Oak Hill Parkway
Biological Resources
Technical Report

OAK HILL
PARKWAY

U.S. Highway 290 (US 290) / State Highway (SH)
71 West from State Loop 1 (Mopac) to Ranch-to-Market (RM) 1826 and SH 71 to Silvermine Drive

Travis County, Texas

CSJ # 0113-08-060 and 0700-03-077

August 2017

CENTRAL TEXAS
Regional Mobility Authority

Texas Department of Transportation

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried-out by TxDOT pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated December 16, 2014, and executed by FHWA and TxDOT.

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1. INTRODUCTION

The Texas Department of Transportation (TxDOT) and the Central Texas Regional Mobility Authority (Mobility Authority) are considering mobility improvements to U.S. Highway 290 (US 290)/State Highway (SH) 71 West through Oak Hill (the Oak Hill Parkway). The project corridor extends along US 290 from State Loop 1 (Loop 1 or Mopac) to Farm-to-Market (FM) 1826 for a distance of approximately 6.15 miles with a transition to the west. The project also includes the interchange on SH 71 from US 290 to Silvermine Drive, a distance of approximately 1.31 miles. The proposed project corridor is within the City of Austin (COA), Travis County, Texas, and includes the proposed location of two stormwater detention ponds: the first along SH 71 north of Covered Bridge Drive and the second between SH 71 and Old Bee Caves Road across from Sunset Ridge. The existing bridge over Williamson Creek and several culverts and/or drainage structures would be replaced or rehabilitated to accommodate the additional roadway width and new alignment. The existing right-of-way ranges from 90 to 260 feet wide and the proposed right-of-way would range from approximately 150 to 600 feet wide.

1.1 Project History

The proposed project evolved from efforts that began in the mid 1980's. The proposed improvements were originally considered and approved in a Final EIS, Record of Decision (ROD), which covered improvements to US 290/SH 71 from RM 1826 to Farm-to-Market (FM) 973. Since the issuance of the ROD in 1988, partial construction of the original project (between Joe Tanner Lane and Riverside Drive) has been constructed and changes in adjacent land use, State and Federal species listings, funding mechanisms, and public input have resulted in a new proposed design concept for this project. The original Final EIS has been reevaluated four times and a Biological Opinion for effects to federally-listed species within the initial project area was issued by the U.S Fish and Wildlife Service in 2006 (USFWS, 2006). Environmental and traffic related studies and reports, as well as public involvement activities have continued since the issuance of the 1988 ROD. In 2012, a Notice of Intent (NOI) was published in both the Texas and Federal Registers announcing TxDOT's intent to prepare a new EIS for the US 290/ SH 71 Oak Hill Parkway project.

1.2 Existing Facility

Currently, the US 290/SH 71 facility consists of a six-lane urban freeway section with two- to four-lane frontage roads from Mopac to just west of Old Fredericksburg Road. Direct connector ramps connect US 290/SH 71 to the Mopac main lanes. Between Old Fredericksburg Road and Joe Tanner Lane, US 290/SH 71 transitions from a freeway/frontage road facility to a four- and five-lane urban highway; this urban highway section continues to just east of the SH 71 junction. Between SH 71 and FM 1826, the existing US 290 roadway consists of four 11-foot travel lanes with intermittent 14-foot center turn lanes and shoulders ranging from 2 to 4 feet in width. The existing SH 71 accommodates four 12-foot travel lanes, two 8-foot shoulders, and a 14-foot continuous center turn lane.

Dual left-turn and right-turn lanes exist on US 290 at Convict Hill Road, the Austin Community College Driveway, the Speedy Stop, Oak Hill United Methodist Church, and FM 1826. Innovative

improvements called continuous flow intersections (CFI) were constructed on US 290 at William Cannon and SH 71, as well as a median U-turn at Joe Tanner Lane. The CFI was constructed in one direction at SH 71 and in two directions at William Cannon.

1.3 Project Information

The project corridor extends along US 290 from Mopac to FM 1826 for a distance of approximately 6.15 miles with a transition to the west. The project also includes the interchange on SH 71 from US 290 to Silvermine Drive, a distance of approximately 1.31 miles. Two proposed stormwater detention pond locations adjacent to SH 71 are also included in the project area (see **Figure 1**). The project is located in Travis County, Texas, and is shown on the USGS 7.5' quadrangle maps for Bee Cave, Oak Hill, and Signal Hill, Texas (see **Figure 2**).

1.4 Build Alternatives

Two design alternatives (*Alternative A* & *Alternative C*) will be advanced through schematic development and environmental analysis as the potential build options for the Oak Hill Parkway project. The *No Build Alternative* will also be carried forward. For purposes of this report, the physical area covered by the combined alternative alignments is considered the project area since there are only slight modifications between the overall alignments of the build alternatives. The project area includes the location of two proposed stormwater detention ponds: the first along SH 71 north of Covered Bridge Drive and the second between SH 71 and Old Bee Caves Road across from Sunset Ridge. Both alternatives would incorporate culverts, vegetative filter strips, and bioretention ponds within the proposed or existing right-of-way. New right-of-way and easements would be required for both design alternatives. See **Figures 1** and **2** in **Attachment A**.

1.4.1 Alternative A

Alternative A is a conventional controlled-access highway with frontage roads. New construction on roadway improvements would begin just east of Joe Tanner Lane where the existing main lanes transition to an urban highway. With *Alternative A*, the main lanes would be elevated over William Cannon Drive and frontage roads would be at grade; both the westbound main lanes and frontage road would be located north of Williamson Creek. The main lanes would be depressed under SH 71 and direct connectors would be provided connecting eastbound SH 71 with US 290 and westbound US 290 to SH 71. Main lanes would vary from four lanes in each direction near William Cannon Drive to a two-lane transition near the western project extent. Grade-separated intersections would be constructed at Convict Hill Road, FM 1826, Scenic Brook Drive, and Circle Drive (S. View Road). Main lanes would generally be 12 feet wide with 10-foot shoulders. Texas turnarounds, which allow vehicles traveling on a frontage road to U-turn onto the opposite frontage road, would be constructed on US 290 frontage roads at Scenic Brook Drive, FM 1826, Convict Hill Drive, and William Cannon Drive.

Along SH 71, the direct connector ramps would extend past Scenic Brook Drive where the main lanes would transition to a five-lane (three lanes northbound, two lanes southbound) rural highway with

Texas turnarounds. Bicycle and pedestrian facilities would be provided via a shared-use path along the entire project length.

Alternative A would require the acquisition of approximately 74.58 acres of new right-of-way, which would include acreages for the two stormwater detention ponds. Approximately 4.08 acres of temporary construction easements and 0.21 acres of shared-use path are outside the right-of-way are currently proposed for this alternative.

1.4.2 Alternative C

Alternative C is a conventional controlled-access highway with frontage roads. New construction on roadway improvements would begin just east of Joe Tanner Lane where the existing main lanes transition to an urban highway. With *Alternative C*, the main lanes would be elevated over William Cannon Drive with eastbound and westbound main lanes located north of Williamson Creek. The frontage roads would be along the existing highway. The main lanes would remain elevated over the intersection with SH 71. West of SH 71, *Alternatives A* and *C* share the same design, and grade-separated intersections would be constructed at Convict Hill Road, FM 1826, Scenic Brook Drive, and Circle Drive (S. View Road). Direct connectors would allow drivers to access westbound SH 71 and eastbound US 290. US 290 would consist of two to four 12-foot lanes with 10-foot shoulders in each direction. Texas turnarounds would be constructed on US 290 frontage roads at Scenic Brook Drive, FM 1826, and Convict Hill Drive.

Along SH 71, the direct connector ramps would extend past Scenic Brook Drive where the main lanes would transition to a five-lane (three lanes northbound, two lanes southbound) rural highway with Texas turnarounds. Bicycle and pedestrian facilities would be provided via a shared-use path along the entire project length.

Alternative C would require the acquisition of approximately 75.19 acres of new right-of-way, which would include acreages for the two stormwater detention ponds. Approximately 4.12 acres of temporary construction easements and 0.21 acres of shared-use path outside of the right-of-way are currently proposed for this alternative.

1.4.3 No Build Alternative

Consistent with the requirements of the National Environmental Policy Act (NEPA) and Federal Highway Administration (FHWA) guidelines, this analysis also considers a *No Build Alternative* that assesses environmental effects if the proposed project were not built. This alternative, would include routine maintenance improvements to the existing roads in the study area and completion of the currently programmed, committed, and funded roadway projects. While the *No Build Alternative* does not meet the project need and purpose, it provides a baseline condition to compare and measure the effects of both build alternatives.

2. GENERAL DESCRIPTION OF THE OAK HILL PARKWAY PROJECT AREA

2.1 Natural Setting

The proposed project is located in the Edwards Plateau Natural Region of Texas (Gould, 1960). The Edwards Plateau is an uplifted ecological region of Central Texas characterized by thin top soils and rolling hills of sandstone, limestone, and shales. Elevations within this region range from 100 feet to 3,000 feet above mean sea level, and the topography is bisected by several river systems, which create a well-drained landscape. Historically a grassland savannah, the Edwards Plateau once supported a diverse assemblage of grasses and forbs with a juniper-oak woodland overstory.

The vegetation and geology of the Edwards Plateau define the distinctiveness of the wildlife community found within this region. The limestone hills and corresponding subterranean systems support an array of species that are endemic to this region. The Edwards Plateau ecoregion also provides habitat for a wide range of reptile, mammal, and avifauna species that are common to the Central Texas environment. However, agricultural practices, grazing operations, and development have transformed the vegetation community in much of this region into a landscape dominated by native-invasive plants (TPWD, 2017).

2.2 Land Use

The proposed project area is located in a primarily urban area. Both commercial and residential structures exist adjacent to the project corridor (**Attachment B**, **Photos 1 – 4**). Several parcels adjacent to the US 290 and SH 71 roadways are vacant, vegetated lots, which contain disturbed oak-juniper and native-invasive woodland vegetation (**Photos 5 - 9**). Undeveloped land is fragmented throughout the project area and includes riparian channels around creek crossings, limestone outcrops, and wooded lots (**Photos 10 – 22**). The proposed stormwater detention pond locations are a mixture of native and introduced vegetation surrounded by residential and commercial land. The proposed pond site located west of SH 71 is currently being used for livestock grazing (**Photo 6**), and the proposed pond site located adjacent to Old Bee Caves Road is currently undeveloped vegetated land.

3. GEOLOGY AND SOILS

3.1 Geology

The geology of the project area is a typical representation of karst topography (eroded limestone) in Central Texas. Two bedrock formations underlie the project area (**Figure 3**). West of the Mount Bonnell Fault lies the Upper Glen Rose Limestone formation which forms the stair-step topography that characterizes the Texas Hill Country region (TNRIS, 2007; Ward, 2006). East of the fault lies the Fredericksburg Group of the Edwards Formation. The Edwards Formation consists almost entirely of limestone, with minor chert lenses or horizons, and weathers mainly by dissolution. The Edwards Formation is known for its cavernous limestone which tends to fracture, creating sinkholes and caves that become avenues for recharge and dissolution (Small et al., 1996). At the intersection between these two formations lies the Mount Bonnell Fault. The surface expression of this fault is known as

the Balcones Escarpment and demarcates the line at which the eastern edge of the Texas Hill Country transitions into the western boundary of the Texas Coastal Plain. Along Williamson Creek the geology is less certain due to the alluvial deposits that mostly contain stream-laid sand and gravel (USGS, 2015). Over time, these deposits have undergone calichification and have created a bedrock-type surface with varying thickness; the areas of such deposits are mapped as alluvium. The eastern project terminus overlies high gravel deposits, which are commonly exposed to the surface; the gravel deposits may be overlaid by a silty-clay top layer with a lower coarse unit that is known to yield water (TNRIS, 2007).

The western portion of Travis County is located on the Edwards Plateau, a broad, flat expanse of Cretaceous-age carbonate rock that is characterized by its cave-containing rock units. These units have varying levels of surface exposure, which influence their likelihood of providing suitable habitat for cave-adapted fauna. Based on the geologic restrictions on the distribution of cave fauna and the locations of known caves, George Veni & Associates (1992) delineated four karst zones that reflect the relative likelihood of finding any of the rare or endemic karst invertebrates; these zones were revised in 2007 based on new occurrence data (Veni and Martinez, 2007).

These four zones are defined as:

- • Zone 1: Areas known to contain one or more of the listed karst invertebrates
- • Zone 2: Areas having a high probability of suitable habitat for the listed karst invertebrates
- • Zone 3: Areas that probably do not contain listed karst invertebrates
- • Zone 4: Areas that are not known to contain listed karst species

The Oak Hill Parkway corridor crosses Karst Zone 3 (east from the intersection of William Cannon to the project terminus at Mopac) and Karst Zone 4 (west from the intersection of William Cannon to the project termini on US 290 and SH 71). The area mapped as Karst Zone 3 is located within the South Travis Karst Fauna Region (KFR). These zones are depicted on **Figure 4**. Karst invertebrates and their potential occurrence within the project area are discussed in **Section 5.3** below.

A Geologic Assessment was conducted for the portion of the project area located over the Edwards Aquifer Recharge Zone in 2009 and updated in 2016 (Rahe, 2009; HDR, 2016). In all, eight potential recharge features were identified in 2009 but only six features were found during the updated survey in 2016. All features were located in the general vicinity of Williamson Creek at the US 290/SH71 crossing (see **Figure 4**). These features included one fault, one closed depression, two zones displaying fractures, three solution cavities, and one feature noted as a natural bedrock feature. Each was characterized using the methodology presented in the guidelines for geologic assessments on the Edwards Aquifer Recharge Zone (TCEQ, 2004). The two features not identified in 2016 (one solution cavity and one non-karst closed depression) and all six of the features described in 2016 were evaluated as sensitive (i.e., they have the potential to provide aquifer recharge pathways).

3.2 Soils

Geologic formations and their associated soils provide the foundation for the vegetation assemblages that are indicative of the Edwards Plateau. Soils from two associations underlie the Oak Hill Parkway project area (NRCS, 2016a) (**Figure 5**). The eastern portion of the project area consists of soils from the Speck-Tarrant association, which are characterized by shallow, stony, loamy soils and very shallow, stony, clayey soils overlying limestone. The western portion of the project area consists of soils from the Brackett association. Brackett soils are characterized by their shallow, gravelly, calcareous, loamy textures and overlie interbedded limestone and marl. Soils within the area of the proposed detention ponds are of the Brackett and Volente series. According to NRCS data (2016a), 12 soil types are located in the project area and have a range of slopes and infiltration characteristics. No soils within the project area are mapped as hydric or containing hydric inclusions. Several soils are mapped as prime farmlands. A list of soils occurring within the project area is included as **Table 1**.

Table 1: Soils within the Oak Hill Parkway Project Area

Soil Series Code	Soil Series	Hydric (Yes/No)	Prime Farmland (Yes/No)
BID	Bracket-Rock outcrop complex, 1 to 12 percent slopes	No	No
BoF	Brackett-Rock outcrop-Real complex, 8 to 30 percent slopes	No	No
CrA	Crawford clay, 0 to 1 percent slopes	No	Yes
CrB	Crawford clay, 1 to 3 percent slopes	No	Yes
DeB	Denton silty clay, 1 to 3 percent slopes	No	Yes
GP	Pits, gravel, 1 to 90 percent slopes	No	No
Md	Mixed alluvial land, 0 to 1 percent slopes, frequently flooded	No	No
PuC	Purves silty clay, 1 to 5 percent slopes	No	No
SaB	San Saba clay, 1 to 2 percent slopes	No	Yes
SsC	Speck stony clay loam, 1 to 5 percent slopes	No	No
TcA	Tarrant and Speck soils, 0 to 2 percent slopes	No	No
VoD	Volente silty clay loam, 1 to 8 percent slopes	No	No

Source: NRCS, 2016a

A brief description of each soil type is summarized from the NRCS Official Soil Series Descriptions below (NRCS, 2016b).

BID – Brackett Soils

These soils occupy gently undulating to rolling topography and are generally found on benches 100 to 500 feet wide that are separated by outcrops of the underlying limestone and marl. About 75 percent of the surface is covered with coarse fragments of limestone or chalk. The surface layer is light brownish-gray gravelly clay loam about 6 inches thick. The next layer is very pale brown clay loam about 12 inches thick, also containing scattered pieces of limestone or chalk. The underlying material is interbedded limestone and marl. These soils exhibit moderately slow permeability and low available water capacity.

CrA and CrB – Crawford Clays

These soils occur on gently undulating topography. They are dark to reddish-brown, moderately deep, noncalcareous clay soils over hard limestone. The surface layer to 14 inches below the surface is dark-brown neutral clay. The next layer is reddish-brown neutral clay about 12 inches thick, followed by about 32 inches of a reddish-brown neutral clay. The underlying material is hard limestone. This soil exhibits high available water capacity, fair slope stability, and high shrink-swell potential.

DeB – Denton Series

This series consists of deep, well-drained, slowly permeable soils that formed in clayey materials over residuum weathered from limestone bedrock. These nearly level or gently sloping soils are on uplands with slopes ranging from 0 to 5 percent.

GP – Pits, Gravel

This is a miscellaneous land type that includes concave landforms, typical of gravel pits.

Md – Mixed Alluvial Land

This is a miscellaneous land type that occurs on floodplains of creeks and rivers. It consists of gravelly alluvium, beds of gravel, and exposed limestone beds and boulders randomly interspersed with moderately deep to deep calcareous alluvial materials.

PuC – Purves Series

This series consists of shallow, well-drained, moderately slowly permeable soils that formed in interbedded limestone and marl. These soils are on gently sloping uplands. Slopes are primarily 1 to 5 percent, but range from 1 to 40 percent.

SaB – San Saba Clay

This soil occupies smooth, single, and complex slopes on broad uplands and in long narrow valleys. The surface layer is very dark grey calcareous clay about 22 inches think. The next layer is dark grey clay about 16 inches thick. The underlying material is grey limestone. This soil exhibits highly available water capacity and a moderate erosion hazard.

SsC – Speck Stony Clay Loam

This soil occurs on smooth, gently undulating topography. It has reddish-brown chert pebbles 2-10 inches in diameter covering 30-50 percent of its surface layer. The remaining surface layer is clay loam. The next layer is dark reddish-brown gravelly clay to about 18 inches below the surface. The underlying material is limestone rock. This soil exhibits low available water capacity and slow permeability.

TcA – Tarrant and Speck Soils

These soils occupy long and narrow areas on ridges, as well as broad and irregular areas. The complex consists of about 63 percent Tarrant soils, 32 percent speck soils, 4 percent dark grey clay that is 18 inches thick, and a small amount (< 1 percent) of Crawford clay and rock outcrop.

VoD – Volente Silty Clay Loam

This complex occupies long and narrow valleys and consists of soils that developed in sloped alluvium. The surface layer is dark greyish-brown silty clay loam about 22 inches thick over dark brown silty clay about 14 inches thick. The next layer is brown silty clay to a depth of about 46 inches. The underlying material is reddish-yellow clay loam to a depth of 54 inches. This soil exhibits high available water capacity and a severe erosion hazard.

4. WATER RESOURCES

The proposed project is located in the Austin-Travis Lakes 8-digit hydrological unit code watershed (12090205). The eastern half of the project is within the Edwards Aquifer Recharge Zone and the remaining project area is over the Contributing Zone. The project area crosses the watersheds of Slaughter, Williamson, and Barton Creeks. Within the project area, US 290 is crossed by Wheeler Branch, Williamson Creek, Devil's Pen Creek, and five unnamed tributaries; SH 71 is crossed by Scenic Brook Tributary, one unnamed tributary, and Williamson Creek. Both alternatives cross Federal Emergency Management Agency (FEMA) designated floodplains associated with Williamson and Devil's Pen Creeks. Williamson Creek and Devil's Pen Creeks are the only intermittent waterways within the project area; the remaining creeks and tributaries are ephemeral. There are no perennial waterways within the Oak Hill Parkway project area. These resources are shown on **Figure 6**.

According to the National Hydrology Dataset (NHD) and the National Wetland Inventory (NWI), several wetlands are mapped within the project area; however, only two were identified during the field investigation within the proposed roadway alignment project area. A preliminary wetland delineation performed by HDR in 2015 identified two aquatic features within the proposed alignments of both alternatives for the Oak Hill Parkway project area: an open water freshwater pond and an emergent wetland. The detention pond (open water freshwater pond) was identified as an impoundment of an unnamed tributary to Williamson Creek on the northwest corner of William Cannon and US 290/SH 71. The detention pond is one of several ponds owned and maintained on the NXP Semiconductors (formerly Freescale) property. The emergent wetland was identified within the proposed project area during the wetland delineation on the south side of US 290 near Boling Drive. This wetland appears to be located on the headwaters of Scenic Brook and is considered a potentially a jurisdictional wetland. To date, no coordination with the USACE regarding jurisdictional determinations or wetland delineations have occurred regarding the Oak Hill Parkway project.

All proposed roadway and drainage improvements would be designed in a manner to avoid or minimize impacts to jurisdictional features. It is anticipated that impacts to waters of the U.S. would be authorized through Nationwide Permit (NWP) #14. If any of the wetlands would be impacted, a Pre-Construction Notification (PCN) would be required. A detailed explanation of wetlands and waters

within the project area can be found in the *Oak Hill Parkway Water Resources Technical Report* (TxDOT, 2017a); potential impacts to these resources are summarized in **Section 6.1**.

The Mount Bonnell Fault forms the boundary between the Recharge Zone and Contributing Zone and transects the project area on a southwest to northeast orientation at the Williamson Creek/ US 290/SH 71 crossing. Generally, the Contributing Zone extends west from the fault line past the project terminus continues to the Blanco County line. The Recharge Zone is located east of the Contributing Zone where the Edwards limestone formations are exposed at the surface. The proposed project area crosses an area which is known to contribute to aquifer recharge via surface and groundwater conduits in the Contributing and Recharge Zones. Without proper controls, activities associated with the project could impact water quality, which could, in turn, impact aquatic resources across a larger geography given the regional nature of aquifer recharge and especially the potential hydrologic connection to the Barton Springs Segment of the Edwards Aquifer. Additional information regarding water quality within the project area can be found in the *Oak Hill Parkway Water Resources Technical Report* (TxDOT, 2017a) and below in **Sections 5.3** and **6.3** as they pertain to aquifer species. Best Management Practices (BMPs) and design considerations would be implemented to ensure water quality impacts would be either avoided or minimized to the extent practicable. An Edwards Aquifer Protection Plan would be required for this project.

5. SPECIFIC AREAS OF ENVIRONMENTAL CONCERN

5.1 Vegetation

The Ecological Mapping Systems of Texas (EMST) is a land classification system that identifies vegetation communities across Texas by computer modeling and field verification (MoRAP, 2013). The following EMST vegetation types were identified within the project area and are further described in TPWD's *Draft Descriptions of Systems, Mapping Subsystems, and Vegetation Types for Phase I* (Elliott, 2014): (1) Edwards Plateau: Ashe Juniper Motte and Woodland, (2) Edwards Plateau: Deciduous Oak/Evergreen Motte Woodland, (3) Edwards Plateau: Savanna Grassland, (4) Edwards Plateau: Floodplain Juniper Shrubland, (5) Edwards Plateau: Riparian Hardwood Forest, (6) Native Invasive: Mesquite Shrubland, and (7) Urban Low Intensity (**Figures 7** and **8**). These seven EMST types correspond to the "Disturbed Prairie", "Edwards Plateau Savannah, Woodland, and Shrubland", "Floodplain", "Riparian", and "Urban" habitat types which are identified in the 2013 TxDOT – Texas Parks and Wildlife (TPWD) Memorandum of Understanding (MOU) and Threshold Programmatic Agreement. The MOU vegetation types have been assigned acreage thresholds for which if exceeded, would require coordination under the TxDOT-TPWD MOU.

5.1.1 Description of Vegetation in the Project Area

Based on site visits conducted in January, May, and June 2016 by qualified biologists, it was determined that much of vegetation within the existing right-of-way consists of maintained grasses and forbs. Although a mixture of native hardwoods, Ashe juniper (*Juniperus ashei)*, and introduced tree species persist as an overstory component adjacent to the roadways in Oak Hill, the majority of vegetation within the current transportation right-of-way fits the description of "Urban Low Intensity"

habitat. Several fragmented patches of unmaintained native vegetation are located within the proposed right-of-way along US 290 and SH 71, west of Williamson Creek (**Photos 7 – 9**). Typical vegetation within these areas consists of an Ashe juniper, sugarberry (*Celtis laevigata*), chinaberry (*Melia azedarach*), American sycamore (*Platanus occidentalis*), black walnut (*Juglans nigra*), Texas mountain laurel (*Sophora secundiflora*), and plateau live oak (*Quercus fusiformis*) overstory with a mixed shrub and grass understory of evergreen sumac (*Rhus sempervirens*), Texas persimmon (*Diospyros texana*), Texas pricklypear (*Opuntia engelmannii)*, saw greenbriar (*Smilax bona-nox*), elbowbush (*Forestiera pubescens*), little bluestem (*Schizachyrium scoparium* var*. frequens*), mustang grape (*Vitis mustangensis*), silver bluestem (*Bothriochloa laguroides*), purple horsemint (*Mondarda citriodora*), and scattered honey mesquite (*Prosopis glandulosa*). The following paragraphs describe each vegetation type identified in the project area per the TxDOT-TPWD 2013 MOU classifications. Field verification of the existing vegetation types identified several discrepancies between the EMST mapped vegetation and the observed vegetation communities throughout the project area where right-of-entry was granted (**Figure 9**). Additional information regarding these discrepancies can be found in the *Oak Hill Parkway Biological Evaluation Form and Tier I Site Assessment* (TxDOT, 2017b). Potential impacts to each vegetation type that could result from the proposed alternatives are discussed in **Section 6.2**.

Urban Low Intensity

The Urban Low Intensity vegetation type was found throughout the proposed project area and was generally composed of a mix of native and introduced grasses and forbs with scattered trees and shrubs. This cover type is generally maintained by periodic mowing and retains low species diversity and native habitat value. The vegetation type was also observed at several of the channelized crossings and within maintained ditches (**Photo 13**). Dominant grasses and herbs that were identified during the site visit include common Bermuda grass (*Cynodon dactylon*), St. Augustine grass (*Stenotaphrum secundatum*), western ragweed (*Ambrosia psilostachya*), clover (*Trifolium* spp.), saw greenbrier, sideoats grama (*Bouteloua curtipendula*), King Ranch bluestem (*Bothriochloa ischaemum)*, Paraguayan windmill grass (*Chloris canterai*), Maximilian sunflower (*Helianthus maximiliani*), southern dewberry (*Rubus trivialis*), silverleaf nightshade (*Solanum elaeagnifolium*), and wild carrot (*Daucus carota*). Scattered shrub and tree species included plateau live oak, huisache (*Acacia farnesiana*), sugarberry, and Ashe juniper.

Edwards Plateau: Riparian Hardwood Forest

The Edwards Plateau: Riparian Hardwood Forest vegetation type was observed in areas along Williamson Creek and its tributaries (**Photos 10, 11,** and **14**). These areas are not presently maintained and may or may not be adjacent to flowing water, depending on the season and precipitation. Understory vegetation consisted of Bermudagrass, wild carrot, silverleaf nightshade, clover, Maximilian sunflower, and silver bluestem. The overstory was dominated by an array of hardwood trees consisting of primarily native species. Species observed include black willow (*Salix nigra*), plateau live oak, wax-leaf ligustrum (*Ligustrum japonica*), Ashe juniper, Texas red oak (*Quercus buckleyi*), American elm (*Ulmus Americana*), Pecan (*Carya illinoinensis*), American sycamore, and sugarberry.

Edwards Plateau: Floodplain Ashe Juniper Shrubland

The Edwards Plateau: Floodplain Ashe Juniper Shrubland vegetation community was observed at the western terminus of the project area along a tributary to Williamson Creek (**Photo 12**). This vegetation type is distinguished from the vegetation types around the other tributaries by the shrubby growth stage of the trees and variation of understory species. Ashe juniper and plateau live oak were the dominant tree species and individuals did not exceed six feet in height. Dominant understory species were Texas bluebonnets (*Lupinus texensis*), Maximilian sunflower, clover, and wild carrot.

Edwards Plateau: Ashe Juniper Motte and Woodland

Several portions of the proposed right-of-way along the US 290 corridor contained unmaintained woodlands best described as Edwards Plateau: Ashe Juniper Motte and Woodland. The canopy of this vegetation type is dominated by Ashe juniper, and the same species is prevalent in the understory as well. Other dominant components of this vegetation type are plateau live oak and other oak species (*Quercus* spp.) in the canopy and agarita (*Mahonia trifoliolata*) and Texas persimmon in the shrub layer. This vegetation type was present on ledges of limestone and in unmaintained areas along the US 290 corridor (**Photos 7, 15,** and **16**).

Edwards Plateau: Savanna Grassland

The Edwards Plateau Savanna Grassland vegetation type is located in the project area in a small area along the US 290 corridor (**Photo 3**). The dominant species observed were plateau live oak and Ashe juniper with an understory of little bluestem, King Ranch bluestem, common Bermudagrass, and sideoats grama. This vegetation type is characterized by reduced woody cover and a grassland under story and represents a transition between prairies and woodlands.

Edwards Plateau Deciduous Oak/Evergreen Motte and Woodland

The understory of the Edwards Plateau Deciduous Oak/Evergreen Motte and Woodland vegetation type is similar to that of the savanna grassland, but its canopy is primarily composed of plateau live oak mottes. This vegetation type was observed in various undeveloped areas throughout the project area, mostly along US 290 from SH 71 west towards the project terminus (**Photo 9**).

Native Invasive Mesquite Shrubland

The Native Invasive Mesquite Shrubland vegetation type is dominated by honey mesquite and Roosevelt weed (*Baccharis neglecta*) in historically overgrazed areas or areas of mismanaged land use. This vegetation type occurs on the portion of the project area along William Cannon drive on the east side of the roadway and along the westbound frontage roads of US 290/SH 71 (**Photo 17**). Understory grasses were consistent with typical right-of-way grasses.

5.1.2 Unusual Vegetation and Special Habitat Features

In addition to the EMST vegetation and habitat descriptions, any unusual vegetation features or special habitat features occurring within the proposed build alternatives were identified and described during field investigations.

Unusual Vegetation Features

Unusual vegetation features are described as including:

- Unmaintained vegetation
- Trees or shrubs along a fence line adjacent to a field (fencerow vegetation)
- Riparian vegetation (particularly where fields/cropland extend up to or abut the vegetation associated with the riparian corridor)
- Trees that are considered historically significant, ecologically significant, or locally important (such as champion trees located on the Texas A&M Forest Service Big Tree Registry)
- Unusual stands or islands (isolated areas) of vegetation

Unusual vegetation features identified within the proposed build alternatives include unmaintained vegetation, riparian vegetation, and historically significant or locally important trees. Unmaintained vegetation occurs along the Williamson Creek drainage, particularly where the creek parallels the US 290/SH 71 roadway. Vegetation found along the Williamson Creek riparian corridor consists of cedar elm (*Ulmus crassifolia*), giant ragweed, live oak, American sycamore, sugarberry, mesquite, Chinaberry, mustang grape, Ashe juniper, greenbrier, and poison ivy (*Toxicodendron radicans*). The COA has identified several trees within the project area as historically significant due to their size and age. Several ordinances outline the protection criteria for natural resources (including trees) within the COA for local government and private citizens. These ordinances are superseded by the State of Texas laws governing transportation projects; therefore, the tree ordinances do not apply to TxDOT projects. However, due to substantial public interest, large trees ("iconic trees") within the Oak Hill Parkway project area were surveyed and several stakeholder meetings were held to discuss landscaping enhancement options for the project area.

