Noise Analysis Technical Report

183A Toll Road Phase III, Austin District and Central Texas Regional Mobility Authority

From Hero Way to 1.1 miles north of State Highway 29

CSJ Number: 0914-05-192
Williamson County, Texas
March 2019

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried out by the Texas Department of Transportation (TxDOT) pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated December 16, 2014, and executed by the Federal Highway Administration and TxDOT.

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Acronyms

CFR	Code of Federal Regulations
CTRMA	Central Texas Regional Mobility Authority
EOS	Edge of shoulder
FHWA	Federal Highway Administration
NAC	Noise Abatement Criteria
RCNM	Roadway Construction Noise Model
TNM®	Traffic Noise Model
TxDOT	Texas Department of Transportation

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I. Project Description, Land Use Description and Noise Study Methods

A. Project Description

The Central Texas Regional Mobility Authority (CTRMA) and Texas Department of Transportation (TxDOT) propose the extension of the 183A Toll main lanes from Hero Way to State Highway (SH) 29 in Williamson County, Texas. The proposed 183A Phase III project begins on existing 183A at Hero Way and extends northward onto existing US 183 to approximately 1.1 miles north of SH 29 within the existing and proposed right-of-way of 183A and US 183 **(Exhibit 1: Project Location Map)**.

The proposed action (Build Alternative) would extend the six-lane, controlled-access, grade-separated 183A tolled main lanes from their current terminus approximately 0.4 mile north of Hero Way to approximately 0.4 mile north of SH 29. The 183A tolled main lanes would be located in the median between the existing 183A frontage roads and between the existing northbound and southbound US 183 four-lane divided roadway. The existing US 183 four-lane divided roadway within the proposed project limits would serve as frontage roads north to SH 29, and transition back to the existing, undivided US 183 approximately 1.1 miles north of SH 29. This transition would allow the 183A tolled main lanes to merge with the proposed non-tolled, four-lane, divided frontage roads and, eventually, with the existing four-lane, non-divided US 183 at the project's northern terminus.

The proposed 183A main lanes would include three 12-foot-wide lanes in each direction, with 10-foot-wide paved shoulders and a 38-foot wide grassy median. The main travel lanes would be tolled as an extension of the existing 183A tollway currently in place south of Hero Way. As previously noted, the existing US 183 facility would serve as frontage roads and, along with the existing 183A frontage roads between Hero Way and US 183, would remain in use as a non-tolled facility. The transition from the 183A main lanes to existing US 183 north of SH 29 would comprise two 12-foot-wide lanes, divided, in each direction, with 10-foot-wide outside shoulders and 4-foot-wide inside shoulders. The 183A main lanes would be depressed under SH 29 and elevated over intersections with:

- Seward Junction (planned facility);
- Whitewing Drive/Larkspur Park Drive;
- South Gabriel Drive/Green Valley Drive (South Fork San Gabriel River bridge);
- US 183/Bryson Ridge Trail; and
- San Gabriel Parkway.

The existing main lanes are already elevated over Hero Way. The proposed divided US 183 section north of SH 29 would have an at-grade intersection at County Road (CR) 213/258 with turnarounds in each direction. Main lane design speed is 70 mph and ramp design speed is 50 mph. The No Build Alternative would not meet project purpose and need.

The design schematic of the proposed improvements was prepared by the CTRMA. Because the project includes the addition of through-traffic lanes and substantial

alterations to vertical alignment, the project is considered a Type I project. TxDOT's *Guidelines for the Analysis and Abatement of Highway Traffic Noise* (2011) establishes the requirements for traffic noise analysis for all Type I projects whether they are federally funded or state-only funded. Type I projects are defined as a project for the construction of a highway at a new location or the physical alteration of an existing highway that significantly changes either the horizontal or vertical alignment or increases the number of through traffic lanes.

B. Sound/Noise Fundamentals

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 "dBA."

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" (see **Table 1**).

C. Surrounding Terrain and Land Use

The proposed project is a former rural area within Williamson County, Texas, that has some residential and commercial development. The existing terrain is nearly level to gently sloping. Land use adjacent to the project primarily consists of single-family residential, commercial and transportation uses. The posted, existing speed limit on US 183 is 60 mph. The design speed for the proposed project is 70 mph. Several areas adjacent to and in and around the area of the 183A Phase III project are under development with most new land use similar to existing land use and several new single-family residential neighborhoods. The project is consistent with local planning efforts. Refer to **Exhibit 2: Aerial Map**, for the aerial photography of the project area.

D. Methods

Federal Highway Administration's (FHWA)'s Traffic Noise Model (TNM®) Version 2.5 computer model (FHWA, 2004) was used to predict Leq(h) traffic noise levels. TNM® was used to predict noise levels at discrete, but representative points by considering interactions between different noise sources and the effects of topographical features on the propagation of noise. The model predicts the traffic noise level at a receiver location resulting from a series of straight-line roadway segments. Noise emissions from free-flowing traffic depend on the number of automobiles, medium trucks, heavy trucks, motorcycles and buses per hour; vehicular speed; and reference noise emission levels of specified vehicles. TNM® considers the effects of intervening barriers, topography, trees, and atmospheric absorption of sound.

By intent and design, noise from sources other than traffic is not included. Therefore, when non-traffic noise such as aircraft noise is considerable in an area, the TNM® modeled results can be slightly less than the measured noise levels.

