 7000 to 4050 BP) complexes (Drass and Clanahan 2008) is the Calf Creek horizon with sites across all of Oklahoma (Brooks and Bowman 2005; Drass and Clanahan 2008; Wyckoff and Brooks 1983). Although there is considerable diversity in settlements, Calf Creek sites are generally found on terraces or uplands overlooking rivers or streams. The site type includes open camps, bison kill sites, and lithic procurement sites. Distinctive lithic tools and the deep basal notched Calf Creek dart points are often associated with hearths, burned rock ovens, extensive lithic debitage, and bison and deer bones. The Kubik site (34KA354), a Middle Archaic site in Kay County, was radiocarbon dated from approximately 5300 to 6000 BP. The material assemblage includes bison and deer bone, Calf Creek dart points, and an abundance of lithic debitage along with intact hearths and burned rock roasting ovens (Brooks and Bowman 2005; Drass and Clanahan 2008). Adjacent to the EIS Study Area, Calf Creek has been documented in good context at the Hester/Adams site (34ML83). Another nearby Middle Archaic complex has been documented in northern Oklahoma; however, little information is available for the McKean complex.

The Late Archaic (approximately 4000 to 2000 BP) is better represented throughout Oklahoma. The climate became wetter after 4500 BP; the favorable conditions lead to larger and more numerous settlements that were more permanently built (Brooks and Bowman 2005). With larger populations, access to resources would have become more restricted leading to conflicts, exchange and trade of goods, and likely plant horticulture. In addition, the archaeological record during the Late Archaic and subsequent Woodland period describes formal and ritual burial treatments; near the EIS Study Area, three individuals with grave goods were found at the Late Archaic Bross site (34OK7) in central Oklahoma (Brooks and Bowman 2005).

The Late Archaic tool kit is similar to those from earlier Archaic period sites, although there is a notable increase of groundstone tools and specialized objects, such as bone and shell ornaments. The material assemblages include grinding stones and basins, handstones, knives, scrapers, bone tools (primarily awls and flakers), and ceramics (Wyckoff and Brooks 1983). Diagnostic dart points include corner notched, weakly barbed dart points (Marcos or Ellis, Palmillas or Williams, and Ensor) and contracting stem dart points (primarily Gary). Burned rock middens, hearths, and roasting ovens are common in Late Archaic open camps/hamlets with large communal bison kill

sites farther west and dispersed local societies relying on local plant and animal species in the central EIS Study Area (Brooks and Bowman 2005).

4.2.1.2.3 Woodland Period

The Woodland period (approximately 2000 to 1000 BP) is marked by the introduction of the bow and arrow, ceramic manufacturing, and farming tools (Drass and Clanahan 2008; Wyckoff and Brooks 1983). Hunting and gathering practices and the use of Late Archaic tools (see above) continued; however, through intensified gathering and horticulture, groups became more sedentary. The typical Woodland assemblage includes corner notched arrow points (Scallorn, Deadman), unifacial and bifacial flaked tools, cordmarked ceramics tempered with crushed stone, horticulture (charred corn), and early farming tools (hoes, axes, and adzes) along with hearths and roasting ovens. Woodland sites are sparse near the EIS Study Area; however, Woodland dated sites have been documented farther east and in the divide between the Washita and Red Rivers. Sites have been recorded as small open camps, workshops, and small farmsteads and attest to prolonged or semi-sedentary occupations (Drass and Clanahan 2008).

The introduction of farming may represent the immigration of ideas or farmers from the northeast and southeast or a natural development from horticulture by native hunters and gatherers. Sites containing smoothed flat bottom ceramics and lithic artifacts indicative of early Caddoan villages, located farther east, may represent trade items or Caddoan hunting camps. According to Wyckoff and Brooks (1983), a burned house from the Pickett Switch site (34PN1) resembles those common to Caddoan sites between 1150 and 1000 BP. Far to the northwest of the EIS Study Area, the Lake Creek and Palo Duro complexes developed in the Texas and Oklahoma Panhandles; the associated cultural assemblages are similar to those in the EIS Study Area with the exception of Mogollon brownware ceramics and, in some cases, Mogollon-style pit houses (Drass and Clanahan 2008).

4.2.1.2.4 Late Prehistoric (Village Farming) Period

The Late Prehistoric period (approximately 1000 to 500 BP) is marked by significant changes in technology, settlement, and subsistence (Drass and Clanahan 2008; Wyckoff and Brooks 1983). Although scattered small settlements existed prior to 950 BP, settlements increased in size and density along stretches of river valleys and major streams; likely due to increased rainfall on the Southern Plains (Wyckoff and Brooks 1983). The most studied period villages near the EIS Study Area include Alcorn (34ML1), Brewer (34ML3), Willingham (34ML5), and Duke (34ML37) (Brooks and Bowman 2005). Characteristics of this period include the intensification of horticulture, exclusive adaptation of the bow and arrow, proliferation of ceramics, extensive use of bison bone for agricultural tools, widespread use of storage pits, the use of permanent houses and larger settlements, and trade items from the Southwest and Caddoan areas to the east. Additionally, horses were used late in the period. The following three period phases have been defined within the EIS Study Area: the Paoli phase (1050 to 550 BP), the overlapping Washita River phase, and the Henrietta phase (750 to 500 BP).

The Paoli phase is characterized by settlement marked by small hamlets and villages along the Washita River with permanent wattle and daub rectangular houses with central hearths, storage pits, and hearths. Evidence of horticulture (corn, probably beans, and marshelder), gathering of wild plants and nuts, fishing, and hunting (primarily deer supplemented with small mammals, fish, and mussels) are common. Bison hunting was more common later in this phase. Diagnostic arrow points include side and corner notched Washita and Harrell with minor numbers of unnotched Fresno. Cordmarked ceramics dominate the assemblages of this phase with minor amounts of grit tempered plain ceramics. The typical Paoli phase assemblage also includes plano convex end scrapers, bifacial knives, abraders, manos, metates, bone awls and tools, and minor amounts of nonlocal lithic materials (Drass and Clanahan 2008).

The Washita River phase exhibits similarities to the Paoli phase as small and medium mammals and the gathering of wild plants remained important resources; however, subsistence emphasized bison hunting and the cultivation of corn, beans, and squash. Villages were more abundant and slightly larger than earlier villages and included nearby burials and distinct cemeteries. Smoothed ceramics were more common, a larger variety of temper was used, and some wares were decorated. Paoli phase lithics continued to be used; however, diamond-beveled knives used to butcher bison became more abundant and the variety of bone tools increased. Exotic cherts and ceramics and seashell ornaments are indicative of widespread trade with Southern Plains farmers (Drass and Clanahan 2008).

The Henrietta phase is in north-central Texas and south-central Oklahoma; most of the investigated sites in Oklahoma are situated along the Red River and its tributaries (Drass and Martin 2010). Villages, small camps, and bison kill sites are found on terraces and uplands near major streams along the Red River Valley. The Henrietta phase resembled the preceding Washita River phase with slight variations; these included oval house shapes with center posts, more stemmed arrow points such as Albas, use of local cherts and quartzites as well as exotic Edwards chert and Alibates agate, a greater variety of tools (hoes and digging sticks) used in plant cultivation, and an increased hunting of deer over bison and increased importance of fish and mussels (Drass and Martin 2010).

4.2.1.2.5 Protohistoric Period

Few Protohistoric period (approximately 450 to 150 BP or AD 1500 to 1800) sites have been identified in south-central Oklahoma. At the time of historic contact, the Wichita (descendants of Plains Villagers) and the Caddo lived in south-central Oklahoma. The Lowrance site (34MR10) is located near the EIS Study Area and has been associated with the Wheeler phase, which is thought to be ancestral to the historic Wichita (Drass and Clanahan 2008). Wheeler phase sites include large villages with houses and arbors and large encampments with fortifications. Bison hunting was emphasized and corn cultivation has been documented. Nonlocal pots, lithics, and shell items indicate intensified trade with Southwestern and Caddo groups. Typical Wheeler phase assemblages include unnotched (Fresno) and side notched (Washita and Harrell) arrow points with minor numbers of basal notched Garza arrow points, black sandy paste ceramics, diamond-beveled knives, expanding base drills, pipe reamers, large scrapers, and nonlocal chert including Alibates

and Edwards. The ceramic assemblages include plain or grog tempered ceramics and Southwestern and Caddoan ceramics (Drass and Clanahan 2008). Although some groups formed large seasonal to permanent villages, others maintained portable dwellings and moved with the bison herds.

Displaced native groups emigrating from the Southern Plains along with the arrival of Europeans dramatically altered native lifeways in Oklahoma. At the Lowrance site (34MR10), an Apache presence is represented in the material culture with intrusive black ceramics and obsidian tools. By AD 1719, the Wichita, Comanche, and Apache had been reported in the general area; pressure from outside native groups and Europeans changed societal dynamics (Brooks and Bowman 2005). European trade goods, including horses and firearms, as well as the introduction of new diseases, brought about systematic changes to village lifestyle, hunting, and warfare; entire villages were decimated. The majority of Protohistoric period investigations within 250 years of European contact have been conducted far from the EIS Study Area in western Oklahoma (Brooks and Bowman 2005). Many groups including the Wichita, who are well represented in south-central Oklahoma archaeological studies, returned to a nomadic way of life. This left large portions of south-central Oklahoma abandoned, contributing to the expansion of the French, Spanish, and American traders and explorers into the area. By AD 1830, the passage of the Indian Removal Act resulted in the removal of specific Native American tribes from the southeastern United States to Indian reservations in Oklahoma. Because of the continued expansion of settlers, establishment of military and trading posts, and the decimation of buffalo herds by white hunters, most of the Native Indians moved to reservations. The EIS Study Area became a buffer between Plains tribes and scattered, struggling communities of resettled Cherokee, Creek, Choctaw, Chickasaw, and Seminole.

4.2.1.3 Oklahoma Border to Dallas and Fort Worth

North and north-central Texas compose two distinct ecoregions: the Cross Timbers to the west, which includes Fort Worth, and the Texas Blackland Prairies, which includes Dallas. The Cross Timbers region is a transitional area between the once prairie regions to the west and the forested low mountains or hills of eastern Oklahoma and Texas. It is a mosaic of forest, woodland, savannah, and prairie. The Texas Blackland Prairies region extends from near Oklahoma to the north and Dallas to the northeast to San Antonio. It is a true tall grass prairie characterized by gently rolling to nearly level topography with forest along streams and uplands (Kenmotsu and Perttula 1993; Prikryl 1993). These habitats historically supported a rich mixture of diverse plant and animal communities available to the prehistoric peoples of north and north-central Texas.

4.2.1.4 Texas Cultural Background

The overview of prehistoric north Texas is derived mainly from the cultural history prepared by Prikryl (1990, 1993) for investigations conducted throughout north and northeast Texas. Additionally, the below culture history draws heavily on three available synthesis/summaries of the region: Story's (1990) synthesis of upper Trinity River basin archaeological data, Lynott's (1981)

work in the Cross Timbers and Blackland Prairie of north Texas, and Hofman's (1989) summary of southern Great Plains archeology.

The earliest investigations in Texas were carried out by E. B. Sayles (1935) in the 1920s and 1930s; he conducted a state-wide reconnaissance and published the first synthesis of Texas prehistory in 1935. In *An Archaeological Survey of Texas*, Sayles compared archaeological sites across the state and defined prehistoric culture and their boundaries. The next significant overview of Texas archaeology was *An Introductory Handbook of Texas Archeology* (Suhm et al. 1954).

The era of reservoir development in north Texas emphasized the Trinity River drainages, resulting in numerous archaeological investigations prior to their inundation. Several large projects took place along the Trinity River's East Fork at Lake Lavon (1950, 1973, 1975) and Lake Ray Hubbard (1963, 1968); these investigations afforded significant contributions to our understanding of prehistory in the region (THC 2014). Investigations along other parts of the Trinity River basin have focused on the upper Elm Fork of the river in the Denton area; these include Ray Roberts Reservoir (1987, 1997, 1987, 1982), Lewisville Lake (1950, 1991, 1998), and Grapevine Lake (1975) (THC 2014). Large-scale research along the West Fork of the Trinity River has been primarily limited to Mountain Creek Lake (1988) (THC 2014).

Following the establishment of federal laws and state regulations to preserve significant cultural resources (principally the NHPA of 1966, as amended, and the Antiquities Code of Texas, as amended), archaeological investigations increased significantly to fulfill environmental assessment requirements related to federally funded, licensed, or permitted projects and state owned lands. Additionally, the Dallas Archeological Society and Texas Archeological Society have produced articles and journals (*The Record* and *Bulletin of the Texas Archeological Society* [BTAS], respectively) resulting in good data. The Texas Archeological Society has conducted annual field schools since 1962 as well as recording thousands of archaeological sites over the years. More than 70 years of research has been published in the BTAS documenting the prehistory and early history of Texas.

4.2.1.4.1 Paleoindian Period

The Paleoindian period represents the first known human occupation of the north-central Texas region (at least 12,000 to 8500 BP) (Bousman et al. 2004; Perttula 2004; Prikryl 1990) and shares its general summary with those presented above under the Oklahoma Cultural Background subheading. These sites are associated with high mobility; distinctive lanceolate, unnotched fluted dart points; and the hunting of extinct Pleistocene mammals.

Few Paleoindian sites have been intensively investigated in north-central Texas, and most data for these sites come from investigations along the Trinity River, especially the Lower Elm Fork (Prikryl 1990). These data are often limited to isolated lithic tools, but discrete components, particularly those associated with Clovis occupations, have been identified at the Lewisville (41DN72) and Aubrey (41DN479) sites, two deeply buried sites (up to 26 feet of Holocene alluvium) in Denton County (Prikryl 1993; Story 1990). These sites feature the main hallmarks of early Paleoindian sites

in Texas such as Clovis dart points and the remains of large mammals; in contrast, many Paleoindian sites across the state harbor medium and small faunal remains, including mammals, reptiles, and fish, which may constitute a testament to a broad-spectrum subsistence strategy (Witt 2005).

Toward the end of the Pleistocene, changing climate and possibly human hunting pressure caused the extinction of the Pleistocene megafauna with the exception of *Bison antiquus*. This change is evident in the faunal assemblages of Folsom and Plainview sites at Blackwater Draw and Lubbock Lake (Johnson and Holliday 1980). Folsom groups primarily hunted *Bison antiquus*; their lithic assemblage included distinctive fluted Folsom dart points and unfluted lanceolate dart points along with tools oriented toward hunting-related tasks.

Late Paleoindian (approximately 10,000 to 9000 BP) people of the Plainview, Plano, Milnesand, and Portales complexes were hunter and gatherers who tracked bison over great distances exploiting diverse plants and animals (Hofman 1989; Prikryl 1990).

