
Noise Analysis Technical Report



U.S. Highway 290 (US 290) / State Highway (SH)
71 West from State Loop 1 (Mopac) to
Ranch-to-Market (RM) 1826 and SH 71 to
Silvermine Drive
Travis County, Texas
CSJ # 0113-08-060 and 0700-03-077
July 2018



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. Project Description

1.1 Introduction

The Texas Department of Transportation (TxDOT) and the Central Texas Regional Mobility Authority (Mobility Authority) are considering implementing mobility improvements to U.S. Highway 290 (US 290) / State Highway (SH) 71 West through Oak Hill (the Oak Hill Parkway). The project corridor extends along US 290 from State Loop 1 (Loop 1 or Mopac) to Ranch-to-Market Road (RM) 1826 for a distance of approximately 6.15 miles with a transition west to Circle Drive. The project also includes the interchange on SH 71 from US 290 to Silvermine Drive, a distance of approximately 1.31 miles. The proposed project corridor occurs within an area that includes the city of Austin, Texas, and its 2-mile extra-territorial jurisdiction (ETJ). The project location is shown on **Figure 1**.

In October of 2012, Notices of Intent were published in both the Federal Register and the Texas Register indicating TxDOT's intent to prepare a new Environmental Impact Statement (EIS) for the proposed project. Steady population growth in the Austin metropolitan area has caused congestion within the Oak Hill Parkway corridor. This congestion is causing unreliable traffic operations, travel time delays, and a poor level of service along the roadway. It may also affect emergency response and transit times, and connectivity of the project corridor to other Austin metropolitan area roadways and areas west and south of the project area. The purpose of the Oak Hill Parkway Project is to improve mobility and operational efficiency; facilitate long-term congestion management in the corridor; and improve safety, emergency response, and transit times.

Following several project team meetings and public involvement activities, several preliminary project design concepts were developed. These concepts were screened against the project's purpose and need and additional measurable elements, including displacements and traffic model peak-period travel times. After screening and evaluation, two project design concepts showing the greatest benefits and the lowest impacts were selected for development as project Build Alternatives. Alternatives A and C, in addition to the No Build Alternative, were carried forward for analysis in the Draft EIS (DEIS), released in April 2018. The Preferred Alternative—Alternative A—includes a combination of alternatives investigated during the study as documented in the DEIS, and was selected based on its ability to best accomplish the need for and purpose of the transportation improvements while minimizing impacts to social, economic, and environmental resources. The following noise analysis was conducted for the Preferred Alternative in order to document the updated traffic volumes and minor project design revisions following the release of the DEIS, in support of the Final EIS for the project.

The study area is located west of Austin in Travis County, Texas. The predominant land uses in the vicinity of the study area are rural, developed, commercial, and transportation. The study

area follows the proposed right-of-way running from east to west along and within the existing right-of-way of US 290 and SH 71.



Figure 1. Project Location

1.2 Existing Facility

The existing facility is comprised of several functional classifications of roadways. SH 71 from the northwest and US 290 from the west converge at a junction, locally known as the “Y,” and continue concurrently to Mopac and further east. The portion of US 290/SH 71 from just west of Old Fredericksburg Road to Mopac is a six-lane urban freeway section (three lanes in each direction) with grade-separated interchanges. Frontage roads in this section consist of four to eight lanes (two to four lanes in each direction). There are direct connector ramps connecting US 290/SH 71 mainlanes to the Mopac mainlanes. The US 290/71 mainlanes are 12 feet wide with 10-foot-wide shoulders, and the frontage road lane widths vary from 12 to 14 feet wide.

Between Old Fredericksburg Road and Joe Tanner Lane, US 290/SH 71 transitions from a freeway/frontage road facility to a four- and five-lane urban highway with a mix of curb-and-gutter and roadside ditch drainage features. These lanes are 11 to 12 feet wide and include an intermittent 12-foot center left-turn lane. The existing US 290 roadway section between SH 71 and RM 1826 consists of four 12-foot-wide lanes with turn lanes and 2-foot-wide shoulders.

The existing SH 71 facility is a four-lane rural highway section with two signalized intersections and left-turn lanes which provide access to shopping centers on both sides of the roadway. Lane widths are 12 feet with 2- to 4-foot shoulders within this area. A 12-foot-wide center turn lane occurs from the shopping center drive to south of Scenic Brook Drive.

Pedestrian facilities along this corridor occur intermittently and are absent in some areas. Drainage facilities vary from curb-and-gutter storm sewer systems to roadside ditches and culverts.

1.3 Proposed Facility

The Preferred Alternative has been guided by the Capital Area Metropolitan Planning Organization (CAMPO) 2040 Regional Transportation Plan (RTP), the regional transportation plan covering the corridor (CAMPO 2015). The proposed project is included in the RTP as well as in CAMPO’s fiscal year (FY) 2017–2020 Transportation Improvement Program (TIP) as a controlled access highway with frontage roads along US 290 and a divided highway with direct connectors along SH 71. The CAMPO 2040 RTP was locally adopted by the Transportation Policy Board on May 11, 2015 and the TIP with amendments was adopted on July 6, 2016. Both were modified on July 18, 2018 to reflect the non-tolled facility. The Preferred Alternative is a conventional controlled-access highway with frontage roads. New construction on roadway improvements would begin just east of Joe Tanner Lane where the existing mainlanes transition to an urban highway. With the Preferred Alternative, the mainlanes would be elevated over William Cannon Drive, and the westbound mainlanes and frontage road would be located north of Williamson Creek. The mainlanes would be depressed under SH 71 and

direct connectors would be provided connecting eastbound SH 71 with US 290 and westbound US 290 to SH 71. Mainlanes would vary from four near William Cannon Drive to two near the western project limit. Grade-separated intersections would be constructed at Convict Hill Road, RM 1826, Scenic Brook Drive, and Circle Drive (South View Road). Mainlanes would generally be 12 feet wide with 10-foot-wide shoulders. Texas turnarounds, which allow vehicles traveling on a frontage road to U-turn onto the opposite frontage road, would be constructed on US 290 frontage roads at Scenic Brook Drive, RM 1826, Convict Hill Drive, and William Cannon Drive.

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

1.4 Summary of Purpose and Need

The purpose of the proposed project is to improve mobility and operational efficiency, facilitate long-term congestion management in the corridor by accommodating the movement of people and goods for multiple modes of travel, and to improve safety and emergency response within the corridor. The need for the proposed project stems from congestion within the corridor brought on by steady population growth in the Austin metropolitan area. This congestion is creating unreliable travel and emergency response times.

1.5 Objectives of this Report

The purpose of this technical report is to present the findings of the noise analysis that was performed for the proposed project including documenting updated traffic volumes and minor project revisions since the release of the DEIS in April 2018. This analysis was accomplished in accordance with TxDOT's (FHWA approved) Guidelines for Analysis and Abatement of Roadway Traffic Noise (April 2011).

1.6 Traffic Noise Overview

Sound from highway traffic is generated primarily from a vehicle's tires, engine and exhaust. It is commonly measured in decibels and is expressed as "dB."

Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dB(A)".

Also, because traffic sound levels are never constant due to the changing number, type and speed of vehicles, a single value is used to represent the average or equivalent sound level and is expressed as "Leq".

The traffic noise analysis typically includes the following elements:

- Identification of land use activity areas that might be impacted by traffic noise
- Determination of existing noise levels
- Prediction of future noise levels
- Identification of possible noise impacts
- Consideration and evaluation of measures to reduce noise impacts

The FHWA has established the Noise Abatement Criteria (NAC) listed in **Table 1** for various land use activity areas that are used as one of two means to determine when a traffic noise impact would occur.

Table 1. Noise Abatement Criteria

	Activity Category	dB(A) Leq	Description of Activity Category
	A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
	B	67 (exterior)	Residential.
	C	67 (exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
	D	52 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
	E	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A-D or F.
	F	–	Agricultural, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
	G	–	Undeveloped lands that are not permitted.

A noise impact occurs when either the absolute or relative criterion is met.

Absolute criterion: The predicted noise level at a receiver approaches, equals, or exceeds the NAC. Approach is defined as 1 dB(A) below the NAC. For example, a noise impact would occur at a Category B residence if the noise level is predicted to be 66 dB(A) or above.

Relative criterion: The predicted noise level substantially exceeds the existing noise level at a receiver even though the predicted noise level does not approach, equal, or exceed the NAC. Substantially exceeds is defined as more than 10 dB(A). For example, a noise impact would occur at a Category B residence if the existing noise level is 54 dB(A) and the predicted noise level is 65 dB(A) (11dB(A) increase).

When a traffic noise impact occurs, noise-abatement measures must be considered. A noise-abatement measure is any positive action taken to reduce the impact of traffic noise on an activity area.

The FHWA traffic noise modelling software was used to calculate existing and predicted traffic noise levels. The model primarily considers the number, type and speed of vehicles; highway alignment and grade; cuts, fills and natural berms; surrounding terrain features; and the locations of activity areas likely to be impacted by the associated traffic noise.

1.7 Results of Traffic Noise Analysis

Existing and predicted traffic noise levels were modelled at receiver locations (**Table 2** and **Figure 2**) that represent the land use activity areas adjacent to the proposed project that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement.