Table 1. Common Sound/Noise Levels

Common Sound/Noise Levels		
Outdoor	**dB(A)**	**Indoor**
Air horn	110	Rock/Blues Band
Jet Flyover at 1000 feet		Baby Crying
Leaf Blower	100	Subway
Gas Weed Eater		Fire Alarms
Riding Lawn Mower	90	Blender
Gas Edger		Crowded Restaurant
Police Whistle	80	Disposal at 3 feet
Air Conditioner Compressor		Shouting at 3 feet
	70	
		Normal Conversation at 3 feet
Normal Conversation at 3 feet	60	Clothes Dryer at 3 feet
Babbling Brook		Large Business Office
Quiet Urban (daytime)	50	Refrigerator
Quiet Urban (nighttime)	40	Quiet Office/Library
Wilderness	30	
	20	Recording Studio
	10	Threshold of Hearing

Source: TxDOT, 2014

Base maps were exported as DXF files and imported into the TNM® package. In addition, ArcGIS was used to develop the TNM® model. Major roadways, topographical features, building rows and sensitive receptors were digitized into the model.

Per TxDOT policy, predicted traffic levels for at least 15 to 20 years in the future are to be used in noise studies (TxDOT *Guidelines for Analysis and Abatement of Highway Traffic Noise*, 2011). For this study the existing year used is 2016 and the future year used is 2042. The traffic noise analysis used projected PM peak traffic volumes and posted speeds for the existing conditions (year 2016), and for the future year (2042) Build alternative. The vehicle mix was determined using data developed for the Phase III project by WSP. For this analysis, the vehicle mix used during the PM peak was 98.1% automobiles, 1.3% medium trucks and 0.6% heavy trucks. The traffic data (volumes and speeds) were applied to the existing and proposed roadways (see **Appendix A** for traffic volumes).

Seventy-five modeling sites (representing 176 residences) were included in the TNM® model for potential noise impacts. The locations of all 75 receptors can be seen in **Exhibit 3**.

Predicted noise levels were compared with the FHWA noise abatement criteria (NAC), as shown in **Table 2**, and the number of affected receptors was counted for the Build Alternative. Mitigation measures were evaluated for engineering feasibility and reasonableness using TxDOT criteria (TxDOT *Guidelines for Analysis and Abatement of Highway Traffic Noise*, 2011) for receptors where noise levels were predicted to approach or exceed the NAC.

Construction noise was qualitatively assessed using FHWA reference levels. Suggested construction noise abatement measures are provided for inclusion in contractor documents.

This analysis conforms to Title 23, Code of Federal Regulations, Part 772 (23 CFR 772), "Procedures for Abatement of Highway Traffic Noise and Construction Noise," and TxDOT's 2011 *Guidelines for Analysis and Abatement of Highway Traffic Noise*.

Table 2. FHWA Noise Abatement Criteria

Activity Category	Leq(h) dB(A)	Evaluation Locations	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	—	—	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

E. Noise Regulation and Impact Criteria

Applicable noise regulations and guidelines provide a basis for evaluating potential noise impacts. FHWA Regulation 23 CFR 772 states that a noise impact occurs when the predicted traffic noise levels for a project approach or exceed the NAC for land use activity categories, shown in **Table 2**, or substantially exceed existing noise levels (US Department of Transportation, FHWA, 1982). TxDOT policy considers a future increase relative to existing noise levels of more than 10 dBA to be a substantial increase. TxDOT policy also considers a noise impact to occur if modeled Leq(h) noise levels are one dBA less than the noise abatement criterion.

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 one 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 level is 54 dB(A) and the predicted level is 65 dB(A).

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 TNM® Version 2.5 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.

II. Existing Noise Levels

The modeled noise levels for the existing conditions along the current roadways range from 51 to 69 dBA Leq as shown in **Table 3** and the modeling locations are shown in **Exhibit 3**. The modeled noise levels at these receptors are dependent upon the proximity of the receptor to the existing roadways, the amount of physical shielding provided by buildings, topography, and the presence of non-traffic-related noise. **Table 3** also shows that seven of the receptors evaluated exceeded FHWA/TxDOT noise abatement criteria limits.

III. Traffic Noise Impacts

The Build Alternative (Year 2042) noise levels along the proposed project would be dependent upon distance of the receivers from the new tolled main lanes and other roadways as well as shielding conditions present.

Build Alternative noise levels are predicted to be -2 to 12 dB(A) higher than existing conditions. The dB(A) decreases are due partly to the fact that some traffic using the

existing US 183 lanes under existing conditions would use the new 183A tolled main lanes under the Build Alternative and would therefore be farther away from the receiver. The modeled noise levels for the Build conditions along the project roadways range from 57 to 73 dB(A) Leq as shown in **Table 3**.

The Build Alternative is predicted to approach or exceed the NAC of 67 dBA at 36 modeling sites (MS1, MS6, M6, M17 to M21, M17A, M18A, M28, M29, M30A, M30B, M31, M31A, M31B, M31D and P1 thru P18). One site, MS1, has an increase of 12 dB(A), which would make it an impact under the "substantially exceeds" criterion, as well. These 36 sites represent 24 homes and 19 outdoor recreation areas (a future park, which is equivalent to 58 residential lots, and a church playground) that are predicted to experience future traffic noise impacts as a result of the Build Alternative. The increase is due to the increase in roadway traffic lanes and traffic volumes.

