Final Golden-cheeked Warbler Habitat Assessment

Loop 1604 from SH 16 to I-35

Prepared by: Zara Environmental LLC
Date: October 9, 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.

Abstract

The Texas Department of Transportation is proposing improvements to Loop 1604 from State Highway 16 to Interstate 35 in Bexar County, Texas. To ensure compliance with the Endangered Species Act of 1973 (as amended), a habitat assessment was conducted within 300 feet of the right of way along the entire length of the project area to identify potential habitat for the federal listed Golden-cheeked Warbler (GCWA; *Setophaga chrysoparia*). Texas Natural Diversity Database element occurrence records were overlain with the Diamond Model C GCWA habitat model, topography, vegetation characterizations, and aerial photography to identify potential habitat for field investigation. The field investigation identified 25 potential habitat segments throughout the study area that either contain vegetation associations that may support breeding, foraging, or stopover habitat, or have apparent connectivity to such areas.

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Introduction

The Texas Department of Transportation (TxDOT) is proposing improvements to Loop 1604 from State Highway 16 (SH 16) to Interstate 35 (I-35) in Bexar County, Texas (Figure 1). TxDOT proposes to expand Loop 1604 from a 4-lane expressway to a 10-lane expressway, reconfigure the layout of auxiliary lanes, and modernize the Interstate 10 (I-10) interchange. TxDOT conducted a habitat assessment for the Golden-cheeked Warbler (GCWA*; Setophaga chrysoparia*) and performed a single year of presence/absence surveys within identified habitat along the length of the project. This document provides the results of the habitat assessment. Presence/absence survey results are provided under separate cover.

Biological Setting

The GCWA is a small, neotropical songbird with bright yellow cheeks and a black head and back that breeds primarily in the Edwards Plateau ecological region of Texas. The breeding range of the GCWA is restricted to the closed-canopy Ashe juniper *(Juniperus ashei)* – oak *(Quercus* spp.) woodlands of the Edwards Plateau, including Bexar County. Breeding habitat for the GCWA includes tall, dense, mature stands of Ashe juniper interspersed with live oak *(Q. fusiformis* or *Q. virginiana)* as well as a variety of deciduous trees, such as Texas red oak (*Q. buckleyi),* post oak *(Q. stellata),* Texas ash *(Fraxinus texensis),* and cedar elm *(Ulmus crassifolia).* Breeding habitat for the GCWA typically occurs in relatively mesic areas with steep canyons and slopes; however, the GCWA are also known to breed in drier, upland Ashe juniper-oak woodlands over flat topography (Campbell 2003). The GCWA breeding season begins in early March and continues through mid-August; and, they typically occupy areas of habitat ranging from 5 acres (ac) to 20 ac in size per breeding pair (Campbell 2003).

The U.S. Fish and Wildlife Service (USFWS) describes three major categories for potential GCWA habitat (USFWS 2010). Those categories are used by the USFWS to assess GCWA habitat and are paraphrased as: vegetation associations where GCWAs are expected to occur; vegetation associations that may be used by GCWAs; and vegetation associations where GCWAs are not expected to occur. The “may be used” and “not expected to occur” vegetation association descriptions include vegetation components that typically may not be used by GCWAs, unless they are adjacent to or near GCWA habitat.

Habitat types where the GCWAs are expected to occur include woodlands with mature Ashe juniper trees (15 feet [ft] in height with a trunk diameter at breast height [dbh] of 5 inches [in]) interspersed with a mix of hardwoods, including oaks and elms *(Ulmus* spp.) in mesic areas encompassing steep canyons and slopes. Canopy cover should be nearly continuous with 50 percent to 100 percent canopy closure and an overall woodland canopy height of 20 ft or more.

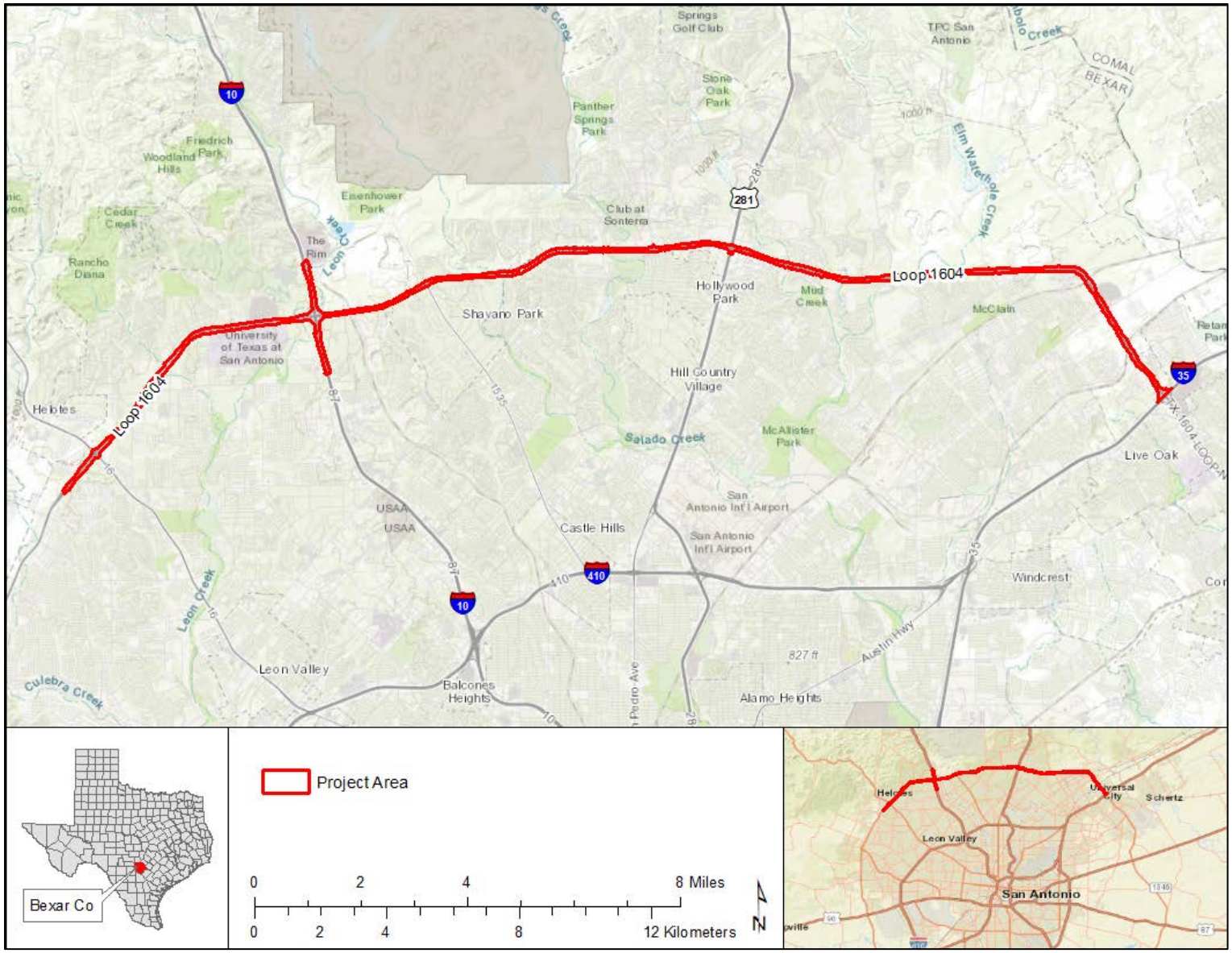


Figure 1. The Texas Department of Transportation is proposing improvements to Loop 1604 from SH 16 to I-35 in Bexar County, Texas.

Habitat types that may be used by GCWAs depend largely on the location, size of tract, land use, adjacent landscape features, and vegetation structure. These habitat types are most often used when adjacent to or near areas of high-quality habitat and are described as follows:

- Stands of mature Ashe juniper with shredding bark amidst scattered live oaks, where the total canopy cover exceeds 35 percent.
- Bottomlands along creeks and drainages that support at least a 35 percent canopy of deciduous trees with mature Ashe juniper growing either in the bottom or on nearby slopes.
- Mixed stands of post oak and/or blackjack oak *(Q. marilandica)* (10 percent to 30 percent canopy cover) with scattered mature Ashe juniper, where the total canopy cover of trees exceeds 35 percent and overall woodland canopy height is 20 ft.
- Mixed stands of shin oak *(Q. sinuata* var. *breviloba)* (10 percent to 30 percent canopy cover) with scattered mature Ashe juniper, where the total canopy cover exceeds 35 percent and overall woodland canopy height is 20 ft.

Vegetation associations where GCWAs are not expected to be found include areas not typical for GCWA habitat, and are unlikely to be used by the GCWA, unless these associations are adjacent to GCWA habitat, as previously described. These areas include the following:

1. Dry, relatively flat areas with small Ashe juniper averaging less than 15 ft in height and 5 in dbh.
2. Pure stands of larger Ashe juniper (greater than 15 ft in height and 5 in dbh), with few or no oaks or other hardwoods.
3. Open park-like woodlands or savannahs where canopy cover is less than 35 percent.
4. Small junipers (less than 15 ft tall) and other trees growing along existing fence lines or under larger hardwoods where junipers have been removed in the past 20 years.

Regulatory Setting

This work ensures project compliance with the Endangered Species Act (ESA). The GCWA was federally listed as endangered on May 4, 1990 by means of an emergency rule (USFWS 1990). The final rule listing the GCWA as endangered under the ESA was published on December 27, 1990. In February 1991, the species was designated as endangered by the State of Texas (USFWS 1992). The ESA prohibits harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, and collecting listed species. The law also protects against interfering with vital breeding and behavioral activities or degrading critical habitat. Current threats to the species include habitat loss and fragmentation from urban sprawl, conversion of wooded areas to agricultural land, juniper eradication, creation of impoundments for flood control and livestock, loss of winter and migration habitat, destruction of oaks by oak wilt, over-browsing by white-tailed deer *(Odocoileus virginianus)* and livestock, and Brown-headed Cowbird *(Molothrus ater)* nest parasitism (USFWS 1992). Critical habitat has not been designated for this species.

Methods

Desktop review

Biologists conducted a desktop review within the study area which included the Loop 1604 right of way (ROW) and easements from SH 16 to I-35 and a 300-ft buffer. The GCWA occurrence data from the Texas Parks and Wildlife (TPWD) Texas Natural Diversity Database (TxNDD) was reviewed for the Culebra, Helotes, Castle Hills, Longhorn, and Schertz U.S. Geological Survey quadrangles. Digital true-color aerial photography at the highest available resolution was used to evaluate percent canopy cover, estimated canopy height, and species composition of woodland habitats, and was compared with the Diamond Model C (Diamond 2007) habitat model, Texas Level III Ecoregions (Griffith et al. 2007), TPWD's Ecological Mapping Systems of Texas (EMST), and the TPWD *Vegetation Types of Texas* maps (McMahan et al. 1984) to better assess the range of habitats potentially occurring on site. Geographically close property parcels potentially meeting habitat definitions defined in Campbell (2003) were lumped into 'segments' of habitat areas to be evaluated in the field.

Field investigation

On March 14, 2019, contract and TxDOT biologists evaluated 57 segments (potential GCWA habitat areas) that were identified during the desktop review. Surveyors assessed each segment on a separate field sheet and noted the development status and vegetative characteristics of the segment. Additional information, such as the surrounding land use, overall woodland health, and proximity to other potential GCWA habitat areas observed outside the study area was recorded to facilitate the habitat determination. Representative habitat was photographed and delineated on field maps with aerial background during the field investigation. Field survey data, aerial imagery, and GCWA habitat data surrounding the study area were reviewed to make a final habitat determination.

Results

Desktop review

The easternmost and westernmost ends of the study area – totaling approximately 40 percent of the project length – are in the Texas Blackland Prairie ecoregion, and the central portion of the study area is in the Edwards Plateau ecoregion (Griffith et al. 2007). The EMST maps approximately 72 percent of the study area as urban high or low intensity, with the dominant vegetation types in the remainder of the study area being mapped as Live Oak Motte and Woodland (3 percent), Ashe Juniper Motte and Woodland (2.8 percent), or Barren (2.2 percent). The TxNDD returned GCWA observations as close as 0.5 mi to the study area just north of La Cantera Parkway and I-10 and along Salado Creek north of Loop 1604 and east of NW Military Highway (Figure 2). Modeled habitat from Diamond (2007) often conflicted with aerial imagery; thus, more recent (2018) aerial imagery was relied upon in this desktop evaluation. Topography within the study area ranges from relatively flat on the eastern project extents (0 percent to 5 percent slopes) to the gently rolling Leon Creek basin to the west (20 percent to 60 percent slopes). In addition to GCWA habitat identified based on apparent percentage of canopy cover, estimated canopy height, and species composition of woodland habitats; habitats not appearing to meet the definition of the GCWA habitat (e.g., areas with open-canopy, low-stature vegetation, and/or not within modeled habitat) were considered when potential GCWA habitat was noted outside but near those habitats.

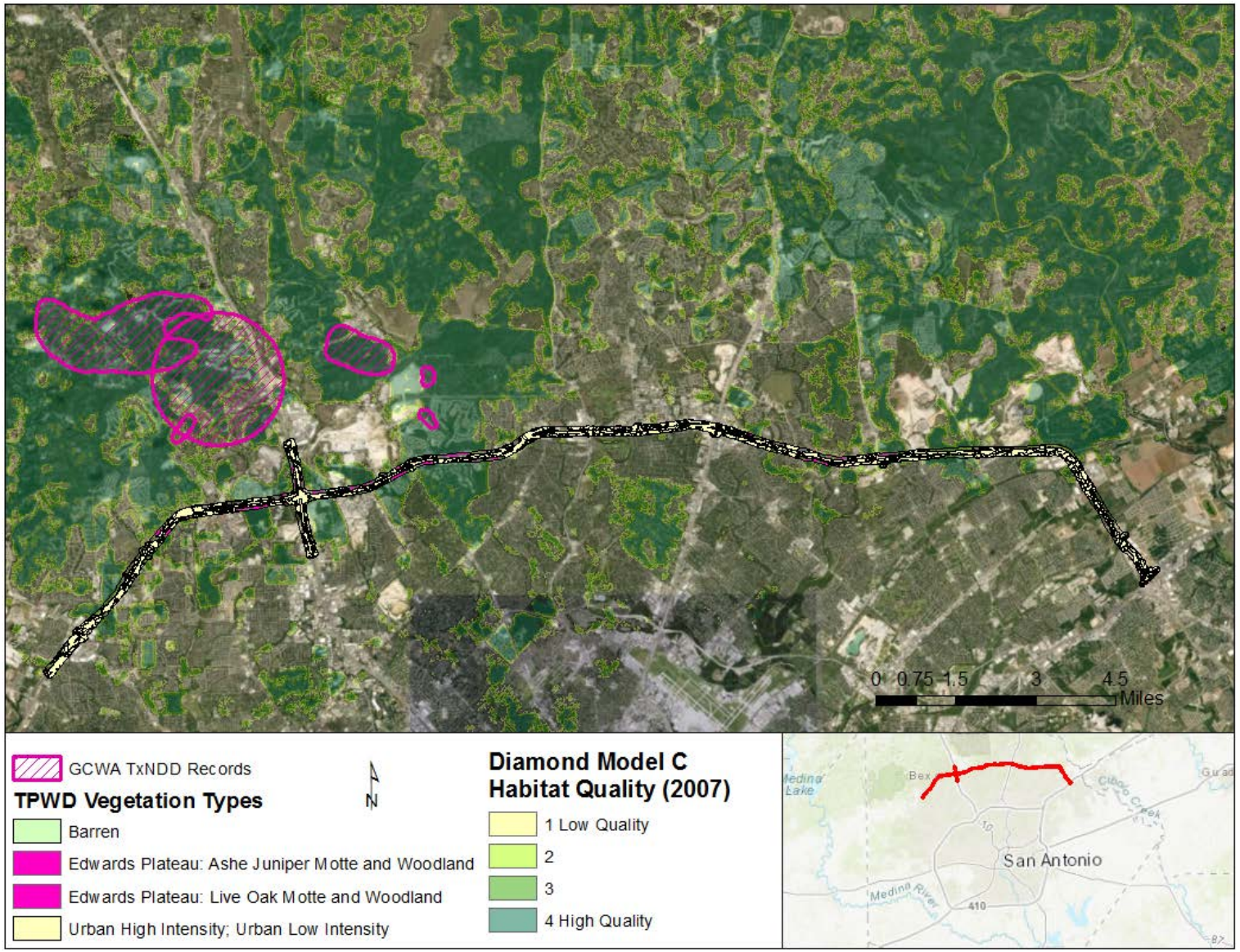


Figure 2. Aerial imagery was compared with mapped TPWD vegetation types and GCWA habitat model data and was evaluated for components of GCWA habitat and proximity to existing GCWA records from the TxNDD.

Field investigation

Fifty-seven potential habitat patches identified during desktop review were field verified, including observations regarding the connectivity to larger areas of potential GCWA habitat outside of the study area. Areas not meeting the definition of habitat where GCWAs are expected to occur or that may be used by GCWAs were not considered habitat and were not evaluated in the field unless they were connected to larger patches of potential GCWA habitat.

Areas not considered habitat were generally near residential and commercial properties, directly adjacent to large roadways, and had land use consistent with grazing or agricultural activities. Furthermore, they were sparsely vegetated with deciduous trees, savannah-like or open parks, relatively flat landscape and xeric (dry), with no water resource nearby. These were dominated by honey mesquite *(Prosopis glandulosa)*, Texas huisache *(Vachellia farnesiana)*, cedar elm, agarita *(Mahonia trifoliolata)*, twistleaf yucca (*Yucca rupicola*), and prickly pear *(Opuntia* spp.*)*. Slopes in non-habitat areas ranged from no slope to gently sloping (5 percent to 20 percent). The average canopy height was approximately 10 ft to 25 ft, with most averaging less than 20 ft. Average canopy coverage ranged from 10 percent to 40 percent, with sparser areas occurring near hilltops, fence lines, and roads (Figure 3), with Ashe juniper representing only 1 percent or 2 percent of the overall canopy. Thirty-two segments that appeared to be habitat based on desktop review were found to be developed or under construction during the field investigation and were no longer considered potential habitat patches following the field investigation (Figure 4).

Figure 3. Typical vegetation community and developed landscape within study area adjacent to roadways along Loop 1604.

Figure 4. This tract appeared to be habitat during the desktop review; however, the field investigation revealed it to be an active construction site being developed for commercial property.

There were 25 segments of varying sizes totaling approximately 258 ac within the study area that qualified as potential GCWA habitat (Figure 5) based on the field investigation. The entire study area is located adjacent to a major roadway supporting commercial and high-density residential development; each segment is displayed over aerial photography and major landmarks in the Appendix. Potential GCWA habitat segments consisted of primarily contiguous live oak-Ashe juniper woodlands. A few segments were sparsely vegetated with deciduous trees, savannah-like or open parks but were adjacent to larger patches of potential GCWA habitat. While habitat connectivity was considered in our analysis, no attempt was made to quantify potential habitat outside of the study area. Therefore, all measurements and data reported herein are reflective only of the study area and the actual size of habitat patches (outside of the 300 ft buffer) may be larger than presented in this report.

Potential GCWA habitat recorded in upland portions of the study area were dominated by Ashe juniper, live oak, honey mesquite, and other deciduous trees sparsely dispersed throughout. Riparian zones primarily consisted of eastern cottonwood *(Populus deltoides*), Texas red oak, box elder (*Acer negundo*), and cedar elm. The average canopy coverage was approximately 35 percent, and the average canopy height was approximately 20 ft. Ashe juniper represented approximately 20 percent of the canopy, and mature Ashe juniper was observed intermittently. Approximately 25 percent of the canopy was represented by live oak. Other woody species observed included cedar elm, hackberry species (*Celtis* spp.), Texas red oak, Texas persimmon (*Diospyros texana*), flameleaf sumac (*Rhus lanceolata*), agarita, prickly pear, and saw greenbrier (*Smilax bona-nox*).

