Cumulative Impacts Analysis Technical Report

SL 288

From IH 35W to IH 35

CSJs: 2250-02-013 & 2250-02-014

Denton County, Texas

December 2019

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

The Texas Department of Transportation (TxDOT), in conjunction with Denton County, is proposing the construction of a four-lane new location frontage road system for State Loop (SL) 288 from Interstate Highway (IH) 35W south of Denton to IH 35 north of Denton, in Denton County, Texas. The distance of the proposed project is approximately 9.0 miles. The proposed project right-of-way (ROW) would include a median that would accommodate the future construction of an ultimate mainlane facility. Construction of the ultimate mainlane facility would be based on projected traffic and funding and would require additional environmental analysis prior to construction.

The new location SL 288 frontage road system would include a northbound and southbound frontage road facility. For rural areas, the facility would consist of two travel lanes (one 12-foot wide lane and one 14-foot wide lane for bicycle accommodation) and 8-foot wide inside and outside shoulders in each direction, with open ditch drainage. For urbanized areas, the facility would consist of two travel lanes (one 12-foot wide lane and one 14-foot wide lane for bicycle accommodation) in each direction, with curb and gutter drainage. The facility would also include 6-foot wide sidewalks along both sides of the road throughout the project limits. The proposed project ROW would include a median (variable width) that would accommodate the future construction of an ultimate mainlane facility.

The proposed project would also construct intersections at six (6) major cross roads as follow: John Paine, Farm-to-Market Road (FM) 2449, Tom Cole/FM 1515, Jim Christal Road, US Highway (US) 380, and Masch Branch Road. In addition, the proposed project would construct a grade separation at the KCS Railroad and would tie into the grade separations at IH 35 and IH 35W.

The proposed SL 288 project (frontage road system) would likely be constructed in two phases based on traffic needs and project funding. A logical sequence for staging the various elements for construction of the new location frontage road system could be as follows:

- Phase 1 would construct a single two-lane, two-way frontage road, and would also acquire the proposed ROW to accommodate the frontage roads and the future ultimate mainlane facility.
- As traffic warrants and funding becomes available, Phase 2 would involve the construction of the two-lane frontage road, which would include the conversion of the two-way frontage road built in Phase 1 to a one-way operation, and the construction of grade separations at specific high-volume intersections.
- Phase 3 (a separate project) would involve the construction of the ultimate mainlane facility in both directions. Construction of the ultimate mainlane facility would be

based on projected traffic and funding and would require additional environmental analysis prior to construction.

The project area includes approximately 26.6 acres of existing roadway ROW, 401.5 acres of proposed ROW, 1.2 acres of proposed permanent drainage easements, and 13.2 acres of proposed ROW by others.

2.0 Cumulative Impacts Methodology

The proposed project would have direct or temporary impacts which would cause no anticipated indirect impacts to land use, ROW acquisition, displacements, prime and unique farmland, access and travel patterns, pedestrian/bicycle travel, public facilities and services, hazardous materials sites, safety, air quality, traffic noise, or have construction impacts. The proposed project would have direct and indirect impacts to ecological resources (vegetation, wildlife, and potential threatened and endangered species habitat) and water resources (waters of the U.S., including wetlands, floodplains, and water quality). The impacts to ecological and water resources are considered substantial; therefore, a detailed Cumulative Impacts Analysis is required for the proposed SL 288 project. The screening tools included in the January 2019 TxDOT guidance document titled *Cumulative Impacts Analysis Guidance* (January 2019 Guidance) were applied in this Cumulative Impacts Analysis. The Cumulative Impacts Analysis focuses on: 1) those resources substantially impacted by the project; and 2) resources currently in poor or declining health or at risk even if the impact from the proposed action is minimal.

Cumulative impacts on the environment are those that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The Cumulative Impacts Analysis includes a series of analyses, focused on each of the resources selected for detailed consideration. The following information describes the potential cumulative impacts associated with the proposed SL 288 project.

The steps for estimating cumulative impacts recommended in the January 2019 Guidance include defining and documenting the following:

1. Resource Study Area, Conditions, and Trends
2. Direct and Indirect Effects on each Resource from the Proposed Project
3. Other Actions – Past, Present, and Reasonably Foreseeable – and their Effect on each Resource
4. The Overall Effects of the Proposed Project Combined with Other Actions

5. Mitigation of Cumulative Effects

3.0 Resource Study Area, Conditions, and Trends

A series of environmental and socioeconomic resources were reviewed as part of the proposed improvements to SL 288. **Table 1** depicts the direct and indirect impacts on each resource and whether a Cumulative Impacts Analysis is necessary for each resource. According to **Table 1**, a Cumulative Impacts Analysis is required for five resources. Vegetation/wildlife habitat and potential threatened and endangered species habitat are grouped into ecological resources. Water quality, floodplains, and waters of the U.S. (including wetlands) are grouped into water resources.

Table 1: Direct, Indirect, and Cumulative Impacts on Environmental/Socioeconomic Resources from the Proposed SL 288 Project

Environmental/Socioeconomic Resources	Direct Impact	Indirect Impact	Cumulative Impacts Analysis Necessary
Community Resources			
Pedestrian/Bicycle Travel	Yes – Improve Access, Mobility, and Safety	No	No
Public Facilities and Services	Yes – Improved Emergency Response Time	No	No
Environmental Justice	No	No	No
Water Resources			
Water Quality	Potential – Erosion or Sedimentation	Potential – Induced Growth/Development	Potential
Groundwater Resources	No	No	No
Floodplains	Yes – Fill	Yes – Induced Growth/Development	Yes
Waters of the U.S., including Wetlands	Yes – Fill	Yes – Induced Growth/Development	Yes
Ecological Resources			
Vegetation and Wildlife Habitat	Yes – Cleared Vegetation	Yes – Induced Growth/Development	Yes
Threatened and Endangered Species	Potential – State Listed Species Habitat Present	Potential – State Listed Species Habitat Present	Potential – State Listed Species Habitat Present
Cultural Resources			
Archeological Resources	No	No	No
Historic Resources	No	No	No
Additional Resources			
Hazardous Materials	Yes – Unresolved Hazardous Materials Concerns	No	No
Air Quality	Yes – Temporary During Construction	No	No
Traffic Noise	Yes	No	No
Prime and Unique Farmland	Yes – 370.4 Acres of Prime Farmland Soils	No	No
Parkland, Section 4(f) or Chapter 26 Properties	No	No	No

3.1 Resource Study Area (RSA)

The proposed project lies within the Trinity River Basin and within the Elm Fork Trinity Watershed, 8-digit Hydrologic Map Unit (HUC) 12030103 which drains approximately 1,189,167.7 acres. The proposed project is located entirely within the Upper Hickory Creek sub watershed HUC 120301030803 (12-digit HUC Unit). Water generally flows southeast from the project area toward Lake Lewisville. The Water Resources RSA (waters of the U.S., including wetlands, floodplains, and water quality) consists of a combination of five 12-digit HUC sub watersheds that make up the Hickory Creek-Little Elm Reservoir, 10-digit HUC 123010308. The five sub watersheds combine to outline the Water Resources RSA (**Table 2**) and total approximately 178.6 square miles (114,285.8 acres) in size (see **Cumulative Impacts Water Resources RSA** in **Appendix A**). The proposed project would have no potential direct, indirect, or cumulative impacts on any sub watersheds outside of this area.

Table 2: Sub Watersheds within the Water Resources RSA

Sub Watershed Name	Hydrologic Unit Code	Size (acres)
Headwaters Hickory Creek	120301030801	26,328.1
South Hickory Creek	120301030802	25,250.4
Upper Hickory Creek	120301030803	16,657.7
Middle Hickory Creek	120301030804	27,164.8
Lower Hickory Creek	120301030805	18,884.8
Total Water Resources RSA	—	**114,285.8**

The Ecological Resources RSAs includes the agricultural and undeveloped areas which may have the presence of natural vegetation, wildlife, and potential threatened or endangered species habitat that has potential to receive direct or indirect impacts as a result of the proposed project. More specifically this analysis will look into specific habitats for state listed threatened and endangered species or species of greatest conservation need (SGCN) within the previously defined Water Resources RSA. The Water Resources RSA was utilized for a baseline boundary; however, transportation projects and other developments are planned north of the project area. The boundary of the Ecological Resources RSAs extends north along IH 35 to Sanger, then west along FM 455 until it intersects the Water Resources RSA east of FM 1173 for a total of 134,003.6 acres. This area encompasses the home range of any individual state listed species or SGCN for which habitat was identified within the proposed project area except the migratory bird species. Habitat for three state listed species and 28 SGCN were observed in the project area and due to similar habitat types, those species were combined into ten Ecological Resources RSAs. Please refer to the **Cumulative Impacts Ecological Resources RSAs** in **Appendix A** for maps showing the RSA boundaries. The ten Ecological Resources RSAs were selected based on species habitats and vegetation types depicted in Texas Parks and Wildlife Department (TPWD) Ecological Mapping Systems of Texas (EMST) data.

Table 3 depicts the ten Ecological Resources RSAs, habitat type (EMST MOUs and/or common name), species habitat within each RSA, and acres of each RSA. Habitat for each Ecological Resources RSA was derived from EMST data. For example, RSA 1 has the entire Tallgrass Prairie, Grassland MOU and Agriculture MOU as a habitat type. RSA 2 has the entire Tallgrass Prairie, Grassland MOU, but only Barren of Agriculture MOU, Crosstimbers: Savanna Grassland of Cross Timbers Woodland and Forest MOU, and Edwards Plateau: Savanna Grassland of Edwards Plateau Savannah, Woodland, and Shrubland MOU as habitat. EMST data is a tool, so vegetation should be field verified to ensure accuracy; however, it would not be feasible to field verify the vegetation in all Ecological Resources RSAs. Actual vegetation types may vary from the EMST data. Beyond the Ecological Resources RSA boundaries, land use primarily consists of developed land which is not anticipated to be redeveloped, would not support the ecological resources depicted in this document, or is deemed too far away from the proposed project to result in a direct, indirect, or cumulative impact.

Table 3: Ecological Resources RSA Description

Ecological Resources RSA ID	Habitat Type	Species (Common name)	Acreage
RSA 1	MOU - Tallgrass Prairie, Grassland and Agriculture	American badger, American bumblebee, and *Arethaea ambulator* (no common name)	57,676.1
RSA 2	MOU - Tallgrass Prairie, Grassland Common Name – Barren; Crosstimbers: Savanna Grassland; and Edwards Plateau: Savanna Grassland	Western burrowing owl	67,572.5
RSA 3	MOU - Tallgrass Prairie, Grassland and Riparian	Strecker's chorus frog, Woodhouse's toad, and Western hognose snake	51,831.8
RSA 4	MOU - Tallgrass Prairie, Grassland	woodland vole, Western rattlesnake, and Topeka purple-coneflower	38,962.6
RSA 5	100-Year Floodplain	alligator gar, chub shiner, smooth softshell, Louisiana pigtoe, and Texas heelsplitter	21,893.7
RSA 6	MOU - Riparian	mink, mountain lion, Texas garter snake, and timber (canebrake) rattlesnake	12,869.2
RSA 7	MOU - Agriculture Common name - Low Intensity Urban	thirteen-lined ground squirrel	36,080.9
RSA 8	All MOUs except Open Water MOU and Urban High Intensity (Common Vegetation Name)	Western hog-nosed skunk	128,446.8
RSA 9	All MOUs except Open Water MOU and Urban MOU	Eastern box turtle, slender glass lizard, and Western box turtle	111,079.4
RSA 10	All forested and woodland Common Names within Riparian MOU; CrossTimbers Woodland and Forest MOU; Edwards Plateau Savannah, Woodland, and Shrubland MOU; and Disturbed Prairie MOU	big brown bat, Eastern red bat, big free-tailed bat, Hoary bat, Mexican free-tailed bat, tricolored bat, long-tailed weasel and Southern short-tailed shrew	16,627.4

In addition to the geographic limits defined for each of the RSAs considered in this analysis, a time frame is needed for the discussion of each resource's condition. In terms of considering relevant past events, the focus was directed to a decade prior to when the North SL 288 (east of IH 35) construction initiated in 1990. Using 1980 as a starting year for this analysis would give a comparison to what occurred to the areas adjacent to the previously constructed North SL 288 (east of IH 35) before and after construction. Those trends could be used to predict what would occur in the RSAs of the proposed North SL 288 project. Additionally, development in Krum, Ponder, Argyle, Corinth, and Sanger were limited in the early 1980s. The proposed project design year is 2042, which was used as the future temporal limit for this analysis. The use of the future reference point was considered to capture the primary effects of the proposed project as well as the expected effects resulting after the implementation of the proposed project on the specific resources in this analysis. The temporal context for this Cumulative Impacts Analysis is therefore established from the year 1980 which is the estimated time that SL 288 east of IH 35 was constructed to the year 2042 (design year).