Table 2. Traffic Noise Levels dB(A) Leq

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R1 (single-family residence) (1)	B	67	68	68	0	YES
R2-1 (apartment floor 1) (2)	B	67	59	60	+1	NO
R2-2 (apartment floor 2) (2)	B	67	62	63	+1	NO
R2-3 (apartment floor 3) (2)	B	67	63	64	+1	NO
R3 (dog park) (1)	C	67	64	65	+1	NO
R4 (dog park) (1)	C	67	62	64	+2	NO
R5 (single-family residence) (1)	B	67	66	68	+2	YES
R6 (single-family residence) (1)	B	67	62	64	+2	NO
R7 (single-family residence) (1)	B	67	65	67	+2	YES
R8 (single-family residence) (1)	B	67	63	65	+2	NO
R9 (single-family residence) (1)	B	67	64	66	+2	YES
R10 (single-family residence) (1)	B	67	70	73	+3	YES
R11 (single-family residence) (1)	B	67	57	59	+2	NO
R12 (single-family residence) (1)	B	67	61	62	+1	NO
R13 (single-family residence) (1)	B	67	61	62	+1	NO
R14 (event center) (1)	E	72	68	71	+3	YES
R15 (restaurant) (1)	E	72	68	69	+1	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R16 (single-family residence) (1)	B	67	56	56	0	NO
R17 (single-family residence) (1)	B	67	55	56	+1	NO
R18 (church) (1)	D	52	43	45	+2	NO
R19 (single-family residence) (1)	B	67	64	66	+2	YES
R20 (single-family residence) (1)	B	67	58	61	+3	NO
R21 (single-family residence) (1)	B	67	56	57	+1	NO
R22 (single-family residence) (1)	B	67	56	58	+2	NO
R23 (single-family residence) (1)	B	67	56	58	+2	NO
R24 (single-family residence) (1)	B	67	59	61	+2	NO
R25 (single-family residence) (1)	B	67	63	65	+2	NO
R26 (single-family residence) (1)	B	67	65	67	+2	YES
R27 (single-family residence) (1)	B	67	63	55	-8	NO
R28 (single-family residence) (1)	B	67	58	53	-5	NO
R29 (single-family residence) (1)	B	67	58	52	-6	NO
R30 (single-family residence) (1)	B	67	57	52	-5	NO
R31 (home-based pre-school) (1)	B/C	67	63	55	-8	NO
R32 (single-family residence) (1)	B	67	64	56	-8	NO
R33 (single-family residence) (1)	B	67	56	52	-4	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R34 (single-family residence) (1)	B	67	61	62	+1	NO
R35 (single-family residence) (1)	B	67	56	55	-1	NO
R36 (single-family residence) (1)	B	67	68	67	-1	YES
R37 (single-family residence) (1)	B	67	57	56	-1	NO
R38 (single-family residence) (1)	B	67	59	57	-2	NO
R39 (single-family residence) (1)	B	67	64	62	-2	NO
R40 (school) (1)	C	67	64	62	-2	NO
R41 (single-family residence) (1)	B	67	59	58	-1	NO
R42 (single-family residence) (1)	B	67	59	58	-1	NO
R43-1 (apartment floor 1) (2)	B	67	61	59	-2	NO
R43-2 (apartment floor 2) (2)	B	67	63	62	-1	NO
R43-3 (apartment floor 3) (2)	B	67	64	63	-1	NO
R44 (single-family residence) (1)	B	67	56	57	+1	NO
R45 (single-family residence) (1)	B	67	56	58	+2	NO
R46 (single-family residence) (1)	B	67	57	59	+2	NO
R47 (single-family residence) (1)	B	67	58	60	+2	NO
R48 (single-family residence) (1)	B	67	59	61	+2	NO
R49 (single-family residence) (1)	B	67	59	61	+2	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R50 (single-family residence) (1)	B	67	59	60	+1	NO
R51 (single-family residence) (1)	B	67	59	61	+2	NO
R52 (single-family residence) (1)	B	67	57	59	+2	NO
R53 (single-family residence) (1)	B	67	58	59	+1	NO
R54 (single-family residence) (1)	B	67	60	61	+1	NO
R55 (single-family residence) (1)	B	67	60	61	+1	NO
R56 (single-family residence) (1)	B	67	59	60	+1	NO
R57 (single-family residence) (1)	B	67	59	60	+1	NO
R58 (church) (1)	D	52	47	47	0	NO
R59 (single-family residence) (1)	B	67	63	63	0	NO
R60 (single-family residence) (1)	B	67	63	63	0	NO
R61 (single-family residence) (1)	B	67	60	61	+1	NO
R62 (single-family residence) (1)	B	67	59	60	+1	NO
R63 (single-family residence) (1)	B	67	58	59	+1	NO
R64 (single-family residence) (1)	B	67	56	57	+1	NO
R65 (single-family residence) (1)	B	67	57	58	+1	NO
R66 (single-family residence) (1)	B	67	56	57	+1	NO
R67 (single-family residence) (1)	B	67	60	61	+1	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R68 (single-family residence) (1)	B	67	61	61	0	NO
R69 (single-family residence) (1)	B	67	61	61	0	NO
R70 (single-family residence) (1)	B	67	60	60	0	NO
R71 (single-family residence) (1)	B	67	61	60	-1	NO
R72 (single-family residence) (1)	B	67	61	61	0	NO
R73 (single-family residence) (1)	B	67	57	58	+1	NO
R74 (single-family residence) (1)	B	67	57	58	+1	NO
R75 (single-family residence) (1)	B	67	57	58	+1	NO
R76 (single-family residence) (1)	B	67	57	58	+1	NO
R77 (single-family residence) (1)	B	67	57	58	+1	NO
R78 (single-family residence) (1)	B	67	57	58	+1	NO
R79 (single-family residence) (1)	B	67	58	58	0	NO
R80 (single-family residence) (1)	B	67	61	61	0	NO
R81 (single-family residence) (1)	B	67	68	66	-2	YES
R82 (single-family residence) (1)	B	67	68	67	-1	YES
R83 (single-family residence) (1)	B	67	61	60	-1	NO
R84 (single-family residence) (1)	B	67	61	60	-1	NO
R85 (single-family residence) (1)	B	67	61	60	-1	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R86 (single-family residence) (1)	B	67	57	57	0	NO
R87 (single-family residence) (1)	B	67	57	57	0	NO
R88 (single-family residence) (1)	B	67	57	56	-1	NO
R89 (single-family residence) (1)	B	67	59	58	-1	NO
R90 (single-family residence) (1)	B	67	60	59	-1	NO
R91 (single-family residence) (1)	B	67	68	66	-2	YES
R92 (single-family residence) (1)	B	67	65	62	-3	NO
R93 (single-family residence) (1)	B	67	58	56	-2	NO
R94 (single-family residence) (1)	B	67	56	55	-1	NO
R95-1 (apartment floor 1) (64)	B	67	67	67	0	YES
R95-2 (apartment floor 2) (64)	B	67	69	69	0	YES
R96 (single-family residence) (1)	B	67	67	63	-4	NO
R97 (single-family residence) (1)	B	67	62	59	-3	NO
R98 (single-family residence) (1)	B	67	66	64	-2	NO
R99 (single-family residence) (1)	B	67	68	69	+1	YES
R100 (church) (1)	D	52	48	45	-3	NO
R101 (church) (1)	C	67	61	57	-4	NO
R102-1 (apartment floor 1) (24)	B	67	62	58	-4	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R102-2 (apartment floor 2) (24)	B	67	64	61	-3	NO
R103-1 (apartment floor 1) (2)	B	67	57	54	-3	NO
R103-2 (apartment floor 2) (2)	B	67	61	57	-4	NO
R104 (mobile home community) (77)	B	67	69	65	-4	NO
R105 (single-family residence) (1)	B	67	59	57	-2	NO
R106 (single-family residence) (1)	B	67	56	55	-1	NO
R107 (single-family residence) (1)	B	67	56	55	-1	NO
R108 (restaurant) (1)	E	72	63	63	0	NO
R109 (single-family residence) (1)	B	67	74	72	-2	YES
R110 (church) (1)	D	52	41	43	+2	NO
R111 (single-family residence) (1)	B	67	63	65	+2	NO
R112 (single-family residence) (1)	B	67	62	63	+1	NO
R113 (single-family residence) (1)	B	67	62	63	+1	NO
R114 (ymca) (1)	C	67	70	67	-3	YES
R115 (single-family residence) (1)	B	67	62	61	-1	NO
R116 (single-family residence) (1)	B	67	62	61	-1	NO
R117 (single-family residence) (1)	B	67	62	61	-1	NO
R118 (single-family residence) (1)	B	67	62	61	-1	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R119 (single-family residence) (1)	B	67	62	61	-1	NO
R120 (single-family residence) (1)	B	67	62	61	-1	NO
R121 (single-family residence) (1)	B	67	62	61	-1	NO
R122 (single-family residence) (1)	B	67	62	61	-1	NO
R123 (single-family residence) (1)	B	67	62	61	-1	NO
R124 (single-family residence) (1)	B	67	62	61	-1	NO
R125 (single-family residence) (1)	B	67	62	61	-1	NO
R126 (school) (1)	C	67	67	66	-1	YES
R127 (single-family residence) (1)	B	67	63	62	-1	NO
R128 (single-family residence) (1)	B	67	62	61	-1	NO
R129 (single-family residence) (1)	B	67	63	62	-1	NO
R130 (single-family residence) (1)	B	67	62	62	0	NO
R131 (single-family residence) (1)	B	67	62	61	-1	NO
R132 (single-family residence) (1)	B	67	60	61	+1	NO
R133 (single-family residence) (1)	B	67	61	62	+1	NO
R134 (single-family residence) (1)	B	67	59	60	+1	NO
R135 (single-family residence) (1)	B	67	67	68	+1	YES
R136 (single-family residence) (1)	B	67	65	67	+2	YES

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R137 (single-family residence) (1)	B	67	55	56	+1	NO
R138 (single-family residence) (1)	B	67	58	59	+1	NO
R139 (single-family residence) (1)	B	67	59	60	+1	NO
R140 (single-family residence) (1)	B	67	56	57	+1	NO
R141 (single-family residence) (1)	B	67	61	61	0	NO
R142 (single-family residence) (1)	B	67	60	61	+1	NO
R143 (single-family residence) (1)	B	67	62	62	0	NO
R144 (single-family residence) (1)	B	67	61	62	+1	NO
R145 (single-family residence) (1)	B	67	61	62	+1	NO
R146 (single-family residence) (1)	B	67	62	65	+3	NO
R147 (single-family residence) (1)	B	67	62	65	+3	NO
R148 (single-family residence) (1)	B	67	62	66	+4	YES
R149 (single-family residence) (1)	B	67	62	65	+3	NO
R150 (single-family residence) (1)	B	67	62	66	+4	YES
R151 (single-family residence) (1)	B	67	62	66	+4	YES
R152 (single-family residence) (1)	B	67	63	66	+3	YES
R153 (single-family residence) (1)	B	67	64	67	+3	YES
R154 (single-family residence) (1)	B	67	65	67	+2	YES

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R155 (single-family residence) (1)	B	67	64	67	+3	YES
R156 (single-family residence) (1)	B	67	64	67	+3	YES
R157 (single-family residence) (1)	B	67	63	67	+4	YES
R158 (single-family residence) (1)	B	67	63	67	+4	YES
R159 (single-family residence) (1)	B	67	63	67	+4	YES
R160 (single-family residence) (1)	B	67	64	68	+4	YES
R161 (single-family residence) (1)	B	67	63	66	+3	YES
R162 (single-family residence) (1)	B	67	63	66	+3	YES
R163 (single-family residence) (1)	B	67	62	65	+3	NO
R164 (single-family residence) (1)	B	67	62	65	+3	NO
R165 (single-family residence) (1)	B	67	62	65	+3	NO
R166 (single-family residence) (1)	B	67	63	66	+3	YES
R167 (single-family residence) (1)	B	67	64	66	+2	YES
R168 (single-family residence) (1)	B	67	63	65	+2	NO
R169 (single-family residence) (1)	B	67	60	62	+2	NO
R170 (single-family residence) (1)	B	67	58	59	+1	NO
R171 (single-family residence) (1)	B	67	57	59	+2	NO
R172 (single-family residence) (1)	B	67	57	59	+2	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R173 (single-family residence) (1)	B	67	57	59	+2	NO
R174 (single-family residence) (1)	B	67	58	60	+2	NO
R175 (single-family residence) (1)	B	67	57	59	+2	NO
R176 (single-family residence) (1)	B	67	56	58	+2	NO
R177 (single-family residence) (1)	B	67	56	58	+2	NO
R178 (single-family residence) (1)	B	67	56	58	+2	NO
R179 (single-family residence) (1)	B	67	56	58	+2	NO
R180 (single-family residence) (1)	B	67	58	59	+1	NO
R181 (single-family residence) (1)	B	67	57	59	+2	NO
R182 (single-family residence) (1)	B	67	57	58	+1	NO
R183 (single-family residence) (1)	B	67	57	58	+1	NO
R184 (single-family residence) (1)	B	67	56	58	+2	NO
R185 (single-family residence) (1)	B	67	57	58	+1	NO
R186 (single-family residence) (1)	B	67	56	58	+2	NO
R187 (single-family residence) (1)	B	67	57	58	+1	NO
R188 (single-family residence) (1)	B	67	57	59	+2	NO
R189 (single-family residence) (1)	B	67	55	57	+2	NO
R190 (single-family residence) (1)	B	67	55	57	+2	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R191 (single-family residence) (1)	B	67	55	57	+2	NO
R192 (single-family residence) (1)	B	67	54	56	+2	NO
R193 (single-family residence) (1)	B	67	54	55	+1	NO
R194 (single-family residence) (1)	B	67	55	57	+2	NO
R195 (single-family residence) (1)	B	67	55	56	+1	NO
R196 (single-family residence) (1)	B	67	56	57	+1	NO
R197 (single-family residence) (1)	B	67	54	56	+2	NO
R198 (single-family residence) (1)	B	67	54	55	+1	NO
R199 (single-family residence) (1)	B	67	53	55	+2	NO
R200 (single-family residence) (1)	B	67	54	55	+1	NO
R201 (single-family residence) (1)	B	67	55	56	+1	NO
R202 (single-family residence) (1)	B	67	56	57	+1	NO
R203 (single-family residence) (1)	B	67	58	59	+1	NO
R204 (single-family residence) (1)	B	67	58	59	+1	NO
R205 (single-family residence) (1)	B	67	58	60	+2	NO
R206 (single-family residence) (1)	B	67	59	61	+2	NO
R207 (single-family residence) (1)	B	67	58	61	+3	NO
R208 (single-family residence) (1)	B	67	59	62	+3	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R209 (single-family residence) (1)	B	67	59	62	+3	NO
R210 (single-family residence) (1)	B	67	59	62	+3	NO
R211 (single-family residence) (1)	B	67	60	63	+3	NO
R212 (single-family residence) (1)	B	67	61	64	+3	NO
R213 (single-family residence) (1)	B	67	62	66	+4	YES
R214 (single-family residence) (1)	B	67	54	55	+1	NO
R215 (single-family residence) (1)	B	67	55	56	+1	NO
R216 (single-family residence) (1)	B	67	55	56	+1	NO
R217 (single-family residence) (1)	B	67	55	57	+2	NO
R218 (single-family residence) (1)	B	67	55	57	+2	NO
R219 (single-family residence) (1)	B	67	55	57	+2	NO
R220 (single-family residence) (1)	B	67	55	57	+2	NO
R221 (single-family residence) (1)	B	67	56	58	+2	NO
R222 (single-family residence) (1)	B	67	58	59	+1	NO
R223 (single-family residence) (1)	B	67	59	60	+1	NO
R224 (single-family residence) (1)	B	67	61	61	0	NO
R225 (single-family residence) (1)	B	67	62	62	0	NO
R226 (single-family residence) (1)	B	67	54	55	+1	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R227 (single-family residence) (1)	B	67	54	55	+1	NO
R228 (single-family residence) (1)	B	67	53	55	+2	NO
R229 (single-family residence) (1)	B	67	55	56	+1	NO
R230 (single-family residence) (1)	B	67	57	57	0	NO
R231 (single-family residence) (1)	B	67	54	55	+1	NO
R232 (single-family residence) (1)	B	67	56	56	0	NO
R233 (single-family residence) (1)	B	67	56	55	-1	NO
R234 (single-family residence) (1)	B	67	59	64	+5	NO
R235 (single-family residence) (1)	B	67	57	60	+3	NO
R236 (single-family residence) (1)	B	67	55	55	0	NO
R237 (single-family residence) (1)	B	67	53	53	0	NO
R238 (single-family residence) (1)	B	67	59	66	+7	YES
R239 (single-family residence) (1)	B	67	56	61	+5	NO
R240 (single-family residence) (1)	B	67	54	57	+3	NO
R241 (single-family residence) (1)	B	67	53	56	+3	NO
R242 (single-family residence) (1)	B	67	58	63	+5	NO
R243 (single-family residence) (1)	B	67	55	59	+4	NO
R244 (single-family residence) (1)	B	67	54	58	+4	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R245 (single-family residence) (1)	B	67	59	64	+5	NO
R246 (single-family residence) (1)	B	67	60	65	+5	NO
R247 (single-family residence) (1)	B	67	59	63	+4	NO
R248 (single-family residence) (1)	B	67	59	63	+4	NO
R249 (single-family residence) (1)	B	67	59	63	+4	NO
R250 (single-family residence) (1)	B	67	59	63	+4	NO
R251 (single-family residence) (1)	B	67	56	59	+3	NO
R252 (single-family residence) (1)	B	67	55	58	+3	NO
R253 (single-family residence) (1)	B	67	56	58	+2	NO
R254 (church) (1)	D	52	40	45	+5	NO
R255 (church) (1)	C	67	56	60	+4	NO
R256-1 (apartment floor 1) (56)	B	67	60	68	+8	YES
R256-2 (apartment floor 2) (56)	B	67	63	72	+9	YES
R256-3 (apartment floor 3) (56)	B	67	65	73	+8	YES
R257 (assisted-living facility) (1)	C	67	59	61	+2	NO
R258 (single-family residence) (1)	B	67	60	58	-2	NO
R259 (single-family residence) (1)	B	67	61	57	-4	NO
R260 (church) (1)	D	52	37	35	-2	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R261 (single-family residence) (1)	B	67	66	60	-6	NO
R262 (single-family residence) (1)	B	67	67	60	-7	NO
R263 (single-family residence) (1)	B	67	66	60	-6	NO
R264 (single-family residence) (1)	B	67	67	61	-6	NO
R265 (single-family residence) (1)	B	67	56	53	-3	NO
R266 (single-family residence) (1)	B	67	57	53	-4	NO
R267-1 (apartment floor 1) (54)	B	67	65	68	+3	YES
R267-2 (apartment floor 2) (54)	B	67	67	72	+5	YES
R267-3 (apartment floor 3) (54)	B	67	68	73	+5	YES
R268 (single-family residence) (1)	B	67	57	55	-2	NO
R269 (single-family residence) (1)	B	67	63	59	-4	NO
R270 (single-family residence) (1)	B	67	58	57	-1	NO
R271 (single-family residence) (1)	B	67	56	55	-1	NO
R272 (single-family residence) (1)	B	67	54	51	-3	NO
R273 (single-family residence) (1)	B	67	54	52	-2	NO
R274 (single-family residence) (1)	B	67	66	60	-6	NO
R275 (single-family residence) (1)	B	67	66	60	-6	NO
R276 (single-family residence) (1)	B	67	59	56	-3	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R277 (single-family residence) (1)	B	67	56	55	-1	NO
R278 (single-family residence) (1)	B	67	57	55	-2	NO
R279 (single-family residence) (1)	B	67	58	56	-2	NO
R280 (single-family residence) (1)	B	67	59	57	-2	NO
R281 (single-family residence) (1)	B	67	61	59	-2	NO
R282 (single-family residence) (1)	B	67	62	61	-1	NO
R283 (single-family residence) (1)	B	67	63	63	0	NO
R284 (single-family residence) (1)	B	67	62	64	+2	NO
R285 (single-family residence) (1)	B	67	61	60	-1	NO
R286 (single-family residence) (1)	B	67	59	57	-2	NO
R287 (single-family residence) (1)	B	67	59	57	-2	NO
R288 (single-family residence) (1)	B	67	58	56	-2	NO
R289 (single-family residence) (1)	B	67	57	55	-2	NO
R290 (single-family residence) (1)	B	67	57	55	-2	NO
R291 (single-family residence) (1)	B	67	57	55	-2	NO
R292 (single-family residence) (1)	B	67	58	56	-2	NO
R293 (single-family residence) (1)	B	67	59	57	-2	NO
R294 (single-family residence) (1)	B	67	58	57	-1	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R295 (single-family residence) (1)	B	67	61	62	+1	NO
R296 (single-family residence) (1)	B	67	61	62	+1	NO
R297 (single-family residence) (1)	B	67	60	61	+1	NO
R298 (single-family residence) (1)	B	67	59	60	+1	NO
R299 (single-family residence) (1)	B	67	63	66	+3	YES
R300 (single-family residence) (1)	B	67	61	64	+3	NO
R301 (single-family residence) (1)	B	67	56	56	0	NO
R302 (single-family residence) (1)	B	67	55	58	+3	NO
R303 (single-family residence) (1)	B	67	56	62	+6	NO
R304 (single-family residence) (1)	B	67	64	69	+5	YES
R305 (single-family residence) (1)	B	67	65	70	+5	YES
R306 (single-family residence) (1)	B	67	66	70	+4	YES
R307 (single-family residence) (1)	B	67	63	69	+6	YES
R308 (single-family residence) (1)	B	67	65	70	+5	YES
R309 (single-family residence) (1)	B	67	65	71	+6	YES
R310 (single-family residence) (1)	B	67	67	72	+5	YES
R311 (single-family residence) (1)	B	67	66	72	+6	YES
R312 (single-family residence) (1)	B	67	65	72	+7	YES

