Biological Technical Report

State Highway 46 from Bulverde Road to Farm-to-Market (FM) 3159, Comal County, Texas

CSJs: 0215-01-044 & 0215-07-027

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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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1.0 INTRODUCTION AND PURPOSE

The San Antonio District of the Texas Department of Transportation (TxDOT) proposes improvements to State Highway (SH) 46 from Bulverde Road to Farm-to-Market Road (FM) 3159, in Comal County. The project area is within the city of Bulverde and unincorporated areas of Comal County. The total length of the proposed project is seven miles. **Figures 1** and **2** in **Attachment A** show the project location and limits, **Photographs 1** and **2** in **Attachment B** show representative views of the project's termini.

The purpose of this report is to describe the biological resources within the SH 46 project area, to analyze possible impacts on those resources from the project, and to assess the potential need for coordination with the Texas Parks and Wildlife Department (TPWD) and the U.S. Fish and Wildlife Service (USFWS).

2.0 SITE DESCRIPTION

2.1 PROJECT DESCRIPTION

TxDOT proposes to widen SH 46 in Comal County, Texas, from two to six lanes and add a raised median. The project would begin at Bulverde Road and continue east to FM 3159, a distance of approximately seven miles. SH 46 is classified as an urban/suburban arterial. The existing SH 46 facility within the project limits is a two-lane, undivided roadway. Lane widths are approximately 12 feet with shoulders of varying widths. Existing right-of-way is approximately 100 feet. The posted speed limit varies from 45 miles per hour (mph) to 55 mph.

Two different configurations would be used to widen the existing two-lane SH46 roadway. The curb and gutter configuration, which would be used in the more developed areas, would consist of six 11-foot travel lanes with a 16-foot raised median. The roadway would have 5-foot bike lanes to accommodate cyclists and 6-foot sidewalks to accommodate pedestrians. Drainage would be via underground storm sewer. Typical right-of-way width of the curb and gutter configuration would be 130 feet. The other configuration, a grass-lined open-ditch configuration, would be constructed in less developed areas and would consist of six 11-foot travel lanes with a 16-foot raised median. The roadway would have 5-foot bike lanes and 6-foot sidewalks to accommodate cyclists and pedestrians. Drainage would be via grass-lined open ditches. Typical right-of-way width for the grass-lined open-ditch section would be 170 feet.

Additional right-of-way would be required for both roadway configurations. A grade-separated intersection would be constructed at SH 46 and FM 3159. The project would transition back to the existing two-lane configuration east of FM 3159.

The proposed SH 46 project would extend between logical termini at Bulverde Road on the western end and FM 3159 on the eastern end. The project has independent utility and no improvements are required beyond the project limits. The proposed project speed limit would be posted at 45 mph.

2.2 NATURAL SETTING AND LAND USE

Natural Setting

The project area is located within the Edwards Plateau ecoregion of Texas, as shown in **Figure 3** (Gould et al. 1960). The project area is underlain by two geologic formations: the Upper and Lower Glen Rose Formations. These formations are Cretaceous age and comprised of limestone, dolomite, and marl.

Land Use

The proposed project area is located within the city of Bulverde, within Comal County. The existing right-of-way is dedicated to transportation use. Land surrounding the existing right-of-way consists of a mixture of rural, residential, and commercial uses (**Photographs 3** through **6**).

3.0 PROJECT AREA VEGETATION

The project area was investigated for the presence of special habitat features and unusual vegetation features as identified by the TxDOT-TPWD Memorandum of Understanding (MOU). Field investigations took place in February and April 2016. Vegetation types observed within the project area are not accurately represented by the Ecological Mapping Systems of Texas (EMST) (MoRAP 2013). The project area is dominated by Low Intensity Urban and Edwards Plateau: Live Oak-Ashe Juniper Woodland EMST vegetation types. The project area also includes relatively small areas best described as Edwards Plateau: Live Oak-Ashe Juniper Shrubland, Edwards Plateau: Live Oak Motte and Woodland, Edwards Plateau: Savannah Grassland, and Row Crops. Existing vegetation at the site, as observed during the field investigations, is described below and shown on **Figure 4a–4g**, with impact acreages summarized in **Table 1**.

The Urban Low Intensity vegetation type is described as maintained roadway grasses in the existing right-of-way. Vegetation was composed of native and non-native herbaceous species that are regularly mowed. These included little bluestem (*Schizachyrium scoparium*), Johnsongrass (*Sorghum halepense*), inland sea oats (*Chasmanthium latifolium*), Bermuda grass (*Cynodon dactylon*), plains love grass (*Eragrostis intermedia*), meadow garlic (*Allium canadense*), king ranch bluestem (*Bothriochloa ischaemem*), saw green briar (*Smilax bona-nox*), southern dewberry (*Rubus trivialis*), and poison ivy (*Toxicodendron radicans*) (**Photographs 4** and **5**).

The Edwards Plateau: Live Oak-Ashe Juniper Woodland composed a majority of the project area's unmaintained vegetation. Dominant plants were plateau live oak *(Quercus virginianus*) and Ashe juniper (*Juniperus ashei*). Ashe juniper trees were immature and appeared to have undergone a clearing regime in the past. The live oak trees were more mature with an average diameter-at-breast height of ten inches. This vegetation type also contained sugarberry (*Celtis laevigata*), mustang grape (*Vitis mustangensis*), and poison ivy, with a midstory of agarita (*Mahonia trifoliolata*), yaupon (*Ilex vomitoria*), elbowbush (*Forestria pubescens*), and joe-pye weed (*Eutrochium fistulosum*). This vegetation was observed throughout the proposed right-of-way along SH 46. (**Photographs 6** and **7**).

The Edwards Plateau: Live Oak-Ashe Juniper Shrubland vegetation type had the same species composition as the Live Oak-Ashe Juniper Woodland, though in an earlier successional stage. Woody vegetation was shorter in height, lacked a clear overstory, and contained a more dominant shrub component. An additional species noted in this habitat type is the Texas sotol (*Dasylirion texanum*). The vegetation was limited to mid-story and understory vegetation. (**Photographs 8** and **9**). This vegetation was observed throughout the proposed right-of-way along SH 46.

The Edwards Plateau: Live Oak Motte and Woodland was dominated by mottes of plateau live oak with little midstory. Some areas appeared to be actively grazed. In addition to plateau live oak, species composition included agarita, Texas prickly pear (*Opuntia engelmanni* var. *engelmannii*), and Roosevelt weed (*Baccharis neglecta*). Herbaceous species included Brazilian vervain (*Verbena brasiliensis*), Canada wild rye (*Elymus canadensis*), and antelope horn milkweed (*Asclepias asperula*). This vegetation was observed throughout the proposed right-of-way along SH 46 (**Photograph 10** and **11**).

A small area of Edwards Plateau: Savannah Grassland was also observed in the proposed right-of-way along SH 46. The savannah vegetation type is characterized by scattered woody vegetation interspersed amid a grassland. This vegetation is a gradient between woodland and grasslands. Species composition was similar to the surrounding area, including plateau live oak, agarita, Ashe Juniper, cedar elm (*Ulmus crassifolia*), little bluestem, and joe-pye weed (**Photograph 12**).

The relatively small areas of Row Crop were observed near the western terminus of the project area. These areas were devoid of vegetation and had been recently cleared, presumably for cultivation in the near future (**Photo 13**). This vegetation type offers little habitat value for wildlife.

The Disturbed Prairie vegetation type represents plant communities recovering from past agricultural uses. Vegetation was composed of native and non-native species in relatively early successional stages with a minor woody species component. The vegetation was not maintained. Species included Roosevelt weed, Johnsongrass, little bluestem, southern dewberry, joe-pye weed, and panic switchgrass (*Panicum virgatum*) (**Photos 11** and **14**).