3.2 Current Conditions

Land use within and adjacent to the proposed SL 288 project area consists of scattered residential, agricultural, or undeveloped properties with several oil/gas production sites and industrial facilities along the project area. Additionally, the Denton Municipal Airport is located east of the project area near Tom Cole Road. Several waterways with floodplains where development has not occurred are located throughout the project area and RSAs. The majority of the land except floodplains and/or waterways east of US 377 (east of project area) to Lake Lewisville has been developed; therefore, further development in that area would be unlikely. West of the project area is mostly undeveloped areas and oil/gas production sites. Development has occurred in Ponder, Krum, and adjacent to major roadways near those two cities. Zoning ordinances are in effect in the cities of Denton, Sanger, and Krum within the RSAs.

According to the TPWD EMST data, approximately 64 percent of the combined Ecological Resources RSAs is mapped as Agriculture or Tallgrass Prairie, Grassland MOU vegetation types or savanna grassland common names within the Edwards Plateau Savannah, Woodland, and Shrubland and Crosstimbers Woodland and Forest MOU vegetation types. Approximately 13 percent of the Ecological Resources RSAs represents the Open Water MOU and potential riparian, floodplain, and/or wetland areas (Riparian MOU type) which will most likely remain undeveloped in the foreseeable future. Urban MOU consists of approximately 14 percent of the Ecological Resources RSAs and the remainder of the area, 9 percent, are MOU types that consist of shrublands or woodlands outside of riparian areas. EMST data is a tool, so vegetation should be field verified to ensure accuracy; however, it would not be feasible to field verify the entire Ecological Resources RSA.

The diversification of vegetation types located within the project area and remainder of the Ecological Resources RSAs could support various wildlife species, such as small birds, mammals, reptiles, etc. Wildlife in the Ecological Resources RSAs may include those species typically found in undeveloped lands near transportation corridors or near waterways. Such wildlife may include raccoons, rabbits, opossums, squirrels, feral hogs, whitetail deer, snakes, frogs, turtles, and a variety of birds. A biological evaluation form (BEF) and Tier I Site Assessment Form have been completed for the proposed project (June 2019). Coordination with TPWD regarding state listed threatened and endangered species or SGCN would occur prior to the implementation of the proposed project. Appropriate Best Management Practices (BMPs) for state listed species or SGCNs would be included in the Environmental Permits, Issues, & Commitments (EPIC) Sheet.

A Water Resources Technical Report (August 2019) was completed for the proposed project and a total of 22 existing water resources were identified at 19 crossings within the project area, including: 5 wetlands, 8 impoundments/ponds, 2 named linear features, and 7 unnamed linear features. A total of 5,723.7 linear feet and 4.61 acres of water features were identified within the project area; however, preliminary determinations identify 5,723.7 linear feet and 4.27 acres as potential jurisdictional waters of the U.S., including wetlands. The USACE has the authority on the jurisdictional determination of waters of the U.S., including wetlands, and has not verified the waters of the U.S. within the project area. According to the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) data, there is the potential for additional wetlands to occur within the Water Resources RSA, outside of the SL 288 project area. No Section 303(d) impaired waters are located within the project area or within the Water Resources RSA. Although no impaired waters are located within the Waters Resources RSA, appropriate water quality BMPs would be incorporated into the proposed project.

3.3 Trends

Land use within the project area was utilized for agriculture and limited residential and/or commercial use prior to 1980. The residential properties that were present prior to 1980 within the RSAs were mostly scattered large lot properties west of IH 35 and US 377 with denser residential in the center of Denton and along major roadways that connect to the City of Lewisville or Lake Lewisville. Areas with mature trees which provide forests and wildlife habitats were located within the floodplain and for the most part, those forested areas remain intact within the Ecological Resources RSAs. Other undeveloped areas within the RSAs were utilized extensively for agricultural purposes or undeveloped prairie/pasture. Trends have shown that residential and commercial developments within the RSAs have been filling in undeveloped areas west of Lake Lewisville between Lewisville and Denton. Limited undeveloped land is currently available in these areas.

Development within the City of Denton has been moving outward toward North SL 288 since construction of the roadway was finished in the 1990s. The 1984 aerial photograph depicts an approximate 0.5 to 1.0 mile buffer from the existing North SL 288 to major developed areas within Denton. Recent aerial photographs depict only a small buffer south of North SL 288 and an area with the floodplain near Shady Oaks Lane (southeast Denton) are undeveloped. Residential developments are visible north of North SL 288, but for the most part those areas are still undeveloped. Additionally, development has occurred along major roadways in the western and northern portions of the RSA within the cites of Ponder, Sanger, and Krum. Correspondence documented in the Indirect Effects Technical Report (August 2019) states the City of Krum has little land remaining for development.

Most of this development adjacent to North SL 288 has occurred within areas which were previously utilized for agricultural purposes or undeveloped land, and development within the forested floodplain and riparian areas was minimal. Encroachment or loss of vegetation and potential wildlife habitat is the trend as population growth and improved access has led to development converting agricultural, native vegetation, and wildlife habitats into residential and commercial properties. Similar trends are anticipated along the proposed SL 288 project.

Historic aerial photographs depict waterbodies within the Water Resources RSA which have been left unaltered over time, including Hickory Creek, Dry Fork Hickory Creek, South Hickory Creek, North Hickory Creek, Graveyard Branch, Roark Branch, Wolf Branch, Crow Branch, Jordan Creek, Bryant Branch, Fletcher Branch, and their numerous unnamed tributaries. Additionally, several large ponds or impoundments with levees are located within the Water Resources RSA. Local roadside drainage ditches direct runoff to the natural waterbodies within the RSA. The 100-year floodplain of many of the listed creeks, rivers, and tributaries are located within the Water Resources RSA. Wetlands were observed within the project area and may be located throughout the undeveloped areas of the Water Resources RSA as the general area is relatively flat and any low areas may potentially hold water for a long enough period of time during the growing season to exhibit wetland characteristics, especially in the floodplain.

The implementation of the proposed project would improve access and mobility in the project area making undeveloped areas more appealing to developers as the proposed SL 288 would create a new bypass around the west side of Denton by connecting IH 35W to IH 35. Such appeal may result in additional residential and/or commercial development which would create loss of vegetation, wildlife, and potential threatened and endangered species habitat as well as potentially fill jurisdictional waters and wetlands. Clearing of vegetation from future developments may impact water quality by increasing erosion and sedimentation in the local waterbodies.

As depicted in the trends of development after the completion of North SL 288 in Denton and the developments within the cities of Ponder, Sanger, and Krum, it is anticipated that areas between Denton and the proposed SL 288 would become densely developed and agriculture or undeveloped land within the western portions of the RSA may be developed by individuals who seek larger lot residential properties similar to those that currently exist along the proposed project area.

4.0 Direct and Indirect Effects on each Resource from the Proposed Project

4.1 Ecological Resources

The proposed roadway facility would be constructed primarily on new location and includes approximately 26.6 acres of existing roadway ROW, 401.5 acres of proposed ROW, 1.2 acres of proposed permanent drainage easements, and 13.2 acres of proposed ROW by others. Land alteration to construct the transportation facility would include the conversion of maintained roadside vegetation within the previously disturbed roadway ROW, agriculture, pasture/undeveloped fields, woodlands, riparian areas, and maintained areas (residential property). The proposed project is on new location; therefore, fragmentation of vegetative and wildlife habitat is anticipated within the proposed project area. Access was not granted for all parcels along the ROW; therefore, observations of vegetation and biological habitat at such parcels occurred from the parcels with right-of-entry and/or aerial photography. Wildlife within the project area and Ecological Resources RSA may adapt to potential future urban/suburban conditions or may relocate to remaining undeveloped areas within the Ecological Resources RSAs.

No federal or state listed threatened and endangered species were observed within the project area; however, two SGCNs were observed during a site visit in May 2019 (alligator gar and the American bumblebee). In addition to the aforementioned species, potential habitat for three state listed species and 27 other SGCNs were observed during field investigations. Such species include the state threatened Louisiana pigtoe, Texas heelsplitter, and timber rattlesnake. Potential habitat for the following SGCNs were observed in the project area: Strecker's chorus frog, Woodhouse's toad, Western burrowing owl, American badger, big brown bat, big free-tailed bat, Eastern red bat, Hoary bat, Mexican free-tailed bat, tricolored bat, long-tailed weasel, mink, mountain lion, Southern short-tailed shrew, thirteen-lined ground squirrel, Western hog-nosed skunk, woodland vole, Eastern box turtle, slender glass lizard, smooth softshell, Texas garter snake, Western box turtle, Western hognose snake, Western rattlesnake, chub shiner, *Arethaea ambulator,* and Topeka purple-coneflower. TPWD has species specific BMPs for state listed threatened or endangered species or SGCNs. Appropriate BMPs would be in place and coordination with TPWD would be completed regarding potential impacts to state listed threatened species and SGCN prior to construction of the proposed project.

Similar conditions for the ecological resources are expected in undeveloped areas throughout the RSA. The conversion of undeveloped land to commercial, residential, or transportation uses as a result of increased growth and development is anticipated within the Ecological Resources RSAs. The direct impacts associated with this project, in addition to increased population growth and development in the project vicinity, would contribute to a cumulative impact of loss or fragmentation of vegetative and wildlife habitat as well as potential SGCN habitat within the Ecological Resources RSAs.

4.2 Water Resources

A detailed Water Resources Technical Report (August 2019) was prepared for this project which discusses the direct and indirect impacts to the water resources discussed in this Cumulative Impacts Analysis Report. As identified in the Water Resources Technical Report, a total of 22 existing water resources were identified at 19 crossings within the project area including: 5 wetlands, 8 impoundments/ponds, 2 named linear features, and 7 unnamed linear features. A total of 5,723.7 linear feet and 4.61 acres of water features were identified within the project area; however, preliminary determinations identify 5,723.7 linear feet and 4.27 acres as potentially jurisdictional waters of the U.S., including wetlands. Direct impacts to 4,154.07 linear feet and 1.20 acres of jurisdictional waters of the U.S., including wetlands, would occur as a result of the improvements to SL 288. The proposed project crosses 5 waterways with a 100-year floodplain designation and approximately 31.7 acres of the 100-year floodplain are located within the proposed project area. Fill within the floodplain to construct the roadway would result in direct impacts; however, the proposed project would not increase the base flood elevation to a level that would violate applicable floodplain regulations or ordinances.

No Section 303(d) impaired waters are located within five miles of the project area or within the Water Resources RSA. BMPs would be in place prior to and during construction; therefore, the proposed improvements to SL 288 are not anticipated to contribute to erosion, sedimentation, or water quality impacts during or following the construction process. An increase in impermeable cover (i.e., roadway) could, however, increase pollutants, such as vehicle oil on the roadway surface, which could enter receiving waters from stormwater runoff. No direct or indirect impacts are anticipated to impact water quality or Section 303(d) impaired waters.

According to the United States Geological Survey (USGS) National Hydrography Dataset (NHD), a total of 418.6 stream miles are located within the Water Resources RSA. Additionally, USFWS NWI data identified 3,910.7 acres of water resources (wetlands, rivers, lakes/ponds, etc.) and the Federal Emergency Management Agency (FEMA) mapped approximately 18,499.4 acres of the 100-year floodplain within the Water Resources RSA. Future impacts to these resources may result from increased population growth and

development within the RSA. The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into waters of the U.S. and regulating quality standards for surface waters through Sections 404, 401, 402, and 303 of the Act. Future impacts may result from increased population growth and development within the RSA. These direct and indirect impacts are anticipated to contribute to a cumulative impact on water resources within the Water Resources RSA; however, such impacts would be documented, coordinated and permitted through the US Army Corps of Engineers (USACE) and/or Texas Commission on Environmental Quality (TCEQ), as needed.