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R313 (single-family residence) (1)	B	67	64	70	+6	YES
R314 (single-family residence) (1)	B	67	64	69	+5	YES
R315 (single-family residence) (1)	B	67	61	65	+4	NO
R316 (single-family residence) (1)	B	67	54	57	+3	NO
R317 (single-family residence) (1)	B	67	54	57	+3	NO
R318 (single-family residence) (1)	B	67	54	58	+4	NO
R319 (single-family residence) (1)	B	67	55	58	+3	NO
R320 (single-family residence) (1)	B	67	55	60	+5	NO
R321 (single-family residence) (1)	B	67	57	61	+4	NO
R322 (single-family residence) (1)	B	67	58	63	+5	NO
R323 (single-family residence) (1)	B	67	58	63	+5	NO
R324 (single-family residence) (1)	B	67	57	60	+3	NO
R325 (single-family residence) (1)	B	67	55	59	+4	NO
R326 (single-family residence) (1)	B	67	62	66	+4	YES
R327 (single-family residence) (1)	B	67	62	66	+4	YES
R328 (single-family residence) (1)	B	67	62	66	+4	YES
R329 (single-family residence) (1)	B	67	63	66	+3	YES
R330 (single-family residence) (1)	B	67	64	67	+3	YES

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R331 (single-family residence) (1)	B	67	65	67	+2	YES
R332 (single-family residence) (1)	B	67	67	69	+2	YES
R333 (single-family residence) (1)	B	67	69	71	+2	YES
R334 (single-family residence) (1)	B	67	60	63	+3	NO
R335 (single-family residence) (1)	B	67	61	64	+3	NO
R336 (single-family residence) (1)	B	67	63	65	+2	NO
R337 (single-family residence) (1)	B	67	66	68	+2	YES
R338 (single-family residence) (1)	B	67	63	65	+2	NO
R339 (single-family residence) (1)	B	67	60	63	+3	NO
R340 (single-family residence) (1)	B	67	59	62	+3	NO
R341 (single-family residence) (1)	B	67	58	61	+3	NO
R342 (single-family residence) (1)	B	67	57	60	+3	NO
R343 (single-family residence) (1)	B	67	59	62	+3	NO
R344 (single-family residence) (1)	B	67	59	61	+2	NO
R345 (single-family residence) (1)	B	67	56	59	+3	NO
R346 (funeral home) (1)	D	52	46	50	+4	NO
R347 (cemetery) (1)	C	67	58	63	+5	NO
R348 (cemetery) (1)	C	67	60	66	+6	YES

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R349 (cemetery) (1)	C	67	59	66	+7	YES
R350 (hotel) (1)	E	72	60	68	+8	NO
R351 (apartment floor 1) (4)	B	67	57	61	+4	NO
R352 (park) (1)	C	67	68	71	+3	YES
R353 (church) (1)	C	67	69	71	+2	YES
R354 (single-family residence) (1)	B	67	60	63	+3	NO
R355 (single-family residence) (1)	B	67	61	65	+4	NO
R356 (single-family residence) (1)	B	67	61	64	+3	NO
R357 (single-family residence) (1)	B	67	61	64	+3	NO
R358 (single-family residence) (1)	B	67	60	63	+3	NO
R359 (single-family residence) (1)	B	67	60	63	+3	NO
R360 (single-family residence) (1)	B	67	69	71	+2	YES
R361 (single-family residence) (1)	B	67	72	72	0	YES
R362 (single-family residence) (1)	B	67	70	71	+1	YES
R363 (single-family residence) (1)	B	67	69	71	+2	YES
R364 (single-family residence) (1)	B	67	68	70	+2	YES
R365 (single-family residence) (1)	B	67	67	70	+3	YES
R366 (single-family residence) (1)	B	67	67	69	+2	YES

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R367 (single-family residence) (1)	B	67	66	69	+3	YES
R368 (single-family residence) (1)	B	67	65	68	+3	YES
R369 (single-family residence) (1)	B	67	64	67	+3	YES
R370 (single-family residence) (1)	B	67	63	66	+3	YES
R371 (single-family residence) (1)	B	67	62	65	+3	NO
R372 (single-family residence) (1)	B	67	63	67	+4	YES
R373 (single-family residence) (1)	B	67	64	67	+3	YES
R374 (single-family residence) (1)	B	67	63	66	+3	YES
R375 (single-family residence) (1)	B	67	63	67	+4	YES
R376 (single-family residence) (1)	B	67	62	65	+3	NO
R377 (single-family residence) (1)	B	67	61	65	+4	NO
R378 (single-family residence) (1)	B	67	61	64	+3	NO
R379 (single-family residence) (1)	B	67	60	63	+3	NO
R380 (single-family residence) (1)	B	67	60	63	+3	NO
R381 (single-family residence) (1)	B	67	63	66	+3	YES
R382 (single-family residence) (1)	B	67	62	66	+4	YES
R383 (single-family residence) (1)	B	67	61	65	+4	NO
R384 (single-family residence) (1)	B	67	61	65	+4	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R385 (single-family residence) (1)	B	67	62	67	+5	YES
R386 (single-family residence) (1)	B	67	61	66	+5	YES
R387 (single-family residence) (1)	B	67	61	66	+5	YES
R388 (single-family residence) (1)	B	67	61	65	+4	NO
R389 (single-family residence) (1)	B	67	61	66	+5	YES
R390 (single-family residence) (1)	B	67	60	65	+5	NO
R391 (single-family residence) (1)	B	67	60	65	+5	NO
R392 (single-family residence) (1)	B	67	60	64	+4	NO
R393 (single-family residence) (1)	B	67	60	65	+5	NO
R394 (single-family residence) (1)	B	67	60	64	+4	NO
R395 (single-family residence) (1)	B	67	60	65	+5	NO
R396 (single-family residence) (1)	B	67	60	64	+4	NO
R397 (single-family residence) (1)	B	67	59	64	+5	NO
R398 (single-family residence) (1)	B	67	59	63	+4	NO
R399 (single-family residence) (1)	B	67	60	64	+4	NO
R400 (single-family residence) (1)	B	67	59	63	+4	NO
R401 (single-family residence) (1)	B	67	59	62	+3	NO
R402 (single-family residence) (1)	B	67	59	62	+3	NO

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R403 (single-family residence) (1)	B	67	63	68	+5	YES
R404 (single-family residence) (1)	B	67	62	66	+4	YES
R405 (single-family residence) (1)	B	67	70	74	+4	YES
R406 (single-family residence) (1)	B	67	69	73	+4	YES
R407 (single-family residence) (1)	B	67	68	72	+4	YES
R408 (single-family residence) (1)	B	67	67	71	+4	YES
R409 (single-family residence) (1)	B	67	66	71	+5	YES
R410 (single-family residence) (1)	B	67	65	69	+4	YES
R411 (single-family residence) (1)	B	67	64	67	+3	YES
R412 (single-family residence) (1)	B	67	62	66	+4	YES
R413 (single-family residence) (1)	B	67	62	65	+3	NO
R414 (single-family residence) (1)	B	67	61	65	+4	NO
R415 (single-family residence) (1)	B	67	61	64	+3	NO
R416 (single-family residence) (1)	B	67	60	64	+4	NO
R417 (single-family residence) (1)	B	67	60	63	+3	NO
R418 (single-family residence) (1)	B	67	71	75	+4	YES
R419 (single-family residence) (1)	B	67	71	75	+4	YES
R420 (single-family residence) (1)	B	67	70	74	+4	YES

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R421 (single-family residence) (1)	B	67	68	73	+5	YES
R422 (single-family residence) (1)	B	67	66	71	+5	YES
R423 (single-family residence) (1)	B	67	67	72	+5	YES
R424 (single-family residence) (1)	B	67	65	68	+3	YES
R425 (single-family residence) (1)	B	67	72	76	+4	YES
R426 (single-family residence) (1)	B	67	70	74	+4	YES
R427 (single-family residence) (1)	B	67	68	72	+4	YES
R428 (single-family residence) (1)	B	67	65	70	+5	YES
R429 (single-family residence) (1)	B	67	64	67	+3	YES
R430 (single-family residence) (1)	B	67	71	74	+3	YES
R431 (single-family residence) (1)	B	67	68	72	+4	YES
R432 (single-family residence) (1)	B	67	66	70	+4	YES
R433 (single-family residence) (1)	B	67	65	69	+4	YES
R434 (single-family residence) (1)	B	67	64	67	+3	YES
R435 (single-family residence) (1)	B	67	62	66	+4	YES
R436 (single-family residence) (1)	B	67	60	64	+4	NO
R437 (soccer field) (1)	C	67	65	69	+4	YES
R438 (soccer field) (1)	C	67	66	69	+3	YES

Representative Receiver (description)(represents)	NAC Category	NAC Level	Existing 2013	Preferred Alternative		
				Predicted 2040	Change (+/-)	Noise Impact
R439 (soccer field) (1)	C	67	62	65	+3	NO
R440 (soccer field) (1)	C	67	61	64	+3	NO
R441-1 (apartment floor 1) (22)	B	67	62	64	+2	NO
R441-2 (apartment floor 2) (22)	B	67	65	67	+2	YES
R442 (golf range) (1)	C	67	71	73	+2	YES
R443 (hotel) (1)	E	72	65	67	+2	NO
R444 (restaurant) (1)	E	72	65	62	-3	NO

As indicated in **Table 2**, the Preferred Alternative would result in traffic noise impacts and the following noise abatement measures were considered: traffic management, alteration of horizontal and/or vertical alignments, acquisition of undeveloped property to act as a buffer zone, and the construction of traffic noise barriers.