Table 1: Impacts to Observed Vegetation Types

	Observed Vegetation Type	Acreage of Impacts	Corresponding MOU Type	MOU Threshold (acres)	Threshold Exceeded?
	Urban Low Intensity	83.07	Urban	None	No
	Edwards Plateau: Live Oak-Ashe Juniper Woodland	52.38	Edwards Plateau Savannah, Woodland, and Shrubland	3.0	Yes
	Edwards Plateau: Live Oak-Ashe Juniper Shrubland	5.62			
	Edwards Plateau: Live Oak Motte and Woodland	5.47			
	Edwards Plateau: Savannah Grassland	0.11			
	Row Crop	1.09	Agriculture	10.0	No
	Disturbed Prairie	3.80	Disturbed Prairie	2.0	Yes
	Total	151.84			

4.0 BIOLOGICAL RESOURCES

It is anticipated that some wildlife species could occur within undeveloped portions of the existing right-of-way. Required clearing or other construction-related activities may directly 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 5.0.

4.1 ENDANGERED SPECIES ACT

The USFWS regulates the take of federally-listed threatened and endangered species. No habitat for federally-listed endangered or threatened species occurs in the project area. See Section 5.0.

4.2 MIGRATORY BIRD TREATY ACT

The project area was investigated for any structures containing migratory birds or indications of nesting migratory birds. No migratory birds were observed nesting during the site visit, although individuals may arrive in the project area to breed during construction of the proposed project. Measures would be taken to avoid the take of migratory birds, their occupied nests, eggs, or young in accordance with the Migratory Bird Treaty Act, through phasing of work or preventative measures. Bird best management practices (BMPs) will be followed to minimize impacts. Bird BMPs include not disturbing, destroying, or removing active nests, including those of ground nesting birds, during the nesting season; avoiding the removal of unoccupied, inactive nests, as practicable; preventing the establishment of active nests during the nesting season on TxDOT-owned and -operated facilities and structures proposed for replacement or repair; and not collecting, capturing, relocating, or transporting birds, eggs, young, or active nests without a permit.

4.3 BALD EAGLE PROTECTION ACT

A qualified biologist did not identify any Bald or Golden Eagles or their habitats within the project area during field investigations. The project does not have the potential to impact Bald or Golden Eagles.

4.4 EXECUTIVE ORDER 13112 ON INVASIVE SPECIES

In accordance with Executive Order (EO) 13112 on Invasive Species, the Executive Memorandum on Beneficial Landscaping, and the 1999 Federal Highway Administration guidance on invasive species, all revegetation will, to the extent practicable, use only native species. Upon completion of earthwork activities, disturbed areas would be reseeded according to TXDOT specifications and in compliance with EO 13112, where applicable.

4.5 PROJECT AREA SOILS

According to date from the Natural Resources Conservation Service (NRCS), the proposed project is underlain by eight different soil types (NRCS 2016). The map unit symbol and names are listed in **Table 2** below.

Table 2: Project Area Soils

Map Unit Symbol	Map Unit Name
BrB	Bolar clay loam, 1 to 3 percent
BtD	Brackett Rock outcrop-Comfort complex, 1 to 8 percent slopes
BIG	Brackett Rock outcrop-Real complex, 8 to 30 percent slopes
DeB	Denton silty clay, 1 to 3 percent slopes
LeB	Lewisville silty clay, 1 to 3 percent slopes, eroded
Pt	Pits
PuC	Purves clay, 1 to 5 percent
SuB	Sunev clay loam, 1 to 3 percent slopes

5.0 HABITAT FOR THREATENED OR ENDANGERED SPECIES

Table 3 lists the federally and state-listed threatened and endangered species and Species of Greatest Conservation Need (SGCN) of potential occurrence in Comal County, along with habitat descriptions for each species, a determination of whether appropriate habitat for the species occurs within the project area, and a discussion of potential effects/impacts to the species.

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

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Plants						
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	Moderate slopes on appropriate geologic formations and soils occur in the project area. Species may occur in oak-juniper woodlands in the project area. No individuals of this species were observed during site visits.
Buckley tridens *Tridens buckleyanus*	NL	SGCN	Occurs in juniper-oak woodlands on rocky limestone slopes; Perennial; Flowering/Fruiting April-Nov	Yes	May impact	Species may occur on limestone slopes in oak-juniper woodlands in the proposed right-of-way in the project area. No individuals of this species were observed during site visits.
Comal snakewood *Colubrina stricta*	NL	SGCN	In El Paso County, found in a patch of thorny shrubs in colluvial deposits and sandy soils at the base of an igneous rock outcrop; the historic Comal County record does not describe the habitat; in Mexico, found in shrublands on calcareous, gravelly, clay soils with woody associates; flowering late spring or early summer	No	No impact	The project area does not contain bare rock, talus/scree, or Chihuahuan desert scrub (NatureServe 2016).
Darkstem noseburn *Tragia nigricans*	NL	SGCN	Occurs in oak-juniper woodlands on mesic limestone slopes and canyon bottoms; Perennial; Flowering/Fruiting April-Oct	No	No impact	No mesic limestone slopes occur in the project area.

Table 3, cont'd

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Glass Mountain coral-root *Hexalectris nitida*	NL	SGCN	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	Yes	May impact	Species may occur in oak-juniper woodlands in the proposed right-of-way of the project area. No individuals of this species were observed during site visits.
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	Species may occur in project area along creek bottoms. No individuals of this species were observed during site visits.
Heller's marbleseed *Onosmodium helleri*	NL	SGCN	Occurs in loamy calcareous soils in oak-juniper woodlands on rocky limestone	Yes	May impact	This species may occur in oak-juniper woodlands in loamy calcareous soils in the proposed right-of-way of the project area. No individuals of this species were observed during site visits.
Hill Country wild-mercury *Argythamnia aphoroides*	NL	SGCN	Texas endemic; mostly in bluestem-grama grasslands associated with plateau live oak woodlands on shallow to moderately deep clays and clay loams over limestone on rolling uplands, also in partial shade of oak-juniper woodlands in gravelly soils on rocky limestone slopes	Yes	May impact	This species may occur in unmaintained areas associated with plateau live oak woodlands on moderately deep soils in the proposed right-of-way of the project area. No individuals of this species were observed during site visits.
Narrowleaf brickellbush *Brickellia epatorioides* 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	Species may occur on limestone slopes in the proposed right-of-way of the project area. No individuals of this species were observed during site visits.

Table 3, cont'd

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
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 prairies occur in the project area.
Osage Plains false foxglove *Agalinis densiflora*	NL	SGCN	Most records are from grasslands on shallow, gravelly, well drained, calcareous soils; Prairies, dry limestone soils; Annual; Flowering Aug-Oct	No	No impact	No native prairies or grasslands occur in the project area.
Plateau loosestrife *Lythrum ovalifolium*	NL	SGCN	Texas endemic; mostly found on deep, loose, whitish sand blowouts (unstable, deep, xeric, sandhill barrens) in Post Oak Savanna landscapes over the Carrizo and Sparta formations; also occurs in early successional grasslands, along right-of-ways, and on mechanically disturbed areas; flowering June-late October or September-November	Yes	May impact	Species may occur along right-of-way or mechanically disturbed vegetation in the project area. No individuals of this species were observed during site visits.
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	Species may occur in juniper-oak and oak-juniper woodlands in the proposed right-of-way of the project area. No individuals of this species were observed during site visits.
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 perennial streams or mesic rocky limestone canyons occur in 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	No	No impact	No steep rocky banks or ledges along intermittent or perennial streams occur in the project area.

Table 3, cont'd

	Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
	Texas almond *Prunis 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	Calcareous soils occur within the project area. Species may occur in unmaintained vegetation in the proposed right-of-way of the project area. No individuals of this species were observed during site visits.
	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 or on dry shelves above water features in the proposed right-of-way of the project area. No individuals of this species were observed during site visits.
	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	This species may occur on water feature terraces in the proposed right-of-way of the project area. No individuals of this species were observed during site visits.
	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	This species may occur in unmaintained vegetation in the proposed right-of-way of the project area. No individuals of this species were observed during site visits.
	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 in the proposed right-of-way of the project area. No individuals of this species were observed during site visits.
	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	Yes	May impact	This species may occur on various host tree species in the project area. No individuals of this species were observed during site visits.