5.0 Other Actions – Past, Present and Reasonably Foreseeable and their Effect on each Resource

5.1 Past Actions

The proposed SL 288 would be a new location roadway west of Denton that connects IH 35W to IH 35 and extends the existing North SL 288. The project area is similar to the conditions adjacent to North SL 288 when it was constructed in the 1990s. Major residential and commercial development inside of North SL 288 has occurred since the completion of the project in the late 1990s. Prior to the timeframe of this analysis (1980) the majority of development within the RSAs was east of IH 35 along US 377, US 77, IH 35, and University Drive. University Drive was the only major roadway west of IH 35 within the RSAs in the 1980s. The remainder of the roadways west of IH 35 were and still remain minor FM or county roads. Prior to 1980, west of IH 35 consisted of scattered large lot residential areas near major roadways, agriculture land, and undeveloped property with minor developments in the cities of Ponder, Sanger, and Krum. Minor residential and commercial development occurred west of IH 35 in the 1980s and 1990s; however, more widespread development was observed east of IH 35 during this timeframe. Oil and gas production sites started becoming prominent in the western portion of the RSAs in the late 1990s and have been steadily increasing since that time. Historic aerial photographs depict earthwork for large residential subdivisions beginning in the early 2000s which expanded the cities of Ponder, Sanger, and Krum and commercial developments near IH 35. Most of this development has occurred within areas which were previously utilized for agricultural purposes, and development within the forested floodplain and riparian areas was minimal. No evidence of channel alteration of natural waterbodies is visible in historic aerial photographs. Such past developments potentially created loss of ecological and water resources within the RSAs, but for the most part, development within the general project area has appeared to avoid areas where ecological and water resources would likely be present.

5.2 Current Actions

Currently, earthwork is being completed and vegetation has been cleared for the expansion of existing residential subdivisions or creation of new residential or commercial

developments within the RSAs. Such current impacts would potentially create loss of vegetation, wildlife, and threatened and endangered species habitat as well as waters of the U.S., including wetlands. Recent aerial photographs and site visits depict detention basins within most new residential or commercial developments. Additionally, BMPs for erosion and sediment control including sediment fences and straw bales to reduce potential water quality impacts were observed during site visits or visible in recent aerial photographs. One area of disturbance was observed within/adjacent to the project area east of Tom Cole Road and east of the Denton Municipal Airport.

5.3 Reasonably Foreseeable Actions

The proposed project area is located within the City of Denton in Denton County. According to the US Census Bureau data collected for the Indirect Impacts Technical Report (August 2019), the population within the area of influence (AOI) increased by nearly 50 percent between 1990 and 2017. Cities and unincorporated areas in the region are currently experiencing a moderate to high degree of development and population growth and are expecting more in the future. The City Planner from Krum stated that the community is largely residential and that the rate of development would likely increase due to improved access to Denton resulting from the proposed project. Industrial and mixed-use development as well as residential development are expected and included in Denton 2030 Plan within the city limits inside the RSAs and along the project area.

The cities of Denton, Krum, and Sanger and Denton County planning information were utilized to determine if undeveloped parcels within the RSAs were platted for residential or commercial development. According to those resources, approximately 6,203 acres or 4.6 percent of the Ecological Resources RSA are planned for development. However, as depicted in the Indirect Impacts Technical Report, approximately 5,163 acres or 18.0 percent of the AOI are planned for development. Most planned developments within the RSAs are located in Krum; however, a large master planned community is located along IH 35W in southwestern Denton. Other large parcels of land are owned by corporations or other companies and many are agricultural. Several residential developments are being constructed or expanded within the RSAs, as visible in recent aerial photography. Expansion of existing residential subdivisions, as well as undeveloped parcels, would provide the potential for future residential, commercial, and industrial development along the project area and within the RSAs.

In addition to the anticipated residential and commercial development, numerous transportation projects are expected to accommodate population growth within the RSAs. Reasonably foreseeable actions that may affect the identified resources include local or regional projects that may interact with the proposed actions (in this case, proposed improvements to SL 288). A list of major projects and planned developments included in the

North Central Texas Council of Governments Metropolitan Transportation Plan – Mobility 2045 (2018), Denton Plan 2030, City of Krum – New Developments, and the 2017 City of Sanger Zoning Map, located within or adjacent to the RSAs, are listed in **Table 4**.

Table 4: Planned Transportation/Development Projects within the RSAs

Transportation Facility/Development	Limits	MTP/RSA ID/CSJ	Project Description
FM 2449	End of Maintenance to IH35W	5685-02-025	Reconstruct Existing Roadway
FM 1515 (New)	Masch Branch Street to Bonnie Brae Street	1951-01-011	Proposed New Location Roadway
IH 35W (New)	Dale Earnhardt Way to S of IH35E/IH35W Interchange	0081-13-065	Proposed New Location Roadway
IH 35W (New)	SH 114 to IH35E/IH35W Interchange	0081-13-059	Proposed New Location Roadway
IH 35W (New)	SH 114 to IH35E/IH35W Interchange	0081-13-050	Proposed New Location Roadway
IH 35W	At W Graham Bridge and KCS RR NB and SB	0081-13-064	Bridge Replacement
IH 35	IH 35W to US 380	0195-03-090	Interchange Improvement
IH 35 (New)	US 380 to US 77	0195-03-061	Proposed New Location Roadway
IH 35 (New)	US 380 to US 77	0195-03-087	Proposed New Roadway Lanes
FM 1173 (New)	FM 156 to IH 35	1059-01-047	Proposed New Location Roadway
FM 2450	FM 156 to Cooke CL	2353-02-026	Reconstruct Existing Roadway
US 377	IH 35E to S of FM 1830	0081-04-025	Widen Roadway Facility
US 377	S of FM 1171 to Crawford Rd	0081-03-047	Proposed New Location Roadway
US 377	N of Hickory Creek to FM 1830	0081-04-038	Proposed New Location Roadway
FM 2181	Lillian Miller to W of FM 2499	2054-02-015	Widen Roadway Facility
IH 35E	FM 407 to Turbeville Road	0196-02-125	Proposed New Location Roadway
Vintage Parkway	IH 35W to US 377	1.430.225	Widen Roadway Facility
IH 35W	IH 25W (North)	5.10.2	New or Additional Freeway Capacity
FM 2499	S of FM 2181 to FM 407	1.475.225	Widen Roadway Facility
IH 35W	Fort Worth ITC to Texas Health Presbyterian Park and Ride in Denton	TR2-0093	New Corridor High-Intensity Bus
Hopkins Meadows – Phases 1&2	East of Hopkins Road	N/A	Planned Single-Family Residential
Fowler Farms	East of Hopkins Road	N/A	Planned Single-Family Residential
The Retreat at Krum	West of Hopkins Road	N/A	Planned Single-Family Residential (Age Restricted)
Aspen Park – Phase 2	East of Shady Lane	N/A	Planned Single-Family Residential
McCart Street LLC – Project A	South of East McCart Street and West of Evans Avenue	N/A	Planned Mixed Use Single-Family Residential/Commercial
McCart Street LLC – Project B	South of East McCart Street and West of Masch Branch Rd	N/A	Planned Mixed-Use Multi-Family Residential/Commercial
McCart Street LLC – Project C	North of East McCart Street and West of East 6th Street	N/A	Planned Commercial
Erickson Project	East of Hopkins Road	N/A	Planned Single-Family Residential
Cole Ranch Master Planned Community	West of IH 35 and in the path of proposed SL 288	N/A	Master Planned Community/Mixed-Use
Unnamed Residential	West of IH 35 and east of Keaton Rd, Sanger, TX	N/A	Single Family Future Land Use

Source: North Central Texas Council of Governments Metropolitan Transportation Plan – Mobility 2045 (2018), TxDOT Project Tracker, City of Krum - New Developments, 2017 City of Sanger Zoning Map, and Indirect Impacts Technical Report (2019).

These reasonably foreseeable transportation projects and planned residential and commercial developments listed in **Table 4** would most likely impact the resources defined in this analysis. The potential for fragmentation or loss of ecological resources as well as impacts to water resources from future transportation projects or residential and commercial developments is foreseeable.

6.0 The Overall Effects of the Proposed Project Combined with Other Actions

As discussed earlier in this analysis, direct and indirect impacts would result from the implementation of the proposed project. Based on the previous direct and indirect impact assessments, resources were further evaluated to consider the cumulative impacts that could occur from the proposed project in the RSAs. The proposed project and other past, present and reasonably foreseeable future actions were considered in the cumulative impacts analysis. The following were identified as part of this analysis: projects under construction, projects that are proposed or planned, reasonably foreseeable projects (including projects listed in **Table 4**), and residential and commercial developments. This assessment considered the impacts of the proposed project combined with the impacts of the other projects on resources within all or part of the same area and timeframe. The direct and indirect impacts from the proposed action may result in potential cumulative impacts to resources within the Ecological Resources and Water Resources RSAs, as discussed below.

6.1 Ecological Resources

The implementation of the proposed project would permanently impact vegetation and wildlife habitat as well as potential state threatened and endangered species habitat. Past and present trends indicate that once new or expanded access to undeveloped lands is provided, natural vegetation, wildlife habitat, and potential threatened and endangered species habitat is converted to urban/suburban areas or other man-made developments.

Foreseeable cumulative impacts may include the fragmentation or complete loss of natural vegetation, wildlife, or threatened and endangered species habitat resulting from development within the Ecological Resources RSAs. Wildlife and birds within the project area and Ecological Resources RSAs may adapt to urban conditions or the fragmented habitat or may relocate to remaining undeveloped areas within the Ecological Resources RSAs. Acreage of proposed project impacts and potential planned developments impacts within the Ecological Resources RSAs and whether each RSA is subject to cumulative impacts are depicted in **Table 5**. After removing potential ecological habitat impacts from proposed projects and planned developments, potential habitat remaining in the Ecological Resource RSAs range from 92.3 percent to 96.7 percent.

Table 5: Ecological Resources RSA Description

Ecological Resources RSA ID	Total Acreage	Direct Impacts Acreage	Planned Developments Acreage	Remaining Acreage (Percentage)	Subject to Cumulative Impacts
RSA 1	57,676.1	182.9	3,946.7	53,546.5 (92.8 %)	Subject to cumulative impacts
RSA 2	67,572.5	205.6	3,961.1	63,405.8 (93.8 %)	Subject to cumulative Impacts
RSA 3	51,831.8	128.7	3,872.7	47,831.1 (92.3%)	Minimal cumulative impacts anticipated
RSA 4	38,962.6	111.5	2,893.8	35,957.3 (92.3 %)	Subject to cumulative impacts
RSA 5	21,893.7	31.70	978.9	20,883.1 (95.4 %)	Minimal cumulative impacts anticipated
RSA 6	12,869.2	17.2	591.5	12,260.5 (95.3 %)	Minimal cumulative impacts anticipated
RSA 7	36,080.9	108.9	1,085.2	34,886.8 (96.7 %)	Minimal cumulative impacts anticipated
RSA 8	128,446.8	438.5	6,130.4	121,877.9 (94.9 %)	Minimal cumulative impacts anticipated
RSA 9	111,079.4	401.1	6,098.1	104,580.2 (94.1 %)	Minimal cumulative impacts anticipated
RSA 10	16,627.4	51.1	630.0	15,946.3 (95.9 %)	Minimal cumulative impacts anticipated

Habitat for all three state listed threatened species (Louisiana pigtoe, Texas heelsplitter, and timber rattlesnake) and six SGCNs (alligator gar, chub shiner, smooth softshell, mink, mountain lion, and Texas garter snake) are located within Ecological Resources RSA 5 (100-Year Floodplain) and Ecological Resources RSA 6 (Riparian MOU). There would be direct impacts to 31.7 acres of floodplain and 17.15 acres of riparian areas as a result of the implementation of the proposed SL 288 project. Planned developments include 978.9 acres of floodplain and 591.5 acres of riparian areas. Minimal indirect or cumulative impacts are anticipated as these habitats would most likely be avoided from future development as previous trends depict such floodplain and riparian areas have been avoided since the development of the project area began.

Habitats for 15 of the 23 remaining SGCNs (Strecker's chorus frog, Woodhouse's toad, Eastern box turtle, slender glass lizard, Western box turtle, Western hognose snake, Western hog-nosed skunk, big brown bat, big free-tailed bat, Eastern red bat, Hoary bat, Mexican free-tailed bat, tricolored bat, long-tailed weasel, and Southern short-tailed shrew) are located within Ecological Resources RSAs 3, 8, 9, and 10 all of which have an overlap of Riparian MOU and one or more habitats; therefore, those species may relocate to riparian areas which are anticipated to have minimal development or cumulative impacts.