Tree Survey Results

Tree surveys were conducted within the project area where right-of-entry was granted by two qualified survey teams (Atkins, 2007; SAM, 2015; SAM 2017). One individual landowner provided the project team with complimentary survey data for trees as well (Powell, 2015). Each survey mapped the location, species, and size of trees within the existing and proposed right-of-way. In all, 518 native hardwood trees, including over 15 distinct species, were mapped as a result of the survey effort. The dominant species included plateau live oak (45 percent), other oaks (18 percent), and pecan trees (16 percent). The size class ranged from 10 inches in diameter at breast height (DBH) to 62 DBH. DBH is a standard measurement of tree trunk diameter and is typically measured at 4.5 (alternatively 1.4 meters) above ground level. Approximately 88 percent of trees measured less than 35 inches

DBH. No tree health metrics or tree conditional assessments were conducted during these initial surveys. Tree impacts from the proposed alternatives are discussed in **Section 6. 2**.

Special Habitat Features

Special habitat features include:

- Bottomland hardwoods
- Caves
- Cliffs and bluffs
- Native prairies (particularly those with climax species of native grasses and forbs)
- Ponds (temporary and permanent, natural, and man-made)
- Seeps or springs
- Snags (dead trees) or groups of snags
- Water bodies (creeks, streams, rivers, lakes, etc.)
- Existing bridges with known or easily observed bird or bat colonies
- Rookeries
- Prairie dog towns

Special habitat features within the proposed project area include water bodies and existing bridges with observed bird colonies. Water bodies within the proposed project area are associated with Wheeler Branch, Williamson Creek, Scenic Brook Tributary, Devil's Pen Creek, several unnamed tributaries to Williamson Creek, and a man-made water quality detention pond located on an adjacent property northwest of the US 290/SH 71/William Cannon interchange. Nesting swallows were observed within the concrete box culverts conveying Devils Pen Creek below US 290 at the western project terminus; no bats or evidence of bats (concrete staining or odor) were observed during visual surveys at any of the crossing structures during field investigation in January, May, or June 2016.

Impacts to special habitat features and unusual vegetation features would be minimized through initial project design considerations and through the avoidance and minimization of vegetation removal. Construction activities would disturb only that which is necessary to construct the proposed project. The removal of native vegetation would be avoided to the greatest extent practicable and best management practices would be utilized to avoid impacts to migratory and nesting birds within the project area during construction activities. Landscaping enhancements such as tree plantings, tree relocation, and native seeding will be incorporated into the post-construction design as a voluntary measure to offset the impacts of tree removal in response to public comments.

5.2 Non-Rare Fish and Wildlife Resources

The vegetation of the Edwards Plateau ecoregion also provides habitat for a wide range of reptilian, mammalian, and avian species that are common to the Central Texas environment. These species, such as the eastern cottontail (*Sylvilagus floridanus*), northern raccoon (*Procyon lotor*), nine-banded armadillo (*Dasypus novemcinctus*), and white-tailed deer (*Odocoileus virginianus*), are expected to occur within the project area and adjacent undeveloped land. Terrestrial wildlife observed within the project area during field investigations include the northern raccoon, eastern cottontail, gray fox (*Urocyon cinereoargenteus*), eastern fox squirrel (*Sciurus niger*), nine-banded armadillo, coyote (*Canis latrans*), Blanchard's cricket frog (*Acris crepitans blanchardii*), and white-tailed deer.

Required clearing or other construction-related activities may directly and/or indirectly affect animals that reside on or adjacent to the project right-of-way. Heavy machinery could kill small, low-mobility animals or could cause soil compaction, impacting animals that live underground. Larger, more mobile species will typically avoid construction activities and move into adjacent areas. In order to minimize disturbance to inert microhabitats (e.g., snags, brush piles), clearing within the right-of-way would be minimized to the extent practicable. A discussion of potential impacts/effects to rare, threatened, or endangered wildlife species and their habitats is included in **Section 6.3**.

5.3 State and Federally Listed Species

Lists of threatened and endangered species maintained by the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Conservation (IPaC) system and TPWD were consulted to determine which species could occur in the proposed project area (**Attachment C**). These species are listed in **Table 2,** along with their listing status, a description of appropriate habitat, a determination of whether habitat for those species occurs within the project area, and level of potential impact or effect to the species. "Impact" determinations apply to state-listed species and Species of Greatest Conservation Need (SGCN), while "effect" determinations apply only to federally-protected species. The following "effect" determinations and their definitions, as summarized from the Endangered Species Consultation Handbook (USFWS and NMFS, 1998), apply to the federally-listed species in **Table 2**.

- **No effect** - This conclusion is reached if the proposed action and its interrelated and interdependent actions will not directly or indirectly affect listed species or destroy/adversely modify designated critical habitat.

- **May affect, not likely to adversely affect**- This conclusion is appropriate when effects to the species or critical habitat are expected to be beneficial, discountable, or insignificant. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact (and should never reach the scale where take occurs), while discountable effects are those that are extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

- **May affect, likely to adversely affect**- This conclusion is reached if any adverse effect to listed species or critical habitat may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable or insignificant (see definition of "is not likely to adversely affect"). In the event the overall effect of the proposed action is beneficial to the listed species or critical habitat, but may also cause some adverse effect on individuals of the listed species or segments of the critical habitat, then the determination should be "is likely to adversely affect." An "is likely to adversely affect" determination requires the initiation of formal section 7 consultation.

Habitat assessment for each species was completed utilizing a combination of desktop analysis such as vegetation mapping, soils and geology information (as described above in **Sections 3.1** and **3.2**), and field verification by qualified biologists (USFWS Species Recovery Permit # TE168185-3 and TPWD Scientific Research Permit # SPR-0691-409). Field visits in January, May, and June of 2016 were conducted within the existing right-of-way to assess suitability of habitat. Several parcels, including the two proposed detention pond locations along SH 71 and Old Bee Caves Road, were denied right-of-entry; therefore, these areas were only assessed where they could be viewed from public roadways (**Figure 9**).

Table 2: Threatened, Endangered, and Species of Greatest Conservation Need of Potential Occurrence in Travis County, Texas

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Plants						
Arrowleaf milkvine *Matelea sagittifolia*	NL	SGCN	Most consistently encountered in thornscrub in South Texas; Perennial; Flowering March-July; Fruiting April-July & Dec	No	No Impact	No thornscrub habitat occurs within the project area. TXNDD recorded EOs within Barton Creek greenbelt in 1984. The proposed project would not have any impact on the Barton Creek greenbelt or similar habitat types.
Basin bellflower *Campanula reverchonii*	NL	SGCN	Texas endemic; among scattered vegetation on loose gravel, gravelly sand, and rock outcrops on open slopes with exposures of igneous and metamorphic rocks; may also occur on sandbars and other alluvial deposits along major rivers; flowering May-July	No	No Impact	Typically associated with the Llano uplift; No granite, loose gravel, or alluvial deposits located within the project area.
Boerne bean *Phaseolus texensis*	NL	SGCN	Narrowly endemic to rocky canyons in eastern and southern Edwards Plateau occurring on limestone soils in mixed woodlands, on limestone cliffs and outcrops, frequently along creeks	Yes	May Impact	Limestone soils in mixed woodlands and rocky outcrops are present within the project area. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Bracted twistflower *Streptanthus bracteatus*	C	SGCN	Texas endemic; shallow, well-drained gravelly clays and clay loams over limestone in oak juniper woodlands and associated openings, on steep to moderate slopes and in canyon bottoms; several known soils include Tarrant, Brackett, or Speck over Edwards, Glen Rose, and Walnut geologic formations; populations fluctuate widely from year to year, depending on winter rainfall; flowering mid-April-late May, fruit matures and foliage withers by early summer	Yes	May Affect	Project is located on Glen Rose formation. Shallow, gravely soils and oak juniper woodlands present. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions. The species is a candidate for federal listing. If the species becomes listed prior to construction, TxDOT would make a determination as to whether additional coordination would occur depending on the results of presence/absence surveys.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Buckley tridens *Tridens buckleyanus*	NL	SGCN	Occurs in juniper-oak woodlands on rocky limestone slopes; Perennial; Flowering/Fruiting April-Nov	Yes	May Impact	Juniper-oak woodlands and limestone slopes occur in the project area. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Correll's false dragon-head *Physostegia correlli*	NL	SGCN	Wet, silty clay loams on streamsides, in creek beds, irrigation channels and roadside drainage ditches; or seepy, mucky, sometimes gravelly soils along riverbanks or small islands in the Rio Grande; or underlain by Austin Chalk limestone along gently flowing spring-fed creek in Central Texas; flowering May-September	No	No Impact	Soils along creeks and streambeds are typically dry; streams are intermittent and are rarely flowing long enough to support seepy or wet soils.
Glass Mountains coral-root *Hexalectris nitida*	NL	SGCN	Apparently rare in mixed woodlands in canyons in the mountains of Brewster County, but encountered with regularity, albeit in small numbers, under *Juniperus ashei* in woodlands over limestone on the Edwards Plateau, Callahan Divide and Lampasas Cutplain; Perennial; Flowering June-Sept; Fruiting July-Sept	Yes	May Impact	Ashe juniper woodlands occur in the project area. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Gravelbar brickellbush *Brickellia dentata*	NL	SGCN	Essentially restricted to frequently-scoured gravelly alluvial beds in creek and river bottoms; Perennial; Flowering June-Nov; Fruiting June-Oct	Yes	May Impact	Potentially suitable habitat exists within the channel of Williamson Creek and its tributaries. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Heller's marbleseed (Heller's false gromwell) *Onosmodium helleri*	NL	SGCN	Occurs in loamy calcareous soils in oak-juniper woodlands on rocky limestone slopes, often in more mesic portions of canyons; Perennial; Flowering March-May	Yes	May Impact	Calcareous soils in oak-juniper woods occur within the project area. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions. TXNDD recorded EOs within the Barton Creek greenbelt (most recent in 1984).
Low spurge *Euphorbia peplidion*	NL	SGCN	Occurs in a variety of vernally-moist situations in a number of natural regions; Annual; Flowering Feb-April; Fruiting March-April	Yes	May Impact	Vernally-moist locations occur throughout the project area at several of the creek crossing locations. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Narrowleaf brickelbush *Brickellia eupatorioides* var. *gracillima*	NL	SGCN	Moist to dry gravelly alluvial soils along riverbanks but also on limestone slopes; Perennial; Flowering/Fruiting April-Nov	Yes	May Impact	Gravelly alluvial soils and limestone slopes occur in the project area. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Net-leaf bundleflower *Desmanthus reticulatus*	NL	SGCN	Mostly on clay prairies of the coastal plain of Central and south Texas; Perennial; Flowering April-July; Fruiting April-Oct	No	No Impact	No clay prairies occur within the project area.
Plateau loosestrife *Lythrum ovalifolium*	NL	SGCN	Banks and gravelly beds of perennial (or strong intermittent) streams on the Edwards Plateau, Llano Uplift and Lampasas Cutplain; Perennial; Flowering/Fruiting April-Nov	No	No Impact	No perennial streams occur within the project area. Williamson Creek is intermittent.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Plateau milkvine *Matelea edwardsensis*	NL	SGCN	Occurs in various types of juniper-oak and oak-juniper woodlands; Perennial; Flowering March-Oct; Fruiting May-June	Yes	May Impact	Juniper-oak and oak-juniper woodlands occur within the project area. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Rock grape *Vitis rupestris*	NL	SGCN	Occurs on rocky limestone slopes and in streambeds; Perennial; Flowering March-May; Fruiting May-July	Yes	May impact	Williamson Creek and rocky slopes occur in the project area. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Scarlet leather-flower *Clematis texensis*	NL	SGCN	Usually in oak-juniper woodlands in mesic rocky limestone canyons or along perennial streams; Perennial; Flowering March-July; Fruiting May-July	No	No Impact	No mesic canyons occur within the project area. This species requires moist soil along streambanks; the project area includes creeks that are intermittent and prone to periods of drought.
Stanfield's beebalm *Monarda punctate var. stanfieldii*	NL	SGCN	Largely confined to granite sands along the middle course of the Colorado River and its tributaries; Perennial	No	No Impact	No granite sands occur within the project area.
Sycamore-leaf snowbell *Styrax platanifolius ssp. platanifolius*	NL	SGCN	Rare throughout range, usually in oak-juniper woodlands on steep rocky banks and ledges along intermittent or perennial streams, rarely far from some reliable source of moisture; Perennial; Flowering April-May; Fruiting May-Aug	No	No Impact	No steep rock banks along Williamson Creek or the other drainages occur within the project area.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Texabama croton *Croton alabamensis* var *texenesis*	NL	SGCN	Texas endemic; in duff-covered loamy clay soils on rocky slopes in forested, mesic limestone canyons; locally abundant on deeper soils on small terraces in canyon bottoms, often forming large colonies and dominating the shrub layer; scattered individuals are occasionally on sunny margins of such forests; also found in contrasting habitat of deep, friable soils of limestone uplands, mostly in the shade of evergreen woodland mottes; flowering late February-March; fruit maturing and dehiscing by early June	Yes	May Impact	Potentially suitable habitat exists along the project area where overstory oaks and juniper shade limestone soils. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Texas almond *Prunus minutiflora*	NL	SGCN	Wide-ranging but scarce, in a variety of grassland and shrubland situations, mostly on calcareous soils underlain by limestone but occasionally in sandier neutral soils underlain by granite; Perennial; Flowering Feb-May & Oct; Fruiting Feb-Sept	Yes	May Impact	Shrubland and grassland habitats occur in the proposed detention pond locations and in unmaintained vegetation along the existing corridor. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Texas amorpha *Amorpha roemeriana*	NL	SGCN	Juniper-oak woodlands or shrublands on rocky limestone slopes, sometimes on dry shelves above creeks; Perennial; Flowering May-June; Fruiting June-Oct	Yes	May Impact	Species may occur in juniper-oak woodlands or shrublands on rock limestone slopes or on dry shelves above Williamson Creek. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Texas barberry *Berberis swaseyi*	NL	SGCN	Shallow calcareous stony clay of upland grasslands/shrublands over limestone as well as in loamier soils in openly wooded canyons and on creek terraces; Perennial; Flowering/Fruiting March-June	Yes	May Impact	Appropriate soils under grassland/shrublands occur within the project area. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Texas fescue *Festuca versuta*	NL	SGCN	Occurs in mesic woodlands on limestone-derived soils on stream terraces and canyon slopes; Perennial; Flowering/Fruiting April-June	Yes	May Impact	Suitable habitat occurs within the undeveloped woodland areas of the project location. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions. Several EO IDs occur within 1.5 miles of the project area.
Texas milk vetch *Astragalus reflexus*	NL	SGCN	Grasslands, prairies, and roadsides on calcareous and clay substrates; Annual; Flowering Feb-June; Fruiting April-June	Yes	May Impact	Roadsides on calcareous and clay substrates occur in the project area. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Texas seymeria *Seymeria texana*	NL	SGCN	Found primarily in grassy openings in juniper-oak woodlands on dry rocky slopes but sometimes on rock outcrops in shaded canyons; Annual; Flowering May-Nov; Fruiting July-Nov	Yes	May Impact	This species may occur in unmaintained vegetation under Ashe juniper woodlands in the project area. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Tree dodder *Cuscuta exaltata*	NL	SGCN	Parasitic on various *Quercus, Juglans, Rhus, Vitis, Ulmus,* and *Diospyros* species as well as *Acacia berlandieri* and other woody plants; Annual; Flowering May-Oct; Fruiting July-Oct	Yes	May Impact	Host tree species occur throughout the project area. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.
Warnock's coral root *Hexalectris warnockii*	NL	SGCN	In leaf litter and humus in oak-juniper woodlands on shaded slopes and intermittent, rocky creekbeds in canyons; on the Edwards Plateau in oak-juniper woodlands on limestone slopes; flowering June-September; individual plants do not usually bloom in successive years	Yes	May Impact	Oak-juniper woodlands on limestone slopes are present; intermittent, rocky creek beds exist along Williamson Creek. No individuals were identified during field vegetation surveys; however, not all project areas were surveyed due to right-of-entry restrictions.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Mollusks						
False spike mussel *Fusconia* (=*Quadrula) mitchelli*	NL	T	This species is native to the Brazos, Colorado, and Guadalupe basins of Central Texas. This species had been presumed extinct, but surveys conducted in recent years have confirmed the presence of live false spike at several locations throughout its historic range, including the lower Guadalupe River near Gonzales, TX	No	No Impact	Historic range included rivers within the Colorado River basins however, Williamson Creek is susceptible to periods of drought, which allow only for small areas of perennial pool refugia around the project area. This species is not known to persist in impoundments or non-flowing streams.
Golden Orb *Quadrula aurea*	C†	T	Sand and gravel in some locations and mud at others; found in lentic and lotic; Guadalupe, San Antonio, Lower San Marcos, and Nueces River basins	No	No Effect	The project area is not located within the Guadalupe, San Antonio, San Marcos, or Nueces River basins.
Smooth pimpleback *Quadrula houstonensis*	C	T	Small to moderate streams and rivers and moderate size reservoirs; mixed mud, sand, and fine gravel, tolerates very slow to moderate flow rates, appears not to tolerate dramatic water level fluctuations, scoured bedrock substrates, or shifting sand bottoms	No	No Effect	Known from the Colorado River basin. However, Williamson Creek is susceptible to periods of drought and experiences dramatic water level fluctuations during rain events, which creates unsuitable substrate habitat for this species.
Texas fatmucket *Lampsilis bracteata*	C	T	Streams and rivers on sand, mud, and gravel substrates; intolerant of impoundment; broken bedrock and coarse gravel or sand in moderately flowing water	No	No Effect	Known from the Colorado River basin; however, Williamson Creek is susceptible to periods of drought, which allow only for small areas of perennial pool refugia around the project area. This species is not known to persist in impoundments or non-flowing streams.
Texas Fawnsfoot *Truncilla macrodon*	C†	T	Little known; possibly rivers and larger streams, and intolerant of impoundment; flowing rice irrigation canals, possibly sand, gravel, and perhaps sandy-mud bottoms in moderate flows; Brazos and Colorado River basins	No	No Effect	Known from the Colorado River basin. However, Williamson Creek is susceptible to periods of drought and does not sustain moderate flows within the project area.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Texas pimpleback *Quadrula petrina*	C	T	Mud, gravel and sand substrates, generally in areas with slow flow rates	No	No Effect	Known from the Colorado River basin. However, Williamson Creek is susceptible to periods of drought and experiences dramatic water level fluctuations during rain events, which creates unsuitable substrate habitat for this species.
Crustaceans						
An amphipod *Stygobromus russelli*	NL	SGCN	Subterranean waters, usually in caves and limestone aquifers; resident of numerous caves; 10 counties of the Edwards Plateau	No	No Impact	No caves are known to be in the project area. Stormwater pollution control BMPs would be in place to protect water quality in receiving streams.
Balcones Cave amphipod *Stygobromus balconi*	NL	SGCN	Subaquatic, subterranean obligate amphipod	No	No Impact	No caves are known to be in the project area. Stormwater pollution control BMPs would be in place to protect water quality in receiving streams.
Bifurcated cave amphipod *Stygobromus bifurcates*	NL	SGCN	Found in cave pools	No	No Impact	No caves are known from the project area. No impacts to cave pools anticipated. Stormwater pollution control BMPs would be in place to protect water quality in receiving streams.
Insects						
Kretschmarr Cave mold beetle *Texamaurops reddelli*	LE	SGCN	Small, cave-adapted beetle found under rocks buried in silt; small, Edwards Limestone caves of the Jollyville Plateau	No	No Effect	Project occurs outside known range of this species. Project occurs within Karst Zone 3, areas which probably do not contain listed karst species.
Tooth Cave blind rove beetle *Cylindropsis* sp 1	NL	SGCN	One specimen collected from Tooth Cave; only known North American collection of this genus	No	No Impact	Project occurs outside known range of this species. Project occurs within Karst Zone 3, areas which probably do not contain listed karst species.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Tooth Cave ground beetle *Rhadine persephone*	LE	SGCN	Resident, small, cave-adapted beetle found in small Edwards Limestone caves in Travis and Williamson Counties	No	No Effect	Project occurs outside known range of this species. Project occurs within Karst Zone 3, areas which probably do not contain listed karst species.
Arachnids						
Bandit Cave spider *Cirurina bandida*	NL	SGCN	Very small, subterranean obligate	No	No Impact	Project occurs outside known range of this species. Project occurs within Karst Zone 3, areas which probably do not contain listed karst species.
Bee Creek Cave harvestman *Texella reddelli*	LE	SGCN	Small, blind, cave-adapted; endemic to a few caves in Travis and Williamson Counties	Yes	No Effect	Project occurs within Karst Zone 3, areas which probably do not contain listed karst species. However, project occurs within the South Travis County Karst Fauna Region (KFR). No occupied karst features are known to occur in the project vicinity. Closest known location for this species occurs approximately 2.12 miles northeast of the Mopac/US290 interchange. No karst features identified within the project limits contained suitable habitat for this species. If caves were encountered during construction, ground-disturbing activities would halt until a habitat survey is completed.
Bone Cave harvestman *Texella reyesi*	LE	SGCN	Small, blind, cave-adapted; endemic to a few caves in Travis and Williamson Counties	No	No Effect	Project occurs outside known range of this species. Project occurs within Karst Zone 3, areas which probably do not contain listed karst species.
Tooth Cave pseudoscorpion *Tartarocreagris texana*	LE	SGCN	Small, cave-adapted; small limestone caves of the Edwards Plateau	No	No Effect	Project occurs outside known range of this species. Project occurs within Karst Zone 3, areas which probably do not contain listed karst species.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Tooth Cave spider *Tayshaneta (=Neoleptoneta) myopica*	LE	SGCN	Very small, cave-adapted, sedentary	No	No Effect	Project occurs outside known range of this species. Project occurs within Karst Zone 3, areas which probably do not contain listed karst species.
Warton's cave meshweaver *Cicurina wartoni*	NL	SGCN	Very small, cave-adapted spider	No	No Impact	This species is only known from one cave, Pickle Pit, in northwestern Travis County. Project occurs outside known range of this species and occurs within Karst Zone 3, areas which probably do not contain listed karst species.
Fishes						
Guadalupe bass *Micropterus treculii*	NL	SGCN	Endemic to perennial streams of the Edwards's Plateaus region; introduced to the Nueces River system	Yes	May Impact	Potential habitat exists within perennial pools of Williamson Creek. This species may occur within the project area during periods of consistent stream flow but resident populations within the project area are highly unlikely. Stormwater pollution control BMPs would be in place to protect water quality in receiving streams.
Smalleye Shiner *Notropis buccula*	LE*	SGCN	Endemic to upper Brazos River system and its tributaries (Clear Fork and Bosque); apparently introduced into adjacent Colorado River drainage; medium to large prairie streams with sandy substrate and turbid to clear warm water; presumably eats small aquatic invertebrates	No	No Effect	According to the life history requirements of this species and the intermittency of Williamson Creek, occupancy within this portion of the Colorado River basin (Williamson Creek) is unlikely due to the presence of impoundments along the river. No recent occurrences of this species have been recorded.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Amphibians						
Austin blind salamander *Eurycea waterlooensis*	LE	SGCN	Mostly restricted to subterranean cavities of the Edwards Aquifer; dependent upon water flow/quality from the Barton Springs segment of the Edwards Aquifer; only known from the outlets of Barton Springs	Yes	May Affect, Not Likely to Adversely Affect	The project area is located within the Barton Springs segment of the Edwards Aquifer. Although no direct effects to salamanders or their subsurface/spring habitat are anticipated, indirect effects to this species due to water quality are considered due to the location of the project over the Recharge Zone. This species has designated Critical Habitat at Barton Springs. Therefore, this project May Affect but is Not Likely to Adversely Affect this species.
Barton Springs salamander *Eurycea sosorum*	LE	E	Dependent upon water flow/quality from the Barton Springs segment of the Edwards Aquifer; spring dweller, but ranges into subterranean water-filled caverns	Yes	May Affect, Not Likely to Adversely Affect	The project area is located with the Barton Springs segment of the Edwards Aquifer. Although no direct effects to salamanders or their subsurface/spring habitat are anticipated, indirect effects to this species due to water quality are considered due to the location of the project over the Recharge Zone. This project May Affect but is Not Likely to Adversely Affect this species.
Jollyville Plateau salamander *Eurycea tonkawae*	LT	SGCN	Known from springs and waters of some caves north of the Colorado River	No	No Effect	No springs are known to occur in the project vicinity. Project area is outside of accepted species range. This species has designated Critical Habitat north of the Colorado River; no effect to any Critical Habitat would occur as a result of the proposed project.
Pedernales River springs salamander *Eurycea sp* 6	NL	SCGN	Endemic; known only from springs	No	No Impact	The project area does not include the Pedernales River or any adjacent springs. Project area is outside of accepted species range.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Reptiles						
Spot-tailed earless lizard *Holbrookia lacerata*	NL	SGCN	Central and southern Texas and adjacent Mexico; moderately open prairie-brushland; fairly flat areas free of vegetation or other obstructions, including disturbed areas; eats small invertebrates; eggs laid underground	No	No Impact	No prairie-bushland or flat, vegetation-free areas known to occur in the project area. TXNDD occurrence record is from 1953; no recent observations in Travis County for this species.
Texas garter snake *Thamnophis sirtalis annectens*	NL	SGCN	Wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August	Yes	May Impact	Potentially suitable habitat exists along riparian areas within the project area.
Texas horned lizard *Phrynosoma cornutum*	NL	T	Open, arid and semi-arid regions with sparse vegetation, soil varies in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September	No	No Impact	No open, arid or semi-arid areas with sparse vegetation occurs within the project area. No harvester ants (food source for the species) were observed during field investigations.
Birds						
American Peregrine Falcon *Falco peregrinus anatum*	DL	T	Resident of west Texas, migrant across the rest of the state; winters along coast; occupies wide range of habitats during migration, including urban; stopovers at leading landscape edges	No	No Impact	No breeding or wintering habitat is present within the project area. The species is a potential migrant; any use of the project area would be incidental.
Arctic Peregrine Falcon *Falco peregrinus tundrius*	DL	SGCN	Migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands	No	No Impact	No breeding or wintering habitat is present within the project area. The species is a potential migrant; any use of the project area would be incidental.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Bald Eagle *Haliaeetus leucocephalus*	DL	T	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water	No	No Impact	No breeding or wintering habitat is present within the project area. The species is a potential migrant; any use of the project area would be incidental and unlikely due to lack of suitable perch trees or foraging habitat.
Black-capped Vireo *Vireo atricapilla*	LE, PDL	E	Oak-juniper woodlands with a distinctive, patchy, two-layered aspect; shrub and tree layer with open, grassy spaces and foliage reaching to ground level for nesting cover	No	No Effect	The vegetation community in the project area lacks the dense understory and mid-story structure required for BCV habitat. Due to the urbanized nature of the project area and the low quality habitat, the probability of BCV utilizing the right-of-way or adjacent area is very low. No BCV habitat is mapped by the BCCP as occurring within or adjacent the project area (BCCP, 2007).
Golden-cheeked Warbler *Setophaga (=Dendroica) chrysoparia*	LE	E	Juniper-oak woodlands; long, fine bark strips from mature Ashe juniper trees used in nest construction; nests in trees other than Ashe juniper; nests late March-early summer	No	No Effect	Although mature oak/Ashe juniper woodland communities exist adjacent to the project corridor, these patches of vegetation are fragmented, resulting in areas that are considered too small for utilization by GCW (Campbell, 1995). The project area is highly urbanized and lacks tracks of continuous tree canopy cover. The majority of the project area is mapped ad Zone 3 “Not Known to be Habitat” by the BCCP (BCCP, 2007). No occupied habitat is mapped within or adjacent to the project area. No BCCP preserve lands would be impacted by the proposed project improvements.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Interior Least Tern *Sterna antillarum athalassos*	LE	E	Nests along sand and gravel bars within braided streams, rivers; also known to nest on man-made structures such as wastewater treatment plants or gravel mines	No	No Effect	No sand or gravel bars or other appropriate nesting habitats occur within the project area. USFWS IPaC only requires this species to be considered for wind energy projects.
Mountain Plover *Charadrius montanus*	NL	SGCN	Breeding: nests on high plains or shortgrass prairie, on ground in shallow depression; nonbreeding: shortgrass plains and bare, dirt (plowed) fields; primarily insectivorous	No	No Impact	No high plains or shortgrass prairie or plowed fields are present within the project area.
Peregrine Falcon *Falco peregrinus*	DL	T	Both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (*F. p. anatum*) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, *F.p. tundrius* is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat	No	No Impact	No breeding or wintering habitat is present within the project area. The species is a potential migrant; any use of the project area would be incidental.
Piping Plover *Charadrius melodus*	LT†	T	Wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats.	No	No Effect	No breeding or wintering habitat is present within the project area. The species is a potential migrant; use of the project area would be incidental and unlikely. USFWS IPaC only requires this species to be considered for wind energy projects.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Red Knot *Calidris canutus rufa*	LT	SGCN	Red knots migrate long distances in flocks northward through the contiguous United States mainly April-June, southward July-October. The Red Knot prefers the shoreline of coast and bays and also uses mudflats during rare inland encounters. Primary prey items include clams in salt water or brackish bays. Wintering Range includes- Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kennedy, Kleberg, Matagorda, Nueces, San Patricio, and Willacy Counties	No	No Effect	No breeding or wintering habitat is present within the project area. The species is a potential migrant; any use of the project area would be unlikely and incidental. USFWS IPaC only requires this species to be considered for wind energy projects.
Sprague's Pipit *Anthus spragueii*	NL	SGCN	Only in Texas during migration and winter, mid-September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges	No	No Impact	No native upland prairie or coastal grasslands within the project area. The species is a potential migrant; any use of the project area would be incidental.
Western Burrowing Owl *Athene cunicularia hypugaea*	NL	SGCN	Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows	No	No Impact	The species is a potential migrant; any use of the project area would be incidental.
Whooping Crane *Grus americana*	LE	E	Potential migrant via plains throughout state to coast; winters in coastal marshes	No	No Effect	No breeding or wintering habitat is present within the project area. No preferred stop-over habitat is present within the project area. The species is a potential migrant; any use of the project area would be incidental.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Mammals						
Cave myotis bat *Myotis velifer*	NL	SGCN	Colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore	Yes	May Impact	No suitable roosting habitat was identified under the Williamson Creek bridge structures; however existing roadway culverts, abandoned buildings, swallow nests, and rock crevices within the project area may provide suitable habitat. No bats or evidence of bat occupation were identified during site visits.
Plains spotted skunk *Spilogale putorius interrupta*	NL	SGCN	Catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie	Yes	May Impact	Potentially suitable habitat exists along fencerows, woodland edges, and brushy areas.
Red wolf *Canis rufus*	LE*	E	Extirpated; formerly known throughout eastern half of Texas	No	No Effect	This species is considered extirpated from Texas and would not be reasonably expected to occur within the project area.

