Noise Technical Report

183 North Mobility Project, Travis and Williamson Counties

From SH 45/RM 620 to Loop 1 (MoPac)

Austin District

CSJs: 0151-05-100 & 3136-01-185

July 2015

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

Table of Contents

List of Tables

List of Figures

List of Appendices

1.0 INTRODUCTION

The Central Texas Regional Mobility Authority (Mobility Authority), in conjunction with the Texas Department of Transportation (TxDOT), is assessing the environmental impacts associated with proposed improvements to US 183 from State Highway (SH) 45/Ranch-to-Market Road (RM) 620 to Loop 1 (MoPac) (CSJ 0151-05-100 and 3136-01-185). As part of the environmental analysis required by the National Environmental Policy Act (NEPA), alternatives for the proposed 183 North Mobility Project were developed and evaluated. Based on the alternatives analysis, the Express Lanes Alternative was identified as the Build Alternative. The Express Lanes Alternative (Build Alternative) and the No Build Alternative were carried forward for further analysis and are discussed in the 183 North Mobility Project Environmental Assessment. This technical report documents the potential noise impacts associated with the Build Alternative, along with associated noise abatement that is proposed for incorporation into the project design.

1.1 TRAFFIC NOISE ANALYSIS

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 process 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

FHWA has established the following Noise Abatement Criteria (NAC), shown 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. As reflected in TxDOT's *Guidance for Analysis and Abatement of Roadway Traffic Noise*

(TxDOT, 2011), TxDOT has adopted the federal NACs as its standard. A noise impact occurs when either the absolute or relative criterion is met:

Absolute criterion: The predicted noise level at the receiver approaches, equals, or exceeds the NAC. Approach is defined as one (1) dB(A) below the NAC (TxDOT, 2011). For example, a noise impact would occur at an exterior activity area of 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) (TxDOT, 2011). For example: a noise impact would occur at an exterior activity area of a Category B residence if the existing level is 54 dB(A) and the predicted level is 65 dB(A) (11 dB(A) increase).

Table 1: FHWA Noise Abatement Criteria (NAC)

Activity Category	FHWA dB(A) Leq	TxDOT dB(A) Leq	Activity Description
A	57 (exterior)	56 (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)	66 (exterior)	Residential
C	67 (exterior)	66 (exterior)	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52 (interior)	51 (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)	71 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	--	--	Agriculture, 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.

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. More information on noise abatement is discussed in **Section 3.0** of this technical report.

1.2 EXISTING CONDITIONS

Land use activity categories located adjacent to the 183 North Mobility Project area include: residential (category B); active sports areas, schools, day care centers, places of worship, and hospitals (category C); schools, day care centers, and places of worship (category D).

Current noise sources include high speed traffic on the existing US 183, SH 45, and MoPac, moderate speed traffic on RM 620 and cross-streets along the corridor, and the Union Pacific Railroad that runs parallel to the east of MoPac.

2.0 DIRECT EFFECTS

This analysis was accomplished in accordance with TxDOT's (FHWA approved) *Guidelines for Analysis and Abatement of Roadway Traffic Noise* (2011).

The FHWA Traffic Noise Model 2.5 (TNM 2.5) was used to calculate existing and proposed traffic noise levels at representative receivers along US 183, RM 620, and MoPac. 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.

Existing and predicted traffic noise levels were modeled at receiver locations (**Table 2** and **Figures 1–15**) that represent the land use activity areas adjacent to the proposed project area 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	Location	NAC Category	NAC Level	Existing (2015)	Predicted (2035)	Change (+/-)	Noise Impact
R1	Residence on RM 620	B	67	61	62	+1	N
R2	Residence on RM 620	B	67	61	63	+2	N
R3	Residence on RM 620	B	67	61	64	+3	N
R4	Residence on RM 620	B	67	58	60	+2	N
R5	Balcones Country Club Golf Course	C	67	73	76	+3	Y
R6	Multi-Family Residence on Research Blvd (Balcones Ranch Apts)	B	67	69	70	+1	Y

Representative Receiver	Location	NAC Category	NAC Level	Existing (2015)	Predicted (2035)	Change (+/-)	Noise Impact
R7	Country Home Learning Center Day Care	C	67	74	77	+3	Y
R8	Club Z After School Program and Summer Camp	C	67	74	76	+2	Y
R9	Christ Community Church	C	67	66	69	+3	Y
R10	Austin Bible Chapel	D	52	50	52	+2	Y
R11	Multi-Family Residence on Research Blvd (Wind River Crossing Apts)	B	67	71	74	+3	Y
R12	Multi-Family Residence on Research Blvd (Balcones Woods Apts)	B	67	66	69	+3	Y
R13	Seton Northwest Hospital	D	52	37	39	+2	N
R14	Grace Covenant Church	D	52	37	37	0	N
R15	Multi-Family Residence on Research Blvd	B	67	64	65	+1	N
R16	Multi-Family Residence on Research Blvd/MoPac Service Rd	B	67	68	70	+2	Y
R17	Multi-Family Residence on MoPac Service Road (Wood Harbour Apts)	B	67	65	71	+6	Y
R18	Multi-Family Residence on MoPac Service Road (Terracina Apts)	B	67	59	62	+3	N
R19	Residence on Northforest	B	67	63	63	0	N
R20	Residence on Northforest	B	67	64	63	-1	N
R21	Residence on Foster Ln	B	67	68	69	+1	Y
R22	Residence on Whiteway Dr	B	67	69	70	+1	Y
R23	Residence on Greenlawn Pkwy	B	67	70	70	0	Y
R24	Residence on Pinecrest Dr	B	67	68	68	0	Y
R25	Residence on Stoneway Dr	B	67	67	67	0	Y
R26	Residence on Borden Rd	B	67	75	76	+1	Y
R27	Multi-Family Residence on North Hills Dr (Somerset Townhomes)	B	67	71	73	+2	Y
R28	Residence on Jamaica Ct	B	67	70	71	+1	Y
R29	Residence on Carlisle Dr	B	67	70	71	+1	Y
R30	Residence on Hunt Trl	B	67	70	70	0	Y
R31	Sports fields @ Gullet Elementary	C	67	63	63	+0	N
R32	Classroom building @ Gullet Elementary	D	52	33	33	+0	N
R33	Residence on Marilyn Ct	B	67	62	63	+1	N
R34	Residence on Fairlane Dr	B	67	67	66	-1	Y

3.0 NOISE ABATEMENT MEASURES

As indicated in **Table 2**, the proposed project would result in a traffic noise impact; therefore, 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 noise barriers.

Before any abatement measure can be proposed for incorporation into the proposed project, it must 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 five 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 five dB(A) and the abatement measure must be able to reduce the noise level for at least one impacted, first row receiver by at least seven 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 ROW 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.

Noise barriers: This is the most commonly used noise abatement measure. Noise barriers were evaluated for each of the impacted receiver locations.