The thirteen-lined ground squirrel habitat is RSA 7 and consists of agriculture and areas of low urban intensity. Future urban development could produce additional potential habitat for

the thirteen-lined ground squirrel; therefore, the proposed project is anticipated to have minimal cumulative impacts on this species.

The habitat for the seven remaining SGCNs (Western burrowing owl, American badger, woodland vole, Western rattlesnake, American bumblebee, *Arethaea ambulator,* and Topeka purple-coneflower) includes Tallgrass Prairie, Grassland MOU, Agriculture MOU, and Savanna Grassland Common Names (Ecological Resources RSAs 1, 2, and 4). The proposed project and planned developments would impact approximately 5,014.1 acres of habitat for these seven species. Suitable habitat for the seven SGCNs that would remain include 80,995.0 acres or 63.4 percent of the total Ecological Resources RSA would remain. Ecological Resources RSAs 1, 2, and 4 do not overlap floodplain or riparian areas which have been avoided since the development of the project area began so these RSAs and the seven remaining SGCNs would be subject to cumulative impacts.

6.2 Water Resources

The project would result in 4,154.07 linear feet and 1.20 acres of impacts to jurisdictional waters of the U.S., including wetlands. Permanent impacts would be minimized to the extent practicable by constructing bridge structures over major water crossings to avoid extensive impacts to the waterbody and adjacent wetland areas. Indirect impacts to water quality may result from erosion and sedimentation due to increased development and the associated removal of vegetation. Potential for cumulative impacts may result from direct and indirect impacts on numerous parcels of land (consecutively or simultaneously) within the Water Resources RSA. Induced growth and development pressures may increase erosion and sedimentation in addition to increasing drainage needs related to commercial and residential development as well as additional transportation infrastructure and infrastructure improvements related to subsurface utilities (i.e., water distribution lines, wastewater collection lines, fire protection lines, electrical/fiber optic or cable utilities, natural gas utilities, etc.). Historic and recent aerial photographs illustrate that development within the 100-year floodplain and areas adjacent to waterways has been avoided, for the most part, and streams follow historic courses. Site visits and aerial photographs depict large developments have incorporated detention basins and other water quality BMPs in design plans.

Readily available planning resources depicts there is approximately 418.6 stream miles, 3,910.7 acres of water resources (wetlands, rivers, lakes/ponds, etc.), and 18,499.4 acres of the 100-year floodplain within the Water Resources RSA. Future development is anticipated to follow past and present trends and avoid major waterways and floodplains as additional coordination and/or mitigation with local, state, and federal agencies may be necessary. Future impacts to water resources may occur; however, due to other available land such impacts are anticipated to be minimal. Potential future impacts to water

resources would be mitigated through water quality certifications implemented and regulated by the TCEQ. Impacts to jurisdictional waters would be documented, coordinated, and permitted through the USACE for both public and private entities, as necessary, and the USACE would require consideration of compensatory mitigation, as applicable. Construction within a floodplain would require coordination with the floodplain administrator and the appropriate floodplain mitigation would need to be installed. Although potential cumulative impacts to water resources are anticipated, current local, state, and federal laws and regulations would require coordination, certification, and potential mitigation prior to any impacts; therefore, cumulative impacts to water resources would be minimal within the Water Resources RSA.

7.0 Mitigation of Cumulative Effects

Any direct, indirect, and cumulative impacts that may occur to ecological resources and water resources would be addressed by the entity impacting the resource. The potential for future transportation projects, private and/or municipal undertakings exists within the project area. The cities of Denton, Sanger, and Krum have planning and zoning policies or ordinances in place that future developers would need to adhere to during the development planning phase. The improved mobility and access along the proposed SL 288 would make the undeveloped areas adjacent to the future SL 288 and other locations within the RSAs more desirable to future residential or commercial development. With the upgraded access of the proposed SL 288 and being in close proximity to Denton, much of the undeveloped areas of the RSA would be expected to be developed. Planning and zoning policies and ordinances would allow the cities along the project area to determine the appropriate development within their limits.

No mitigation is offered for the cumulative impacts potentially occurring as a result of the proposed project as the goals of the project would be accomplished with impacts but without detriment to local resources. The construction of SL 288 on new location would add continuous one-way frontage roads, shared bicycle lanes, and sidewalks. These additions would meet the project goals of improving mobility, accommodating future traffic demand, enhancing access, and improving safety along SL 288 between IH 35W and IH 35. Sensitive or vulnerable resources are not anticipated to be impacted or decline as a result of the implementation and construction of the proposed SL 288 project. The following section discusses how each of these potential impacts would be addressed.

7.1 Ecological Resources

The proposed project would result in direct impacts including alteration of vegetation within 26.6 acres of existing ROW, approximately 402.7 acres of proposed ROW and drainage easements, and 13.2 acres of proposed ROW by others. Such vegetated areas that would be altered for the construction of the SL 288 project may have potential wildlife habitat or

threatened and endangered species habitat. Future impacts to ecological resources would be assessed and addressed for each individual project that might involve federal funds, including TxDOT projects. Other privately funded land development projects would not be expected to prepare publicly available environmental documentation. The only exception would be developments that were required to meet federal requirements such as Section 404 permitting through the USACE and adherence with the Endangered Species Act. Such federal requirements would allow for regulation on threatened and endangered species for privately funded projects. Continued development in the project area is expected and will likely result in the conversion of vegetation, wildlife habitat, and potential threatened and endangered species habitat on undeveloped land to residential, commercial, and light industrial uses.

7.2 Water Resources

The proposed project would result in direct impacts to waters of the U.S., including wetlands, and fill within floodplains. BMPs for erosion and sediment control would be in place prior to and during construction activities to limit water quality impacts. Cumulative impacts to water resources are expected to occur due to increased development in the general project area once improvements to SL 288 are complete. The associated removal of vegetation with increased development may result in increased erosion and sedimentation of local waterbodies. The CWA regulates the discharges of pollutants into waters of the U.S. and regulating quality standards for surface waters through Sections 404, 401, 402, and 303 of the Act for both public and private entities. TCEQ Construction General Permit requirements would necessitate BMPs for erosion and sediment control at construction sites. In addition to an increase in drainage needs related to commercial and residential development, other cumulative impacts may include the construction of additional transportation infrastructure, water distribution lines and wastewater collection lines, the treatment of wastewater, etc. Many of these potential impacts would be mitigated through water quality BMPs implemented and regulated by TCEQ. Impacts to jurisdictional waters would be documented, coordinated, and permitted through the USACE, as necessary, and the USACE would require consideration of compensatory mitigation in some instances. Construction within a floodplain would require coordination with the floodplain administrator and the appropriate floodplain mitigation would need to be installed.

8.0 References

AASHTO. 2011. Practitioner's Handbook #12 Assessing Indirect Effects and Cumulative Impacts under NEPA.

CEQ, 1997. Considering Cumulative Effects under the National Environmental Policy Act: Council on Environmental Quality.

City of Denton

- 2015. Denton Plan 2030
- 2015. Mobility Plan
- 2016. Existing Land Use Map
- 2016. Zoning Map
- 2017. Future Land Use Map

City of Krum

- 2005. Comprehensive Plan Map
- 2018. Parks and Open Space Master Plan
- 2019. CIP Mapping
- 2019. CIP Costs
- 2019. Zoning Map

City of Ponder

- 2000. Zoning District Map

Denton County

- 2017. Thoroughfare Plan

FHWA, 2003. FHWA Interim Guidance: Questions and Answers Regarding Indirect and Cumulative Impact Considerations in the NEPA Process.

NCHRP, 2008. NRCHP Project 25-25, Task 43, Legal Sufficiency Criteria for Adequate Indirect Effects and Cumulative Impacts Analysis as Related to NEPA Documents.

North Central Texas Council of Governments (NCTCOG). 2018. Mobility 2045 – 2045 Metropolitan Transportation Plan.

Texas Department of Transportation (TxDOT).

- 2014. Risk Assessment for Cumulative Impacts Analysis Guidelines
- 2014. Cumulative Impacts Decision Tree
- 2015. Scope Development Tool
- 2019. Cumulative Impacts Analysis Guidelines

- 2019. SL 288 Water Resources Technical Report
- 2019. SL 288 BEF/Tier I Site Assessment Forms
- 2019. SL 288 Indirect Impacts Technical Report