Sources: TPWD, 2016, "Annotated County Lists of Rare Species: Travis County" (last revision 5/16/2016), (included as **Attachment C**); USFWS, 2017, "Official Species List for Project Area", included as **Attachment C**).

Status Codes:
LE = Federally Listed Endangered
LT = Federally Listed Threatened
E = State-Listed Endangered
T = State-Listed Threatened
SGCN = Species of Greatest Conservation Need
NL = Not listed
PDL or DL = Proposed for Delisting or Delisted
C = Candidate for listing

* = Species not recognized by the USFWS (according to "Official Species List") as occurring within the project area but designated by TPWD as potentially occurring within the county.

† = Species not recognized by the TPWD (according to the Travis County List) as occurring within the project area but listed on the USFWS "Official Species List" for the project area.

Note: Pfeiffer et al., 2015 clarifies the genetic position of the false spike mussel and Lovette et al., 2010 does the same for the golden-cheeked warbler. USFWS, 2016 proposes the delisting of the black-capped vireo and USFW, 2017 refers to a different genus for the Tooth Cave spider.

The Texas Natural Diversity Database (TXNDD) was reviewed on December 22 2016, to assess the potential for rare, threatened, or endangered species to occur within range of the proposed project limits (TXNDD, 2017). **Table 3** provides elements of occurrence (EO) within 1.5 miles of the project area for protected species and TPWD-tracked species**. Figure 10** displays the locations of EO in relation to the Oak Hill Project area. The TXNDD is a database collection of recorded occurrences that cannot be interpreted as presence/absence data.

Table 3: Results from Review of the Texas Natural Diversity Database

Element Occurrence #	Scientific Name	Common Name	Status	Last Observation
5625	*Vireo atricapilla*	Black-capped Vireo	LE, PDL	1994
1782	*Vireo atricapilla*	Black-capped Vireo	LE, PDL	1983
8195	*Setophaga chrysoparia*	Golden-cheeked Warbler	LE	1991
7576	*Setophaga chrysoparia*	Golden-cheeked Warbler	LE	2000
6983	*Setophaga chrysoparia*	Golden-cheeked Warbler	LE	2000
5617	*Setophaga chrysoparia*	Golden-cheeked Warbler	LE	1992
5447	*Setophaga chrysoparia*	Golden-cheeked Warbler	LE	1992
1882	*Setophaga chrysoparia*	Golden-cheeked Warbler	LE	1989
1499	*Setophaga chrysoparia*	Golden-cheeked Warbler	LE	1992
871	*Setophaga chrysoparia*	Golden-cheeked Warbler	LE	2000
12789	*Conepatus leuconotus*	American hog-nosed skunk	--	1964
6994	*Thamnophis sirtalis annectens*	Texas garter snake	SGCN	1942
10652	*Matelea sagittifolia*	Arrowleaf milkvine	SGCN	1984
11065	*Festuca versuta*	Texas fescue	SGCN	1917
10999	*Festuca versuta*	Texas fescue	SGCN	1999
9575	*Holbrookia lacerata*	Spot-tailed earless lizard	SGCN	1953
6485	*Onosmodium helleri*	Heller's marbleseed	SGCN	1983
4475	*Onosmodium helleri*	Heller's marbleseed	SGCN	1943

Source: TXNDD, 2016
Status Codes: LE = Federally Listed Endangered; LT = Federally Listed Threatened; SGCN = Species of Greatest Conservation Need; PDL = Proposed for Delisting

5.3.1 Federally-Listed Species

According to the USFWS (2017) and TPWD (2016) data, 23 species federally listed as threatened, endangered, or candidate species have the potential to occur in Travis County. Initial field investigations were performed in the spring and winter of 2016; it was determined that the project area contains potentially suitable habitat for three federally listed endangered species and one candidate species. The species that may have suitable habitat within the project area or may be affected as a result of the proposed project are discussed in detail below.

Edwards Aquifer Salamander Species – Federal and State Endangered

Due to the similarities in life history characteristics and species habitat requirements (USFWS, 2015), the discussion of the Barton Springs salamander (*Eurycea sosorum*) (BSS) and Austin blind salamander (*Eurycea waterlooensis*) (ABS) is concurrent. Both species are small (about 2 inches), entirely aquatic salamanders found in springs, spring runs, wet caves, groundwater, and spring-fed tributaries of the Edwards Aquifer (USFWS, 2005). However, little is known of the biological needs of the species beyond their preference for cool, clear spring water, large cobble substrates, a reliance on aquatic invertebrates as a prey base, and their use of subsurface habitat within the underground aquifer (USFWS, 2005). While the species are known to periodically retreat underground into spring conduits, the duration of their life cycle spent underground is unknown. In contrast to the BSS, the ABS is rarely seen at spring surfaces and is assumed to be subterranean for the majority of its life (USFWS, 2013; Hillis et al., 2001). There are four main Barton Springs outlets (Parthenia, Eliza, Old Mill, and Upper) which collectively make up the Barton Springs Complex. The largest and most stable populations of BSS are within Parthenia Springs and Eliza Springs of the Barton Springs Complex (USFWS, 2013). The ABS has been found in three of the four springs in the Barton Springs Complex, but has not been observed in Upper Barton Springs.

Until recently, both the BSS and the ABS were presumed to be endemic to the Barton Springs Complex; however, recent genetic analysis of salamanders collected at several locations in southwestern Travis County and northern Hays County that discharge water to the Barton Springs Segment of the Edwards Aquifer suggest otherwise (Chippendale, 2014). Of the four collection sites discussed by Chippendale (2014), two locations (Cold Springs and Blowing Sink Cave) are indirectly associated with the Oak Hill Parkway project area. Cold Springs is notable because the project area is located within the Cold Springs groundwater basin and dye trace studies have shown flow paths linking Williamson Creek to this location (Hauwert et al., 2004). Similarly, Blowing Sink Cave is located approximately 3.8 miles south of the Mopac/US 290 interchange and flow paths to Barton Springs have been mapped from this location (Hauwert et al., 2004). Blowing Sink cave is located within the Slaughter Creek watershed and stormwater runoff leaving the west end of the project area and draining into Devil's Pen Creek may contribute to recharge in this area. Additionally, in 2015, a single Barton Springs Salamander was identified from a sampling well on FM 1626, approximately 9.5 miles south of the Barton Springs Complex (TXNDD, 2015). This most recent observation confirms that the habitat for this species is not limited to the Barton Springs Complex and likely extends through the subterranean aquifer system, although the extent of the habitat and size of subterranean populations are unknown.

Urbanization and declines in water quality and quantity in the aquifer are cited by the USFWS as the primary threats to the species (USFWS, 2013). Water quality is influenced by an assortment of parameters, such as amount of impervious cover, total suspended solids (TSS), total organic carbon (TOC), dissolved pollutants (such as heavy metals and petroleum hydrocarbons), nutrients, dissolved oxygen, and chemicals such as pesticides and herbicides. All of these have been identified by the USFWS as factors that influence the survival of aquifer-dependent salamanders. There has been substantial urbanization and development over the Barton Springs Zones since the listing of the BSS

in 1997. A recent study estimated an almost 1,400-acre increase in impervious cover for the Williamson Creek watershed from 1991 to 2008 (Sung et al. 2013; Barrett, 2016). It is widely accepted that an increase in impervious cover can generate an increased volume and velocity of stormwater runoff, which can have a detrimental effect on water resources. Stormwater runoff can negatively affect water quality when it contains untreated urban pollutants such as those constituents associated with highway runoff (e.g. TSS, zinc, and other heavy metals) (Sung et al., 2013; Barrett, 2016).

According to the Barton Springs Edwards Aquifer Conservation District (BSEACD), the Barton Springs segment of the Edwards Aquifer is approximately 155 square miles (BSEACD, 2003) (**Figure 11**). Approximately 85 percent of recharge to the Barton Springs segment comes from six streams located within the Recharge Zone (USFWS, 2005). Williamson Creek and Slaughter Creek are two of these streams and both occur or have tributaries within the Oak Hill Parkway project area. Three groundwater basins have been delineated within this segment; Cold Springs, Sunset Valley, and the Manchaca groundwater basins and are identified on **Illustration 1** below (Hauwert et al., 2004, Hauwert, 2013). In general, dye trace studies have concluded that most groundwater recharge in the Barton Springs segment discharges at Barton Springs, located approximately four miles northeast of the eastern project terminus (BSEACD, 2010; Smith et al., 2005) (**Figure 11**). As depicted on Hauwert et al. (2004) (**Illustration 1**), recent studies have linked flow paths from upper Williamson Creek to discharge sites at Cold Springs and from lower Williamson Creek to discharge sites at the Barton Springs Complex (Hauwert et al., 2004; Hauwert, 2013; Slade, 2014). Although the majority of the Oak Hill corridor lies within the Cold Springs groundwater basin, surface water that does not recharge within features restricted to the Cold Springs basin will flow downstream through the Sunset Valley and Manchaca basins, which discharge primarily at the Barton Springs Complex. Dye trace studies have shown that potential pollutants in the upper reaches of Williamson Creek can reach Cold Springs (through groundwater paths) in about eight days and can reach Barton Springs from the lower reaches in as little as 30 hours under high flow conditions (Hauwert et al., 2004; Hauwert, 2013). Similarly, dye injected into recharge features along Slaughter Creek downstream of the project area was recovered from Parthenia, Eliza, and Old Mill outlets at the Barton Springs Complex after 7 to 8 days (Hauwert et al., 2004). These results suggest that water quality at Barton Springs is directly influenced by surface water recharging into features throughout the Barton Springs segment of the aquifer, which could affect both salamander species through a degradation in water quality, particularly during storm events.

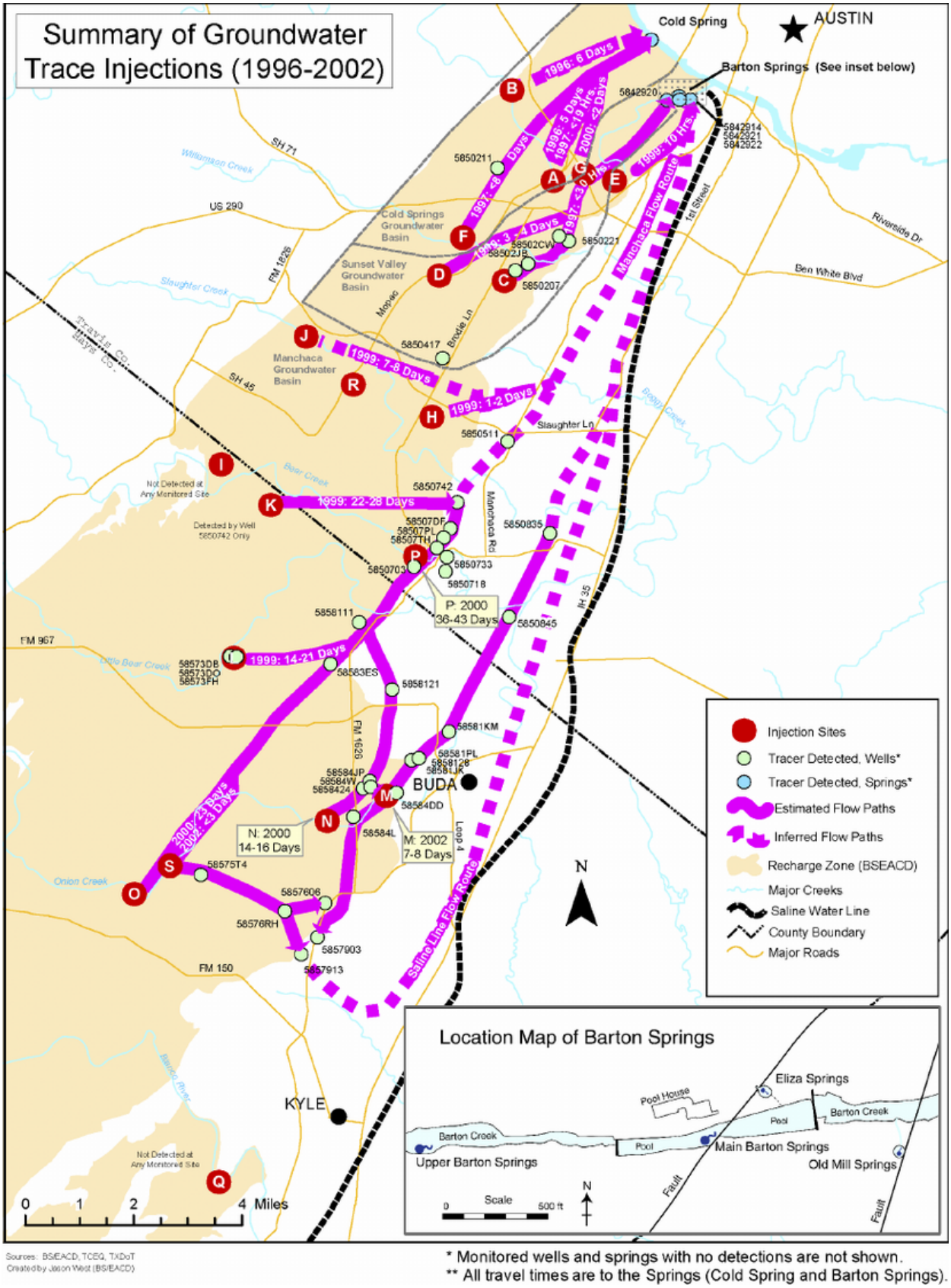


Illustration 1. Mapped Flow Paths, Groundwater Basins, and Spring Locations.

Included with permission from Hauwert et al., 2004: Figure 1, "Flow Systems of the Edwards Aquifer Barton Springs Segment Interpreted from Tracing and Associated Field Studies".

A Geologic Assessment identified eight potential recharge features within the project area (Rahe, 2009) (see **Figure 4**). Five of these features were evaluated as sensitive, with potential for infiltration into the aquifer. Because groundwater moves through highly permeable fractures and voids, the aquifer has little ability to filter potential contaminants. This characteristic makes the Edwards Aquifer's water quality highly dependent on the quality of surface water flowing over the Recharge Zone and the aquifer species particularly susceptible to upstream contamination (Mahler and Massei, 2007).

To date, there has been no critical habitat designated for the BSS; however, in 2013 the USFWS designated one Critical Habitat Unit (CHU) for the ABS. This CHU encompasses 120 acres surrounding the Barton Springs Complex, including both surface habitat at the spring outlets and subsurface habitat extending 984-feet in all directions from spring outlets. In addition to the CHU, the USFWS identified several primary constituent elements (PCE) for the ABS (USFWS, 2013):

Surface Habitat PCEs

- *Water from the Barton Springs Segment of the Edwards Aquifer*. The groundwater is similar to natural aquifer conditions as it discharges from natural spring outlets. Concentrations of water quality constituents and contaminants are below levels that could exert direct lethal or sublethal effects (such as effects to reproduction, growth, development, or metabolic processes), or indirect effects (such as effects to the ABS's prey base). Hydrologic regimes similar to the historical pattern of the specific sites are present, with constant surface flow. The water chemistry is similar to natural aquifer conditions.
- *Rocky substrate with interstitial spaces*. Rocks in the substrate of the salamander's surface aquatic habitat are large enough to provide salamanders with cover, shelter, and foraging habitat (larger than 2.5 in [64 mm]). The substrate and interstitial spaces have minimal sedimentation.
- *Aquatic invertebrates for food*. The spring environment supports a diverse aquatic invertebrate community that includes crustaceans, insects, and flatworms.
- *Subterranean aquifer*. Access to the subsurface water table exists to provide shelter, protection, and space for reproduction. This access can occur in the form of large conduits that carry water to the spring outlet or fissures in the bedrock.

Sub-surface Habitat PCEs

- *Water from the Barton Springs Segment of the Edwards Aquifer*. The groundwater is similar to natural aquifer conditions. Concentrations of water quality constituents and contaminants are below levels that could exert direct lethal or sublethal effects (such as effects to reproduction, growth, development, or metabolic processes), or indirect effects (such as effects to the ABS's prey base). Hydrologic regimes similar to the historical pattern of the specific sites are present, with continuous flow in the subterranean habitat. The water

chemistry is similar to natural aquifer conditions, including temperature, dissolved oxygen, and specific water conductance.

- *Subsurface spaces*. Conduits underground are large enough to provide salamanders with cover, shelter, and foraging habitat.
- *Aquatic invertebrates for food*. The habitat supports an aquatic invertebrate community that includes crustaceans, insects, or flatworms.

The project area does not include any of the salamander PCEs for surface habitat. As discussed previously, the project area occurs partially within the Barton Springs Segment of the Edwards Aquifer. It is likely that the subsurface geology under the portions of the project area occurring within the Recharge Zone could support the appropriate water, conduits, and aquatic food sources required to sustain either the ABS or the BSS; however, there is no designated subsurface critical habitat within or adjacent to the Oak Hill Parkway project area.

Potential effects to the BSS and ABS as a result of the Oak Hill Parkway project are discussed in **Section 6.3** below.

Bee Creek Cave harvestman – Federal and State Endangered

The Bee Creek Cave harvestman (*Texella reddelli*) is a small troglobitic arachnid known from only a small number of caves in Travis County. This species has long appendages, small eyes, and relies on limestone caves with near 100 percent humidity and constant temperatures. Like most *Texella*, this species preys on springtails. This species is unique in its dispersal across Travis County due to its occurrence both north and south of the Colorado River, which is typically a barrier for most terrestrial troglobytes, including the other federally listed invertebrates in Travis County (USFWS, 1994). The closest occupied feature to the Oak Hill Parkway project area is located on the Barton Creek Greenbelt, approximately two miles northeast of the Mopac/US 290 interchange. A geologic assessment was conducted along the project corridor for the area mapped as Karst Zone 3 but a karst habitat assessment has not been completed. None of the features identified in the geologic assessment were described as having cave characteristics or were measured at a depth that would support constant temperatures and humidity. A detailed description of the karst features identified during the survey can be found in the *GA* (provided under separate cover (Rahe, 2009)). Although the Oak Hill Parkway occurs within the South Travis County KFR, the project area crosses Karst Zones 3 and 4, areas that are unlikely to contain listed karst invertebrates. The proposed project is not anticipated to affect the Bee Creek Cave harvestman.

Bracted Twistflower – Federal Candidate and State SGCN

The bracted twistflower (*Streptanthus bracteatus*) is a rare annual wildflower endemic to South-Central Texas that became a federal candidate for listing in 2011. This species is associated with oak-juniper woodlands and openings on slopes and in canyon bottoms with shallow, well-drained gravelly clay and clay loam soils over limestone. Fall and winter rainfalls stimulate seed germination with flowering occurring in the spring, displaying showy, lavender-purple flowers (NatureServe, 2012;

Poole et al., 2007). This species is typically found in areas with dense herbaceous groundcover. Pedestrian surveys for this species were conducted during the flowering period in the spring of 2016 but no individuals were observed. Surveys were not conducted in areas of the right-of-way for which right-of-entry was denied by landowners, including both proposed detention pond locations. While this species could possibly occur within the project area where gravelly clay and clay loam soils exist, it is not likely given the disturbed nature of the woodlands along the corridor and the prevalence of herbivores such as the white-tailed deer. Given the uncertainty associated with its presence or absence, the Oak Hill Parkway project may potentially affect this species. If the species becomes listed prior to construction, presence-absence surveys would be conducted in appropriate habitat within existing and proposed right-of-way and additional coordination with the USFWS may occur.

5.3.2 State-Listed Species

In addition to the federally listed/candidate species described above in **Table 2**, five additional species designated by TPWD (2016) as state threatened or endangered have the potential to occur in Travis County (false spike mussel, Texas horned lizard, American peregrine falcon, peregrine falcon, and the bald eagle). None of these species or their habitat were observed during field visits. The proposed project is not anticipated to have any impact on state-listed species.

5.3.3 Species of Greatest Conservation Need

Table 2 also lists species with no regulatory status that are considered species of greatest conservation need (SGCN) in Texas that could occur within Travis County. SGCN are species that, due to limited distributions and/or declining populations, face the threat of extirpation or extinction but lack legal protection. TPWD designated 42 SGCN species as having the potential to occur in Travis County that are not listed as candidates or federally protected under the Endangered Species Act. Of these 42 species, suitable habitat occurs within the project area for 18 plants, 2 mammals, 1 fish, and 1 reptile as determined by qualified biologists during visual surveys in January, May, and June 2016. Several undeveloped tracts of land, including the two proposed detention pond locations, were not granted right-of-entry during the time of field investigation (**Figure 9**). For these areas, qualified biologists based the determination of suitable habitat on a desktop analysis of soils, geology, and aerial imagery. BMPs identified to minimize or avoid impacts to these species are summarized in **Section 6.4**.

<u>Plants</u>

Although the project area is primarily a suburban community of residential and commercial properties, it has fragmented patches of native vegetation along US 290 from west of William Cannon to the project terminus and along SH 71 north of Scenic Brook at the creek crossings and detention pond locations. The vegetation communities in these areas are best described as Ashe juniper motte and woodlands, deciduous oak/evergreen woodlands, savanna grasslands, and small tracks of riparian forest along the creeks and streams (**Figures 7** and **8**). The majority of the project area is underlain by clays and clay-loam soils derived from limestone. These gravelly, calcareous soils provide suitable substrate for many plant species adapted to the eastern Edwards Plateau. The 18

SGCN plant species identified in **Table 2** have the potential to occur in the areas of unmaintained or native vegetation within the existing and proposed right-of-way, along creek drainages, and on rocky outcrops or slopes. Pedestrian surveys were conducted where right-of-entry was granted within the project area (**Figure 9**); qualified biologists walked these areas on multiple occasions (January, May, and June 2016) and visually inspected the unmaintained vegetation, embankments, and riparian areas for presence of SGCN species. No individuals of these species were identified during these surveys. According to TPWD data, all of these species have a range that extends across the Edwards Plateau, and none are restricted solely to habitats occurring within the Oak Hill Parkway project area.

Cave Myotis Bat

The cave myotis bat (*Myotis velifer*) is an insectivorous bat and is the largest myotis species within the Central Texas environment. It inhabits a wide variety of habitats, many of which are associated with riparian areas or waterways within arid or semiarid environments. Its range stretches across the Southwestern United States into Central America. In Texas, they are common from the southwestern counties through the Edwards Plateau and into the northwestern portion of the Panhandle (Tuttle, 2003). This species mates from September to March and forms maternity colonies from April to May. Cave myotis commonly roost in rock crevices, caves, old buildings, bridges, and culverts and hibernate during the winter in groups (Tuttle, 2003). Although no bridges within the project right-of-way exhibited suitable habitat for this species (the bridges lack the structural components typically utilized by bats), the bats may roost in culvert locations, abandoned buildings, swallow nests, or rocky outcrops within the project area. The following structures and National Bridge Inventory (NBI) number were investigated for suitable habitat: US 290 over Williamson Creek (NBI 142270011308022), William Cannon Drive over Williamson Creek (NBI 142270B03854003), SH 71 over Draw (NBI 142270070003013), SH 71 over Williamson Creek (NBI 142270070003012), and US 290 over Draw (NBI 142270011308048).

Plains Spotted Skunk

The plains spotted skunk (*Spilogale putorius interrupta*) is a slender-bodied skunk with distinctive white spots, six anterior dorsal stripes, and a white-tipped black tail. Smaller and more active than other skunks common to Texas, this species is almost entirely nocturnal and is rarely observed during the daytime (Schmidly, 2004). This species is catholic in its range but is most often associated with wooded areas and tall grass prairies. Where available, rock outcrops and rocky canyons are preferred (Schmidly, 2004). Although urban habitation is less common, this species can be found around agricultural fields and low-density residential areas. Their den sites range from tree cavities to rock crevices, burrows under large rocks, and under buildings. Like many omnivores, this species' diet consists of fruits, small mammals, bird eggs, and insects. Population dynamics for the plains spotted skunk are not well understood. The species was once relatively common but is now believed to be rare across the state and its current status is unknown. Although the preferred habitat of tall prairie grasses is lacking in the project right-of-way, the small undeveloped tracts of land adjacent to the project right-of-way cannot be excluded as potential habitat for this species, especially those areas

along US 290 with rocky outcrops. No individuals or suitable den sites were identified during field investigations.

Guadalupe Bass

The Guadalupe bass (*Micropterus treculii*) is endemic to streams of the Edwards Plateau, including portions of the Brazos, Colorado, Guadalupe, and San Antonio river basins (Hendrickson and Cohen, 2015). The species is typically absent from extreme headwaters and prefers spring-fed streams with clear water and consistent temperatures, and lentic environments with flowing water, eddies, riffles, and deep pools (Hendrickson and Cohen, 2015; TPWD, 2015). The preferred habitat elements for the Guadalupe bass are silt substrates, large rocks, and cypress knees, though the species will use varying stream substrates depending on available conditions (Perkins et al., 2010). The main branch of Williamson Creek is the only stream of potentially suitable habitat within the project area. This species is unlikely to persist year-round within Williamson Creek due to the perennial drought conditions that typically occur during summer months; however, individuals may migrate upstream in high-flow events during spawning periods (early March through May or June). Although juvenile fish were noted within Williamson Creek during field investigations, no identification or collection efforts took place.

Texas Garter Snake

The Texas garter snake (*Thamnophis sirtalis annectens*) generally inhabits mesic Hill Country streams with permanent water or soil moisture in floodplains but can be found in a wide range of habitats, including drainage ditches, metropolitan areas, and grassy or brush vegetation (Werler and Dixon, 2010). This species is generally uncommon throughout its range but, like most other garter snakes, its secretive nature and preference for dense ground cover often inhibit detection. Although no individuals of this species were observed during site visits, the presence of Texas garter snakes in the riparian corridors associated with Williamson Creek, Wheeler Branch, Devil's Pen Creek, and the unnamed tributaries across the project area cannot be ruled out.

5.4 Preserve and Conservation Lands

The Barton Creek Habitat Preserve is located approximately 0.35-mile from the proposed project area just east of US 71 and north of Southwest Parkway. This 4,084-acre preserve is positioned along Barton Creek and serves to protect the habitat of the federally endangered Black-capped Vireo (*Vireo atricapilla*) and Golden-cheeked Warbler (*Setophaga chrysoparia*) that nest in Central Texas. The Preserve is protected and managed by the Nature Conservancy as part of the Balcones Canyonland Conservation Plan (BCCP), which was developed to conserve habitat amidst the growth of the Austin area (The Nature Conservancy, 2016).

No additional preserves or conservation lands were identified within the project area. Neither alternative for the proposed project would result in an effect to the Barton Creek Habitat Preserve or the endangered birds which nest there. Participation under the BCCP is not anticipated for this project.

5.5 Migratory Bird Treaty Act

Under the Migratory Bird Treaty Act (MBTA), it is unlawful "by any means or manner, to pursue, hunt, take, capture, [or] kill" any migratory birds except as permitted by regulation (16 U.S.C. 703-704). Nesting swallows were noted under several bridges within the project area and several inactive bird nests were noted within roadside vegetation adjacent to US 290 and SH 71. In the event that nesting migratory birds are encountered on-site during project construction, every effort would be made to avoid protected birds, active nests, eggs, and/or young. The contractor will be advised of the potential to find nesting migratory birds within the project area and will be instructed to avoid harming these species. The birds listed below in **Table 4** were observed during the field work and are comprised of both resident and migratory species.

Table 4: Observed Avian Species

Common Name	Scientific Name	Status	MBTA Protected
Carolina Chickadee	*Poecille carolinensis*	--	Yes
Black-crested Titmouse*	*Baeolophus atricristatus*	--	Yes
Blue Jay	*Cyanocitta cristata*	--	Yes
Brown-headed Cowbird	*Molothrus ater*	--	Yes
Cave Swallow	*Petrochelidon fulva*	--	Yes
Cedar Waxwing	*Bombycilla cedrorum*	--	Yes
Cliff Swallow	*Petrichelidon pyrrhonota*	--	Yes
Common Yellowthroat	*Geothlypis trichas*	--	Yes
Eurasian Collared-Dove	*Streptopelia decaocto*	--	No
Greater Roadrunner	*Geococcyx californianus*	--	Yes
Great-tailed Grackle	*Quiscalus mexicanus*	--	Yes
House Finch	*Haemorhous mexicanus*	--	Yes
House Sparrow	*Passer domesticus*	--	No
Killdeer	*Charadrius vociferus*	--	Yes
Mourning Dove	*Zenaida macroura*	--	Yes
Northern Cardinal	*Cardinalis cardinalis*	--	Yes
Northern Mockingbird	*Mimus polyglottos*	--	Yes
Red-tailed Hawk	*Buteo jamaicensis*	--	Yes
Savannah Sparrow	*Passerculus sandwhichensis*	--	Yes
Turkey Vulture	*Cathartes aura*	--	Yes
White-winged Dove	*Zenaida asiatica*	--	Yes

Status Codes: LE = Federally Listed Endangered; LT = Federally Listed Threatened; C = Candidate for Listing; -- = Species Not Considered Rare; SGCN = Species of Greatest Conservation Need; E = State-Listed Endangered; T = State-Listed Threatened

*Note that most titmice in the Austin area are considered hybrids between Black-crested and Tufted Titmouse (*Baeolophus bicolor*)

Source: Study Team

5.6 Bald and Golden Eagle Protection Act

Within the U.S. or anywhere within its jurisdiction, Bald Eagles (*Haliaeetus leucocephalus*) and Golden Eagles (*Aquila chrysaetos*) are protected by the Bald and Golden Eagle Protection Act (BGEPA) of 1940. No suitable nesting or foraging habitat exists within the project area for either of these species. Therefore, no impacts to eagles are anticipated from construction of the proposed project.

5.7 Executive Order 13112 on Invasive Species

On February 3, 1999, the President of the U.S. issued Executive Order 13112 to prevent the introduction of invasive species; provide for their control; and minimize their economic, ecological, and human health impacts. In accordance with Executive Order 13112 on invasive species, native plant species would be used in landscaping and in the seed mixes where practicable following construction activities. Soil disturbance would be minimized in the right-of-way in order to minimize invasive species establishment.

5.8 Executive Memorandum on Beneficial Landscaping

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

- Use regionally native plants for landscaping;
- Design, use, or promote construction practices that minimize adverse effects on the natural habitat;
- Seek to prevent pollution by reducing fertilizer and pesticide use, using integrated pest management techniques, recycling green waste, and minimizing runoff;
- Implement water-efficient practices, such as the use of mulches, efficient irrigation systems, and the selecting and siting of plants in a manner that conserves water and controls soil erosion; and
- Create outdoor demonstrations incorporating native plants, pollution prevention techniques, and water conservation techniques to promote awareness of the environmental and economic benefits of implementing this directive.

5.9 Farmland Protection Policy Act

The Farmland Protection Policy Act (FPPA) provides protection to prime and unique farmlands, as well as farmlands of statewide or local importance. Statewide and locally important farmland, as well as unique farmland, is defined by the State Conservationist. The State of Texas has not identified any unique farmland within the state. Projects considered exempt under the FPPA include those that require no additional right-of-way or permanent easements, or require right-of-way that is developed, urbanized, or zoned for urban use. Although several of the soils within the build alternative alignments are mapped as prime farmland soils (**Table 1**), the project area is located within an urbanized area as mapped by the U.S. Census Bureau in 2010; therefore, the project is not subject to the conditions of the FPPA.