4.2.1.4.2 Archaic Period

The Archaic period in north-central Texas extended from approximately 8500 to 1250 BP with roughly three 2,400-year periods regarded as early, middle, and late sub-divisions (Prikryl 1990). Prikryl (1990) suggests that diagnostic artifacts associated with the Early Archaic consist of split-stem varieties, while the Middle Archaic is represented by basal-notched types such as Bell, Andice, Carrollton, and Bulverde. Late Archaic dart points include the Castroville, Marshall, Edgewood, Elam, Trinity, and Gary types (Prikryl 1990). Unfortunately, few discrete Archaic occupations have been analyzed in north-central Texas, but the Archaic record may reflect a slowly increasing population responding to warmer and drier climatic conditions (Lynott 1981). As such, Archaic groups in the Cross Timbers and prairies of the region may have developed diversified hunting and gathering patterns focused on bottomland resources of rivers and major creeks (Hofman 1989). Two Late Archaic occupations were examined near the EIS Study Area at Mountain Creek Lake and Ray Roberts Reservoir that indicate repeated occupations by small groups.

In north-central Texas, the Late Archaic (and subsequent Late Prehistoric) archaeological record commonly describes human burials, several of which are associated with Wylie pit features. Such pit features are large (approximately 52.5 feet in diameter and 6.5 to 13 feet deep) man-made depressions originally identified during investigations along the East Fork Trinity River and a hallmark of the Wylie focus (Stephenson 1952) initially dated to the Late Prehistoric. The Wylie pit features were likely used for large-scale food processing similar to the burned rock middens of central Texas. Later investigations at the Richland-Chambers Reservoir indicated that Wylie pit feature extend back to the Late Archaic and functioned in large-scale processing of subsistence resources (Bruseth and Martin 1987). Taken together, the burials and pit features suggest group aggregations and large-scale processing of food resources during the Late Archaic and extending into the Late Prehistoric.

4.2.1.4.3 Late Prehistoric Period

Prikryl (1993) divides the Late Prehistoric period into Late Prehistoric I (approximately 1250 to 750 BP) and Late Prehistoric II (approximately 750 to 250 BP) subdivisions based on projectile point and ceramic types. Temporally diagnostic arrow points from the Late Prehistoric I subperiod include Scallorn, Catahoula, Steiner, Alba, and Bonham. Diagnostic ceramics primarily consist of grog tempered undecorated varieties. However, influence from Caddo ceramics of East Texas is noted in similar designs.

During the Late Prehistoric II subdivisions, the archaeological record for the region exhibits influences from southern Plains groups, which correspond to an increase in the size of the north-central Texas bison herd. At this same time, however, increased population is thought to have limited hunting ranges and resulted in the gradual trend toward horticulture and sedentary village life (Harris and Harris 1970; Morris and Morris 1970). Plains-influenced material culture (Prikryl 1990) included calcareous-tempered ceramics and unstemmed triangular arrow points like Maud, Fresno, Harrell, Washita, and Perdiz. Also typical are thumbnail scrapers and two- and four-beveled knives (i.e., Harahey). Evidence of horticulture is evidenced in bison scapula hoes, such as those found during investigations for the Lewisville Lake and Lavon Lake in Denton and Collin Counties, respectively (Barber 1969).

The Plains influences in the north-central Texas region assisted with the development of the Henrietta complex. The site type for the complex is the M. D. Harrell site discovered on the Brazos River in Young County. This site and associated sites (often on sandy elevated landforms and terraces above river valleys) contain middens, house structures, rock hearths, storage pits, and burials (Brooks 1989). Excavated Henrietta complex sites include the Coyote and Glass sites in Montague County.

With the arrival of the 18th century, Plains groups had moved into and beyond north-central Texas and were documented by traders and explorers, thereby heralding the beginning of the Historic period. During this time, documented groups in and around the region included Tonkawa, Apache, Comanche, Wichita, Caddo, Delaware, and Kickapoo (Newcomb 1961; Newcomb and Campbell 1982). Sites attributed to this period contain European ceramics, glass beads, flintlock musket fragments, and metal arrow points in conjunction with chipped lithic tools. Few known sites can be definitively associated with these historic groups, though a Wichita site was investigated in Hill County.

4.2.2 Central Section: Dallas and Fort Worth to San Antonio

The Central Section extends from Dallas and Fort Worth to San Antonio. Given the large geographic area encompassed by this section, there is overlap in the northern reaches of the Central Section with the culture history of north-central Texas and, as such, the cultural history will not be repeated here. Similarly, the southern reaches of the Central Section overlap with prehistoric culture areas and chronologies associated with south Texas, which are discussed in Section 4.2.3, San Antonio to South Texas (Southern Section).

From synthesized interpretations of archaeological research in the region (Black 1989; Collins 1995; Prewitt 1981), the prehistoric cultures of central Texas were organized into small bands and, for the most part, practiced hunter gatherer subsistence up to Historic times. These ancient peoples are now only represented by the refuse they left behind, which includes lithic tools, flaking debris from lithic tool production, burned rock from hearth/cooking features, and disarticulated and fractured animal bone.

Distinctive artifact styles such as lithic arrow and dart points are often used as relative chronological indicators. Typological frameworks established by Kelley (1947) and Suhm et al. (1954) are based on specimens recovered from hundreds of excavated sites throughout Texas and the United States. These stylistically diverse diagnostic types are often used as temporal and cultural markers and have been the basis for establishing a Central Texas archaeological chronology (Collins 1995; Prewitt 1981). Arguing that stylistic variability in diagnostic artifact forms is in itself insufficient to distinguish cultural change, recent refinement by Johnson and Goode (1994) used radiocarbon dating to account for paleoclimatic influences to refine the central Texas archaeological chronology.

The culture history of central Texas has been divided into four general periods: Paleoindian, Archaic, Late Prehistoric, and Historic (Collins 1995; Johnson and Goode 1994; Prewitt 1981; Suhm et al. 1954). These periods are divided into subperiods based on changes in the archaeological and paleoenvironmental record.

4.2.2.1 Paleoindian Period

The Paleoindian period represents the first known human occupation of the area and generally dates from approximately 11,500 to 8800 BP (Collins 1995). However, aboriginal peoples likely lived in central Texas much earlier as evidenced by pre-Clovis findings at the Levi rock shelter (Collins 1995) and Gault site followed by Clovis culture (12,800 to 13,100 BP). During the terminal Pleistocene, the Paleoindian period is noted for its association with the hunting of megafauna and high mobility. However, recent inquiries into Paleoindian subsistence have revealed greater reliance on small-game and plant resources (Meltzer and Bever 1995). This period is divided into two subperiods: Early Paleoindian and Late Paleoindian.

The Early Paleoindian period in central Texas dates from approximately 11,500 to 9500 BP (Collins 1995). This subperiod of prehistory is represented by three general cultural traditions defined by subsistence and tool technology: Clovis, Folsom, and Plainview.

The Clovis culture is the first well-documented, large-scale intrusion of people to enter North America. Named after the famous site on Blackwater Draw near Clovis, N.M., the Clovis technological complex is represented archaeologically by distinctive fluted dart points and association with extinct Pleistocene mammals including mammoth, bison, camel, and Pleistocene horse. Though Clovis materials are found over a wide range of North America, there is a paucity of Clovis sites having materials in situ with stratigraphic integrity.

Toward the end of the Pleistocene, changing climate and possibly human hunting pressure caused the abrupt extinction of the Pleistocene megafauna with the exception of *Bison antiquus*. This change is evident in the faunal assemblages of Folsom and Plainview complex sites including Blackwater Draw (Hester 1972), Lubbock Lake (Johnson and Holliday 1980), and Wilson Leonard (Collins 1998). Mesic conditions and vast Great Plains grasslands supported an abundance of the now-extinct form of bison. It appears Folsom and Plainview peoples tracked bison over great distances as evidenced by lithic sourcing and technological organization. The Plainview bison kill/butchering component at the Lubbock Lake Site (41LU1) is radiocarbon dated as being post-Folsom at 9900 BP (Johnson and Holliday 1980).

Late Paleoindian sites and associated artifacts are dated from 9500 to 8800 BP. This subperiod is marked by changes in site frequency and artifact density with these sites being more numerous and containing higher artifact densities. Diagnostic tool types associated with the Late Paleoindian subperiod have been recovered at sites across the Edwards Plateau and include Scottsbluff, Wilson, San Patrice, Big Sandy, St. Mary's Hall, Barber, and Golondrina (Collins 1995). Though the San Patrice and Big Sandy types are more common in the southeastern United States, these types along the eastern plateau margin represent the western extent of those technological traditions (Patterson 1989).

4.2.2.2 Archaic Period

The Archaic period, which dates from 8800 to 1200 BP, is the longest of the defined cultural periods and composes two-thirds of central Texas prehistory. This period, which represents a central Texas adaptation, is divided into three subperiods: Early, Middle, and Late Archaic. Marked changes in the material culture of the Archaic from the Paleoindian period include burned rock middens and ground stone indicative of a shift toward more intensified use of local flora and fauna (Collins 1995). The majority of the Archaic is marked by a prolonged drought that ended by the Late Archaic subperiod with a change to a more mesic climate.

The Early Archaic period dates from approximately 8800 to 6000 BP. This subperiod is represented by four diagnostic tool traditions: Angostura, Gower, Uvalde, and Martindale. From data on Early Archaic site distribution, it appears that these sites occur with greater frequency along the eastern margin of the plateau (Collins 1995). With more reliable water resources along the escarpment (Comal, San Marcos, and Barton Springs), the eastern plateau and its many springs may have proved more hospitable during these dryer times.

The Middle Archaic subperiod dates from 6000 to 4000 BP and is represented by numerous diagnostic dart points including Andice, Bell, Early Triangular, Nolan, and Travis. The Middle Archaic coincides with the onset of a xeric climatic interval that has been referred to as the Middle Holocene Altithermal. This middle Holocene climatic interval is marked by extensive erosion or limited alluvial deposition. Erosion destroyed many of the Middle Archaic sites that would have formed on stream terraces. Surface stability allowed the other stream terraces to accumulate

cultural debris into aggregates or palimpsests representing centuries or even millennia of occupation (Collins 1995; Holliday 1999).

The Late Archaic subperiod dates from 4000 to 1200 BP and is represented by a wide variety of diagnostic dart points including Bulverde, Pedernales, Castorville, Fairland, Frio, Ensor, and Darl (Collins 1995). The Late Archaic shows a shift to a mesic climatic interval and the resumption of aggradation of many stream terraces. Increased distribution and density of Late Archaic sites in central Texas may be attributed to population growth resulting from an increased resource base associated with increased precipitation.

4.2.2.3 Late Prehistoric Period

The Late Prehistoric period spans 1200 to 500 BP and is represented by several notable technological changes, including the introduction of the bow and arrow and ceramics. The climate shifted again to a xeric interval that increased in intensity throughout the period. In central Texas, two subperiods (or phases) are recognized: Austin and Toyah. These subperiods are based on changes in artifact assemblages and subsistence practices (Collins 1995; Prewitt 1981).

The Austin subperiod dates from approximately 1400 to 800 BP and is represented by Edwards and Scallorn arrow points. Austin-phase materials found in association with burned rock middens are not uncommon, suggesting similar subsistence practices to earlier Archaic hunter-gatherers (Collins 1995).

The Toyah subperiod, which dates from approximately 800 to 500 BP, is represented by plainware ceramics and Perdiz arrow points. A shift toward bison hunting is apparent with increased bison remains present in Toyah sites (Collins 1995). Lithic tools such as thin beveled bifaces and end scrapers are also present in Toyah sites (Prewitt 1981).

4.2.2.4 Protohistoric Period

The Protohistoric period has been posited for the transitional period from the Late Prehistoric to the Historic period. This transition is poorly documented and is marked by the end of the Toyah Phase, roughly AD 1250/1300 to 1600/1650 (Hester 1995), and the appearance of Spanish explorers in the area in the early 16th century. Following the establishment of a strong Spanish presence in the region in the late 1600s and early 1700s, sporadic encounters occurred between indigenous populations and Europeans. Archaeologically, the transitional period is difficult to discern in the absence of artifacts clearly Spanish in origin, as Protohistoric sites tend to have both Late Prehistoric and Historic artifacts.

4.2.3 Southern Section: San Antonio to South Texas

The Southern Section encompasses parts of the South Texas Plains and the Gulf Coast Prairies cultural region, which is close to the extent of Blair's (1950) Tamaulipan Biotic Province. It is a transitional zone between a temperate zone to the north, a xeric zone to the west, and a subtropical zone to the south with a reduced mix of woodland, desert, and subtropical species. The Coastal

Sand Plains are to the north, the South Texas Brush Country is to the south, and the Gulf Coast Plains are to the east; it has scattered to thick patches of low lying brush intermixed with isolated stands, or single trees, of mesquite or huisache. Overall, the region is one of the most poorly known in Texas, and the Rio Grande plain itself is one of the least known of the subregions.

The earliest synthesis of the South Texas region's archaeology was attempted by Sayles (1935), who defined several cultural complexes along the Texas coast that indicated extensive campsites inland. Later, Kelley (1947) defined the Monte aspect in this region, and MacNeish (1947, 1958) included some parts of Texas along the lower Rio Grande in his archaeological survey of Tamaulipas, creating the Brownsville, Abasolo, and Repelo cultural complexes.

Suhm et al. (1954) summarized the archaeology of this region, incorporating newly collected data from the Falcon Reservoir survey and excavations. Two new foci were defined consisting of the Falcon focus and Mier focus. The Falcon focus represented the Archaic of the region, while the Mier focus, with smaller dart points and arrow points, was considered later in time. The prehistoric cultures of south Texas and its subareas have been most recently synthesized by Hester (1989, 1995) and Black (1989); the following brief summary draws mostly from those sources. The cultural periods are Paleoindian (11,200 to 8000 BP), Early Archaic (8000 to 4500 BP), Middle Archaic (4500 to 2400 BP), Late Archaic (2400 to 1200 BP), and Late Prehistoric (1200 to 400 BP) (Black 1989).

4.2.3.1 Paleoindian Period

The earliest evidence of the human presence in south Texas dates to the Paleoindian period (approximately 11,200 to 8000 BP). This period originally included the earliest inhabitants of the New World who spread across the American continent in the waning years of the Pleistocene era. Possible pre-Clovis finds in both North and South America may significantly refine the chronology of New World occupation, but the finds are still sporadic and not universally accepted. In any case, the evidence for such early cultures has not been forthcoming in Texas.

Paleoindian cultures are typically identified by their distinctive lithic technology, including well-made dart points such as Clovis, Folsom, and Plainview and a wide range of related lanceolate forms. Other diagnostic technologies include large polyhedral blade cores and prismatic blades associated with the Clovis techno-cultural complex and large bifacial cores and ultra-thin bifaces associated with the Folsom techno-cultural complex. Throughout the South Texas Plains area, most of these artifacts are scattered surface finds rather than recovered from buried stratified sites. Data from the broader area comprising southern, southwest, and central Texas indicate that primary site types from this period include open sites and rock shelters with evidence of general occupation along with specialized activities such as lithic tool making, hunting, and game processing. Lithic artifact caches and human burials have also been found that date to the Paleoindian era. In the past, the Paleoindian peoples have typically been characterized as a nomadic, big-game hunting culture, but evidence in nearby regions from sites such as Baker Cave suggests a broader range of subsistence activities within a rich and complex cultural tradition (Hester 1983).