Table 3, cont'd

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Texas wild rice *Zizania texana*	LE	E	Texas endemic; spring-fed river, in clear, cool, swift water mostly less than 1 m deep, with coarse sandy soils rather than finer clays; flowering year-round, peaking March-June	No	No affect	No spring-fed rivers occur within the project area.
Mollusks						
False spike mussel *Fusconia (=Quadrula) mitchelli*	NL	T	Native to the Guadalupe and other basins and was presumed extinct until recent surveys confirmed live false spike at several locations throughout its historic range	No	No impact	No perennial streams occur in the project area. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.
Golden orb *Quadrula aurea*	C	T	Sand and gravel in some locations and mud at others; intolerant of impoundment in most instances; Guadalupe, San Antonio, and Nueces River basins	No	No effect	No perennial streams occur in the project area. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.
Horseshoe liptooth snail *Daedalochila hippocrepis*	NL	SGCN	Terrestrial snail known only from the steep, wooded hillsides of Landa Park in New Braunfels	No	No impact	The project area is not located within or adjacent to Landa Park or similar habitats.
Texas fatmucket *Lampsilis bracteata*	C	T	Streams and rivers on sand, mud, and gravel substrates; intolerant of impoundment; broken bedrock and course gravel or sand in moderately flowing water; Colorado and Guadalupe River basins	No	No effect	No perennial streams occur in the project area. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.
Texas pimpleback *Quadrula petrina*	C	T	Mud, gravel and sand substrates, generally in areas with slow flow rates; Colorado and Guadalupe River basins	No	No effect	No perennial streams occur in the project area. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.

Table 3, cont'd

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Crustaceans						
Ezell's cave amphipod *Stygobromus flagellatus*	NL	SGCN	Known only from artesian wells	No	No impact	No known artesian wells are present in the project area.
Long-legged cave amphipod *Stygobromus longipes*	NL	SGCN	Subaquatic crustacean; subterranean obligate; found in subterranean streams	No	No impact	No known karst features are present in the project area.
Peck's cave amphipod *Stygobromus pecki*	LE	E	Aquatic, subterranean environments of the Edwards Aquifer. Previously collected at Comal Springs and Hueco Springs in Comal County, Texas	No	No effect	The proposed project does not involve excavations into the Edwards Aquifer. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.
Insects						
Comal Springs diving beetle *Comaldessus stygius*	NL	SGCN	Known only from the outflows at Comal Springs; aquatic; diving beetles generally inhabit the water column	No	No impact	No known springs occur in the project area. Project area is outside this species' current known range. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.
Comal Springs dryopid beetle *Sygoparnus comalensis*	LE	E	Usually found clinging to objects in streams, otherwise found crawling on stream bottoms or along shores	No	No effect	No known springs occur in the project area. Project area is outside this species' current known range. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.

Table 3, cont'd

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Comal Springs riffle beetle *Heterelmis comalensis*	LE	E	Previously collected in Comal and San Marcos Springs	No	No effect	No known springs occur in the project area. Project area is outside this species' currently understood range. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.
Edwards Aquifer diving beetle *Haideoporus texanus*	NL	SGCN	Habitat poorly known. Previously collected from an artesian well in Hays County	No	No impact	No known artesian wells occur within the project site. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.
Mayfly *Pseudocentroptiloides morihari*	NL	SGCN	Mayflies distinguished by aquatic larval stage; adult stage generally found in shoreline vegetation	No	No impact	Medium rivers do not occur within the proposed project area (NatureServe, 2016). Surface water quality will be protected through the use of erosion and sedimentation control BMPs.
Fishes						
Fountain darter *Etheostoma fonticola*	LE	E	Known only from the San Marcos and Comal rivers; springs and spring-fed streams in dense beds of aquatic plants growing close to bottom, which is normally mucky	No	No effect	No rivers occur in the project area. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.
Guadalupe bass *Micropterus treculii*	NL	SGCN	Endemic to perennial streams of the Edward's Plateau region; introduced in Nueces River system	No	No impact	No perennial streams occur in the project area. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.

Table 3, cont'd

	Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
	Amphibians						
	Cascade caverns salamander *Eurycea latitans complex*	NL	T	Endemic; subaquatic; springs and caves in Medina River, Guadalupe River, and Cibolo Creek watersheds within Edwards Aquifer area	Yes	No impact	The proposed project lies over the Cibolo Creek Watershed within the Edwards Aquifer Contributing Zone. Drilling and excavations are planned for the bridge at FM 3159. According to well data from the Texas Water Development Board, the two closest wells to the proposed bridge locations reach water at 860 feet and 1,065 feet above mean sea level. The elevation at the proposed bridge location is approximately 1,330 feet above mean sea level (TWDB 2016). The typical maximum depth of bridge piers is approximately 40 feet; therefore, direct impacts the aquifer are not anticipated. In the event that a void is breached, bridge shafts would be encapsulated to prevent further impacts. No known springs or caverns occur in the project area. Surface water quality would be protected through the use of erosion and sedimentation control BMPs.

Table 3, cont'd

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Comal blind salamander *Eurycea tridentiflora*	NL	T	Endemic; semi-troglobitic; found in springs and waters of caves	Yes	No impact	The proposed project lies over the Cibolo Creek Watershed within the Edwards Aquifer Contributing Zone. Drilling and excavations are planned for the bridge at FM 3159. According to well data from the Texas Water Development Board, the two closest wells to the proposed bridge locations reach water at 860 feet and 1,065 feet above mean sea level. The elevation at the proposed bridge location is approximately 1,330 feet above mean sea level (TWDB 2016). The typical maximum depth of bridge piers is approximately 40 feet; therefore, direct impacts the aquifer are not anticipated. In the event that a void is breached, bridge shafts would be encapsulated to prevent further impacts. No known springs or caverns occur in the project area. Surface water quality would be protected through the use of erosion and sedimentation control BMPs.
Comal springs salamander *Eurycea* sp. 8	NL	SGCN	Endemic; Comal Springs	No	No impact	Comal springs are not intersected by the project area. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.

Table 3, cont'd

	Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
	Edward's Plateau spring salamander *Eurycea* sp. 7	NL	SGCN	Endemic; springs and waters of some caves of this region	Yes	No impact	The proposed project lies over the Cibolo Creek Watershed within the Edwards Aquifer Contributing Zone. Drilling and excavations are planned for the bridge at FM 3159. According to well data from the Texas Water Development Board, the two closest wells to the proposed bridge locations reach water at 860 feet and 1,065 feet above mean sea level. The elevation at the proposed bridge location is approximately 1,330 feet above mean sea level (TWDB 2016). The typical maximum depth of bridge piers is approximately 40 feet; therefore, direct impacts the aquifer are not anticipated. In the event that a void is breached, bridge shafts would be encapsulated to prevent further impacts. No known springs or caverns occur in the project area. Surface water quality would be protected through the use of erosion and sedimentation control BMPs.
	San Marcos salamander *Eurycea nana*	LT	T	Headwaters of the San Marcos River downstream to ca. ½ mile past IH-35; water over gravelly substrate characterized by dense mats of algae (*Lyngbya*) and aquatic moss (*Leptodictym riparium*), and water temperatures of 21-22°C	No	No effect	The project would not intersect the San Marcos River or its watershed. Surface water quality will be protected through the use of erosion and sedimentation control BMPs
	Texas blind salamander *Eurycea (Typhlomolge) rathbuni*	LE	E	Troglobitic; water-filled subterranean caverns along a six mile stretch of the San Marcos Spring Fault, in the vicinity of San Marcos; eats small invertebrates, including snails, copepods, amphipods, and shrimp	No	No effect	The project site is south of the San Marcos Spring Fault and the previously reported occurrence sites. Surface water quality will be protected through the use of erosion and sedimentation control BMPs

Table 3, cont'd

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Reptiles						
Cagle's map turtle *Graptemys caglei*	NL	T	Endemic; Guadalupe River System; short stretches of shallow water with swift to moderate flow and gravel or cobble bottom, connected by deeper pools with a slower flow rate and a silt or mud bottom; gravel bar riffles and transition areas between riffles and pools especially important in providing insect prey items; nest on gently sloping sand banks within ca. 30 feet of water's edge	No	No impact	No suitable streams with swift to moderate flow connected by deeper pools with a slower flow rate occur in the project area. Surface water quality will be protected through the use of erosion and sedimentation control BMPs.
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 flat areas free of vegetation in the project area.
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	The species could occur within unmaintained vegetation near water feature crossings in the project area.
Texas horned lizard *Phrynosoma cornutum*	NL	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	No	No impact	No areas of sparse vegetation or sandy soils occur within the project area. No harvester any mounds were observed.