Before any abatement measure can be proposed for incorporation into the project, it must be both feasible and reasonable. In order to be "feasible," the abatement measure must be able to reduce the noise level at greater than 50% of impacted, first-row receivers by at least 5 dB(A); and to be "reasonable," it must not exceed the cost-effectiveness criterion of \$25,000 for each receiver that would benefit by a reduction of at least 5 dB(A) and the abatement measure must be able to reduce the noise level of at least one impacted, first-row receiver by at least 7 dB(A).

Traffic management: control devices could be used to reduce the speed of the traffic; however, the minor benefit of one dB(A) per five mph reduction in speed does not outweigh the associated increase in congestion and air pollution. Other measures such as time or use restrictions for certain vehicles are prohibited on state highways.

Alteration of horizontal and/or vertical alignments: any alteration of the existing alignment would displace existing businesses and residences, require additional right-of-way and not be cost effective/reasonable.

Buffer zone: the acquisition of undeveloped property to act as a buffer zone is designed to avoid rather than abate traffic noise impacts and, therefore, is not feasible.

Traffic noise barriers: this is the most commonly used noise abatement measure. Traffic noise barriers were evaluated for each of the impacted receiver locations with the following results:

Preferred Alternative

Traffic noise barriers would not be feasible and reasonable for any of the following impacted receivers and, therefore, are not proposed for incorporation into the project:

R1 (Figure 2, Map 1): this receiver represents a single impacted residence with a driveway facing the roadway. A continuous traffic noise barrier would restrict access to this residence. Gaps in a traffic noise wall would satisfy access requirements but the resulting non-continuous walls segments would not be sufficient to achieve the minimum, feasible reduction of 5 dB(A) or the noise reduction design goal of 7 dB(A).

R5, R7, R9-R10, R14 (Figure 2, Maps 1 and 2): these receivers represent a total of five impacted residences. A traffic noise wall that would achieve the minimum feasible reduction of 5 dB(A) while achieving a 7 dB(A) noise reduction design goal at this receiver would exceed the reasonable, cost-effectiveness criterion of \$25,000 per benefited receiver.

R19 (Figure 2, Map 2): this receiver represents a single impacted residence. A traffic noise barrier placed along the right-of-way line, up to 20 feet in height, was not sufficient to achieve the minimum, feasible reduction of 5 dB(A) or the noise reduction design goal of 7 dB(A).

R26 (Figure 2, Map 2) and R36 (Figure 2, Map 3): these receivers are separate, individual residences. Traffic noise walls that would achieve the minimum feasible reduction of 5 dB(A) while achieving a 7 dB(A) noise reduction design goal at each of these receivers would exceed the reasonable, cost-effectiveness criterion of \$25,000 per benefited receiver.

R81-and R82 (Figure 2, Map 8): these receivers represent a total of two impacted residences. A traffic noise barrier placed along the right-of-way line, up to 20 feet in height, was not sufficient to achieve the minimum, feasible reduction of 5 dB(A) or the noise reduction design goal of 7 dB(A).

R91 (Figure 2, Map 8): this receiver represents a single impacted residence. A traffic noise barrier placed along the right-of-way line, up to 20 feet in height, was not sufficient to achieve the minimum, feasible reduction of 5 dB(A) while achieving the noise reduction design goal of 7 dB(A).

R95-1, R95-2 and R99 (Figure 2, Map 7): these receivers represent 128 1st and 2nd story receivers at Settler's Creek Apartments and a single impacted residence, of which 10 are first-row impacted receivers. A traffic noise barrier placed along the right-of-way line, up to 20 feet in height, was evaluated in this area attempting to shield these

impacted residences. A traffic noise wall was unable to be designed that would achieve the minimum, feasible reduction of 5 dB(A) for greater than 50% of impacted, first-row receivers while achieving the noise reduction design goal of 7 dB(A).

R109 and R114 (Figure 2, Map 13): these receivers represent a single impacted residence and the YMCA, both with driveways facing the roadway. A continuous traffic noise barrier would restrict access to these residences. Gaps in a noise wall would satisfy access requirements but the resulting non-continuous walls segments would not be sufficient to achieve the minimum, feasible reduction of 5 dB(A) or the noise reduction design goal of 7 dB(A).

R126 (Figure 2, Map 14): this receiver represents a single impacted school, with direct driveway access to the service road creating a gap in the traffic noise barrier. A traffic noise barrier placed along the right-of-way line, up to 20 feet in height, was not sufficient to achieve the minimum, feasible reduction of 5 dB(A) or the noise reduction design goal of 7 dB(A).

R135-R136 (Figure 2, Map 1): these receivers represent a total of two impacted residences. A traffic noise barrier placed along the right-of-way line, up to 20 feet in height, was not sufficient to achieve the minimum, feasible reduction of 5 dB(A) or the noise reduction design goal of 7 dB(A).

R213 (Figure 2, Map 3): this receiver is a separate, individual residence. A noise wall that would achieve the minimum feasible reduction of 5 dB(A) while achieving a 7 dB(A) noise reduction design goal would exceed the reasonable, cost-effectiveness criterion of \$25,000 per benefited receiver.

R238 (Figure 2, Map 3 and 4): this receiver represents a single impacted residence. A traffic noise barrier placed along the right-of-way line, up to 20 feet in height, was not sufficient to achieve the minimum, feasible reduction of 5 dB(A) while achieving the 7 dB(A) noise reduction design goal.

R299, R304-R314 (Figure 2, Map 10): these receivers represent a total of 12 impacted residences. These receivers are located on a cliff overlooking US 290 making designing an effective traffic noise barrier difficult. Due to this reason, as well as breaks in the barrier for frontage road access and multiple elevated mainline structures, a traffic noise barrier was unable to be designed that was able to achieve the minimum feasible reduction of 5 dB(A) while achieving the 7 dB(A) noise reduction design goal.

R326-R333, R337 (Figure 2, Map 10 and 12): these receivers represent a total of nine impacted residences. A traffic noise barrier placed along the William Cannon

Drive right-of-way line, up to 20 feet in height, was not sufficient to achieve the minimum, feasible reduction of 5 dB(A) or the noise reduction design goal of 7 dB(A).

R348 and R349 (Figure 2, Map 12): these receivers represent two common areas at a cemetery. A traffic noise barrier, up to 20 feet in height placed along the right-of-way line was not sufficient to achieve the minimum feasible reduction of 5 dB(A) while achieving the 7 dB(A) noise reduction design goal.

R352 (Figure 2, Map 13): this receiver represents impacted recreational land use in the area. Due to breaks in the barrier for access, a traffic noise barrier placed along the right-of-way line, up to 20 feet in height, was not sufficient to achieve the minimum feasible reduction of 5 dB(A) while achieving the 7 dB(A) noise reduction design goal.

R353 (Figure 2, Map 13): this receiver represents a single impacted receiver (an outdoor activity area associated with a church). A traffic noise wall that would achieve the minimum feasible reduction of 5 dB(A) while achieving a 7 dB(A) noise reduction design goal at this receiver would exceed the reasonable, cost-effectiveness criterion of \$25,000 per benefited receiver.

R360-R370, R372-R375, R381-R382, R385-R387, R389 (Figure 2, Maps 13): these receivers represent a total of 21 impacted residences. Multiple barrier configurations were evaluated in this area in an attempt to design a feasible and reasonable traffic noise barrier. A traffic noise barrier placed along the right-of-way line, between 10 and 20 feet in height and 477 and 1,681 feet in length was not sufficient to achieve the minimum feasible reduction of 5 dB(A) while achieving the 7 dB(A) noise reduction design goal.

R437-R438 (Figure 2, Map 14): these receivers represent impacted recreational land uses in the area. A traffic noise barrier placed along the right-of-way line, up to 20 feet in height, was not sufficient to achieve the minimum feasible reduction of 5 dB(A) while achieving the 7 dB(A) noise reduction design goal.

R441-2 (Figure 2, Map 15): this receiver represents the Monterey Ranch Apartments 2nd story units. A traffic noise barrier placed along the right-of-way line, up to 20 feet in height, was not sufficient to achieve the minimum feasible reduction of 5 dB(A) while achieving the 7 dB(A) noise reduction design goal.

R442 (Figure 2, Map 15): this receiver represents impacted recreational land use in the area. Due to breaks in the barrier for access, a traffic noise barrier placed along the right-of-way line, up to 20 feet in height, was not sufficient to achieve the minimum, feasible reduction of 5 dB(A) or the noise reduction design goal of 7 dB(A).

Traffic noise barriers would be feasible and reasonable for the following impacted receivers and, therefore, are proposed for incorporation into the project:

R148, R150-R162, R166-R167 (Figure 2, Map 2): these receivers represent a total of 16 impacted residences, of which 16 are first-row impacted receivers. Based on preliminary calculations, a traffic noise barrier 1,951 feet in length and 14 feet in height would reduce noise levels by at least 5 dB(A) for 16 first-row impacted receivers and 4 additional benefited receivers at a total cost of \$491,652 or \$24,583 for each benefited receiver. Five first-row impacted receivers are predicted to meet the TxDOT noise reduction design goal of 7 dB(A) or more.

R256-1, R256-2 and R256-3 (Figure 2, Map 5): Receiver 256 represents 168 first-, second- and third-story receivers at Vineyard Hills Apartments. Twenty-three receivers are impacted in this area, of which 20 are first-row receivers. Based on preliminary calculations, a traffic noise barrier 599 feet in length and 20 feet in height would reduce noise levels by at least 5 dB(A) for 13 first-row impacted receivers and 5 additional benefited receivers at a total cost of \$215,640 or \$11,980 for each benefited receiver. Eleven first-row impacted receivers are predicted to meet the TxDOT noise reduction design goal of 7 dB(A) or more.

R267-1, R267-2 and R267-3 (Figure 2, Map 6): Receiver 267 represents 162 first-, second- and third-story receivers at Bell Quarry Hill Apartments. Forty-six receivers are impacted in this area, of which 43 are first-row receivers. Based on preliminary calculations, a traffic noise barrier 842 feet in length and 20 feet in height would reduce noise levels by at least 5 dB(A) for 36 first-row impacted receivers and 9 additional benefited receivers at a total cost of \$303,120 or \$6,736 for each benefited receiver. Twenty-eight (28) first-row impacted receivers are predicted to meet the TxDOT noise reduction design goal of 7 dB(A) or more.

R403-R412, R418-R435 (Figure 2, Map 14): these receivers represent a total of 28 impacted residences, of which four are first-row receivers. Based on preliminary calculations, a traffic noise barrier 667 feet in length and 19 feet in height would reduce noise levels by at least 5 dB(A) for three first-row impacted receivers and 11 additional benefited receivers at a total cost of \$228,114 or \$16,294 for each benefited receiver. Three first-row impacted receivers are predicted to meet the TxDOT noise reduction design goal of 7 dB(A) or more.

Table 3 summarizes the proposed traffic noise barriers for the Preferred Alternative.

Table 3. Traffic Noise Barrier Proposal (Preliminary) – Preferred Alternative

Barrier	Representative Receivers	Total # Benefited	Length (feet)	Height (feet)	Total Cost	Cost per Benefited Receiver
A1	R148, R150-R162, R166-R167	20	1,951	14	\$491,652	\$24,583
A2	R256-1, R256-2, R256-3	18	599	20	\$215,640	\$11,980
A3	R267-1, R267-2, R267-3	45	842	20	\$303,120	\$6,736
A4	R403-R412, R418-R435	14	667	19	\$228,114	\$16,294

Any subsequent project design changes may require a re-evaluation of this preliminary traffic noise barrier proposal. The final decision to construct the proposed noise barrier will not be made until completion of the project design, utility evaluation, and polling of adjacent property owners.

To avoid noise impacts that may result from future development of properties adjacent to the project, local officials responsible for land use control programs must ensure, to the maximum extent possible, no new activities are planned or constructed along or within the following predicted (2040) noise impact contours, as shown on **Table 4**. Due to the extreme geometry, changes in alignment, and changes in speed limit located throughout the project area, these distances are very approximate.