5.10 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA), as amended in 1964, was enacted to protect fish and wildlife when federal actions result in the control or modification of a natural stream or body of water. The statute requires federal agencies to take into consideration the effect that water-related projects would have on fish and wildlife resources, take action to prevent loss or damage to these resources, and provide for the development and improvement of these resources. Preliminary design indicates that the proposed project would be authorized under a NWP #14 from the U.S. Army Corps of Engineers (USACE) and, therefore, coordination under FWCA would not be required for the proposed project. If a USACE Individual Permit was necessary for construction of the Oak Hill Parkway project, then additional coordination with the USFWS would need to occur for compliance under FWCA.

5.11 Essential Fish Habitat

No tidally influenced waters are located within the action area of the proposed project. The National Oceanographic and Atmospheric Administration Essential Fish Habitat (EFH) mapper was accessed for the proposed project area. No Habitat Areas of Particular Concern or EFH area protected from fishing were identified within or adjacent to the project area (NMFS, 2016).

5.12 Marine Mammal Protection Act

Travis County is not a coastal county (**Figure 1**). The action area of the proposed project is not located on the Gulf Coast or within a tidal area; therefore, it is not within range of marine mammals or their habitat. No portion of the proposed project occurs within intertidal or beach areas where marine mammals would be expected to occur.

5.13 Coastal Barrier Resources Act

Travis County is not a coastal county (**Figure 1**). The proposed project is not located within a designated Coastal Barrier Resources Act map unit. The USFWS CBRA mapper was accessed for the project area (July 11, 2016).

5.14 Texas Parks and Wildlife Coordination

In accordance with the TxDOT-TPWD MOU effective September 1, 2013, a Tier I Site Assessment was completed in order to determine impacts and the need for coordination with TPWD. The Tier I Site Assessment concluded that the proposed project exceeded several of the MOU coordination triggers and coordination with TPWD would be required. No coordination with TPWD has occurred to date on this project. The MOU coordination triggers for the Oak Hill Parkway project are listed in **Table 5** below as outlined in the TxDOT-TPWD MOU; additional information regarding these triggers can be found in the *Oak Hill Parkway Tier I Site Assessment* (TxDOT, 2017b).

Table 5: Tier I Site Assessment – TPWD Coordination Triggers Summary

	Trigger	Applies to the Project?	Explanation
	The project is within the range of a state threatened or endangered species or SGCN, as identified by the TPWD county list, and there is suitable habitat for the species within the project area unless BMPs as defined in the MOU are implemented as provided by a programmatic agreement.	Yes	The project is within range of and suitable habitat is present for several federally and state-listed species. Additionally, the project is within range of and suitable habitat is present for several SGCN species. No BMPs have been established for the following species: Austin blind salamander or Barton Springs salamander, or any of the SGCN plant species. The BMPs for the remainder of the SGCNs are defined in the Best Management Practices Programmatic Agreement under the MOU, as listed in **Table 6**.
	The project may adversely impact important remnant vegetation based on the judgment of a qualified biologist or as mapped in the TXNDD.	No	No important remnant vegetation was identified within the project area by project biologists or mapped by the TXNDD. The TCAP was utilized as a reference in this determination.
	The project requires a nationwide permit with pre-construction notification or an individual permit issued by the USACE.	Yes	Final quantification of impacts is pending and will be dependent on the chosen alternative; however, several linear water features are intersected by both designs. Impacts to waters of the U.S. would be minimized through the use of bridges and culverts at each feature. Impacts are anticipated to be authorized under NWP 14 with a PCN.
	The project includes in the TxDOT right-of-way or conservation, construction, or drainage easement, more than 200 linear feet of stream channel for each single and complete crossing of one or more of the following that is not already channelized or otherwise maintained: a) channel realignment; or b) stream bed or stream bank excavation, scraping, clearing, or other permanent disturbance.	No	Culvert expansions are proposed at a tributary to Williamson Creek. Impacts are not anticipated to exceed 200 linear feet; a bridge is proposed to span the main channel of Williamson Creek.
	The project contains known isolated wetlands outside existing TxDOT right-of-way that will be directly impacted by the project.	No	Project will not impact isolated wetlands outside of the existing TxDOT right-of-way.

	Trigger	Applies to the Project?	Explanation
	The project may impact at least 0.10 acre of riparian vegetation based on the judgment of a qualified biologist or as mapped in the EMST.	Yes	Under the proposed design, *Alternative A* may impact approximately 19.44 acres and *Alternative C* may impact approximately 18.01 acres of riparian vegetation (**Table 7**).
	The project disturbs habitat in an area equal to or greater than the area of disturbance indicated in the TxDOT-TPWD Threshold Table Programmatic Agreement.	Yes	Both alternatives would exceed thresholds for the "Edwards Plateau Savannah, Woodland, and Shrubland", "Riparian", and "Disturbed Prairie" MOU types (**Table 7**). The vegetation assessment was conducted from field observation and compared to the mapped EMST data. Additional information regarding the discrepancy between the observed and mapped vegetation types can be found in the *Oak Hill Parkway Tier I Site Assessment* (TxDOT, 2017b).

The *Best Management Practices Programmatic Agreement* between TxDOT and TPWD (2013) identifies both species-specific and generic taxa BMPs that must be utilized if the project is within range and within suitable habitat of tracked species. Therefore, in order to minimize or avoid impacts to SGCN species, the following species-specific BMPs would be in place:

Table 6: BMPs for State-Listed Species and SGCNs

	Species Name	BMP
	Plains spotted skunk	• Contractors will be advised of potential occurrence in the project area, to avoid harming the species if encountered, and to avoid unnecessary impacts to dens.
	Guadalupe bass	• For projects within the range of a SGCN or State-Listed fish, and work is in the water: TPWD coordination required.

Species Name	BMP
Cave myotis bat	All bat surveys and other activities that include direct contact with bats shall comply with TPWD-recommended white-nose syndrome protocols located on the TPWD Wildlife Habitat Assessment Program website under "Project Design and Construction". The following survey and exclusion protocols should be followed prior to commencement of construction activities. For the purposes of this document, structures are defined as bridges, culverts (concrete or metal), wells, and buildings. • For activities that have the potential to impact structures, cliffs or caves, or trees; a qualified biologist will perform a habitat assessment and occupancy survey of the feature(s) with roost potential as early in the planning process as possible or within one year before project letting. • For roosts where occupancy is strongly suspected but unconfirmed during the initial survey, revisit feature(s) at most four weeks prior to scheduled disturbance to confirm absence of bats. • If bats are present or recent signs of occupation (i.e., piles of guano, distinct musky odor, or staining and rub marks at potential entry points) are observed, take appropriate measures to ensure that bats are not harmed, such as implementing non-lethal exclusion activities or timing or phasing of construction. • Exclusion devices can be installed by a qualified individual between September 1 and March 31. Exclusion devices should be used for a minimum of seven days when minimum nighttime temperatures are above 50°F AND minimum daytime temperatures are above 70°F. Prior to exclusion, ensure that alternate roosting habitat is available in the immediate area. If no suitable roosting habitat is available, installation of alternate roosts is recommended to replace the loss of an occupied roost. If alternate roost sites are not provided, bats may seek shelter in other inappropriate sites, such as buildings, in the surrounding area. See Section 2: Standard Recommendations for recommended acceptable methods for excluding bats from structures. • If feature(s) used by bats are removed as a result of construction, replacement structures should incorporate bat-friendly design or artificial roosts should be constructed to replace these features, as practicable. • Conversion of property containing cave or cliff features to transportation purposes should be avoided where feasible. • Avoid unnecessary removal of dead fronds on native and ornamental palm trees in south Texas (Cameron, Hidalgo, Willacy, Kenedy, Brooks, Kleberg, Nueces, and San Patricio counties) from April 1 through October 31. If removal of dead fronds is necessary at other times of the year, limit frond removal to extended warms periods (nighttime temperatures ≥ 55°F for at least two consecutive nights), so bats can move away from the disturbance and find new roosts. • Large hollow trees, snags (dead standing trees), and trees with shaggy bark should be surveyed for colonies and, if found, should not be disturbed until the bats are no longer occupying these features. Post-occupancy surveys should be conducted by a qualified biologist prior to tree removal from the landscape. • Retain mature, large diameter hardwood forest species and native/ornamental palm trees where feasible. • In all instances, avoid harm or death to bats. Bats should only be handled as a last resort and after communication with TPWD.

Species Name	BMP
Texas garter snake	• Apply hydromulching and/or hydroseeding in areas for soil stabilization and/or revegetation of disturbed areas where feasible. If hydromulching and/or hydroseeding are not feasible due to site conditions, utilize erosion control blankets or mats that contain no netting or contain loosely woven, natural fiber netting is preferred. Plastic netting should be avoided to the extent practicable. • For open trenches and excavated pits, install escape ramps at an angle of less than 45 degrees (1:1) in areas left uncovered. Visually inspect excavation areas for trapped wildlife prior to backfilling. • Inform contractors that if reptiles are found on project site allow species to safely leave the project area. • Avoid or minimize disturbing or removing downed trees, rotting stumps, and leaf litter where feasible. • Contractors will be advised of potential occurrence in the project area, and to avoid harming the species if encountered.

Source: TxDOT-TPWD MOU September 2013.

In addition to the species-specific BMPs, the following generic taxa or resource BMPs would be followed:

Migratory Bird BMPs

- The disturbance, destruction, or removal of active nests, including ground nesting birds, during the nesting season would be prohibited.
- The removal of unoccupied, inactive nests would be avoided as practicable.
- The establishment of active nests during the nesting season on TxDOT-owned and -operated facilities and structures proposed for replacement or repair would be prevented.
- The collection, capture, relocation, or transportation of birds, eggs, young, or active nests without a permit would be prohibited.

6. POTENTIAL PROJECT IMPACTS

6.1 Water Resources

The Oak Hill Parkway Project has the potential to impact one wetland and eight streams. Both wetlands and streams may contain suitable habitat for state-listed species and SGCNs. The impacts to these potentially jurisdictional resources are similar under either build alternative, although within the limits of *Alternative C* there are an additional 1.34 acres of water resource compared to *Alternative A*. The impacts to these waters would occur from extending existing culverts, placing fill for concrete aprons and/or rock rip-rap at bridges, and placing temporary fills during construction. Exact fill type and amounts would be determined and, if necessary, would be permitted with a NWP from the USACE. Mitigation for these impacts would also be determined, if necessary, and calculated based on amount and type of impact to each jurisdictional water. No significant impacts to waters of the U.S. or wetlands, as they pertain to biological resources (species habitat), are anticipated as a result of either build alternative. Additional information on wetlands, waters of the U.S., and water

quality impacts is included in the *Oak Hill Parkway Water Resources Technical Report* (TxDOT, 2017a).

No Build Alternative

Under the *No Build Alternative*, no impacts to wetlands or waters of the U.S. would occur. Water quality impacts as a result of current roadway operation and maintenance would continue. Under current operation and design, the existing US 290 and SH 71 roadways do not meet current TCEQ water quality protection standards since they were constructed prior to the establishment of the Edwards Aquifer Rules. Therefore, without the BMP improvements and proposed Hazardous Materials Trap (HMT) anticipated under the build alternatives, water quality would be expected to deteriorate (e.g. the TSS load would increase) as traffic and congestion increase over time.

6.2 Vegetation, Including Large Tree Impacts

Vegetation within the project area was mapped using the EMST vegetation classifications and field verified during pedestrian surveys in 2016. Several discrepancies were noted between the mapped and observed vegetation communities. The *Oak Hill Parkway Biological Evaluation and Tier I Site Assessment* (TxDOT, 2017b) provide additional information on the vegetation discrepancies. Anticipated impacts to vegetation communities within the alignments of both *Alternative A* and *Alternative C* are identified in **Table 7** below and in **Figures 7** and **8**; these impacts are based on observed and field verified vegetation within the project area. According to the TxDOT-TPWD *Threshold Table Programmatic Agreement* under the MOU, coordination thresholds for four MOU habitat types would be exceeded by the proposed alignments. *Alternative A* would impact approximately 0.88 acres of vegetation more than *Alternative C*. No remnant vegetation communities were identified within the existing or proposed right-of-way for either alternative.

Table 7: Impacts to Observed Vegetation Types

Observed Vegetation Type	Corresponding MOU Type	Impacts Alt. A (acres)	Impacts Alt. C (acres)	PA Threshold (acres)	Threshold Exceeded?
Urban	Urban	121.46	123.78	None	N/A
Edwards Plateau Ashe Juniper, Motte and Woodland	Edwards Plateau Savannah, Woodland, and Shrubland	25.78	25.78	3.0	Yes
Edwards Plateau Deciduous Oak/ Evergreen Mottle Woodland		53.29	53.29		
Edwards Plateau: Savanna Grassland		19.03	19.03		
	MOU Total	*98.10*	*98.10*		

Observed Vegetation Type	Corresponding MOU Type	Impacts Alt. A (acres)	Impacts Alt. C (acres)	PA Threshold (acres)	Threshold Exceeded?
Edwards Plateau: Floodplain Ashe Juniper Shrubland	Riparian	0.06	0.06	0.1	Yes
Riparian		19.38	17.95		
	MOU Total	*19.44*	18.01		
Native Invasive: Mesquite Shrubland	Disturbed Prairie	3.81	3.81	3.0	Yes
Total		**242.81**	**243.69**		

For TxDOT projects, tree removal is not typically discussed separately from the vegetation impact assessment. However, during the early public involvement stages of this project, trees were identified as an important resource by community members. Therefore, additional survey effort was expended to identify and attempt to minimize impacts to large trees within the project area. **Tables 8** and **9** summarize the estimated impacts to trees mapped within the existing and proposed right-of-way.

Table 8: Total Tree Impacts by Alternative

Tree Impact	Alternative A				Alternative C			
	2007 Survey	2015 Survey	2017 Survey	Total	2007 Survey	2015 Survey	2017 Survey	Total
Trees to remain	94	128	15	**237**	96	126	15	**237**
Trees to be removed	157	106	18	**281**	155	108	18	**281**
Total number of trees	251	234	33	**518**	251	234	33	**518**

Results represent trees greater than 10 inches DBH; the tree survey efforts conducted in 2007, 2015, and 2017 covered different areas as a result of changes in project design.
Sources: 2007 Survey was conducted by Atkins, 2015 Survey was a combination of a private landowner survey and SAM, 2017 survey was conducted by SAM.

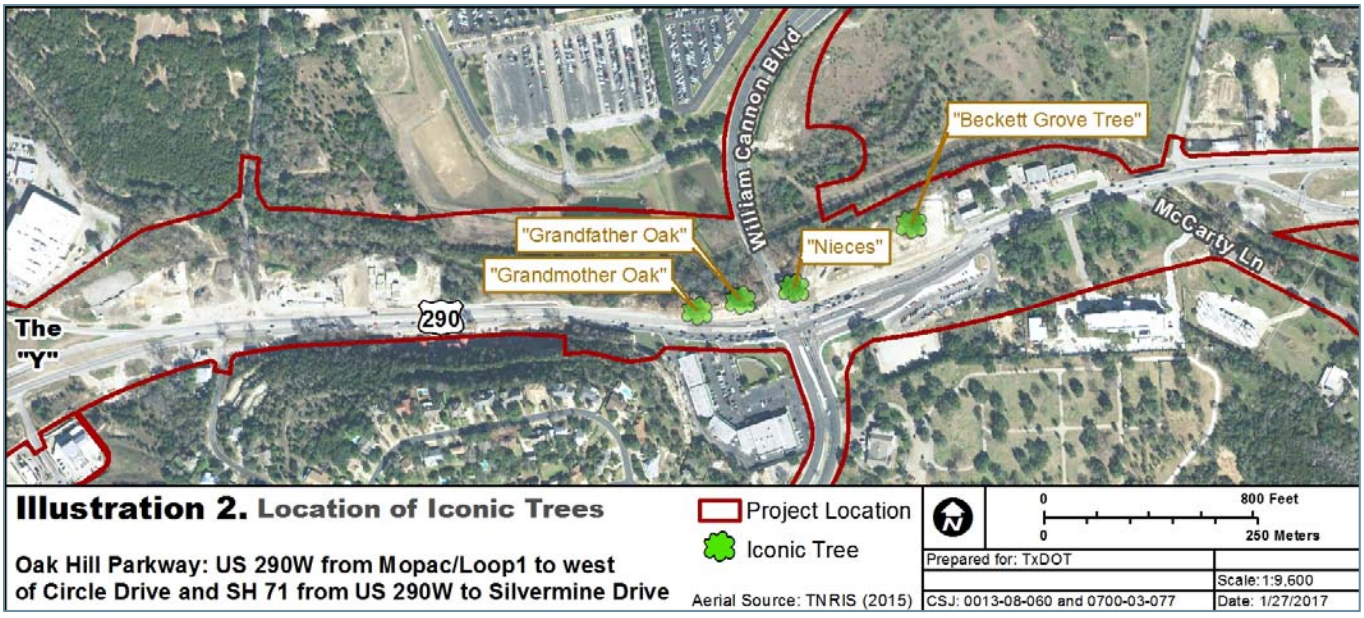
Table 9: Tree Impact by Species and Alternative

Species Common Name	Species Scientific Name	Alternative A		Alternative C	
		Take	Leave	Take	Leave
Ash	*Fraxinus sp.*	0	1	0	1
Bitternut Hickory	*Carya cordiformis*	2	1	2	1
Cedar Elm	*Ulmus crassifolia*	11	9	12	8
Cottonwood	*Populus deltoides*	1	2	1	2
Elm (non-cedar)	*Ulmus sp.*	24	21	23	22
Hackberry	*Celtis laevigata*	3	8	3	8
Live Oak	*Quercus virginiana*	130	103	132	101
Bigtooth Maple	*Acer grandidentatum*	0	1	0	1
Oak (other)	*Quercus sp.*	46	49	42	53
Pecan	*Carya illinoinensis*	51	30	53	28
Red Oak	*Quercus buckleyi*	1	0	1	0

Species Common Name	Species Scientific Name	Alternative A		Alternative C	
		Take	Leave	Take	Leave
Sycamore	*Platanus occidentalis*	8	9	8	9
Unknown	--	2	2	2	2
Western Soapberry	*Sapindus drummondii*	0	1	0	1
Black Willow	*Salix nigra*	2	0	2	0
Total		**281**	**237**	**281**	**237**

Results represent trees greater than 10 inches DBH

Although the final number of trees to be removed as a result of a build alternative would be determined once design has been finalized, preliminary results indicate that approximately 281 trees greater than 10 inches DBH would be removed in order to accommodate the Oak Hill Parkway improvements, regardless of the alternative selected. Live oaks are the dominant species across the project area and thus would experience the largest impact; nearly half of all trees removed would be live oaks. Although all native hardwoods with a DBH of greater than 10 inches were mapped within the project area, only 29 trees with a DBH greater than 35 inches would be removed under *Alternative A*, and 26 such trees would be removed under *Alternative C*. During the early stages of this project, members of the public identified several "iconic" trees that held a higher community value due to their size, location, or local history (**Illustration 2**).



With that knowledge, the project team prioritized these trees for protection during project development. Neither of the build alternatives will remove the following "iconic" trees: "Beckett Grove Tree", "Grandmother Oak", "Grandfather Oak", or "the Nieces".

No Build Alternative

Under the *No Build Alternative*, no vegetation impacts or tree removal would be anticipated. Regular tree trimming, mowing, and herbicide treatment along the existing right-of-way would continue as a result of normal transportation operation and maintenance.

6.3 Threatened and Endangered Species

In 2006, TxDOT concluded consultation with the USFWS under Section 7 of the Endangered Species Act for the previously approved US 290/SH 71 EIS project limits discussed in **Section 1** (USFWS, 2006). This consultation received USFWS concurrence that the proposed project may affect, but was not likely to adversely affect the Barton Springs or Austin blind salamanders. The USFWS Biological Opinion also concurred with TxDOT's determination of "No Effect" on the Golden-cheeked Warbler, Black-capped Vireo, and Bee Creek Cave Harvestman. Although the Oak Hill Parkway project generally occurs within the same action area of the initial Biological Assessment, substantial modifications to the new project's limits and roadway design and TxDOT's decision to initiate a new EIS to address the current Oak Hill Parkway project, requires that a new consultation with the USFWS be initiated for any impacts that may result in an effect to a federally-listed species.

6.3.1 Aquifer Species

The BSS and ABS are not known to occur within the limits of the project area. Both species have been recorded from spring outlets at Barton Springs in Zilker Park, approximately 2.6 miles northeast of the US290/Mopac interchange. An additional confirmed location for the BSS has been recorded at an unnamed well along FM 1626 in South Austin and recent sampling efforts by Chippendale (2014) have suggested additional locations, which establishes the potential for this species to occur throughout a much wider subterranean range than previously thought. Through stormwater runoff, the project area contributes surface and potential subsurface recharge to the Barton Springs segment of the Edwards Aquifer, therefore potentially impacting water quality at the Barton Springs Complex.

Potential impacts to aquatic resources associated with the construction and operational phases of roadways include impacts from altered hydrology and impacts from roadway-associated pollution. Pollutants can enter the aquatic environment via untreated stormwater runoff or spills, and the addition of impervious cover can influence the volume and quality of runoff leaving the project area. The Recharge Zone of the Barton Springs segment encompasses approximately 78 square miles (or 50,000 acres). Approximately 74.0 and 73.6 acres of impervious cover would be added as a result of *Alternative A* or *Alternative C*, respectively (KFA, 2017). The new impervious cover would be less than 0.15 percent of the Barton Springs Recharge Zone total. Construction activities such as excavation, trenching, geotechnical boring, and vegetation clearing could increase the sediment loading in stormwater by loosening topsoil and increasing the erodibility of surfaces within the project area. This loosened sediment could be transported down-gradient and deposited in recharge features, stream terraces, or other water bodies by runoff or rainfall. In the designation of critical habitat for the ABS, the USFWS identified dissolved oxygen, conductivity, sedimentation, and point and non-point source contaminants as water quality parameters that have the potential to impact sensitive species (USFWS, 2013). Direct impacts caused by construction activities and indirect impacts caused by operation and maintenance of roadway facilities over time could have a negative impact on the water quality parameters mentioned above.

Since the listing of the BSS in 1997, a wealth of information has been collected on water quality at Barton Springs and on the impact of water quality on the BSS and ABS. A recent report by Barrett (2016) evaluated the results of over 20 years of water quality data, including roadway runoff constituents (TSS & zinc) at Barton Springs. Barrett's report also examined the effectiveness of typical BMPs that are frequently used to treat stormwater runoff under COA regulations and the TCEQ Edwards Aquifer Rules. He concluded that these typical BMPs are successful at removing pollutants from highway runoff and cited the findings of historical water quality data collected by the COA and the USGS at Barton Springs. Of particular importance to highway runoff are TSS, zinc, and copper levels, all of which have been stable or decreasing over the last 20 years despite the increased urbanization over the Barton Springs Zone (Barrett, 2016). Several water quality constituents (nitrate, dissolved oxygen, sulfate, calcium, strontium, etc.) studied in Barrett's report were found to have worsened over the same period (Herrington and Heirs, 2010; Barrett, 2016). The increase in these constituents is explained in detail by Barrett (2016). Briefly, the increase in nitrates is likely associated with an increase in septic or wastewater systems throughout the Barton Springs Zone (Mahler et al., 2011). The increases in many of the other constituents can be explained as the result of their natural occurrences in the aquifer and by the increased water supply demands, which can cause saline water from the eastern boundary of the Edwards Aquifer to move west and increase its discharge at Barton Springs (Mahler et al., 2006). This saline water (also known as the "bad water line") is well documented as the cause of increases in the concentrations of sulfate, fluoride, sodium, chloride, strontium, and other minerals, and it can discharge at Barton Springs under certain conditions (Barrett, 2016). Based on Barrett's analysis, none of the water quality data analyzed for Barton Springs indicated any degradation due to stormwater runoff or an increase in impervious cover.

Barrett's (2016) report also focused on the effectiveness of various BMPs for stormwater runoff within the Barton Springs Zone. He concluded that, based on the water quality analysis of the constituents that are typically found in stormwater or highway runoff, the TCEQ and COA BMP standards are effective at preventing degradation to water quality by matching or improving on background water quality parameters (Barrett, 2016).

As discussed previously, no springs or caves occur within the project area and all known locations of BSS or ABS are at a considerable distance from the project area. The greatest possibility of direct effects to these species could occur if voids connected to the aquifer or containing groundwater are intersected during the down cutting of bedrock below the current grade or other excavation activities, such as bridge piers. Preliminary design indicates that *Alternative A* would require the placement of approximately 167 columns and *Alternative C* would require the placement of approximately 152 columns within the Recharge Zone. Columns would reach depths between 19 and 33 feet, which would be shallower than the all recorded wells near the project area. Therefore, any direct impacts, including mortality or physical harm caused by construction activities, are extremely unlikely to occur.

However, based on the project-related increase in impervious cover, the project's location over the Recharge Zone of the Edwards Aquifer, and the known aquifer flow paths to Barton Springs from the impacted watersheds, this project may impact water quality through increased stormwater

contribution; therefore, this project may contribute to the downstream degradation of water quality parameters that are essential to the BSS and ABS at discharge sites within the Barton Springs Complex. However, once stormwater leaves the project area and infiltrates into the subsurface environment (e.g. groundwater), the flow path and amount of mixing with other subsurface waters is unknown. In the event of a BMP failure within the project area, any change in runoff water quality would be temporary and immeasurable due to the effects of dilution within the aquifer. Therefore, effects to the BSS and ABS as a result of indirect water quality impacts are not reasonably foreseeable and are not likely to adversely affect either species.

To mitigate for the increase of impervious cover within the project area and to ensure protection of downstream resources (including salamanders), BMPs would be applied to reduce the intensity of stormwater runoff and amount of roadway pollutants entering Williamson and Slaughter Creeks. In 2007, the TCEQ published a set of voluntary Optional Enhanced Measures (OEMs) as an appendix to their guidance document, *Complying with the Edwards Aquifer Rules: Technical Guidance on Best Management Practices* (TCEQ, 2005; TCEQ, 2007). These measures provide a suite of options that can be used to enhance water quality by committing to construction, post-construction, and maintenance phase BMPs. According to the TCEQ's *Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer Report (Revised) – Appendix A to RG-348* (TCEQ, 2005; TCEQ, 2007) the USFWS concurred with the TCEQ's "no effect" determination for aquifer species for projects that adopt the OEM. Although this document does not address the ABS, due to similarities in life history and habitat (USFWS, 2015), it is assumed that the OEMs would be effective for this species as well.

TSS is often used as an indicator of water quality because it includes both large and small sediment particles. Most BMPs designed to improve water quality focus on TSS removal in stormwater runoff. The proposed Oak Hill Parkway project would strictly adhere to the TCEQ standards for BMPs over the Edwards Aquifer and would commit to at least 80 percent removal of the incremental increase in TSS resulting from the proposed projects' addition of impervious cover. Where practicable, the project would adopt the OEMs to ensure the protection of water quality. A *Preliminary Water Quality Analysis and Design Report* (KFA, 2017) has been prepared to address permanent water quality BMPs for the Oak Hill Parkway project and it is available under separate cover for review; in addition, the following BMPs have been recommended as permanent water quality protection measures for the Oak Hill Parkway project:

Permanent BMPs

- Upstream Stormwater Detention Ponds – Upstream stormwater detention basins or ponds are stormwater management facilities that passively collect stormwater upstream of the project area and would mitigate any increase in downstream flooding risks associated with the changes to drainage patterns as a result of increases in impervious cover. Two upstream stormwater detention ponds are proposed for the Oak Hill Parkway project.

- Bioretention Ponds – Bioretention ponds are stormwater storage facilities that passively collect stormwater and thus delay its conveyance downstream. The ponds also filter the stormwater, typically using sand or vegetative media. Multiple (between 15 to 17, depending on alternative) bioretention ponds utilizing classic sand filter systems, biofiltration, or extended detention will be incorporated throughout undeveloped portions of the project right-of-way. Ponds will be a mixture of vegetated and non-vegetated systems depending on location (e.g., non-vegetated under roadway overpass). Pond depths will vary but are expected to be approximately two to three feet deep.

- Vegetative Filter Strips (VFS) – A VFS is a section of land located adjacent to the roadway shoulder or median that has moderate slopes designed to accept runoff as overland sheet flow. Pollutant removal is achieved through velocity reduction, filtration by vegetation, and infiltration. Optimal performance of a VFS relies on maintaining a dense mix of erosion-resistant vegetation. VFS will be utilized along pavement edges, within the medians as practicable, and along the shared-use path of the Oak Hill Parkway project.

- Hazardous Materials Trap (HMT) – An HMT is a detention pond that captures and contains liquid hazardous material spills or stormwater runoff. The pond is built to operate in an open-close cycle to allow particulates to settle prior to releasing the less turbid water. HMTs are being considered at the Williamson Creek crossings within the project area.

The following BMPs may be applied to the Oak Hill Parkway project to minimize downstream impacts to water quality and sensitive aquatic resources as practicable throughout the construction and operation phases of the project:

General BMPs

- Erosion Control - The project will incorporate temporary erosion control structures to minimize erosion. Erosion control measures, such as, temporary seeding and mulching, hydro-mulch, and erosion control blankets, will be incorporated as a first step in construction and will be maintained throughout active construction activities. In addition, permanent stormwater quality BMPS, such as stormwater ponds, wetlands, or detention basins, may be required for projects that require coverage under the Texas Pollutant Discharge Elimination System General Permit.

- Sediment Control - The Stormwater Pollution Prevention Plan (SW3P) will describe the temporary and permanent structural and vegetative measures to be used for soil stabilization, runoff control, and sediment control for each stage of the project from initial land clearing and grubbing to project close-out. The SW3P will include a description of structural practices to divert flows from exposed soils, store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site to the degree attainable.

- Roadside Drainage - Where feasible, vegetated swales would be used to assist with filtering sediment and other pollutants from stormwater before it reaches streams and adjacent wetlands.

- Revegetation - All temporarily disturbed areas created by construction activities would be revegetated following TxDOT specifications. Permanent revegetation will occur after sections are completed and will consist of a variety of grasses and forbs, including legumes, wildflowers, and cereals. The species used shall be suitable to the area and should not compete with permanently planted grasses. Temporary stabilization methods will include seeding, mulch consisting of hay, straw, wood fiber, or other suitable material that will be placed evenly after applying the seed mix.

- Equipment Service/Maintenance - The SW3P and TxDOT Environmental Permits, Issues, and Commitments (EPIC) form may require that any areas used for servicing or maintaining construction equipment will be located away from streams, wetlands, and ponds and outside the 100-year floodplain. The contractor will submit a proposed plan designating staging areas, and this plan will be reviewed and approved by the engineer prior to construction. Materials that may leach pollutants will be stored under cover and out of the weather. Fuel tanks located on-site will have double containment systems and any fuels or other spills must be cleaned up immediately and in accordance with an approved spill response plan. Concrete or other material wash outs will be located in designated areas away from aquatic resources. All construction equipment will be maintained in proper mechanical condition so fuel, oil, and other pollutants do not get into water bodies during construction activities.

Wetland/Stream Protection

- Establish and/or maintain buffers around known or discovered recharge features.

- Locate, design, construct, and maintain stream crossings to provide maximum erosion protection.