Table 3, cont'd

	Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
	Birds						
	American Peregrine Falcon *Falco peregrinus anatum*	DL	T	Resident in west Texas; migrant across rest of state; winters along coast and farther south; occupies wide range of habitats during migration, including urban, with stopovers at leading landscape edges	No	No impact	Species is a potential migrant. Any use of the project area would be incidental.
	Arctic Peregrine Falcon *Falco peregrinus tundrius*	DL	SGCN	Winters along the coast and farther south. Occupies a wide range of habitats during migration including urban and leading landscape edges such as lake shores, coastlines, etc.	No	No impact	Species is a potential migrant. Any use of the project area would be incidental.
	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 rivers, lakes, or tall trees occur in the project area.
	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	No	No effect	No oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces are located in project area.

Table 3, cont'd

	Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
	Golden-cheeked Warbler *Dendroica (=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	No	No affect	No mature juniper-oak woodlands occur in the project area.
	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 plains or prairies occur in the project area.
	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	Undisturbed prairie habitat is not present in the project area.
	Western Burrowing Owl *Athene cunicularia hypugea*	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	Yes	May impact	This species may occur in the project area in savannas.
	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	No	No effect	No plains or stopever habitat occur in the project area. The species is a potential migrant.

Table 3, cont'd

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information
Zone-tailed Hawk *Buteo albonotatus*	NL	T	Arid open country, including open deciduous or pine-oak woodland, mesa or mountain country, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions	No	No impact	Arid open country, including open deciduous or pine-oak woodland, mesa or mountain country does not occur in the project area.
Mammals						
Black bear *Ursus americanus*	NL	T	Bottomland hardwoods and large tracts of inaccessible forested areas	No	No impact	No bottomland hardwoods or large tracts of inaccessible forested areas occur within the project area.
Cave myotis bat *Myotis velifer*	NL	SGCN	Colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and 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	Yes	May impact	The species could occur within the project area in association with existing culverts or other natural structures.
Jaguarundi *Herpailurus yaguarondi*	LE*	E	Thick brushlands, near water favored; 60 to 75 day gestation, young born sometimes twice per year in March and August, elsewhere the beginning of the rainy season and end of the dry season	No	No effect	No thick brushlands near water occur within the project site.
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	This species may occur in unmaintained vegetation in the project area.
Red wolf *Canis rufus*	LE*	E	Extirpated; formerly known throughout eastern half of Texas in brushy/forested areas and coastal prairies	No	No effect	Species is extirpated and would not be reasonably expected to occur in Comal County.

Table 3, cont'd

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/ Impact	Pertinent Project Information

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
C = Candidate for Listing
DL = Delisted

* = Species not recognized by the USFWS as occurring within the project area but designated by TPWD as potentially occurring within the county.

Sources: TPWD (2016), USFWS (2016), TWDB (2016), NatureServe (2016a), NatureServe (2016b)

6.0 TEXAS PARKS AND WILDLIFE DEPARTMENT ANALYSIS

The project is within range of and contains potentially suitable habitat for the following SGCNs: bracted twistflower *(Streptanthus bracteatus)* (also a candidate for federal listing), Buckley tridens (*Tridens buckleyanus*), Glass Mountain coral-root (*Hexalectris nitida*), gravelbar brickellbush (*Brickellia dentata*), Heller's marbleseed (*Onosmodium helleri*), Hill Country wild mercury (*Argythamnia aphoroides*), narrowleaf brickellbush (*Brickellia epatorioides* var. *gracillima*), Plateau loosestrife (*Lythrum ovalifolium*), Plateau milkvine (*Matelea edwardsensis*), Texas almond (*Prunis minutiflora*), Texas amorpha (*Amorpha roemeriana*), Texas barberry (*Berberis swaseyi*), Texas fescue (*Festuca versuta*), Texas seymeria (*Seymeria texana*), tree dodder (*Cuscuta exaltata*), Edwards Plateau spring salamander (*Eurycea* sp. 7), Texas garter snake (*Thamnophis sirtalis annectens*), cave myotis bat (*Myotis velifer*), Western Burrowing Owl (*Athene cunicularia hypugea*), and plains spotted skunk (*Spilogale putorius interrupta*). The project is in range of the following state-listed threatened species: Cascade caverns salamander (*Eurycea latitans complex*), and Comal blind salamander (*Eurycea* sp. 8). No individuals of these species were identified during field investigations.

In accordance with the *Best Management Practices Programmatic Agreement between TxDOT and TPWD Under the 2013 MOU*, BMPs have been defined for implementation by TxDOT in order to minimize impacts to federally and state-listed species and SGCNs. **Table 4** lists those BMPs related to species that may have suitable habitat in the proposed project area.

Table 3: BMPs for State-Listed Species and SGCNs

Species Name	BMP
Cave myotis bat	• All bat surveys will comply with TPWD recommended white-nose syndrome protocols • Habitat assessment by a qualified biologist to determine if bats are present • If bats are present, take appropriate measures as practicable to ensure that bats are not harmed such as exclusion or timing activities. For maternity colonies, exclusion activities should be timed to avoid separating lactating females from nursing pups. • If structures 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.
Texas garter snake	• Contractors will be advised of potential occurrence in the project area and to avoid harming the species if encountered
Western Burrowing Owl	• Not disturbing, destroying, or removing active nests, including ground nesting birds, during the nesting season • Avoiding the removal of unoccupied, inactive nests, as practicable • Preventing the establishment of active nests during the nesting season on TxDOT-owned and -operated facilities and structures proposed for replacement or repair • Not collecting, capturing, relocating, or transporting birds, eggs, young, or active nests without a permit
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

Source: Best Management Practices Programmatic Agreement between TxDOT and TPWD Under the 2013 MOU.

6.1 ELEMENTS OF OCCURRENCE WITHIN 1.5 MILES OF THE PROJECT

TPWD's Texas Natural Diversity Database (TXNDD) was reviewed on October 17, 2016, using data obtained from TPWD. Information files were reviewed for known locations of species in the *Anhalt, Bergheim, Kendalia, Spring Branch, Fischer, Devils Backbone, Sattler, Smithson Valley, New Braunfels West, Bat Cave, Bulverde,* and *Camp Bullis.* U.S. Geological Survey 7.5-minute topographic quadrangle maps (including the project area and surrounding vicinity). The Comal Springs salamander has NDD locations within 1.5 miles of the project area (**Figure 6** in **Appendix A**). The TXNDD cannot be used for presence/absence determinations.

7.0 SPECIAL HABITAT FEATURES

As defined in the 2013 MOU, special habitat features can include bottomland hardwoods, caves, cliffs and bluffs, native prairies, seeps or springs, snags or groups of snags, existing bridges with known or observed bird or bat colonies, rookeries, and prairie dog towns. According to TxDOT's MOU with TPWD, no special habitat features would be impacted by the proposed project.