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

Receiver R5: This receiver represents a green on the Balcones Country Club Golf Course. R5 represents three equivalent receivers based on the impacted area divided by the average residential lot size in the vicinity of the project area. A barrier 286 feet in length and 11 feet in height would achieve the minimum feasible reduction of 5 dB(A) at greater than 50% of first row receivers and reduce the noise level at one or more receivers by at least 7 dB(A). However, a preliminary evaluation of engineering feasibility

identified constructability and utility constraints. In order to accommodate the barrier, overhead utility lines would need to be relocated. Due to the lack of available TxDOT ROW along US 183, the utility lines would need to be relocated onto the adjacent property. The cost of the barrier and the associated utility relocations, including a 20-foot easement, would exceed the reasonable, cost-effectiveness criterion of $25,000 (see **Appendix A** for utility relocation costs). Therefore, a barrier at this location is not proposed for incorporation into the project.

Receiver R6: This receiver represents a pool area of a multi-family residential community. The pool is located behind a 25-foot tall apartment office building. Gaps in a noise barrier would satisfy access requirements to the property 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). Based upon the modeling analysis of a 20-foot barrier, the maximum noise reduction that could be provided is one dB(A). Therefore, a barrier at this location is not proposed for incorporation into the project.

Receiver R7: This receiver represents an outdoor play area at a day care. R7 represents one receiver based on the impacted area divided by the average residential lot size in the vicinity of the project area. Gaps in a noise barrier would satisfy access requirements to the property 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). Based upon the modeling analysis of a 20-foot barrier, the maximum noise reduction that could be provided is four dB(A). Therefore, a barrier at this location is not proposed for incorporation into the project.

Receiver R8: This receiver represents an outdoor play area at an after-school day care and summer camp facility. R8 represents two equivalent receivers based on the impacted area divided by the average residential lot size in the vicinity of the project area. A noise barrier would not be sufficient to achieve the minimum, feasible reduction of 5 dB(A) or the noise reduction design goal of 7 dB(A). Based upon the modeling analysis of a 20-foot barrier, the maximum noise reduction that could be provided is four dB(A). Therefore, a barrier at this location is not proposed for incorporation into the project.

Receiver R9: This receiver represents an outdoor recreational area of a church. R9 represents one receiver based on the impacted area divided by the average residential lot size in the vicinity of the project area. A 12-foot building is located between US 183 and the playground area. A noise barrier would not be sufficient to achieve the minimum, feasible reduction of 5 dB(A) or the noise reduction design goal of 7 dB(A). Based upon the modeling analysis of a 20-foot barrier, the maximum noise reduction that could be provided is two dB(A). Therefore, a barrier at this location is not proposed for incorporation into the project.

Receiver R10: This receiver represents an interior location of a church with single-glazed windows. An interior receiver was chosen because there is not an exterior area of frequent activity. R10 represents two equivalent receivers based on the impacted area divided by the average residential lot size in the vicinity of the project area. A barrier 110 feet in length and 9 feet in height would achieve the minimum feasible reduction of 5 dB(A) at greater than 50% of first row receivers and reduce the noise level at one or more receivers by at least 7 dB(A). However, a preliminary evaluation of engineering feasibility identified constructability and utility constraints. In order to accommodate the barrier, overhead utility lines would need to be relocated. Due to the lack of available TxDOT ROW along US 183, the utility lines would need to be relocated onto the adjacent property. The cost of the barrier and the associated utility relocations, including a 20-foot easement, would exceed the reasonable, cost-effectiveness criterion of $25,000 (see **Appendix A** for utility relocation costs). Therefore, a barrier at this location is not proposed for incorporation into the project.

Receiver R11: This receiver represents a balcony that faces US 183 at a multi-residential community. A total of 27 first-floor and 27 second-floor receivers were modeled for the barrier analysis. A barrier 1,222 feet in length and 16 feet in height would achieve the minimum feasible reduction of 5 dB(A) at greater than 50% of first row receivers and reduce the noise level at one or more receivers by at least 7 dB(A). However, a preliminary evaluation of engineering feasibility identified constructability and utility constraints. In order to accommodate the barrier, overhead utility lines would need to be relocated. Due to the lack of available TxDOT ROW along US 183, the utility lines would need to be relocated onto the adjacent property. The cost of the barrier and the associated utility relocations, including a 20-foot easement, would exceed the reasonable, cost-effectiveness criterion of $25,000 (see **Appendix A** for utility relocation costs). Therefore, a barrier at this location is not proposed for incorporation into the project.

Receiver R12: This receiver represents a balcony that faces US 183 at a multi-family residential community. A total of 9 first-floor and 9 second-floor receivers were modeled for the barrier analysis. The community has an existing 10-foot neighborhood wall along the property perimeter of US 183 and Balcones Woods Drive. Gaps in a noise barrier would satisfy access requirements to the property 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). Based upon the modeling analysis of a 20-foot barrier, the maximum noise reduction that could be provided is four dB(A). Therefore, a barrier at this location is not proposed for incorporation into the project.

Receiver R16: This receiver represents a balcony of a multi-family residential community. A total of 7 first-floor, 7 second-floor, and 7 third-floor receivers were modeled for the barrier analysis. A noise

barrier that would achieve the minimum feasible reduction of 5 dB(A) at greater than 50% of first row receivers and reduce the noise level at one or more receivers by at least 7 dB(A) would exceed the reasonable, cost-effectiveness criterion of $25,000. Therefore, a barrier at this location is not proposed for incorporation into the project.

Receiver R17: This receiver represents five equivalent receivers in a courtyard seating area in the center of a multi-family residential community. A 25-foot building is between US 183 and the receiver. A noise barrier would not be sufficient to achieve the minimum, feasible reduction of 5 dB(A) or the noise reduction design goal of 7 dB(A). Based upon the modeling analysis of a 20-foot barrier, the maximum noise reduction that could be provided is two dB(A). Therefore, a barrier at this location is not proposed for incorporation into the project.

Receiver R21, R22, R23, R24: These receivers represent 53 single-family residences in the Allandale Neighborhood. Situated between MoPac and the Allandale Neighborhood are two Union Pacific Railroad tracks that parallel MoPac and Great Northern Boulevard. In order to determine if rail noise is the dominant noise source in the Allandale Neighborhood, 24-hour counts of freight operations were conducted, in accordance with the Federal Transit Administration's *Transit Noise and Vibration Impact Assessment* (May 2006).

Results indicate that rail noise is the dominant noise source in the Allandale Neighborhood. Therefore, a combined FHWA/FTA noise assessment was conducted to determine if a barrier would be feasible and reasonable at abating noise associated with the cumulative effects of highway and rail (see **Appendix B**). While a sound wall along MoPac in the TxDOT ROW would provide mitigation for the highway traffic noise, it would not provide abatement for the train noise. Therefore, a barrier was modeled between Anderson Lane and Far West Boulevard along Great Northern Boulevard, which is located between the railroad tracks and the residences.