Overall, the Paleoindian era is one that is marked by a gradual warming trend at the close of the final Pleistocene Wisconsonian glaciation. This warming trend is associated with a dramatically shifting faunal and floral environment, to which the cultural traditions quickly adapted.

4.2.3.2 Archaic Period

The transition from Paleoindian to the Early Archaic (approximately 8000 to 1200 BP) is difficult to define precisely, but the Archaic dart points begin to shift from lanceolate forms to stemmed points, though some later lanceolate forms such as Golondrina and Angostura may persist longer. Unfortunately, beyond a few excavated sites, subsistence data are scarce for sites of this period. Early Archaic sites are known throughout the area, though few have been excavated, and there are little data on such sites in the Rio Grande Plain subregion (Black 1989). Sites are found on high terraces and in the uplands, but buried alluvial sites have also been identified. As with the Paleoindian period, the widespread distribution of artifact types and low site counts suggest a small population, small band sizes, and large territorial ranges, though as Story (1990) and Black (1989) have argued, these generalizations probably apply to a wide area of the West Gulf Coastal Plain. Regional themes in the Archaic period include the emergence of a triangular tool-type tradition including the widespread use of distally beveled tools and the development of subregionalized and sometimes intrusive, but poorly understood, mortuary complexes.

Despite its later date, the Middle Archaic of the South Texas Plains is little better known than its Early Archaic and Paleoindian antecedents. Hampered by the paucity of excavated sites and the near absence of radiocarbon dates, much must be inferred by comparisons with adjacent regions (Black 1989). By the Middle Archaic, groundstone, including manos and metates, occurs at a number of sites, perhaps indicating a greater reliance on plant materials than during previous periods and methods of food processing. Unifacial, distally beveled tools also continue, while triangular dart points characterize the diagnostic points of this period. Stemmed points are also present (Hester 1995). The persistent *Clear Fork* tool type continues in both bifacial and unifacial forms, though much smaller than its earlier cousins (Turner and Hester 1999). Sites have been identified in the uplands as well as alluvial settings and along estuary bays in the Coastal Bend. Chronologically diagnostic artifact scatters appear for the first time in the Rio Grande delta during this period (Black 1989). Middle and Late Archaic sites occur on terraces, arroyo banks, and in hilly areas overlooking arroyos and their tributaries. The presence of burned rock accumulations is indicative of a greater reliance on plant materials, and population densities may have increased during this period along with more-defined territories.

Late Archaic sites in south Texas are numerous, and this period is better known than its predecessors. During this time, plant and marine resources probably took on a greater role than hunting of large mammals. In fact, resource specialization may have reached a peak during the Late Archaic, followed by a somewhat more generalized subsistence in the subsequent Late Prehistoric period (Black 1989). A further increase in population is implied by the increase in site density during this period. Regional distinctions in artifact assemblages and other cultural traits also become prominent at this time.

4.2.3.3 Late Prehistoric/Protohistoric Period

The final prehistoric period, the Late Prehistoric (approximately 1200 to 400 BP), is well represented in south Texas. This period is marked by the introduction of new technologies, including the bow and arrow and ceramics, as well as potentially new adaptive strategies. Site types are varied and include open campsites, lithic scatters, and cemeteries. Site types indicate local lithic styles and intrusions from adjacent areas. Local ceramic styles are infrequent if non-existent unless associated with assemblages also occurring in other regions. At the southernmost tip of the culture area, the Brownsville complex is noted for its shell-working industry and influences from groups along the Mexican coast. Two subperiods that have been defined for this period in central Texas also have relevance to the Late Prehistoric of the South Texas Plains. The earliest part of this period, the Austin subperiod (beginning about 1300 to 1200 BP), reflects a certain degree of cultural and economic continuity underlying the adoption of new technologies, while the later Toyah subperiod (extending roughly to the beginning of the historic era) may indicate the introduction of immigrants following a southward extension of the range of the bison. Throughout most of the state, there is an intensification of animal exploitation as evidenced by the faunal remains that occur during the Late Prehistoric period, particularly during the Toyah Phase.

The transition to the Protohistoric/Historic period reflects catastrophic replacement of indigenous groups. Little is known of the fate of the prehistoric inhabitants of south Texas during this period. Though a number of small groups have been documented in the early historic era of south, south-central, and coastal Texas, most disappeared quickly from the written records. In south Texas, Campbell (1958) documented the available evidence of the numerous Native American bands that roamed this region in the early historic era. With increasing Anglo settlement in south Texas in the early to mid-19th century as well as antagonistic official policies and continuous onslaughts of epidemic diseases, Native American populations began to dwindle. While the Comanches and a few other groups were able to maintain social cohesion, most groups were eliminated or lost their individual identities as the survivors merged with isolated survivors from other bands. Remnants of bands from the Plains and from across the continent, including Kickapoo, Seminole, and others, ranged across northern Mexico and southern Texas seeking refuge from annihilation.

4.3 Archaeological Sites

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.

Based on data provided by the THC/Texas SHPO and Oklahoma SHPO, the following three categories of archaeological sites are within the EIS Study Area: archaeological sites listed on the

NRHP, archaeological sites determined NRHP-eligible by the Texas or Oklahoma SHPO, and archaeological sites with undetermined NRHP eligibility. As previously stated, archaeological sites with undetermined NRHP eligibility have not yet been sufficiently assessed; therefore, for this service-level analysis, these sites are treated as NRHP-eligible sites because final eligibility determinations have not been made by the Texas or Oklahoma SHPO. A complete list of identified NRHP-listed, NRHP-eligible, and undetermined NRHP-eligible archaeological sites is provided in Tables 4-2 through 4-5.

The Northern Section crosses through Oklahoma (Table 4-2) and Texas (Table 4-3); the Central Section (Table 4-4) and Southern Section (Table 4-5) are entirely situated within Texas. Figure 4-1 is an index map, and the locations of archaeological sites are shown on Figures 4-2 through 4-13. Archaeological sites that have been determined ineligible for inclusion in the NRHP have not been included in this service-level analysis.

Table 4-2: Archaeological Sites in Oklahoma—Northern Section (presented north to south and west to east)

Site Trinomial	Description	NRHP Status	Notes/ Recommendations	Alternative
34OK63 Figure 4-2	Prehistoric open camp; possibly Archaic period	Undetermined	Further work needed	N4A CONV
34OK99 Figure 4-2	Late Prehistoric period open camp	Undetermined	NRHP testing needed	N4A CONV
34CL179 Figure 4-2	Norman Historic Naval Air Station/archaeological deposits	NRHP-eligible	Further NRHP assessment needed	N4A CONV
34CL57 Figure 4-2	Prehistoric open camp	Undetermined	Two site plots, one within the EIS Study Area, need further assessment	N4A CONV
34GV291 Figure 4-2	Archaic period prehistoric open camp	Undetermined	Site may extend east of railroad	N4A CONV
34GV295 Figure 4-2	Plains Village prehistoric open camp	Undetermined	Investigation of subsurface needed	N4A CONV
34GV136 Figure 4-2	Washita River Phase prehistoric village	Undetermined	Investigation of subsurface needed	N4A CONV
34MR110 Figure 4-3	Prehistoric open camp and historic farmstead	Undetermined	Site inventory and full recording needed	N4A CONV
34LV27 Figure 4-3	Archaic period prehistoric open camp	Undetermined	None	N4A CONV
Sources: THC (2014); University of Texas (2014); OAS (2014).				

Table 4-3: Archaeological Sites in Texas—Northern Section (presented north to south and west to east)

Site Trinomial	Description	NRHP Status	Notes/Recommendations	Alternative
41TR235 [a] Figure 4-4	1890s Historic Railroad Roundhouse	Undetermined; demolished structure ineligible	Possible associated buried artifacts	N4A CONV, C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR
41TR226 [a] Figure 4-4	Historic Walker Branch Railroad Bridge	Undetermined; railroad bridge-ineligible, cleared in past	Possible associated buried artifacts	N4A CONV, C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41TR70 [a] Figure 4-4	Early Archaic through Late Prehistoric open camp	Undetermined	NRHP testing recommended	N4A CONV, C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41TR140 [a] Figure 4-4	Prehistoric open camp	Undetermined	None	N4A CONV, C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41TR3 [a] Figure 4-4	Paleoindian period dart points, no additional data available	Undetermined	None	N4A CONV, C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41DL54 [a] Figure 4-4	Prehistoric open camp	Undetermined	Investigation of the subsurface and site inventory needed; two possible site locations, one within the EIS Study Area	N4A CONV, C4A HrSR, C4A HSR, C4C HrSR, C4C HSR

[a] Site is also in the Central Section.

Sources: THC (2014); University of Texas (2014); OAS (2014).

Table 4-4: Archaeological Sites—Central Section (presented north to south, and west to east)

Site Trinomial	Description	NRHP Status	Notes/Recommendations	Alternative
41TR235[a] **Figure 4-4**	1890s Historic Railroad Roundhouse	Undetermined; demolished structure ineligible	Possible associated buried artifacts	N4A CONV, C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR
41TR226[a] **Figure 4-4**	Historic Walker Branch Railroad Bridge	Undetermined; railroad bridge-ineligible, cleared in past	Possible associated buried artifacts	N4A CONV, C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41TR70[a] **Figure 4-4**	Early Archaic through Late Prehistoric open camp	Undetermined	NRHP testing recommended	N4A CONV, C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41TR140[a] **Figure 4-4**	Prehistoric open camp	Undetermined	None	N4A CONV, C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41TR3[a] **Figure 4-4**	Paleoindian period dart points, no additional data	Undetermined	None	N4A CONV, C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41DL54[a] **Figure 4-4**	Prehistoric open camp	Undetermined	Investigation of the subsurface and site inventory needed; two possible site locations, one within the EIS Study Area	N4A CONV, C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41DL51 Figure 4-4	Caddoan period prehistoric open camp	Undetermined	None	C4B HrSR, C4B HSR
41TR48 Figure 4-4	1890-1940 Historic Mars Tenant Farm	NRHP-eligible	None	C4B HrSR, C4B HSR

Site Trinomial	Description	NRHP Status	Notes/Recommendations	Alternative
41TR244 Figure 4-4	Late 19th century historic farmstead with features	Undetermined; small portion ineligible	None	C4B HrSR, C4B HSR
41DL355 Figure 4-4	No data available	Undetermined	None	C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41DL356 Figure 4-4	Late Prehistoric period open camp with features	Undetermined	None	C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41DL273 Figure 4-4	Prehistoric lithic scatter and historic debris	Undetermined	None	C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41DL277 Figure 4-4	Historic wagon trail	Undetermined	Unlikely intact, later paved	C4A HrSR, C4A HSR, C4C HrSR, C4C HSR
41HI255 Figure 4-5	1890s historic recreational facility	Undetermined	Most structures destroyed; associated features intact	C4C HrSR, C4C HSR
41ML96 Figure 4-5	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 4-6	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 4-6	Prehistoric quarry and workshop	Undetermined	None	C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR

Site Trinomial	Description	NRHP Status	Notes/Recommendations	Alternative
41WM958 Figure 4-6	Late Prehistoric/Neo-American period campsite	Undetermined	Extensive site size, full boundary unknown	C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR
41TV1344 Cemetery No. TV-C058 Figure 4-6	Rose Hill Cemetery	Undetermined	None	C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR
41TV1221 Figure 4-6	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 4-6	Prehistoric open camp with historic house debris	Undetermined	None	C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR
41TV1262 Figure 4-6	Prehistoric lithic scatter with tools	Undetermined	None	C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR
41TV1266 Figure 4-6	Prehistoric lithic scatter and procurement site	Undetermined	None	C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR
41TV1267 Figure 4-6	Prehistoric lithic scatter	Undetermined	Site may not be intact	C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR

Site Trinomial	Description	NRHP Status	Notes/Recommendations	Alternative
41TV1642 Figure 4-6	Historic 20th century house	Undetermined	Further work needed	C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR
41TV285 Figure 4-6	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 4-7	Prehistoric lithic scatter	Undetermined	None	C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR
41BX910 Figure 4-7	Prehistoric open camp	Undetermined	None	C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR
BX-C084 (Cemetery No.) Schulmeier Cemetery Figure 4-7	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 4-7	Alazan acequia associated with San Pedro Springs	NRHP-eligible	None	C4A HrSR, C4A HSR, C4B HrSR, C4B HSR, C4C HrSR, C4C HSR

[a] Site is also in the Northern Section.

Sources: THC (2014); University of Texas (2014).

Table 4-5: Archaeological Sites—Southern Section (Alternatives S4 and S6 presented north to south and west to east)

Site Trinomial	Description	NRHP Status	Notes/Recommendations	Alternative
41FR94 Figure 4-8	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 4-9	Middle to Transitional Archaic period prehistoric open camp	Undetermined	High research potential, testing recommended	S6 HrSR, S6 HSR
41DM99 Figure 4-9	Prehistoric open camp	Undetermined	High research potential	S6 HrSR, S6 HSR
41DM112 Figure 4-9	Prehistoric open camp	Undetermined	High research potential	S6 HrSR, S6 HSR
41WB726 Figure 4-9	Early-Mid 20th century historic homestead, windmill, artifact scatter	Undetermined	None	S6 HrSR, S6 HSR
41WB343 Figure 4-9	Prehistoric lithic scatter	Undetermined	NRHP testing recommended	S6 HrSR, S6 HSR
41WB205 Figure 4-9	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 4-8	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 4-10	Prehistoric open camp	Undetermined	None	S4 HrSR
41AT20 Figure 4-10	Prehistoric open camp	Undetermined	None	S4 HrSR
41LK83 Figure 4-10	Paleoindian through Late Prehistoric period open camp	Undetermined	None	S4 HrSR
41LK84 Figure 4-10	Archaic period prehistoric open camp	Undetermined	NRHP testing recommended	S4 HrSR

Site Trinomial	Description	NRHP Status	Notes/Recommendations	Alternative
41LK339 Figure 4-10	Prehistoric open camp	Undetermined	The site may be deeply buried	S4 HrSR
41WB774 Figure 4-9	Prehistoric open camp	Undetermined	The site may be partially destroyed	S4 HrSR
41WB380 Figure 4-9	No data available	Undetermined	None	S4 HrSR
41WB443 Figure 4-9	Prehistoric open camp	Undetermined	Possible buried intact deposits	S4 HrSR
41WB449 Figure 4-9	Prehistoric open camp	Undetermined	NRHP testing recommended	S4 HrSR
41WB452 Figure 4-9	Prehistoric open camp	Undetermined	Possible buried intact deposits	S4 HrSR
41WB450 Figure 4-9	Prehistoric open camp	Undetermined	Intact buried deposits, NRHP testing recommended	S4 HrSR
41WB448 Figure 4-9	Prehistoric open camp	Undetermined	One buried occupation	S4 HrSR
41WB463 Figure 4-9	Prehistoric open camp	Undetermined	None	S4 HrSR
41WB687 Figure 4-9	Prehistoric open camp	Undetermined	None	S4 HrSR
41DV134 Figure 4-11	Prehistoric quarry with lithic tools	Undetermined	None	S4 HrSR
41JW1 Figure 4-12	No data available	Undetermined	None	S4 HrSR
41BK5 Figure 4-12	Historic early 20th century Trosada Well and Ruins	Undetermined	Possible station for steam train; archival research and NRHP testing recommended	S4 HrSR
41CF208 Figure 4-13	Historic Old Military Road'	Undetermined	Good research potential; most of the road has been paved	S4 HrSR
41NU12 Figure 4-12	No data available	Undetermined	None	S4 HrSR
41NU73 Figure 4-12	No data available	Undetermined	None	S4 HrSR
Sources: THC (2014); University of Texas (2014).				