Table 3. Modeled Traffic Noise Levels

Site ID	Receiver Represented	NAC Category*	NAC Level	Existing (2016) dBA Leq(h)	Build Alternative (2041) Leq(h)	Change (+/-)	Build Alternative Impact (Yes/No)
MS1 (residence)	1	B	67	54	**66**	**12^**	Yes
MS2 (parkland)	1***	C	67	65	**N/A*** **	-	-
MS3 (undeveloped)	N/A**	G	-	63	66	3	No
MS4 (undeveloped)	N/A**	G	-	64	68	4	No
MS5 (retail center)	13	E	72	68	70	2	No
MS6 (residence)	1	B	67	64	**69**	5	Yes
M1 (residence)	7	B	67	56	62	6	No
M2 (residence)	6	B	67	56	60	4	No
M3 (residence)	2	B	67	57	61	4	No
M4 (residence)	6	B	67	55	62	7	No
M5 (residence)	5	B	67	54	62	8	No
M6 (residence)	2	B	67	65	**67**	2	Yes
M7 (residence)	6	B	67	53	60	7	No
M8 (residence)	5	B	67	51	57	6	No
M9 (residence)	1	B	67	58	65	7	No
M10 (thrift shop)	1	F	-	68	71	3	No
M11 (residence)	1	B	67	60	65	5	No
M12 (residence)	4	B	67	51	58	7	No
M13 (residence)	7	B	67	53	60	7	No
M14 (residence)	9	B	67	58	64	6	No
M15 (residence)	10	B	67	54	61	7	No
M16 (undeveloped)	N/A**	G	-	65	68	3	No
M17 (residence)	1	B	67	63	**68**	5	Yes
M17A (residence)	1	B	67	58	**67**	9	Yes

Site ID	Receiver Represented	NAC Category*	NAC Level	Existing (2016) dBA Leq(h)	Build Alternative (2041) Leq(h)	Change (+/-)	Build Alternative Impact (Yes/No)
M18 (residence)	2	B	67	65	**73**	8	Yes
M18A (residence)	1	B	67	58	**67**	9	Yes
M19 (residence)	2	B	67	59	**67**	8	Yes
M19A (residence)	2	B	67	58	65	7	No
M20 (residence)	3	B	67	**66**	**70**	4	Yes
M20A (residence)	2	B	67	58	65	7	No
M21 (residence)	3	B	67	**66**	**70**	4	Yes
M21A (residence)	2	B	67	59	65	6	No
M21B (residence)	1	B	67	58	65	7	No
M21C (residence)	1	B	67	59	65	6	No
M22 (residence)	1	B	67	58	63	5	No
M23 (residence)	1	B	67	60	65	5	No
M24 (residence)	1	B	67	59	61	2	No
M25 (residence)	1	B	67	59	61	2	No
M26 (undeveloped)	N/A**	G	-	64	65	1	No
M27 (emergency center)	1	C	67	60	64	4	No
M28 (church playground)	1	C	67	**69**	**67**	-2	Yes
M29 (residence)	1	B	67	65	**67**	2	Yes
M30 (residence)	1	B	67	59	65	6	No
M30A (residence)	1	B	67	64	**69**	5	Yes
M30B (residence)	1	B	67	62	**67**	5	Yes
M30C (residence)	1	B	67	60	65	5	No
M30D (residence)	1	B	67	58	64	6	No
M30E (residence)	1	B	67	56	64	8	No
M30F (residence)	1	B	67	58	65	7	No

Site ID	Receiver Represented	NAC Category*	NAC Level	Existing (2016) dBA Leq(h)	Build Alternative (2041) Leq(h)	Change (+/-)	Build Alternative Impact (Yes/No)
M30G (residence)	1	B	67	57	64	7	No
M30H (residence)	1	B	67	58	65	7	No
M31 (residence)	1	B	67	64	**68**	4	Yes
M31A (residence)	1	B	67	61	**68**	7	Yes
M31B (residence)	1	B	67	59	**66**	7	Yes
M31C (residence)	1	B	67	57	64	7	No
M31D (residence)	1	B	67	62	**68**	6	Yes
M31E (residence)	1	B	67	59	65	6	No
M31F (residence)	1	B	67	57	64	7	No
M32 (residence)	1	B	67	53	57	4	No
M33 (residence)	1	B	67	55	61	6	No
M34 (residence)	1	B	67	53	60	7	No
P1 (parkland)	4	C	67	65	**69**	4	Yes
P2 (parkland)	3	C	67	**66**	**72**	6	Yes
P3 (parkland)	3	C	67	**66**	**72**	6	Yes
P4 (parkland)	3	C	67	**66**	**71**	5	Yes
P5 (parkland)	3	C	67	65	**71**	6	Yes
P6 (parkland)	3	C	67	**66**	**71**	5	Yes
P7 (parkland)	3	C	67	65	**71**	6	Yes
P8 (parkland)	4	C	67	65	**71**	6	Yes
P9 (parkland)	4	C	67	65	**71**	6	Yes
P10 (parkland)	3	C	67	60	**67**	7	Yes
P11 (parkland)	3	C	67	60	**67**	7	Yes
P12 (parkland)	3	C	67	61	**68**	7	Yes
P13 (parkland)	3	C	67	61	**68**	7	Yes

Site ID	Receiver Represented	NAC Category*	NAC Level	Existing (2016) dBA Leq(h)	Build Alternative (2041) Leq(h)	Change (+/-)	Build Alternative Impact (Yes/No)
P14 (parkland)	3	C	67	61	**68**	7	Yes
P15 (parkland)	3	C	67	61	**68**	7	Yes
P16 (parkland)	3	C	67	61	**69**	8	Yes
P17 (parkland)	3	C	67	61	**69**	8	Yes
P18 (parkland)	4	C	67	61	**69**	8	Yes

*Note **bold** indicates noise level above or approaching the NAC.
^Substantial Increase (>10 dBA)
**Site used for verification purposes only.
***Planned park area represented by Sites P1 through P18.

IV. Mitigation of Traffic Noise Impacts

Because predicted traffic noise levels under the Build Alternative are expected to exceed FHWA/TxDOT noise criteria limits at 36 sites, representing 24 homes and 19 outdoor recreation areas (a future park, which is equivalent to 58 residential lots, and a church playground), noise abatement must be considered for the Build Alternative. The following noise abatement measures were considered: traffic management, alteration of horizontal and/or vertical alignments, and acquisition of undeveloped property to act as a buffer zone and the construction of noise barriers.