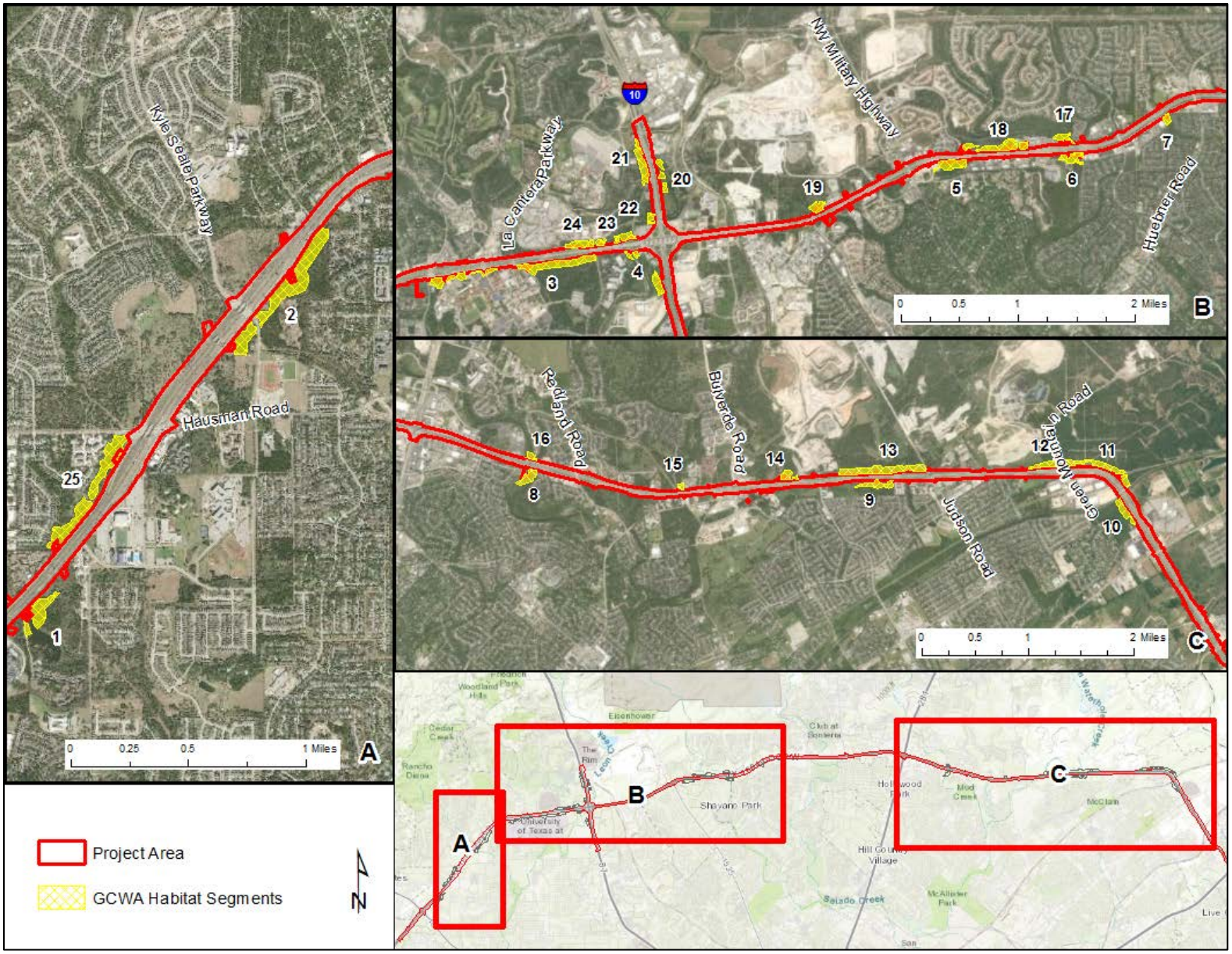


Figure 5. Twenty-five potential GCWA habitat segments were identified along the Loop 1604 study area from SH 16 to I-35.

Segment 1

Segment 1 was 5.94 ac within the study area and located northeast of Bandera Road and south of North Loop 1604, directly adjacent to the Hidden Lake Apartments (Figure 5). The northern portion of this segment was dominated by honey mesquite and grasses. Additional woody species were recorded in this segment included Ashe juniper, Texas huisache, walnut (*Juglans* sp.), hackberry (*Celtis* spp.), possumhaw (*Ilex decidua*), green ash *(Fraxinus pennsylvanica),* black willow *(Salix nigra),* yaupon holly *(Ilex vomitoria),* box elder, American elm *(Ulmus americana),* and glossy privet *(Ligustrum lucidum),* and it contained a small pond. Although this segment had open park-like woodlands, and small junipers and other trees growing along fence lines (Figure 6), biologists concluded that it may be used by GCWAs because it included mature Ashe juniper, an average canopy coverage of 80 percent, an average canopy height of 25 percent, and contained the water feature. This segment connected to potential GCWA habitat along French Creek to the southeast between Loop 1604 and South Hausman Road (see Appendix).

Figure 6. Ashe juniper and mixed hardwoods growing along an existing fence line in Segment 1.

Segment 2

Segment 2 was 22.88 ac within the study area and located northeast of Hausman Road and south of North Loop 1604 (Figure 5). This segment was dominated by Ashe juniper with live oak, honey mesquite, hackberry and yaupon holly scattered throughout (Figure 7). Biologists concluded that it may be used by GCWAs because the average canopy coverage was approximately 75 percent, canopy height was approximately 25 ft, and it contained mature Ashe juniper and scattered live oaks. This segment connected to potential GCWA habitat between Loop 1604 and a residential development to the southeast (see Appendix).

Figure 7. Ashe juniper was dominant in Segment 2.

Segment 3

Segment 3 was 32.79 ac of disjunct patches of potential habitat within the study area along Loop 1604 on the University of Texas at San Antonio (UTSA) campus between Babcock Road and Valero Way (Figure 5). This segment was dominated by Ashe juniper with live oak, cedar elm, Texas red oaks, and prickly pear scattered throughout. Although this segment had an average canopy height of only 15 ft and consisted of stands of small Ashe juniper and open park-like woodlands, biologists concluded that it may be used by GCWAs because the average canopy cover was approximately 70 percent and there was connectivity to adjacent potential habitat. The eastern part of the segment was connected to a heavily vegetated drainage adjacent to Babcock Road to the south, and the western part of the segment was connected to a large tract of potential GCWA habitat to the south between Bauerle Road and Valero way (see Appendix).

Segment 4

Segment 4 was 8.69 ac within the study area and located on disjunct parcels southwest of the intersection of North Loop 1604 and I-10, adjacent to Old Fredericksburg Road (Figure 5). This segment encompassed a portion of the Leon Creek Greenway that included Leon Creek and a hike-and-bike trail with daily human traffic. Dominant woody vegetation included Ashe juniper, cedar elm, honey mesquite, hackberry, possumhaw, and box elder (Figure 8). Along Leon Creek, the riparian zone included American sycamore *(Platanus occidentalis),* hackberry, black walnut *(Juglans nigra),* green ash, red mulberry *(Morus rubra),* box elder, American elm, glossy privet, and Ashe juniper. Ashe juniper made up approximately 15 percent of the canopy and oak species made up approximately 25 percent of the canopy. The riparian zone supported at least a 35 percent canopy of deciduous trees with mature Ashe juniper growing on nearby slopes of Leon Creek. Biologists concluded that this segment may be used by GCWAs because it included stands of mature Ashe juniper with scattered live oaks, a total canopy coverage of approximately 80 percent, and an overall

woodland canopy height of approximately 25 ft. This segment connected to additional potential habitat (Segment 3) to the west and south (see Appendix).

Figure 8. Typical upland vegetation community along the Leon Creek Greenway hike-and-bike trail within Segment 4.

Segment 5

Segment 5 was 10.58 ac within the study area and located between eastbound North Loop 1604 and Kinnan Way and east of NW Military Highway (Figure 5). Biologists concluded that this segment may be used by GCWAs because it included mature Ashe junipers mixed with hardwoods, was located in a relatively moist area with slopes of approximately 20 percent, and had continuous canopy coverage of approximately 80 percent with an average overall canopy height of approximately 30 ft (Figure 9). This segment connected to additional potential habitat extending south from the study area to Kinnan Way (see Appendix).

Figure 9. Although located adjacent to a large parking lot for a commercial property, Segment 5 supported a dense Ashe juniper community mixed with oak species.

Segment 6

Segment 6 was 6.94 ac within the study area and located on eastbound North Loop 1604 near Spring Lake Drive (Figure 5). There was an intermittent stream (drainage) in this segment that was dry at the time of the field visit. Ashe juniper and oak species made up approximately 55 percent of the canopy. Biologists concluded that this segment may be used by GCWAs because it included mature Ashe juniper and hardwoods and had an average canopy cover of approximately 65 percent, an average canopy height of 35 ft, and an approximate slope of 15 percent. This segment connected to additional potential habitat along Salado Creek to the south and west of the study area, south of Patricia J. Blattman Elementary School (see Appendix).

Segment 7

Segment 7 was 2.51 ac within the study area and located on eastbound North Loop 1604, just west of Huebner Road (Figure 5). Dominant woody vegetation in this segment included live oak, Ashe juniper, cedar elm, hackberry, and Texas huisache. Ashe juniper made up approximately 60 percent of the canopy. Biologists concluded that this segment may be used by GCWAs because it included mature Ashe juniper and hardwoods, had mesic habitat with approximately 20 percent slopes surrounding an intermittent stream, an average canopy coverage of approximately 80 percent, and an average canopy height of approximately 30 ft. This segment connected to additional potential habitat along a riparian corridor to the southeast (see Appendix).

Segment 8

Segment 8 was 8.63 ac within the study area and located on eastbound Loop 1604, west of Redland Road (Figure 5). Dominant woody vegetation included live oak, Ashe juniper, cedar elm, hackberry, and Texas huisache, with Ash juniper making up approximately 40 percent of the canopy. Biologists concluded that this segment may be used by GCWAs because the average canopy coverage was approximately 90 percent and the average canopy height was approximately 30 ft, with an average slope of approximately 40 percent. This segment connected to a large patch of potential habitat to the south along Mud Creek and to the south and east, south of the Canyon View residential neighborhood (see Appendix).

Segment 9

Segment 9 was 9.84 ac within the study area and located between O'Conner Road and Judson Road on eastbound Loop 1604, just north of the San Antonio Steubing Ranch development and on the westbound side of Loop 1604 (Figure 5). Woody vegetation in this segment included Ashe juniper, live oak, cedar elm, black willow, honey mesquite, and Texas huisache, with Ashe juniper making up approximately 25 percent to 30 percent of the canopy. Biologists concluded that this segment may be used by GCWAs because the average canopy coverage was approximately 40 percent and average canopy height was approximately 20 ft, with an average slope of approximately 15 percent. This segment was situated amidst a larger potential GCWA habitat patch that extends to the east and west along Loop 1604 (see Appendix).

Segment 10

Segment 10 was 8.41 ac within the study area and located between eastbound Loop 1604 and Stahl Road, just north of Nacogdoches Road and south of the train tracks (Figure 5). Woody vegetation observed included mature Ashe juniper, glossy privet, honey mesquite, and cedar elm. Although this segment contained only a few oaks, biologists concluded that it may be used by GCWAs because the average canopy coverage was approximately 90 percent and average canopy height was approximately 30 ft. Additionally, the segment included a small drainage that had a surrounding average slope of 20 percent that was vegetated with Ashe juniper and honey mesquite (Figure 10 and Figure 11). This segment connected to a larger potential habitat patch extending west from Loop 1604 to Green Mountain Road and Stahl Road (see Appendix).

Figure 10. Dry drainage on Segment 10 with oak species, Texas huisache, and other woody species in background.

Figure 11. Picture showing biologist assessing potential GCWA habitat at Segment 10. Notice the slope around the drainage.

Segment 11

Segment 11 was 17.38 ac within the study area and located on westbound Loop 1604 between Green Mountain Road and the train tracks (Figure 5). Woody vegetation observed included cedar elm, live oak, Ashe juniper, honey mesquite, Texas huisache, and hackberry. Other vegetation observed included possumhaw, yaupon holly, and prickly pear. Biologists concluded that this segment may be used by GCWAs because the average canopy cover was approximately 85 percent and the average canopy height was approximately 30 ft. Additionally, this segment contained an intermittent stream running approximately parallel to the curve of Loop 1604, with an average slope of approximately 45 percent around the stream. This segment connected to a much larger potential habitat patch extending to the north (see Appendix).

Segment 12

Segment 12 was 7.73 ac within the study area and located on westbound Loop 1604 just west of Green Mountain Road (Figure 5). Woody vegetation observed included honey mesquite, Texas huisache, western soapberry (*Sapindus saponaria* var. *drummondii*), chinaberry (*Melia azedarach*), and Ashe juniper. Although this segment had an average canopy coverage of less than 10 percent and an average canopy height of only approximately 15 ft, was sparsely wooded and used for low-impact grazing and was in close proximity to a large quarry, biologists concluded that it may be used by GCWAs because it was adjacent to potential GCWA habitat. This segment connected to potential GCWA habitat to the north and was just across Green Mountain Road from Segment 11, which was connected to a very large potential habitat patch (see Appendix).

Segment 13

Segment 13 was 29.87 ac within the study area and located on westbound Loop 1604 between O'Connor Road and Judson Road (Figure 5). Woody vegetation observed included Texas huisache, Ashe juniper, black willow, live oak, and cedar elm. Although this segment was in close proximity to a large quarry, biologists concluded that it may be used by GCWAs because the average canopy coverage was approximately 80 percent, the average canopy height was approximately 20 ft., there was an average slope of approximately 30 percent, and there was a nearby water feature (pond and stream). This segment connected to potential GCWA habitat (Bulverde Oaks Nature Preserve) to the north and to potential habitat along bottomlands along Elm Waterhole Creek and its tributaries (see Appendix), which supported approximately 35 percent canopy coverage of deciduous trees (Figure 12).

Figure 12. Segment 13 had a vegetation community with a dense canopy cover and mix of deciduous trees as well as being located adjacent to Bulverde Oaks Nature Preserve.

Segment 14

Segment 14 was 5.17 ac within the study area and located along westbound Loop 1604 east of Bulverde Road (Figure 5). The dominant vegetation consisted of Ashe juniper and cedar elm (Figure 13), with Ashe juniper and oak species making up approximately 40 percent of canopy. A drainage associated with Elm Waterhole Creek and the Soil Conservation Reservoir ran through this segment. Although this segment was in close proximity to a large quarry, biologists concluded that it may be used by GCWAs because it included an average canopy coverage of approximately 70 percent, an overall average canopy height of approximately 20 ft, slopes of approximately 30 percent surrounding a nearby water feature, and stands of mature Ashe juniper. This segment connected to additional potential GCWA habitat to the north and west (see Appendix).

Figure 13. Segment 14 had fence lines running throughout the tract, but supported a dense, deciduous canopy with heights greater than 20 ft.

Segment 15

Segment 15 was 1.61 ac within the study area and located on westbound Loop 1604, west of the Christian Family Church and immediately east of Emerald Forest Drive (Figure 5). Woody vegetation observed included cedar elm, live oak, Ashe juniper, and agarita. Biologists concluded that this segment may be used by GCWAs because it had mixed Ashe juniper and hardwoods, an average canopy cover of approximately 70 percent and an average canopy height of approximately 25 ft (Figure 14). This segment connected to additional potential GCWA habitat to the north along East Elm Creek (see Appendix).

Figure 14. Segment 15 had mixed Ashe juniper and hardwoods, an average canopy cover of approximately 70 percent and an average canopy height of approximately 25 ft.

Segment 16

Segment 16 was 2.74 ac within the study area and located on westbound Loop 1604, west of Redland Road and directly east of Community Bible Church (Figure 5). Dominant woody vegetation observed included live oak, Ashe juniper, and cedar elm. Biologists concluded that this segment may be used by GCWAs because it included Ashe juniper and hardwoods, had an average canopy coverage of approximately 80 percent, an average overall canopy height of approximately 35 ft, and contained slopes averaging approximately 25 percent (Figure 15). This segment connected to additional potential GCWA habitat to the north and west (see Appendix).

Figure 15. Segment 16 was a small area, but had a dense canopy, water features, and was adjacent to habitat where the GCWA are expected to occur.

Segment 17

Segment 17 was 4.36 ac within the study area and located on Loop 1604 along Medicine Wall Road (Figure 5). Dominant woody vegetation observed included Ashe juniper, cedar elm, and Texas oak. Ashe juniper and oak species made up approximately 70 percent of the canopy. Biologists concluded that this segment may be used by GCWAs because it occurs in a mesic area and had an average overall canopy height of approximately 25 ft with mature Ashe junipers mixed with hardwoods, had a 25 percent slope, and continuous canopy coverage of approximately 80 percent. This segment connected to potential GCWA habitat to the north to a residential neighborhood and west along Salado Creek (see Appendix).

Segment 18

Segment 18 was 16.72 ac within the study area and located on westbound Loop 1604, west of an apartment complex and east of Shavano Ranch (Figure 5). Dominant woody vegetation observed included cedar elm, Ashe juniper, and live oak. Biologists concluded that this segment may be used by GCWAs because it occurs in a mesic area, included an average canopy coverage of approximately 80 percent, and had an average overall canopy height of approximately 30 ft (Figure 16). This segment connected to potential GCWA habitat extending to the north and east of the segment along Salado Creek (see Appendix).

Figure 16. Segment 18 was a relatively large tract with mature Ashe juniper throughout and a dense canopy, despite being adjacent to apartments and roadways.

Segment 19

Segment 19 was 5.74 ac within the study area and located on westbound Loop 1604, east of Lou Mell Drive and adjacent to a commercial shopping center (Figure 5). Woody vegetation observed included Ashe juniper, live oak, honey mesquite, cedar elm, and Texas huisache. Biologists concluded that this segment may be used by GCWAs because it had an average canopy coverage of approximately 50 percent and an average canopy height of approximately 25 ft. This segment connected to potential GCWA habitat to the north and west (see Appendix).

Segment 20

Segment 20 was 5.01 ac within the study area and located on northbound I-10 between Loop 1604 and Rim Pass (Figure 5). Dominant upland woody vegetation observed included live oak, Ashe juniper, cedar elm, and honey mesquite. The riparian zone along Leon Creek was dominated by bald cypress (*Taxodium distichum*), eastern cottonwood, green ash, hackberry, and American sycamore. Although this segment had open park-like woodlands in the upland areas and the bottomlands along Leon Creek supported few deciduous trees or mature Ashe junipers, biologists conservatively concluded that this segment may be used by GCWAs because it included an average canopy coverage of approximately 60 percent and an average canopy height of approximately 35 ft. It is likely that land use in this segment will change quickly, as large tracts of habitat were for sale at the time of the surveys (Figure 17). This segment had limited connectivity to potential habitat to the west along Leon Creek (see Appendix).

Figure 17. Segment 20 had large tracts of habitat areas for sale on northbound I-10.

Segment 21

Segment 21 was 11.45 ac within the study area and located on southbound I-10 just north of Old Fredericksburg Road (Figure 5). Dominant woody vegetation observed included live oak, Ashe juniper, Texas oak, cedar elm, eastern cottonwood, and black willow. The riparian zone along Leon Creek included eastern cottonwood, sycamore, Texas oak, hackberry, and box elder. A hike and bike trail was being constructed in this segment at the time of the habitat assessment (Figure 18). Biologists concluded that this segment may be used by GCWAs because it included an average canopy coverage of approximately 75 percent and an average canopy height of approximately 30 ft, with mature Ash junipers growing along the slopes on the southern extend of the segment. This segment connected to potential GCWA habitat to the west and south (see Appendix).

Figure 18. During the field investigation for Segment 21, there was active construction along Leon Creek to install a pedestrian hike-and-bike trail.