8.0 UNUSUAL VEGETATION FEATURES

Unusual vegetation features can include unmaintained vegetation, fencerow vegetation, riparian vegetation, significant (historically or ecologically) or locally important trees, or unusual stands or islands of vegetation. Unusual vegetation features identified within the project area include unmaintained vegetation. Approximately 67.69 acres of unmaintained vegetation (composed of Edwards Plateau Savannah, Woodland, and Shrubland, and disturbed prairie vegetation types) would be impacted by the proposed project. Impacts to these vegetation features would be minimized to the extent practicable during the design phase of the project.

9.0 TPWD COORDINATION

A Tier I Site Assessment in accordance with TxDOT's 2013 *Memorandum of Understanding with the Texas Parks and Wildlife Department* was performed to determine whether coordination with TPWD would be required for the proposed project. The Tier I Site Assessment defines the type and amount of habitat impacted using information from the Texas Conservation Action Plan (TPWD 2012); EMST; TXNDD; lists of rare, threatened, and endangered species maintained by TPWD and USFWS; information collected during field investigations; and the most current aerial photography available. **Table 5** lists the coordination triggers and responses to each. A copy of the Biological Evaluation Form is included as a separate document.

As described in **Table 5**, the proposed project requires coordination with TPWD in accordance with TxDOT's 2013 *Memorandum of Understanding with the Texas Parks and Wildlife Department*.

Table 5: Tier 1 Site Assessment – TPWD Coordination Triggers

	Trigger	Applies to the Project?	Explanation
	The project is within the range of a state threatened or endangered species or SGCNs, 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	Habitat is present within the existing project right-of-way for the following species: bracted twistflower, Buckley tridens, Glass Mountain coral-root, gravelbar brickellbush, Heller's marbleseed, Hill Country wild mercury, narrowleaf brickellbush, Plateau loosestrife, Plateau milkvine, Texas almond, Texas amorpha, Texas barberry, Texas fescue, Texas seymeria, tree dodder, Edwards Plateau spring salamander, Texas garter snake, cave myotis bat, Western Burrowing Owl, and plains spotted skunk. The project is in range of the following state-listed species: Cascade caverns salamander, and Comal blind salamander No BMPs have been established for the state-designated SGCNs bracted twistflower, Buckley tridens, Glass Mountain coral-root, gravelbar brickellbush, Heller's marbleseed, Hill Country wild mercury, narrowleaf brickellbush, Plateau loosestrife, Plateau milkvine, Texas almond, Texas amorpha, Texas barberry, Texas fescue, Texas seymeria, tree dodder, Edwards Plateau spring salamander, or state-listed threatened species: Cascade caverns salamander and Comal blind salamander.

			The BMPs for the remainder of these species are defined in the MOU PA, as listed in Table 4.
	The project may adversely impact important remnant vegetation based on the judgment of a qualified biologist or as mapped in the TXNDD.	No	No remnant vegetation occurs in the project area.
	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.	No	No riparian vegetation occurs within the proposed project area.
	The project disturbs habitat in an area equal to or greater than the area of disturbance indicated in the *Threshold Table Programmatic Agreement*.	Yes	The project disturbs an area equal to or greater than the area indicated in the *Threshold Table Programmatic Agreement* for Edwards Plateau Savannah, Woodland, and Shrubland and Disturbed Prairie vegetation types. Mapped EMST vegetation is not consistent with observed vegetation in the project site. For a description of the discrepancy, see the Biological Evaluation Form submitted under separate cover.

10.0 LIMITATIONS

The site visit was conducted on April 7, 2016. At the time of the field survey, no right-of-entry had been obtained for the proposed right-of-way. The findings and recommendations summarized in this report reflect an analysis based on aerial imagery (historic and current), soil surveys, geologic atlas, NWI maps, and from a pedestrian survey conducted in the transportation right-of-way. Species composition for areas outside of the existing right-of-way was field verified to the extent visually accessible from adjacent roads and parcels. The species and vegetation impact determinations (**Section 3, 4, 5, 6, 7, & 8**) reflect this right-of-entry limitation where applicable.

11.0 REFERENCES CITED

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Attachment A

Figures

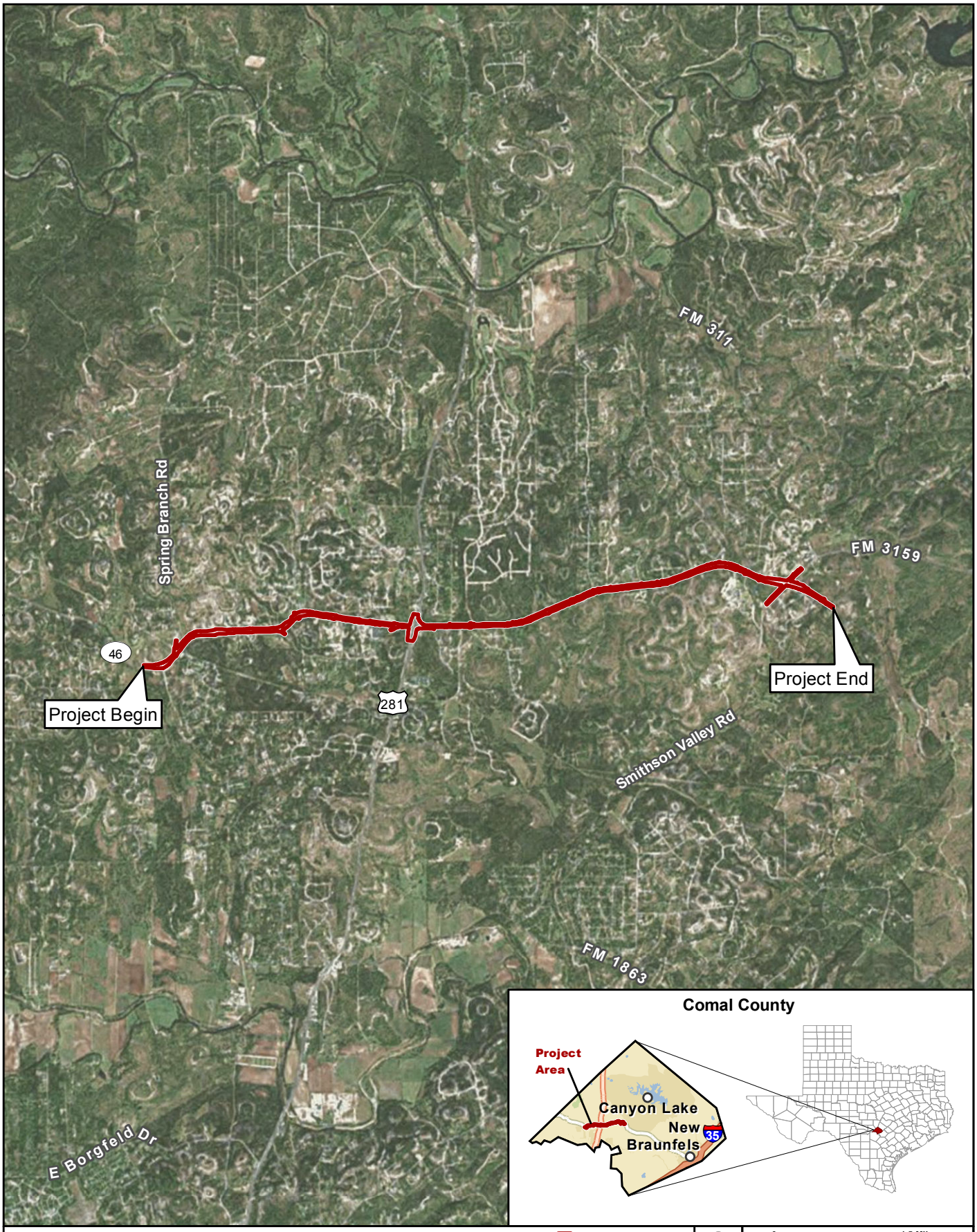

Figure 1

Project Location (Aerial Base)

SH 46 from Bulverde Rd to FM 3159

Project Location

Basemap Source: ESRI (2015)