Before any abatement measure can be proposed or incorporated into the project, it must be both feasible and reasonable. In order to be feasible, the abatement measure must reduce the noise level at an impacted receiver by at least five dBA, and to be reasonable it must not exceed the cost-effectiveness criterion of $25,000 for each benefited receiver. A receiver is counted as benefited if/when the abatement measure will reduce the noise level at the receiver by at least five dBA for more than 50% of the noise receivers in the first row of impacted receptors. The reasonable noise reduction goal is -7 dB at one or more of the first-row noise receivers.

Traffic management: control devices could be used to reduce the speed of the traffic; however, the minor benefit of one dBA 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 practicable.

For highway projects that involve the addition of a through-traffic lane, the three previous abatement measures normally will not provide a substantial noise reduction and/or will not be reasonable due to excessive costs.

Noise barriers: this is the most commonly used noise abatement measure. Noise barriers were considered as abatement for the 36 sites with noise levels predicted to approach or exceed the FHWA/TxDOT noise criteria limits. Before a noise barrier can be proposed the following considerations must be addressed:

- Noise barriers must be of sufficient length and height to effectively reduce noise levels. The FHWA approved, TNM 2.5 model, should be used to determine the optimum overall dimensions.
- Noise barriers located along the edge of roadway shoulders are normally not effective for receivers on hillsides overlooking the highway or for receivers at heights above the top of a noise barrier. However, if the project right-of-way were along the hillside at a height comparable to the roadway, a noise barrier would be effective in blocking the line of sight.
- It is normally not cost-effective to build a noise barrier for a single receiver.

- A noise barrier of sufficient height to break the line of sight from the receiver to the highway will normally result in a noise level reduction of 5 dBA.
- Large gaps for driveways and alleys entering onto a roadway greatly reduce the effectiveness of a barrier. However, small gaps and drainage holes (less than three percent of the total surface area) will not reduce the overall effectiveness.
- Access streets should not be closed to eliminate large gaps in a noise barrier and enhance the effectiveness of a noise barrier unless requested and approved by local government officials. Associated responsibilities should be clearly spelled out in a written agreement prior to the final environmental clearance.
- Earth berms, though natural in appearance, require large areas (right-of-way) to reach the height required to be effective.
- Noise barriers should not be proposed in locations that would cause any displacements.

The noise barriers analyzed for each of the 36 sites are listed below and shown in **Exhibit 4**:

Build Alternative, Site M28 – This receiver represents 1 affected outdoor play area of the New Life Church located along the east side of US 183.

A barrier (NB-1) was evaluated up to 20 feet in height along the proposed southbound edge-of-shoulder (EOS). Based on preliminary calculations, a barrier with a total length of 333 feet, NB-1, would achieve the minimum feasible reduction of 5 dB(A) but not the noise reduction design goal of 7 dB(A).

Build Alternative, Site M6 and M29 – These receivers represent 3 single-family residences south of Mourning Dove Lane along the west side of southbound US 183/proposed 183A.

A barrier (NB-2) was evaluated up to 20 feet in height along the proposed southbound 183A Toll main lanes EOS. Based on preliminary calculations, a barrier with a total length of 804 feet, NB-2, was evaluated on the southbound side EOS. The barrier would not be feasible since it would not provide 5 dBA of noise reduction.

An additional barrier location was modeled along the EOS US 183 general purpose lanes; however, it would not be feasible because it would block access to the property.

Build Alternative, Sites M30A, M30B, M31, M31A, M31B and M31D – These receivers represent 6 affected single-family residences located in the residential subdivision south of Trellis Boulevard along the east side of northbound US 183/proposed 183A.

For the 6 total affected residences, based on preliminary calculations, a barrier with a total length of 1,780 feet, NB-3, was evaluated on the northbound 183A Toll main lanes EOS up to 20 feet in height. A 14-foot-high barrier would achieve the minimum feasible reduction of 5 dB(A) and the noise reduction design goal of 7 dB(A). With the 14-foot-high barrier, an additional 7 non-impacted receptors would meet the 5 dB(A) reduction goal. The total cost would be $448,560, or $34,504 per benefitted receiver, which would not fall within the reasonable criteria. The barrier would be feasible but not reasonable since the cost would be greater than $25,000 per benefitted receiver (see **Table 4**).

An additional barrier location was modeled along the EOS of the US 183 northbound general purpose lanes. Based on preliminary calculations, a barrier with a total length of 650 feet, NB-3, was evaluated on the northbound side general purpose lanes EOS. The barrier would achieve the minimum feasible reduction of 5 dB(A) but not the noise reduction design goal of 7 dB(A).

Build Alternative, Sites MS6, M17, M17A, M18, M18A, M19, M20 and M21 – These receivers represent 14 affected single-family residences located in the residential subdivision south of the South Fork San Gabriel River along the west side of southbound US 183/proposed 183A.

For the 14 total affected residences, based on preliminary calculations, a combination of two noise barriers, NB-4A and NB-4B, was evaluated on the 183A Toll main lane southbound EOS and the EOS of the main lane off-ramp to the US 183 general purpose lanes up to 20 feet in height. The 4,587-foot long and 16-foot-high noise barrier would reduce noise levels by 5 to 10 dBA for a total of 21 benefited receivers (14 impacted residences and 7 additional benefitted residences). The total cost of the noise barrier would be $1,321,056, or $62,907 for each benefited receiver. The barrier would not be reasonable since the cost is greater than $25,000 per benefitted receiver (see **Table 4**).