Segment 22

Segment 22 was 2.48 ac within the study area and located at the northwest corner of the I-10 interchange with Loop 1604 (Figure 5). The dominant woody vegetation observed included live oak, Ashe juniper, cedar elm, green ash, hackberry, and Texas huisache. The bottomlands along the Leon Creek riparian zone consisted primarily of Texas huisache, green ash, cedar elm, and hackberry. The average slope was approximately 40 percent with Ashe juniper and oak species making up approximately 90 percent of the canopy (Figure 19). Biologists concluded that this segment may be used by GCWAs because the average canopy coverage was approximately 80 percent, the average canopy height was approximately 40 ft, and there were large stands of mature Ashe juniper mixed with other hardwoods along Leon Creek. This segment connected to potential GCWA habitat to the west and north (see Appendix).

Figure 19. Ashe juniper and oak species made up the canopy of Segment 22.

Segment 23

Segment 23 was 7.46 ac within the study area and located on westbound Loop 1604 between Agave Pass and Old Fredericksburg Road (Figure 5). Dominant woody vegetation observed included live oak, Ashe juniper, and cedar elm. The Leon Creek riparian zone consisted primarily of cedar elm, live oak, and Ashe juniper (Figure 20). Biologists concluded that this segment may be used by GCWAs because it had an average canopy coverage of approximately 60 percent and an average overall canopy height of approximately 25 ft, with mature Ash juniper and hardwoods. This segment connected to potential GCWA habitat to the north and east (see Appendix).

Figure 20. Dense canopy along Leon Creek in Segment 23 included cedar elm, live oak, and Ashe juniper.

Segment 24

Segment 24 was 7.43 ac within the study area and located on westbound Loop 1604 directly west of Agave Pass and south of the Shops at La Cantera (Figure 5). Dominant woody vegetation observed included live oak, cedar elm, and Ashe juniper. Other vegetation observed included Texas huisache, agarita, Texas persimmon, western soapberry, chinaberry, honey mesquite, and prickly pear (Figure 21). Although this segment had an average canopy height of only 15 ft, biologists concluded that it may be used by GCWAs because the average canopy coverage was approximately 75 percent and it connected to . potential GCWA habitat to the east along Loop 1604. The potential habitat along Loop1 604 connected this segment to Segment 23 (see Appendix).

Figure 21. Segment 24 was directly adjacent to a large shopping center and had relatively numerous stands of invasive trees, such as the chinaberry pictured.

Segment 25

Segment 25 was 15.71 ac within the study area and located on westbound Loop 1604 immediately south of Hausman Road and east of residential development (Figure 5). Dominant woody vegetation observed included hackberry, cedar elm, Ashe juniper, and live oak; and Ashe juniper made up approximately 50 percent of the canopy. Other vegetation observed included Texas persimmon, flameleaf sumac, honey mesquite, Texas huisache, and prickly pear (Figure 22). Although this segment had stands of small Ashe juniper and open park-like woodlands, biologists concluded that it may be used by GCWAs because the average canopy coverage was approximately 70 percent and the average canopy height was approximately 20 ft. This segment connected to potential GCWA habitat along French Creek to the southeast between Loop 1604 and Hausman Road (see Appendix).

Figure 22. Segment 25 had large tracts of vegetation that occur with relatively dry landscapes (e.g., prickly pear cactus).

Discussion

Undeveloped areas along Loop 1604 were evaluated for their potential to provide habitat for GCWA. Portions of the study area that were determined not to provide potential GCWA habitat due to development or lack of appropriate vegetation associations are not described in this report. The assessment identified 25 segments, some of them consisting of multiple, disparate parcels, that may provide breeding or foraging habitat for GCWA. The entire study area is along a major roadway and much of the San Antonio area is highly urbanized, thus even segments identified as providing potential habitat are impacted by edge effects and habitat fragmentation. The USFWS (2010) defines vegetation associations where GCWA are not expected to be found (based on Campbell [2003]) but indicates that even these associations may provide foraging habitat when adjacent to vegetation associations that may be used by GCWA or when adjacent to vegetation associations where GCWAs are expected to occur. Because the study area for this assessment was limited to areas within 300 ft of Loop 1604, adjacent habitat (beyond the boundaries of the study area) was evaluated based on aerial photography and observations available in the field, but were necessarily limited in scope. Therefore, habitat assessments were made conservatively and often based on the apparent connectivity of the segments to additional potential habitat.

Literature Cited

Campbell, L. 2003. Endangered and Threatened Animals of Texas: Their Life History and Management. Golden-cheeked Warbler *(Dendroica chrysoparia).* Texas Parks and Wildlife Department, Austin, Texas.

Diamond, D. 2007. Range-wide Modeling of Golden-cheeked Warbler Habitat. Missouri Resource Assessment Partnership. University of Missouri. Columbia, Missouri, USA.

Griffith, G.E., S.A. Bryce, J.M. Omernik, J.A. Comstock, A.C. Rogers, B. Harrison, S.L. Hatch, and D. Bezanson. 2004. Ecoregions of Texas. (2 sided color poster with map, descriptive text, and photographs). U.S. Geological Survey, Reston, VA. Scale 1:2,500,000.

McMahan, C.A., R.G. Frye, and K. Brown. 1984. *The Vegetation Types of Texas Including Croplands.* Austin:Texas Parks and Wildlife Department.

U.S. Fish and Wildlife Service [USFWS]. 2010. USFWS Section 10(a)(1)(A) Scientific Permit Requirements for Conducting Presence/Absence Surveys and Habitat Assessments for Endangered Golden-cheeked Warblers. Available at: https://www.fws.gov/southwest/es/Documents/R2ES/GCWA_Survey_Guidelines_20100113.pdf

USFWS. 1992. Golden-cheeked Warbler Recovery Plan. U.S. Fish and Wildlife Service. Region 2. Albuquerque, NM.

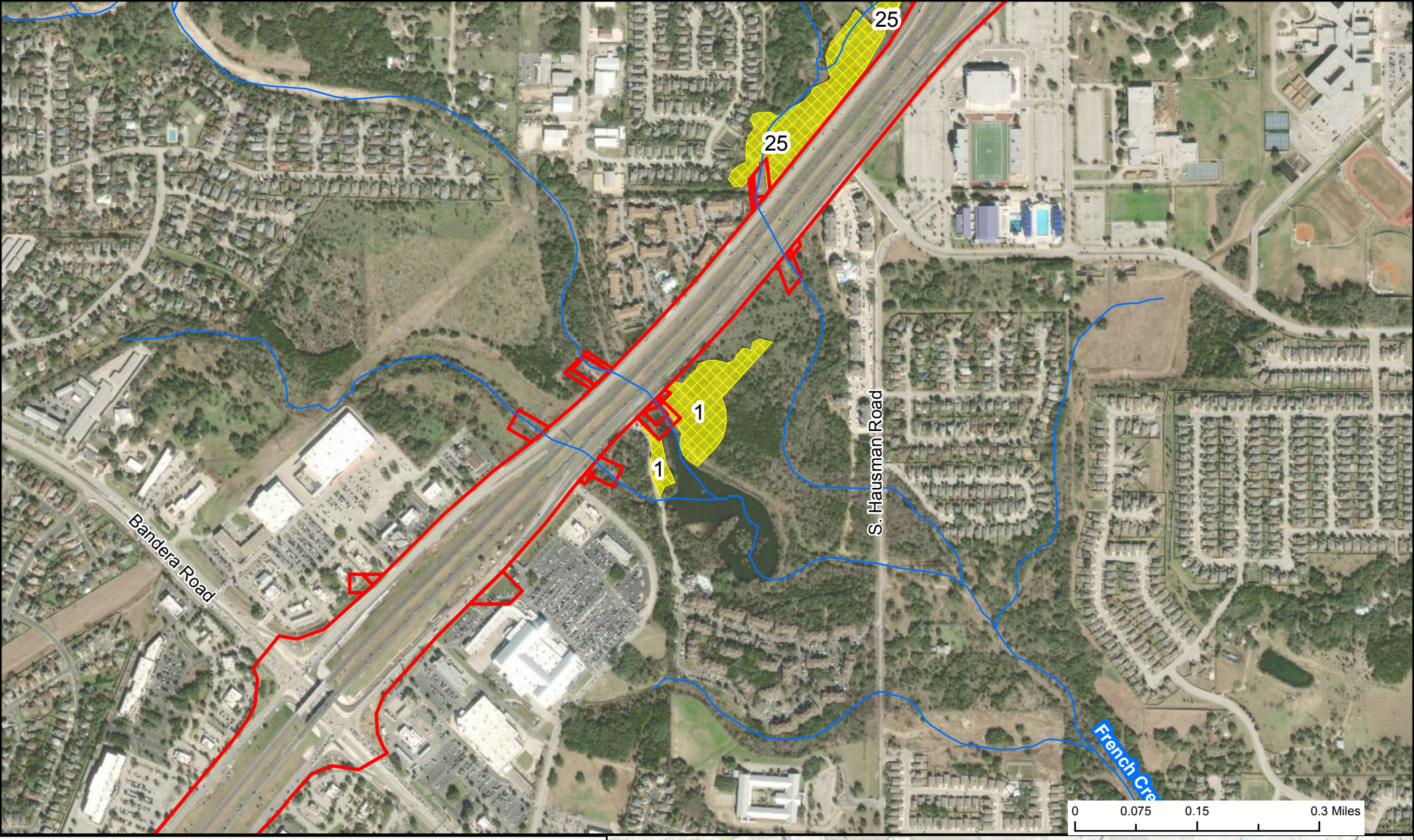
USFWS. 1990. Emergency. Endangered and Threatened Wildlife and Plants. Emergency Rule to List the Golden-cheeked Warbler as Endangered. 55 Federal Register 55: 18844 – 18845.

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

ZARA
ENVIRONMENTAL LLC
1707 West FM 1626
Manchaca, Texas 78652
www.zaraenvironmental.com

Appendix

Segment Maps



Golden-cheeked Warbler
Habitat Assessment
Loop 1604 from SH 16 to IH 35
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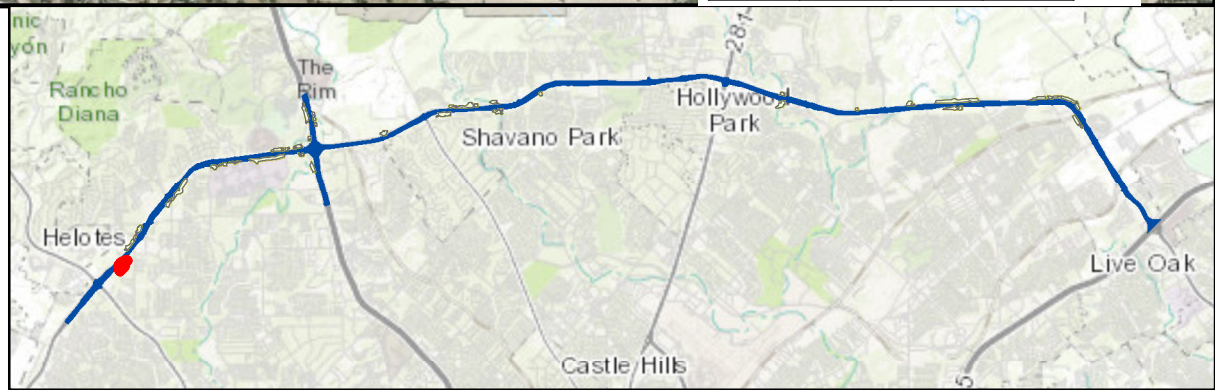
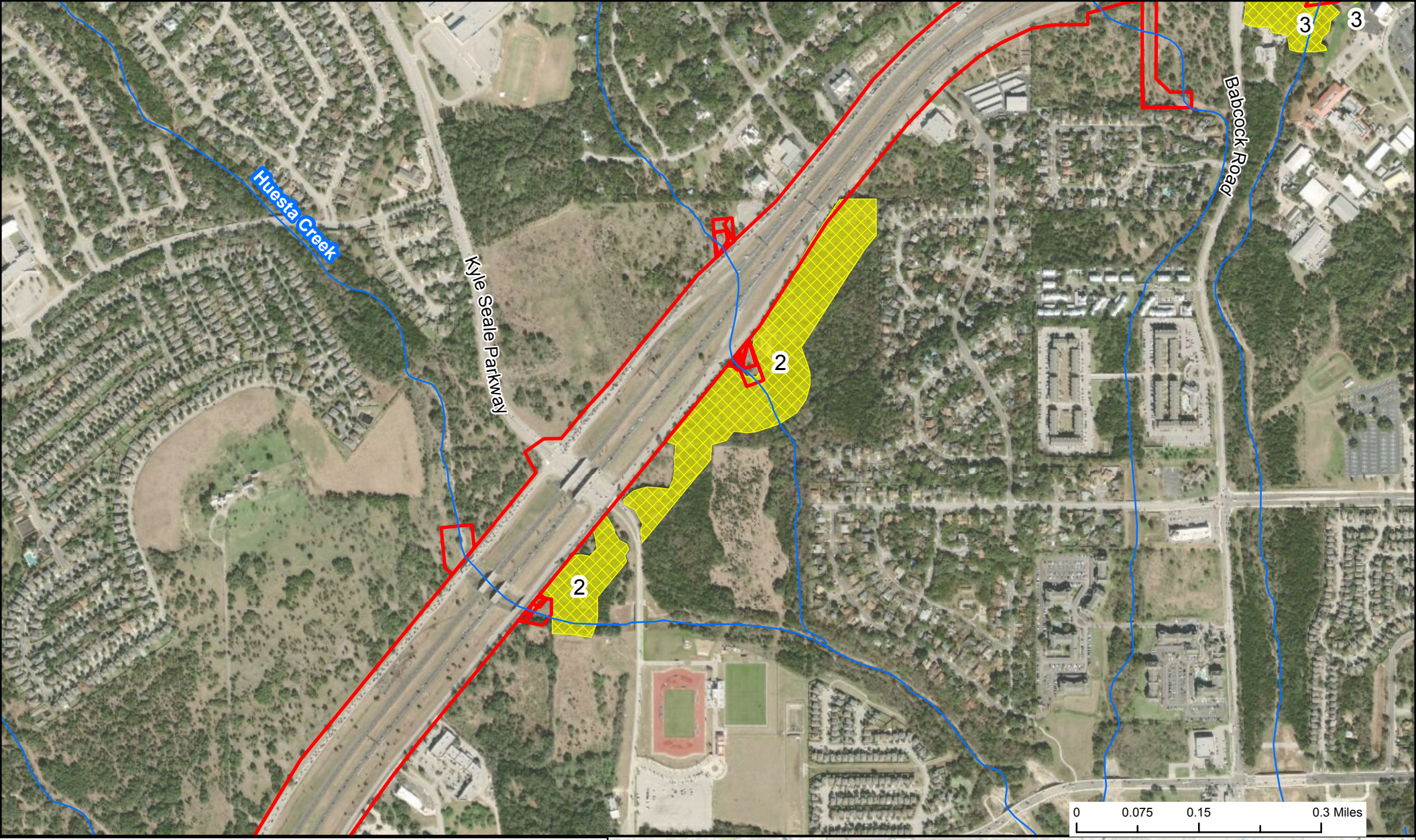
GCWA Habitat Segments





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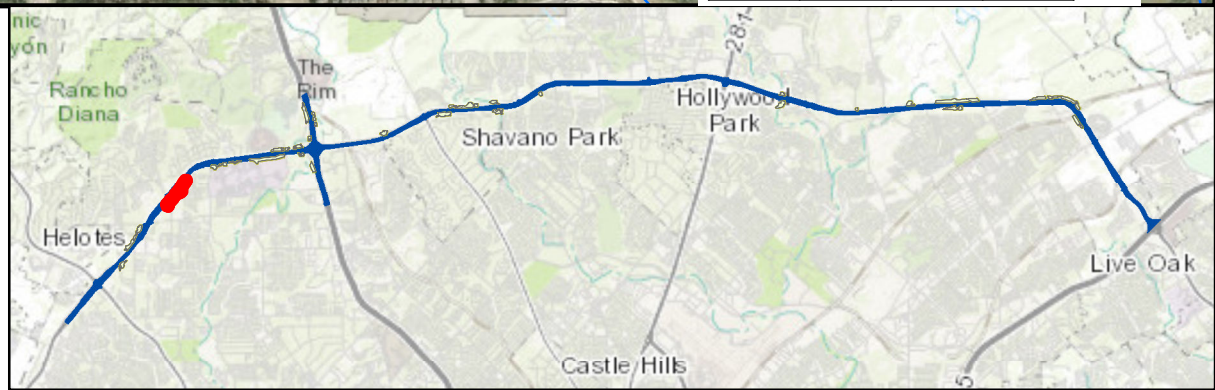

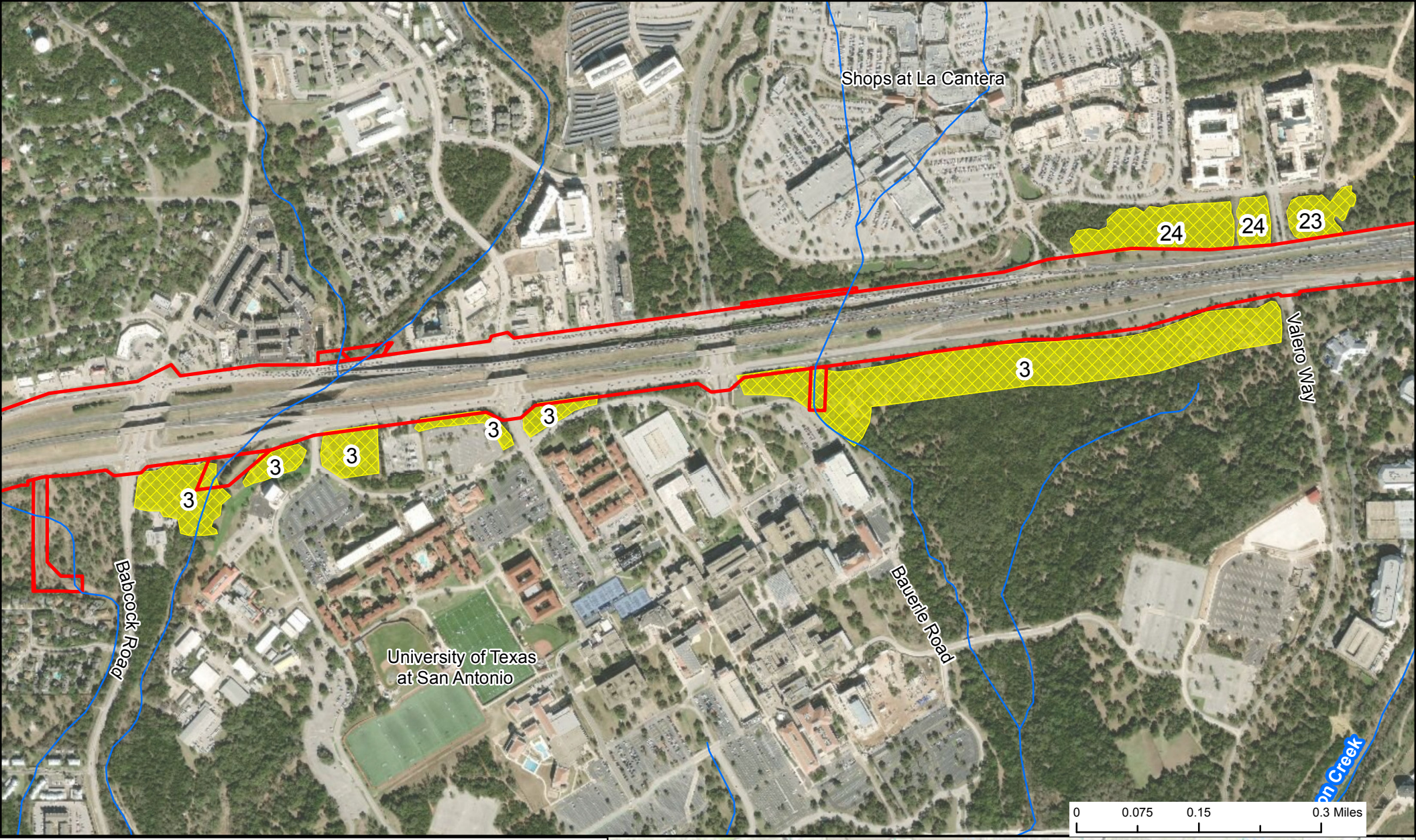

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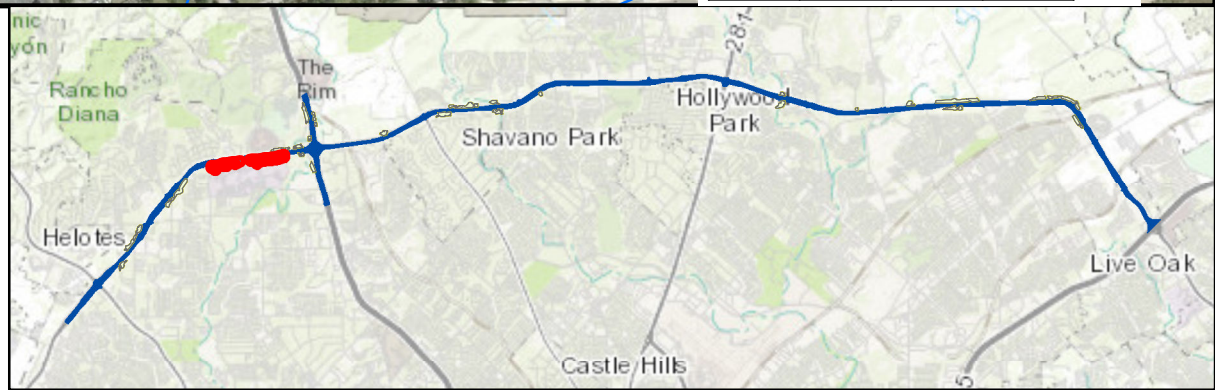