A barrier 3,060 feet in length and 18 feet in height would achieve the minimum feasible reduction of 5 dB(A) at greater than 50% of first row receivers and reduce the noise level at one or more receivers by at least 7 dB(A). However, a preliminary evaluation of engineering feasibility identified constructability and utility constraints. In order to accommodate the barrier, overhead utility lines would need to be relocated. The cost of the barrier and the associated utility relocations would exceed the reasonable, cost-effectiveness criterion of $25,000 (see **Appendix A** for utility relocation costs). Therefore, a barrier at this location is not proposed for incorporation into the project.

Receivers R25, R26, R28, R29, and R30: These receivers represent 54 single-family residences in the Allandale Neighborhood. The same methods used to determine the combined highway/rail noise for R21–R24 were used for these receivers. Results of the analysis indicate that a noise barrier that would achieve the minimum feasible reduction of 5 dB(A) at greater than 50% of first row receivers and reduce the noise level at one or more receivers by at least 7 dB(A) would exceed the reasonable, cost-effectiveness criterion of $25,000. Therefore, a barrier at this location is not proposed for incorporation into the project.

Receiver R27: This receiver represents a pool area of a multi-family residential community. A total of 11 first-floor, 11 second-floor, and 11 third-floor receivers were modeled for the barrier analysis. A barrier 547 feet in length and 19 feet in height would achieve the minimum feasible reduction of 5 dB(A) at greater than 50% of first row receivers and reduce the noise level at one or more receivers by at least 7 dB(A). However, a preliminary evaluation of engineering feasibility identified constructability and utility constraints. In order to accommodate the barrier, overhead utility lines would need to be relocated. Due to the lack of available TxDOT ROW along MoPac, the utility lines would need to be relocated onto the adjacent property. The cost of the barrier and the associated utility relocations, including a 20-foot easement, would exceed the reasonable, cost-effectiveness criterion of $25,000 (see **Appendix A** for utility relocation costs). Therefore, a barrier at this location is not proposed for incorporation into the project.

Receiver R34: This receiver represents 31 single-family residences in the Allandale Neighborhood. The noise analysis from the MoPac Improvement Project resulted in a feasible and reasonable noise barrier (Sound Wall #3) for the benefit of this neighborhood and it has been approved for construction. The limits of Sound Wall #3 can be seen on **Figure 15**. Any additions to this barrier that would provide an additional minimum feasible reduction of 5 dB(A) at greater than 50% of first row receivers and reduce the noise level at one or more receivers by at least 7 dB(A) would exceed the reasonable, cost-effectiveness criterion of $25,000.

No barriers were determined to be feasible and reasonable for the impacted receivers; therefore, noise barriers are not proposed for incorporation into the project. Any subsequent project design changes may require a reevaluation of this preliminary noise barrier proposal.