Table 4. Worst-Case Impact Contour Distance for the Preferred Alternative

Land Use	Impact Contour	Distance from Right of Way
NAC category B & C	66 dB(A)	≈ 495 feet
NAC category E	71 dB(A)	≈ 335 feet

Noise associated with the construction of the project is difficult to predict. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. None of the receivers is expected to be exposed to construction noise for a long duration; therefore, any extended disruption of normal activities is not expected. Provisions will be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

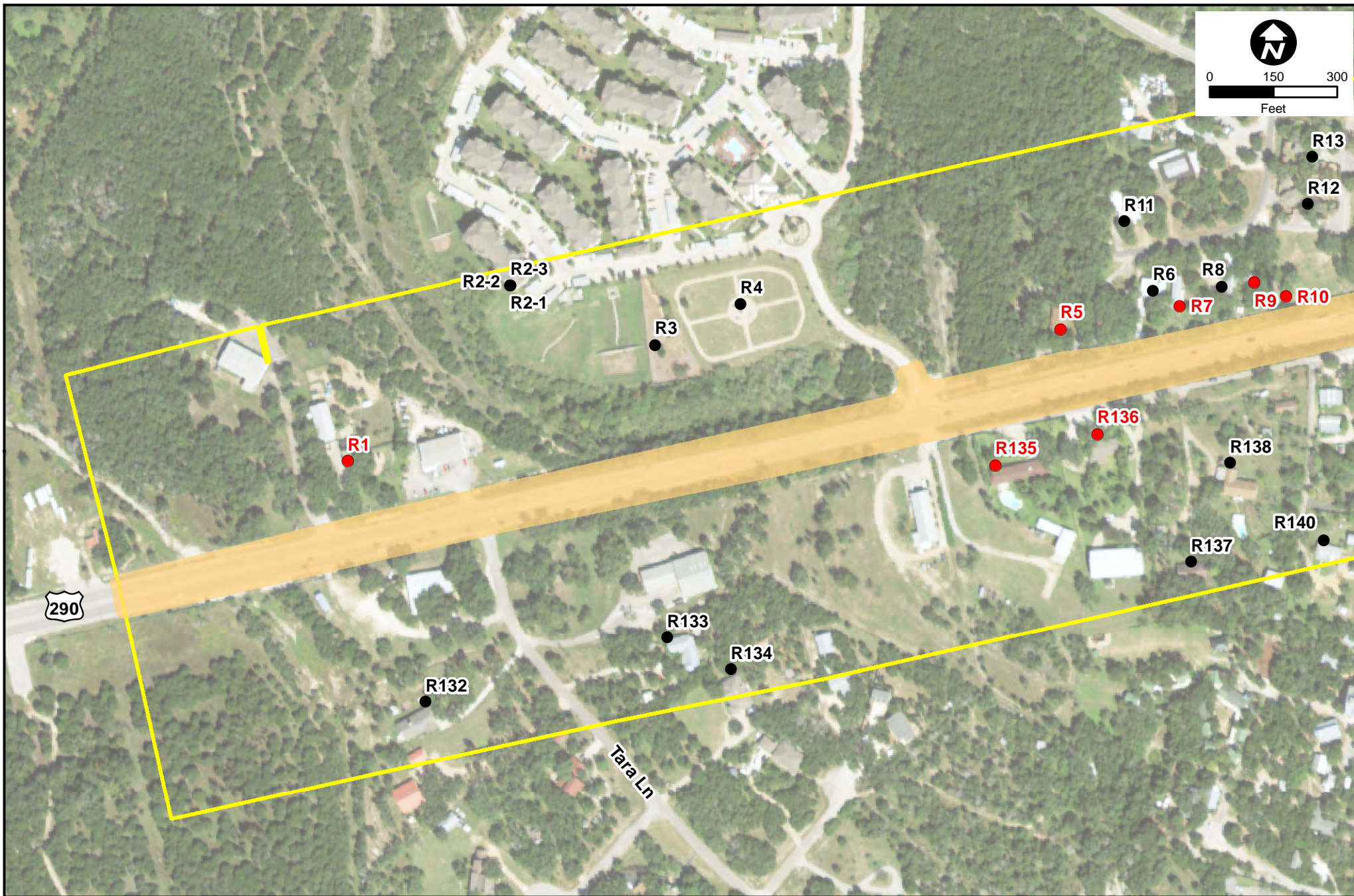
A copy of this traffic noise analysis will be available to local officials. On the date of approval of this document (Date of Public Knowledge), FHWA and TxDOT are no longer responsible for providing noise abatement for new development adjacent to the project.

Acronyms and Abbreviations

dB	Decibels
dB(A)	A-weighting
FHWA	Federal Highway Administration
Leq	Average or equivalent sound level
Mobility Authority	Central Texas Regional Mobility Authority
Mopac	State Loop 1
NAC	Noise Abatement Criteria
RM	Ranch-to-Market Road
SH	State Highway
SL	State Loop
TxDOT	Texas Department of Transportation
US	U.S. Highway

Appendix A
Figure 2

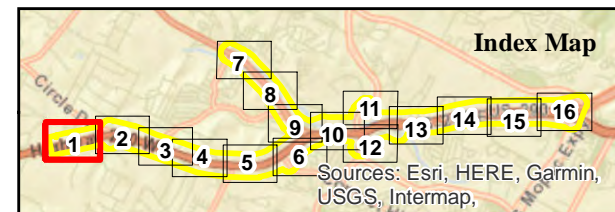
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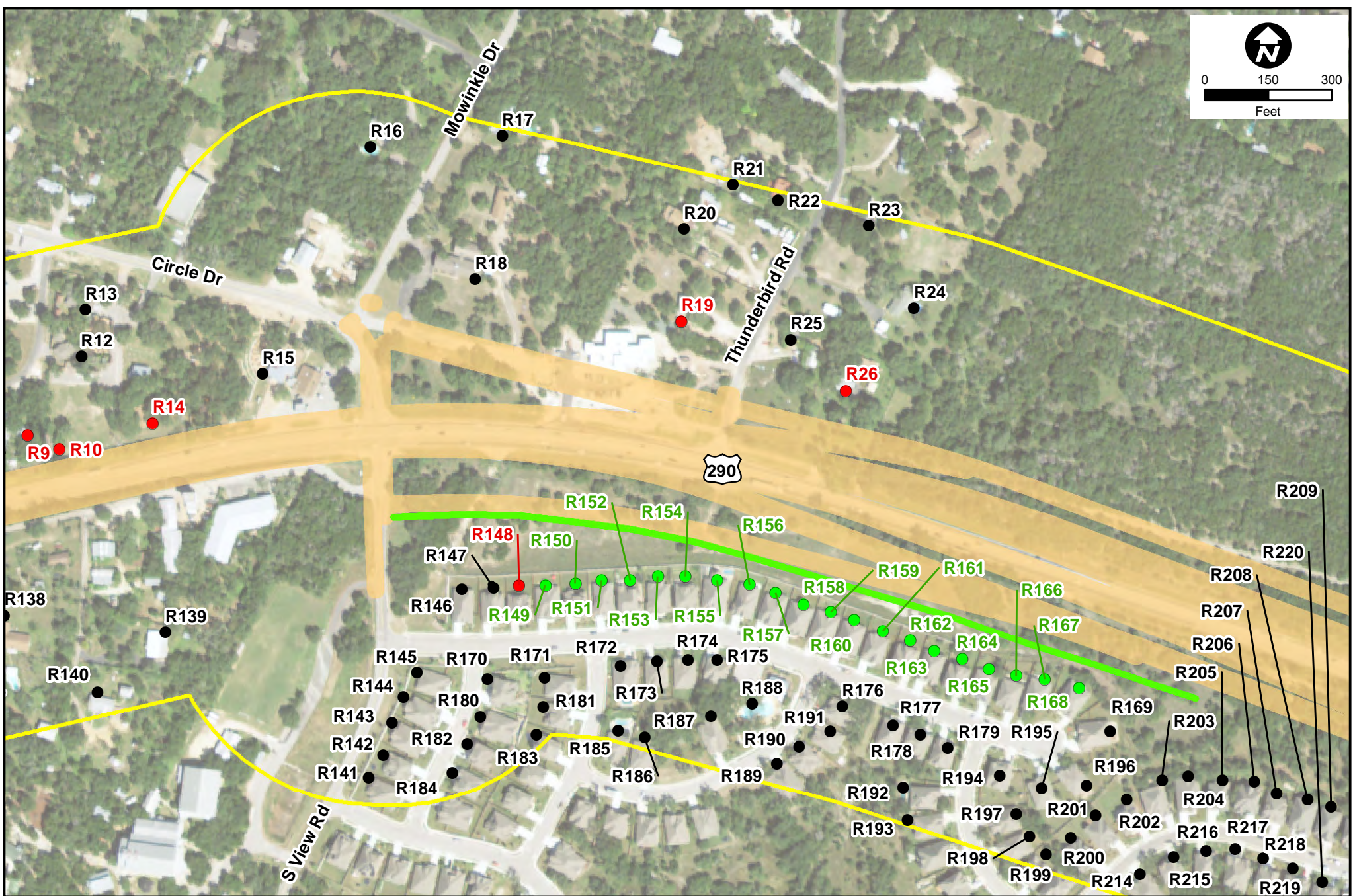
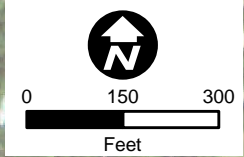
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- █ Proposed Route
- Study Area
- Impacted Receiver
- Benefitted Receiver
- Receiver

**FIGURE 2 - RECEIVER LOCATION MAP
PREFERRED ALTERNATIVE
Oak Hill Parkway Improvements**









Sources: Esri, HERE, Garmin, USGS, Intermap,

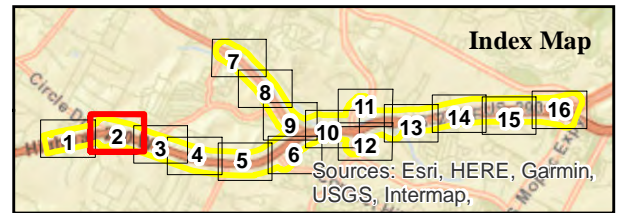
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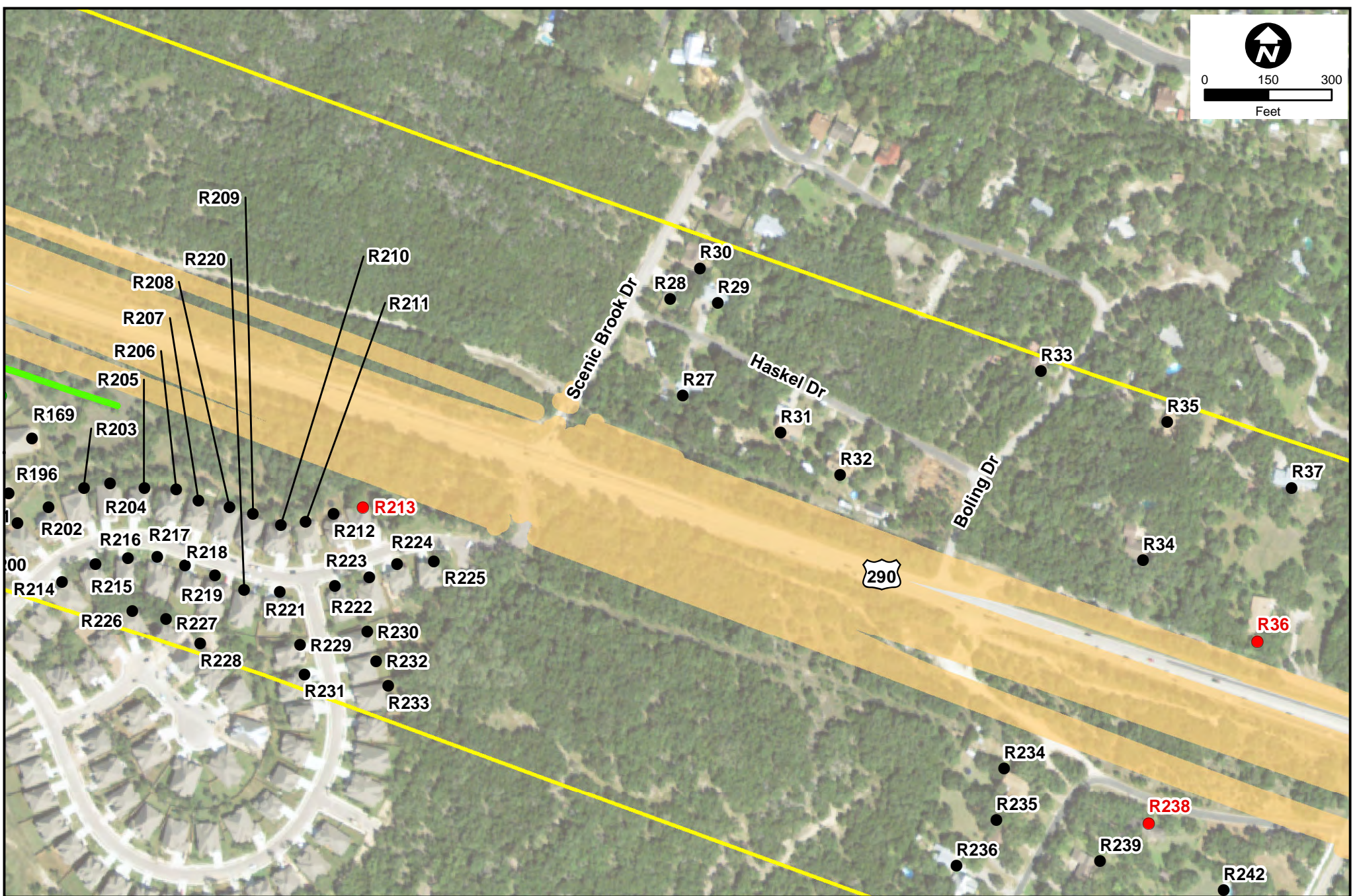
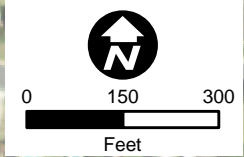
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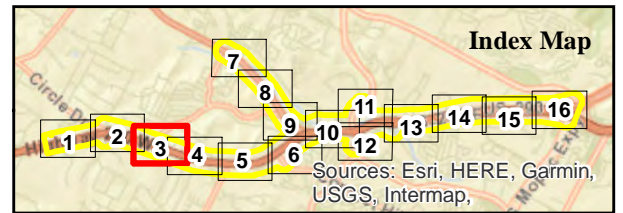
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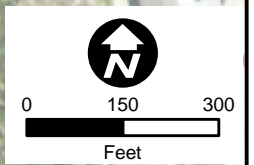
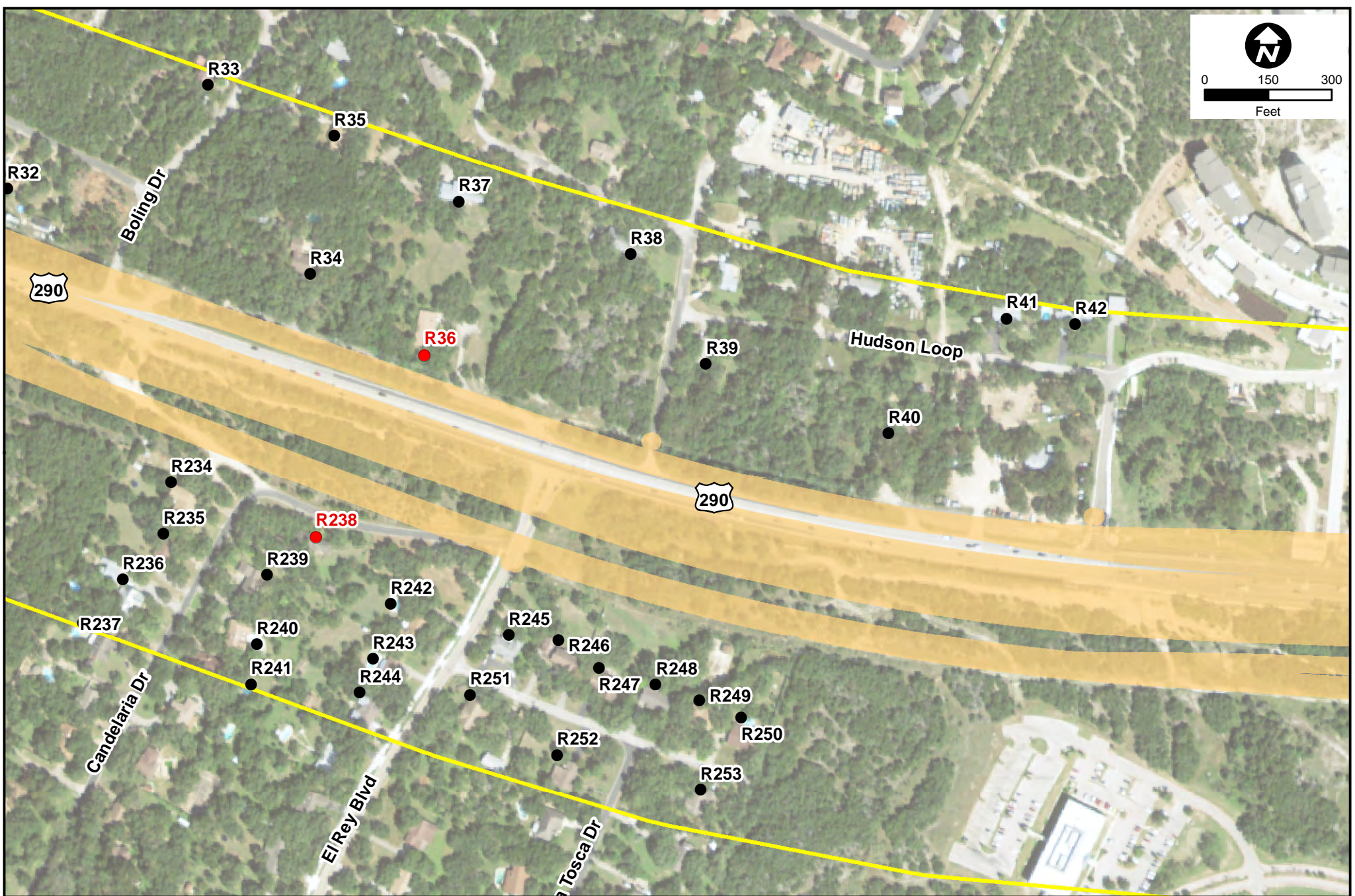
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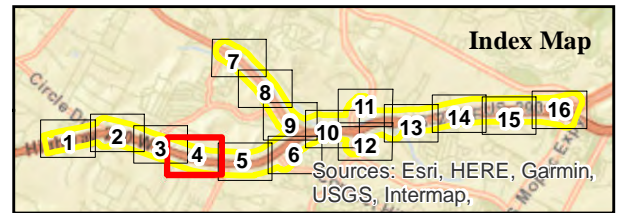