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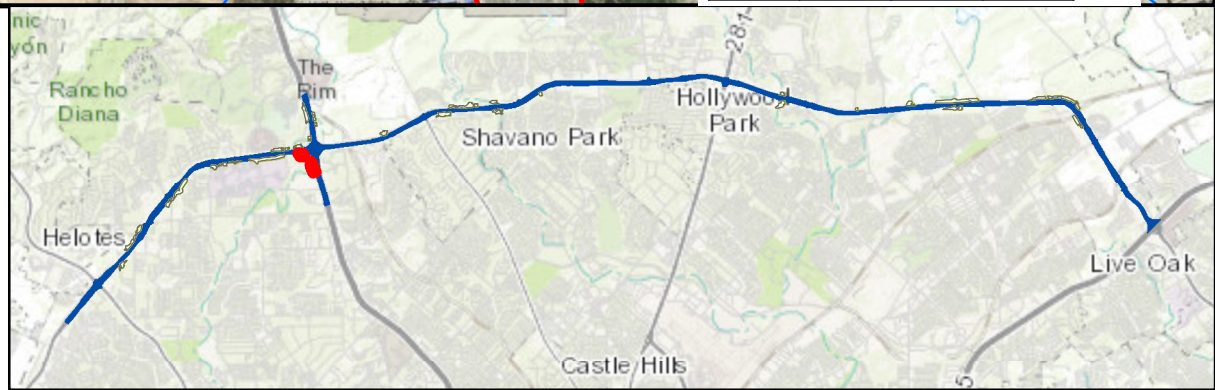

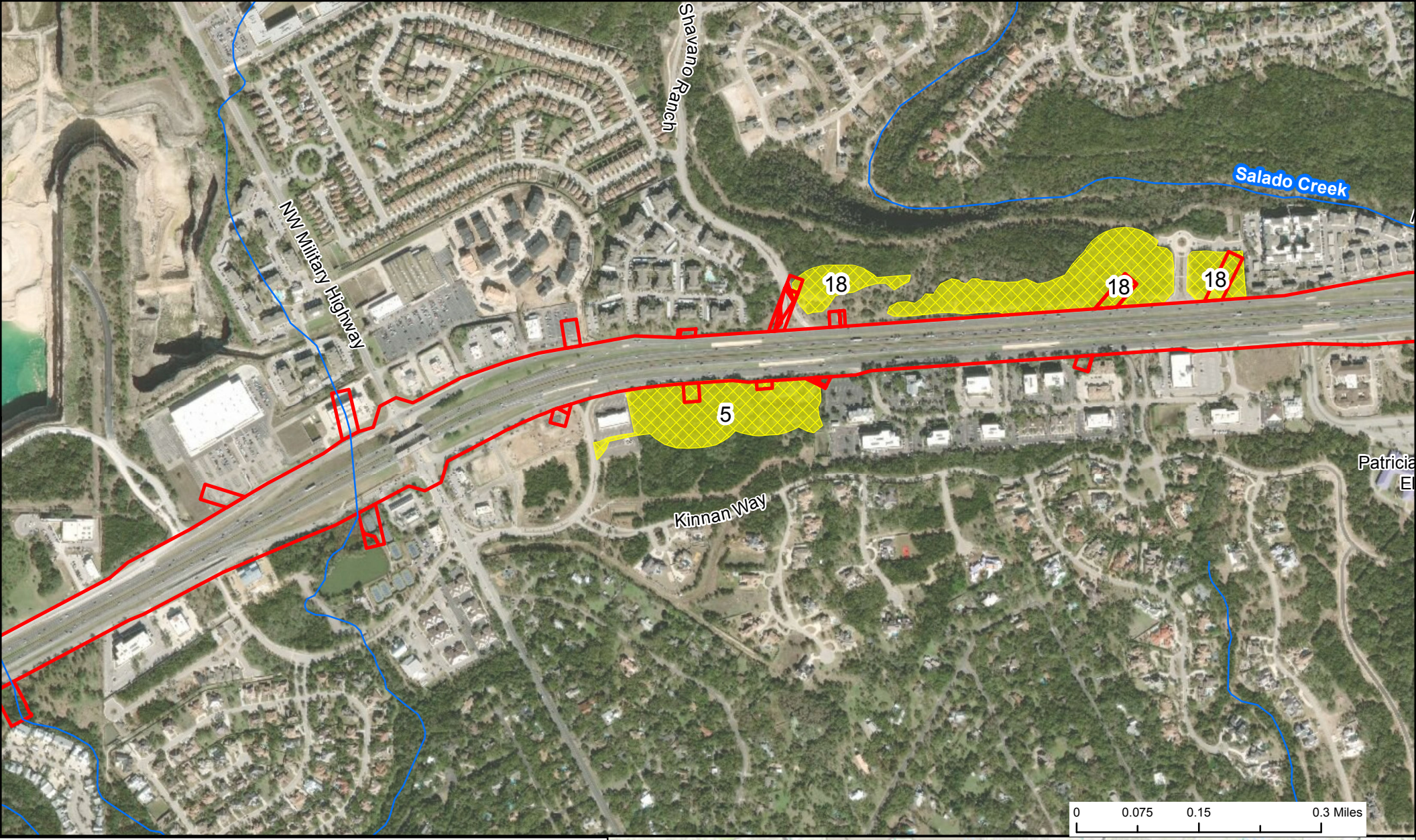

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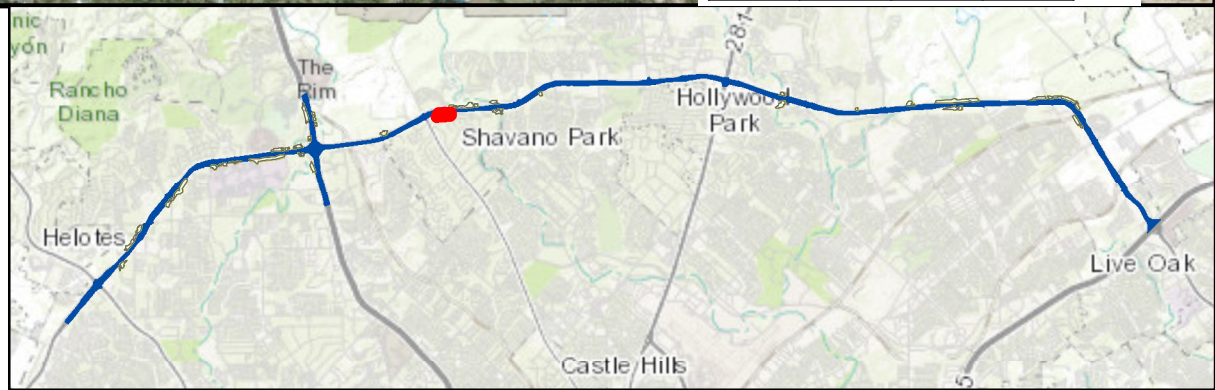

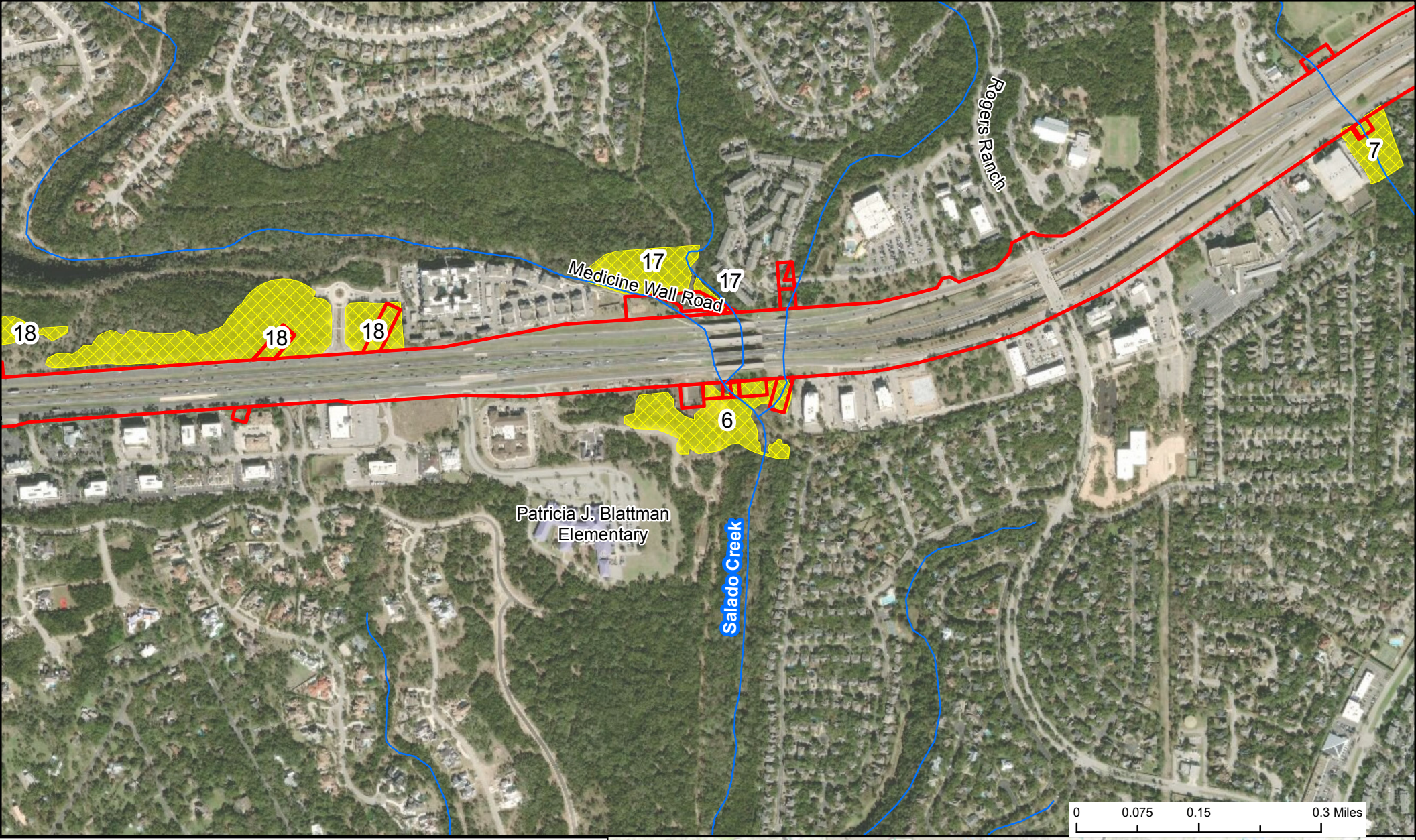

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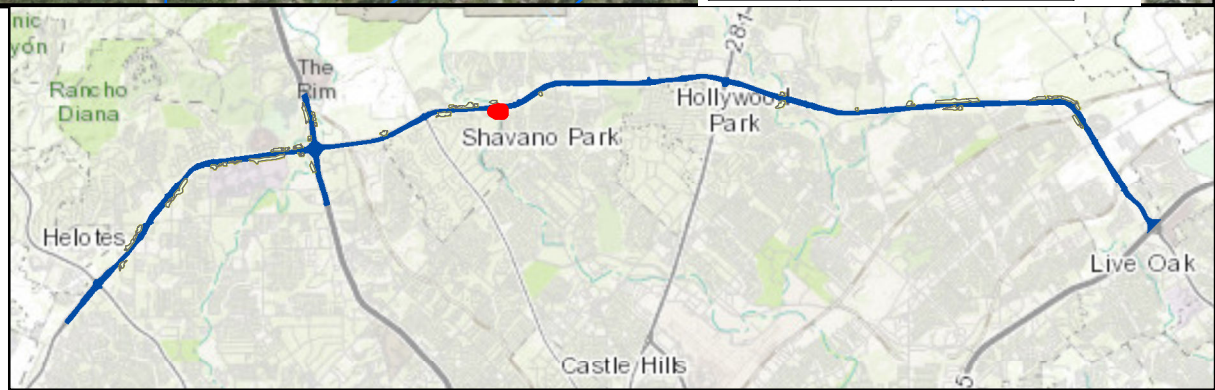

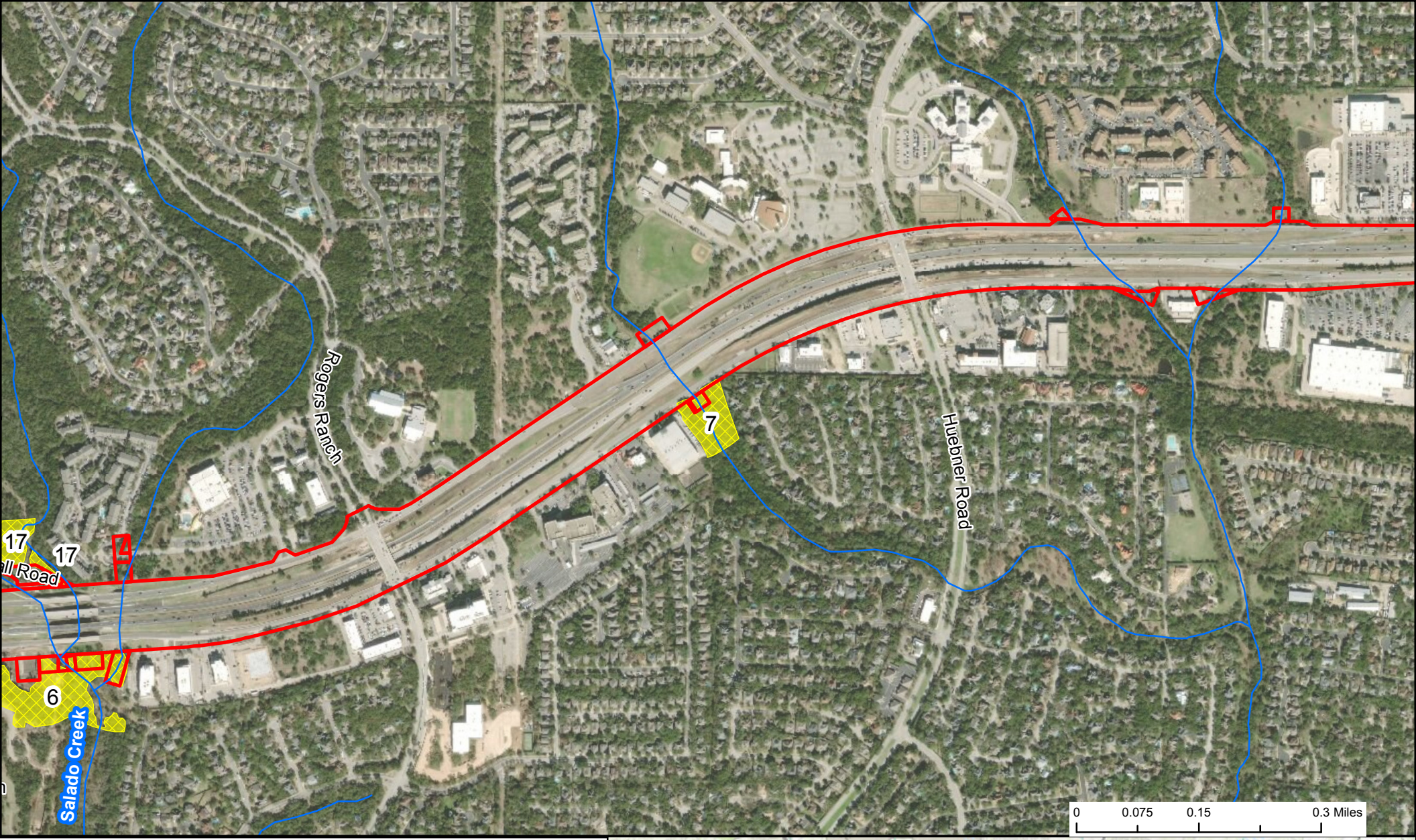

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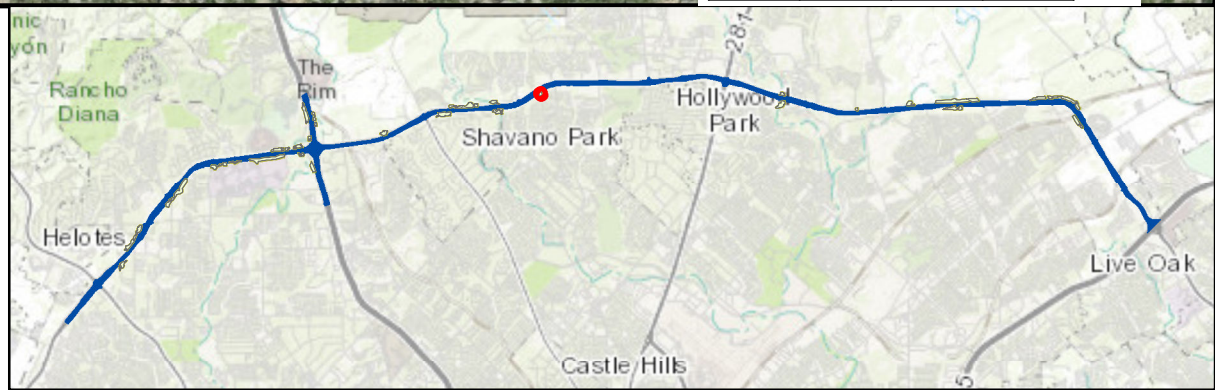