Figure 1: Representative Receivers

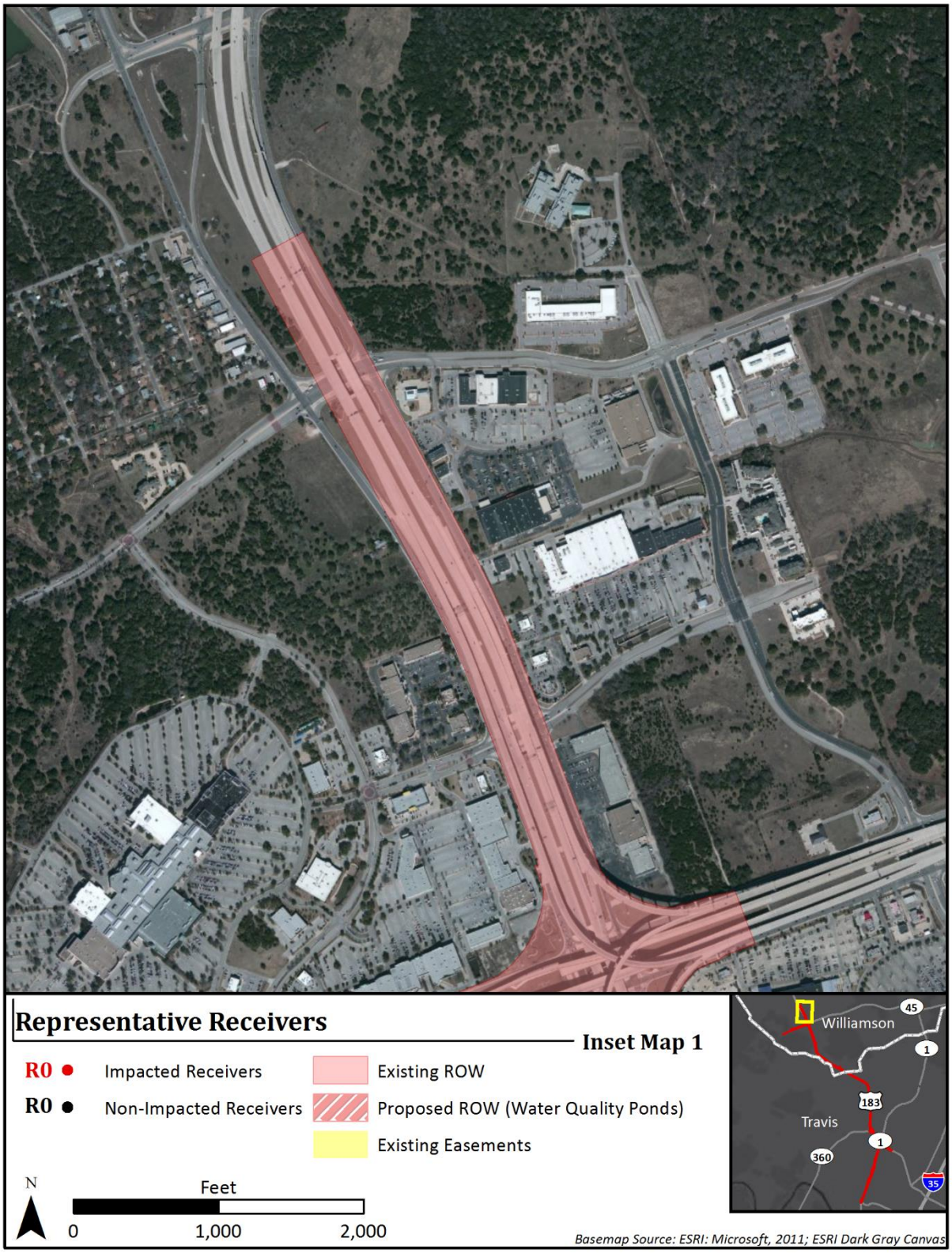


Figure 2: Representative Receivers

Figure 3: Representative Receivers

Figure 4: Representative Receivers

Figure 5: Representative Receivers

Figure 6: Representative Receivers

Figure 7: Representative Receivers

Figure 8: Representative Receivers

Figure 9: Representative Receivers

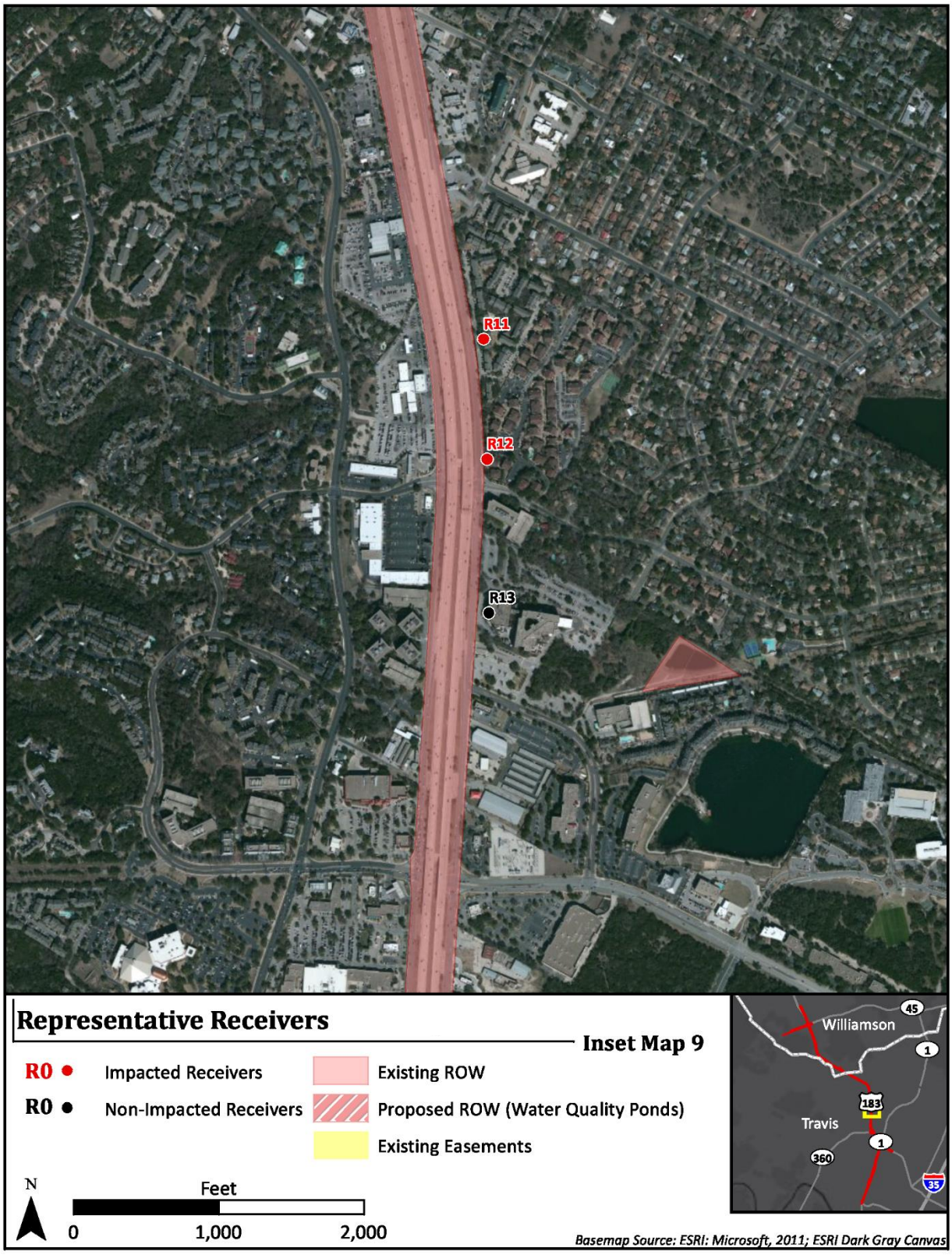


Figure 10: Representative Receivers

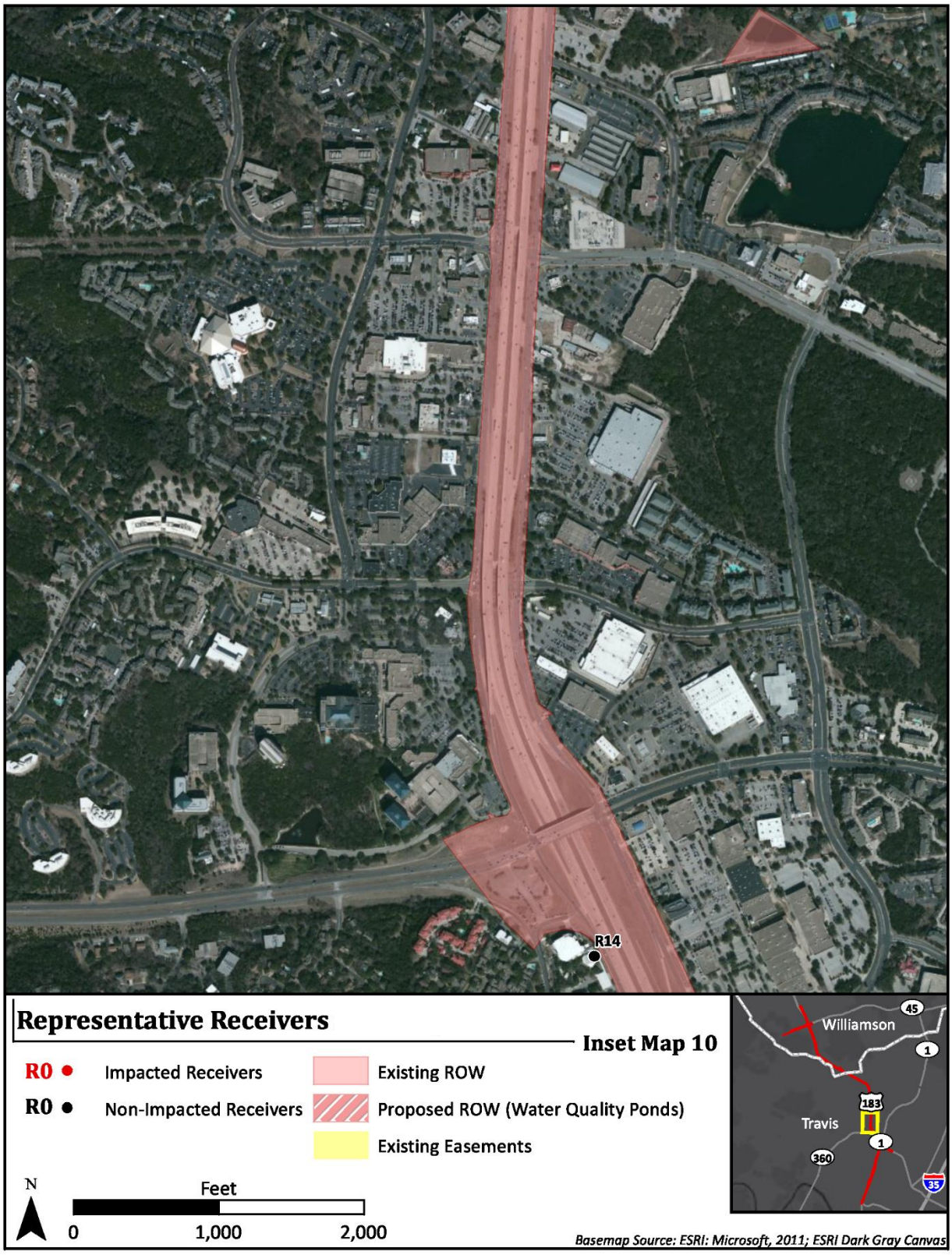


Figure 11: Representative Receivers

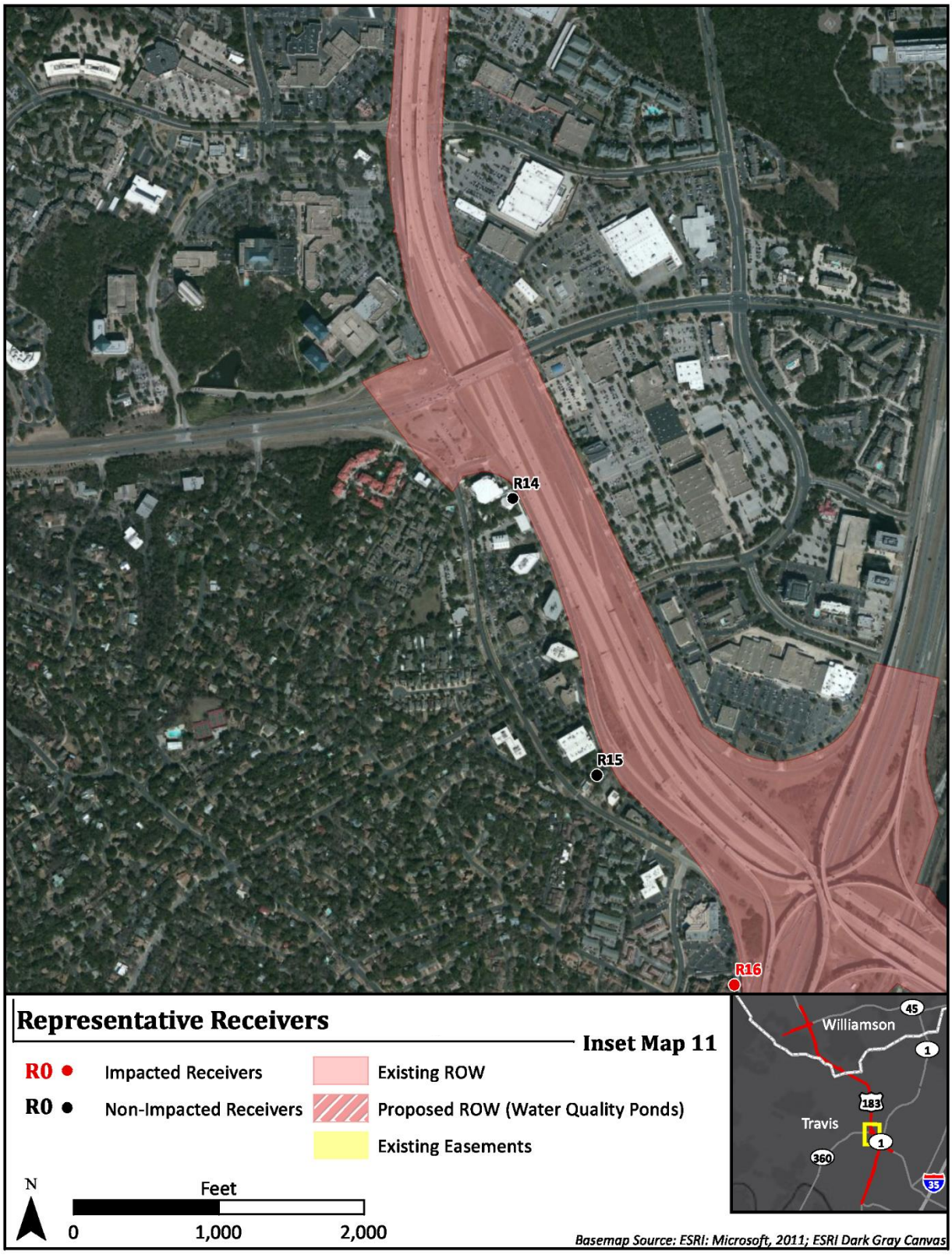


Figure 12: Representative Receivers

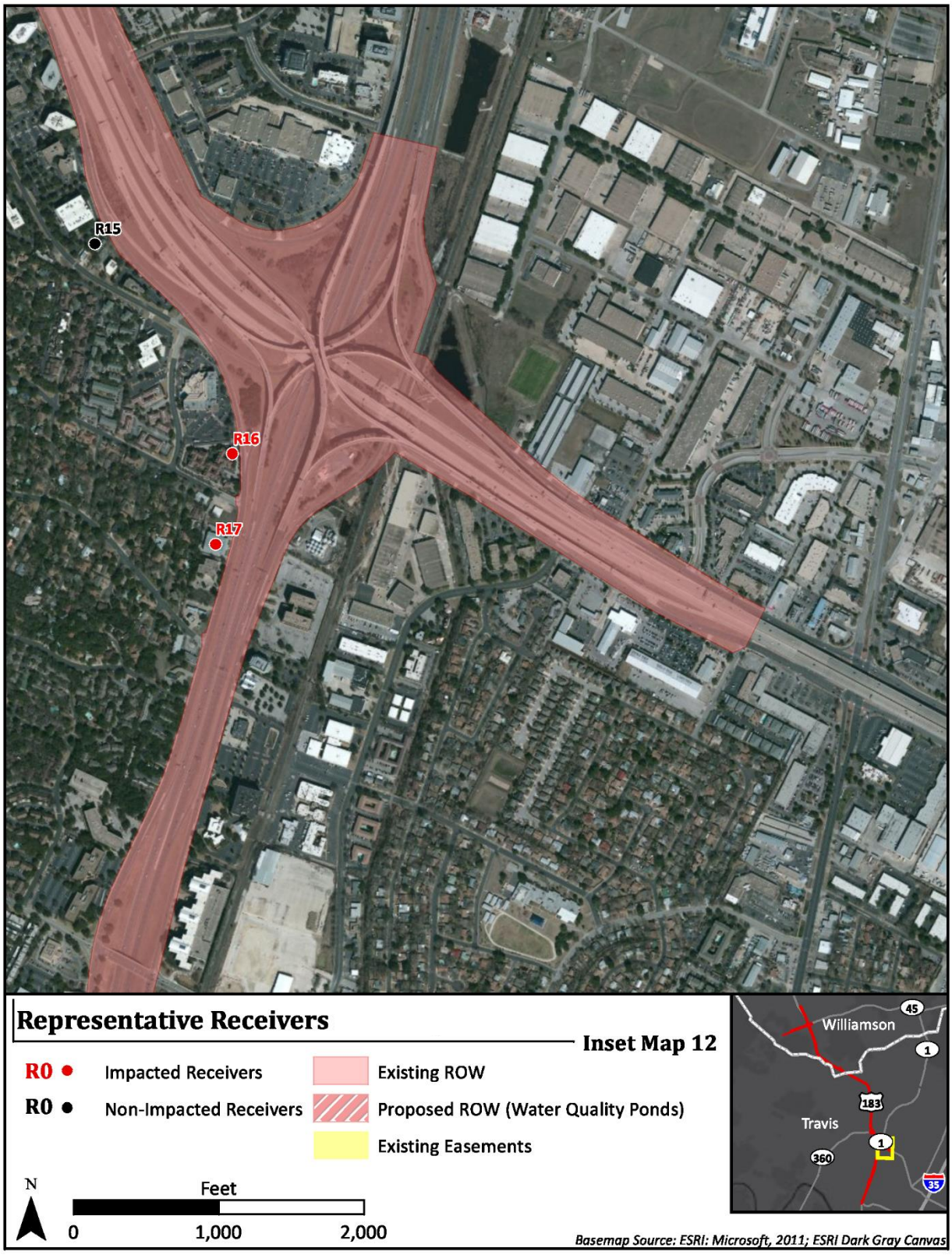


Figure 13: Representative Receivers