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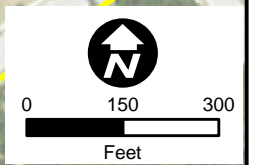
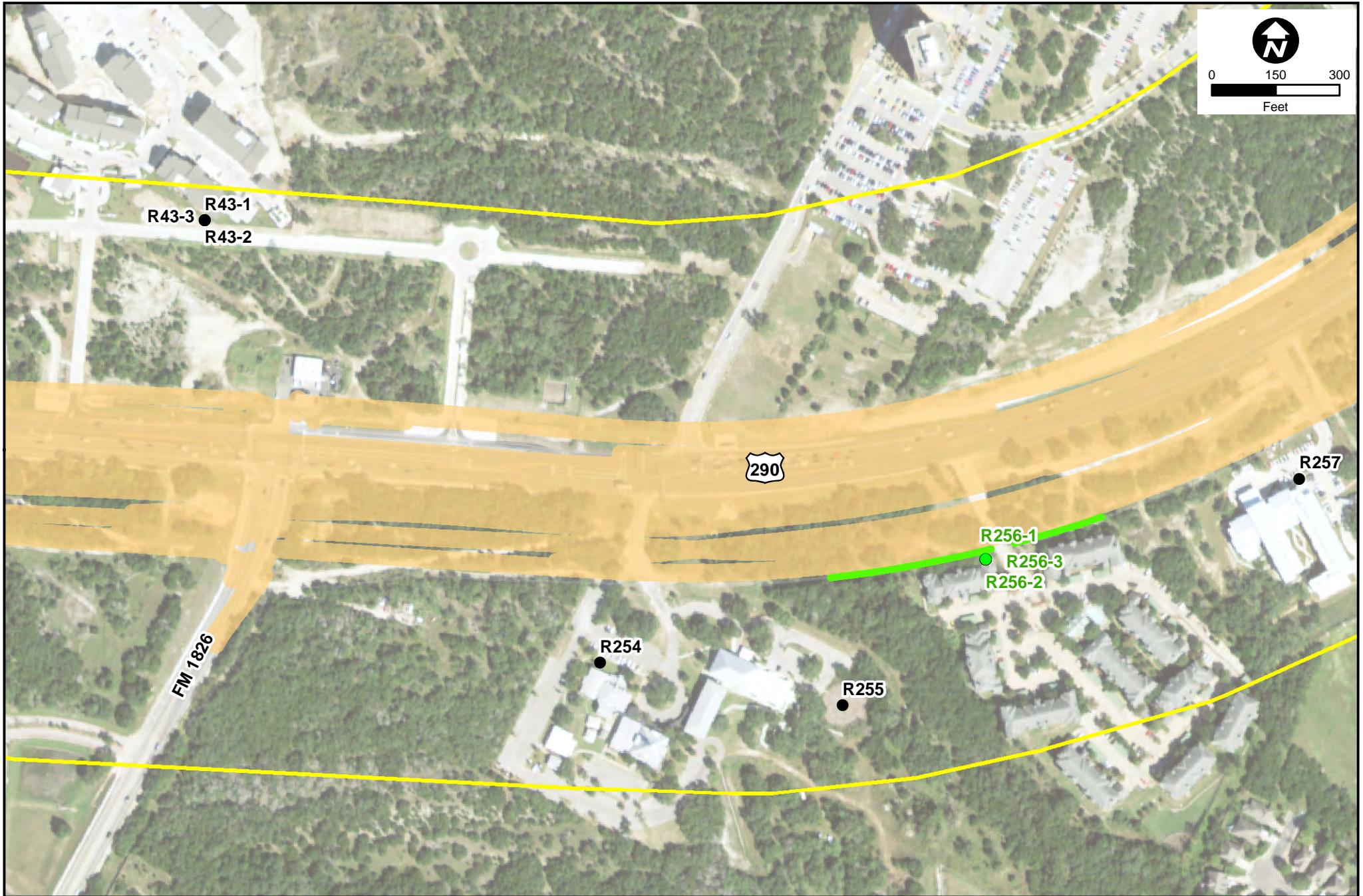
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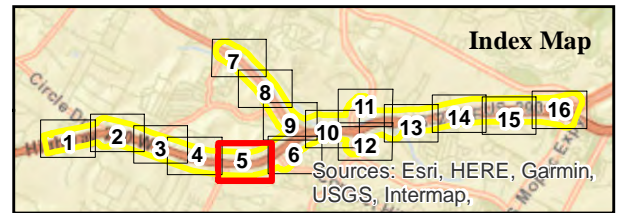
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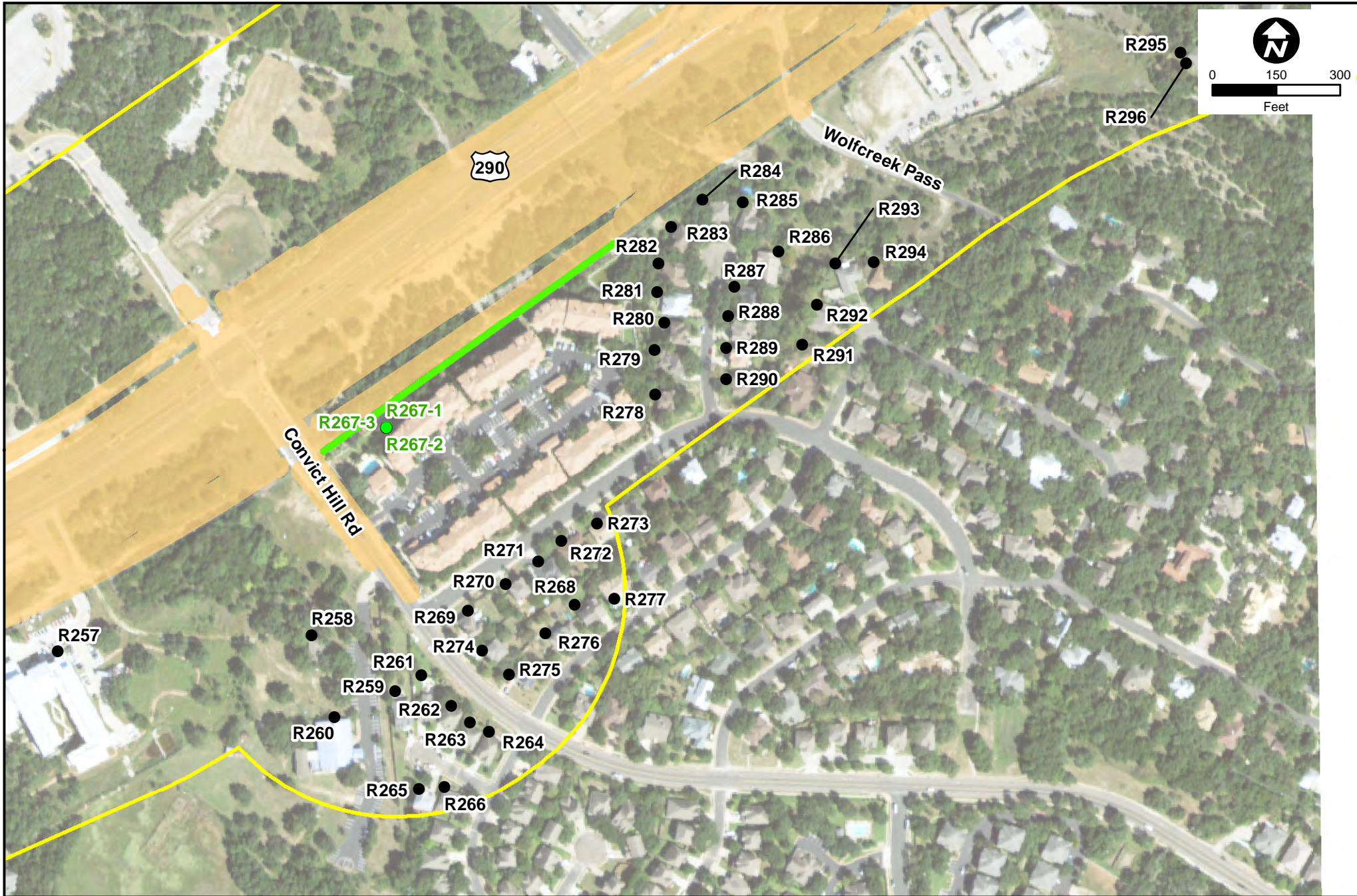