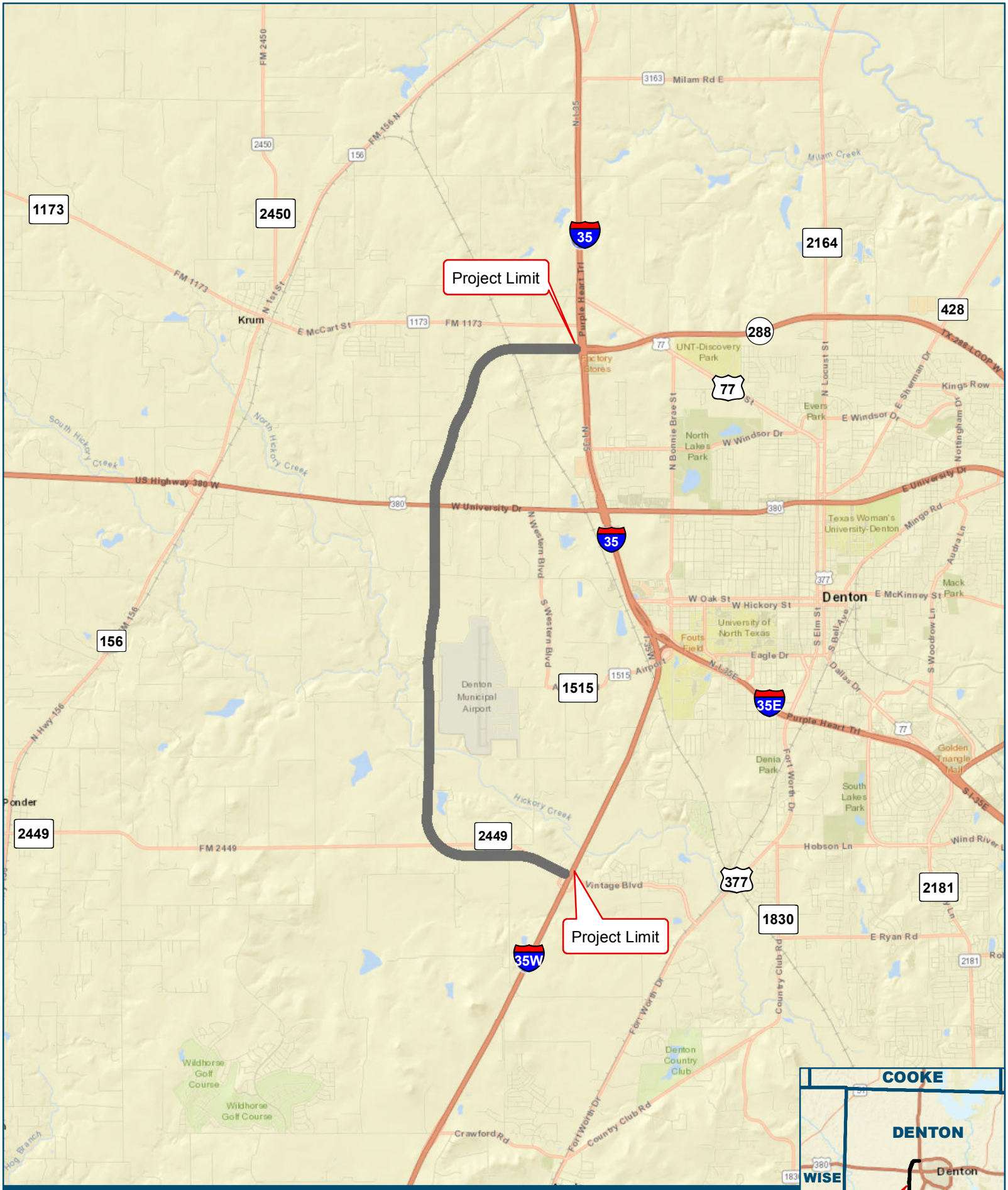
APPENDIX A

EXHIBITS

PROJECT LOCATION MAP

CUMULATIVE IMPACTS WATER RESOURCES RSA MAP

CUMULATIVE IMPACTS ECOLOGICAL RESOURCES RSA MAPS



Project Location Map

SL 288

From IH 35W to IH 35

Denton County | CSJ: 2250-02-013 & 2250-02-014

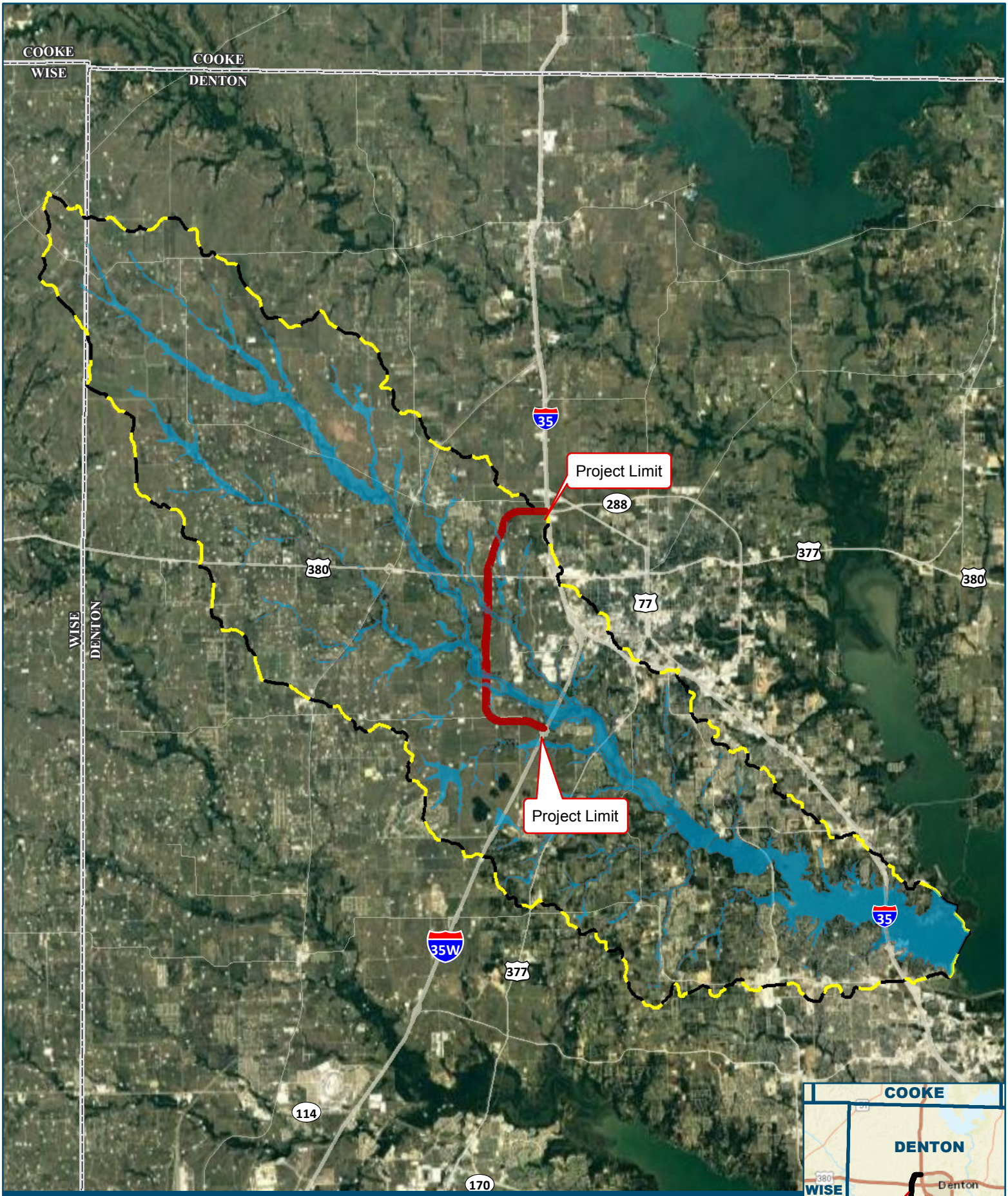
Project Area

Miles

0 0.5 1

NORTH

Basemap: ESRI Street



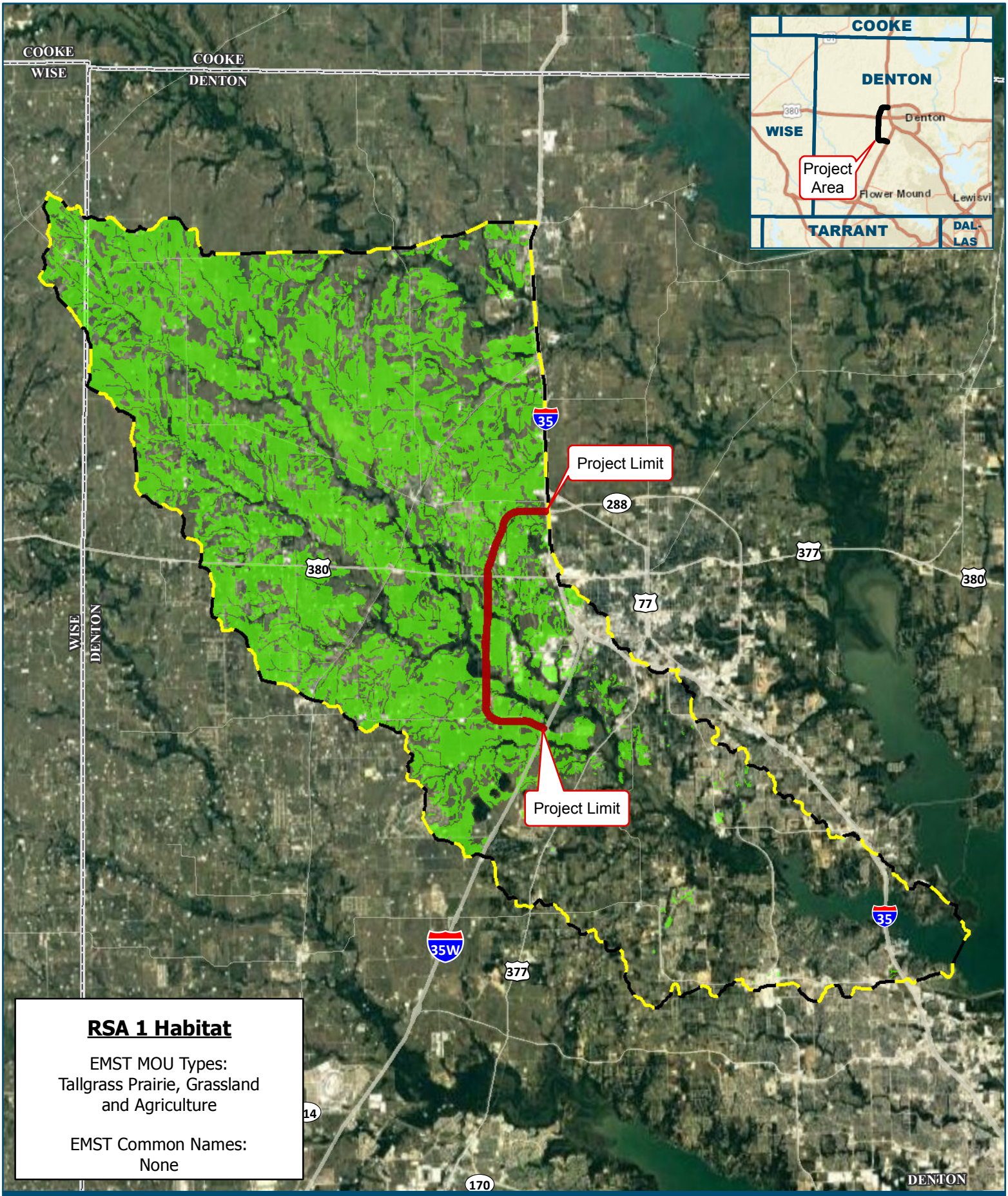
Cumulative Impacts
Water Resources RSA

SL 288
From IH 35W to IH 35
Denton County | CSJ: 2250-02-013 & 2250-02-014

Project Area
County Boundary
Water Resources RSA
100-year Floodplain

NORTH
Miles
0 1 2

Sources: Google Imagery, NRCS Watersheds, FEMA



Cumulative Impacts
Ecological Resources RSA 1

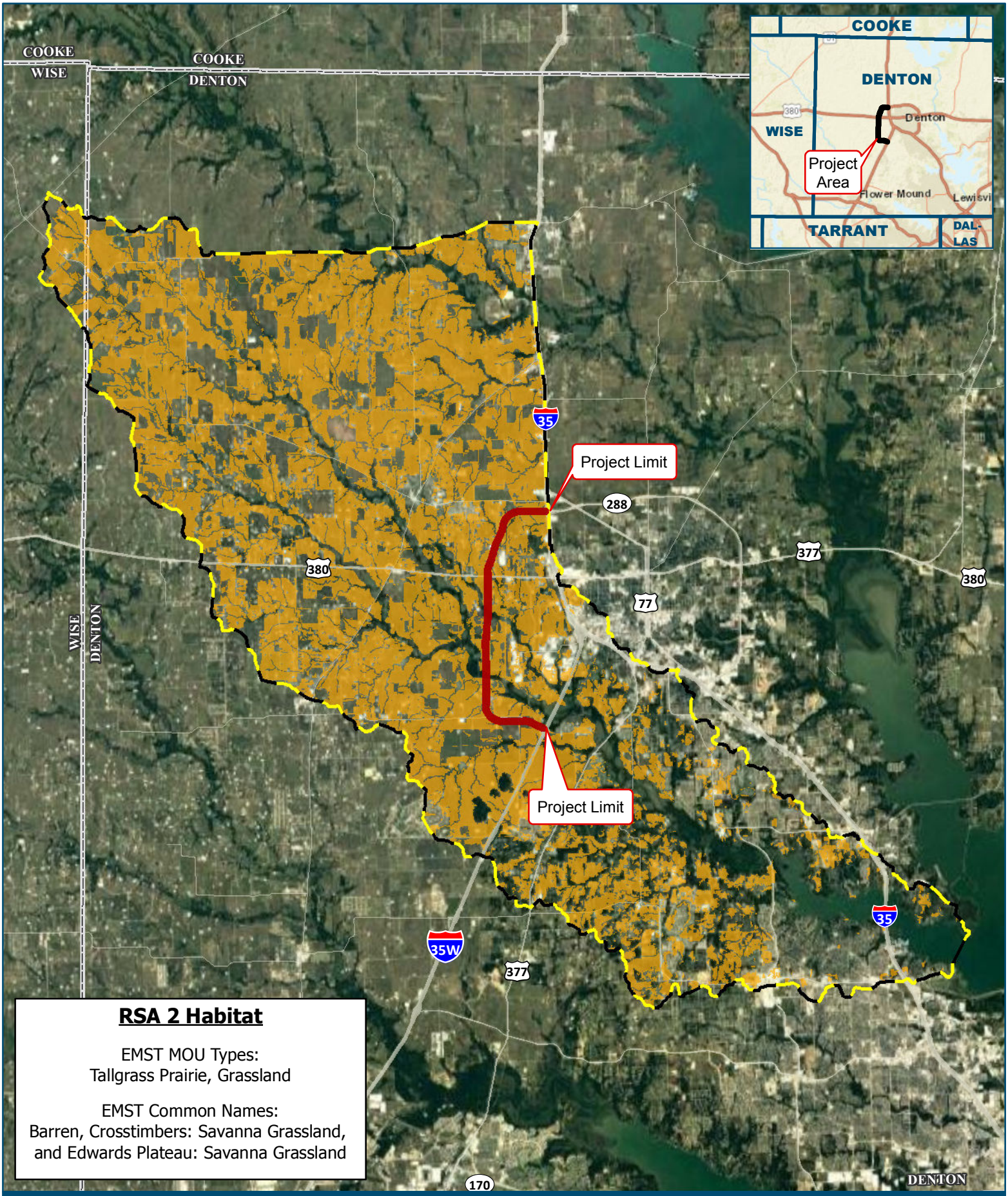
SL 288

From IH 35W to IH 35
Denton County | CSJ: 2250-02-013 & 2250-02-014

RSA 1 Habitat
Project Area
RSA Boundary
County Boundary

NORTH
Miles
0 1 2

Sources: Google Imagery, NRCS Watersheds, TxDOT EMST



Cumulative Impacts
Ecological Resources RSA 2

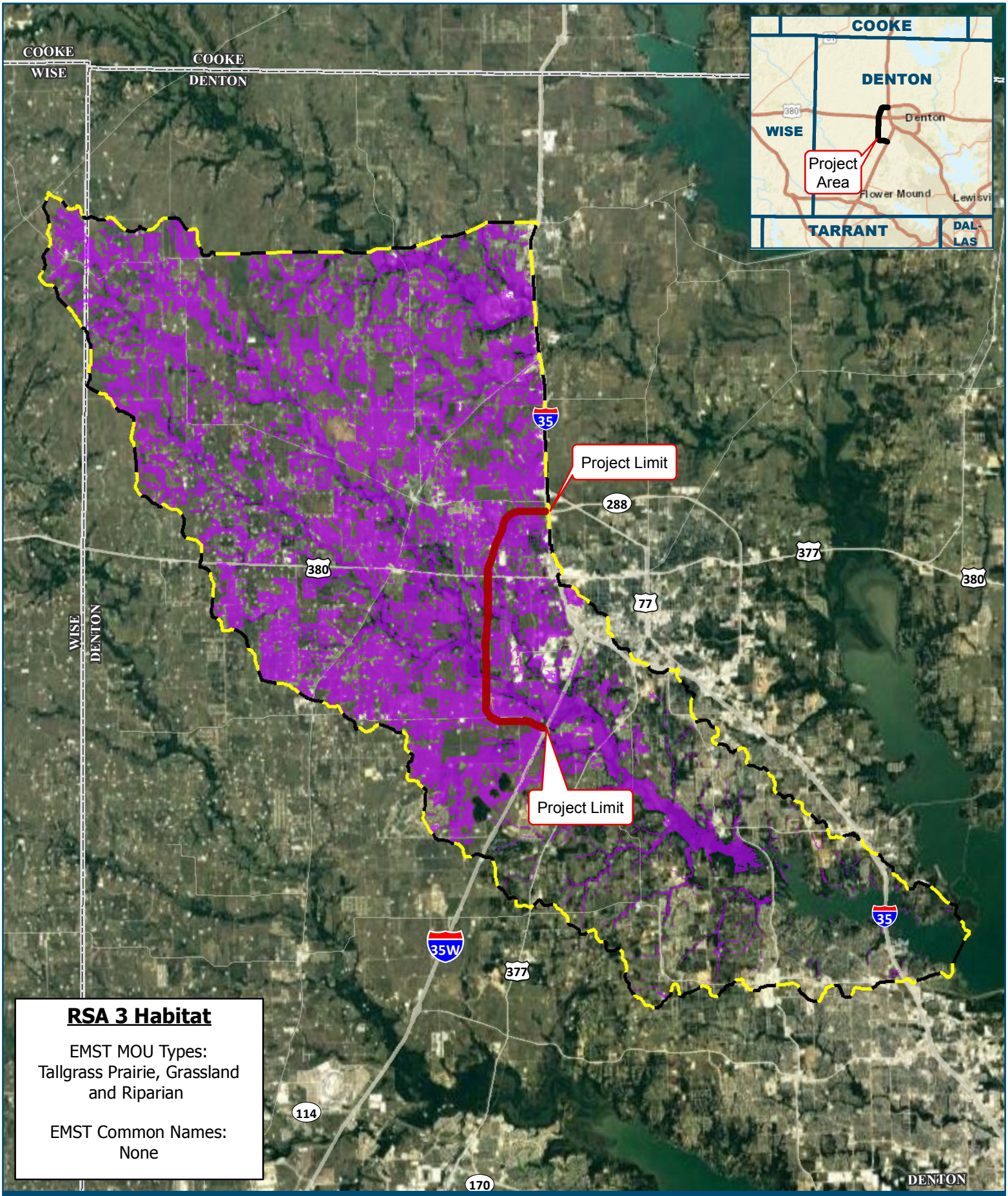
SL 288

From IH 35W to IH 35
Denton County | CSJ: 2250-02-013 & 2250-02-014

RSA 2 Habitat
Project Area
RSA Boundary
County Boundary

NORTH
Miles
0 1 2

Sources: Google Imagery, NRCS Watersheds, TxDOT EMST



Cumulative Impacts
Ecological Resources RSA 3

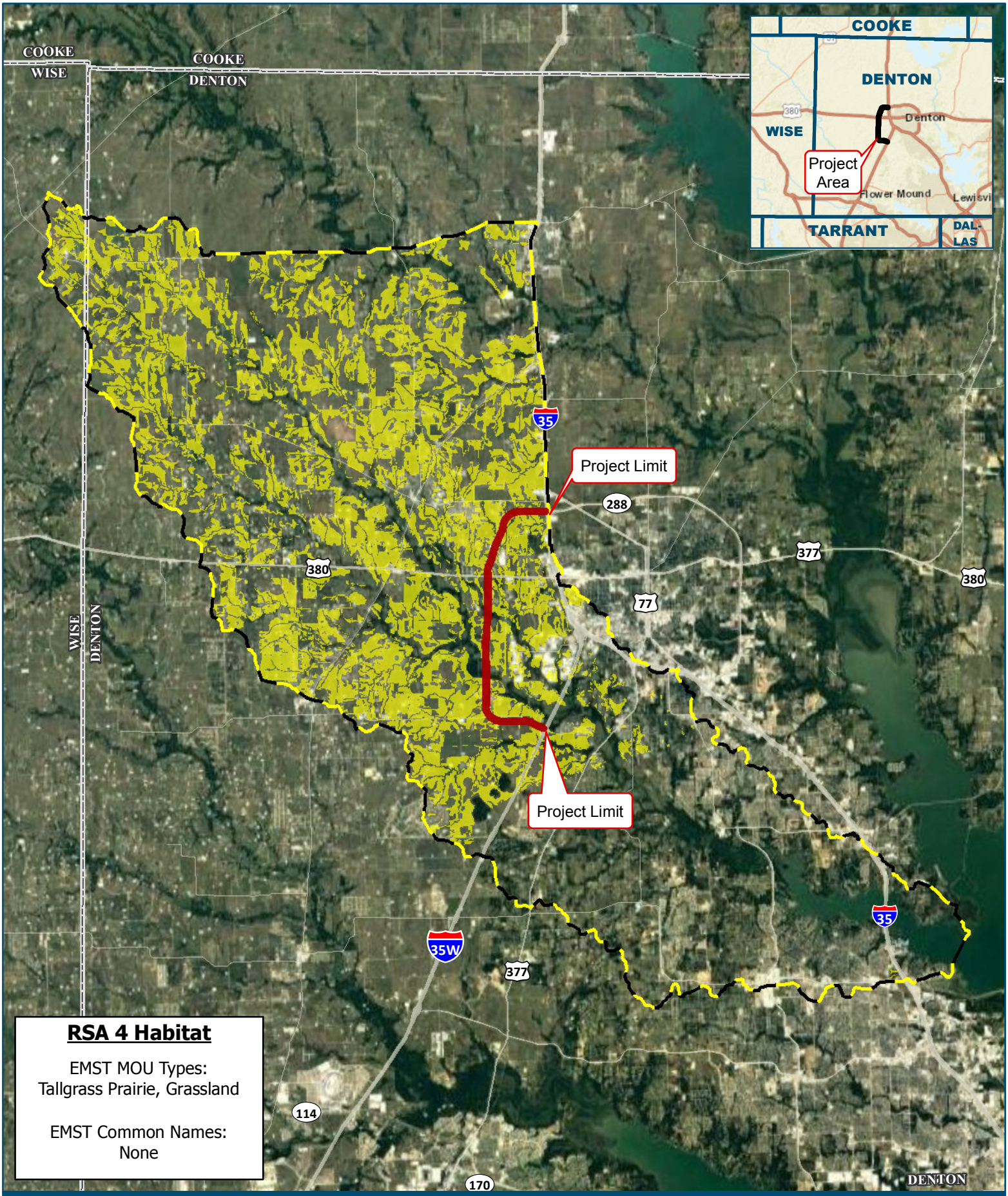
SL 288

From IH 35W to IH 35
Denton County | CSJ: 2250-02-013 & 2250-02-014

RSA 3 Habitat
Project Area
RSA Boundary
County Boundary

NORTH
Miles
0 1 2