An additional barrier location was modeled along the EOS of the US 183 southbound general purpose lanes. Based on preliminary calculations, a barrier with a total length of 3,968 feet, NB-4A and NB-4B, was evaluated on the southbound side general purpose lanes EOS. The 3,968-foot long and 20-foot-high noise barrier would reduce noise levels by 5 to 8 dBA for a total of 11 benefited receivers (7 impacted residences and 4 additional benefitted residences). The total cost of the noise barrier would be $1,428,480, or $129,862 for each benefited receiver. The barrier would not be reasonable since the cost is greater than $25,000 per benefitted receiver (see **Table 4**).

Build Alternative, Site MS2 – This receiver represents 1 affected former residential property that has been purchased and designated by the City of Leander as part of a new park located north of the South Fork San Gabriel River along the east side of northbound US 183/proposed 183A. The future park is approximately 77 acres in size. The impacted area of the future park is approximately 14.6 acres, which is equivalent to 58 average residential lots (0.25 acre per residence).

For the 58 affected represented “residences,” based on preliminary calculations (P1-P18), a combination of two noise barriers, NB-5A and NB-5B, was evaluated on the 183A Toll main lane northbound EOS and the EOS of the main lane off-ramp to the US 183 general purpose lanes up to 20 feet in height. The 3,188-foot-long, 14-foot-high noise barrier would reduce noise levels by 5 to 8 dBA. The total cost of the noise barrier would be $803,376, or $13,851 for each benefited receiver. The barrier would be considered reasonable since the cost is less than $25,000 per benefitted receiver (see **Table 4**).

An additional barrier location was modeled along the EOS US 183 general purpose lanes; however, it would not be feasible because it would block access to the property.

Build Alternative, Site MS1 – This receiver represents 1 affected residence located north of San Gabriel Parkway along the east side of the northbound 183A frontage road.

A barrier (NB-6) was evaluated up to 20 feet in height along the proposed northbound edge-of-shoulder (EOS). Based on preliminary calculations, a 16-foot high barrier with a total length of 2,021 feet would achieve the minimum feasible reduction of 5 dB(A) and the noise reduction design goal of 7 dB(A). The total cost of the noise barrier would be $582,048, or $582,048 for each benefited receiver. The barrier would not be reasonable since the cost is greater than $25,000 per benefitted receiver (see **Table 4**).

Table 4. Build Alternative Noise Barrier Proposal (preliminary)

Barrier	Representative Receivers	Total # Benefited	Length	Height	Total Cost	$/Benefited Receiver
NB-3 (Main lane)*	M30A, M30B, M31, M31A, M31B and M31D	13	1,780	14	$448,560	$34,504
NB-4A* & NB-4B* (Main lane)	MS6, M17, M17A M18, M18A, M19, M20 & M21	21	4,587	16	$1,321,056	$62,907
NB-4A* & NB-4B* (Frontage)	MS6, M17, M17A M18, M18A, M19, M20 & M21	11	3,968	20	$1,428,480	$129,862
NB-5A & NB-5B (Main lane)	MS2 (P1-P18)	58	3,188	14	$803,376	$13,851
NB-6*	MS1	1	2,021	16	$582,048	$582,048

*Does not meet Reasonableness Criteria.

Any subsequent project design changes may require a reevaluation of this noise barrier proposal. The final decision to construct the proposed noise barrier would not be made until after the 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, that no new activities are planned or constructed along or within the following predicted 2042 noise impact contours (**Table 5**).

Table 5. Predicted 2042 Noise Impact Contour

Area	NAC Category B & C 66 dB(A) Impact Contour Distance	NAC Category E 71 dB(A) Impact Contour Distance
North of CR 213/258 - East Side	110-120 feet*	60-70 feet*
North of CR 213/258 - West Side	110-120 feet*	65-70 feet*
CR 213/258 to SH 29 - East Side	90-100 feet*	20-25 feet*
CR 213/258 to SH 29 - West Side	110-120 feet*	40-50 feet*
SH 29 to Mourning Dove Lane - East Side	190-200 feet*	70-80 feet*
SH 29 to Mourning Dove Lane - West Side	200-210 feet*	70-80 feet*
Mourning Dove Lane to Whitewing Drive - East Side	250-275 feet*	100-110 feet*
Mourning Dove Lane to Whitewing Drive - West Side	220-250 feet*	70-80 feet*

Area	NAC Category B & C 66 dB(A) Impact Contour Distance	NAC Category E 71 dB(A) Impact Contour Distance
Whitewing Drive to Bryson Ridge Trail - East Side	175-200 feet*	15-20 feet*
Whitewing Drive to Bryson Ridge Trail - West Side	420-430 feet*	50-75 feet*
Bryson Ridge Trail to South End- East Side	400-425 feet*	20-30 feet*
Bryson Ridge Trail to South End - West Side	60-70 feet*	15-20 feet*

*Dependent on vertical alignment of roadway to receiver and terrain of the area.

V. Construction Noise Analysis

If the Build Alternative were to be constructed, areas adjacent to the project would be exposed to construction noise. Although of a temporary nature, the additional noise can be annoying to the public.

Estimates of maximum noise levels at a distance of 50 feet for various pieces of construction equipment are provided in **Table 6**. While actual noise levels will vary due to particular equipment, phase of construction, and the influence of the person using the equipment, every effort should be made to minimize the adverse effects of construction noise whenever possible. A list of potential construction noise abatement methods is included at the end of this chapter.

Construction noise is typically regulated on a project-specific basis in the form of Standard Specifications or Special Provisions in the contractor's documents.