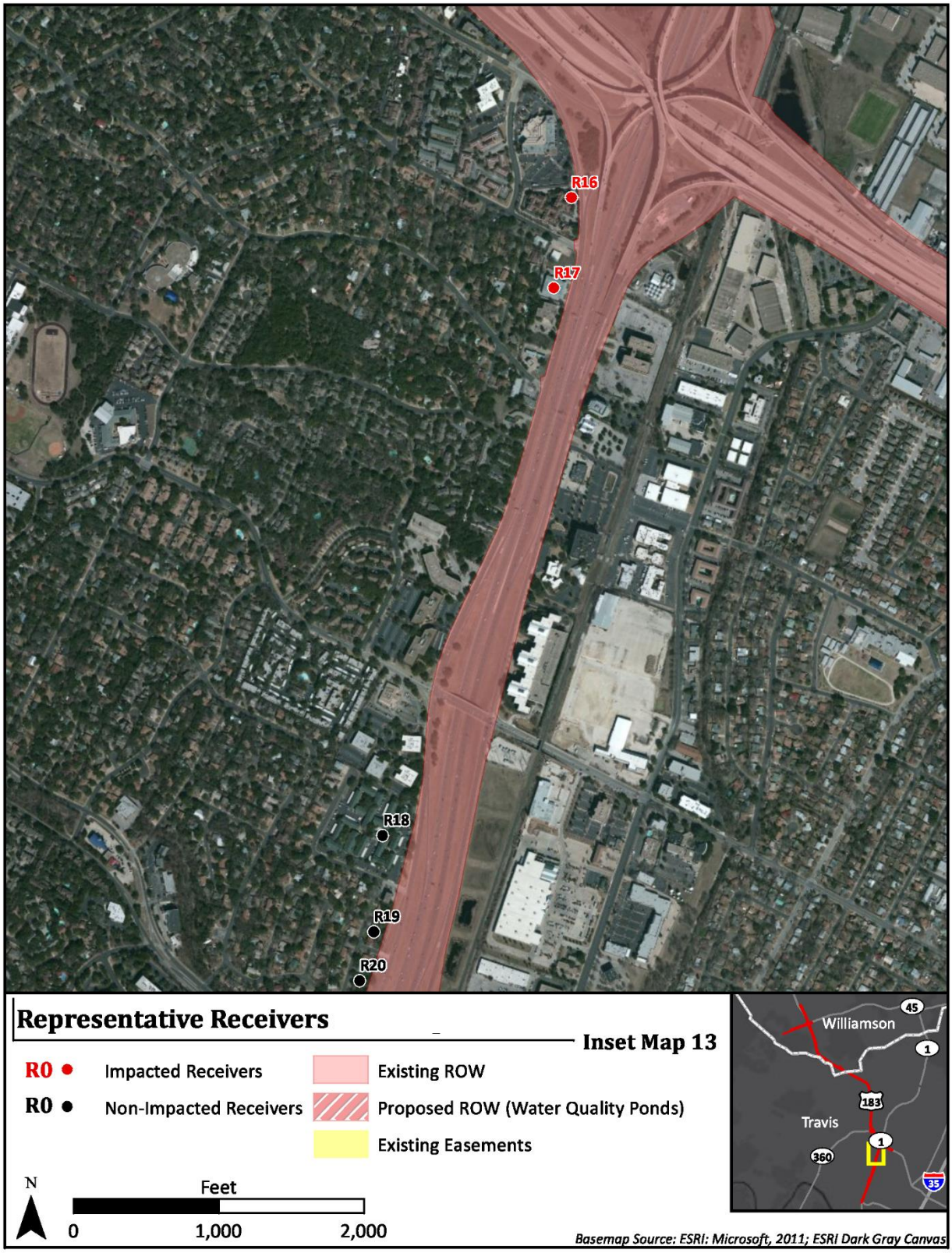


Figure 14: Representative Receivers

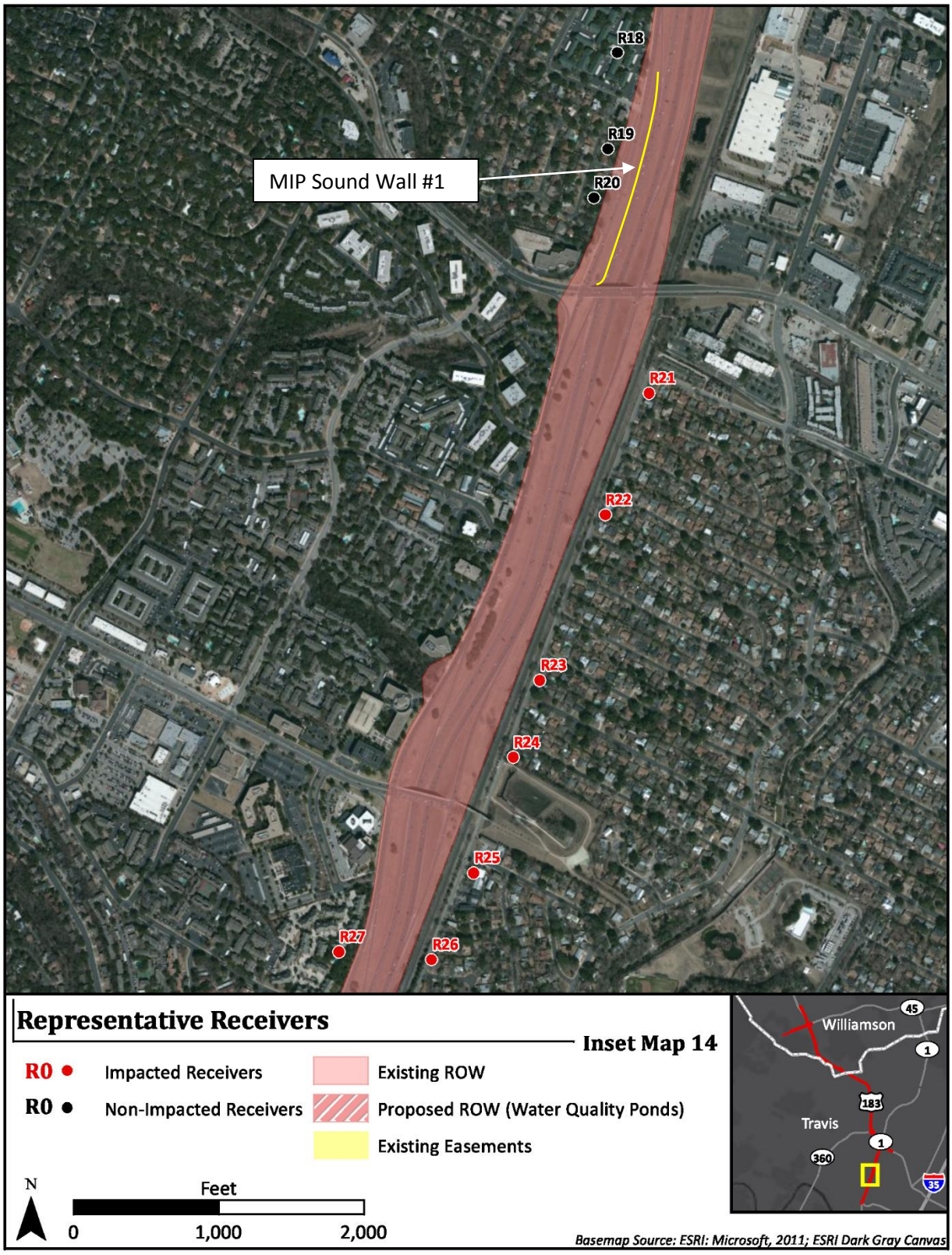
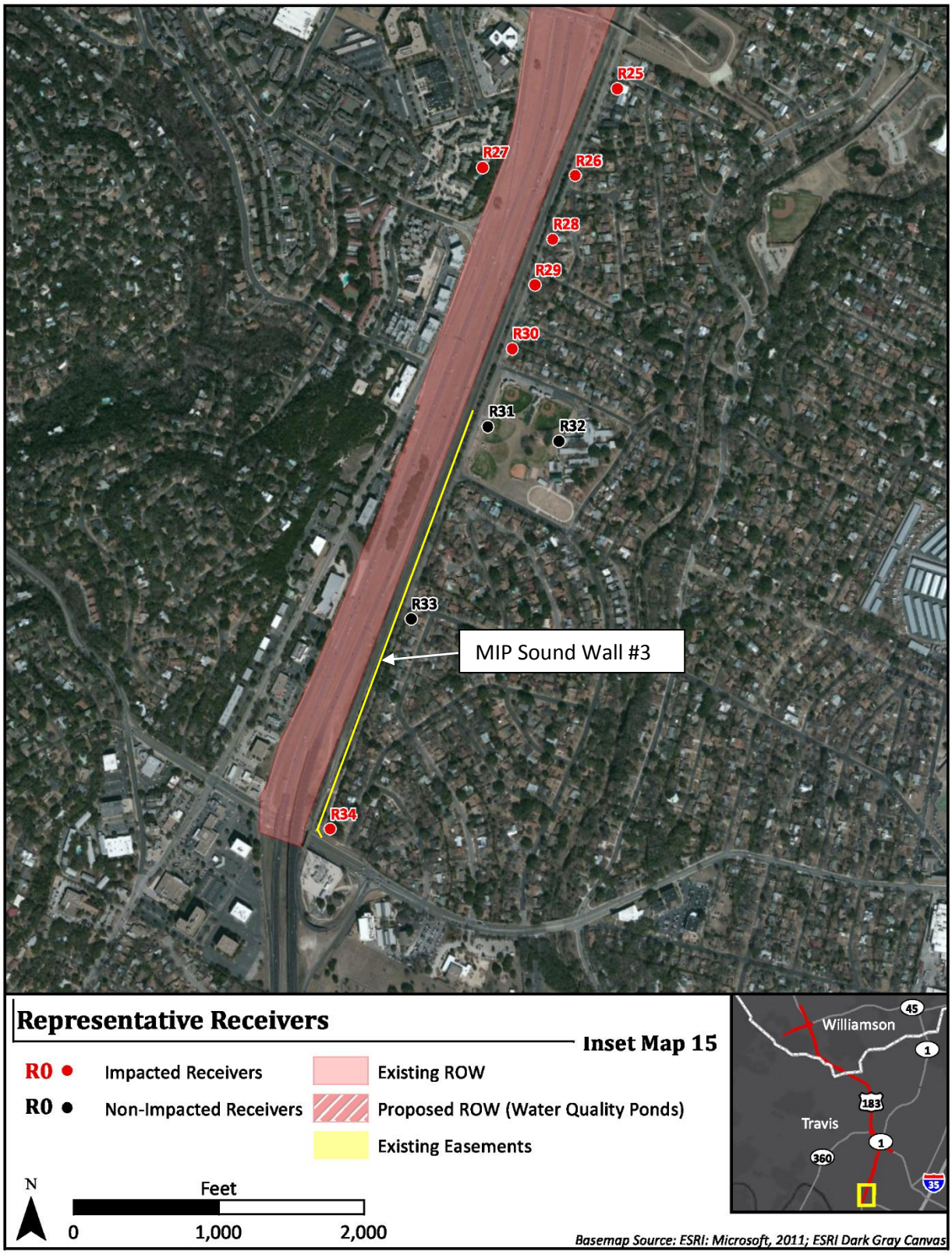


Figure 15: Representative Receivers



4.0 NOISE PLANNING

To avoid noise impacts that may result from future development of properties adjacent to the proposed 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 (2035) noise impact contours (see **Table 3**).

Table 3: Proposed Contours

Location	Distance from ROW	
	NAC Category B & C 66 dB(A)	NAC Category E 71 dB(A)
RM 620: east of Ridgeline Blvd	0 ft	0 ft
US 183: NB, north of SH 45	280 ft	80 ft
US 183: SB, north of SH 45	200 ft	80 ft
NW of 183/SH 45/RM 620 intersection	160 ft	0 ft
US 183: SB, north of Spicewood Springs Rd.	420 ft	180 ft
US 183: NB, north of Duval Rd.	280 ft	60 ft

5.0 CONCLUSION

Based on this modeled noise analysis, the increased traffic generated from the project would cause noise impacts throughout the corridor. Barrier analyses were conducted and results indicated that no barriers would be feasible and reasonable for the impacted receivers. Therefore, noise barriers are not proposed for incorporation into the project. Increases in traffic noise levels resulting from the proposed project are considered a direct effect and were considered in the traffic noise analysis (discussed above). Additional impacts, in the form of encroachment-alteration effects, would not occur. Noise associated with the construction of the proposed 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. No extended disruption of normal activities is 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 would be made available to local officials to ensure, to the maximum extent possible, future developments are planned, designed and programmed in a manner that would avoid traffic noise impacts. On the date of approval of this document (Date of Public Knowledge), TxDOT is no longer responsible for providing noise abatement for new development adjacent to the proposed project.