Sources: Google Imagery, NRCS Watersheds, TxDOT EMST



Cumulative Impacts
Ecological Resources RSA 4

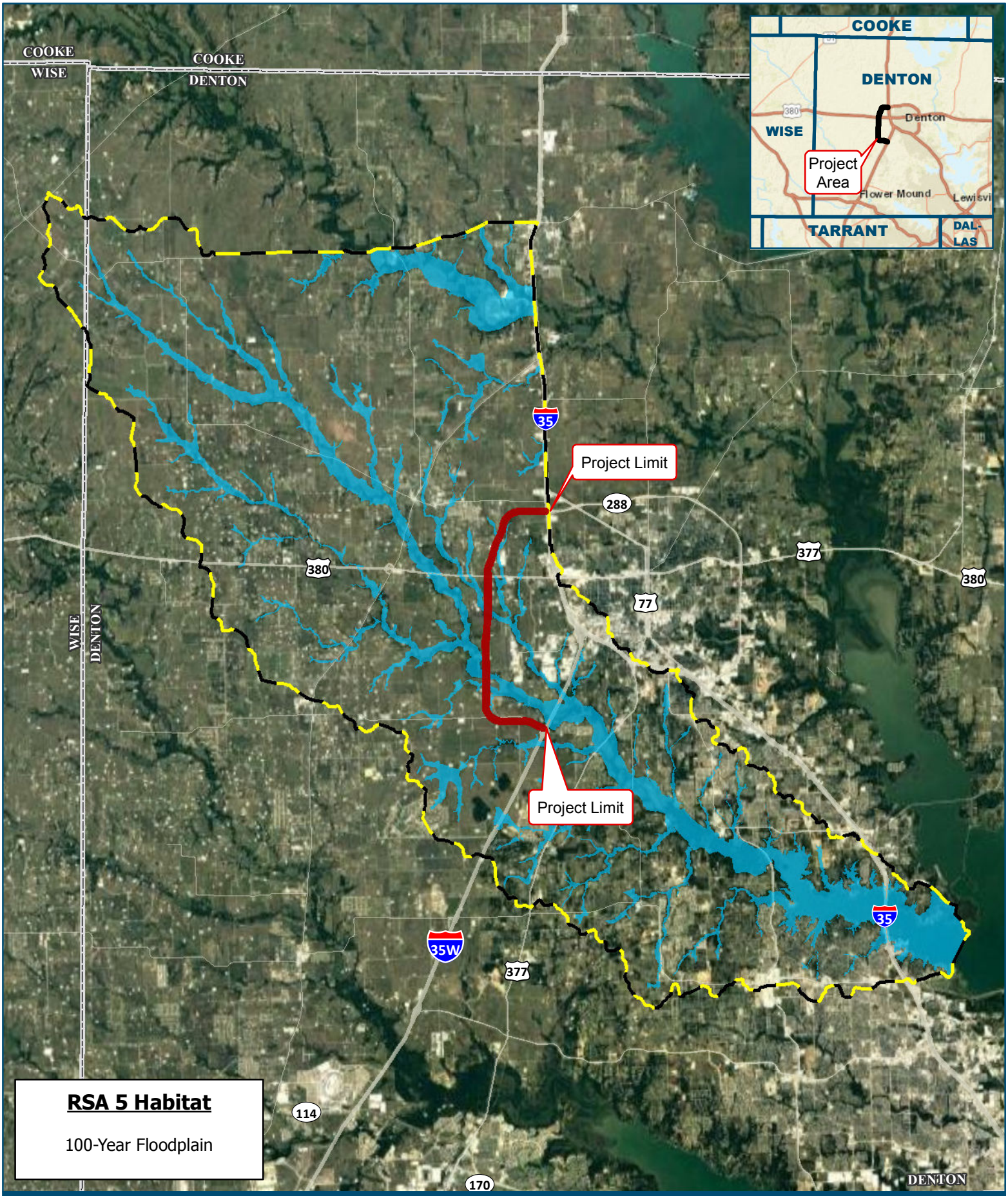
SL 288

From IH 35W to IH 35
Denton County | CSJ: 2250-02-013 & 2250-02-014

RSA 4 Habitat
RSA Boundary
Project Area
County Boundary

NORTH
Miles
0 1 2

Sources: Google Imagery, NRCS Watersheds, TxDOT EMST



Cumulative Impacts
Ecological Resources RSA 5

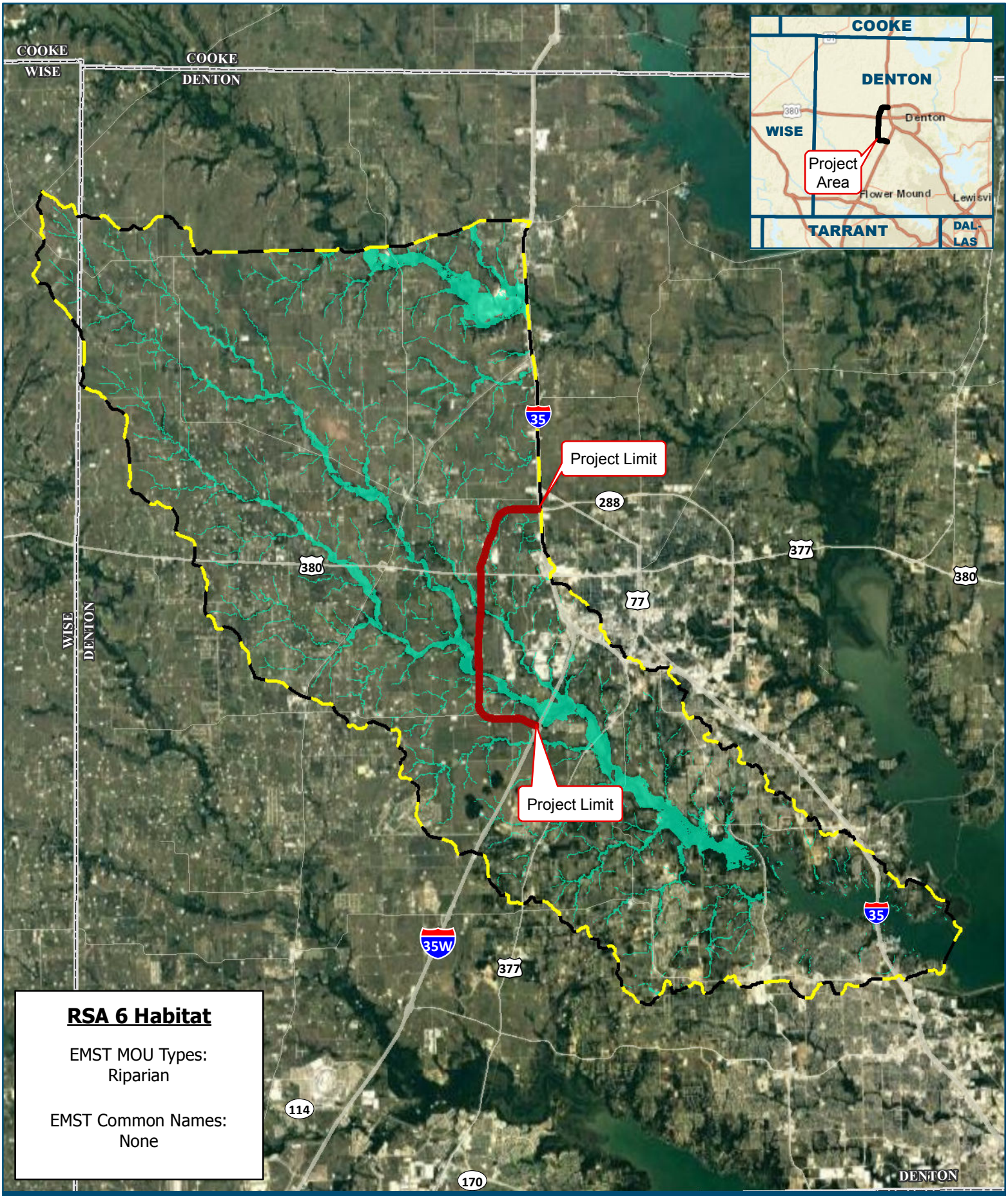
SL 288

From IH 35W to IH 35
Denton County | CSJ: 2250-02-013 & 2250-02-014

RSA 5 Habitat
RSA Boundary
Project Area
County Boundary

NORTH
Miles
0 1 2

Sources: Google Imagery, NRCS Watersheds, TxDOT EMST



Cumulative Impacts
Ecological Resources RSA 6

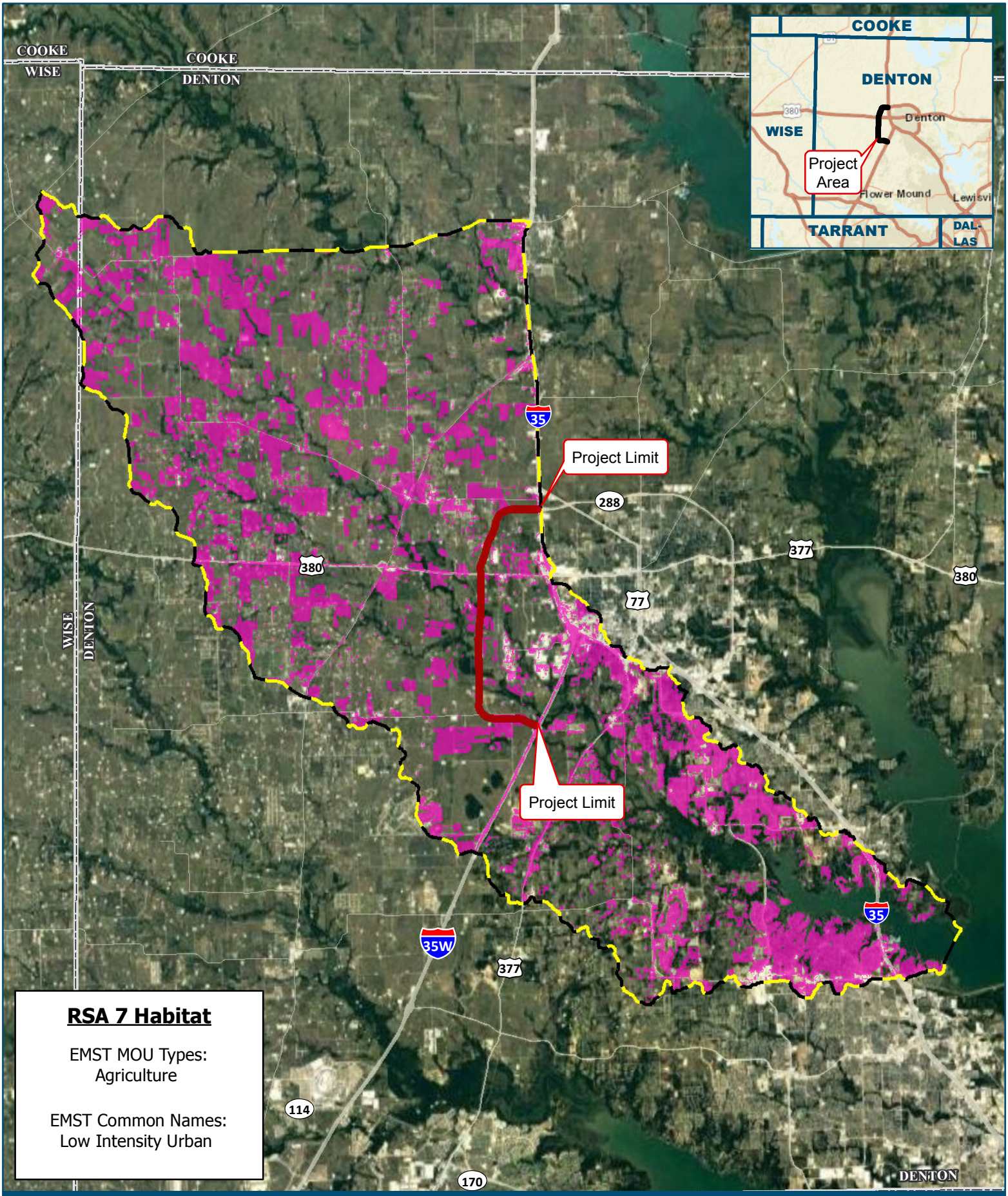
SL 288

From IH 35W to IH 35
Denton County | CSJ: 2250-02-013 & 2250-02-014

RSA 6 Habitat
Project Area
RSA Boundary
County Boundary

NORTH
Miles
0 1 2

Sources: Google Imagery, NRCS Watersheds, TxDOT EMST



Cumulative Impacts
Ecological Resources RSA 7

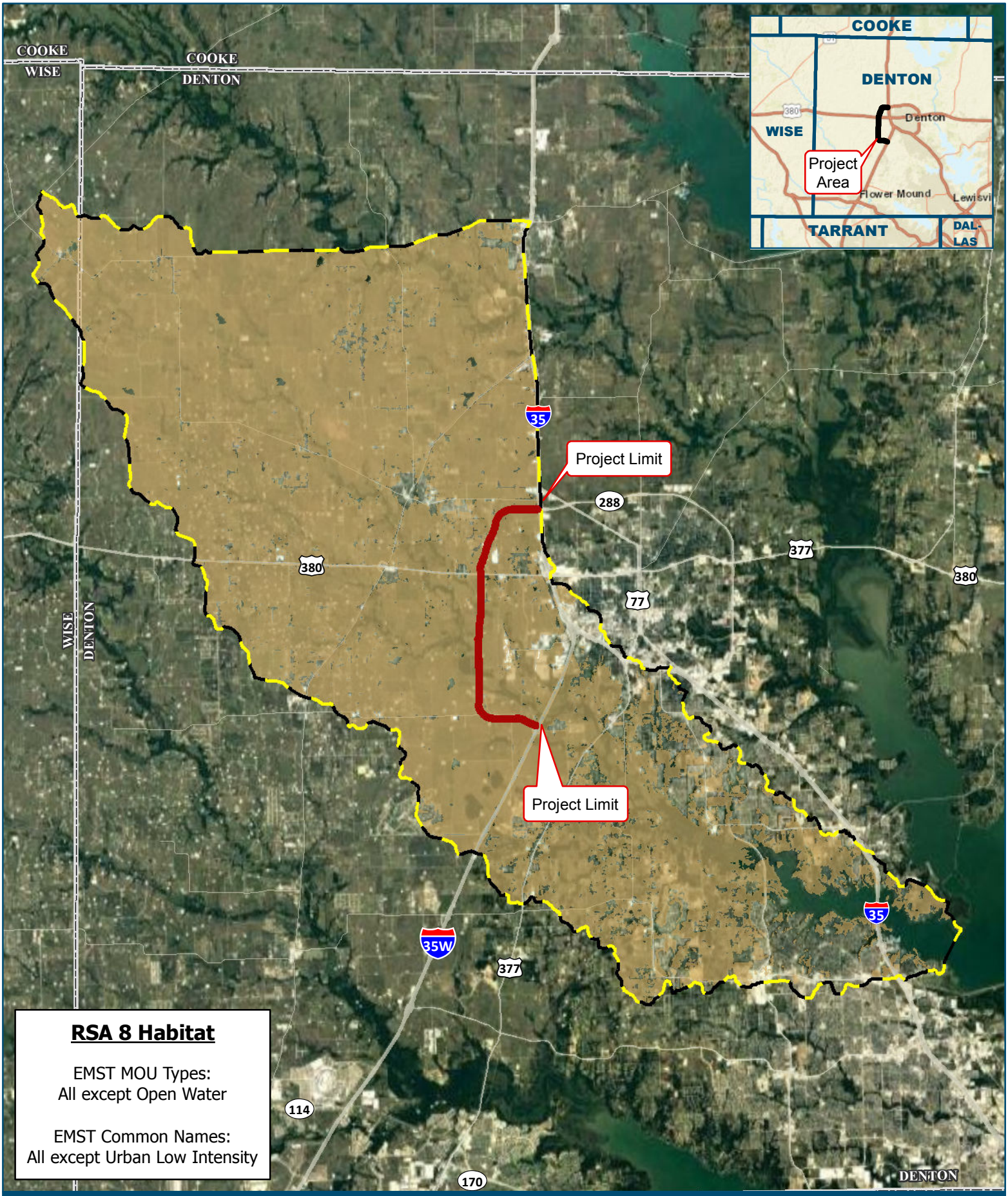
SL 288

From IH 35W to IH 35
Denton County | CSJ: 2250-02-013 & 2250-02-014

RSA 7 Habitat
Project Area
RSA Boundary
County Boundary

NORTH
Miles
0 1 2

Sources: Google Imagery, NRCS Watersheds, TxDOT EMST



Cumulative Impacts
Ecological Resources RSA 8

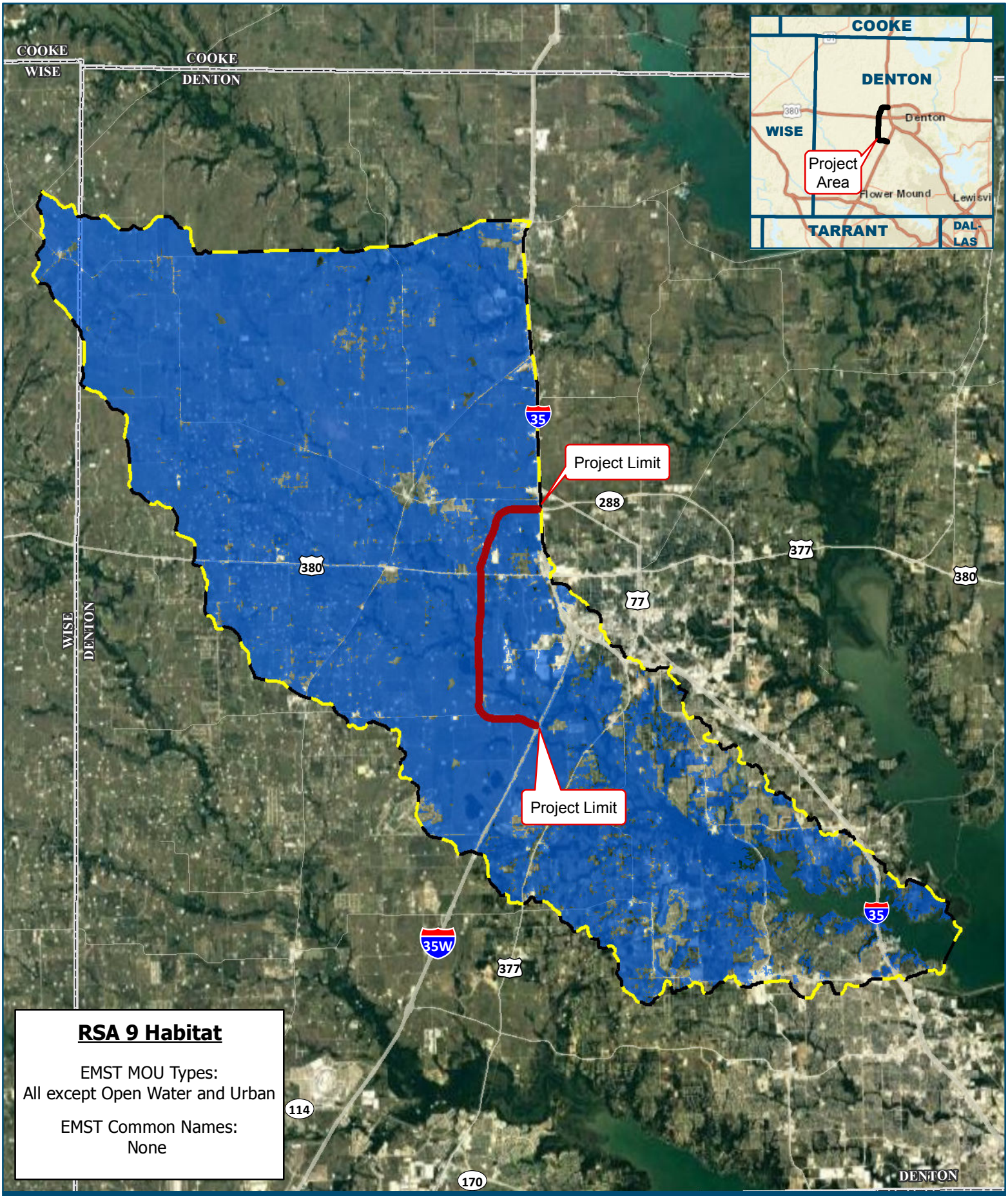
SL 288

From IH 35W to IH 35
Denton County | CSJ: 2250-02-013 & 2250-02-014

RSA 8 Habitat
Project Area
RSA Boundary
County Boundary

NORTH
Miles
0 1 2

Sources: Google Imagery, NRCS Watersheds, TxDOT EMST



Cumulative Impacts