0 1.5 Miles

0 2 Kilometers

Prepared for: TxDOT	1 in = 1.5 miles
	Scale: 1:95,040
CSJ: 0215-01-044, 0215-07-027	Date: 10/19/2016

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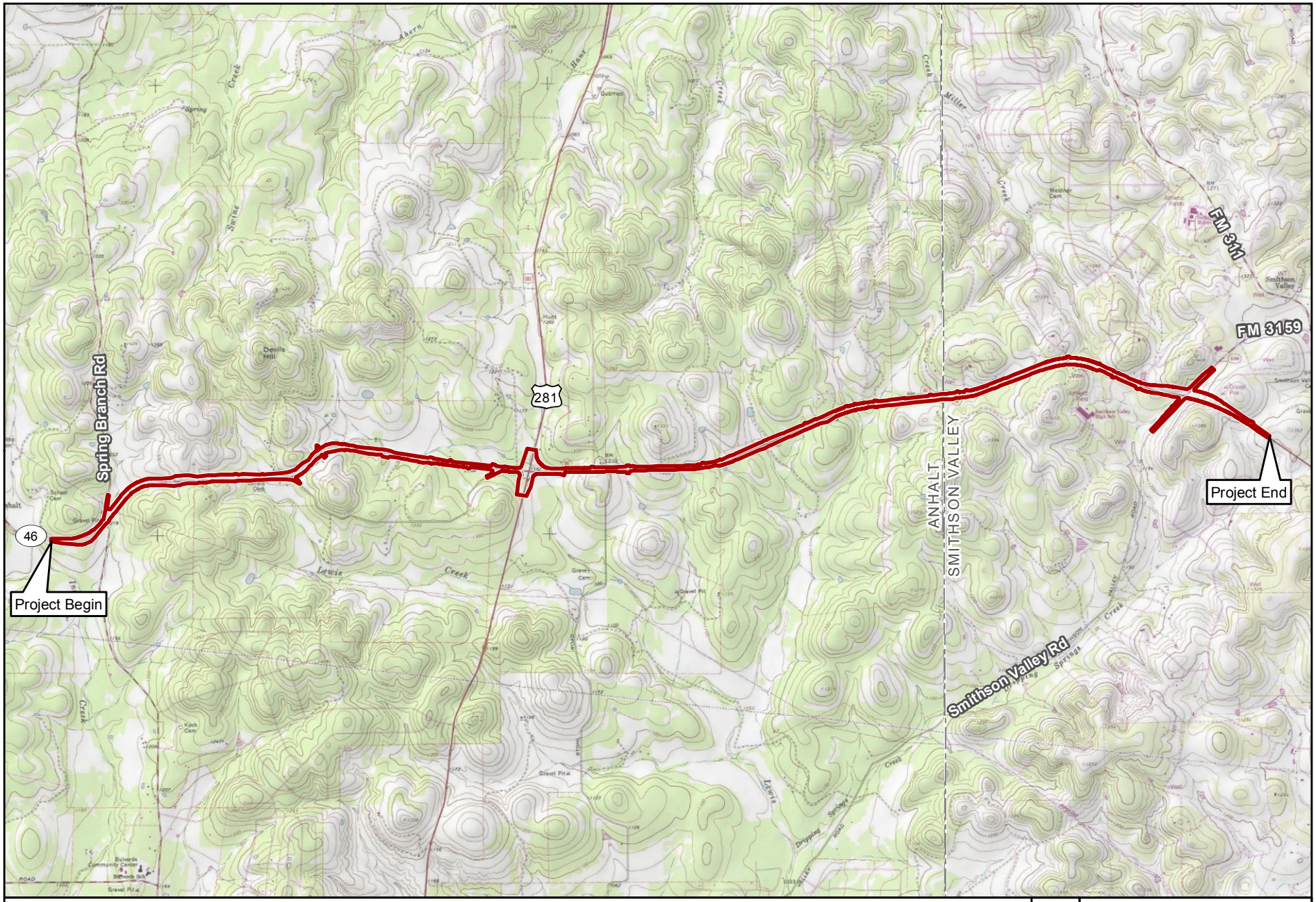

Figure 2

Project Location (Topographic Base)

SH 46 from Bulverde Rd to FM 3159

Project Location

Basemap Source: USGS Anhalt (1973) and Smithson Valley (1994) 7.5' Quadrangles

0 4,500 Feet
0 1,500 Meters

Prepared for: TxDOT	1 in = 4,500 feet
	Scale: 1:54,000
CSJ: 0215-01-044, 0215-07-027	Date: 10/19/2016

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Figure 3

Ecoregions of Texas

SH 46 from Bulverde Rd to FM 3159

Data Source: TCAP (2011)/EPA (2004)
Basemap Source: ESRI (2016)

Prepared for: TxDOT	1 in = 110 miles
	Scale: 6,969,600
CSJ: 0215-01-044, 0215-07-027	Date: 10/24/2016

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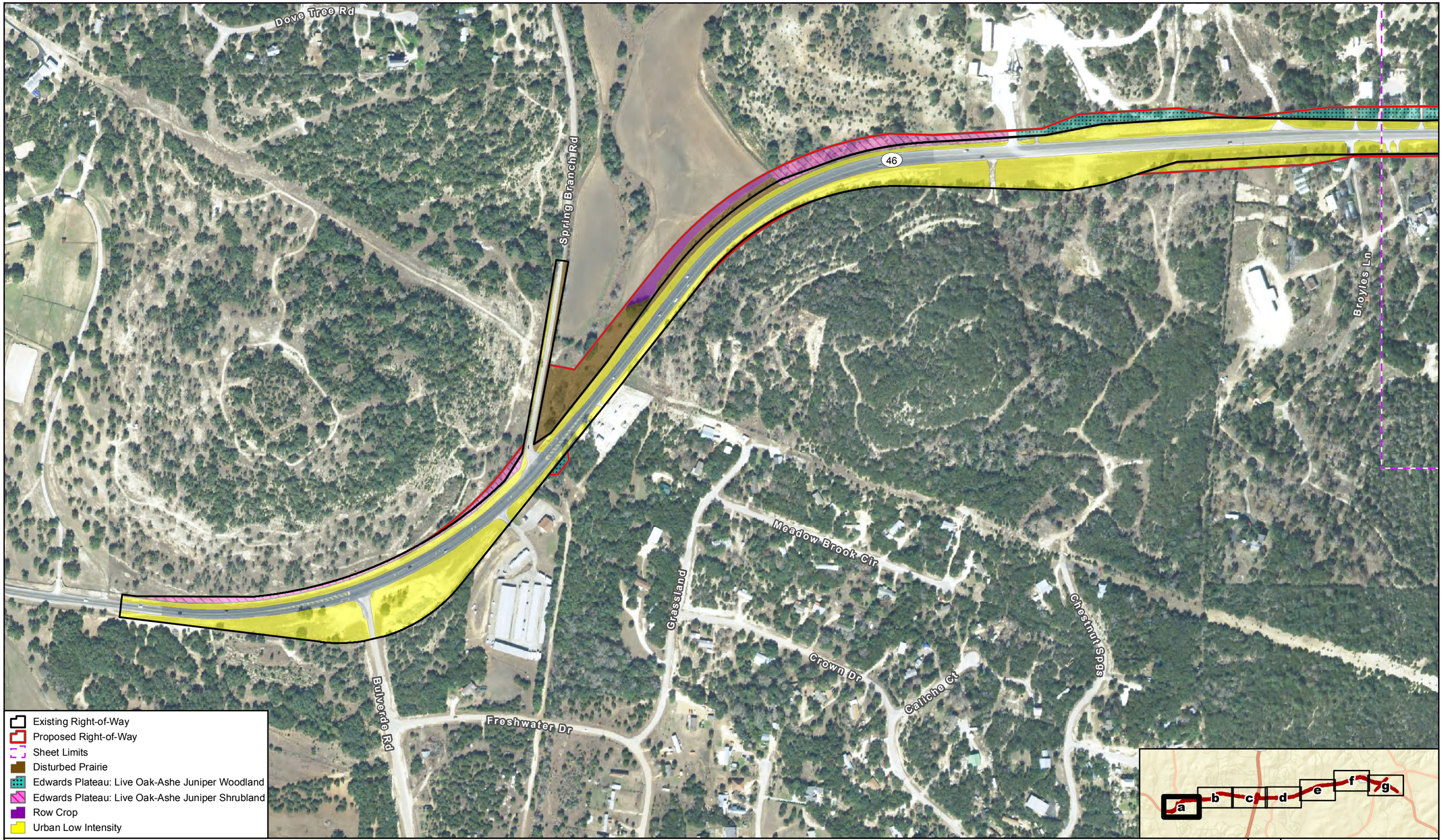