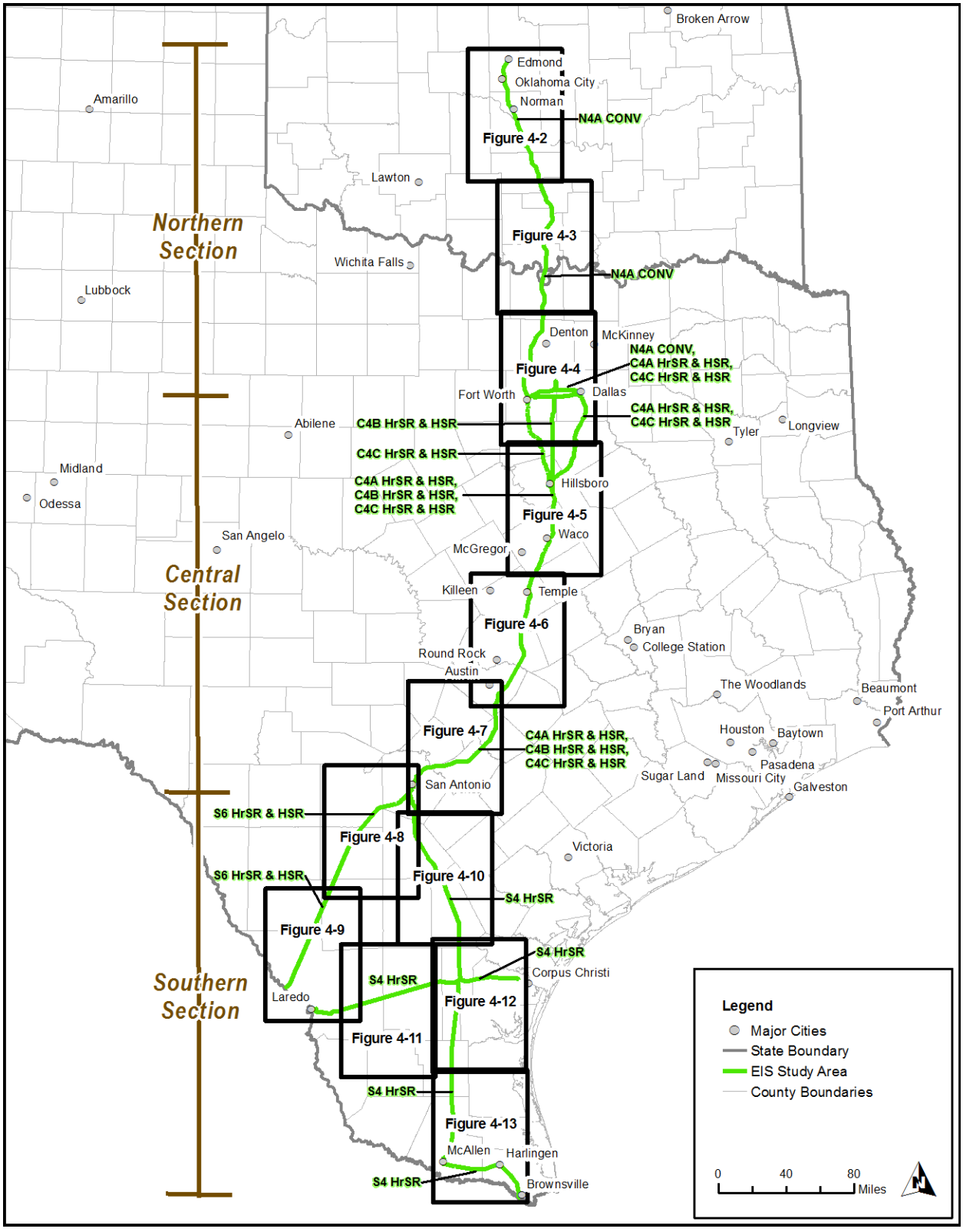


Figure 4-1: Index Map

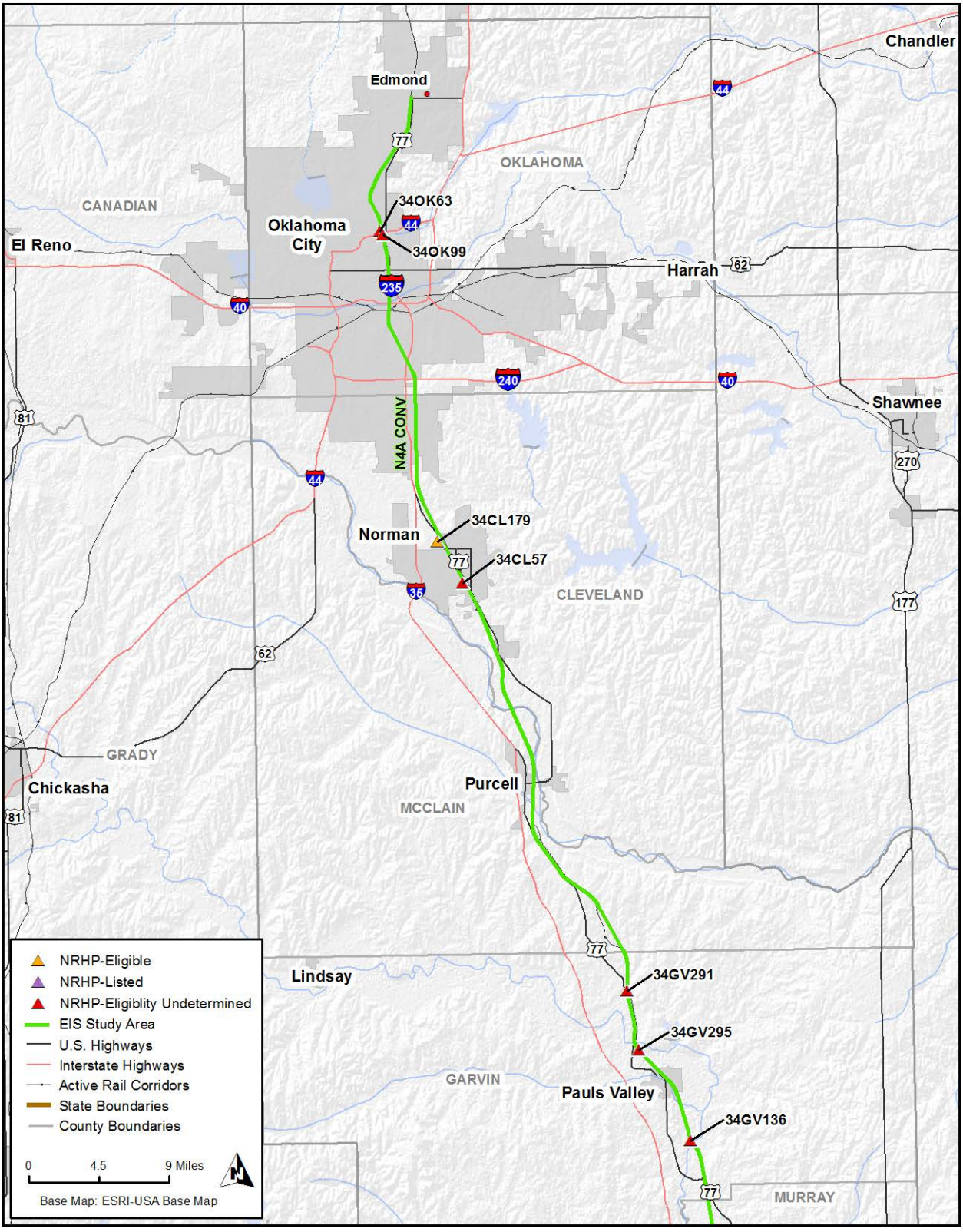


Figure 4-2: Archaeological Cultural Resources within the EIS Study Area – Map 1

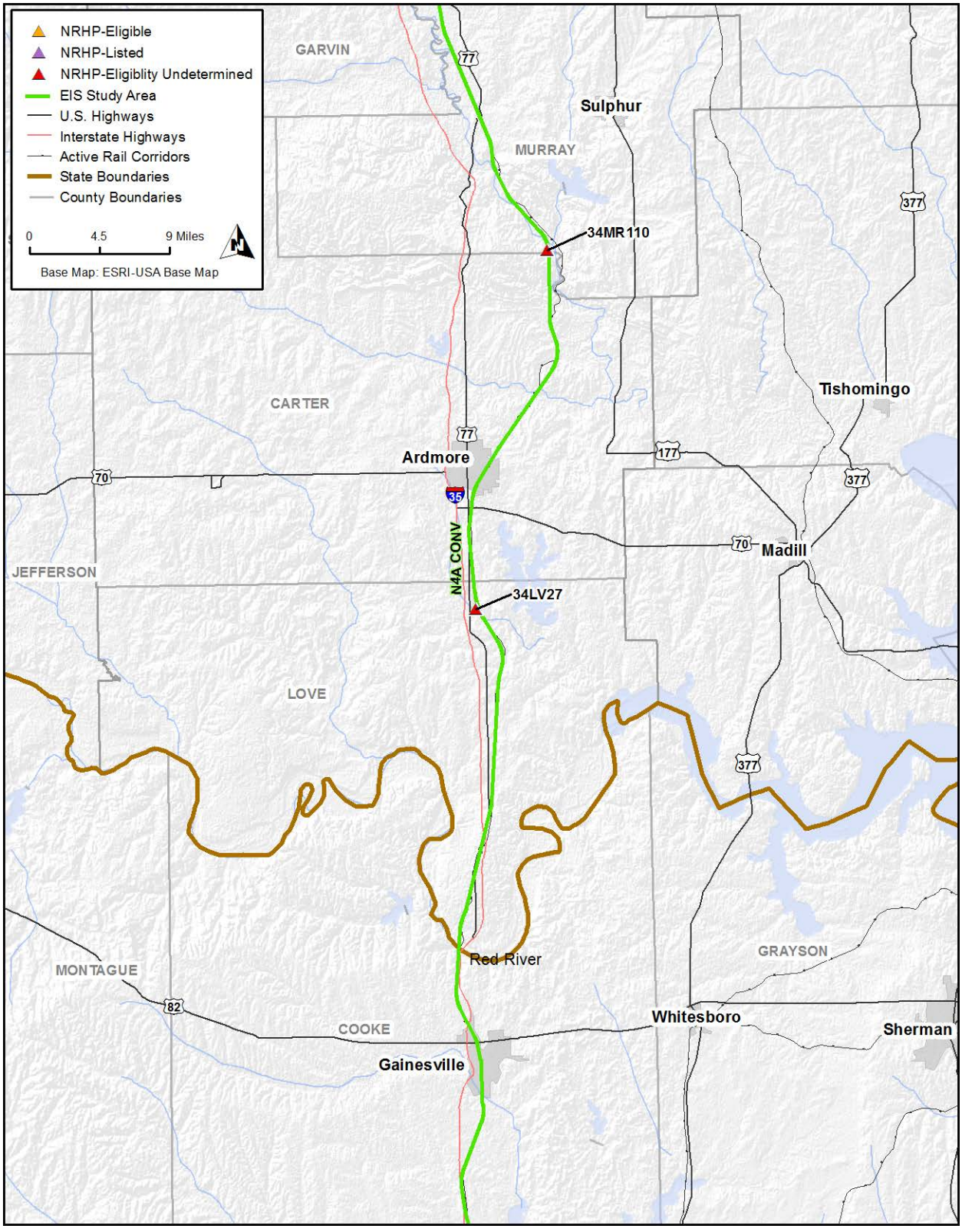


Figure 4-3: Archaeological Cultural Resources within the EIS Study Area – Map 2

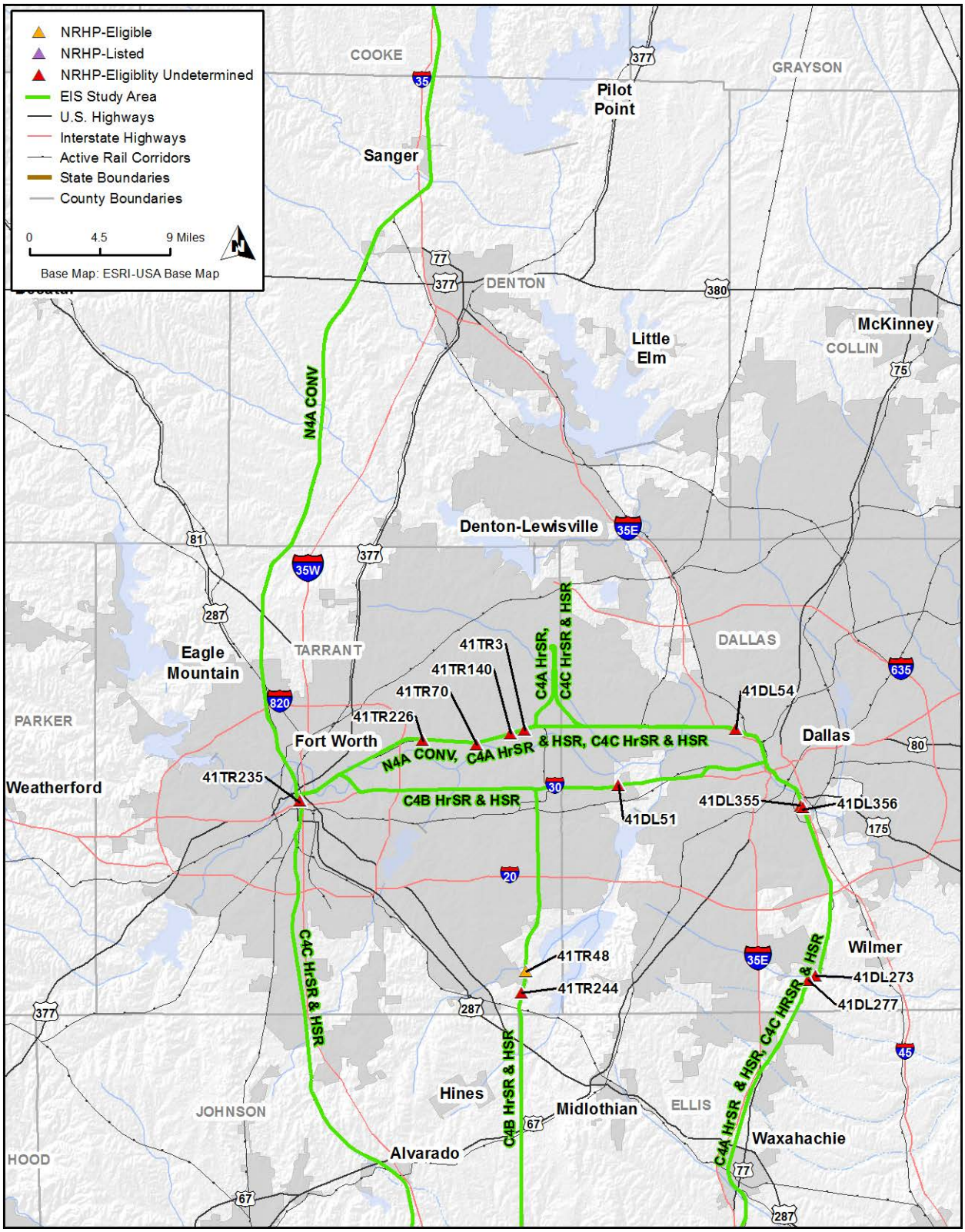


Figure 4-4: Archaeological Cultural Resources within the EIS Study Area – Map 3