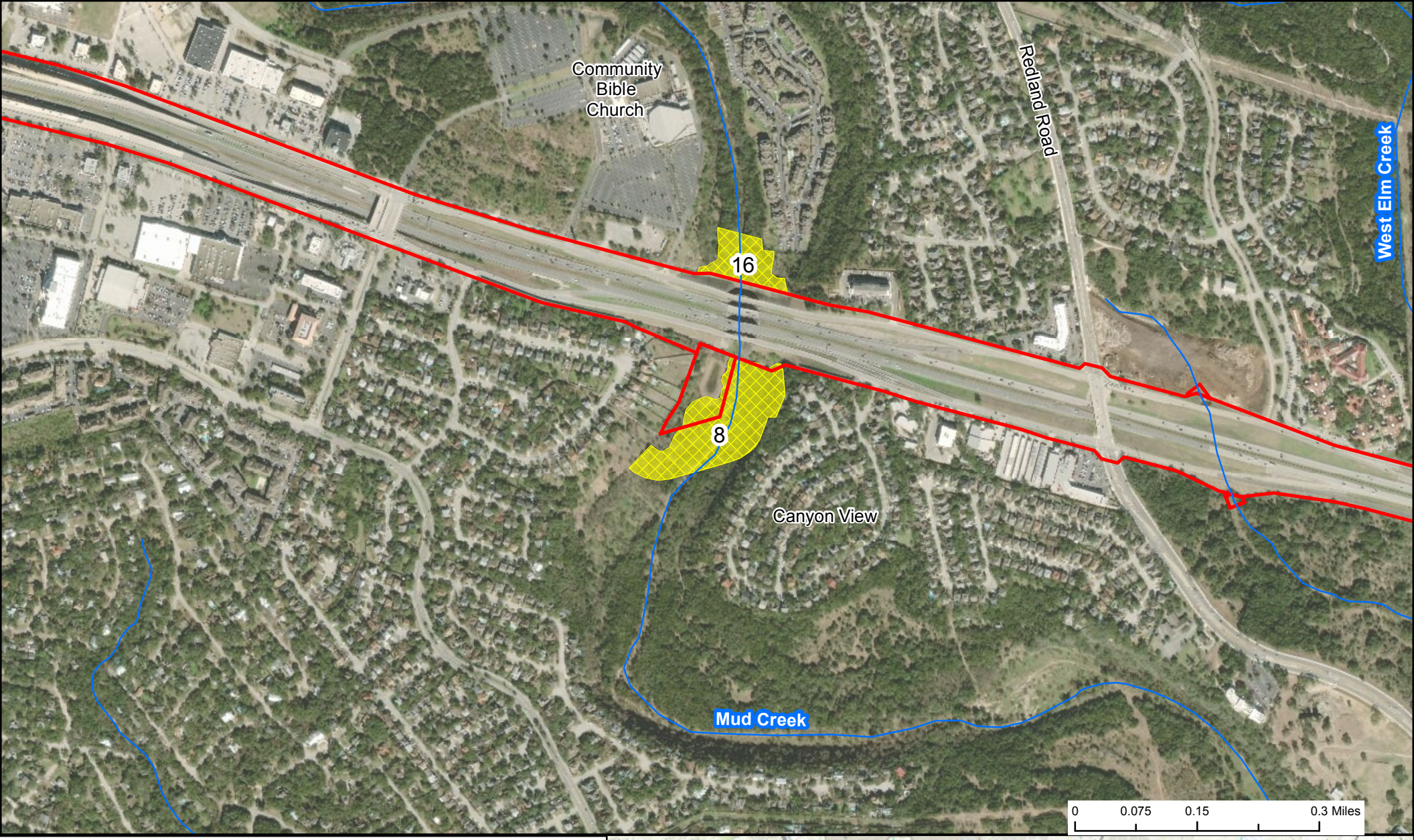

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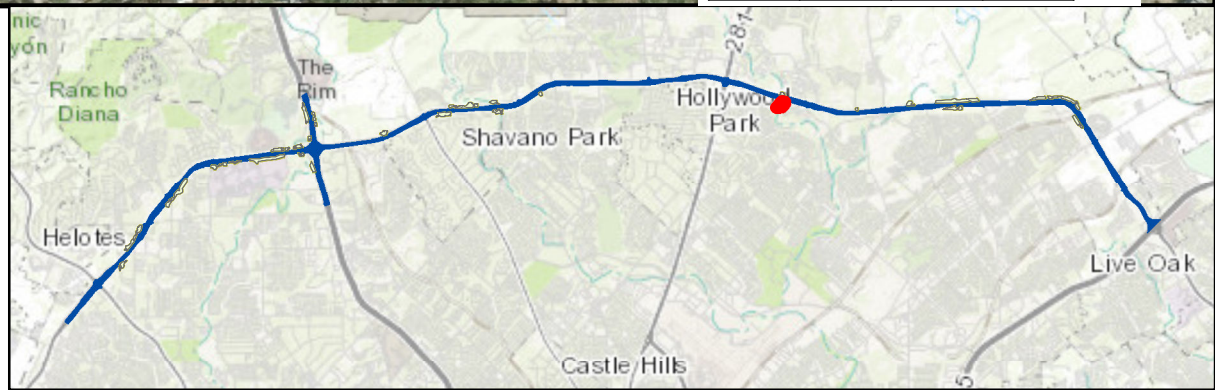

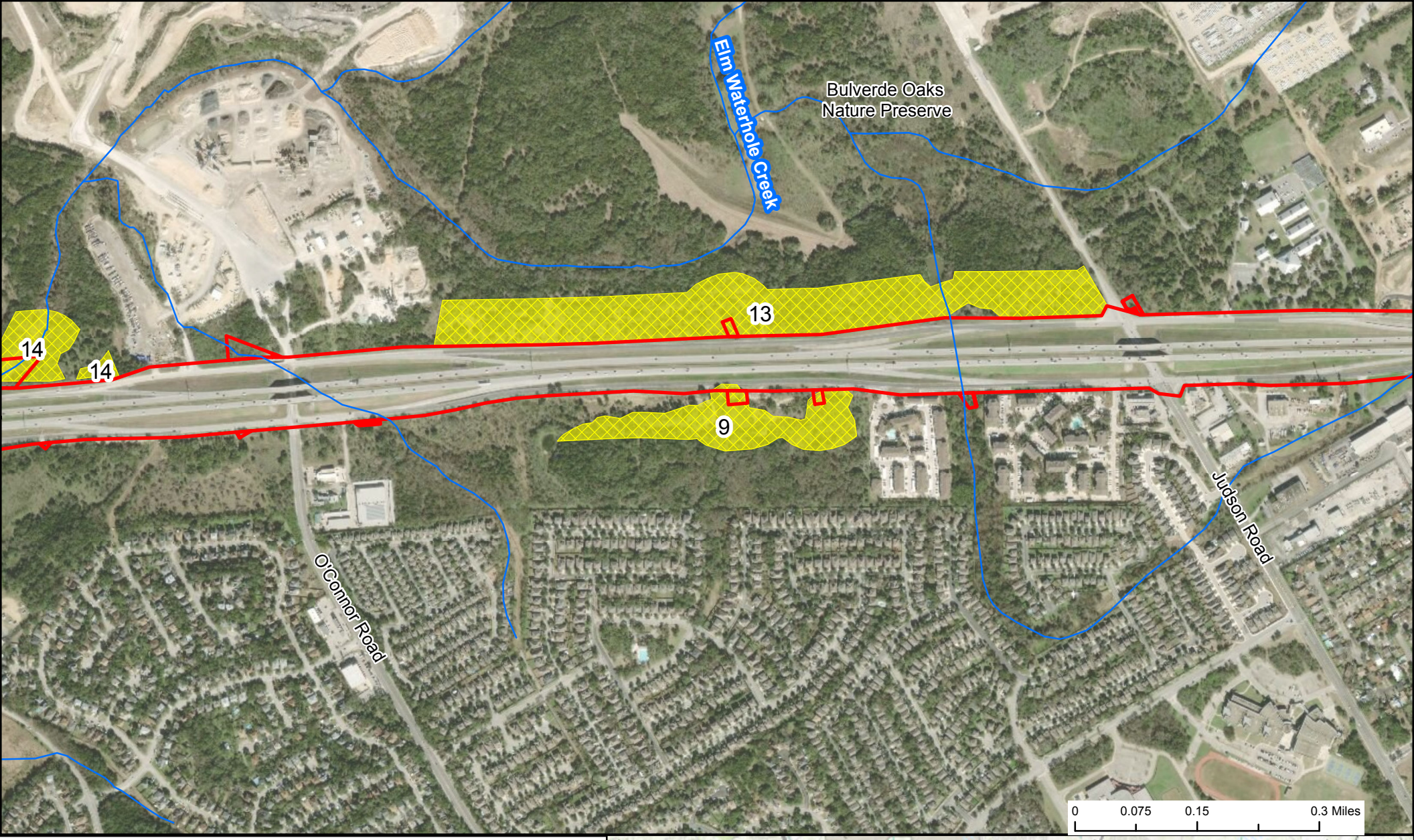

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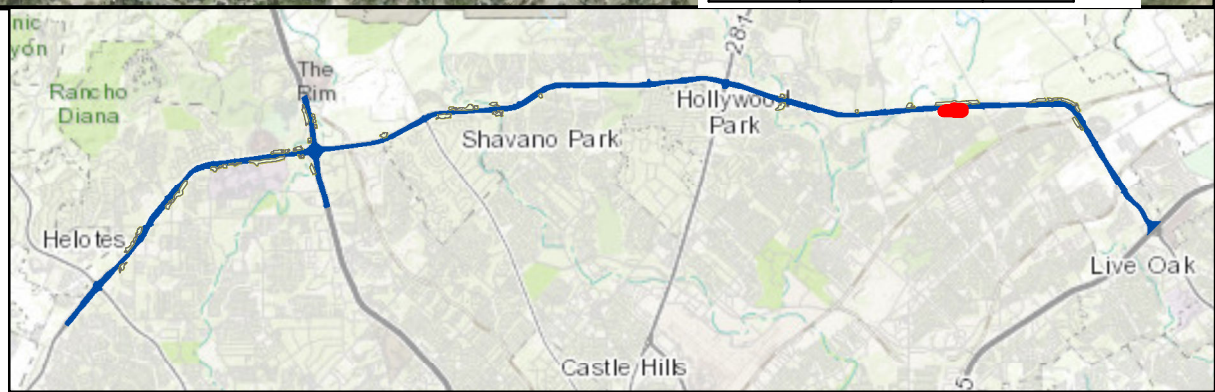

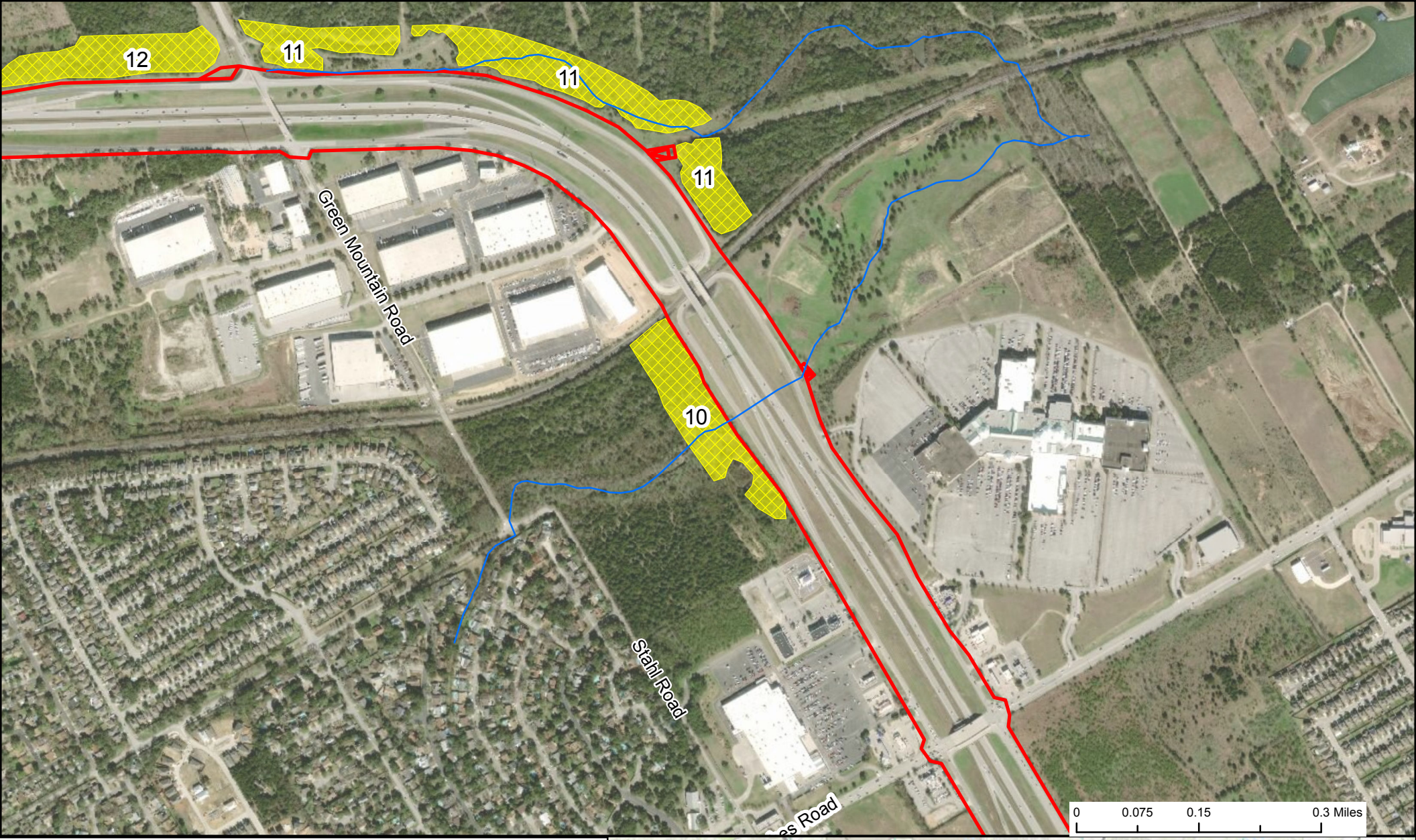

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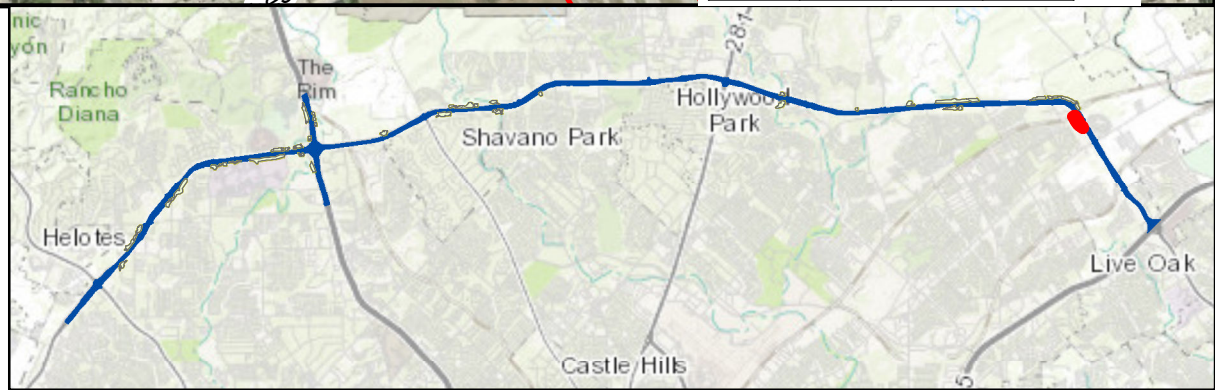

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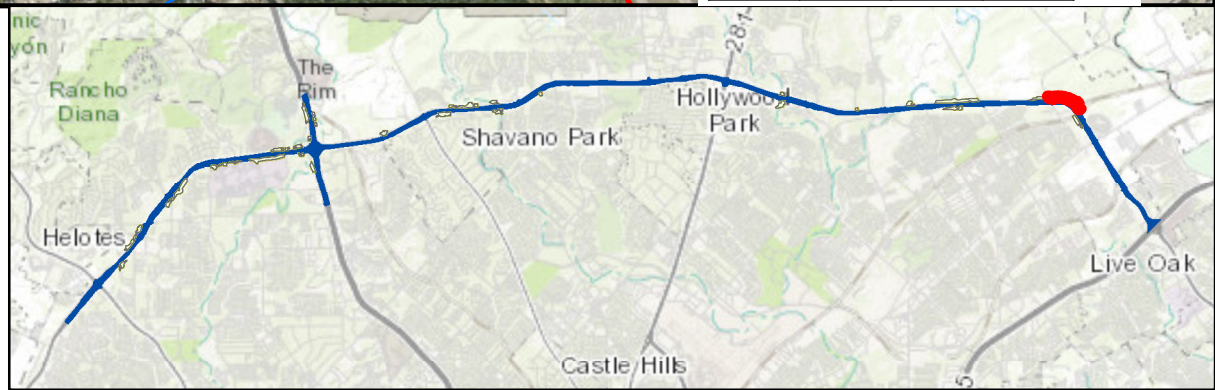

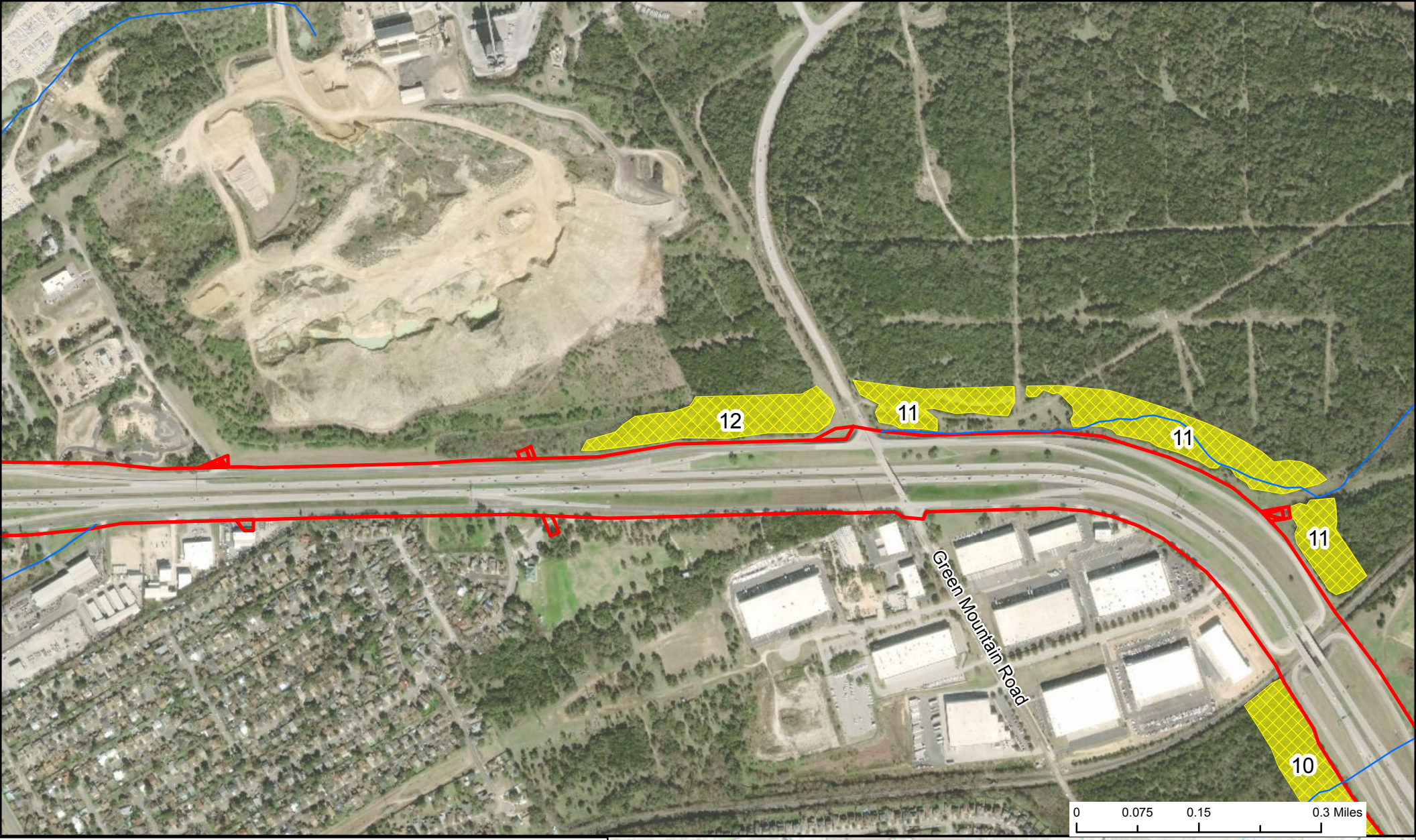

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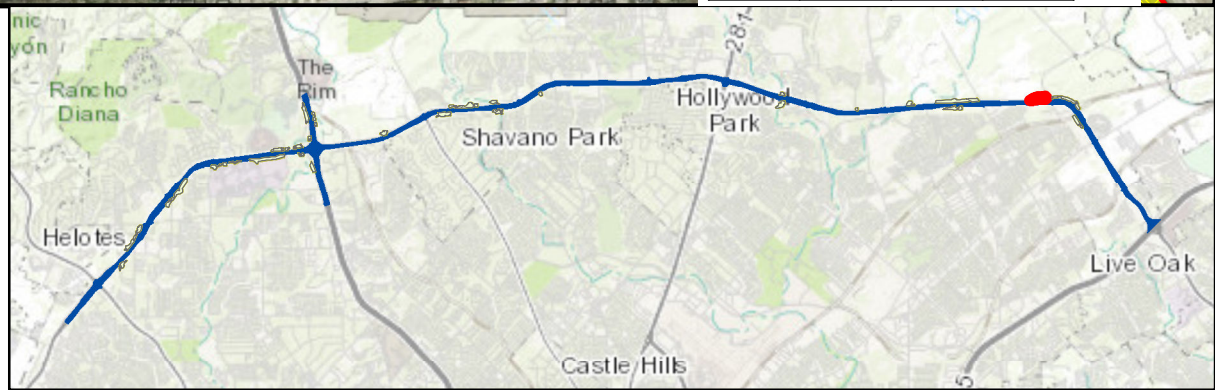