- Maintain existing road ditches, culverts, and turnouts to ensure proper drainage and minimize the potential for the development of ruts and mud holes and other erosion-related problems.

- Stabilize, seed, and mulch eroded roadsides and new road cuts with native grasses and legumes, where feasible, in a timely manner to minimize impacts to water bodies.

- Implement erosion and sediment controls where appropriate. Maintain protective vegetative covers over all compatible areas, especially on steep slopes. Where necessary, gravel, fabrics, mulch, riprap, or other materials that are environmentally safe and compatible with the location may be used, as appropriate, for erosion control in problem areas.

- Water quality protection BMPs will have multiple levels of oversight to ensure their continued proper function. In addition to Contractor inspectors who are responsible for daily monitoring of BMPs, TxDOT inspectors will conduct weekly inspections and will submit compliance reports to the Project Engineer. Additional oversight will be provided by the TxDOT Project Manager

(who will be on site each day) and staff from the District Environmental Office, including the District Environmental Quality Coordinator.

Bridge Construction and Geotechnical Drilling Protection

- Monitor drill shafts for voids and leave steel casings in place if water is encountered during drilling activities.
- Backfill annular spaces outside of cased excavations with washed pea gravel covered with a layer of bentonite chips and Portland cement from land surface to a depth of three feet.
- Install concrete surface caps at the above-ground base of each bridge column.
- Provide bridge deck drains that will capture bridge deck runoff and direct it to sedimentation basins, if feasible.
- A specific karst void discovery protocol would be developed for the project for all excavation phases.

No Build Alternative

Under the *No Build Alternative* stormwater runoff would continue to flow into adjacent streams and recharge features, while vehicular traffic on the roadway would continue to increase. Temporary changes to water quality as a result of the construction phase of the project would not occur. However, an important change to the existing conditions under either build alternative would be the inclusion of required BMPs to control the quality, quantity, and velocity of water, including roadway runoff, entering streams and recharge features with flow paths to Barton Springs. It is possible that new BMP implementation under either *Alternative A* or *Alternative C* would result in an improvement to water quality leaving the project area. It is also anticipated that due to the US 290 bridge improvements and the creation of upstream detention basins under the build alternatives there would be a reduction in flood levels (0.5 feet) in Williamson Creek that would reduce overland flow into the Barton Creek watershed; under the *No Build Alternative* the flood levels would remain the same (Eric Friedrich, H&H Resources, 2017).

6.3.2 Karst Species

Although the Oak Hill Parkway project occurs partially within the South Travis County KFR, the nearest record of occurrence for a listed karst invertebrate is located more than 2-miles north of the eastern project terminus. A Geologic Assessment was conducted for areas of the project which occur over the Recharge Zone of the Edwards Aquifer (Rahe, 2009; HDR, 2016). Several sensitive recharge features were identified; however, no features exhibited habitat characteristics required for listed karst invertebrates. Although the project would minimize the need for excavation activities to the extent practicable, the potential for impacting a undiscovered cave or void remains. Excavation, geotechnical boreholes, and bridge pier drilling have the potential to alter a cave's ecosystem. However, due to the lack of suitable karst features identified during the geologic assessment and the location of the project area in areas mapped as Karst Zone 3 (i.e., areas that probably do not contain

endangered cave fauna), neither alternative is anticipated to have an effect on listed karst invertebrates. Void mitigation and protection BMPs would be utilized if a void were discovered during project construction.

Standard Void Mitigation BMPs

- Portions of the project area are within a known karst area. Fractured material, boulders, underground large voids (greater than one cubic foot in volume or greater than six inches in all directions), ground water, unstable material, and drastically varying strata can be expected.
- Voids discovered in drilled shafts that are greater than 6 inches across in any direction will require assessment to determine whether mitigation procedures are appropriate.
- Voids discovered in drilled shafts that are greater than 12 inches across in any direction will require steel casing within the shaft that extends a minimum of 12 inches above and below the extent of the void's opening.
- A dry void that is less than 1 cubic foot in volume or less than 6 inches in all directions will not require action. All other voids require action. TxDOT/Mobility Authority shall be notified immediately via email and phone when a void is found that requires action. TxDOT/Mobility Authority will determine within 24 hours if a standard response can be implemented. If a standard response does not apply, TxDOT/Mobility Authority will provide guidance to the Contractor within 6 business days of email notification.
- All voids require an email notification to the designated representative within 2 hours of discovery. The email must include location information, dates of discovery, video/picture documentation, etc. Contact the District Construction Office for an example email that must be followed.
- During excavations other than the construction of drilled shafts, all voids that require action shall be temporarily covered with a plastic tarp (overlap edge of void minimum of 3 feet) or plywood (overlap edge of void minimum of 1 foot). Erosion control logs shall be placed around the feature at an offset of 10 feet from the nearest edge. Work within 50 feet of the void shall be suspended. The logs will be paid for using the appropriate bid item or silt fence. The tarp and plywood are subsidiary.

No Build Alternative

The *No Build Alternative* would have no effect on listed karst invertebrates or known and occupied karst features.

6.4 Species of Greatest Conservation Need

Depending on the alternative selected, between 119.91 and 121.35 acres of non-urban vegetation that could support suitable habitat for SGCN species would be removed. Potential construction phase impacts to the four animal species (cave Myotis bat, plains spotted skunk, Guadalupe bass, and

Texas garter snake) would be temporary and limited to the construction period of the Oak Hill Parkway project. Vegetation that is removed and converted to transportation use would permanently eliminate these areas from being suitable habitat for sheltering or foraging. Due to the mobility of these species, the current fragmentation of habitat within the project area, and the proximity of higher quality suitable habitat adjacent to the US 290/SH 71 project area, impacts to these species are not anticipated to result in long-term effects to the species as a whole. Species-specific BMPs, as identified in **Table 6,** would be utilized to minimize construction impacts to species and their potential habitat within the project area. For the 18 plants species that may occur within the project area, direct impacts associated with vegetation removal, including physical destruction of individual plant populations, would be permanent within the area of disturbance.

While direct impact to individuals or populations of these species may occur as a result of construction activities, these impacts would be limited to areas that are necessary to accommodate the additional pavement width, sidewalks, bridges, and detention ponds. All vegetation removal would be limited to the amount practicable for the project construction.

No Build Alternative

The *No Build Alternative* would not result in any impacts to SGCN or their habitat. Typical roadway maintenance and landscaping activities (mowing/tree trimming) would continue as a result of regular facility operation.

7. PERMITS AND COMMITMENTS

Construction activities at culvert extension locations would be authorized by a Section 404 NWP #14. A PCN may be required if placement of fill within a special aquatic site (wetlands, riffle pool complexes, and vegetated shallows) is unavoidable.

Pre- and post-construction BMPs for erosion control, sedimentation control, and TSS control would be implemented in compliance with Section 401 of the Clean Water Act and would strictly adhere to TCEQ standards for construction activities over the Edwards Aquifer. During construction, project activities would be guided by an Environmental Compliance Management Plan (ECMP) which would include protocols designed to avoid environmental impacts. Final BMPs (including VFS, bioretention ponds, and HMTs) would be designed upon selection of the preferred alternative and are discussed in detail in the *Preliminary Water Quality Analysis and Design Report* (KFA, 2017).

Upon completion of earthwork operations, disturbed areas would be restored and reseeded in accordance with TxDOT's *Vegetation Management Guidelines* and in compliance with the intent of the FHWA Executive Memorandum on Environmentally and Economically Beneficial Landscape Practices. Landscaping enhancements would include measures to address large tree impacts across the project area. A combination of tree relocations, tree plantings, and general landscaping improvements would be utilized to off-set impacts to native hardwood trees (identified as a community resource) that result from the build alternative.

The project is likely to have an insignificant and discountable effect on two federally listed species. Consultation with the USFWS for indirect impacts to the Austin Blind and Barton Springs salamanders is anticipated. Suitable habitat exists within the project area for several SGCN species; as a result, potential impacts to individuals or their habitats are anticipated. Coordination with TPWD under the 2013 TxDOT-TPWD MOU would be required for impacts to vegetation and because of the potential presence of several SGCNs. BMPs for the cave myotis bat, Guadalupe bass, plains spotted skunk, and Texas garter snake would be followed as described in Table 6. Project activities would be compliant with the regulations of the MBTA.

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Attachment A

Figures

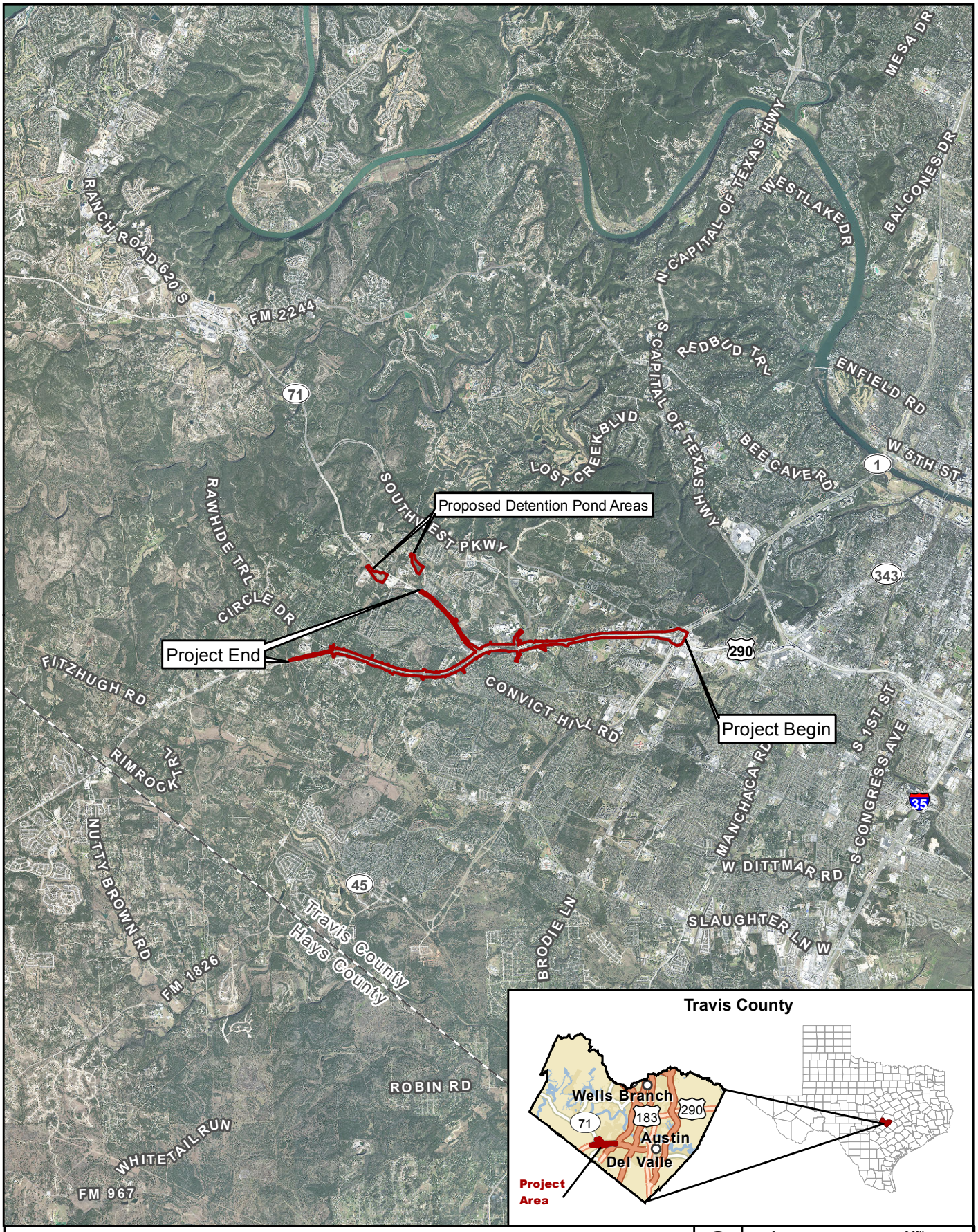

Figure 1. **Project Location (Aerial Base)**

Oak Hill Parkway: US 290W from Mopac/Loop1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Project Location

Basemap Source: TNRIS (2015)

0 2 Miles
0 3 Kilometers

Prepared for: TxDOT	1 in = 2 miles
	Scale:1:126,720
CSJ: 0013-08-060 and 0700-03-077	Date: 6/6/2017

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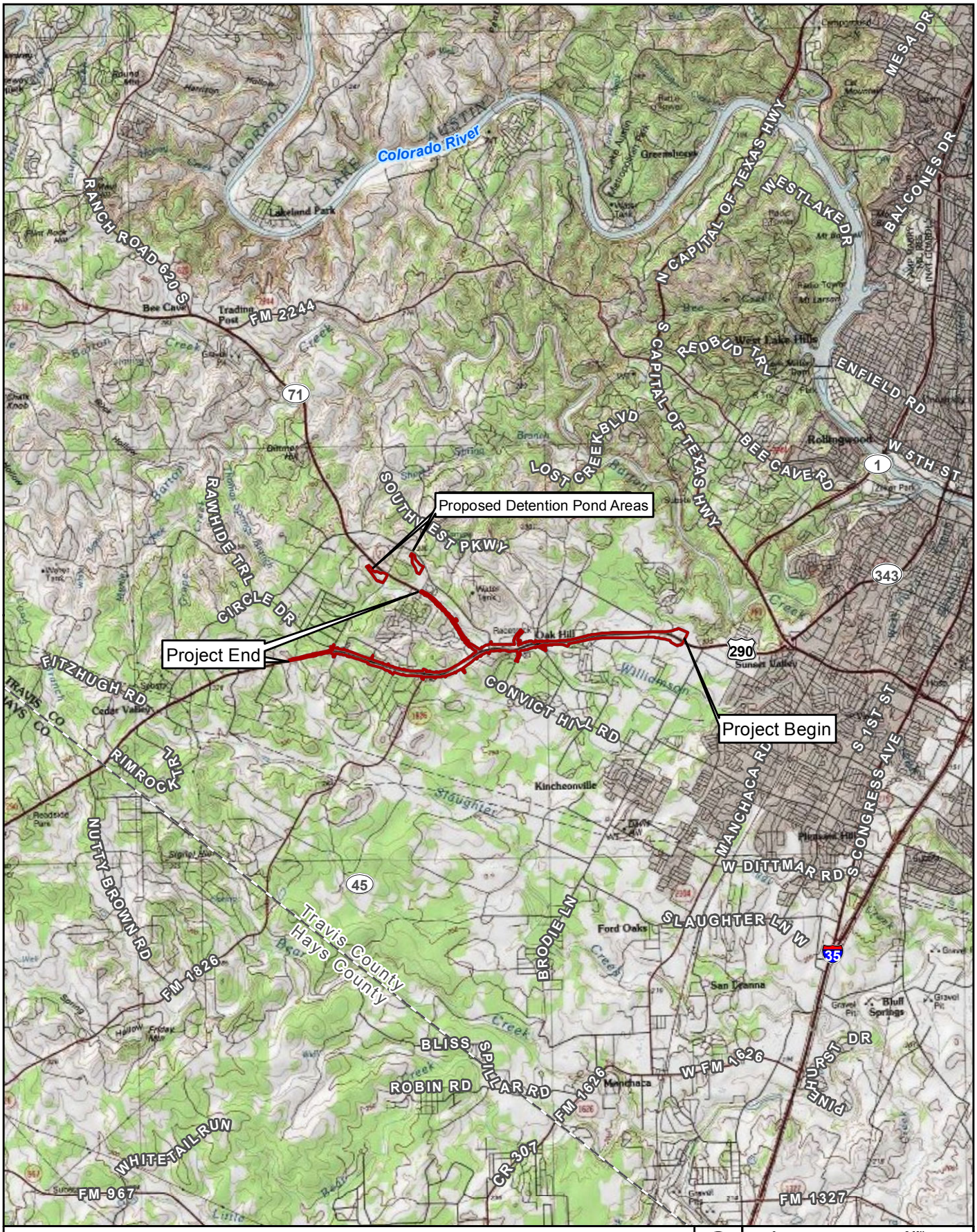

Figure 2. **Project Location (Topographic Base)**

Project Location

Oak Hill Parkway: US 290W from Mopac/Loop1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Topographic Source: USGS Austin, Texas 30' x 60' Quadrangle (1985)

0 2 Miles
0 3 Kilometers

Prepared for: TxDOT	1 in = 2 miles
	Scale:1:126,720
CSJ: 0013-08-060 and 0700-03-077	Date: 6/6/2017

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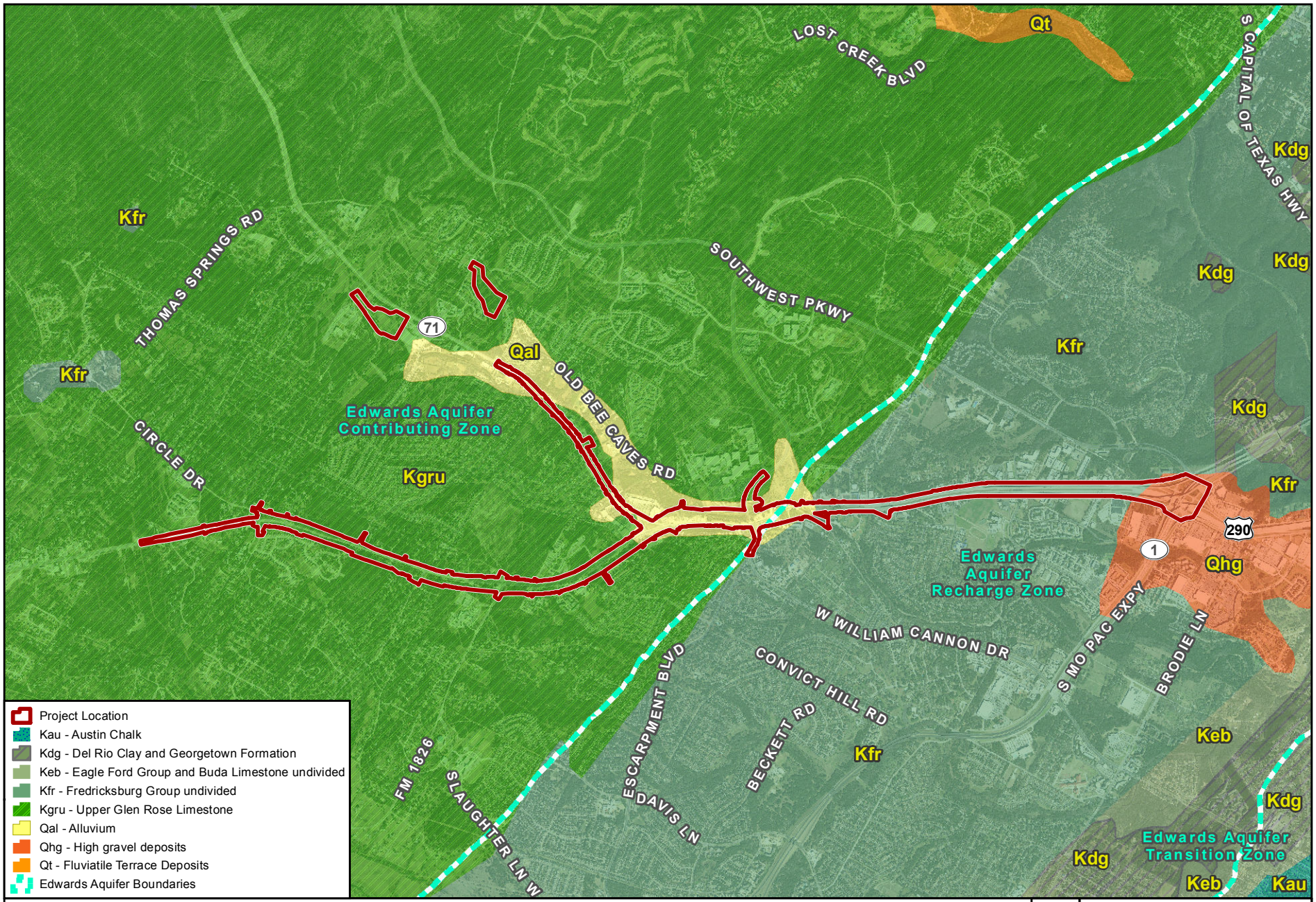

Figure 3. Project Area Geology

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Sources: Geologic Database of Texas (2007)/
Geologic Atlas of Texas Austin Sheet (1981), TCEQ (2005)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 0.75 mile
	Scale: 1:47,520
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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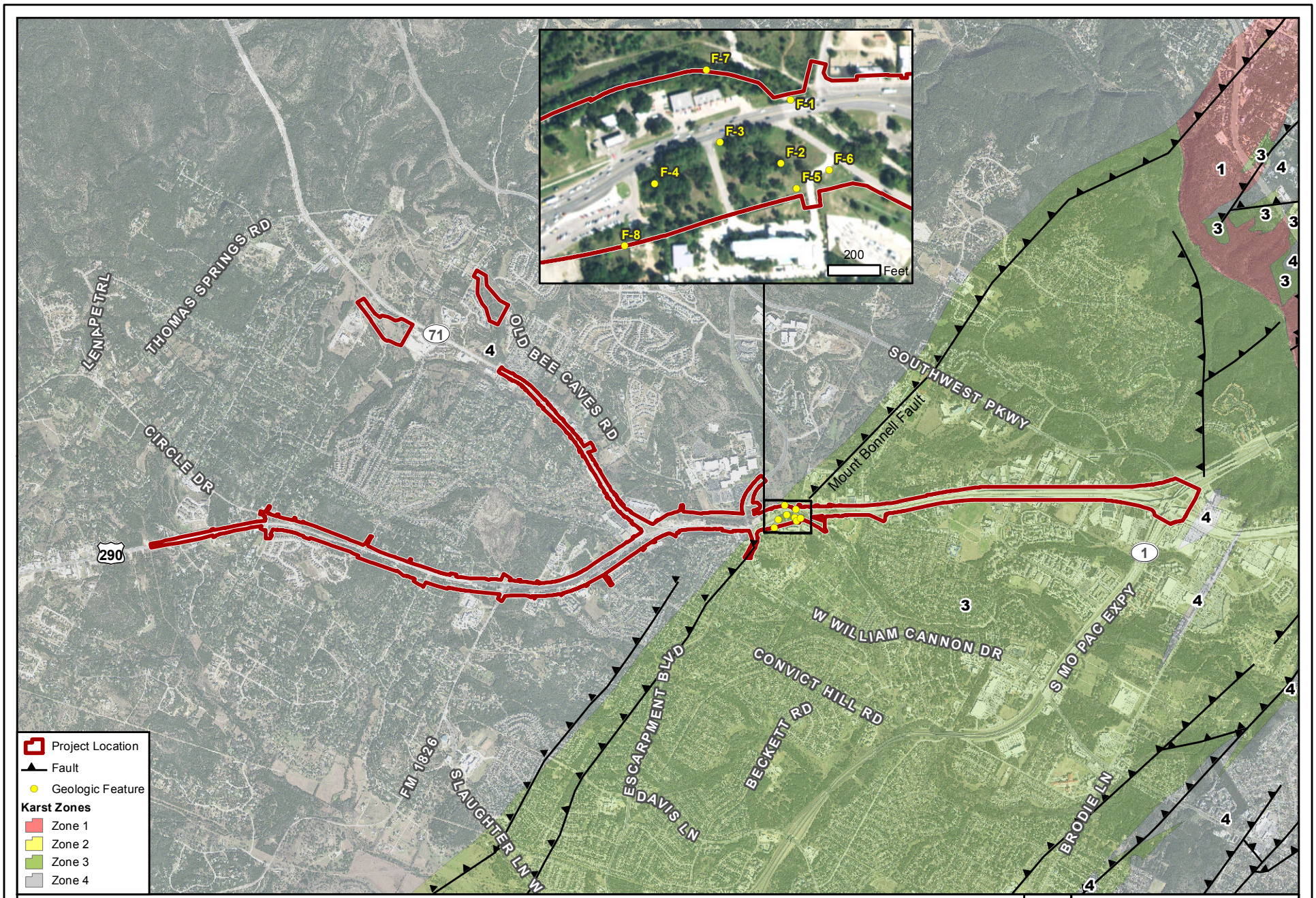

Figure 4. **Geologic Features and Karst Zones**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Sources: Geologic Database of Texas (2007), Veni (2007), CMH2H (2009)
Aerial Source: TNRIS (2015)
Inset Aerial Source: ESRI (2015)

Prepared for: TxDOT	1 in = 0.75 mile
	Scale: 1:47,520
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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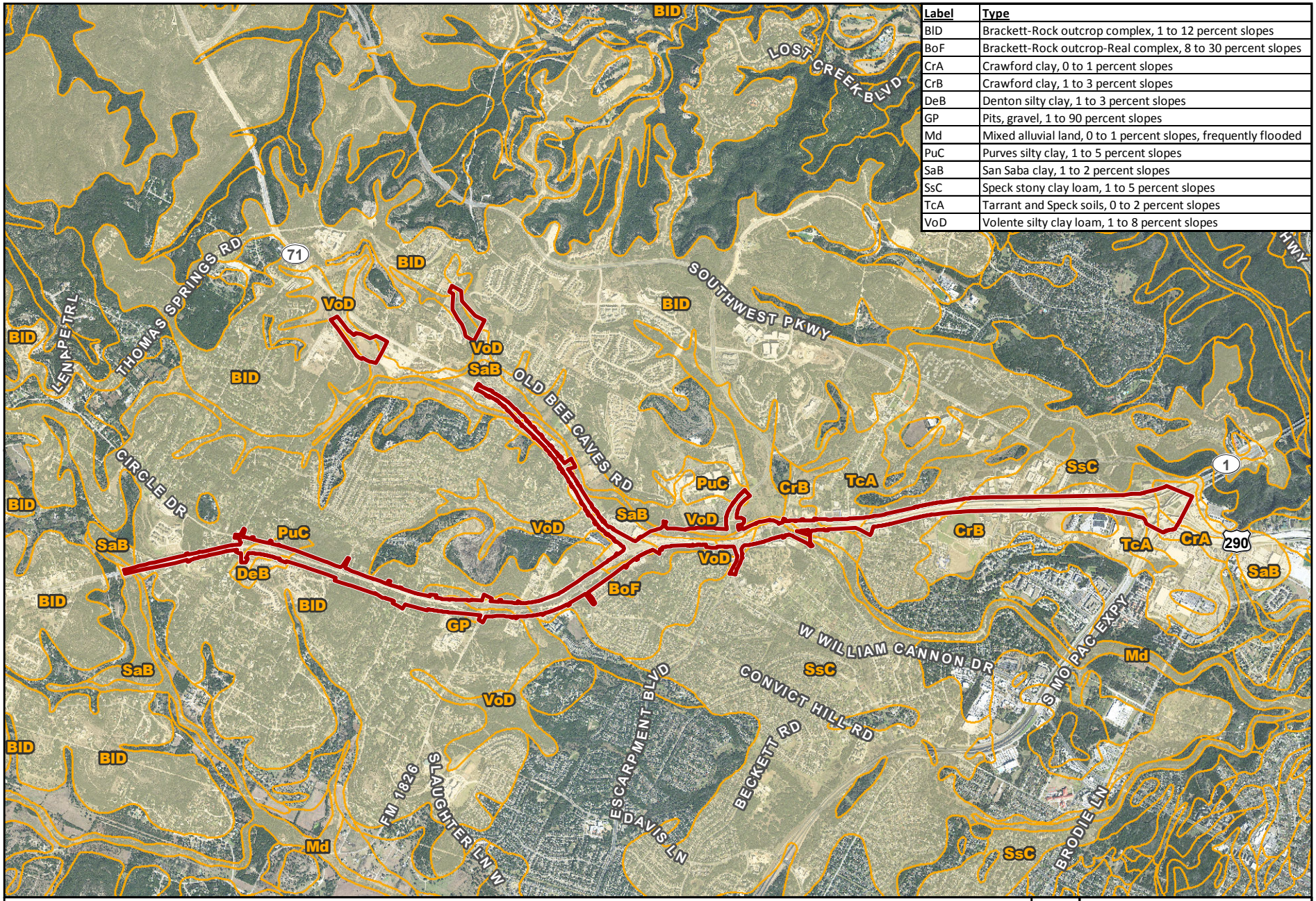

Label	Type
BID	Brackett-Rock outcrop complex, 1 to 12 percent slopes
BoF	Brackett-Rock outcrop-Real complex, 8 to 30 percent slopes
CrA	Crawford clay, 0 to 1 percent slopes
CrB	Crawford clay, 1 to 3 percent slopes
DeB	Denton silty clay, 1 to 3 percent slopes
GP	Pits, gravel, 1 to 90 percent slopes
Md	Mixed alluvial land, 0 to 1 percent slopes, frequently flooded
PuC	Purves silty clay, 1 to 5 percent slopes
SaB	San Saba clay, 1 to 2 percent slopes
SsC	Speck stony clay loam, 1 to 5 percent slopes
TcA	Tarrant and Speck soils, 0 to 2 percent slopes
VoD	Volente silty clay loam, 1 to 8 percent slopes

Figure 5. Project Area Soils

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Project Location
Soils

Data Source: NRCS (2016)
Aerial Source: TNRIS (2015)

0 0.75 Miles
0 1 Kilometer

Prepared for: TxDOT	1 in = 0.75 mile
	Scale: 1:47,520
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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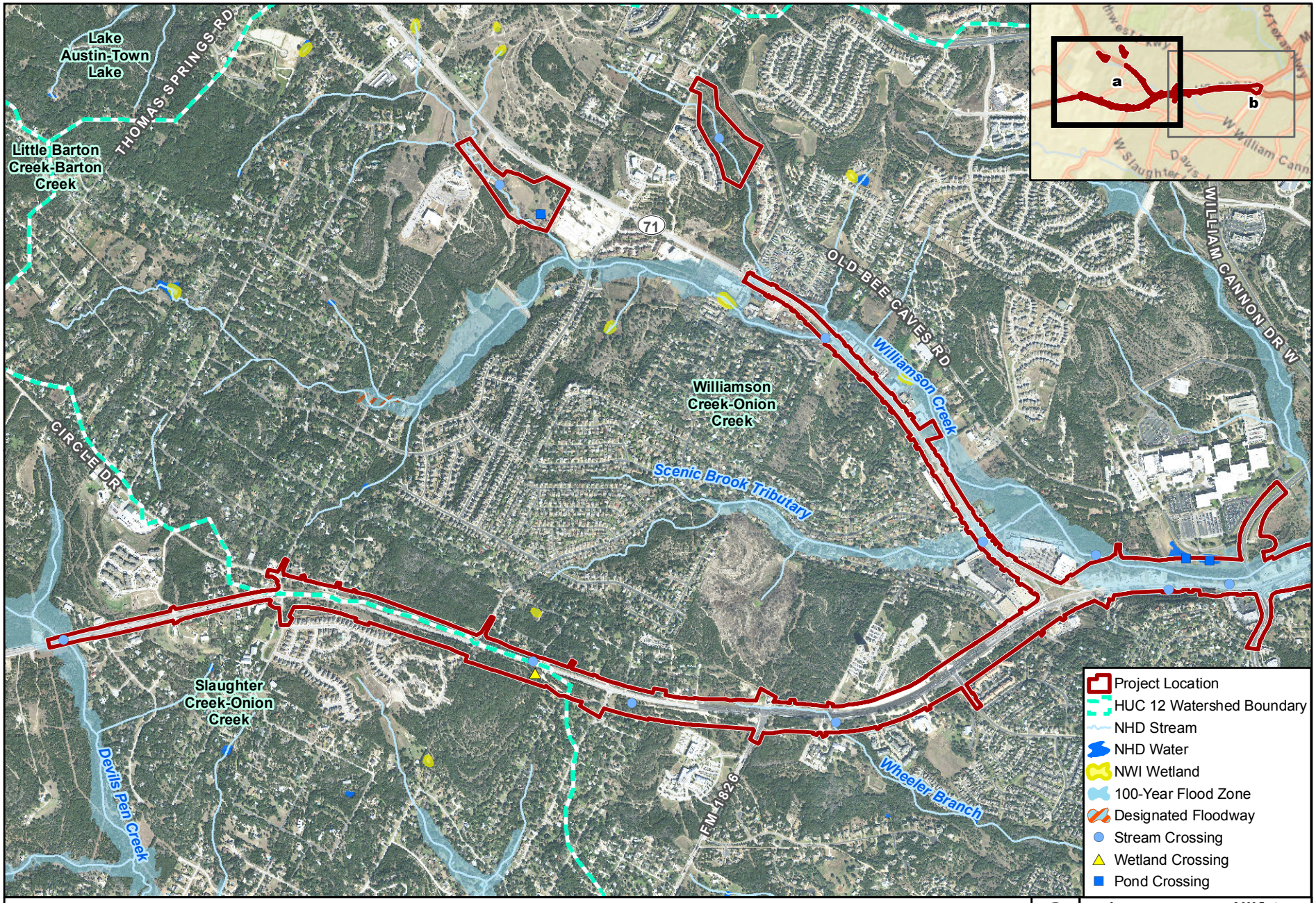