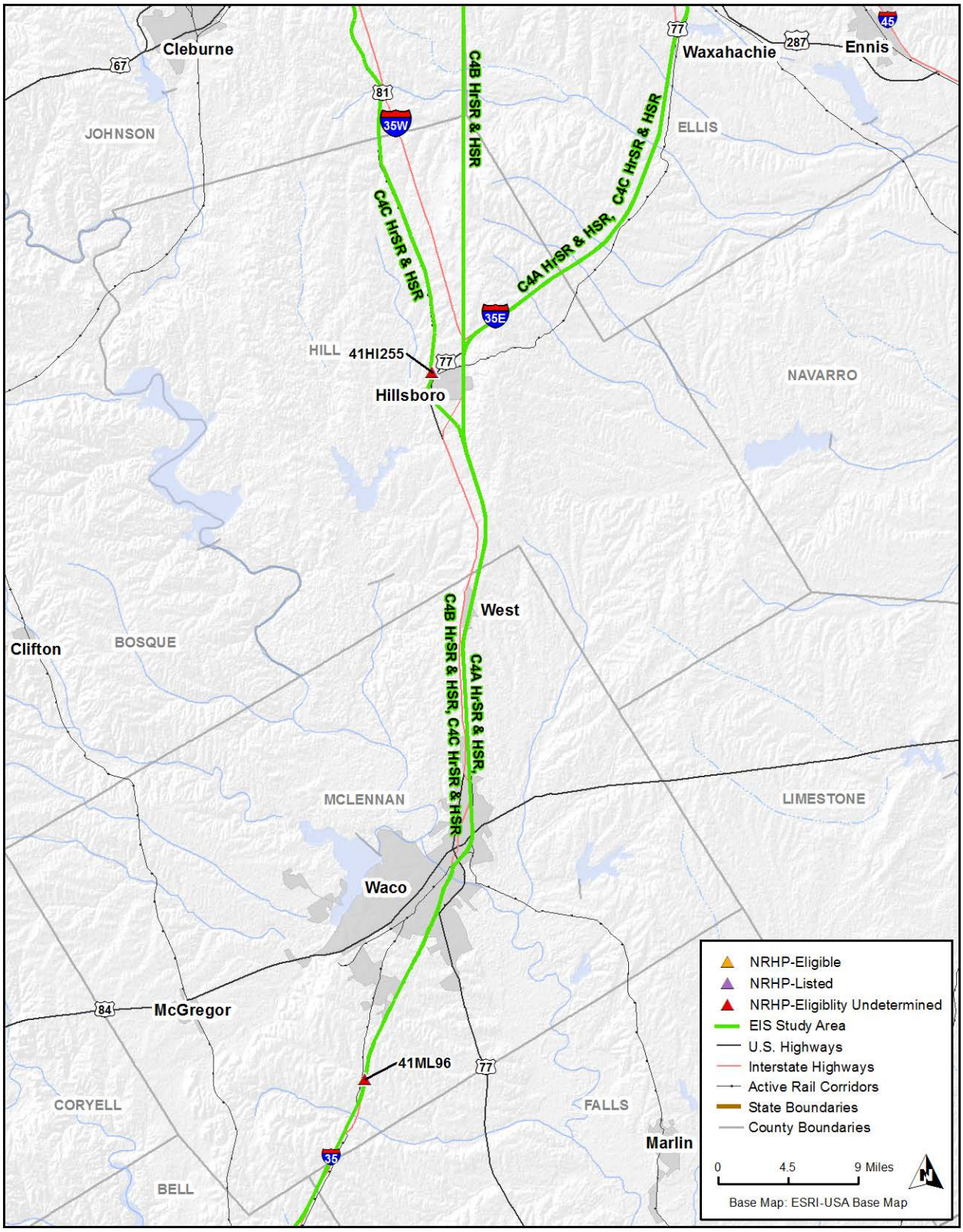


Figure 4-5: Archaeological Cultural Resources within the EIS Study Area – Map 4

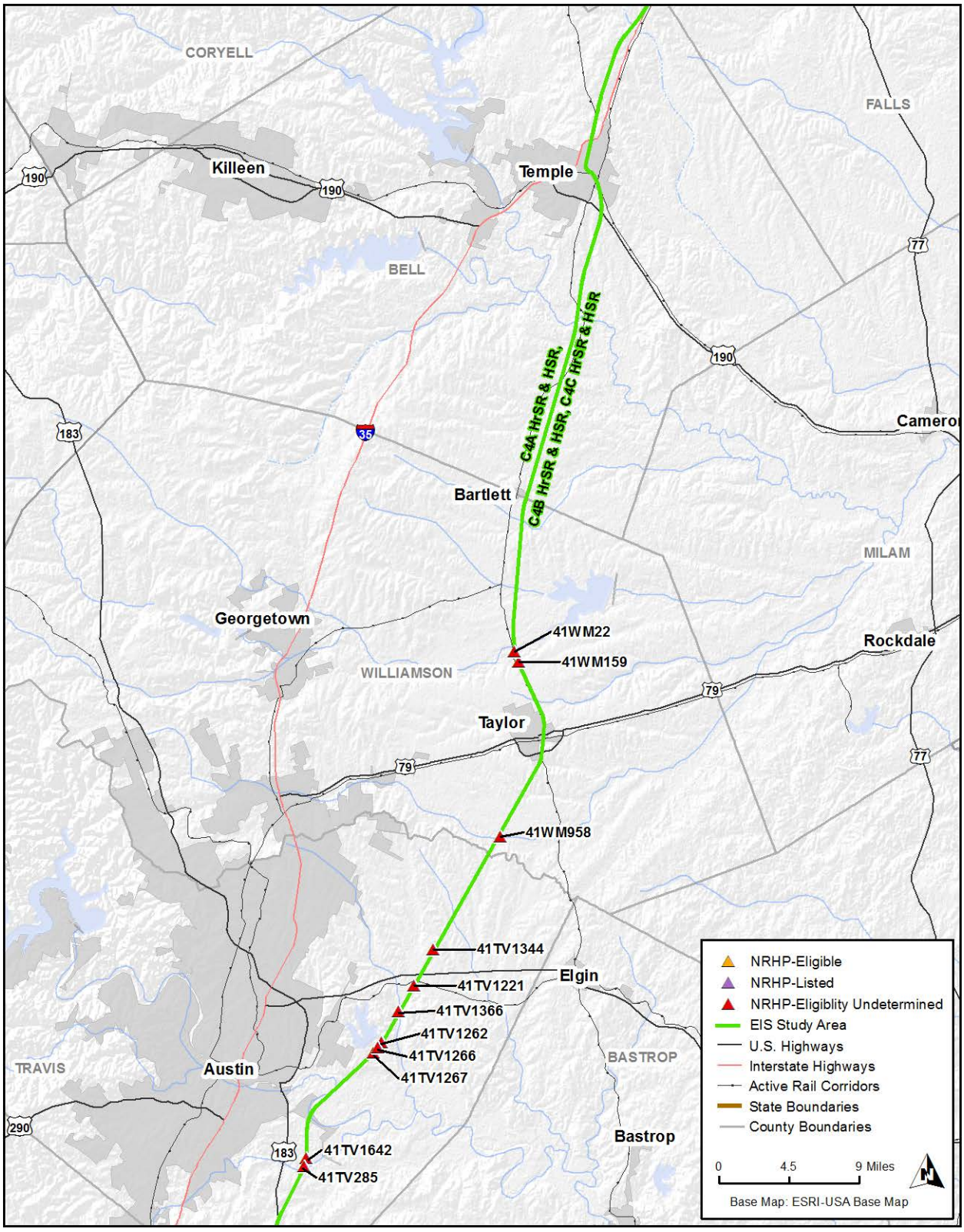


Figure 4-6: Archaeological Cultural Resources within the EIS Study Area – Map 5

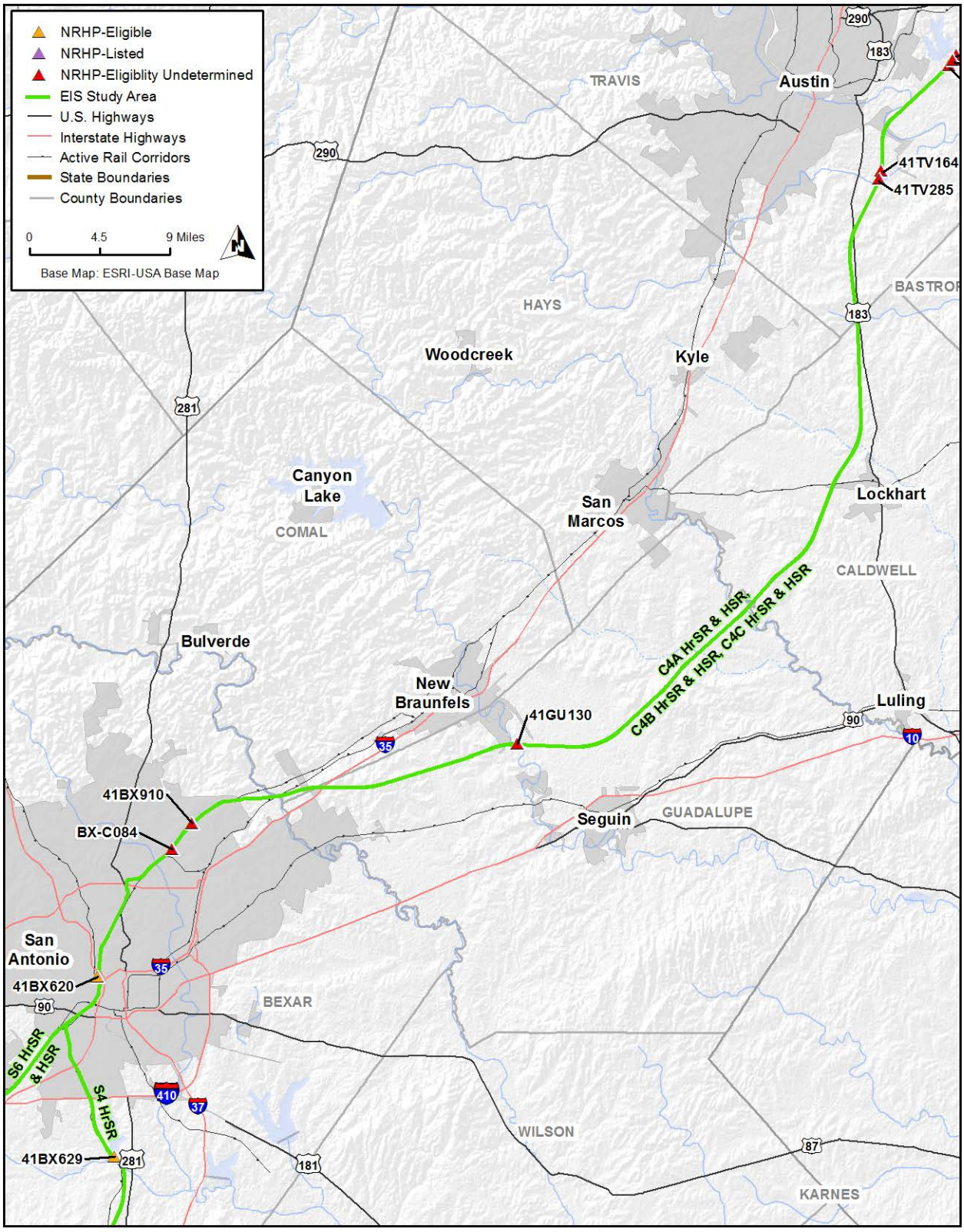


Figure 4-7: Archaeological Cultural Resources within the EIS Study Area – Map 6

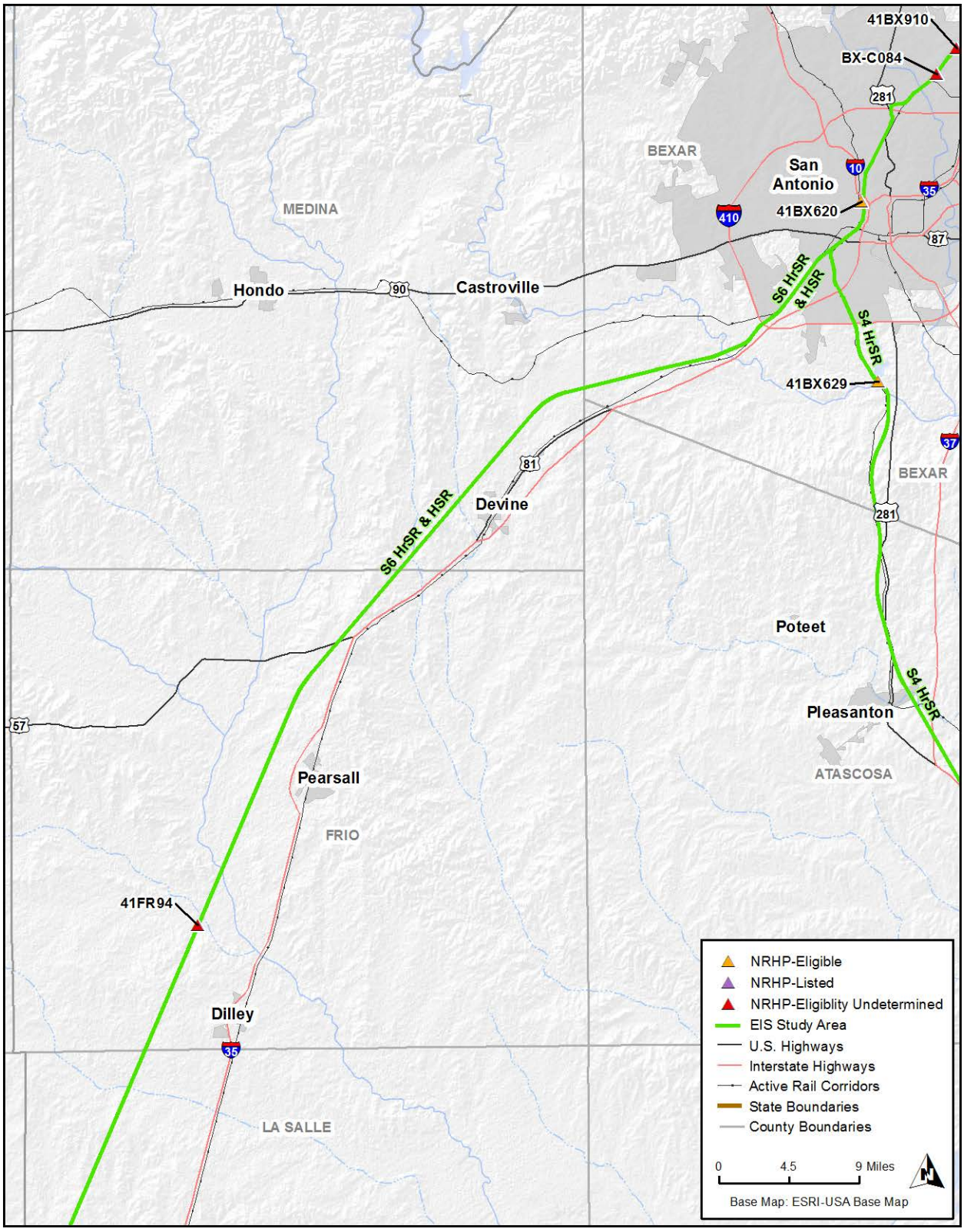