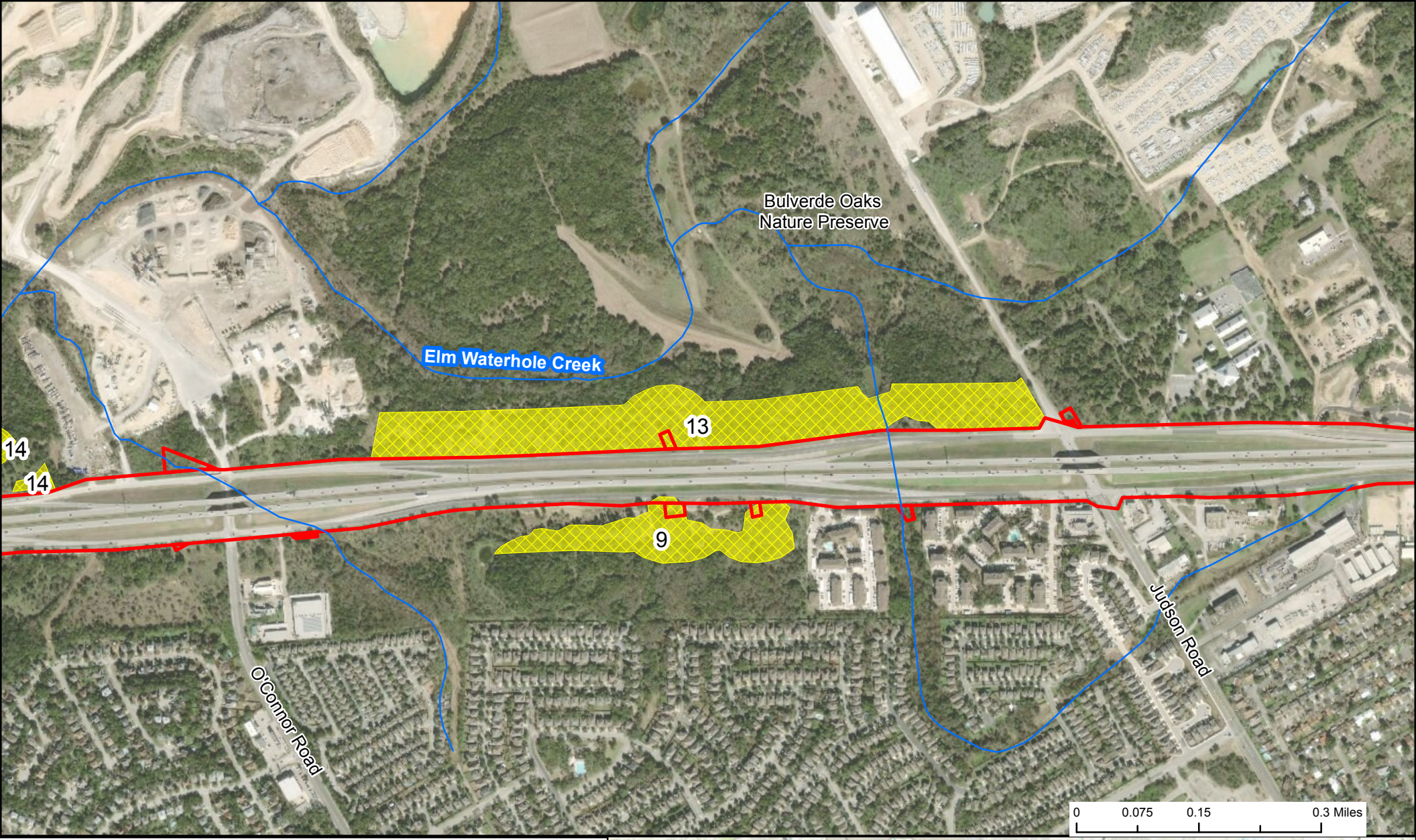

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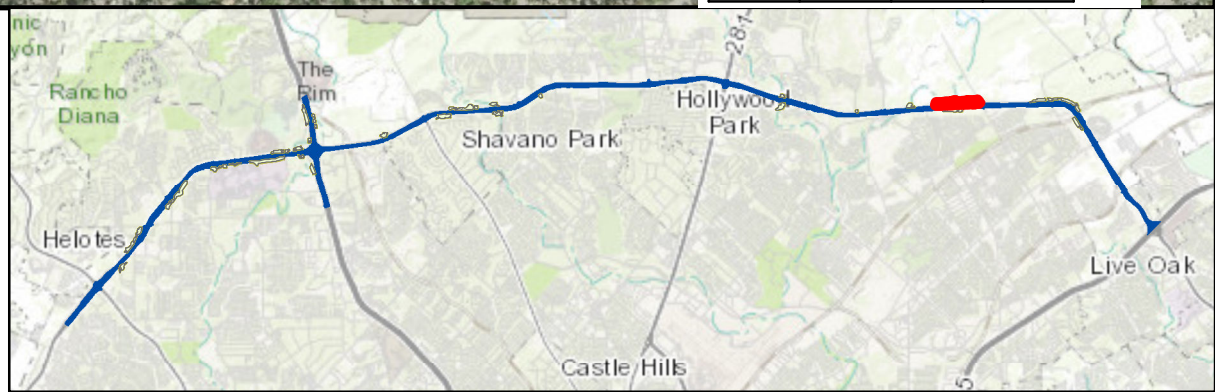

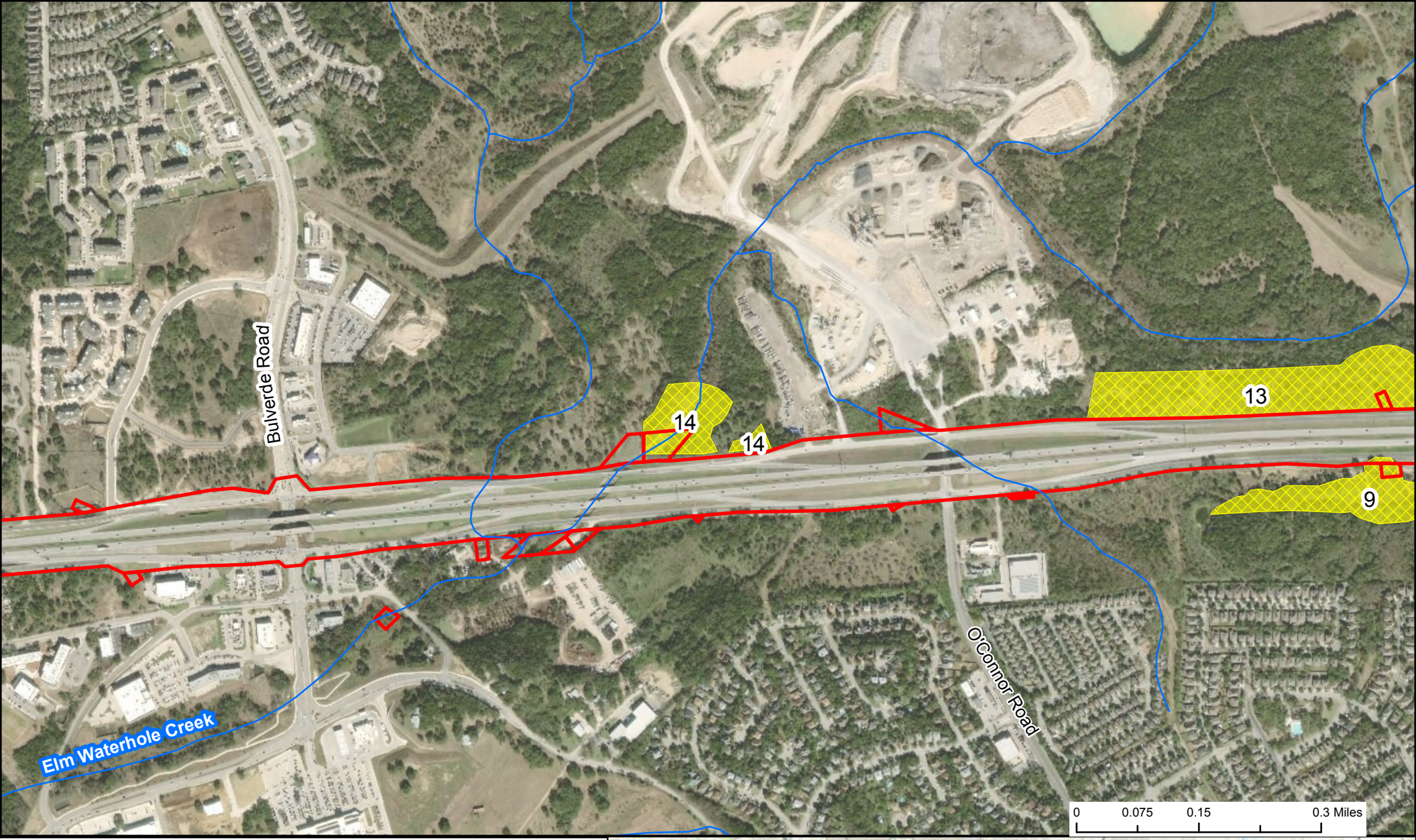

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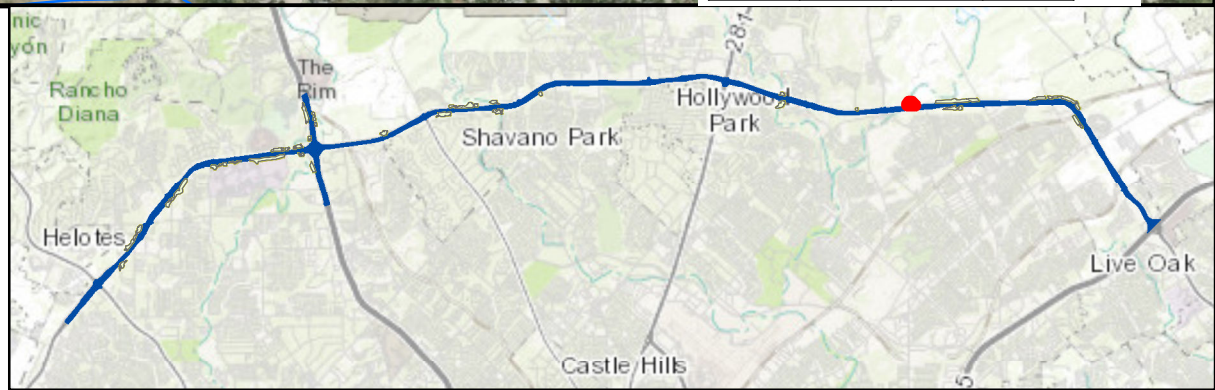

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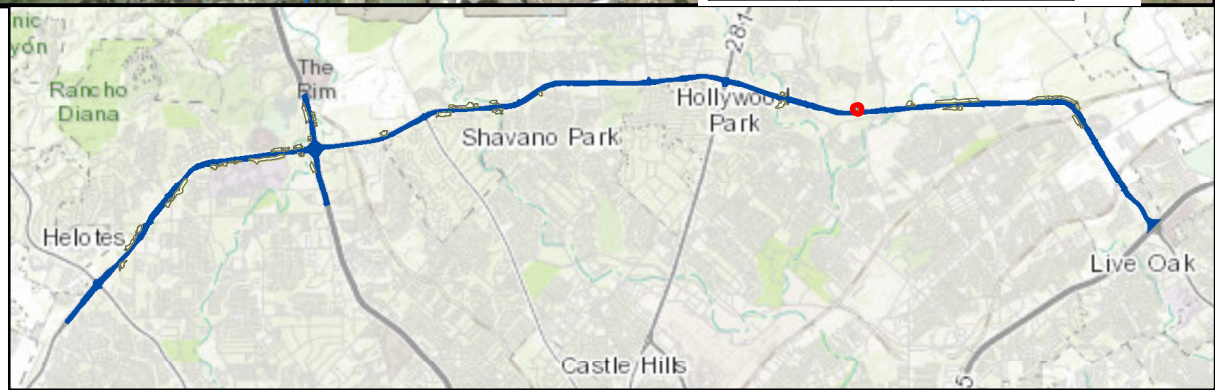

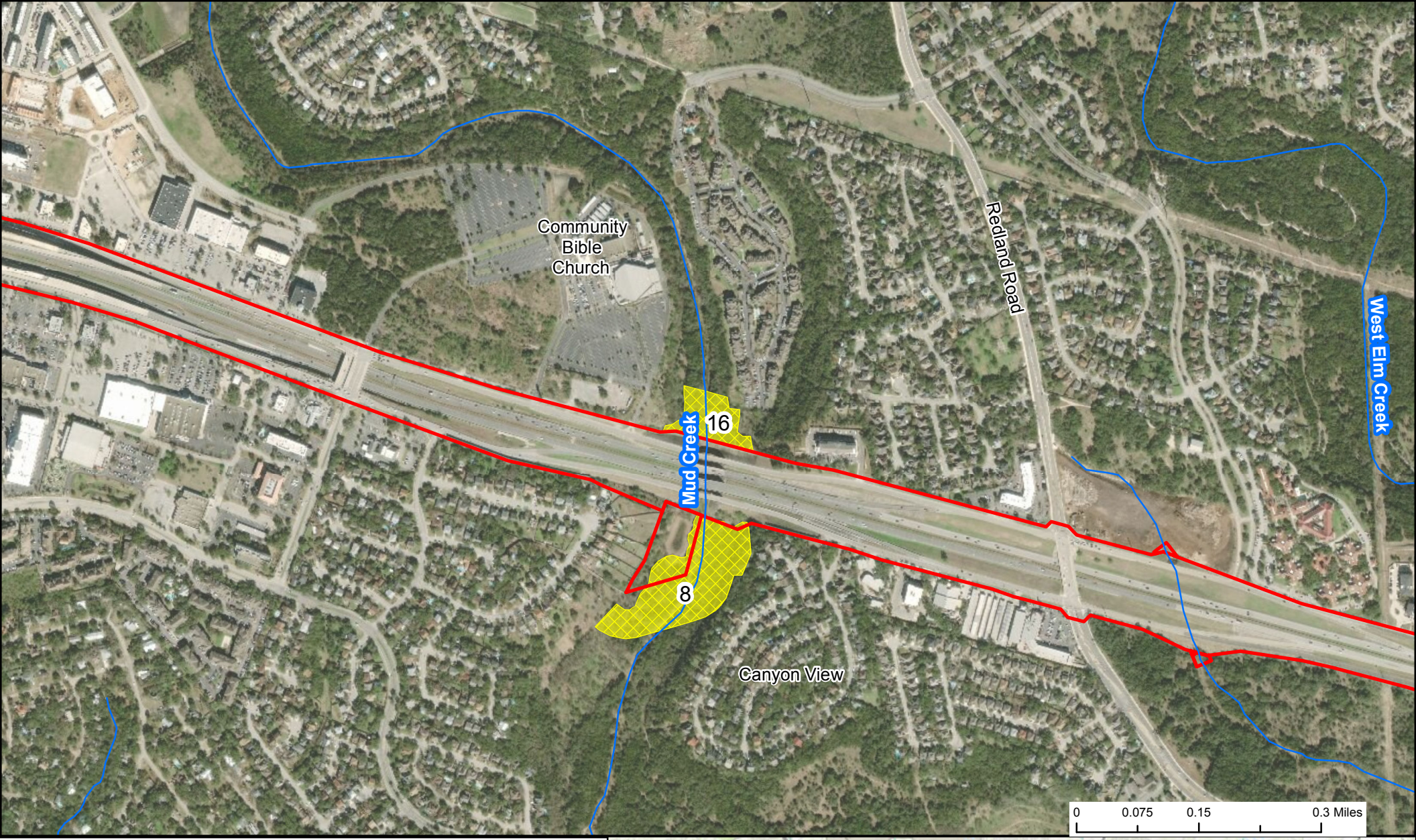

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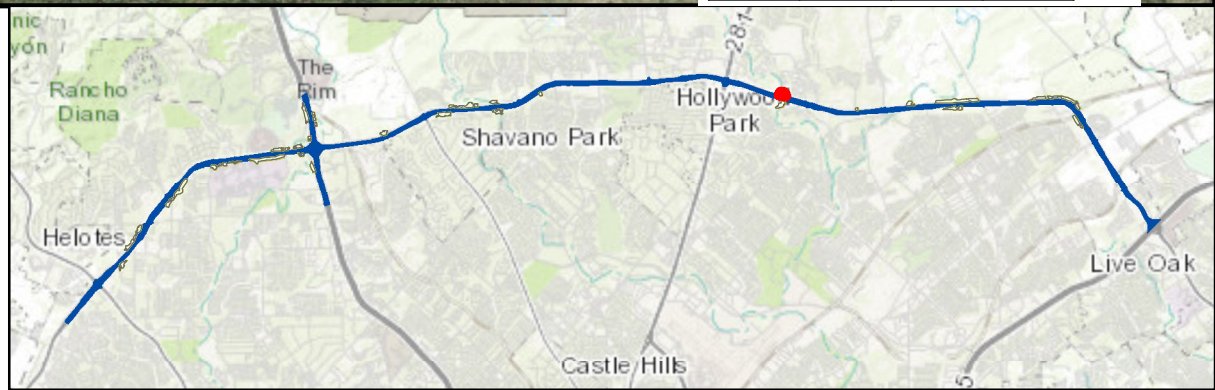