Figure 4a

Observed Vegetation Types

SH 46 from Bulverde Rd to FM 3159

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

0 400 Feet
0 120 Meters

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0215-01-044, 0215-07-027	Date: 11/14/2016

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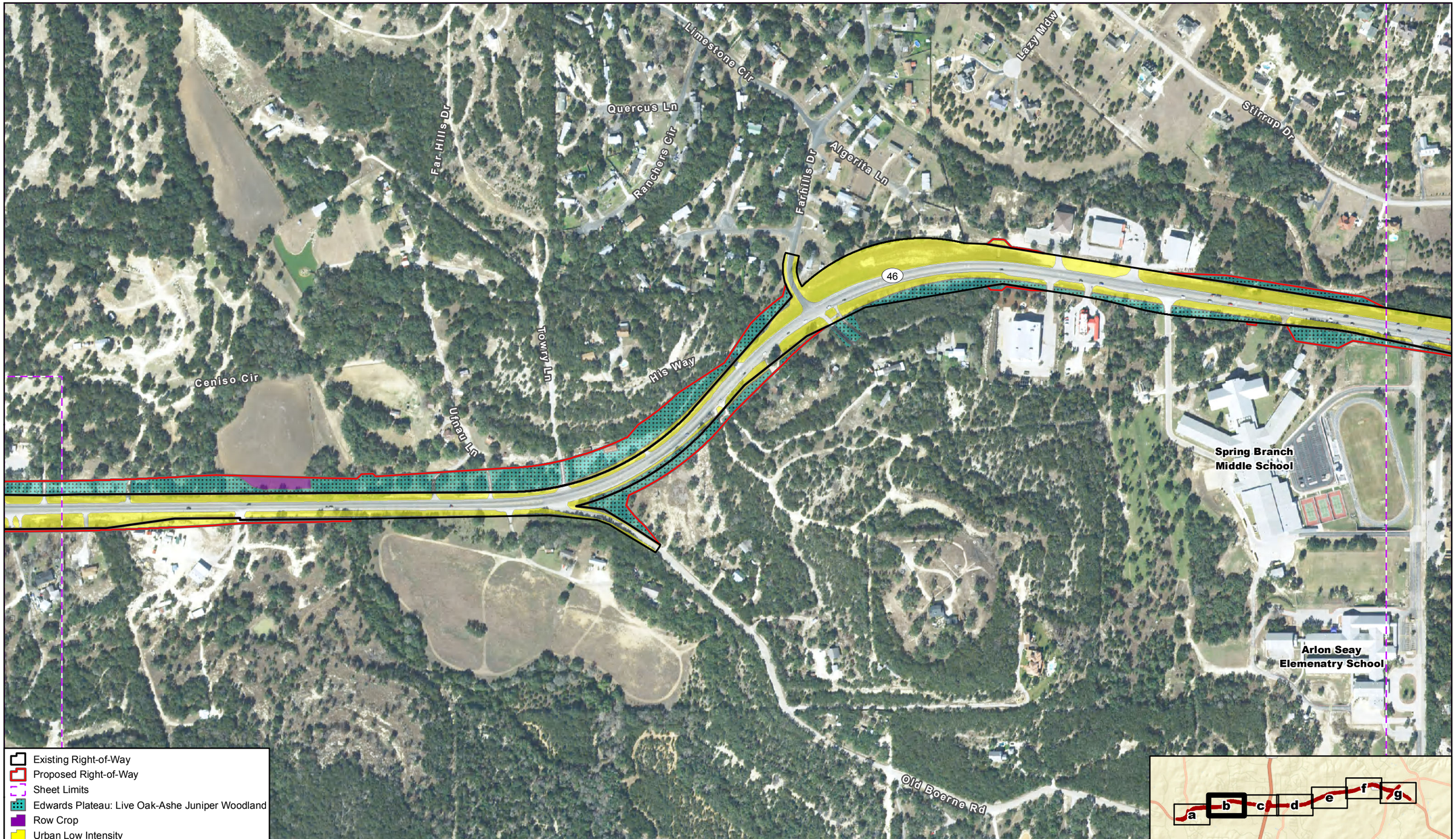

Figure 4b

Observed Vegetation Types

SH 46 from Bulverde Rd to FM 3159

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

0 400 Feet
0 120 Meters

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0215-01-044, 0215-07-027	Date: 11/14/2016

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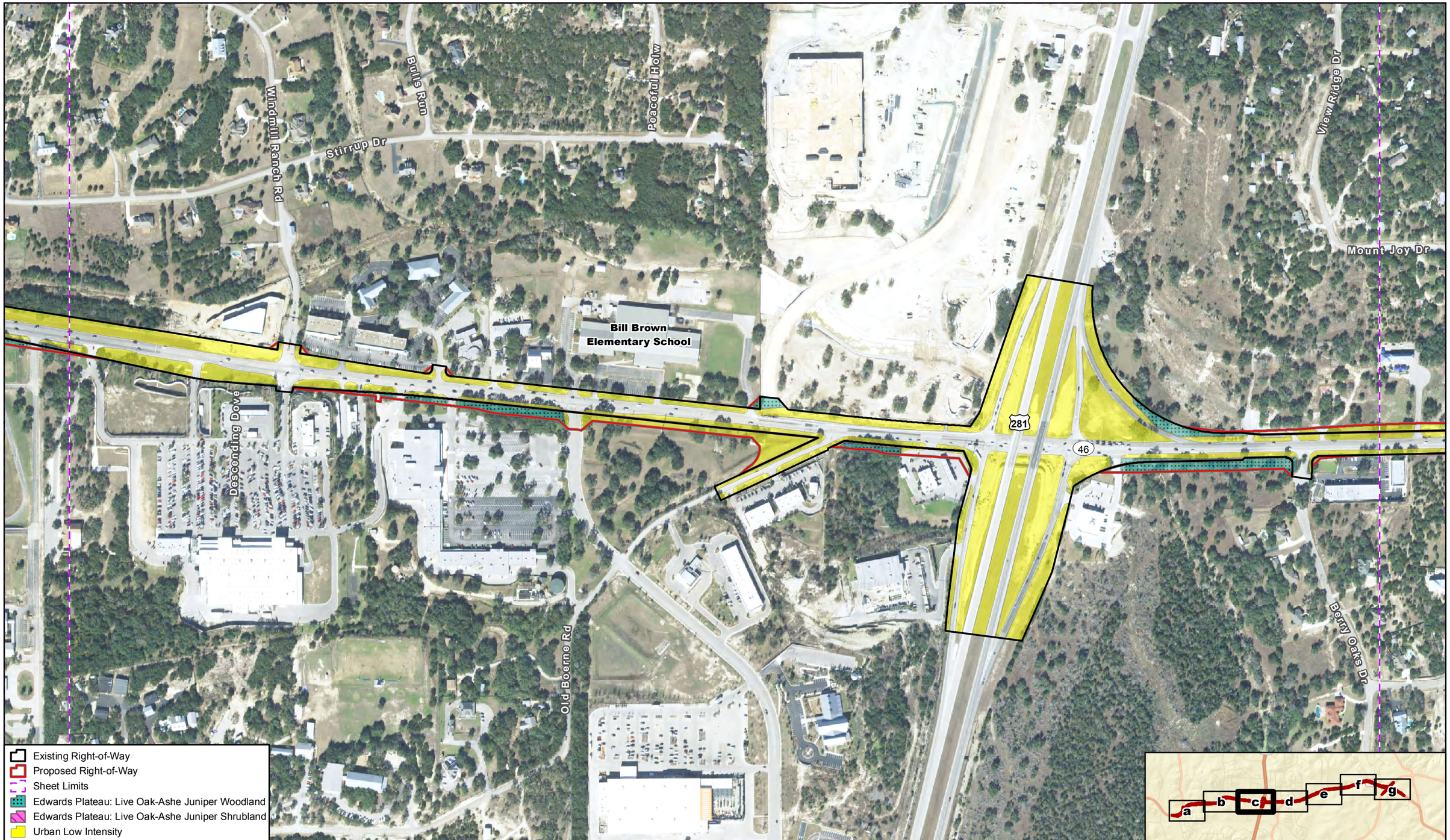