Figure 4-8: Archaeological Cultural Resources within the EIS Study Area – Map 7

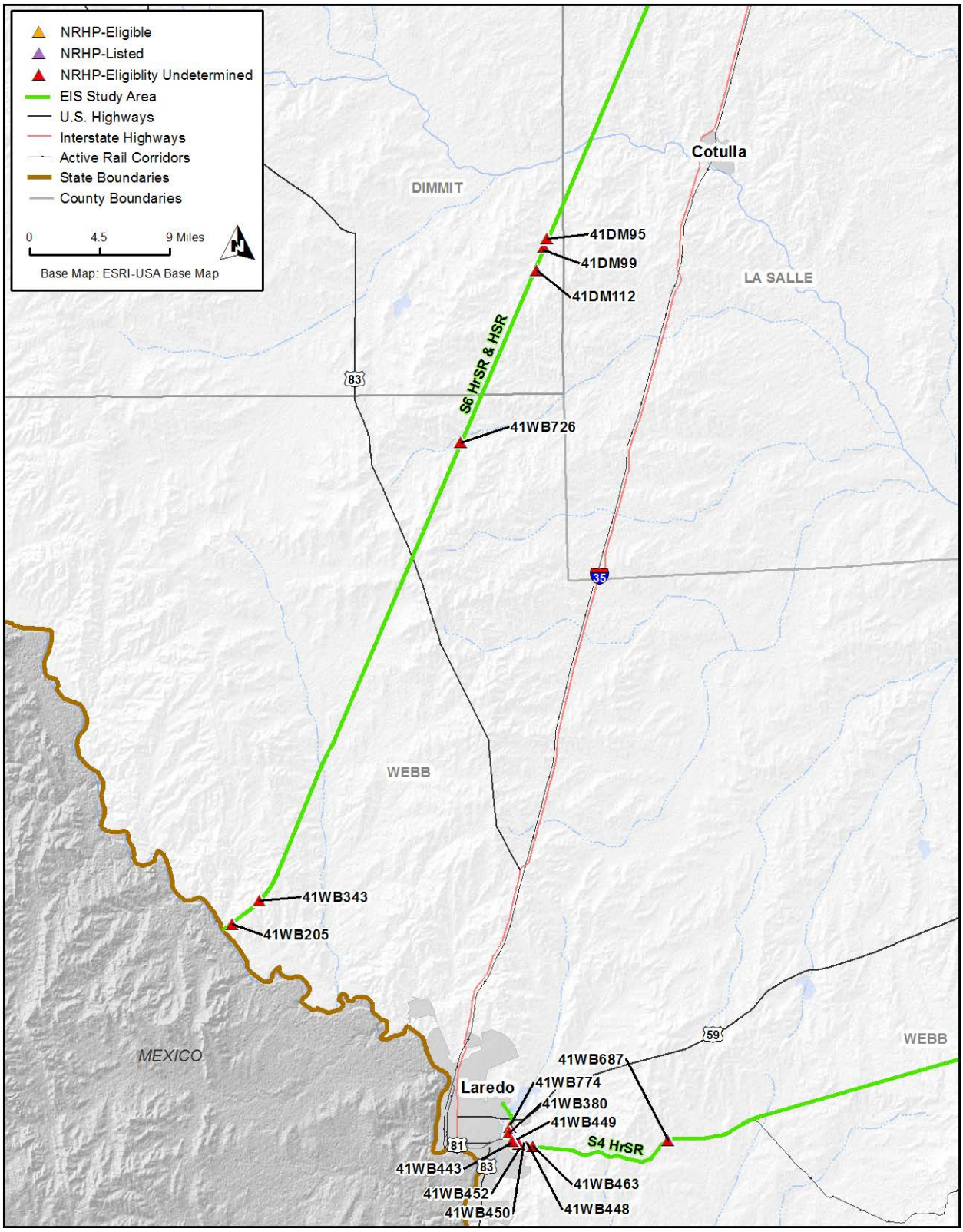


Figure 4-9: Archaeological Cultural Resources within the EIS Study Area – Map 8

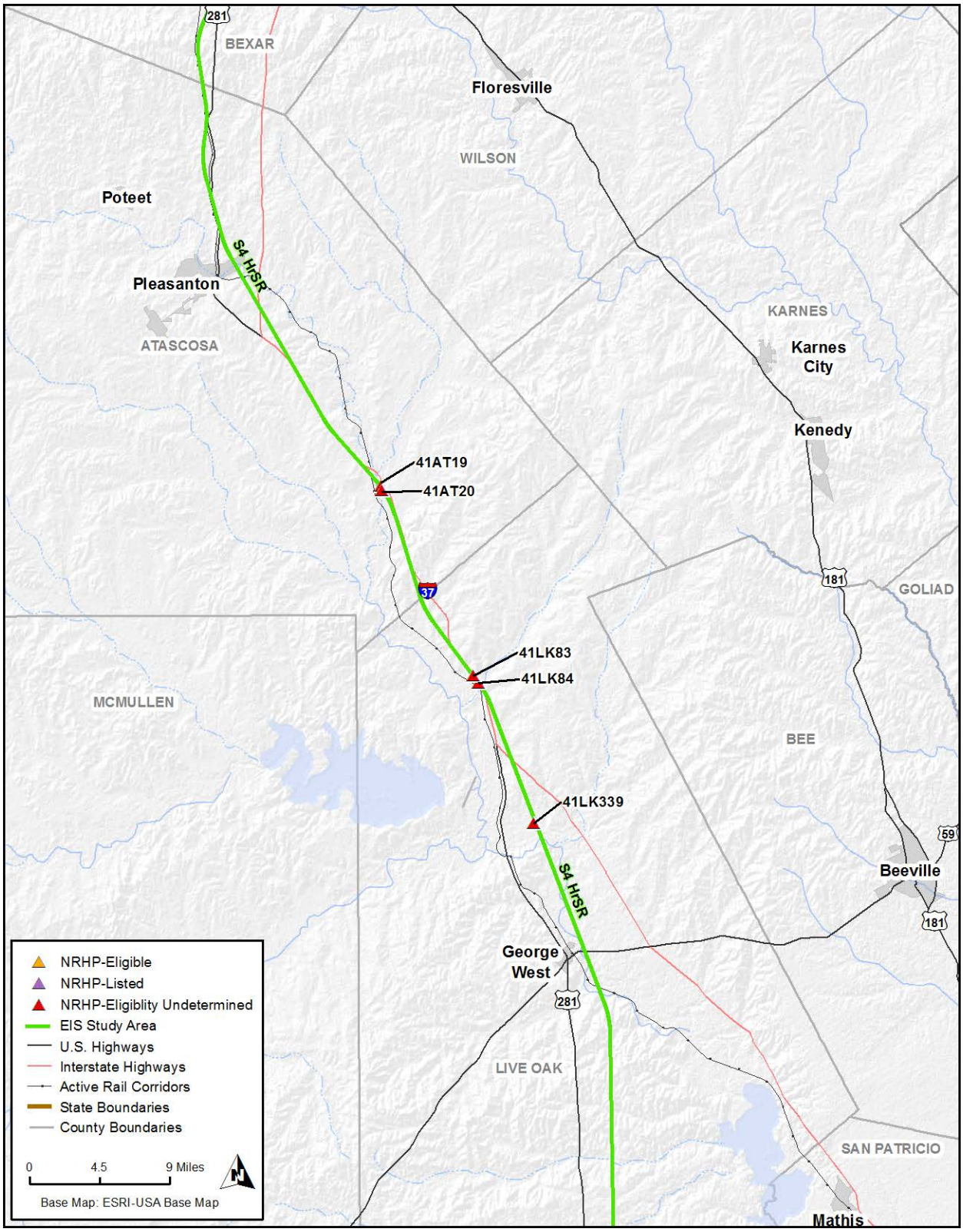


Figure 4-10: Archaeological Cultural Resources within the EIS Study Area – Map 9

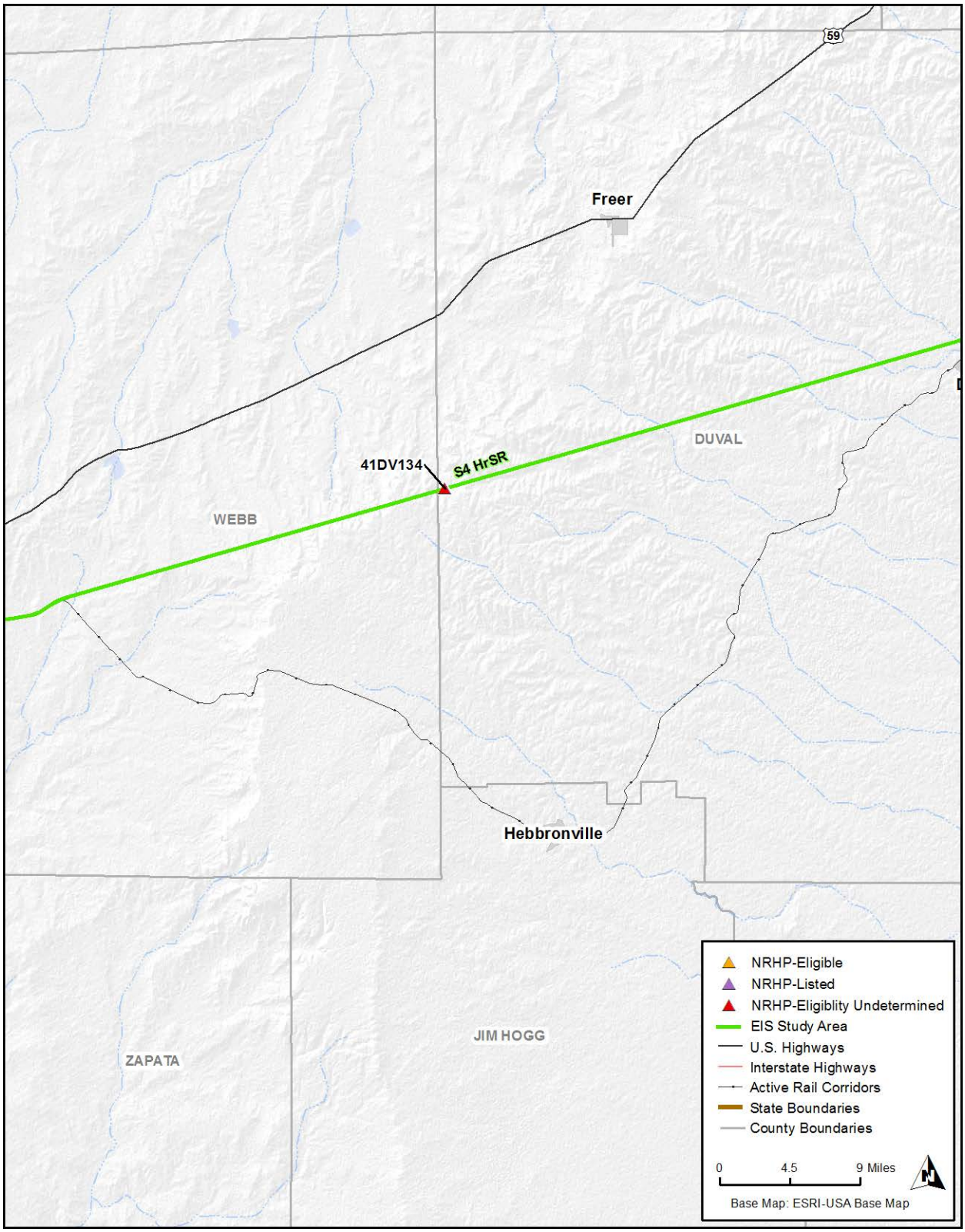


Figure 4-11: Archaeological Cultural Resources within the EIS Study Area – Map 10