Table 6. Construction Equipment Noise Levels

Equipment Description	Impact Device	Acoustic Usage Factor (%)	Specified Limit L_{max} @ 50 feet (dBA, Slow)	Actual Measured L_{max} @ 50 feet (dBA, Slow)
All Other Equipment > 5 HP	No	50	85	N/A
Auger Drill Rig	No	20	85	84
Backhoe	No	40	80	78
Bar Bender	No	20	80	N/A
Blasting	Yes	N/A	94	N/A
Boring Jack Power Unit	No	50	80	83
Chain Saw	No	50	85	84
Clam Shovel (dropping)	Yes	20	93	87
Compactor (ground)	No	20	80	83
Compressor (air)	No	40	80	78
Concrete Batch Plant	No	15	83	N/A
Concrete Mixer Truck	No	40	85	79
Concrete Pump Truck	No	20	82	81
Concrete Saw	No	20	90	90
Crane	No	16	85	81
Dozer	No	40	85	82
Drill Rig Truck	No	20	84	79

Equipment Description	Impact Device	Acoustic Usage Factor (%)	Specified Limit L_{max} @ 50 feet (dBA, Slow)	Actual Measured L_{max} @ 50 feet (dBA, Slow)
Drum Mixer	No	50	80	80
Dump Truck	No	40	84	76
Excavator	No	40	85	81
Flat Bed Truck	No	40	84	74
Front End Loader	No	40	80	79
Generator	No	50	82	81
Generator (<25 KVA, VMS signs)	No	50	70	73
Gradall	No	40	85	83
Grader	No	40	85	83
Grapple (on backhoe)	No	40	85	87
Horizontal Boring Hydraulic Jack	No	25	80	82
Hydra Break Ram	Yes	10	90	N/A
Impact Pile Driver	Yes	20	95	101
Jackhammer	Yes	20	85	89
Man Lift	No	20	85	75
Mounted Impact Hammer (hoe ram)	Yes	20	90	90
Pavement Scarafier	No	20	85	90
Paver	No	50	85	77
Pickup Truck	No	40	55	75
Pneumatic Tools	No	50	85	85
Pumps	No	50	77	81
Refrigerator Unit	No	100	82	73
Rivet Buster/Chipping Gun	Yes	20	85	79
Rock Drill	No	20	85	81
Roller	No	20	85	80
Sand Blasting (Single Nozzle)	No	20	85	96
Scraper	No	40	85	84
Shears (on Backhoe)	No	40	85	96
Slurry Plant	No	100	78	78
Soil Mix Drill Rig	No	50	80	N/A
Tractor	No	40	84	N/A
Vacuum Excavator (Vac-truck)	No	40	85	85
Vacuum Street Sweeper	No	10	80	82
Ventilation Fan	No	100	85	79
Vibrating Hopper	No	50	85	79
Vibratory Concrete Mixer	No	20	80	80
Vibratory Pile Driver	No	20	95	101
Warning Horn	No	5	85	83
Welder/Torch	No	40	73	74

Source: USDOT, FHWA 2006

Several construction noise abatement methods can be implemented to limit the effect on the noise environment. Shown below is a list of standard noise control specifications that may be incorporated into construction contracts to mitigate the effects of construction noise:

- All equipment used shall have sound control devices no less effective than those provided on the original equipment. No equipment shall have unmuffled exhaust.
- All equipment shall comply with the pertinent equipment noise standards found in the FHWA Roadway Construction Noise Model (RCNM) as shown in Table 6.
- No pile driving, hoe ramming, or blasting operations shall be performed within 2,000 feet of any occupied dwelling unit on Sundays, legal holidays or between the hours of 8:00 pm and 8:00 am on other days, without the approval of the Engineer.
- The noise from rock crushing or screening operations within 2,000 feet of any occupied dwelling shall be mitigated by strategic placement of material stockpiles between the operation and the affected dwelling or by other means approved by the Engineer.

Should specific noise complaints occur during the construction of the project, one or more of the following noise abatement measures may be required at the Contractor's expense, as directed by the Engineer:

- Locate stationary construction equipment as far from the nearby noise sensitive properties as possible.
- Shut off idling equipment.
- Use alternative methods or equipment that produces less noise.
- Reschedule construction operations to avoid periods of noise annoyance identified in the complaint.
- Notify nearby residences whenever extremely noisy work will be occurring.
- Install temporary or portable acoustic barriers around stationary construction noise sources.
- Operate electric-powered equipment using line voltage power instead of on-site generators.
- Use manually-adjustable and/or the new broadband backup alarms set to the low noise setting on all construction vehicles used during nighttime hours.

VI. Local Officials' Statement

A copy of this traffic noise analysis will be provided to local officials to ensure, to the maximum extent possible, future developments are planned, designed and programmed in a manner that will avoid traffic noise impacts. On the date of approval of this document (Date of Public Knowledge), FHWA, TxDOT and CTRMA are no longer responsible for providing noise abatement for new development adjacent to the project.