Figure 4c

Observed Vegetation Types

SH 46 from Bulverde Rd to FM 3159

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

0 400 Feet
0 120 Meters

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0215-01-044, 0215-07-027	Date: 11/14/2016

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Figure 4d

Observed Vegetation Types

SH 46 from Bulverde Rd to FM 3159

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

0 400 Feet
0 120 Meters

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0215-01-044, 0215-07-027	Date: 11/14/2016

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Figure 4e

Observed Vegetation Types

SH 46 from Bulverde Rd to FM 3159

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

0 400 Feet
0 120 Meters

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0215-01-044, 0215-07-027	Date: 11/14/2016

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Figure 4f

Observed Vegetation Types

SH 46 from Bulverde Rd to FM 3159

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

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0215-01-044, 0215-07-027	Date: 11/14/2016

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Figure 4g

Observed Vegetation Types

SH 46 from Bulverde Rd to FM 3159

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

Prepared for: TxDOT	1 in = 400 feet
	Scale: 1:4,800
CSJ: 0215-01-044, 0215-07-027	Date: 11/14/2016

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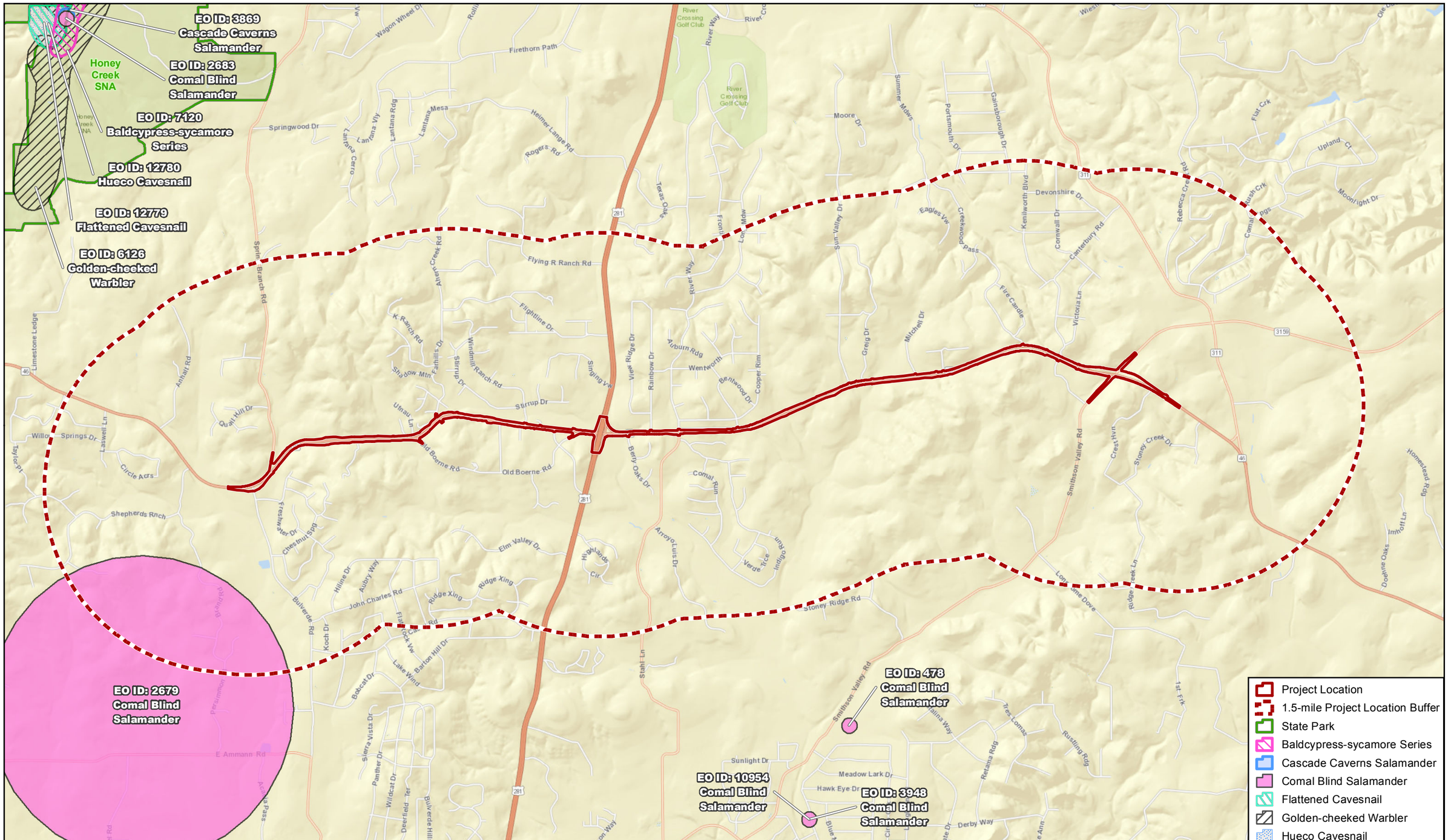

Figure 5a

TXNDD Elements of Occurrence

SH 46 from Bulverde Rd to FM 3159

Data Sources: TPWD (1/20/2016, 2014)
Basemap Source: ESRI (2015)

Prepared for: TxDOT	1 in = 0.75 mile
	Scale: 1:47,520
CSJ: 0215-01-044, 0215-07-027	Date: 10/21/2016

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Attachment B

Project Area Photographs

Photo 1: Western project limit; facing east.

Photo 2: Eastern project limit; facing west.

Photo 3: Proposed project area; facing west.

Photo 4: Proposed project area and Urban Low Intensity habitat type along the existing right-of-way; facing west.

Photo 5: Proposed project area and Urban Low Intensity habitat type along the existing right-of-way; facing west.

Photo 6: Proposed project area and Edwards Plateau: Live Oak-Ashe Juniper Woodland habitat type in the proposed right-of-way; facing west.

Photo 7: Edwards Plateau: Live Oak-Ashe Juniper Woodland habitat type in the proposed right-of-way; facing southwest. Plateau live oaks are mature while the Ashe junipers are not.

Photo 8: Edwards Plateau: Live Oak-Ashe Juniper Shrubland habitat type in the proposed right-of-way; facing north.

Photo 9: Edwards Plateau: Live Oak-Ashe Juniper Shrubland habitat type in the proposed right-of-way; facing north.

Photo 10: Edwards Plateau: Live Oak Motte and Woodland habitat type in the proposed right-of-way; facing north.

Photo 11: Edwards Plateau: Live Oak Motte and Woodland (background) and Disturbed Prairie (foreground) habitat types in the proposed right-of-way; facing west.

Photo 12: Edwards Plateau: Savannah Grassland habitat type within the proposed right-of-way; facing north.

Photo 13: Row crop habitat type within the proposed right-of-way; facing north.

Photo 14: Disturbed Prairie Vegetation type (to the left of the fence); facing east.