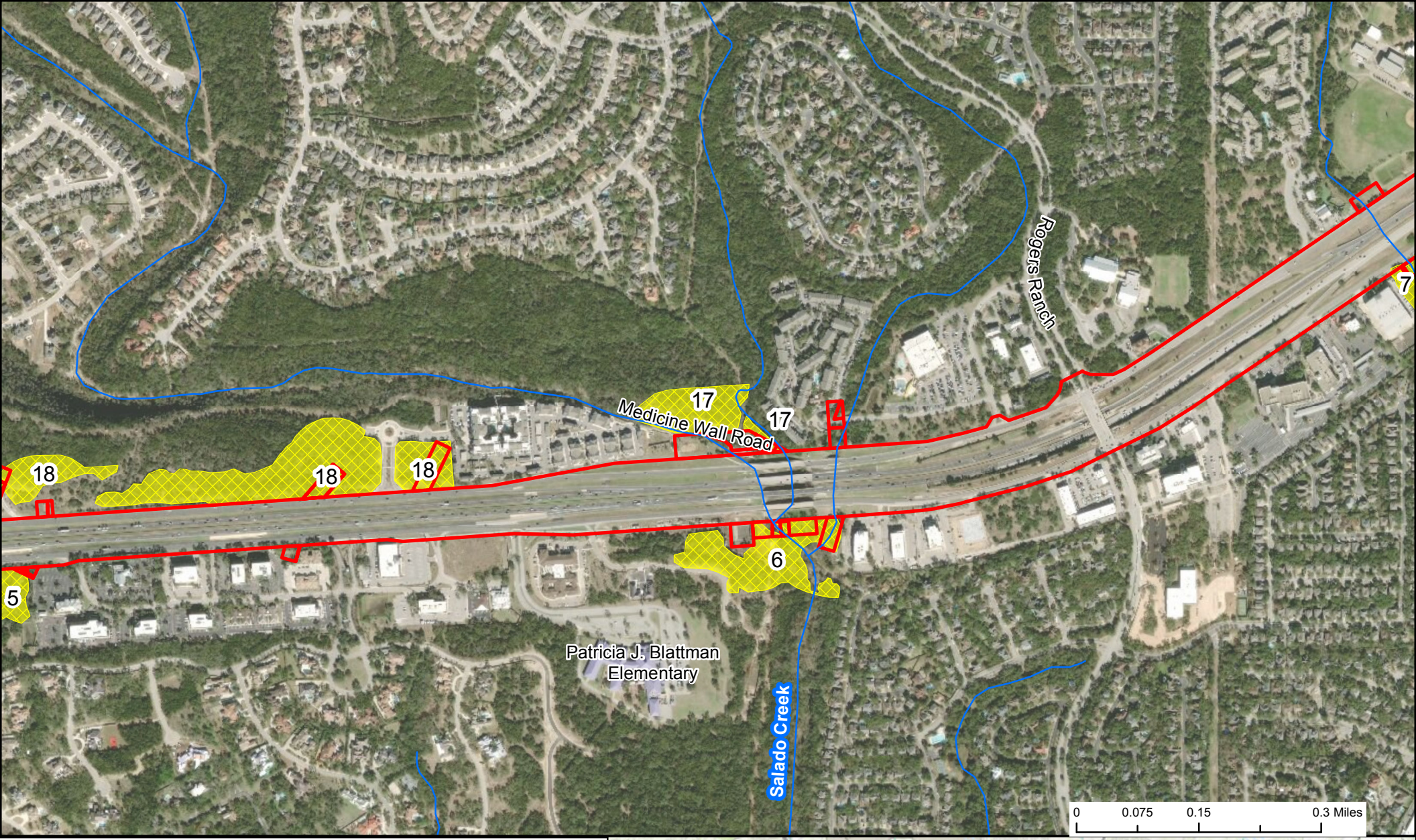

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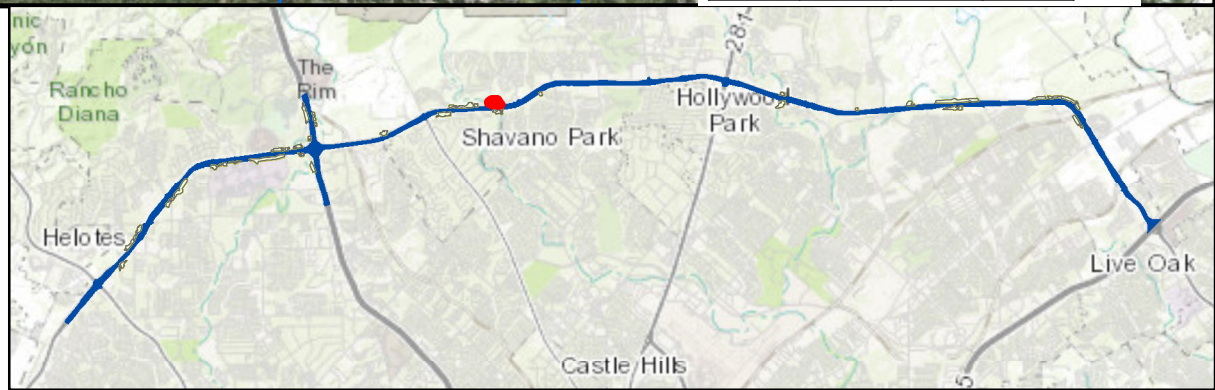

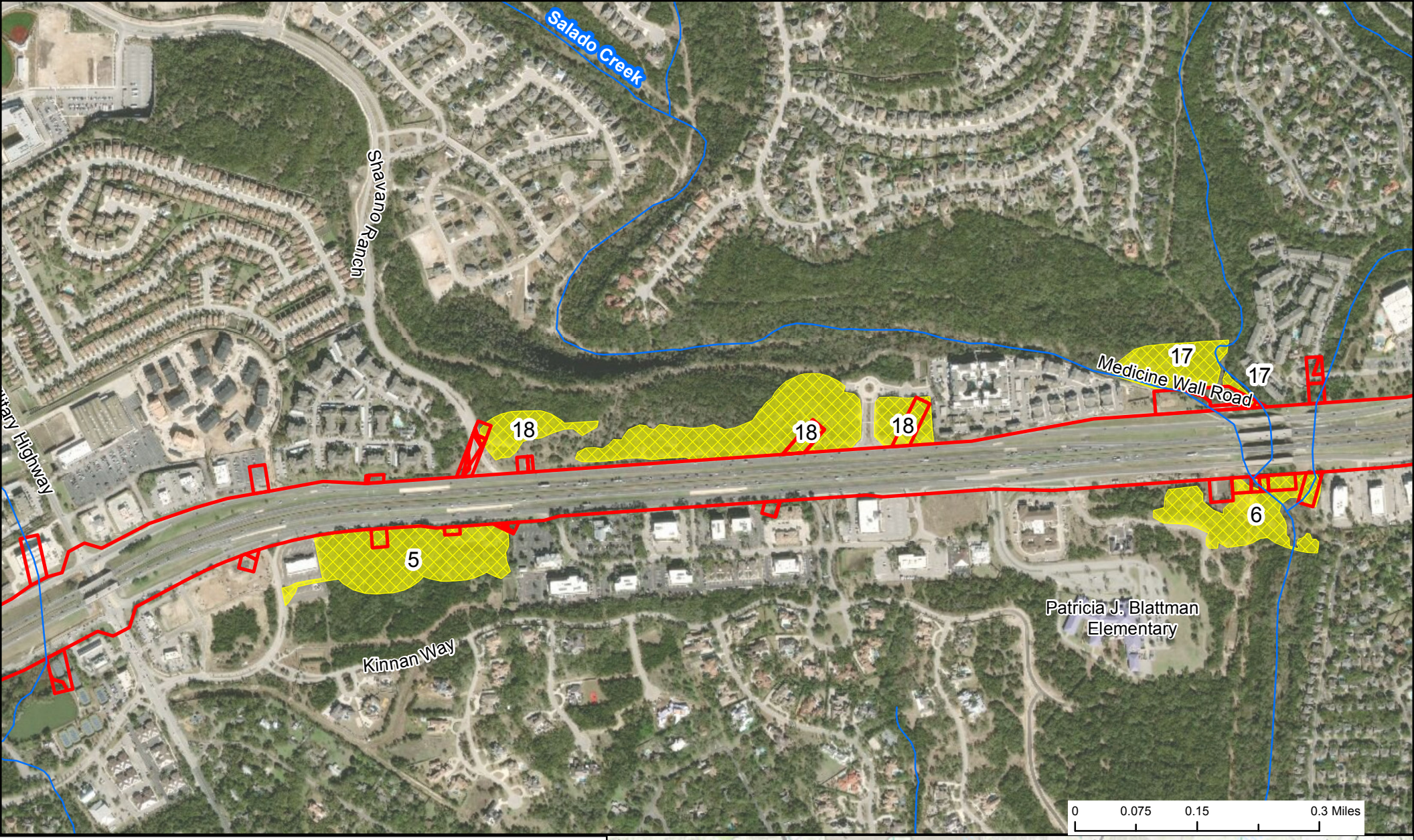

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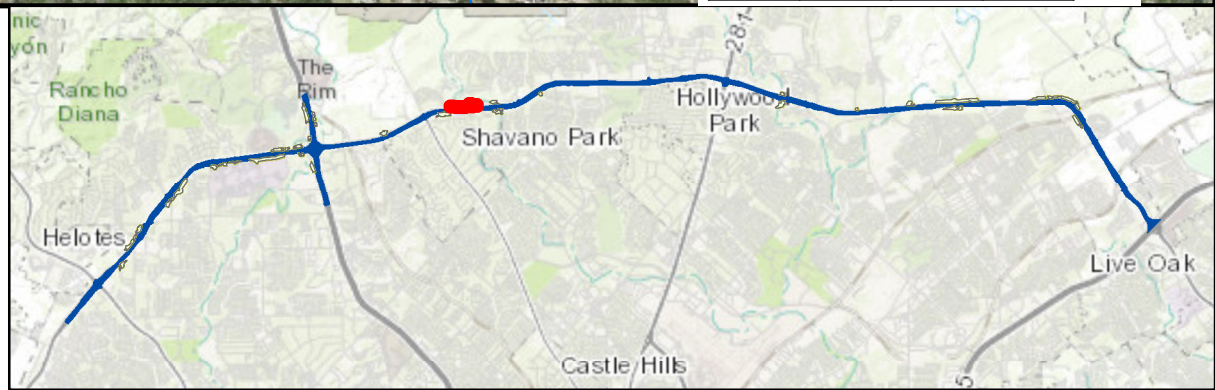

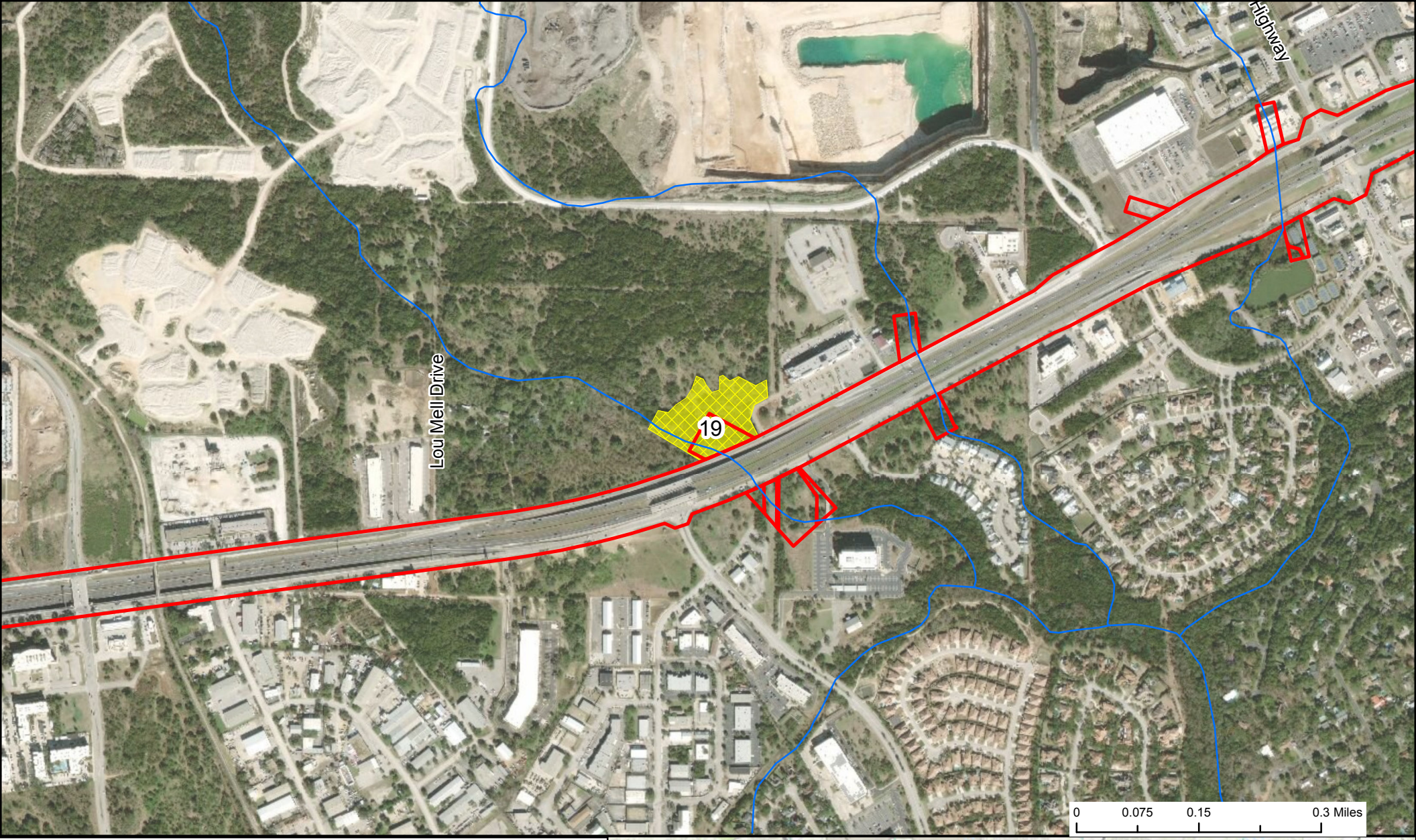

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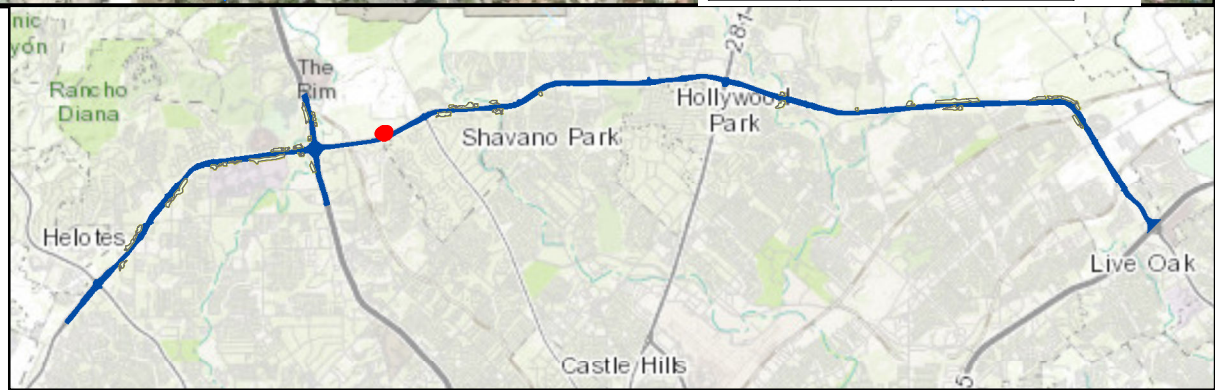

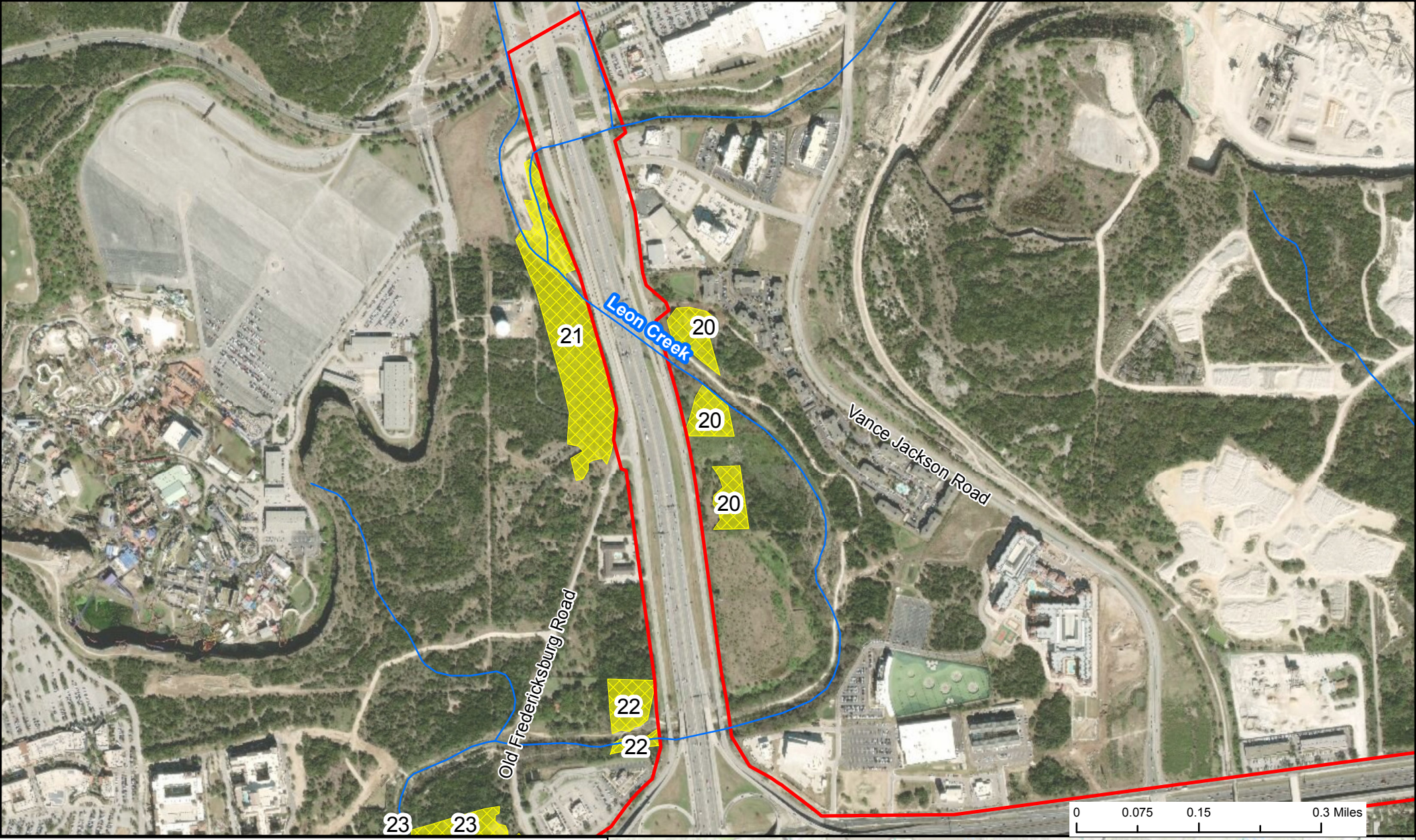

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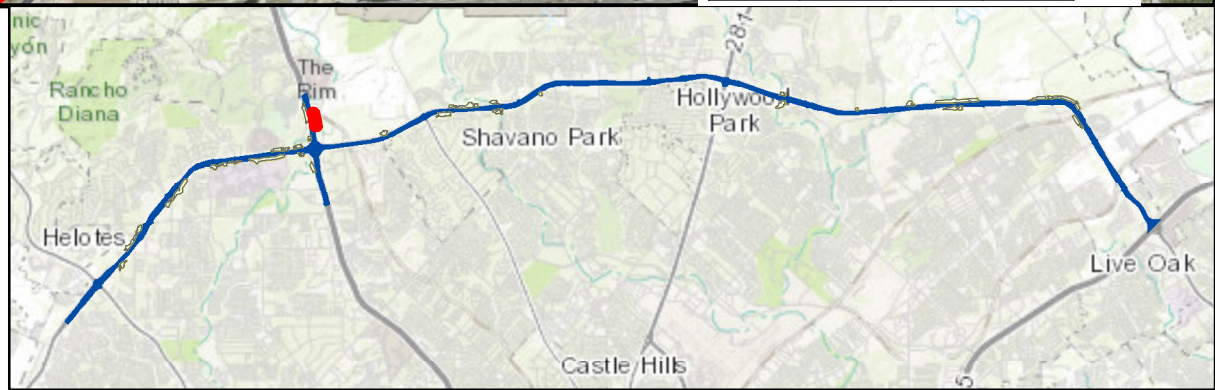