Appendix A

Utility Relocation Cost Estimate

183 North Mobility Project: Estimated Cost of Noise Walls

BY: MSC
Date: 5/11/2015

TCAD Parcel
Property ID 836716
Owner: Balcones Country Club
Appraised Value: $ 3,993,974.00
Land: 278.27 ac
12,121,440.40 sf
Market Land Value: $ 2,226,160.00
$ 0.18 per sf

Wall at R5 (Balcones Country Club)

		Quantity	Unit Price	Cost
Soundwall (sf)	286' long 11' tall	3,146	$ 18.00	$ 56,628.00
Utility Relocation				
OHE (lf)	1	286	$ 82.50	$ 23,595.00
OHC (lf)	1	286	$ 45.00	$ 12,870.00
			Subtotal	**$ 93,093.00**
*20-ft Easement (sf)		5,720	$ 0.22	$ 1,260.61
			Total Estimated Cost for Wall	**$ 94,353.61**

Balcones:
Overhead electric = 1 primary (three conductors, 1 neutral)
Overhead cable = 1 (telecom, time warner, etc.)

Wall at R21-24 (Allandale Neighborhood) - MIP Sound Wall #2

		Quantity	Unit Price	Cost
Soundwall (sf)	3060' long 18' tall	55,080	$ 18.00	$ 991,440.00
Utility Relocation				
OHE (lf)	2	6,120	$ 82.50	$ 504,900.00
OHC (lf)	3	9,180	$ 45.00	$ 413,100.00
			Subtotal	**$ 1,909,440.00**
City of Austin ROW		183,600		$ -
			Total Estimated Cost for Wall	**$ 2,322,540.00**

Great Northern:
Overhead electric = 2 primary (three conductors, 1 neutral)
Overhead cable = 3 (telecom, time warner, etc.)

TCAD Parcel
Property ID 167325
Owner: 4105 Limited Partnership L.P.
Appraised Value: $ 1,472,114.00
Land: 1.64 ac
71,599.00 sf
Market Land Value: $ 429,594.00
$ 6.00 per sf

Wall at R10 (Austin Bible Chapel)

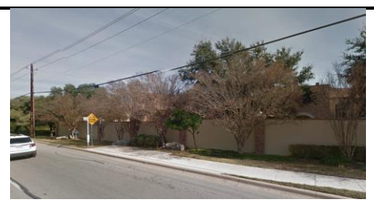
		Quantity	Unit Price	Cost
Soundwall (sf)	110' long 9' tall	990	$ 18.00	$ 17,820.00
Utility Relocation				
OHE (lf)	1	110	$ 82.50	$ 9,075.00
OHC (lf)	2	220	$ 45.00	$ 9,900.00
			Subtotal	**$ 36,795.00**
*20-ft Easement (sf)		4,400	$ 7.20	$ 31,680.00
			Total Estimated Cost for Wall	**$ 68,475.00**

Church/Office Park:
Overhead electric = 1 primary (three conductors, 1 neutral)
Overhead cable = 2 (telecom, time warnter, etc.)
Actual owner of overhead cable not known.

TCAD Parcel
Property ID 263428
Owner: Westdale Wind River Crossing
Appraised Value: $ 23,783,817.00
Land: 13.13 ac
571,942.80 sf
Market Land Value: $ 5,719,420.00
$ 10.00 per sf

Wall at R11 (Wind River Crossing Apartments)

		Quantity	Unit Price	Cost
Soundwall (sf)	1222' long 16' tall	19,552	$ 18.00	$ 351,936.00
Utility Relocation				
OHE (lf)	1	1,222	$ 82.50	$ 100,815.00
OHC (lf)	1	1,222	$ 45.00	$ 54,990.00
			Subtotal	**$ 507,741.00**
*20-ft Easement (sf)		24,440	$ 12.00	$ 293,279.59
			Total Estimated Cost for Wall	**$ 801,020.59**



Apartments:
Overhead electric = 1 primary (three conductors, 1 neutral)
Overhead cable = 1 (telecom, time warnter, etc.)
Actual owner of overhead cable not known.

TCAD Parcel
Property ID 133195
Owner: Belkorp Holdings
Appraised Value: $ 21,323,174.00
Land: 8.78 ac
382,456.80 sf
Market Land Value: $ 2,294,742.00
$ 6.00 per sf

Wall at R27 (Somerset Townhomes)

		Quantity	Unit Price	Cost
Soundwall (sf)	547' long 19' tall	10,393	$ 18.00	$ 187,074.00
Utility Relocation				
OHE (lf)	1	547	$ 82.50	$ 45,127.50
OHC (lf)	5	2,735	$ 45.00	$ 123,075.00
			Subtotal	**$ 355,276.50**
*20-ft Easement (sf)		54,700	$ 7.20	$ 393,840.21
			Total Estimated Cost for Wall	**$ 749,116.71**

Apartments MIP:
Overhead electric = 1 primary (three conductors, 1 neutral)
Overhead cable = 5 (telecom, time warnter, etc.)
Actual owner of overhead cable not known.

Notes:
OHE overhead electric
OHC overhead cable, telecom, etc.
*Assumed value for land only per TCAD. Cost may be higher or lower depending on actual appraisal.
Utility Cost per LF includes pole and any secondary service.

Appendix B

FHWA/FTA Combined Noise Methodology

FHWA/FTA Combined Noise Methodology

1) Conducted 24-hour counts of freight operations along Great Northern Boulevard in the area of MIP Sound Wall #2 and the portions of MIP Sound Wall #3 that will not be built as part of MIP. Data was collected between 7 am on April 30, 2015 and 7 am on May 1, 2015. Data that was collected included:
    - Train type (freight vs. passenger)
    - # of locomotives per event
    - # of rail cars per event
    - Train speed
    - Duration of idling locomotives
    - Blown horns
2) Train data was separated by daytime events (7 am to 10 pm) and nighttime events (10 pm to 7 am). Input data into FTA spreadsheet to determine Incremental Ldn for receivers.
3) Modeled receivers in TNM with highway noise only. Compared rail only noise (from FTA spreadsheet) to highway only noise (from TNM) and determined that rail was the dominant noise source in the neighborhood.
4) Modeled one of the railroad tracks as a terrain line and one of the tracks as a roadway with user-defined traffic. Input parameters for the user-defined vehicle was based on a similar style vehicle (heavy truck). Input the remaining user-defined parameters and toggled the # of vehicles and speed until the resulting noise level was equal to the rail only noise obtained from the FTA spreadsheet.
5) Ran TNM noise models (existing, proposed, and barrier analysis) to come up with noise levels and proposed abatement taking into account combined highway and rail noise.