VII. Exhibits

Project Location Map - **Exhibit 1**

183A Phase III - From Hero Way to 1.1 mi north of SH 29 , CSJ: 0914-05-192

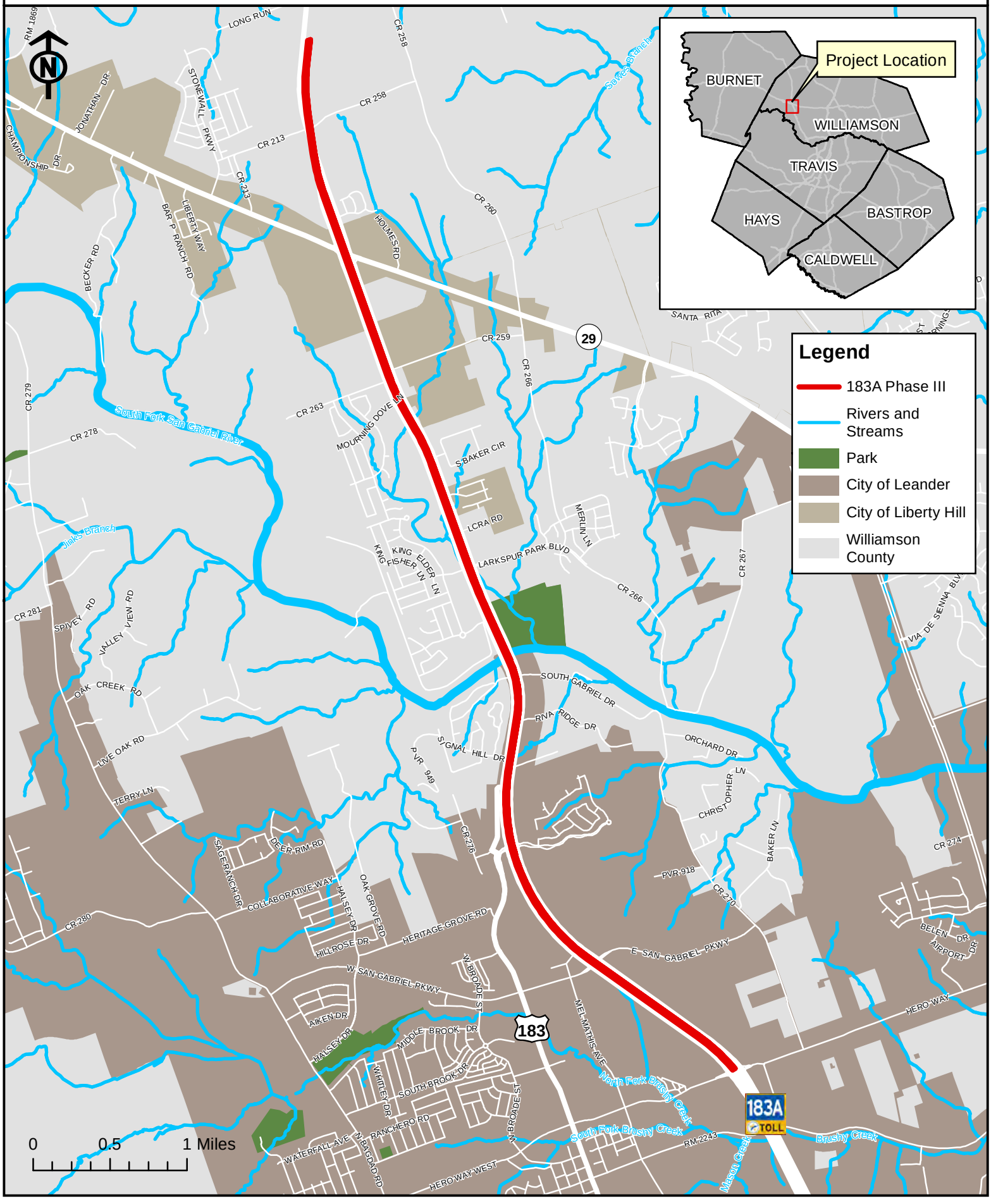


Exhibit 2 Aerial Map with Project Limits