Figure 6a. Water Resources

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Sources: NHD (2014), NWI (2014), FEMA NFHL (2014), TWDB (2016), HDR (03/2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 2,000 feet
	Scale: 1:24,000
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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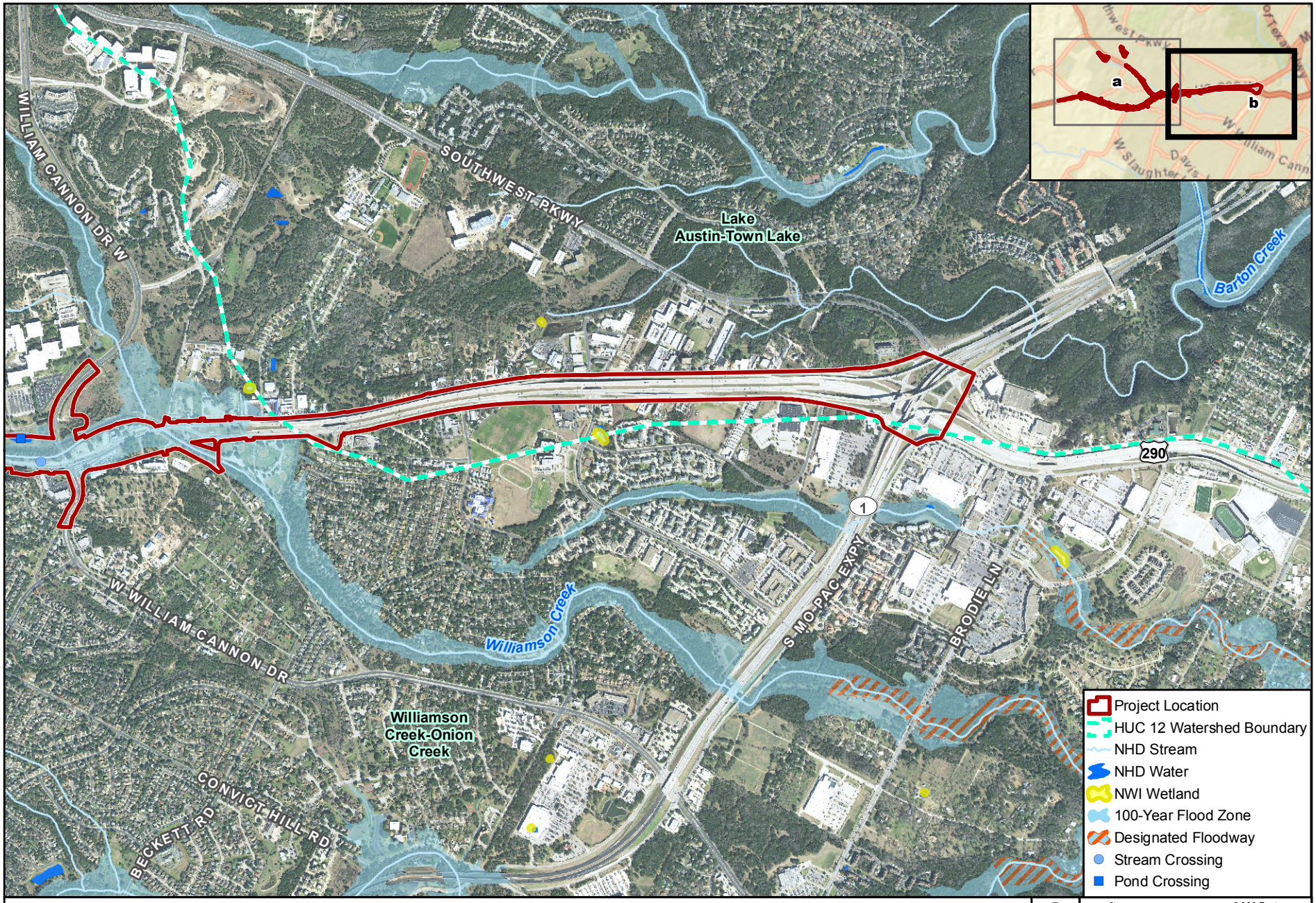

Figure 6b. Water Resources

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Sources: NHD (2014), NWI (2014), FEMA NFHL (2014), TWDB (2016), HDR (03/2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 2,000 feet
	Scale: 1:24,000
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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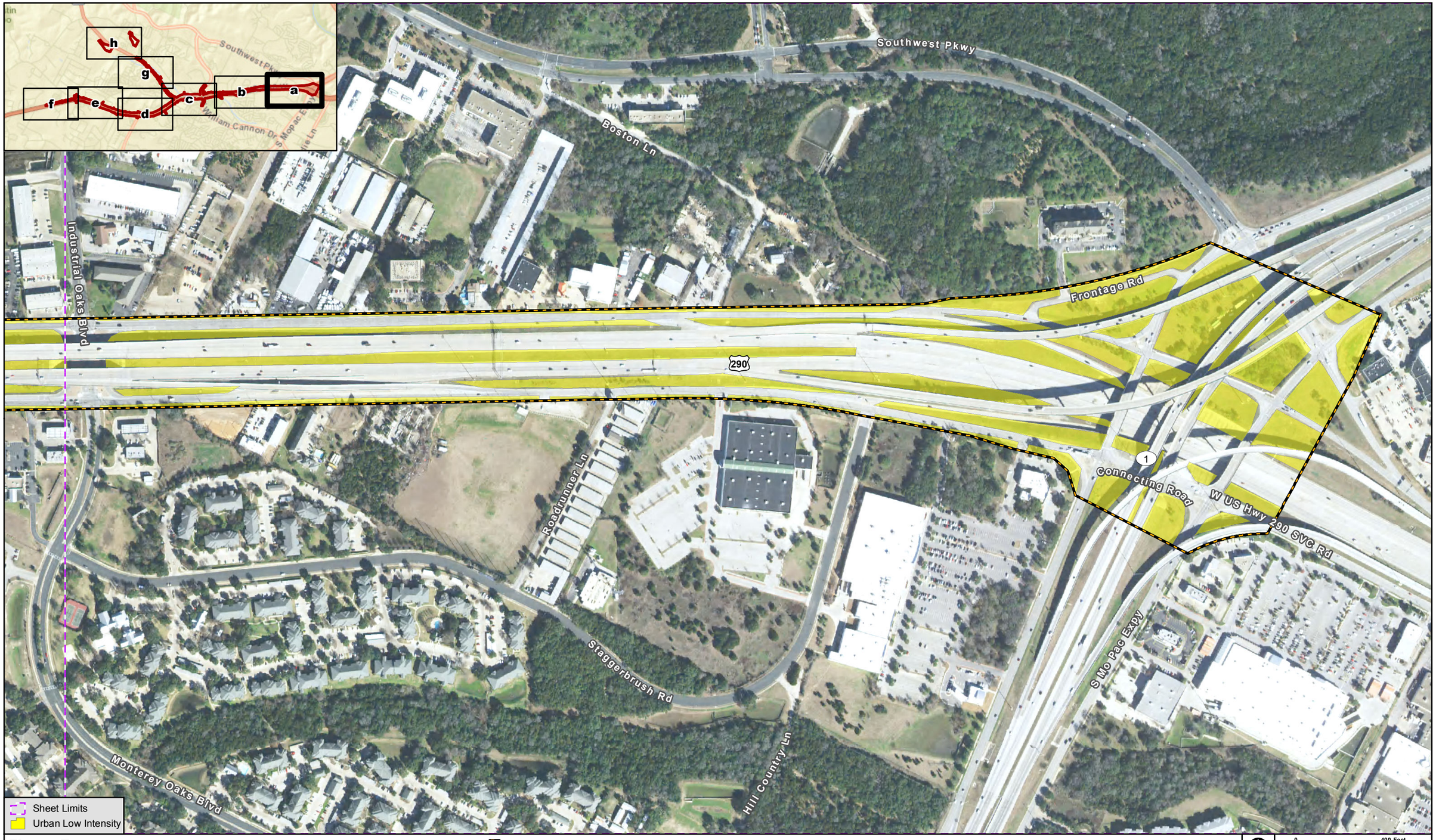

Figure 7a. Alternative A Observed Vegetation Types

Existing Right-of-Way

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

0 400 Feet
0 120 Meters

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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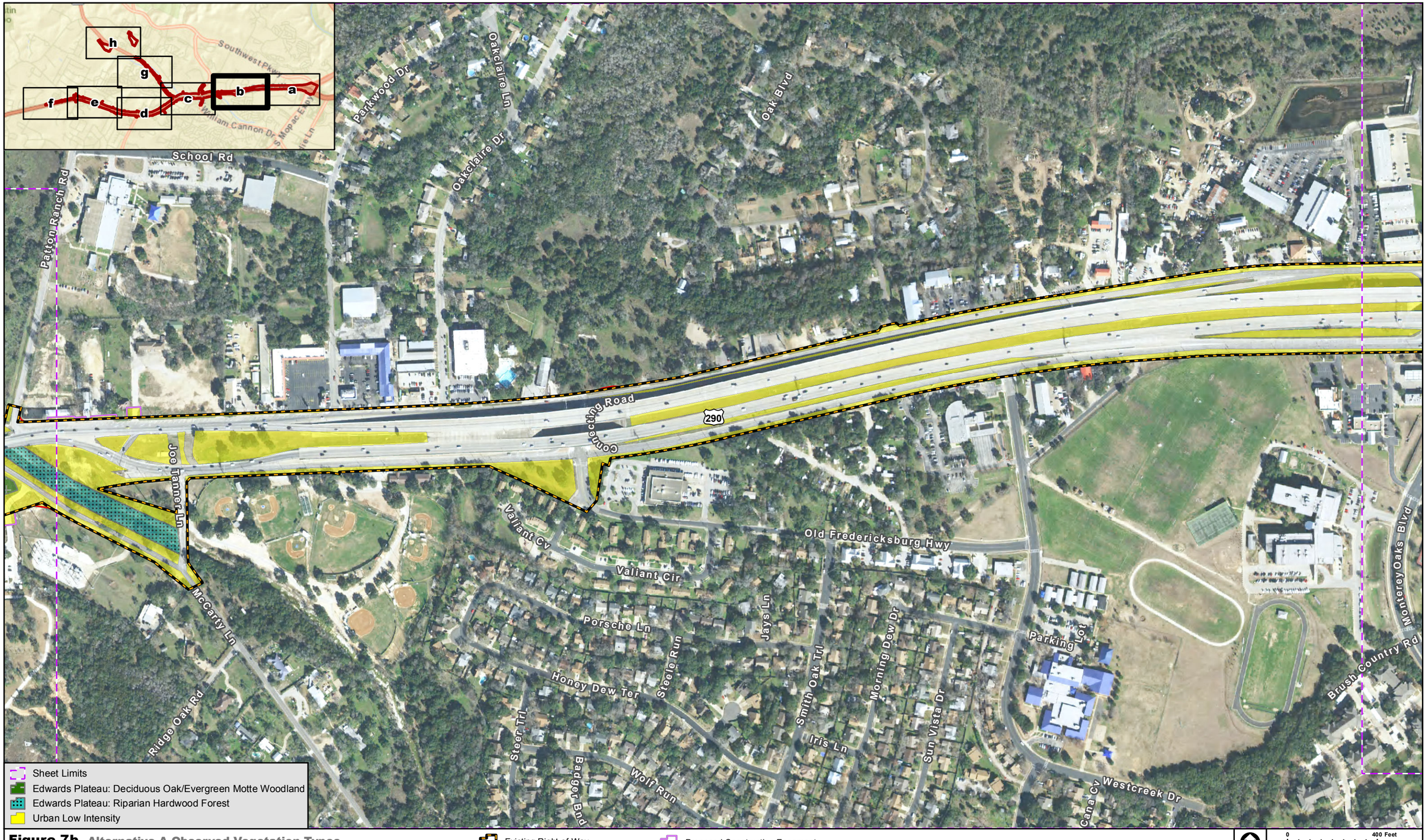

Figure 7b. **Alternative A Observed Vegetation Types**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Existing Right-of-Way
Proposed Right-of-Way, Alternative A
Proposed Construction Easement

0 400 Feet
0 120 Meters

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

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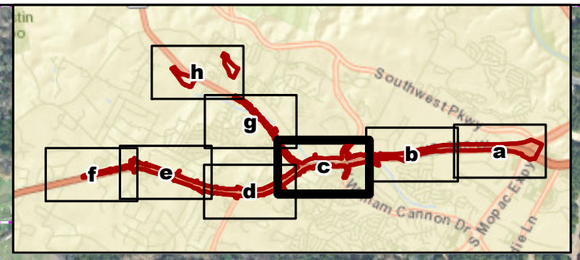

Sheet Limits
Edwards Plateau: Ashe Juniper Motte and Woodland
Edwards Plateau: Deciduous Oak/Evergreen Motte Woodland
Edwards Plateau: Riparian Hardwood Forest
Native Invasive: Mesquite Shrubland
Urban Low Intensity

Figure 7c. Alternative A Observed Vegetation Types

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Existing Right-of-Way
Proposed Right-of-Way, Alternative A
Proposed Construction Easement
Proposed Shared-Use Path, Alternative A

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

0 400 Feet
0 120 Meters

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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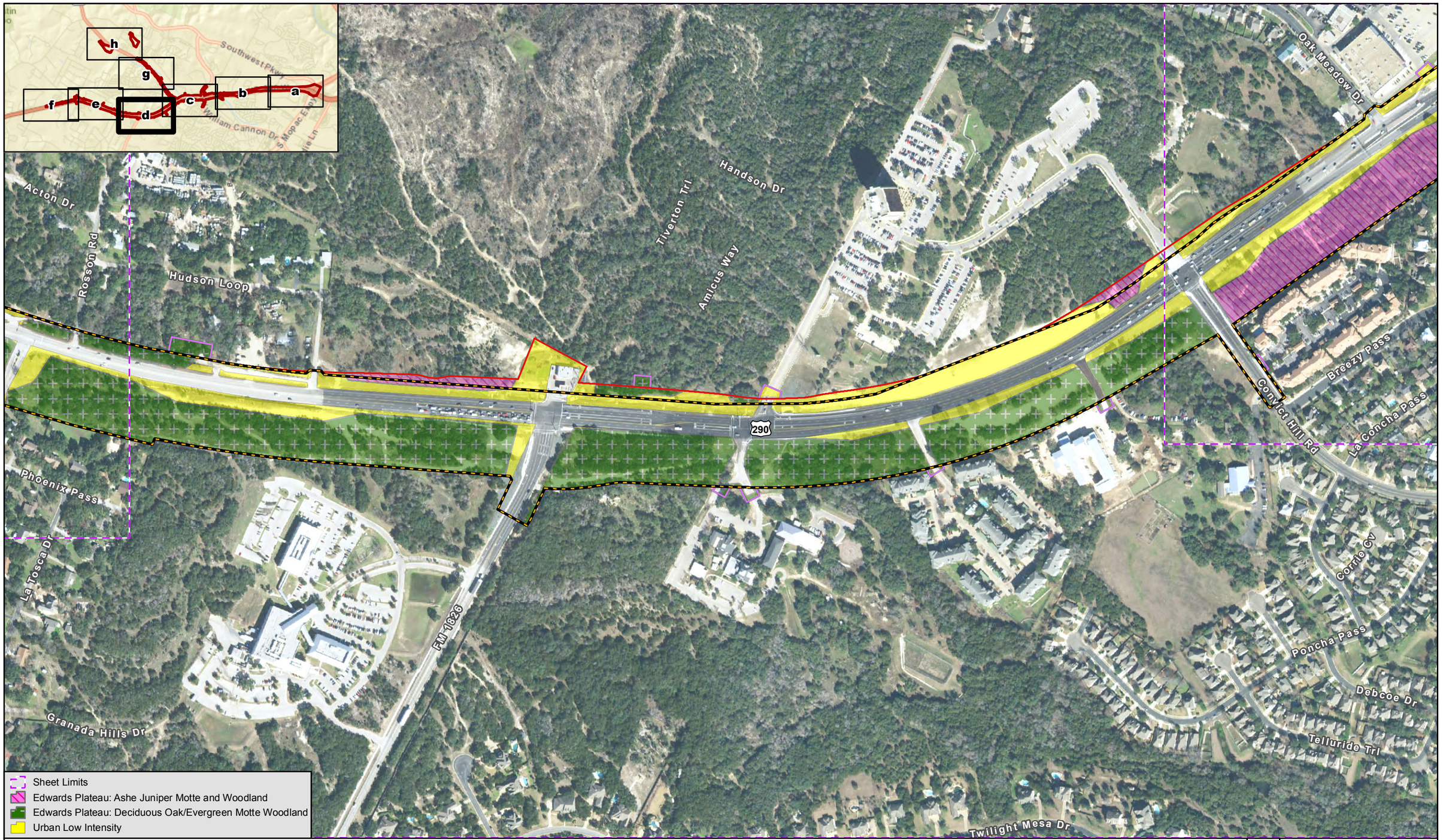

Figure 7d. **Alternative A Observed Vegetation Types**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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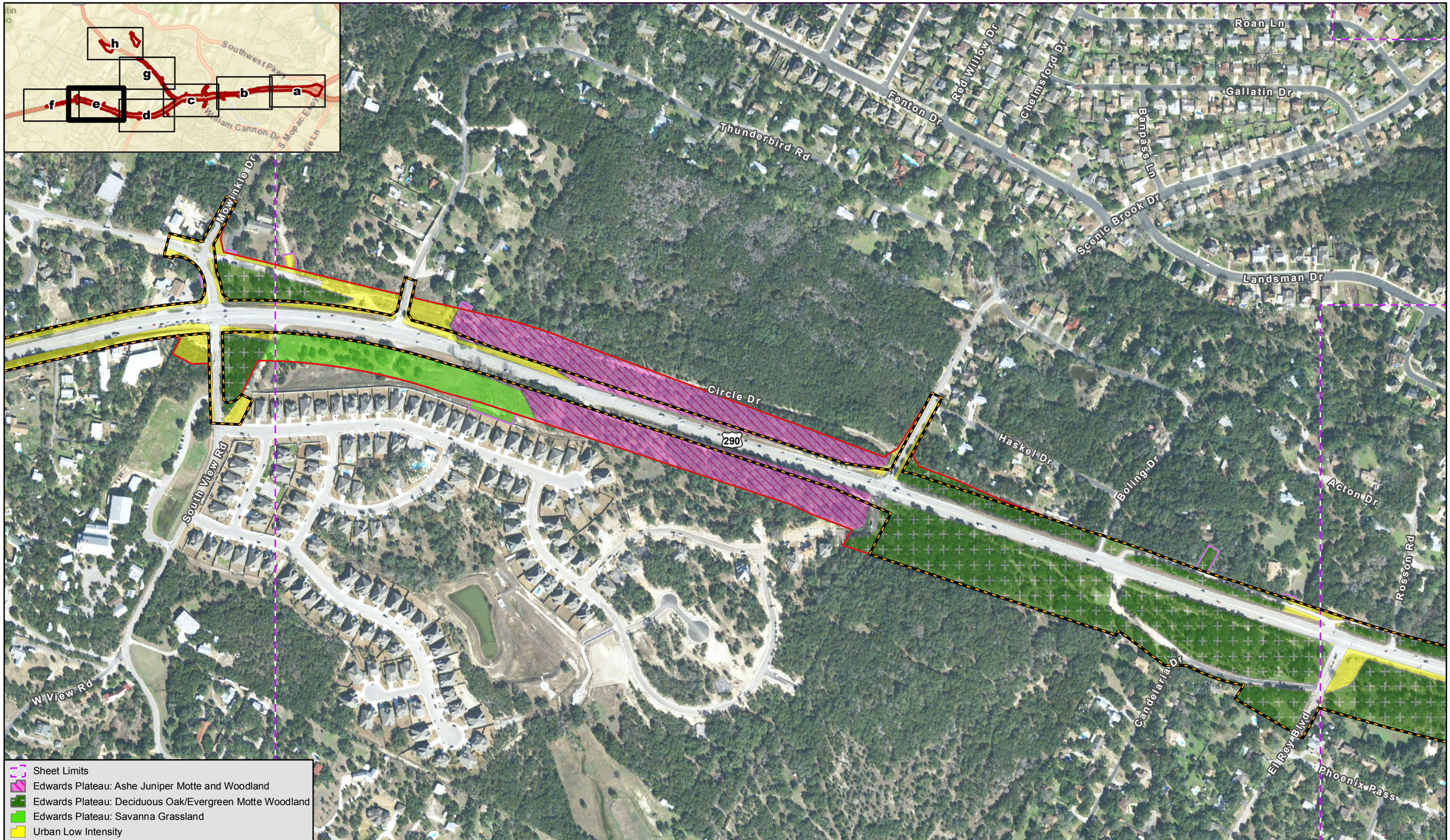

Figure 7e. **Alternative A Observed Vegetation Types**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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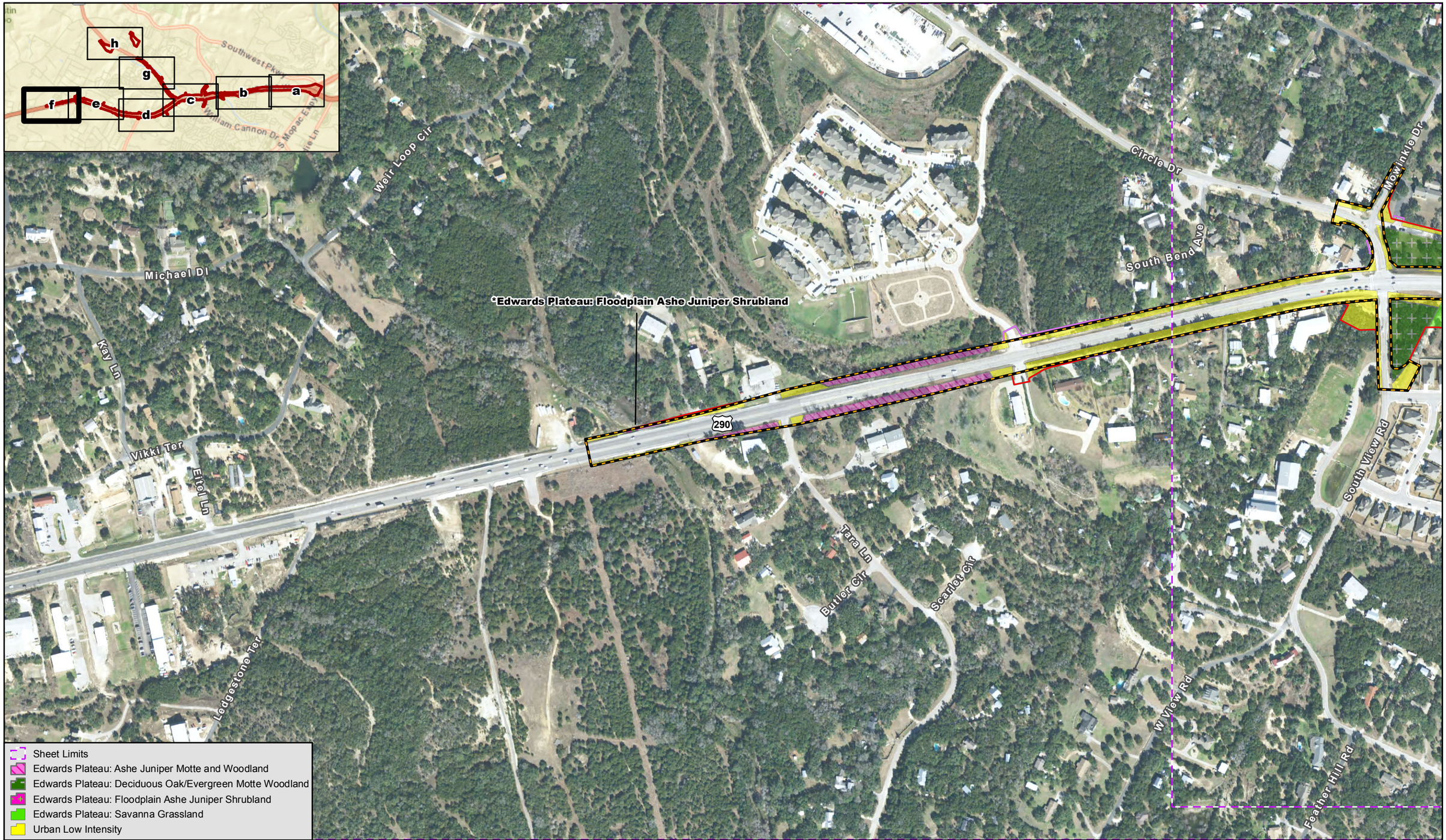

Figure 7f. **Alternative A Observed Vegetation Types**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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Figure 7g. **Alternative A Observed Vegetation Types**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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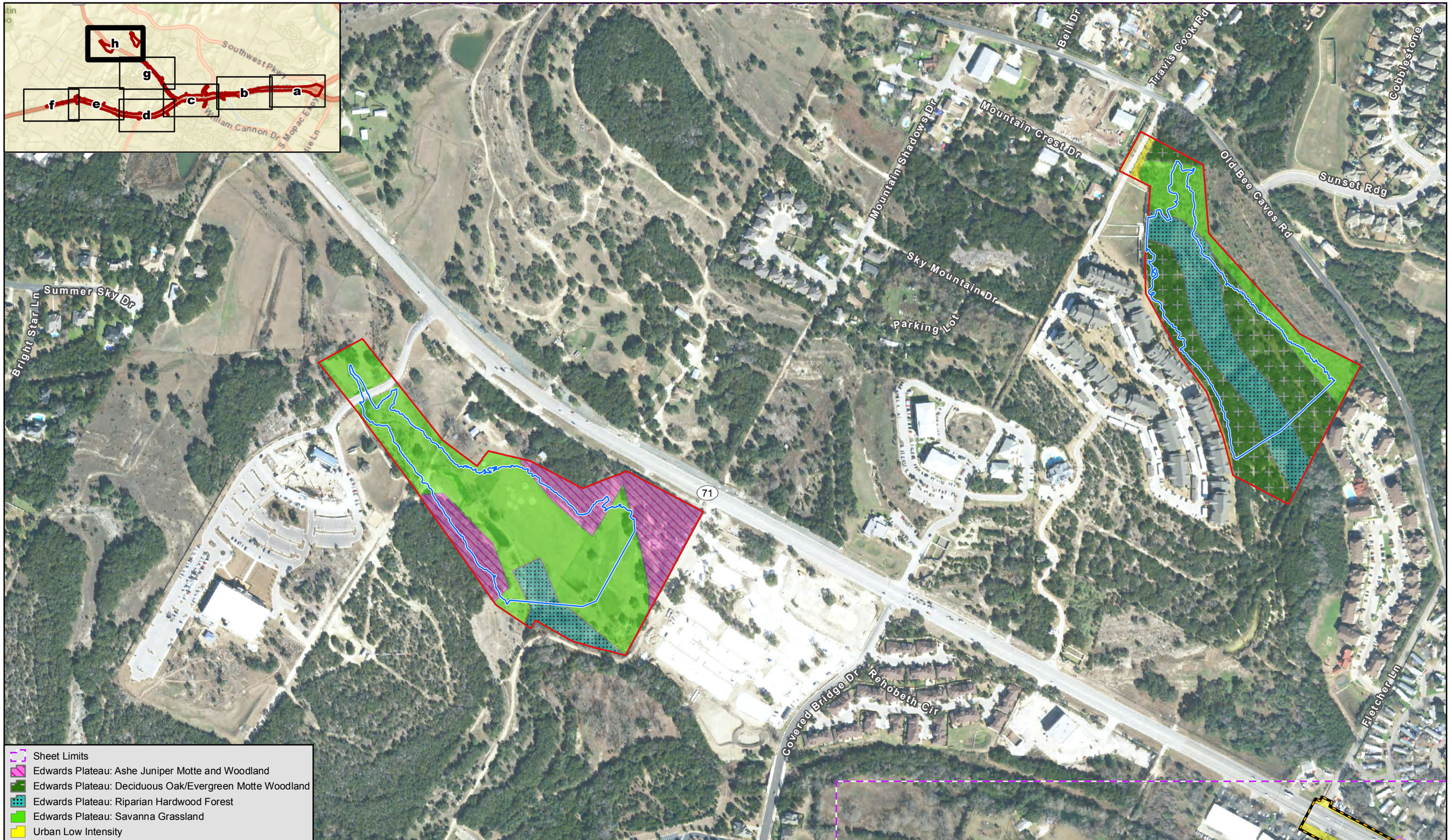