Ecological Resources RSA 9

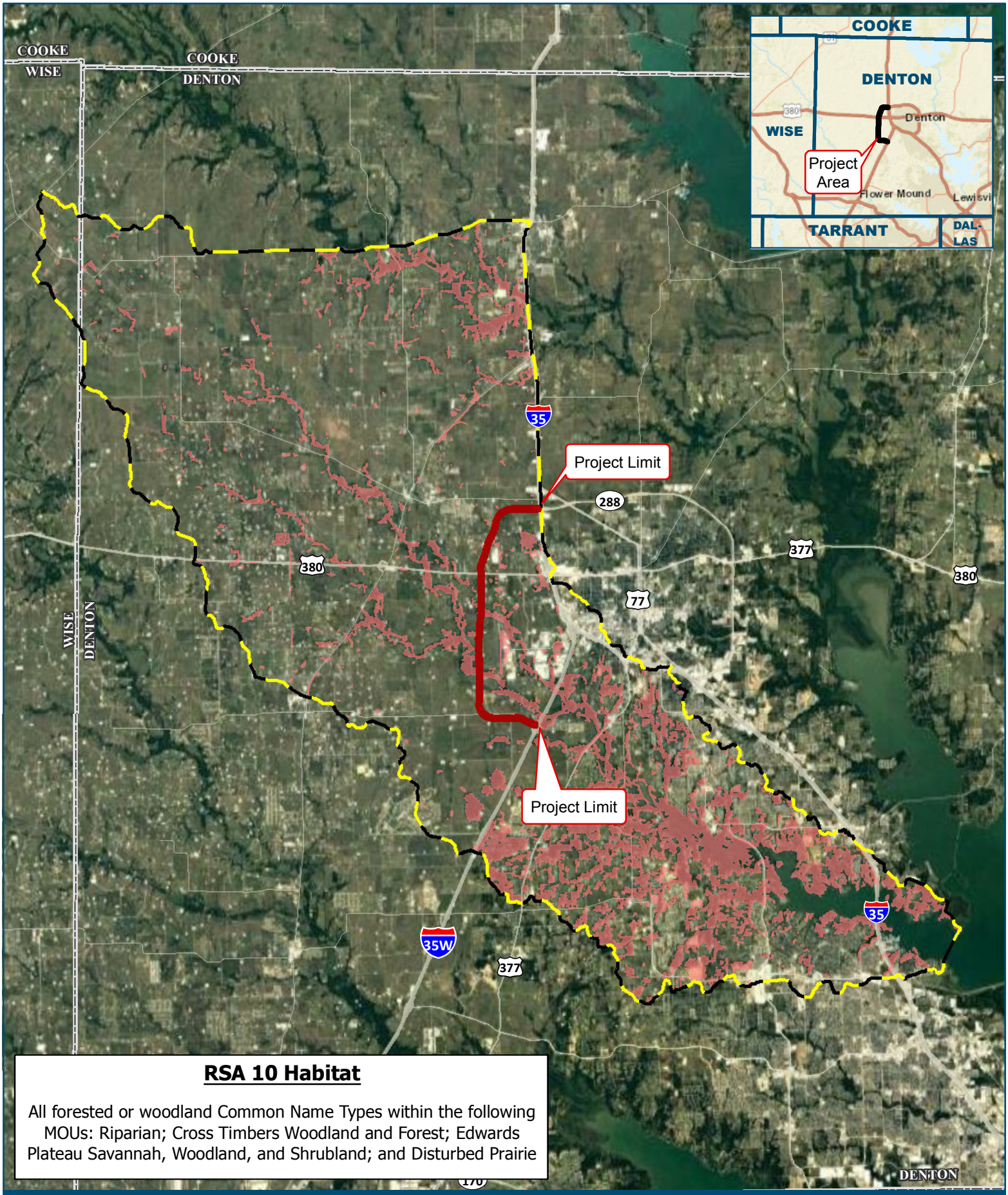
SL 288

From IH 35W to IH 35
Denton County | CSJ: 2250-02-013 & 2250-02-014

RSA 9 Habitat
Project Area
RSA Boundary
County Boundary

NORTH
Miles
0 1 2

Sources: Google Imagery, NRCS Watersheds, TxDOT EMST



RSA 10 Habitat

All forested or woodland Common Name Types within the following MOUs: Riparian; Cross Timbers Woodland and Forest; Edwards Plateau Savannah, Woodland, and Shrubland; and Disturbed Prairie

Cumulative Impacts
Ecological Resources RSA 10

SL 288

From IH 35W to IH 35
Denton County | CSJ: 2250-02-013 & 2250-02-014

RSA 10 Habitat
Project Area
RSA Boundary
County Boundary

NORTH
Miles
0 1 2

Sources: Google Imagery, NRCS Watersheds, TxDOT EMST

APPENDIX B

SUPPORTING DOCUMENTATION

TEXAS PARKS AND WILDLIFE DEPARTMENT'S ECOLOGICAL MAPPING SYSTEMS OF TEXAS VEGETATION WITHIN THE CUMULATIVE IMPACTS ECOLOGICAL RESOURCES RSA

Texas Parks and Wildlife Department's Ecological Mapping Systems of Texas Vegetation Within the Cumulative Impacts Ecological Resources RSA

Common Name	Common Name Acreage	MOU Vegetation Type	MOU Type Acreage	Percent in RSA
Barren	415.6	Agriculture	18,713.5	13.96 %
Grass Farm	45.7			
Row Crops	18,252.2			
Blackland Prairie: Disturbance or Tame Grassland	11.9	Tallgrass Prairie, Grassland	38,962.6	29.08 %
Grand Prairie: Tallgrass Prairie	38,950.7			
Central Texas: Floodplain Deciduous Shrubland	37.8	Riparian	12,869.2	9.60 %
Central Texas: Floodplain Evergreen Shrubland	22.9			
Central Texas: Floodplain Hardwood/Evergreen Forest	53.8			