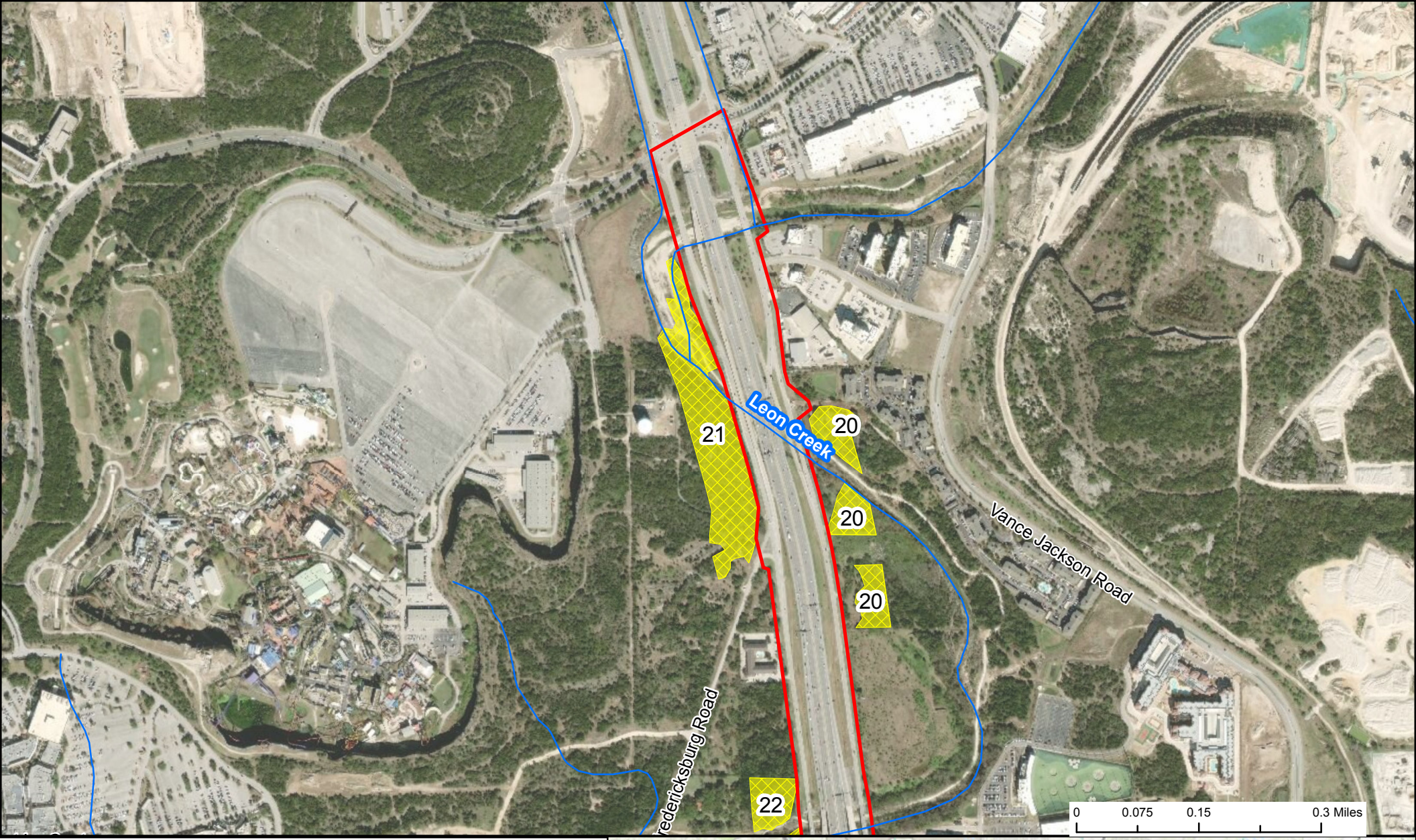

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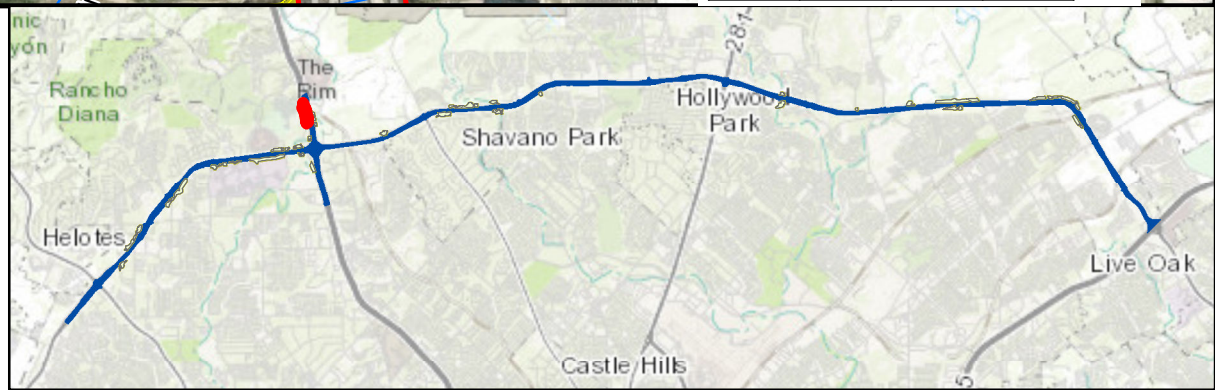

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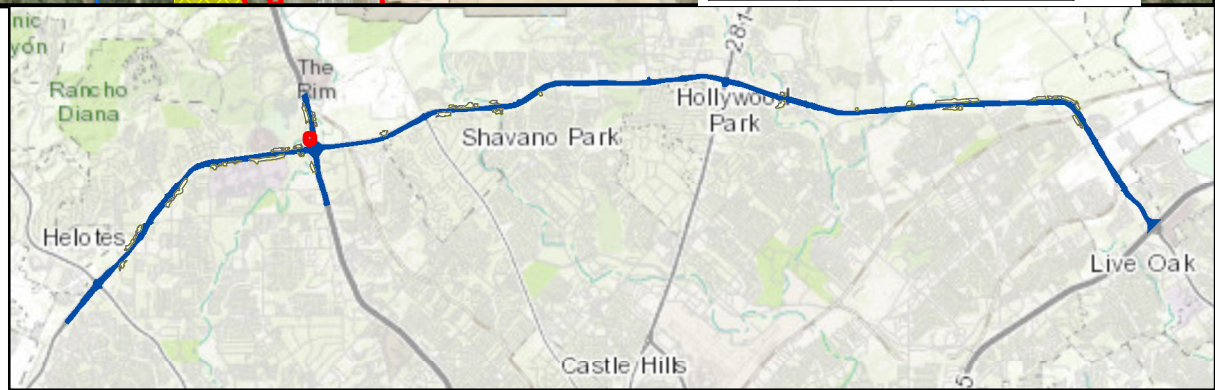

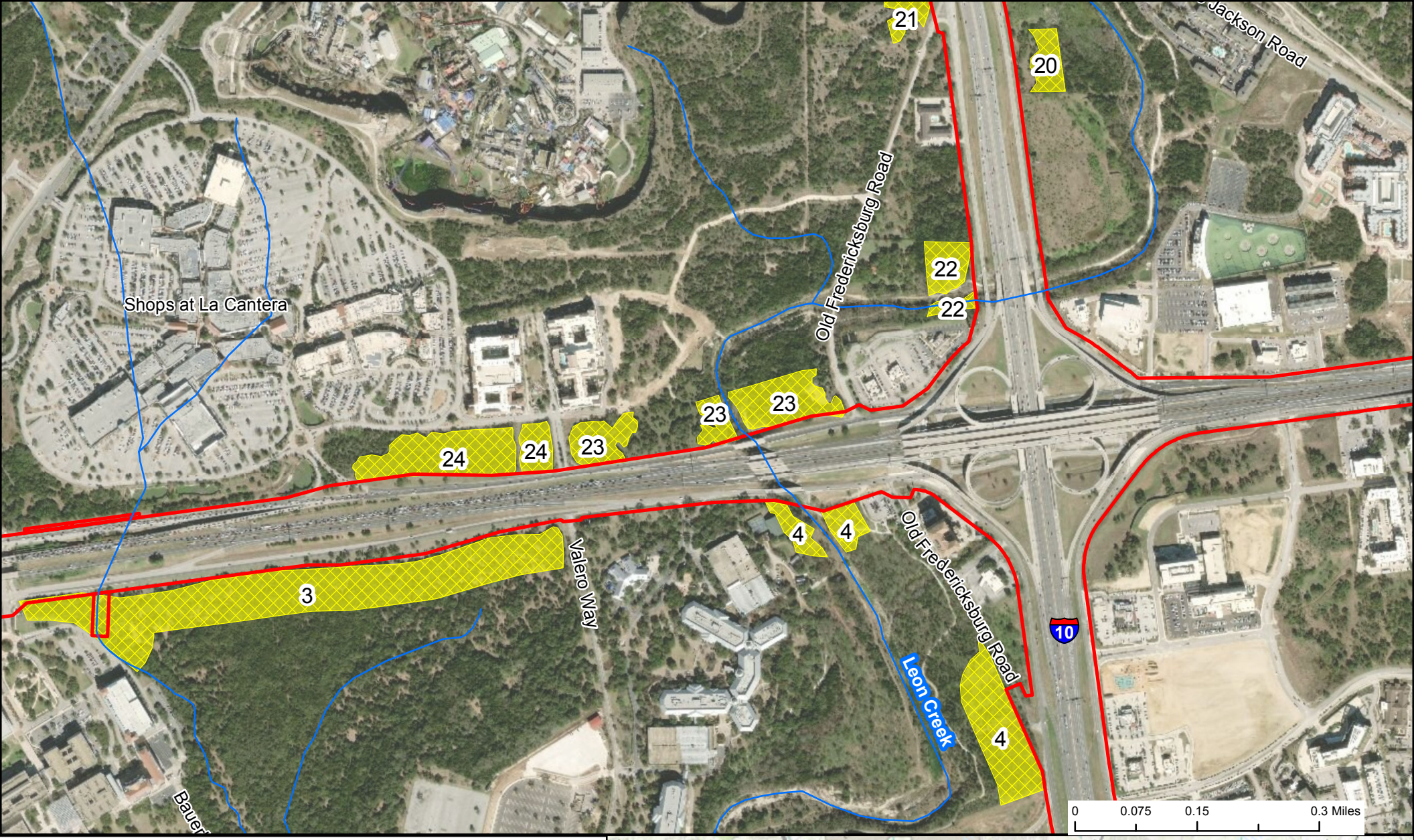

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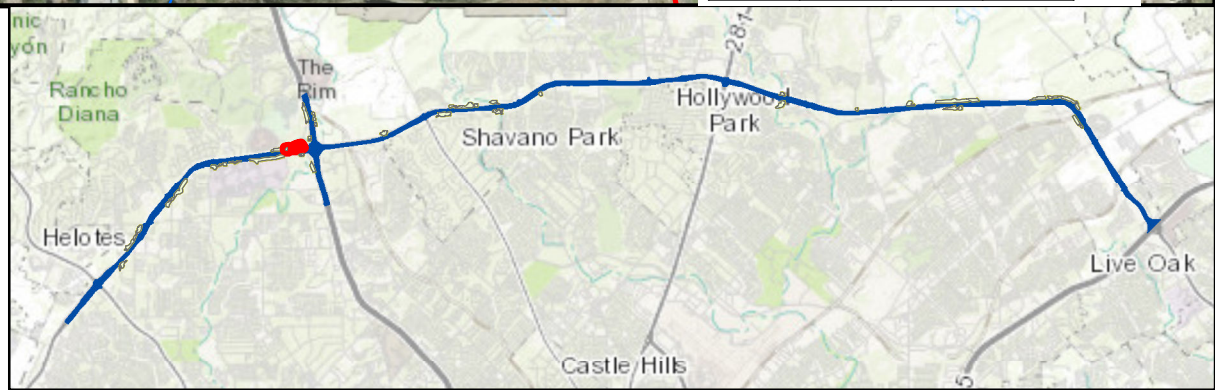

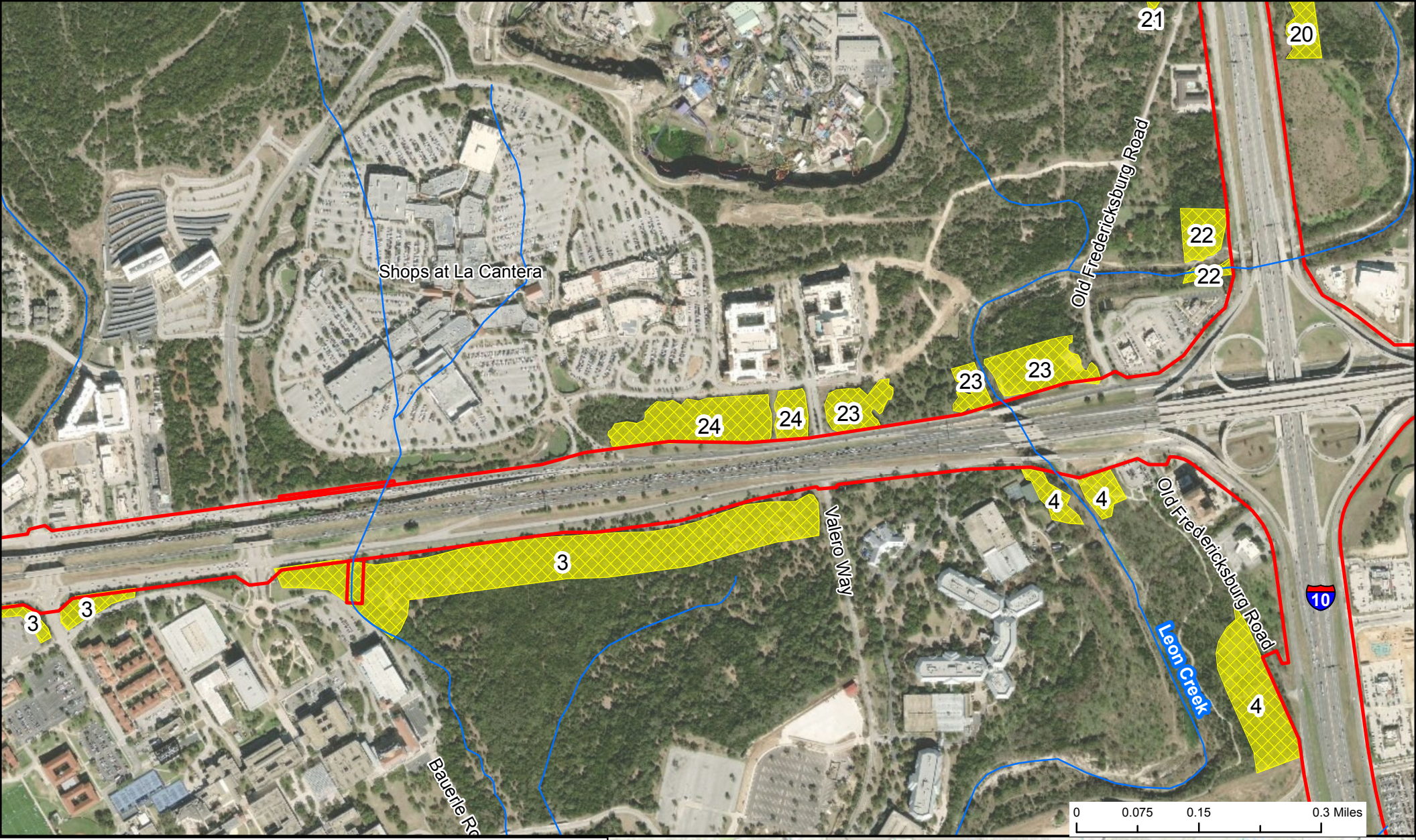

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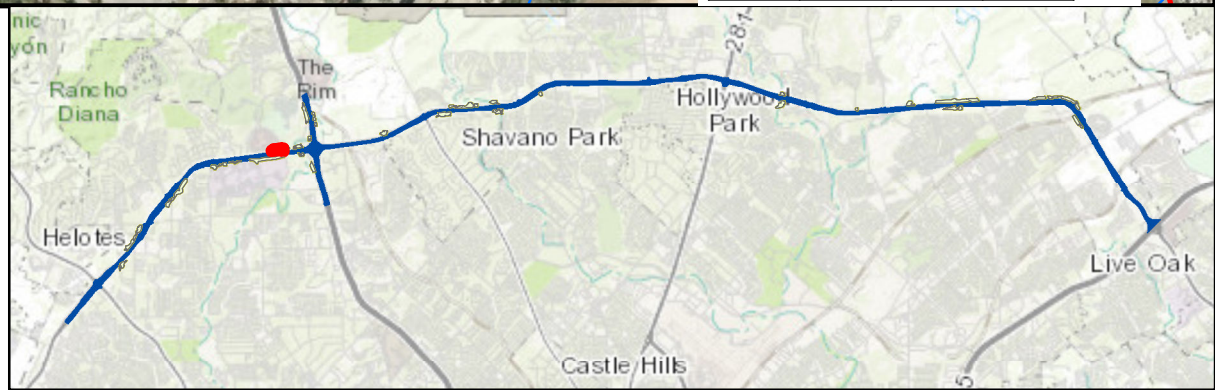

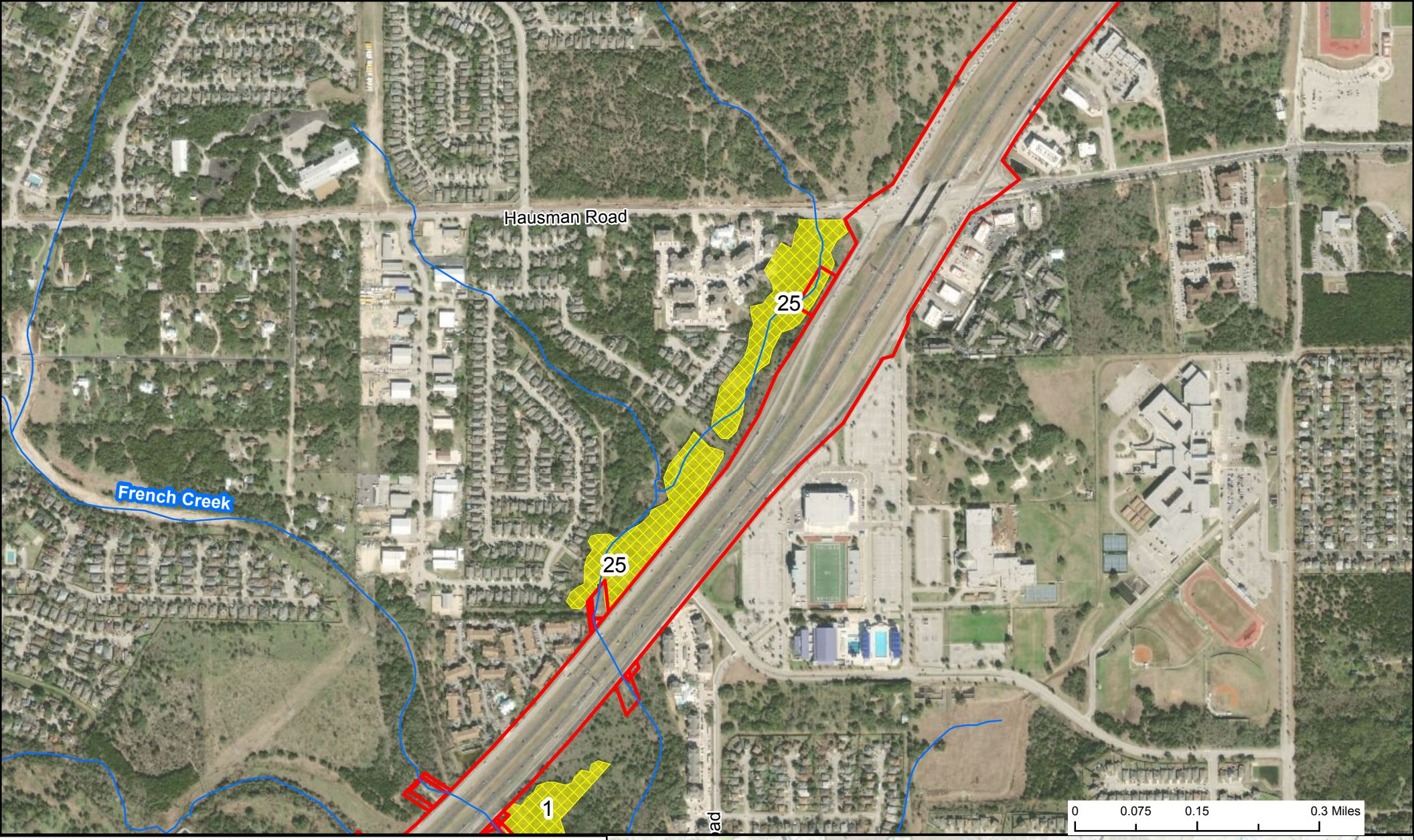

Golden-cheeked Warbler
Habitat Assessment
Loop 1604 from SH 16 to IH 35
San Antonio, Bexar County, Texas

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Project Area

GCWA Habitat Segments