Figure 7h. **Alternative A Observed Vegetation Types**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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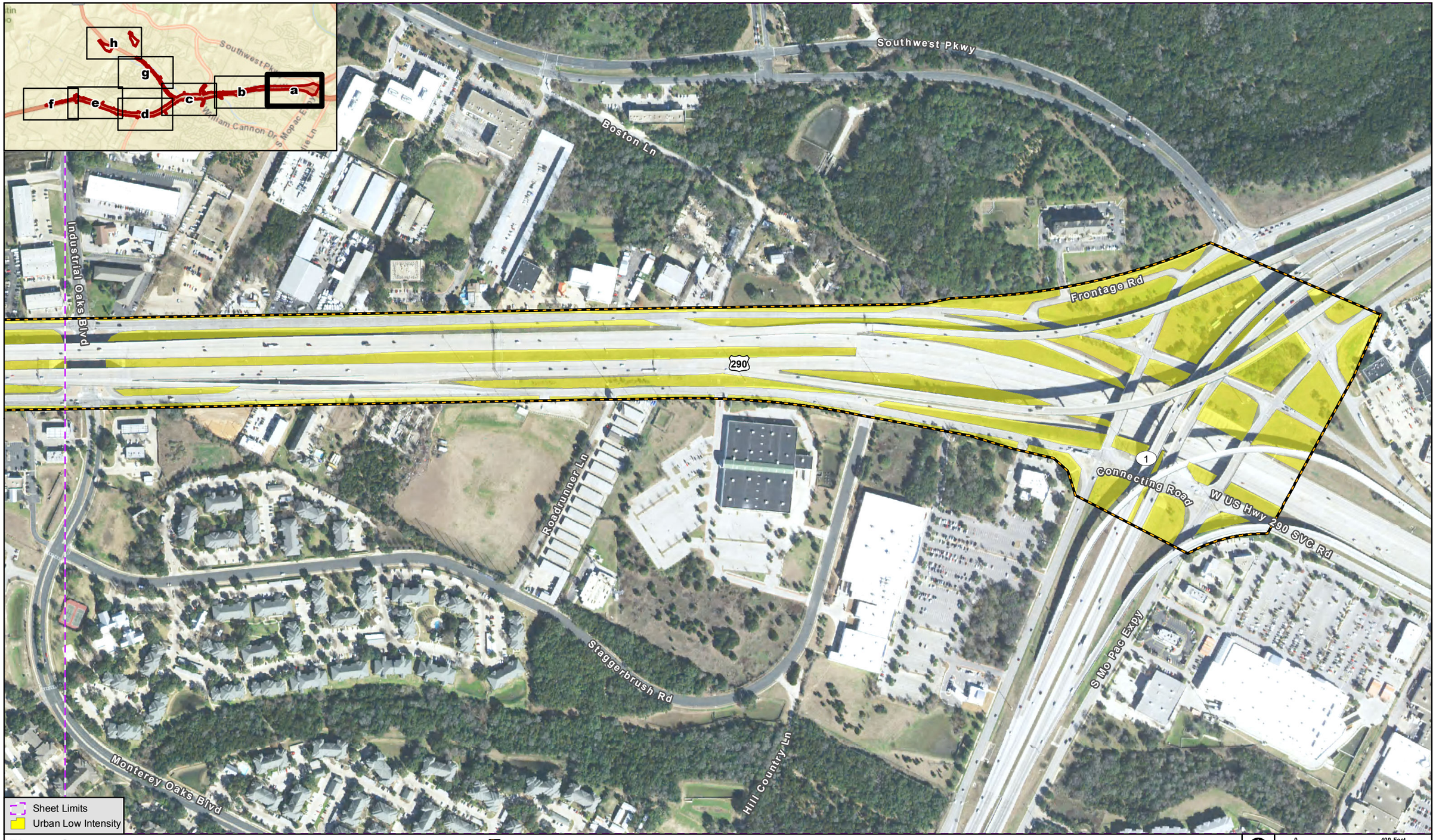

Figure 8a. **Alternative C Observed Vegetation Types.**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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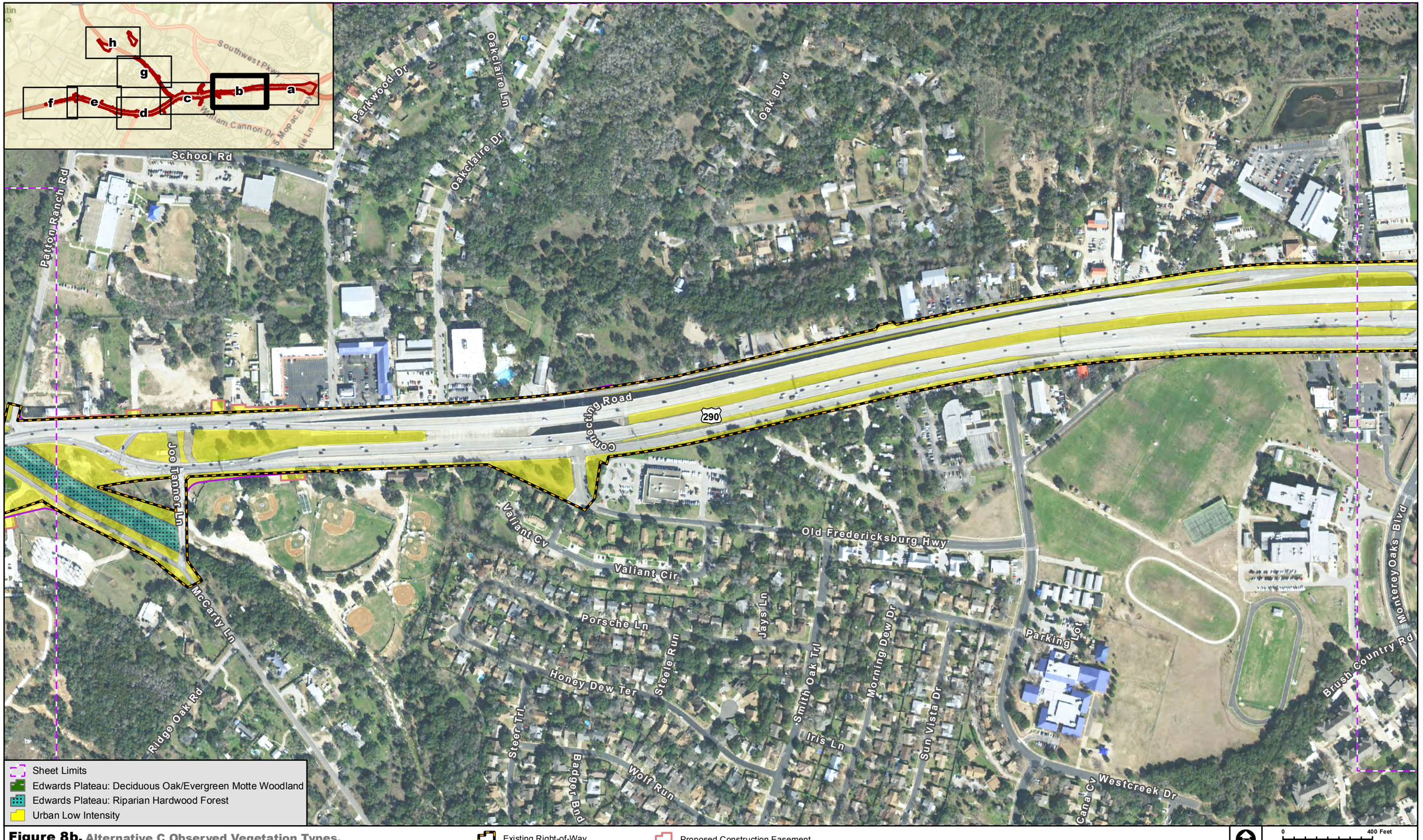

Figure 8b. **Alternative C Observed Vegetation Types.**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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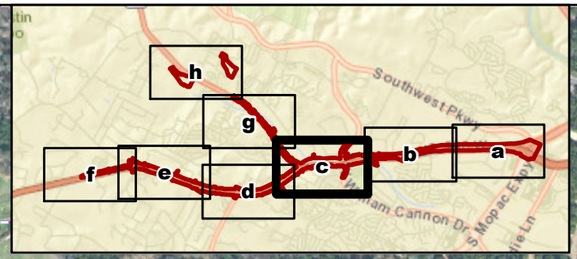

71
290
Oak Meadow Dr
Convict Hill Rd
Breezy Pass
Breezy Pass Cv
La Concha Pass
Upslope Dr
Noma Dr
Hill Oaks Dr
Poncha Pass
Samar Cv
Old Bee Caves Rd
Parking Lot
Wolfcreek Pass
Kenosha Pass
Bending Oak Rd
Wandering Oak Rd
Gentle Oak Dr
Latigo Pass
Escarpment Blvd
William Cannon Dr W
W William Cannon Dr
McCarty Ln
Patton Ranch Rd

- Sheet Limits
- Edwards Plateau: Ashe Juniper Motte and Woodland
- Edwards Plateau: Deciduous Oak/Evergreen Motte Woodland
- Edwards Plateau: Riparian Hardwood Forest
- Native Invasive: Mesquite Shrubland
- Urban Low Intensity

Figure 8c. Alternative C Observed Vegetation Types.

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

- Existing Right-of-Way
- Proposed Right-of-Way, Alternative C
- Proposed Construction Easement
- Proposed Shared-Use Path, Alternative C

0 400 Feet
0 120 Meters

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

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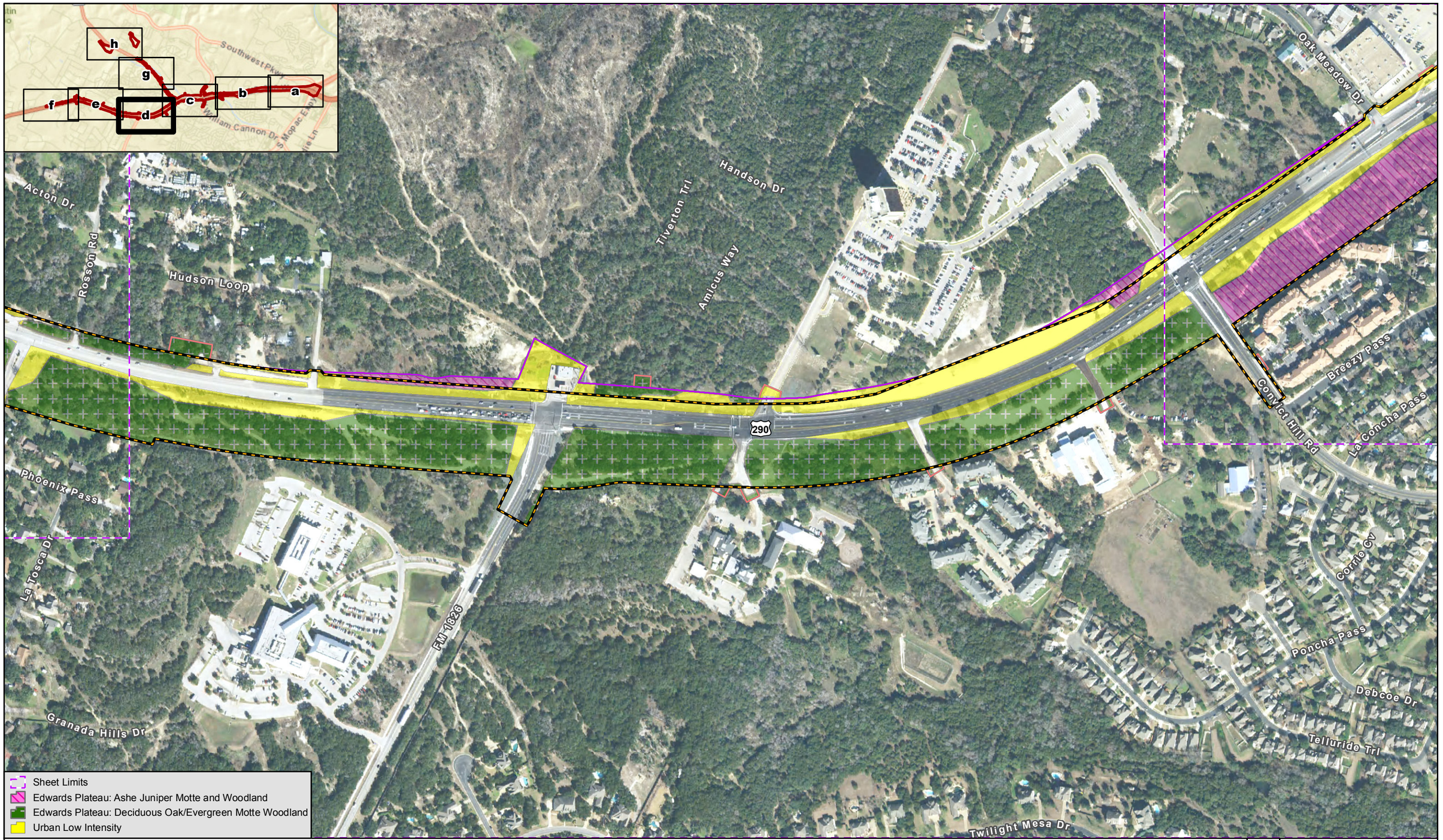

Figure 8d. **Alternative C Observed Vegetation Types.**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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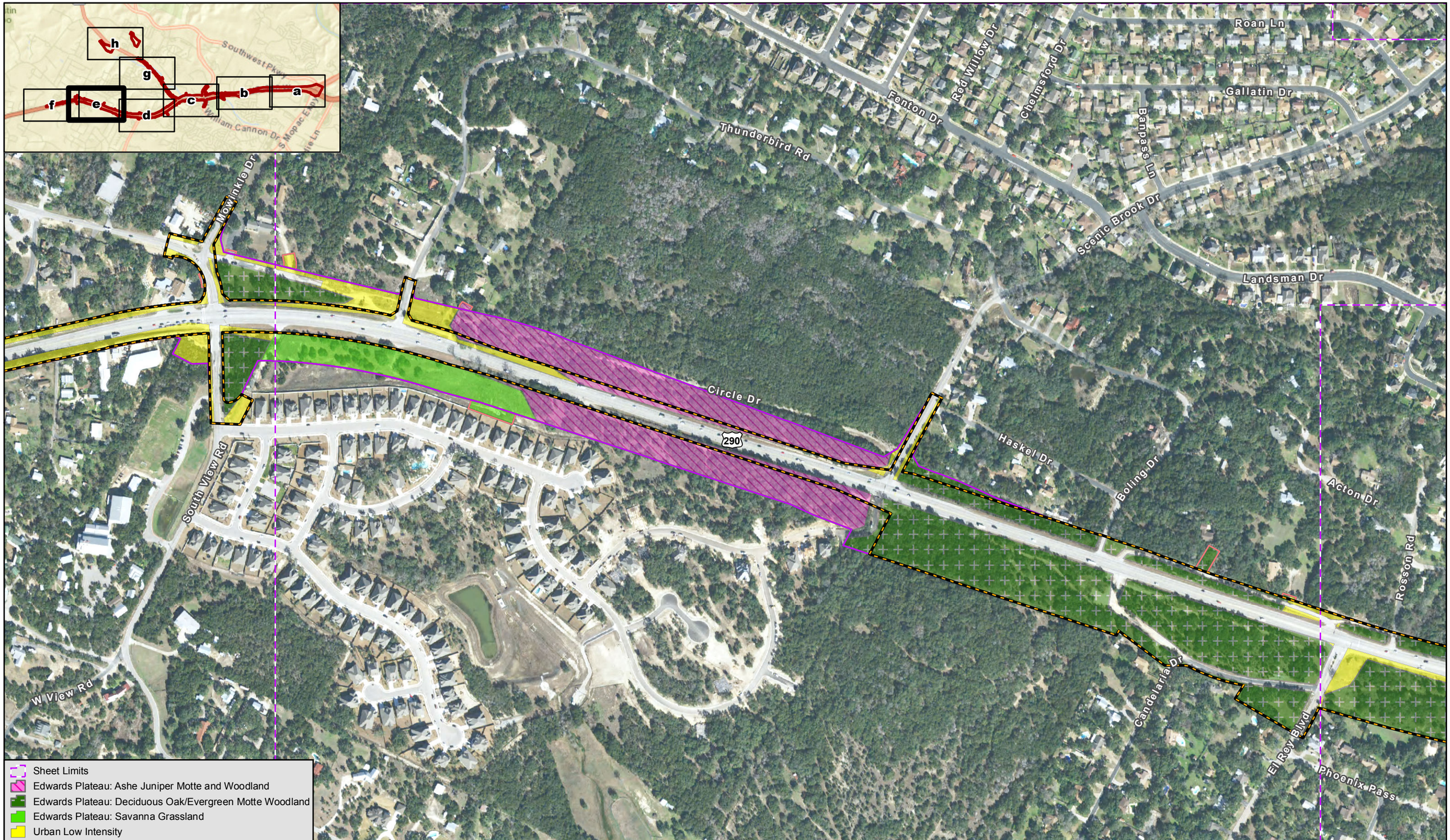

Figure 8e. **Alternative C Observed Vegetation Types.**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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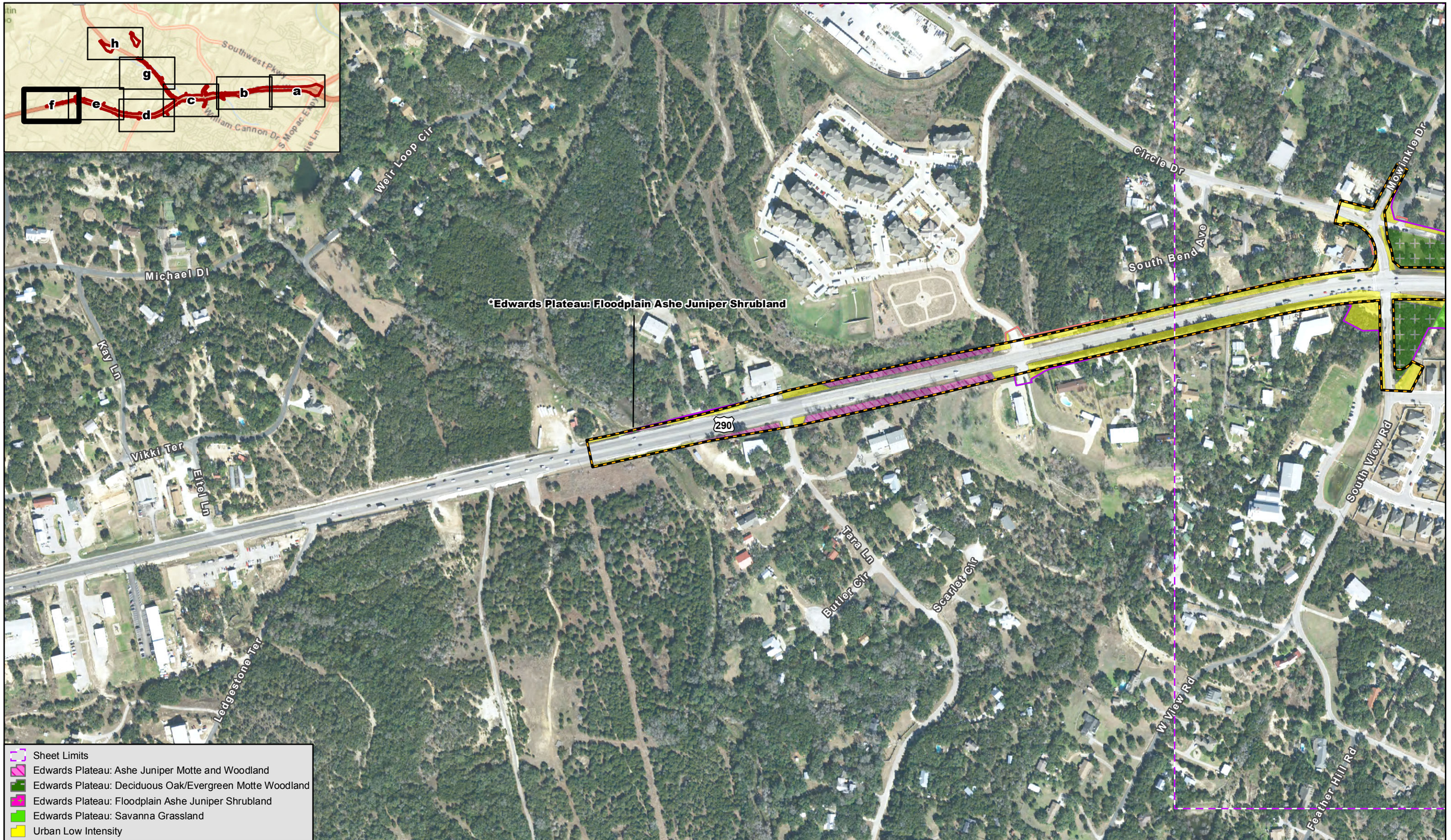

Figure 8f. **Alternative C Observed Vegetation Types.**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Existing Right-of-Way
Proposed Right-of-Way, Alternative C
Proposed Construction Easement

0 400 Feet
0 120 Meters

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

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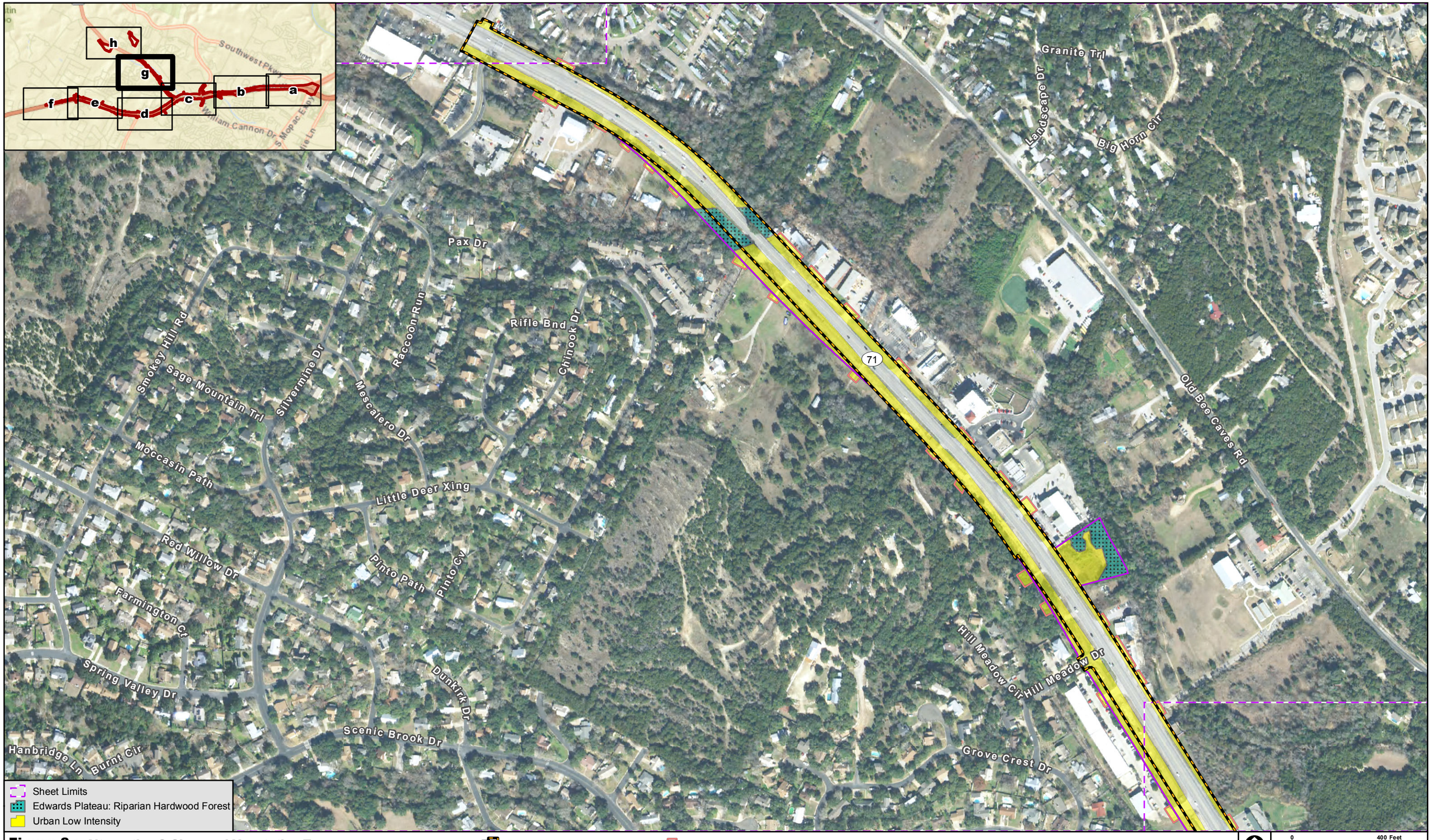

Figure 8g. **Alternative C Observed Vegetation Types.**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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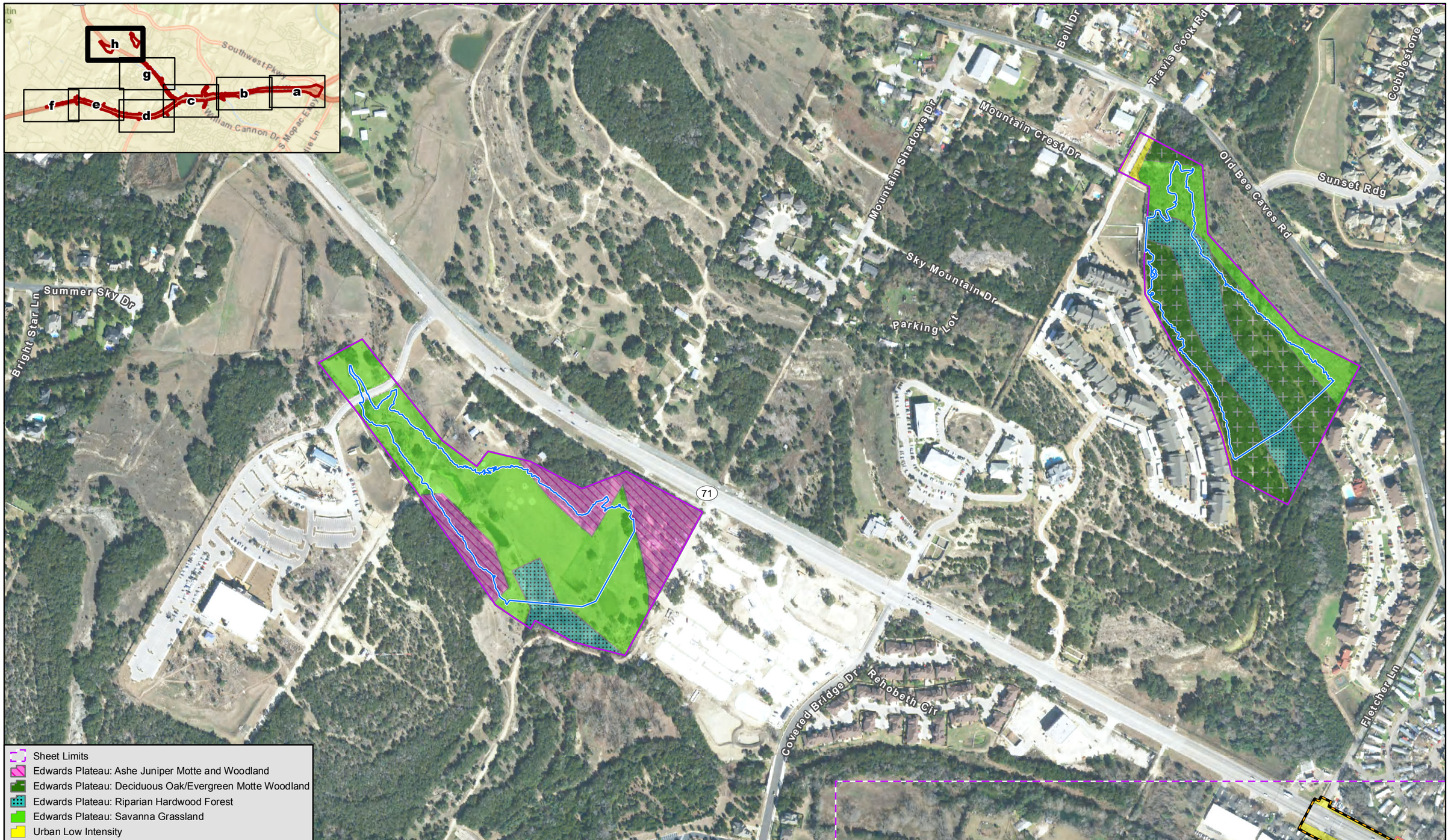

Figure 8h. **Alternative C Observed Vegetation Types.**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Source: CMEC (2016)
Aerial Source: TNRIS (2015)

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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Figure 9. Right-of-Entry

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Project Location
Existing Right-of-Way
Proposed ROW/Easement: Right-of-Entry Denied/No Response
Proposed ROW/Easement: Right-of-Entry Granted

Data Sources: TCAD (2016), TxDOT (2016)
Basemap Source: ESRI (2017)

0 2,250 Feet
0 750 Meters

Prepared for: TxDOT	1 in = 2,250 feet
	Scale: 1:27,000
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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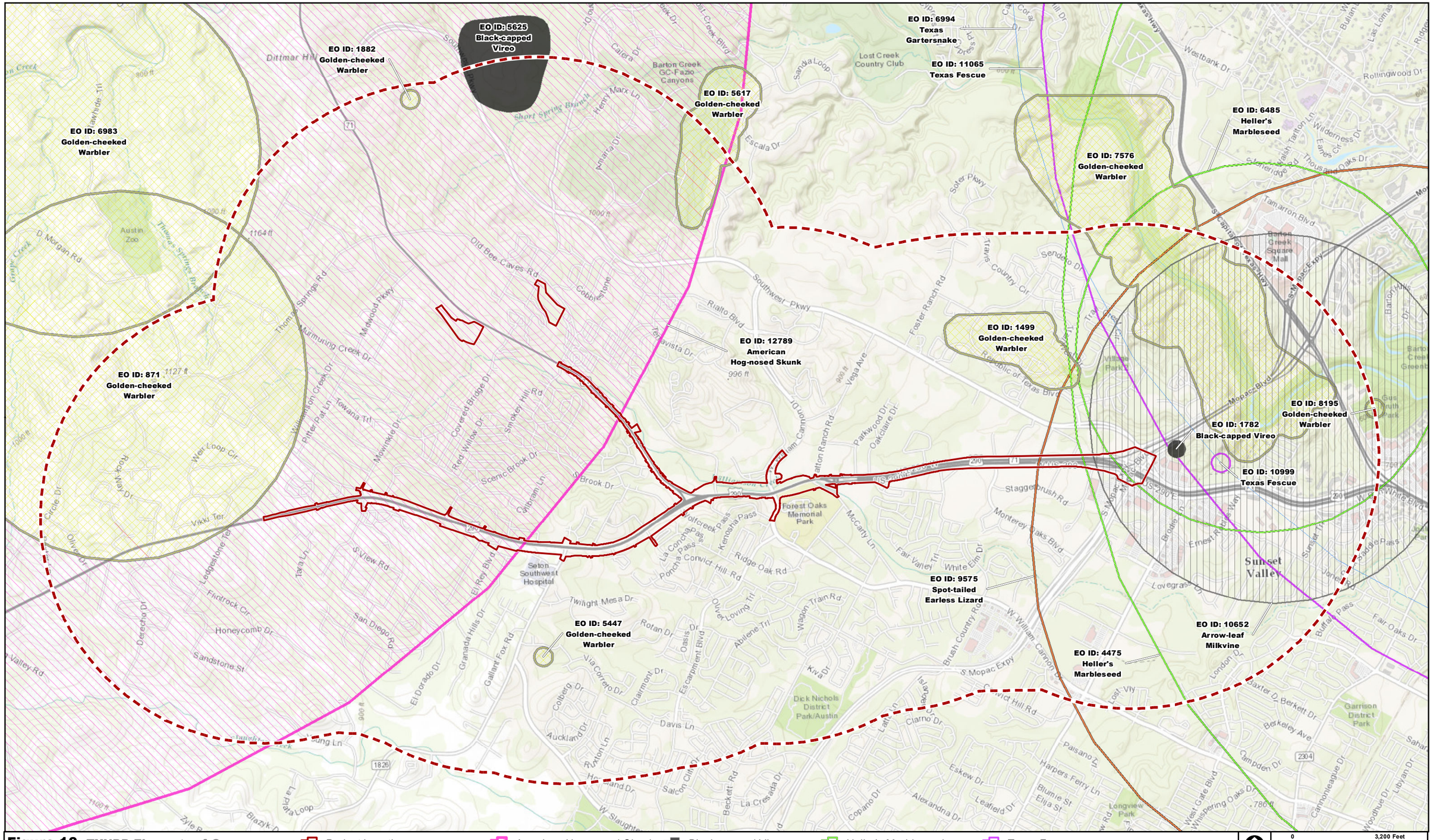