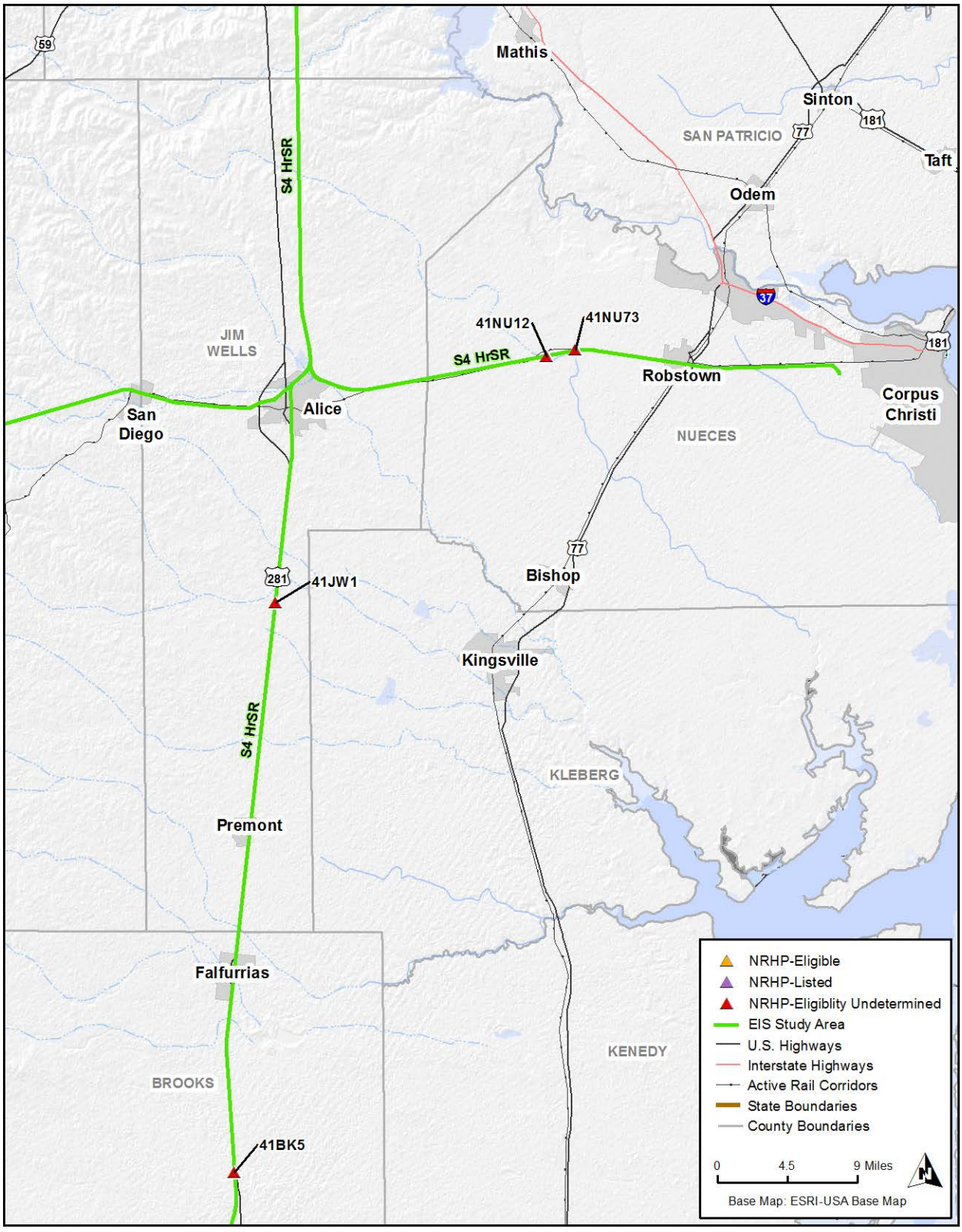


Figure 4-12: Archaeological Cultural Resources within the EIS Study Area – Map 11

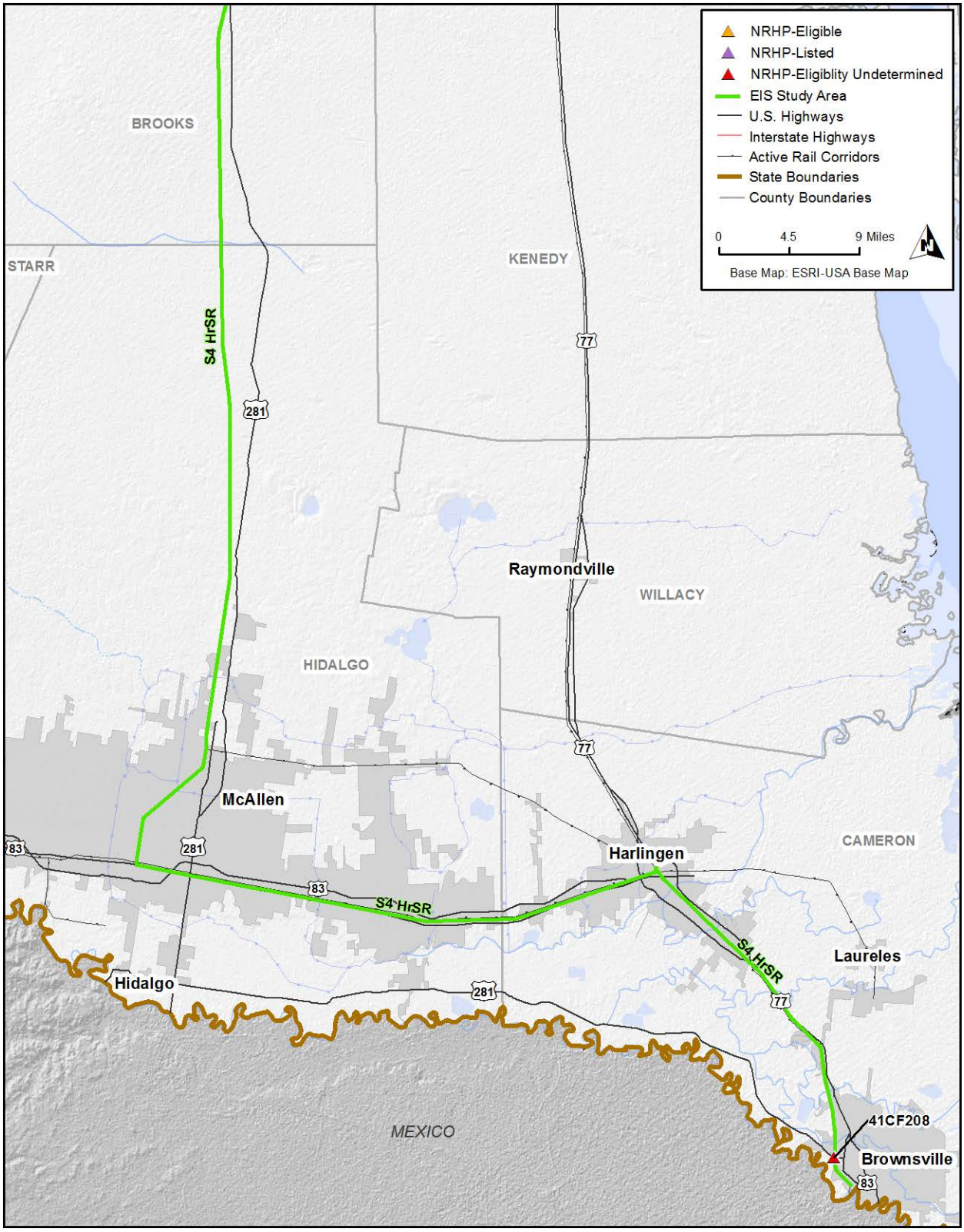


Figure 4-13: Archaeological Cultural Resources within the EIS Study Area – Map 12

5.0 Effects on Archaeological Sites

This section analyzes the potential effects on archaeological sites identified within the EIS Study Area. All alternatives, except for the No Build Alternative, have potential to affect archaeological sites.

The archaeological sites are presented by geologic section (Northern, Central, and Southern) in Table 5-1 and by alternative in Table 5-2.

Table 5-1: Summary of Archaeological Sites by Geographic 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**
Total Sites by NRHP Eligibility	**0**	**4**	**69** [a]	**73**

[a] Includes six sites represented twice on overlapping Northern and Central sections.

Table 5-2: Summary of Archaeological Sites by Alternative

Alternative	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 C4A HSR	0	1	25	**26**
C4B HrSR and C4B HSR	0	2	18	**20**
C4C HrSR and C4C HSR	0	1	26	**27**
S4 HrSR	0	1	20	**21**
S6 HrSR and S6 HSR	0	NA	7	**7**

The number of identified archaeological historic properties does not reflect the significance of archaeological sites nor a comprehensive number of known or unknown resources present 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 significant archaeological sites) were not identified in during this service-level analysis; areas of high sensitivity would be further refined and assessed during project-level analyses.

The intensity of an effect as a result of the route alternatives are characterized are negligible, moderate, or substantial compared to 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 the 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 occur in areas with a high likelihood archaeological resources present. For example, this may occur for roadway undercrossings and pier structure foundations.

The following analysis presents anticipated construction effects in urban, suburban, and rural settings for each alternative and associated stations. Operational phases would not disturb archaeological sites except that the program alternatives may influences additional development activities. To address these potential effects, site-specific review of indirect and cumulative effects would be included during the project-level analysis. These actions are not covered in this analysis and therefore operational effects are not discussed further.

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 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.

The discussion of effects below reflects a high-level analysis for the previously documented and registered archaeological sites identified within the EIS Study Area. Additional archaeological sites would likely be identified at the project level when a detailed field survey and site evaluations would be conducted. Most archaeological sites would likely be avoided and/or further assessed at the project level.

5.1 No Build Alternative

The No Build Alternative is used as a basis for comparison with 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; therefore, the No Build Alternative would not affect archaeological sites. However, 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.

5.2 Northern Section: Oklahoma City to Dallas and Fort Worth

In the Northern Section, only one alternative and the No Build Alternative were carried forward for further evaluation. Alternative N4A Conventional would follow the same general alignment within Dallas and Fort Worth as several of the alternatives in the Central Section. As a result, six archaeological sites are within both the Northern and Central Sections. These archaeological sites in the overlapping sections are identified in Table 4-3 and are illustrated on Figure 4-4.

5.2.1 Alternative N4A Conventional Rail

Data collection revealed one NRHP-eligible archaeological site and 14 archaeological sites with undetermined NRHP eligibility within the EIS Study Area for Alternative N4A Conventional (see Table 5-2). The 15 archaeological sites are considered to have moderate to high potential for significant archaeological deposits (see Tables 4-2 and 4-3 for specific data regarding individual archaeological sites). Specific areas of high sensitivity were not identified during this service-level analysis; however, as detailed in Section 4, areas located along major streams and rivers may require further investigations to identify significant archaeological sites.

During construction, Alternative N4A Conventional would likely have a negligible effect on urban, suburban, and rural archaeological sites as it would likely utilize an existing railroad infrastructure. However, if built parallel and adjacent to existing railroad facilities and tracks, minimal new rights-of-way and easements would be required, resulting in potential moderate effects on archaeological sites. Expansion of existing stations and construction of new stations within urban, suburban, and rural areas would cause moderate potential effects on archaeological sites. In addition, construction activities, including vehicular and heavy equipment access/egress, parking facilities,

and staging areas, would potentially cause moderate effects on archaeological sites compared to the No Build Alternative.

The 15 archaeological sites previously recorded in the Alternative N4A Conventional Rail corridor may have been affected by previous development; therefore, field investigations may be necessary to further assess their degree of integrity and significance. Additional archaeological sites identified during the project-level analysis would also require significance assessments. Effects on significant archaeological sites would be minimized and avoided, if possible, during construction. Minimization and avoidance of urban, suburban, and rural archaeological historic properties would likely be developed at the project level.

5.3 Central Section: Dallas and Fort Worth to San Antonio

In the Central Section, six alternatives and the No Build Alternative were carried forward for further evaluation. Several of the alternatives in the Central Section would follow the same general alignment as Alternative N4A Conventional. As stated above, six archaeological sites are within both the Northern and Central Sections. These overlapping archaeological sites are identified in Table 4-4 and are illustrated on Figure 4-4.

Four of the alternatives in the Central Section (Alternative C4A [both service types] and Alternative C4B [both service types]) follow the same alignment from Hillsboro to San Antonio (see Figures 1-1 and 4-4 through 4-7). Because effects on archaeological sites occur primarily during construction and differ only slightly by service type (high-speed and higher-speed rail) based on use of existing versus new right-of-way, the effects for these four alternatives are the same between Hillsboro and San Antonio.

5.3.1 Alternative C4A Higher-Speed Rail

Data collection revealed one NRHP-eligible site and 25 sites with undetermined NRHP eligibility within the EIS Study Area for Alternative C4A Higher-Speed Rail (see Table 5-2). The 26 archaeological sites are considered to have moderate to high potential for significant archaeological deposits (see Table 4-4 for specific data regarding individual archaeological sites). Specific areas of high sensitivity were not identified during this service-level analysis; however, as detailed in Section 4, areas specifically located along major streams and rivers may require further investigations to identify significant archaeological sites.

Within Alternative C4A Higher-Speed Rail, the densest concentration of previously recorded archaeological sites is largely within Dallas and Fort Worth; this site concentration is likely a result of intensive archaeological investigations associated with large-scale development projects. In these areas, the alternative would likely be located within existing railroad right-of-way, and new construction would likely be directly adjacent to existing railroad facilities and tracks. If built parallel and adjacent to existing railroad facilities and tracks, minimal new rights-of-way and easements would be required, resulting in potentially moderate effects on archaeological sites as compared to the No Build Alternative. Expansion of existing stations and construction of new stations within

urban, suburban, and rural areas would cause moderate potential effects on archaeological sites. In addition, construction activities, including vehicular and heavy equipment access/egress, parking facilities, and staging areas, would cause moderate potential effects on archaeological sites.

The 26 archaeological sites previously recorded in the Alternative C4A Higher-Speed Rail corridor may have been affected by previous development; therefore, field investigations may be necessary to further assess their degree of integrity and significance. Additional archaeological sites identified during the project-level analysis would also require significance assessments. Effects on significant archaeological sites would be minimized or avoided, if possible, during construction.

In areas where new location alignments may be necessary, the potential for effects on significant archaeological sites is high. Minimization of effects on or avoidance of urban, suburban, and rural archaeological historic properties would likely be conducted at the project level.

5.3.2 Alternative C4A High-Speed Rail

Alternative C4A High-Speed Rail has the same EIS Study Area as Alternative C4A Higher-Speed Rail, and therefore it would potentially affect the same resources. Data collection revealed one NRHP-eligible site and 25 sites with undetermined NRHP eligibility within the EIS Study Area for Alternative C4A High-Speed Rail (see Table 5-2). The 26 archaeological sites are considered to have moderate to high potential for significant archaeological deposits (see Table 4-4 for specific data regarding individual archaeological sites). Specific areas of high sensitivity were not identified during this service-level analysis; however, areas specifically located along major streams and rivers may require further investigation to identify significant archaeological sites.

In major urban areas such as Fort Worth, Dallas, and San Antonio, Alternative C4A High-Speed Rail facilities would be on a new alignment. Because dense development in these areas may limit the ability to avoid effects on archaeological sites at the project level, the potential for effects on such sites is considered 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 cause moderate potential effects on archaeological sites based on the same potential limitations.

In suburban areas, effects on archaeological sites would be moderate during construction because a new alignment and stations would be required. However, suburban areas typically feature more open space than dense urban environments, which may enable more flexibility to minimize or avoid, if possible, effects on archaeological historic properties at the project level.

High-speed rail service requires crossings to be grade-separated, which would require structural support or deep excavation. These 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 of effects on or

avoidance of urban, suburban, and rural archaeological historic properties would likely be conducted at the project level wherever possible.

5.3.3 Alternative C4B Higher-Speed Rail

Data collection revealed two NRHP-eligible sites and 18 sites with undetermined NRHP eligibility within the EIS Study Area for Alternative C4B Higher-Speed Rail (see Table 5-2). The 20 previously recorded archaeological sites are considered to have moderate to high potential for significant archaeological deposits (see Table 4-4 for specific data regarding individual archaeological sites). Specific areas of high sensitivity were not identified during at this service-level analysis; however, as detailed in Section 4, areas specifically located along major streams and rivers may require further investigations to identify significant archaeological sites.