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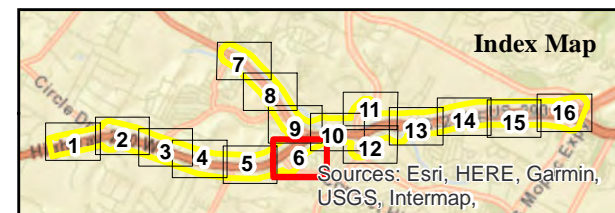
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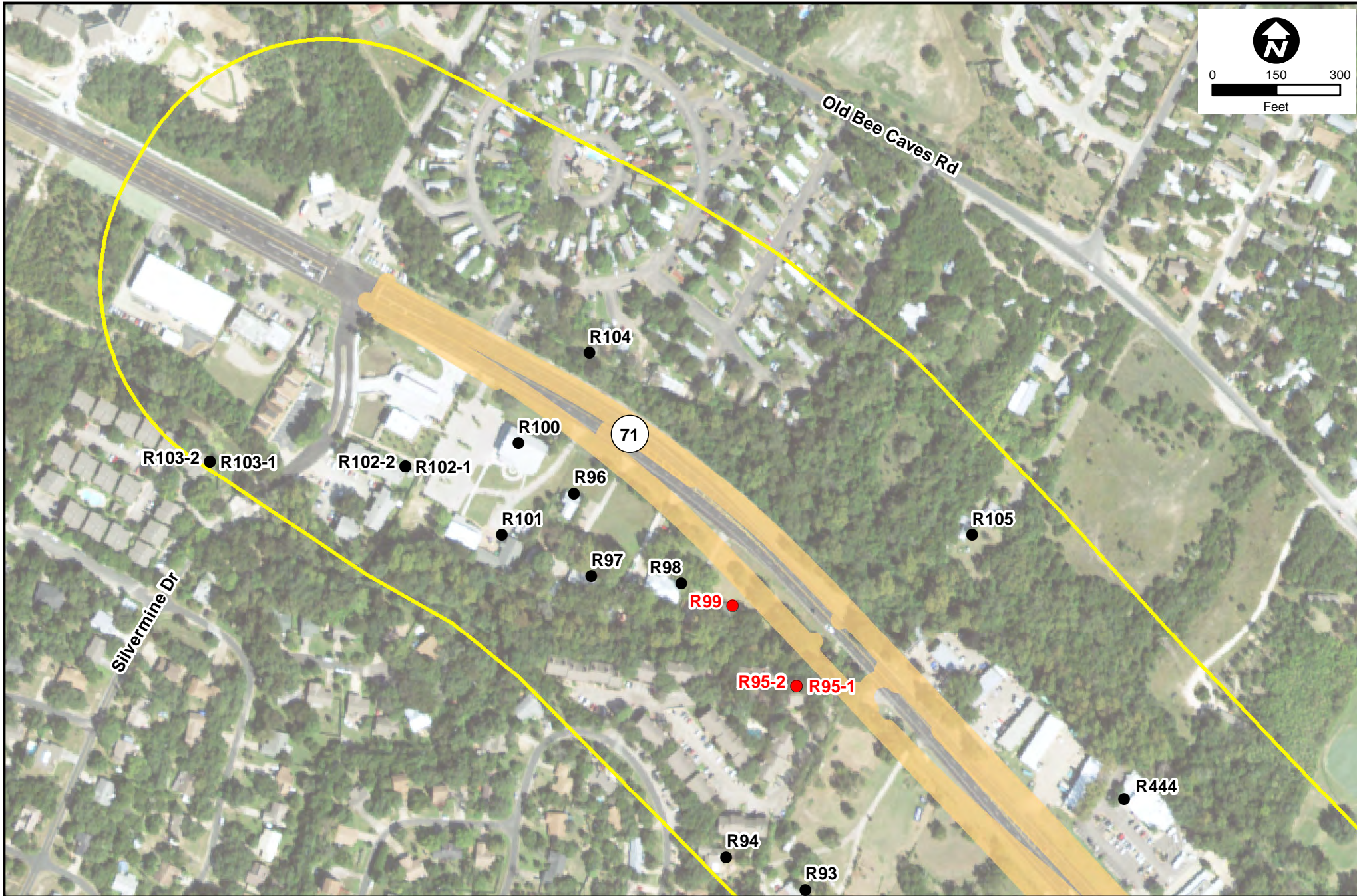
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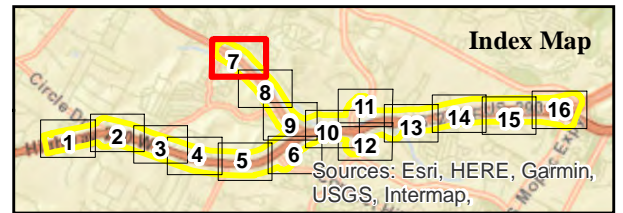
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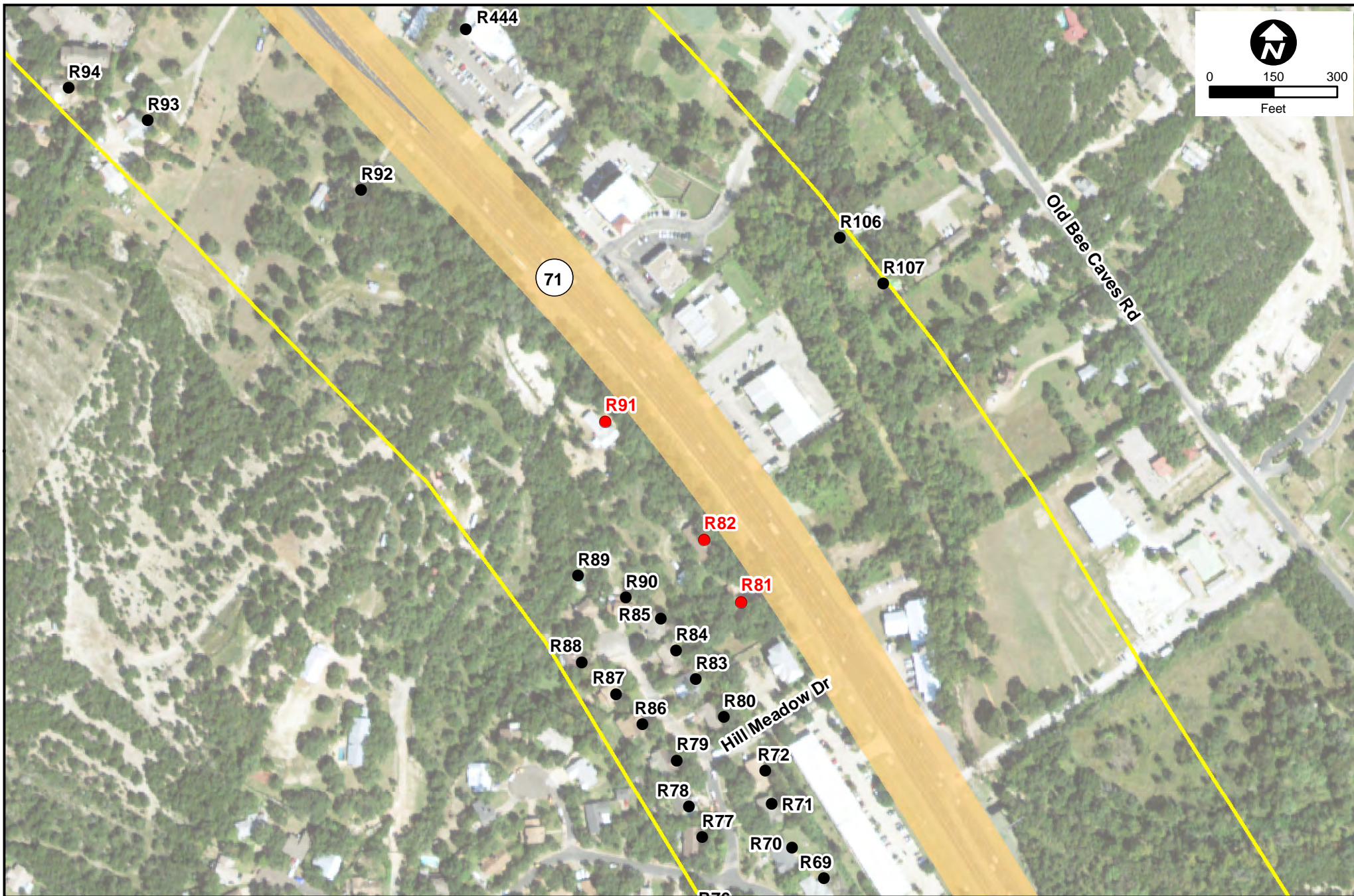


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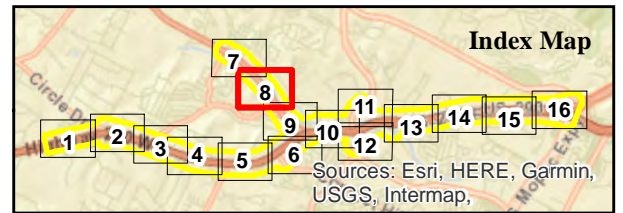


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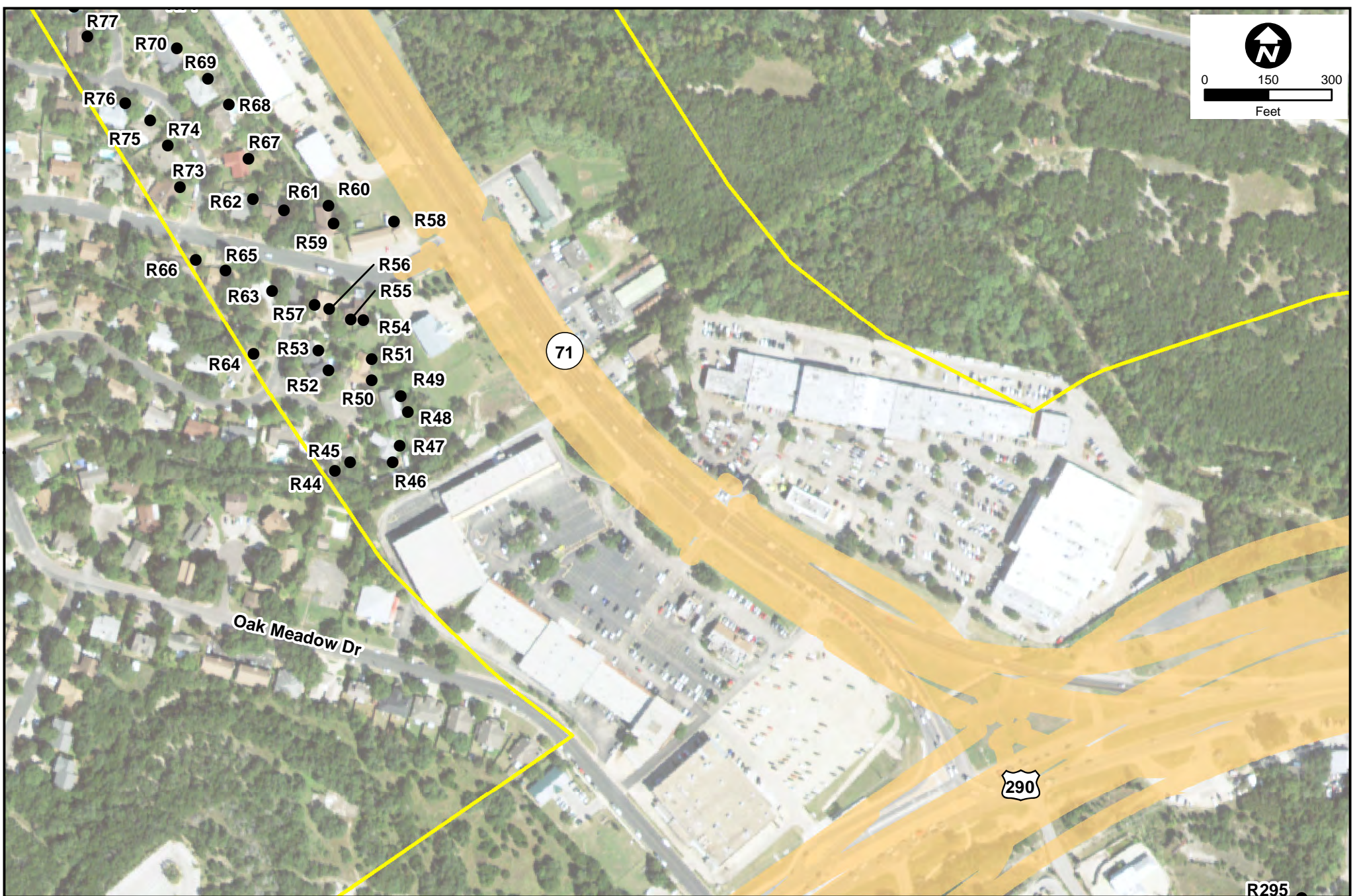
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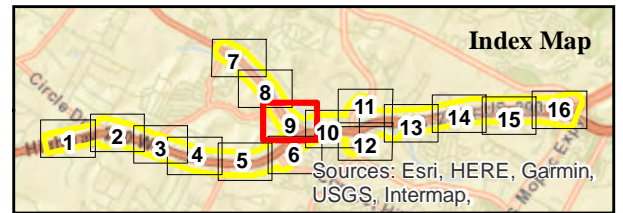
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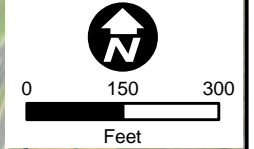
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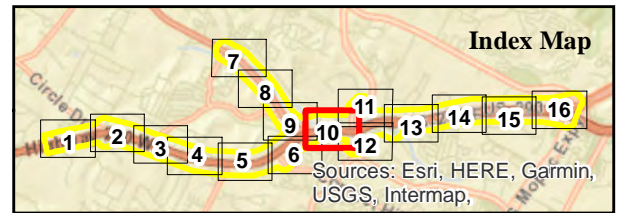
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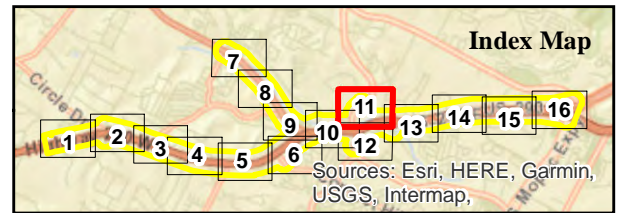