Figure 10. **TXNDD Elements of Occurrence**

Oak Hill Parkway: US 290W from Mopac/Loop 1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

- Project Location
- 1.5-mile Project Location Buffer
- American Hog-nosed Skunk
- Arrow-leaf Milkvine
- Black-capped Vireo
- Golden-cheeked Warbler
- Heller's Marbleseed
- Spot-tailed Earless Lizard
- Texas Fescue
- Texas Gartersnake

Data Sources: TPWD (12/19/2016, 2014)
Basemap Source: ESRI (2017)

0 3,200 Feet
0 1,000 Meters

Prepared for: TxDOT	1 in = 3,200 feet
	Scale: 1:38,400
CSJ: 0013-08-060 and 0700-03-077	Date: 8/14/2017

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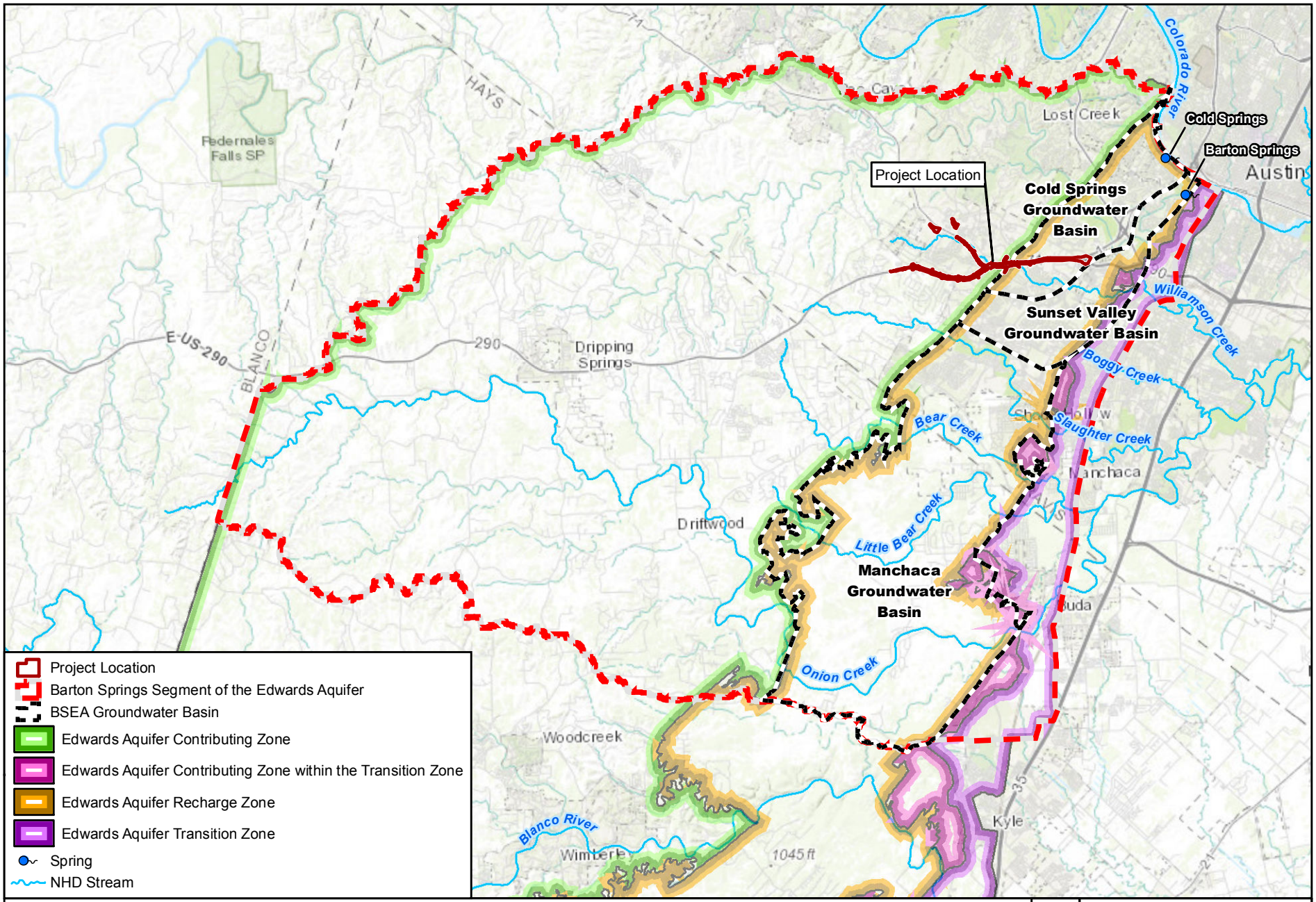

Figure 11. **Groundwater Basins within the Barton Springs Segment of the Edwards Aquifer**

Oak Hill Parkway: US 290W from Mopac/Loop1 to west of Circle Drive and SH 71 from US 290W to Silvermine Drive

Data Sources: TCEQ (2005), Hauwert, et al. (2004), COA (2016)
Basemap Source: ESRI (2017)

0 4 Miles
0 6 Kilometers

Prepared for: TxDOT	1 in = 4 miles
	Scale1:253,440
CSJ: 0013-08-060 and 0700-03-077	Date: 6/8/2017

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Attachment B

Project Area Photographs

Photograph 1: Commercial land use along SH 71 south of Williamson Creek crossing; facing south.

Photograph 2: Urban land use and commercial properties along US 290; facing east.

Photograph 3: Edwards Plateau: Savannah Grassland with juniper overstory along US 290 (foreground) and residential development in background; facing southeast.

Photograph 4: Project eastern terminus at Mopac; facing east.

Photograph 5: Oak-juniper woodland and native-invasive vegetation along US 290; facing west.

Photograph 6: Looking north across potential detention pond location, west of SH 71; facing north.

Photograph 7: Urban low intensity along US 290 adjacent to roadway and Edwards Plateau: Ashe Juniper Motte and Woodland outside the fenceline; facing east.

Photograph 8: Live Oak grove at Circle Drive and US 290; facing northeast

Photograph 9: Edwards Plateau: Deciduous Oak/Evergreen Motte and Woodland vegetation type along US 290; facing north.

Photograph 10: Riparian vegetation at SH 71 Williamson Creek crossing; facing southeast.

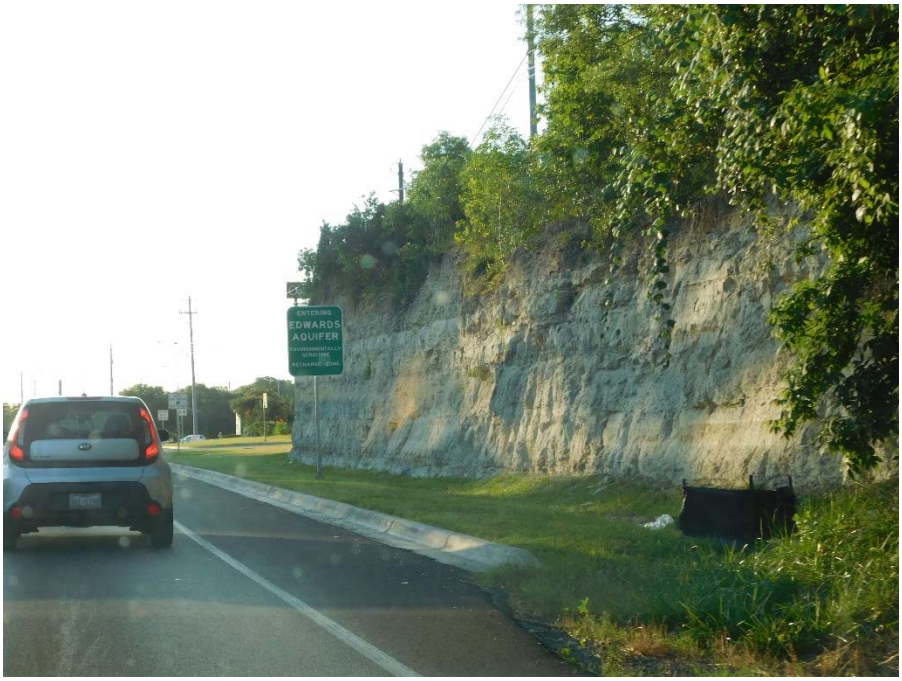
Photograph 11: Riparian vegetation along Williamson Creek at Joe Tanner; facing northwest towards US 290/SH71.

Photograph 12: Riparian vegetation at US 290 tributary crossing near project terminus; facing north.

Photograph 13: Unnamed tributary (dry) to Williamson Creek crossing under SH 71; facing west.

Photograph 14: Riparian vegetation along Williamson Creek at Old Bee Caves Road; facing east.

Photograph 15; Limestone outcrop along US 290; facing west.



Photograph 16: Urban Low Intensity vegetation and limestone cliff at the start of Recharge Zone along US290/SH71 at William Cannon; facing east.

Photograph 17: Native invasive vegetation and Urban Low Intensity along US290/SH71 at William Cannon; facing east.

Photograph 18: Native oak grove in front of Hampton Inn along US 290; facing north.

Photograph 19: Low water crossing of Williamson Creek at Joe Tanner Lane; facing southeast.

Photograph 20: Williamson Creek at SH 71 bridge; facing northeast.

Photograph 21: Austin Community College Pinnacle Campus from US 290 at Convict Hill; facing north.

Photograph 22: US 71 at Silvermine Drive; facing south.

Attachment C

County Lists

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, TX 78758-4460
Phone: (512) 490-0057 Fax: (512) 490-0974
http://www.fws.gov/southwest/es/AustinTexas/
http://www.fws.gov/southwest/es/EndangeredSpecies/lists/

In Reply Refer To: May 16, 2017
Consultation Code: 02ETAU00-2016-SLI-0397
Event Code: 02ETAU00-2017-E-01464
Project Name: U.S. Highway 290 (US 290) / State Highway (SH) 71 West

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the county of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

Please note that new information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Also note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of federally listed as threatened or endangered species and to determine whether projects may affect these species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

While a Federal agency may designate a non-Federal representative to conduct informal consultation or prepare a biological assessment, the Federal Agency must notify the Service in writing of any such designation. The Federal agency shall also independently review and evaluate the scope and content of a biological assessment prepared by their designated non-Federal representative before that document is submitted to the Service.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by a federally funded, permitted or authorized activity, the agency is required to consult with the Service pursuant to 50 CFR 402. The following definitions are provided to assist you in reaching a determination:

- No effect - the proposed action will not affect federally listed species or critical habitat. A “no effect” determination does not require section 7 consultation and no coordination or contact with the Service is necessary. However, if the project changes or additional information on the distribution of listed or proposed species becomes available, the project should be reanalyzed for effects not previously considered.
- May affect, but is not likely to adversely affect - the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented in order to reach this level of effect. The Federal agency or the designated non-Federal representative should consult with the Service to seek written concurrence that adverse effects are not likely. Be sure to include all of the information and documentation used to reach your decision with your request for concurrence. The Service must have this documentation before issuing a concurrence.
- Is likely to adversely affect - adverse effects to listed species may occur as a direct or indirect result of the proposed action. For this determination, the effect of the action is neither discountable nor insignificant. If the overall effect of the proposed action is beneficial to the listed species but the action is also likely to cause some adverse effects to individuals of that species, then the proposed action “is likely to adversely affect” the listed species. The analysis should consider all interrelated and interdependent actions. An “is likely to adversely affect” determination requires the Federal action agency to initiate formal section 7 consultation with our office.

Regardless of the determination, the Service recommends that the Federal agency maintain a complete record of the evaluation, including steps leading to the determination of effect, the qualified personnel conducting the evaluation, habitat conditions, site photographs, and any other related information. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered

Species Consultation Handbook" at:
http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF.

Migratory Birds

For projects that may affect migratory birds, the Migratory Bird Treaty Act (MBTA) implements various treaties and conventions for the protection of these species. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. Migratory birds may nest in trees, brushy areas, or other areas of suitable habitat. The Service recommends activities requiring vegetation removal or disturbance avoid the peak nesting period of March through August to avoid destruction of individuals, nests, or eggs. If project activities must be conducted during this time, we recommend surveying for nests prior to conducting work. If a nest is found, and if possible, the Service recommends a buffer of vegetation remain around the nest until the young have fledged or the nest is abandoned.

For additional information concerning the MBTA and recommendations to reduce impacts to migratory birds please contact the U.S. Fish and Wildlife Service Migratory Birds Office, 500 Gold Ave. SW, Albuquerque, NM 87102. A list of migratory birds may be viewed at https://www.fws.gov/birds/management/managed-species/migratory-bird-treaty-act-protected-spe . Guidance for minimizing impacts to migratory birds for projects including communications towers can be found at:
https://www.fws.gov/birds/management/project-assessment-tools-and-guidance/guidance-docume . Additionally, wind energy projects should follow the wind energy guidelines

https://www.fws.gov/birds/management/project-assessment-tools-and-guidance/guidance-docume) for minimizing impacts to migratory birds and bats.

Finally, please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan
https://www.fws.gov/birds/management/project-assessment-tools-and-guidance/guidance-docume .

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, TX 78758-4460
(512) 490-0057

Project Summary

Consultation Code: 02ETAU00-2016-SLI-0397

Event Code: 02ETAU00-2017-E-01464

Project Name: U.S. Highway 290 (US 290) / State Highway (SH) 71 West

Project Type: TRANSPORTATION

Project Description: US 290 / SH 71 West from State Loop 1 (Mopac) to Ranch-to-Market (RM) 1826
CSJ: 0113-08-060 & 0700-03-077

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/30.251562258201012N97.89973236593721W

Counties: Travis, TX

Endangered Species Act Species

There is a total of 21 threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 3 of these species should be considered only under certain conditions. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area. Please contact the designated FWS office if you have questions.

Birds

NAME	STATUS
Black-capped Vireo *(Vireo atricapilla)*	Endangered
No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5716	
Golden-cheeked Warbler (=wood) *(Dendroica chrysoparia)*	Endangered
No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/33	
Least Tern *(Sterna antillarum)*	Endangered
Population: interior pop. No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/8505	
Piping Plover *(Charadrius melodus)*	Threatened
Population: except Great Lakes watershed There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/6039	
Red Knot *(Calidris canutus rufa)*	Threatened
No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/1864	
Whooping Crane *(Grus americana)*	Endangered
Population: Wherever found, except where listed as an experimental population There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/758	

Amphibians

NAME	STATUS
Austin Blind Salamander *(Eurycea waterlooensis)* There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5737	Endangered
Barton Springs Salamander *(Eurycea sosorum)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1113	Endangered
Jollyville Plateau Salamander *(Eurycea tonkawae)* There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3116	Threatened

Clams

NAME	STATUS
Golden Orb *(Quadrula aurea)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9042	Candidate
Smooth Pimpleback *(Quadrula houstonensis)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8967	Candidate
Texas Fatmucket *(Lampsilis bracteata)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9041	Candidate
Texas Fawnsfoot *(Truncilla macrodon)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8965	Candidate
Texas Pimpleback *(Quadrula petrina)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8966	Candidate

Insects

NAME	STATUS
Kretschmarr Cave Mold Beetle *(Texamaurops reddelli)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3140	Endangered
Tooth Cave Ground Beetle *(Rhadine persephone)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5625	Endangered

Arachnids

NAME	STATUS
Bee Creek Cave Harvestman *(Texella reddelli)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2464	Endangered
Bone Cave Harvestman *(Texella reyesi)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5306	Endangered
Tooth Cave Spider *(Neoleptoneta myopica)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2360	Endangered
Tooth Cave Pseudoscorpion *(Tartarocreagris texana)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6667	Endangered

Flowering Plants

NAME	STATUS
Bracted Twistflower *(Streptanthus bracteatus)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2856	Candidate

Critical habitats

There are no critical habitats within your project area.

TRAVIS COUNTY

AMPHIBIANS

		Federal Status	State Status
Austin blind salamander	*Eurycea waterlooensis*	E	

mostly restricted to subterranean cavities of the Edwards Aquifer; dependent upon water flow/quality from the Barton Springs segment of the Edwards Aquifer; only known from the outlets of Barton Springs (Sunken Gardens (Old Mill) Spring, Eliza Spring, and Parthenia (Main) Spring which forms Barton Springs Pool); feeds on amphipods, ostracods, copepods, plant material, and (in captivity) a wide variety of small aquatic invertebrates

Barton Springs salamander	*Eurycea sosorum*	LE	E

dependent upon water flow/quality from the Barton Springs pool of the Edwards Aquifer; known from the outlets of Barton Springs and subterranean water-filled caverns; found under rocks, in gravel, or among aquatic vascular plants and algae, as available; feeds primarily on amphipods

Jollyville Plateau salamander	*Eurycea tonkawae*	T	

known from springs and waters of some caves north of the Colorado River

Pedernales River springs salamander	*Eurycea sp 6*		

endemic; known only from springs

ARACHNIDS

		Federal Status	State Status
Bandit Cave spider	*Cicurina bandida*		

very small, subterrestrial, subterranean obligate

Bee Creek Cave harvestman	*Texella reddelli*	LE	

small, blind, cave-adapted harvestman endemic to a few caves in Travis and Williamson counties

Bone Cave harvestman	*Texella reyesi*	LE	

small, blind, cave-adapted harvestman endemic to several caves in Travis and Williamson counties; weakly differentiated from Texella reddelli

Tooth Cave pseudoscorpion	*Tartarocreagris texana*	LE	

small, cave-adapted pseudoscorpion known from small limestone caves of the Edwards Plateau

Tooth Cave spider	*Tayshaneta myopica*	LE	

very small, cave-adapted, sedentary spider

Warton's cave meshweaver	*Cicurina wartoni*		

very small, cave-adapted spider

TRAVIS COUNTY

BIRDS

		Federal Status	State Status
American Peregrine Falcon	*Falco peregrinus anatum*	DL	T

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon	*Falco peregrinus tundrius*	DL	

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bald Eagle	*Haliaeetus leucocephalus*	DL	T

found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Black-capped Vireo	*Vireo atricapilla*	LE	E

oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous and broad-leaved shrubs and trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer

Golden-cheeked Warbler	*Setophaga chrysoparia*	LE	E

juniper-oak woodlands; dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer

Interior Least Tern	*Sterna antillarum athalassos*	LE	E

subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony

Mountain Plover	*Charadrius montanus*		

breeding: nests on high plains or shortgrass prairie, on ground in shallow depression; nonbreeding: shortgrass plains and bare, dirt (plowed) fields; primarily insectivorous

Peregrine Falcon	*Falco peregrinus*	DL	T

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

Red Knot	*Calidris canutus rufa*	T	

TRAVIS COUNTY

BIRDS

Federal Status State Status

Red knots migrate long distances in flocks northward through the contiguous United States mainly April-June, southward July-October. A small plump-bodied, short-necked shorebird that in breeding plumage, typically held from May through August, is a distinctive and unique pottery orange color. Its bill is dark, straight and, relative to other shorebirds, short-to-medium in length. After molting in late summer, this species is in a drab gray-and-white non-breeding plumage, typically held from September through April. In the non-breeding plumage, the knot might be confused with the omnipresent Sanderling. During this plumage, look for the knot's prominent pale eyebrow and whitish flanks with dark barring. The Red Knot prefers the shoreline of coast and bays and also uses mudflats during rare inland encounters. Primary prey items include coquina clam (Donax spp.) on beaches and dwarf surf clam (Mulinia lateralis) in bays, at least in the Laguna Madre. Wintering Range includes- Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kennedy, Kleberg, Matagorda, Nueces, San Patricio, and Willacy. Habitat: Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and Tidal flat/shore.

Sprague's Pipit *Anthus spragueii*

only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.

Western Burrowing Owl *Athene cunicularia hypugaea*

open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows

Whooping Crane *Grus americana* LE E

potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties

CRUSTACEANS

Federal Status State Status

An amphipod *Stygobromus russelli*

subterranean waters, usually in caves and limestone aquifers; resident of numerous caves in ca. 10 counties of the Edwards Plateau

Balcones Cave amphipod *Stygobromus balconis*

subaquatic, subterranean obligate amphipod

Bifurcated cave amphipod *Stygobromus bifurcatus*

found in cave pools

FISHES

Federal Status State Status

Guadalupe bass *Micropterus treculii*

endemic to perennial streams of the Edward's Plateau region; introduced in Nueces River system

TRAVIS COUNTY

FISHES		Federal Status	State Status
Smalleye shiner	*Notropis buccula*	LE	

endemic to upper Brazos River system and its tributaries (Clear Fork and Bosque); apparently introduced into adjacent Colorado River drainage; medium to large prairie streams with sandy substrate and turbid to clear warm water; presumably eats small aquatic invertebrates

INSECTS		Federal Status	State Status
Kretschmarr Cave mold beetle	*Texamaurops reddelli*	LE	

small, cave-adapted beetle found under rocks buried in silt; small, Edwards Limestone caves in of the Jollyville Plateau, a division of the Edwards Plateau

Tooth Cave blind rove beetle *Cylindropsis sp 1*

one specimen collected from Tooth Cave; only known North American collection of this genus

Tooth Cave ground beetle *Rhadine persephone* LE

resident, small, cave-adapted beetle found in small Edwards Limestone caves in Travis and Williamson counties

MAMMALS		Federal Status	State Status
Cave myotis bat	*Myotis velifer*		

colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (Hirundo pyrrhonota) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore

Plains spotted skunk *Spilogale putorius interrupta*

catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

Red wolf *Canis rufus* LE E

extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies

MOLLUSKS		Federal Status	State Status
False spike mussel	*Quadrula mitchelli*		T

possibly extirpated in Texas; probably medium to large rivers; substrates varying from mud through mixtures of sand, gravel and cobble; one study indicated water lilies were present at the site; Rio Grande, Brazos, Colorado, and Guadalupe (historic) river basins

TRAVIS COUNTY

MOLLUSKS

		Federal Status	State Status
Smooth pimpleback	*Quadrula houstonensis*	C	T

small to moderate streams and rivers as well as moderate size reservoirs; mixed mud, sand, and fine gravel, tolerates very slow to moderate flow rates, appears not to tolerate dramatic water level fluctuations, scoured bedrock substrates, or shifting sand bottoms, lower Trinity (questionable), Brazos, and Colorado River basins

Texas fatmucket	*Lampsilis bracteata*	C	T

streams and rivers on sand, mud, and gravel substrates; intolerant of impoundment; broken bedrock and course gravel or sand in moderately flowing water; Colorado and Guadalupe River basins

Texas pimpleback	*Quadrula petrina*	C	T

mud, gravel and sand substrates, generally in areas with slow flow rates; Colorado and Guadalupe river basins

REPTILES

		Federal Status	State Status
Spot-tailed earless lizard	*Holbrookia lacerata*		

central and southern Texas and adjacent Mexico; moderately open prairie-brushland; fairly flat areas free of vegetation or other obstructions, including disturbed areas; eats small invertebrates; eggs laid underground

Texas garter snake	*Thamnophis sirtalis annectens*		

wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August

Texas horned lizard	*Phrynosoma cornutum*		T

open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September

PLANTS

		Federal Status	State Status
Arrowleaf milkvine	*Matelea sagittifolia*		

GLOBAL RANK: G3 ; Most consistently encountered in thornscrub in South Texas; Perennial; Flowering March-July; Fruiting April-July & Dec?

Basin bellflower	*Campanula reverchonii*		

Texas endemic; among scattered vegetation on loose gravel, gravelly sand, and rock outcrops on open slopes with exposures of igneous and metamorphic rocks; may also occur on sandbars and other alluvial deposits along major rivers; flowering May-July

Boerne bean	*Phaseolus texensis*		

Narrowly endemic to rocky canyons in eastern and southern Edwards Plateau occurring on limestone soils in mixed woodlands, on limestone cliffs and outcrops, frequently along creeks.

TRAVIS COUNTY

PLANTS

Federal Status State Status

Bracted twistflower *Streptanthus bracteatus* C

Texas endemic; shallow, well-drained gravelly clays and clay loams over limestone in oak juniper woodlands and associated openings, on steep to moderate slopes and in canyon bottoms; several known soils include Tarrant, Brackett, or Speck over Edwards, Glen Rose, and Walnut geologic formations; populations fluctuate widely from year to year, depending on winter rainfall; flowering mid April-late May, fruit matures and foliage withers by early summer

Buckley tridens *Tridens buckleyanus*

GLOBAL RANK: G3 ; Occurs in juniper-oak woodlands on rocky limestone slopes; Perennial; Flowering/Fruiting April-Nov

Correll's false dragon-head *Physostegia correllii*

wet, silty clay loams on streamsides, in creek beds, irrigation channels and roadside drainage ditches; or seepy, mucky, sometimes gravelly soils along riverbanks or small islands in the Rio Grande; or underlain by Austin Chalk limestone along gently flowing spring-fed creek in central Texas; flowering May-September

Glass Mountains coral-root *Hexalectris nitida*

GLOBAL RANK: G3; Apparently rare in mixed woodlands in canyons in the mountains of the Brewster County, but encountered with regularity, albeit in small numbers, under Juniperus ashei in woodlands over limestone on the Edwards Plateau, Callahan Divide and Lampasas Cutplain; Perennial; Flowering June-Sept; Fruiting July-Sept

Gravelbar brickellbush *Brickellia dentata*

GLOBAL RANK: G3; Essentially restricted to frequently-scoured gravelly alluvial beds in creek and river bottoms; Perennial; Flowering June-Nov; Fruiting June-Oct

Heller's marbleseed *Onosmodium helleri*

GLOBAL RANK: G3; Occurs in loamy calcareous soils in oak-juniper woodlands on rocky limestone slopes, often in more mesic portions of canyons; Perennial; Flowering March-May

Low spurge *Euphorbia peplidion*

GLOBAL RANK: G3; Occurs in a variety of vernally-moist situations in a number of natural regions; Annual; Flowering Feb-April; Fruiting March-April

Narrowleaf brickellbush *Brickellia eupatorioides var. gracillima*

GLOBAL RANK: G5T3; Moist to dry gravelly alluvial soils along riverbanks but also on limestone slopes; Perennial; Flowering/Fruiting April-Nov

Net-leaf bundleflower *Desmanthus reticulatus*

GLOBAL RANK: G3; Mostly on clay prairies of the coastal plain of central and south Texas; Perennial; Flowering April-July; Fruiting April-Oct

Plateau loosestrife *Lythrum ovalifolium*

GLOBAL RANK: G4; Banks and gravelly beds of perennial (or strong intermittent) streams on the Edwards Plateau, Llano Uplift and Lampasas Cutplain; Perennial; Flowering/Fruiting April-Nov

TRAVIS COUNTY

PLANTS

Federal Status State Status

Plateau milkvine *Matelea edwardsensis*

GLOBAL RANK: G3 ; Occurs in various types of juniper-oak and oak-juniper woodlands; Perennial; Flowering March-Oct; Fruiting May-June

Rock grape *Vitis rupestris*

GLOBAL RANK: G3; Occurs on rocky limestone slopes and in streambeds; Perennial; Flowering March-May; Fruiting May-July

Scarlet leather-flower *Clematis texensis*

GLOBAL RANK: G3; Usually in oak-juniper woodlands in mesic rocky limestone canyons or along perennial streams; Perennial; Flowering March-July; Fruiting May-July

Stanfield's beebalm *Monarda punctata var. stanfieldii*

GLOBAL RANK: G5T3 ; Largely confined to granite sands along the middle course of the Colorado River and its tributaries; Perennial

Sycamore-leaf snowbell *Styrax platanifolius ssp. platanifolius*

GLOBAL RANK: G3T3; Rare throughout range, usually in oak-juniper woodlands on steep rocky banks and ledges along intermittent or perennial streams, rarely far from some reliable source of moisture; Perennial; Flowering April-May; Fruiting May-Aug

Texabama croton *Croton alabamensis var texensis*

Texas endemic; in duff-covered loamy clay soils on rocky slopes in forested, mesic limestone canyons; locally abundant on deeper soils on small terraces in canyon bottoms, often forming large colonies and dominating the shrub layer; scattered individuals are occasionally on sunny margins of such forests; also found in contrasting habitat of deep, friable soils of limestone uplands, mostly in the shade of evergreen woodland mottes; flowering late February-March; fruit maturing and dehiscing by early June

Texas almond *Prunus minutiflora*

GLOBAL RANK: G3; Wide-ranging but scarce, in a variety of grassland and shrubland situations, mostly on calcareous soils underlain by limestone but occasionally in sandier neutral soils underlain by granite; Perennial; Flowering Feb-May & Oct; Fruiting Feb-Sept

Texas amorpha *Amorpha roemeriana*

GLOBAL RANK: G3; Juniper-oak woodlands or shrublands on rocky limestone slopes, sometimes on dry shelves above creeks; Perennial; Flowering May-June; Fruiting June-Oct

Texas barberry *Berberis swaseyi*

GLOBAL RANK: G3; Shallow calcareous stony clay of upland grasslands/shrublands over limestone as well as in loamier soils in openly wooded canyons and on creek terraces; Perennial; Flowering/Fruiting March-June

Texas fescue *Festuca versuta*

GLOBAL RANK: G3; Occurs in mesic woodlands on limestone-derived soils on stream terraces and canyon slopes; Perennial; Flowering/Fruiting April-June

TRAVIS COUNTY

PLANTS

Federal Status State Status

Texas milk vetch *Astragalus reflexus*

GLOBAL RANK: G3; Grasslands, prairies, and roadsides on calcareous and clay substrates; Annual; Flowering Feb-June; Fruiting April-June

Texas seymeria *Seymeria texana*

GLOBAL RANK: G3; Found primarily in grassy openings in juniper-oak woodlands on dry rocky slopes but sometimes on rock outcrops in shaded canyons; Annual; Flowering May-Nov; Fruiting July-Nov

Tree dodder *Cuscuta exaltata*

GLOBAL RANK: G3; Parasitic on various Quercus, Juglans, Rhus, Vitis, Ulmus, and Diospyros species as well as Acacia berlandieri and other woody plants; Annual; Flowering May-Oct; Fruiting July-Oct

Warnock's coral-root *Hexalectris warnockii*

in leaf litter and humus in oak-juniper woodlands on shaded slopes and intermittent, rocky creekbeds in canyons; in the Trans Pecos in oak-pinyon-juniper woodlands in higher mesic canyons (to 2000 m [6550 ft]), primarily on igneous substrates; in Terrell County under Quercus fusiformis mottes on terrraces of spring-fed perennial streams, draining an otherwise rather xeric limestone landscape; on the Callahan Divide (Taylor County), the White Rock Escarpment (Dallas County), and the Edwards Plateau in oak-juniper woodlands on limestone slopes; in Gillespie County on igneous substrates of the Llano Uplift; flowering June-September; individual plants do not usually bloom in successive years

This report was written on behalf of the Texas Department of Transportation by

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