Within Alternative C4B Higher-Speed Rail, the densest concentration of archaeological sites is largely within Dallas and Fort Worth; this site concentration is likely a result of intensive archaeological investigations associated with large-scale development projects. In these areas, the alternative may be located within existing railroad right-of-way, and new construction would likely be directly adjacent to existing railroad facilities and tracks resulting in moderate effects on archaeological sites. If built parallel and adjacent to existing railroad facilities and tracks, minimal new rights-of-way and easements would be required, potentially resulting in moderate effects on archaeological sites. Expansion of existing stations and new stations within urban, suburban, and rural areas would cause moderate potential effects on archaeological sites. In addition, construction activities, including vehicular and heavy equipment access/egress, parking facilities, and staging areas, would cause moderate potential effects on archaeological sites.

The 20 previously recorded archaeological sites may have been affected by previous development; therefore, field investigations may be necessary to further assess their degree of integrity and significance. Additional archaeological sites identified during the project-level analysis would also require significance assessments. Effects on significant archaeological sites would be minimized or avoided, if possible, during construction.

In areas where new location alignments may be necessary, the potential for effects on significant archaeological sites is high. Minimization or avoidance of urban, suburban, and rural archaeological historic properties would likely be conducted at the project level.

5.3.4 Alternative C4B High-Speed Rail

Alternative C4B High-Speed Rail has the same EIS Study Area as Alternative C4B Higher-Speed Rail, and therefore it would potentially affect the same resources. Data collection revealed two NRHP-eligible sites and 18 sites with undetermined NRHP eligibility within the EIS Study Area for Alternative C4B High-Speed Rail (see Table 5-2). The 20 archaeological sites within this alternative are considered to have moderate to high potential for significant archaeological deposits (see Table 4-4 for specific data regarding individual archaeological sites). Specific areas of high sensitivity were not identified during this service-level analysis; however, as detailed in Section 4, areas

located along major streams and rivers may require survey to identify significant archaeological sites.

In major urban areas such as Fort Worth, Dallas, Waxahachie, Waco, Temple, Austin, and San Antonio, Alternative C4B High-Speed Rail facilities would be on a new alignment. Because dense development in these areas may limit the ability to avoid effects on archaeological sites at the project level, the potential for effects on such sites is considered 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 result in moderate potential effects on archaeological sites based on the same potential limitations.

Unlike the higher-speed rail option, Alternative C4B High-Speed Rail is limited in its flexibility to avoid and minimize effects on archaeological sites because of design constraints (e.g., curve radii must be a minimum of 5 miles in diameter). Therefore, effects on archaeological historic properties, if present, may be difficult, if not impossible, to avoid or minimize and would potentially be substantial.

High-speed rail service requires crossings to be grade-separated, which would require structural support or deep excavation. These 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 of effects on or avoidance of urban, suburban, and rural archaeological historic properties would likely be conducted at the project level wherever possible.

5.3.5 Alternative C4C Higher-Speed Rail

Data collection revealed one NRHP-eligible site and 26 sites with undetermined NRHP eligibility within the EIS Study Area for Alternative C4C Higher-Speed Rail (see Table 5-2). The 27 archaeological sites within this alternative are considered to have moderate to high potential for significant archaeological deposits (see Table 4-4 for specific data regarding individual archaeological sites). Specific areas of high sensitivity were not identified during this service-level analysis; however, as detailed in Section 4, areas specifically located along major streams and rivers may require further investigations to identify significant archaeological sites.

Within Alternative C4C Higher-Speed Rail, the densest concentration of archaeological sites is largely within Dallas and Fort Worth; this site concentration is likely a result of intensive archaeological investigations associated with large-scale development projects. In these areas, the alternative may be located within existing railroad right-of-way and directly adjacent to existing railroad facilities and tracks resulting in moderate effects on archaeological resources. If built parallel and adjacent to existing railroad facilities and tracks, minimal new rights-of-way and easements would be required, resulting in potential moderate effects on archaeological sites. Expansion of existing stations and new stations within urban, suburban, and rural areas would result in moderate potential effects on archaeological sites. In addition, construction activities,

including vehicular and heavy equipment access/egress, parking facilities, and staging areas, would result in moderate potential effects on archaeological sites.

The 27 previously recorded archaeological sites in the EIS Study Area may have been affected by previous development; therefore, field investigations may be necessary to further assess their degree of integrity and significance. Additional archaeological sites identified during the project-level analysis would also require significance assessments. Effects on significant archaeological sites would be minimized or avoided, if possible, during construction.

In areas where new location alignments may be necessary, the potential for effects on significant archaeological sites is high. Minimization of effects on or avoidance of urban, suburban, and rural archaeological historic properties would likely be conducted at the project level.

5.3.6 Alternative C4C High-Speed Rail

Alternative C4C High-Speed Rail has the same EIS Study Area as Alternative C4C Higher-Speed Rail, and therefore it would potentially affect the same resources. Data collection revealed one NRHP-eligible site and 26 sites with undetermined NRHP eligibility within the EIS Study Area for Alternative C4C High-Speed Rail (see Table 5-2). The 27 previously recorded archaeological sites within this alternative are considered to have moderate to high potential for significant archaeological deposits (see Table 4-4 for specific data regarding individual archaeological sites). Specific areas of high sensitivity were not identified during this service-level analysis; however, as detailed in Section 4, areas located along major streams and rivers may require survey to identify significant archaeological sites.

In major urban areas such as Fort Worth, Dallas, Waxahachie, Waco, Temple, Austin, and San Antonio, Alternative C4C High-Speed Rail facilities would be on new alignment. Because dense development in these areas may limit the ability to avoid effects on archaeological sites at the project level, the potential for effects on such sites is considered substantial 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 result in substantial potential effects on archaeological sites based on the same potential limitations.

In suburban areas, effects on archaeological sites are anticipated to be moderate to substantial during construction because a new alignment and stations would be required. However, suburban areas typically feature more open space than dense urban environments, which may enable more flexibility to minimize or avoid, if possible, effects on archaeological historic properties at the project level.

High-speed rail service requires crossings to be grade-separated, which would require structural support or deep excavation. These 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 likely be conducted at the project level wherever possible.

5.4 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. Alternative S6 (both service types) has relatively few previously identified archaeological sites compared to Alternative S4 Higher-Speed Rail. The following discusses the effects of these three alternatives on archaeological resources.

5.4.1 Alternative S4 Higher-Speed Rail

Data collection revealed 1 NRHP-eligible archaeological site and 20 sites with undetermined NRHP eligibility previously recorded within the EIS Study Area for Alternative S4 Higher-Speed Rail (see Table 5-2). The 21 previously recorded archaeological sites within this alternative are considered to have moderate to high potential for significant archaeological deposits (see Table 4-5 for specific data regarding individual archaeological sites). 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. Additionally, as detailed in Section 4, high-probability areas (areas located along major streams and rivers) may require further investigations to identify significant archaeological sites.

Within Alternative S4 Higher-Speed Rail, the densest concentration of archaeological sites is largely within Laredo; this site concentration is likely a result of intensive archaeological investigations associated with large-scale development projects. In these areas, the alternative may be located within the existing railroad right-of-way and directly adjacent to existing railroad facilities and tracks, and therefore, avoidance design refinement may result in moderate effects. If built parallel and adjacent to existing railroad facilities and tracks, minimal new rights-of-way and easements would be required, resulting in potential moderate effects on archaeological sites as compared with the No Build Alternative. Expansion of existing stations and new stations within urban, suburban, and rural areas would result in moderate potential effects on archaeological sites. In addition, construction activities, including vehicular and heavy equipment access/egress, parking facilities, and staging areas, would potentially result in moderate effects on archaeological sites.

The 21 previously identified archaeological sites may have been affected by previous development; therefore, field investigations may be necessary to further assess their degree of integrity and significance. Additional archaeological sites identified during the project-level analysis would also require significance assessments. Effects on significant archaeological sites would be minimized or avoided, if possible, during construction.

In areas where new location alignments may be necessary, the potential for effects on significant archaeological sites is high. Minimization of effects on or avoidance of urban, suburban, and rural archaeological sites would likely be conducted at the project level.

5.4.2 Alternative S6 Higher-Speed Rail

Data collection revealed seven archaeological sites with undetermined NRHP eligibility within the EIS Study Area for Alternative S6 Higher-Speed Rail (see Table 5-2). The seven archaeological sites within this alternative are considered to have moderate to high potential for significant archaeological deposits (see Table 4-5 for specific data regarding individual archaeological sites). Specific areas of high sensitivity were not identified during this service-level analysis; however, as detailed in Section 4, areas specifically located along major streams and rivers may require further investigation to identify significant archaeological sites.

During construction, Alternative S6 Higher-Speed Rail would likely have similar effects on archaeological sites as the other higher-speed rail options. Although a limited number of archaeological sites were previously identified within Alternative S6 Higher-Speed Rail, this likely reflects the limited number of archaeological investigations within this area. The alternative may be located within existing railroad right-of-way, when possible, and directly adjacent to existing railroad facilities and tracks. However, this is a small area of the alignment, and therefore it is more likely that new rights-of-way and easements would be required, resulting in potential moderate effects on archaeological sites. Expansion of existing stations and new stations within urban, suburban, and rural areas would result in moderate potential effects on archaeological sites. In addition, construction activities, including vehicular and heavy equipment access/egress, parking facilities, and staging areas, would potentially result in moderate effects on archaeological sites.

The seven previously recorded archaeological sites may have been affected by previous development; therefore, field investigations may be necessary to further assess their degree of integrity and significance. Additional archaeological sites identified during the project-level analysis would also require significance assessments. Effects on significant archaeological sites would be minimized or avoided, if possible, during construction. Minimization of effects on or avoidance of urban, suburban, and rural archaeological historic properties would likely be conducted at the project level.

5.4.3 Alternative S6 High-Speed Rail

Alternative S6 High-Speed Rail has the same EIS Study Area as Alternative S6 Higher-Speed Rail, and therefore it would potentially affect the same resources. Data collection revealed seven previously recorded archaeological sites with undetermined NRHP eligibility within the EIS Study Area for Alternative S6 High-Speed Rail (see Table 5-2). The seven previously recorded archaeological sites are considered to have moderate to high potential for significant archaeological deposits (see Table 4-5 for specific data regarding individual archaeological sites). Specific areas of high sensitivity were not identified during this service-level analysis; however, as

detailed in Section 4, areas specifically located along major streams and rivers may require further investigation to identify significant archaeological sites.

In urban areas, Alternative S6 High-Speed Rail facilities would be on a new alignment. Because dense development in these areas may limit the ability to avoid effects on archaeological sites at the project level, the potential for effects on such sites is considered 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 result in moderate potential effects on archaeological sites based on the same potential limitations.

Although high-speed rail construction requires large horizontal curves, which makes avoidance of individual archaeological sites more difficult in urban areas, the availability of large swaths of undeveloped land in rural areas allow the possibility for avoidance or archaeological historic properties at the project level. Therefore, effects on archaeological sites in rural areas of Alternative S6 High-Speed Rail are anticipated to be moderate during construction.

High-speed rail service requires crossings to be grade-separated, which would require structural support or deep excavation. These 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 of effects on or avoidance of urban, suburban, and rural archaeological historic properties would likely be conducted at the project level wherever possible.

6.0 Avoidance, Minimization, and Mitigation Strategies

Mitigation strategies are conceptual measures that are often developed in the early stages during 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 and may result in agreements, such as a Memorandum of Agreement (MOA) or Program Agreement executed among agencies. An MOA would be coordinated with both Texas and Oklahoma SHPOs, Native American tribes, and other interested parties as appropriate. A project-level Program Agreement would be coordinated with FRA, TxDOT, ODOT, and Texas and Oklahoma 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 UDP would be followed.

Mitigation measures for archaeological historic properties would be further developed in consultation with Texas and Oklahoma SHPOs and in consultation with Native American Indian tribes during project-level analyses once an archaeological site has been determined eligible for the NRHP. Project-level review would include a more detailed analysis of potentially moderate or substantial impacts and mitigation measures to reduce such effects. For actions that would result in moderate or substantial effects 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 effects and proposed mitigation measures at the project level.

At the project level, recommended mitigation measures include various levels of excavation that could be used in cases where moderate or substantial effects on archaeological historic properties cannot be avoided or minimized. These options could include full excavation of the affected archaeological historic property, sampling the archaeological deposits, or focused excavation of the most intact archaeological deposits. The mitigation strategies often include NRHP nominations, short- and long-term archaeological site management, and educational materials for public outreach, including brochures, displays, and websites. Information gathering would be necessary before construction (including required documentation of the archaeological site), and development and publication of the associated education materials would occur during the construction and operations phase.

7.0 Summary

Within the regulatory context and purpose of the proposed Program, this technical study has examined archaeological sites within the EIS Study Area based on described evaluation methods within general cultural contexts. Examination of potential effects on the archaeological sites during the construction phase of each alternative, as well as preliminary assessments of the intensity of these potential effects on sites, indicates that all alternatives, except for the No Build Alternative, have the potential to disturb known archaeological sites, which are underground remnants from prehistoric and historic cultural activities (see Table 7-1). No archaeological probes were conducted for this service-level EIS; therefore, this evaluation does not provide a true representation of archaeological resources present within the EIS Study Area and only presents information on previously recorded archaeological resources in the EIS Study Area.

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. Additionally, future project-level analysis regarding prehistoric cultural history will be required to determine a more detailed measure of prehistoric archaeological sensitivity for each specific project. This effort may include preparation of archaeological sensitivity maps and may require the incorporation of that future dataset into site location predictive settlement models. The project-level analysis will also need to consider that the potential for previously identified historic properties identified in this service-level analysis may include previously unidentified archaeological deposits that contribute to the significance of those historic properties.

Alternative N4A Conventional may only result in negligible effects because this alternative may be limited to improvements of existing rail tracks where previously recorded archaeological sites may already have been removed or disturbed. If further design results in locating the alternative parallel to existing tracks, it would potentially result in moderate effects on archaeological resources.

The Central Section higher-speed rail alternatives could result in moderate effects on archaeological resources. High-speed rail alternatives would likely result in substantial effects on archaeological resources because of the extent of project-related deep excavations necessary for such alternatives. Although 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 are necessary.

In the Southern Section, Alternative S4 Higher-Speed Rail would have moderate effects on archaeological resources based on the extent of possible project-related disturbances. Alternative S6 Higher-Speed Rail is shorter in length compared to Alternative S4 and has fewer previously identified archaeological resources, but it may still result in moderate effects on archaeological

resources based on the extent of possible project-related disturbances associated with the rail construction.

Potential strategies to mitigate or minimize possible adverse effects on identified archaeological historic properties within the EIS Study Area will be conducted at the project level and will include the development of MOAs and Program Agreements, as necessary. Minimization of adverse effects on or avoidance of archaeological historic properties would likely be conducted at the project-level evaluation. However, if minimization or avoidance is not possible, measures to mitigate adverse effects on such properties through various levels of archaeological excavation or alternative mitigation strategies would be used.

Table 7-1: Summary of Potential Intensity of Effects on Archaeological Sites

Section	Alternative	Context No. of NRHP listed or eligible sites	Potential Intensity of Effects[a, b]
No Build Alternative[c]		Not applicable	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

[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.

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