Central Texas: Floodplain Hardwood Forest	4,343.9			
Central Texas: Floodplain Herbaceous Vegetation	3,732.9			
Central Texas: Floodplain Juniper Forest	4.2			
Central Texas: Floodplain Live Oak Forest	94.5			
Central Texas: Riparian Deciduous Shrubland	53.8			
Central Texas: Riparian Evergreen Shrubland	30.4			
Central Texas: Riparian Hardwood/Evergreen Forest	10.3			
Central Texas: Riparian Hardwood Forest	1,012.2			
Central Texas: Riparian Live Oak Forest	19.2			
Central Texas: Riparian Herbaceous Vegetation	3,374.8			
Swamp	78.4			
Crosstimbers: Oak/Hardwood Slope Forest	166.6	Crosstimbers Woodland and Forest	25,147.8	18.77 %
Crosstimbers: Post Oak/Juniper Woodland	32.7			
Crosstimbers: Post Oak Woodland	8,198.0			
Crosstimbers: Sandyland Oak Woodland	8.6			
Crosstimbers: Savanna Grassland	16,741.9			
Edwards Plateau: Ashe Juniper/Live Oak Shrubland	55.7	Edwards Plateau Savannah, Woodland, and Shrubland	12,528.8	9.35 %
Edwards Plateau: Deciduous Oak/Evergreen Motte and Woodland	6.3			
Edwards Plateau: Live Oak Motte and Woodland	251.8			
Edwards Plateau: Oak/Hardwood Slope Forest	92.2			
Edwards Plateau: Savanna Grassland	11,452.4			
Native Invasive: Deciduous Woodland	1,662.6	Disturbed Prairie	2,857.5	2.13 %
Native Invasive: Juniper Shrubland	139.0			
Native Invasive: Mesquite Shrubland	1,055.9			
Open Water	3,794.5	Open Water	3,794.5	2.83 %
Urban High Intensity	1,762.3	Urban	19,129.7	14.28 %
Urban Low Intensity	17,367.4			
Total Ecological Resources RSA	**134,003.6**	—	**134,003.6**	**100 %**