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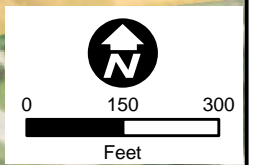
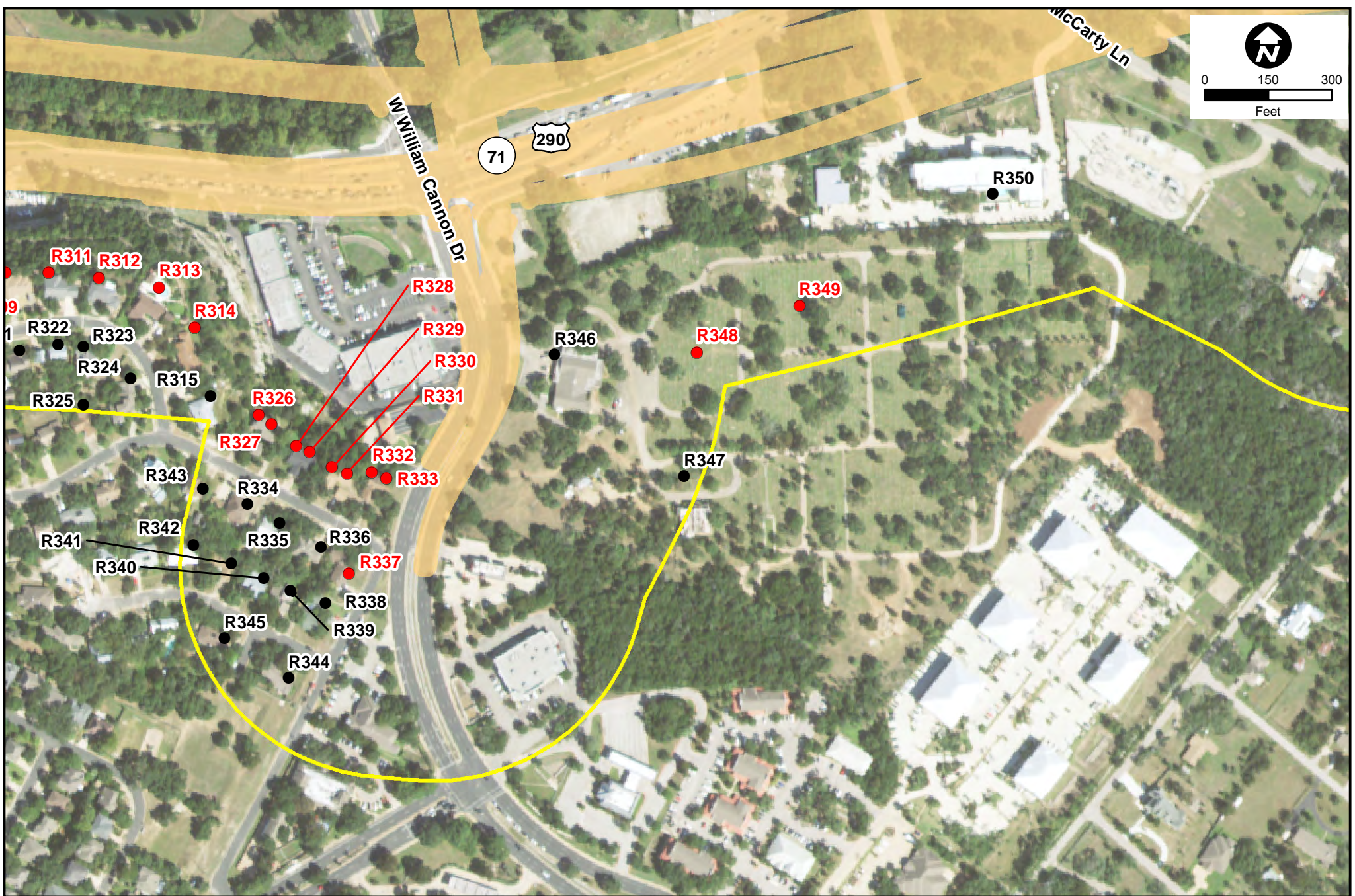


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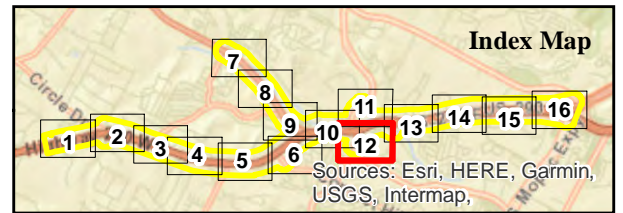


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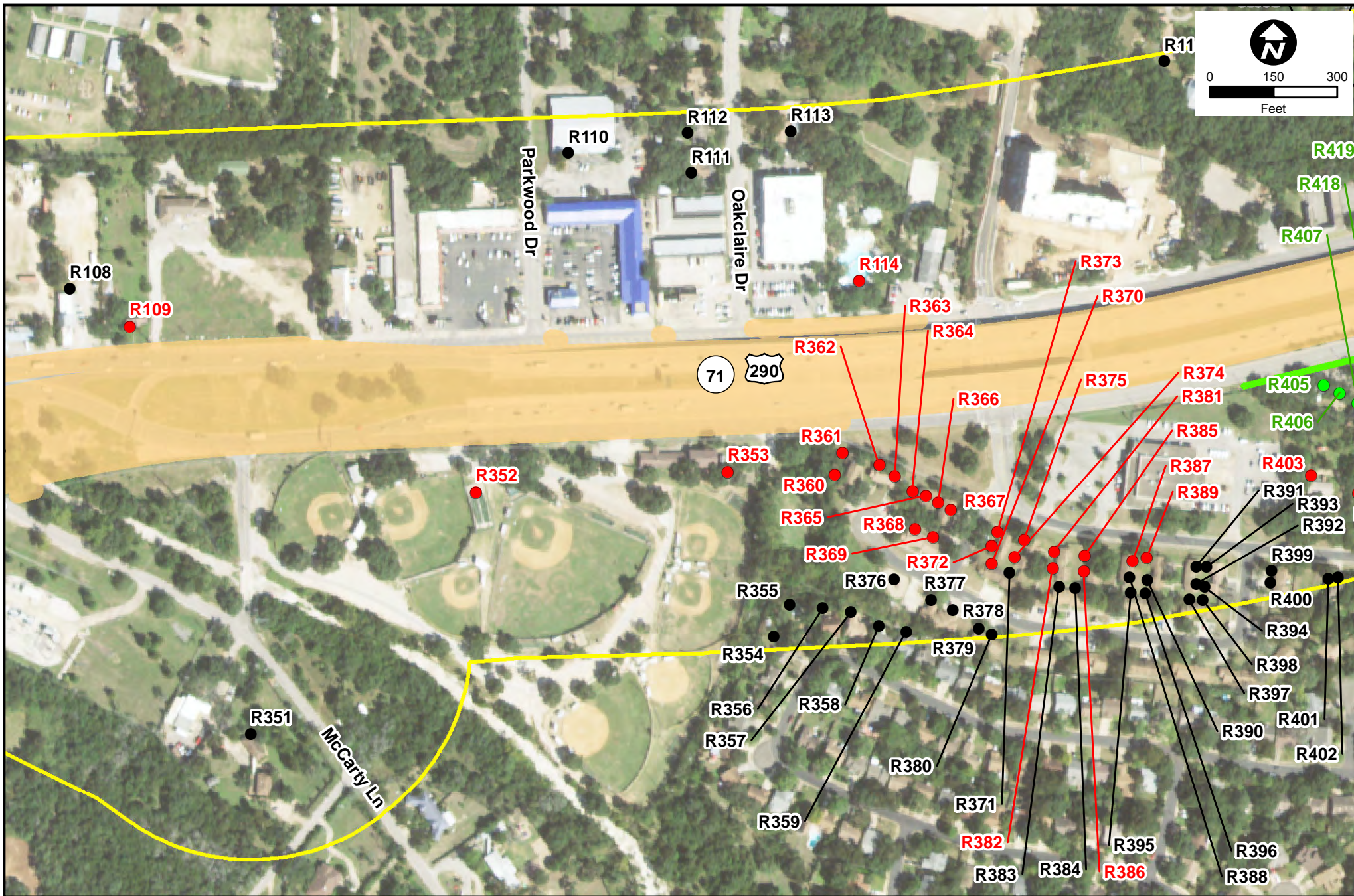
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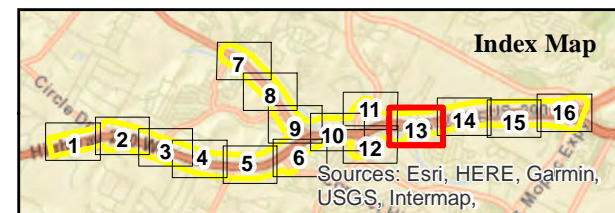
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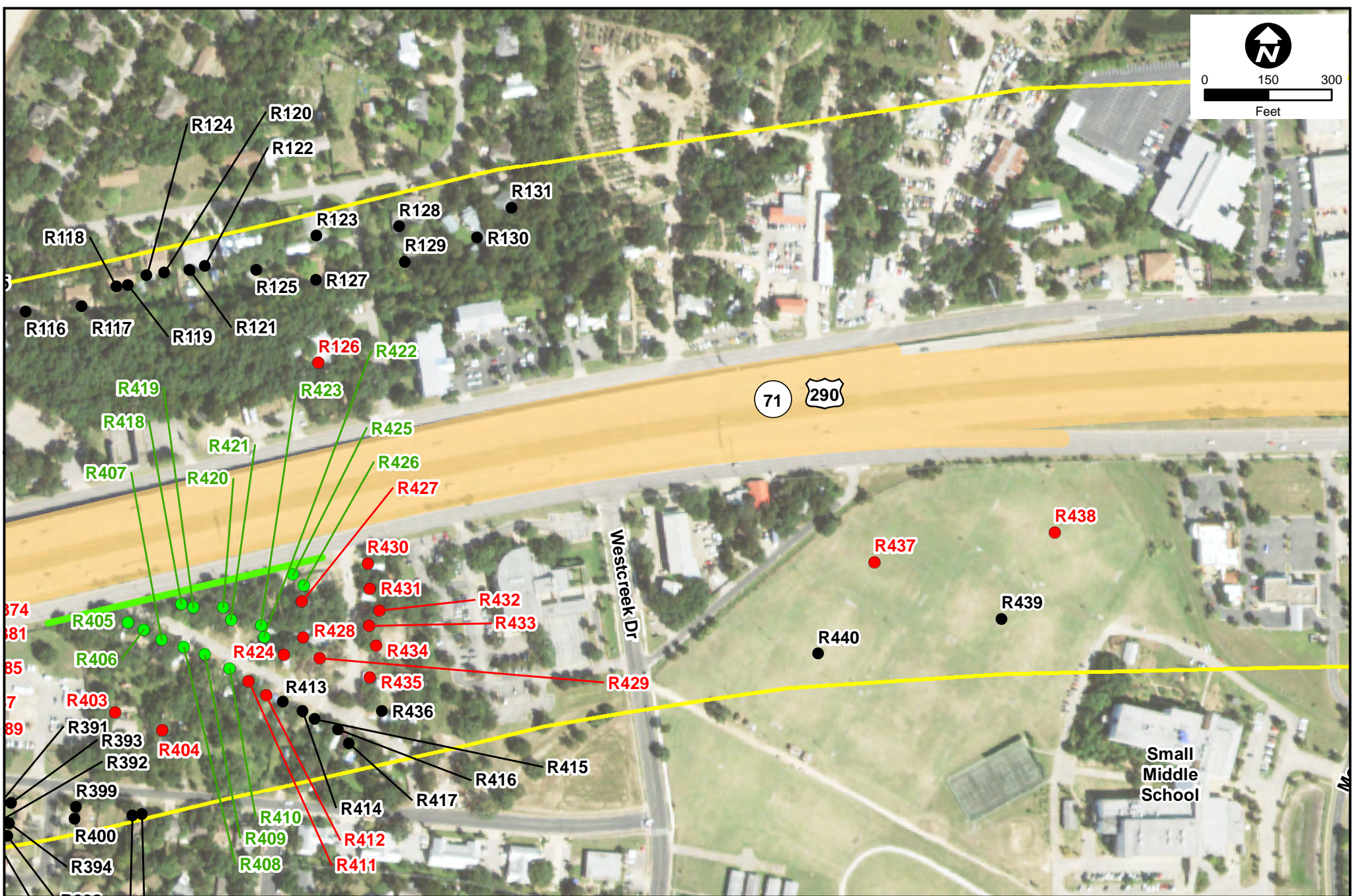
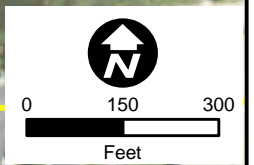
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Oak Hill Parkway Improvements**









Sources: Esri, HERE, Garmin, USGS, Intermap,

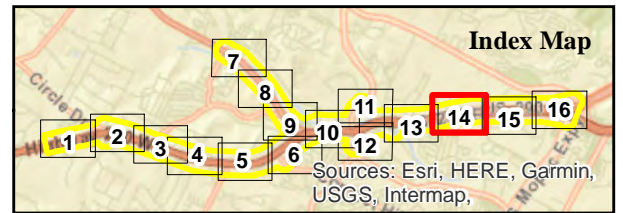
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Legend

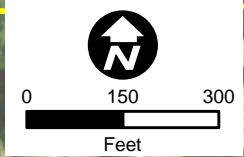
-  Proposed Noise Barrier
-  Impacted Receiver
-  Proposed Route
-  Benefitted Receiver
-  Study Area
-  Receiver

**FIGURE 2 - RECEIVER LOCATION MAP
PREFERRED ALTERNATIVE
Oak Hill Parkway Improvements**



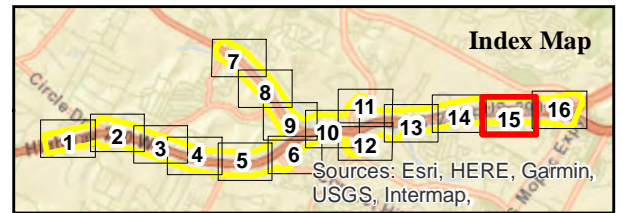
Sources: Esri, HERE, Garmin, USGS, Intermap,

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- Legend**
- █ Proposed Noise Barrier
 - █ Proposed Route
 - Study Area
 - Impacted Receiver
 - Benefitted Receiver
 - Receiver

**FIGURE 2 - RECEIVER LOCATION MAP
PREFERRED ALTERNATIVE
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Legend

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**FIGURE 2 - RECEIVER LOCATION MAP
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