Exhibit 3 Noise Modeling Locations

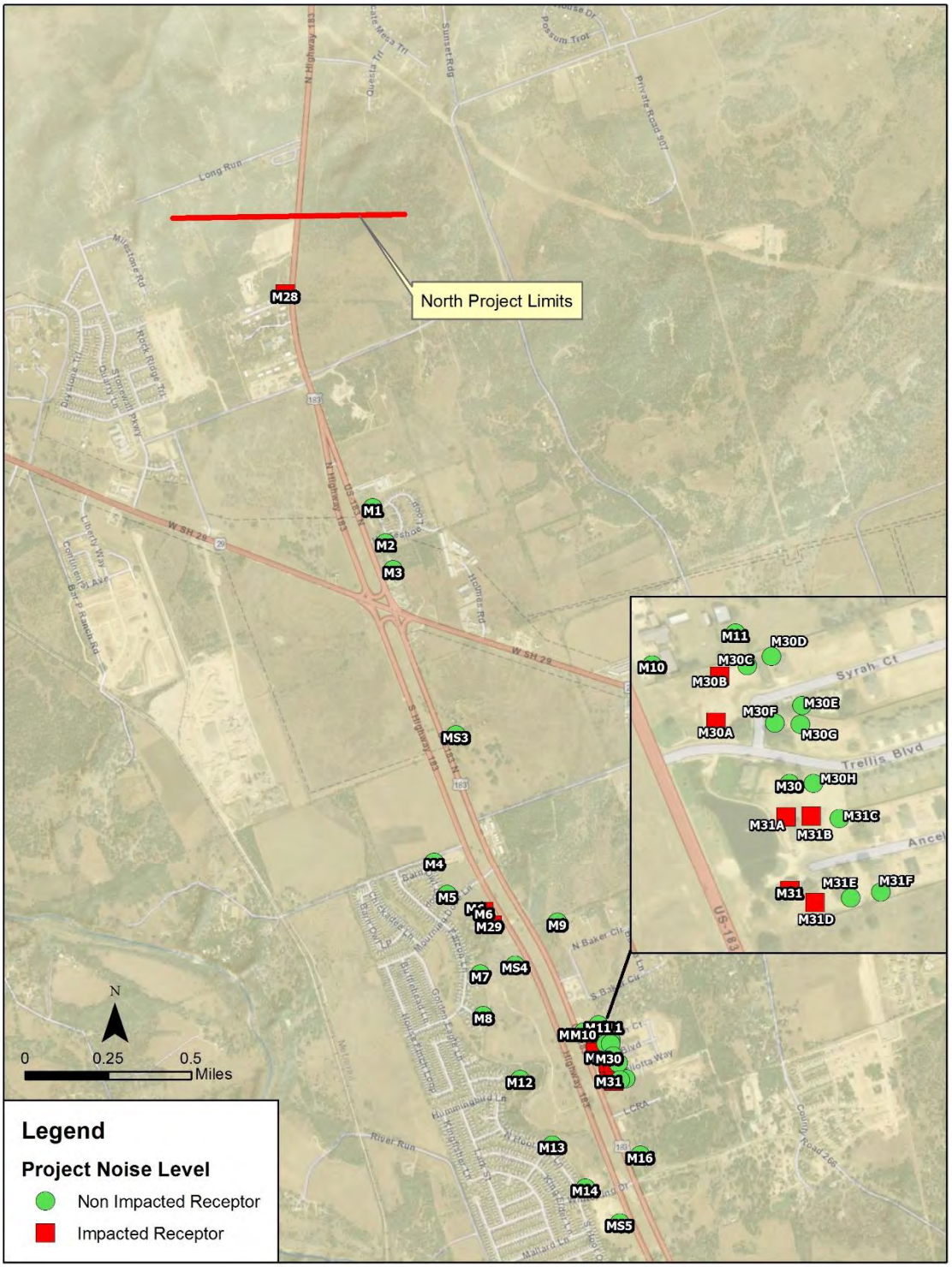


Exhibit 3 Noise Modeling Locations (Continued)

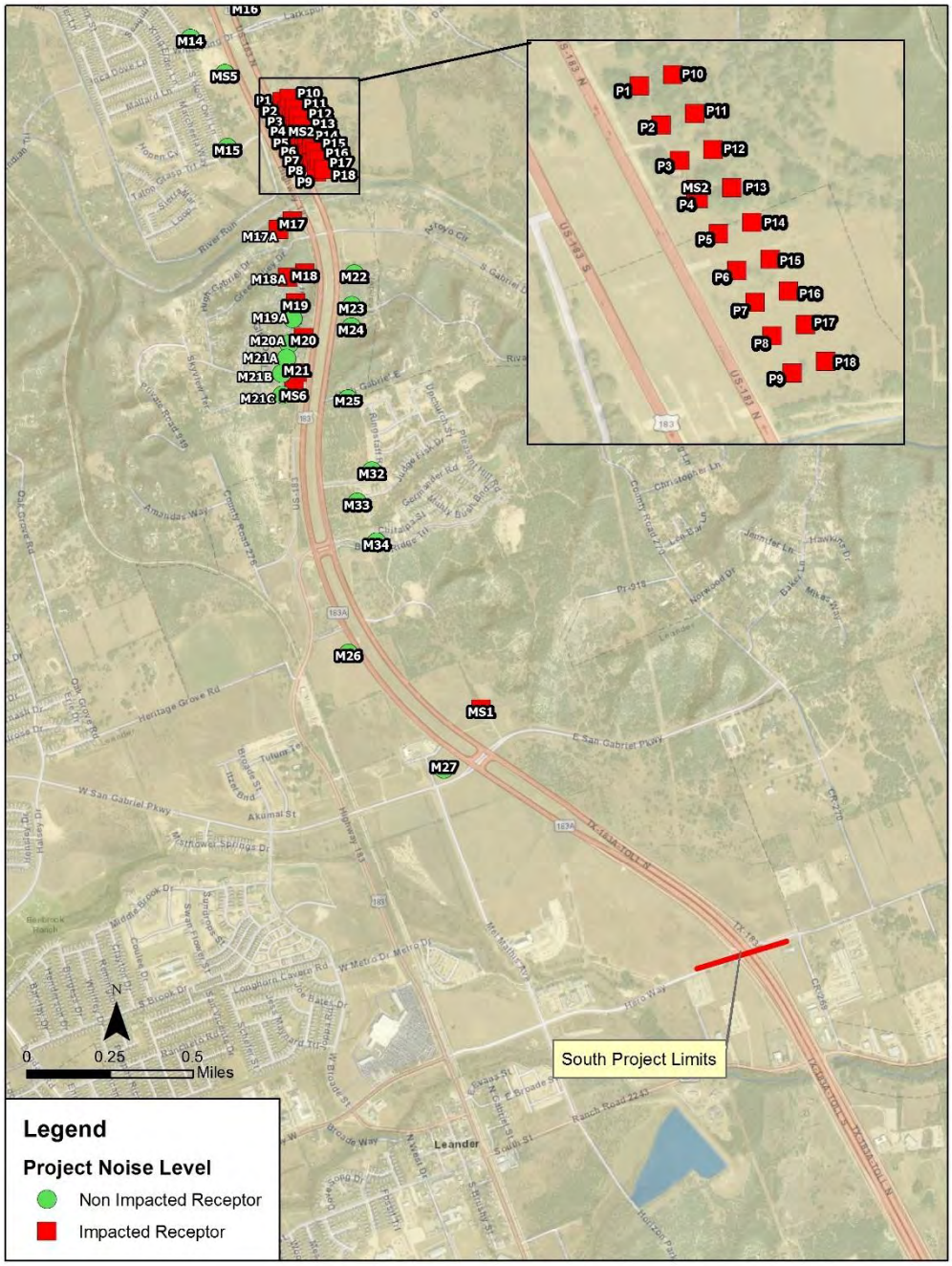


Exhibit 4 Evaluated Noise Barrier Locations

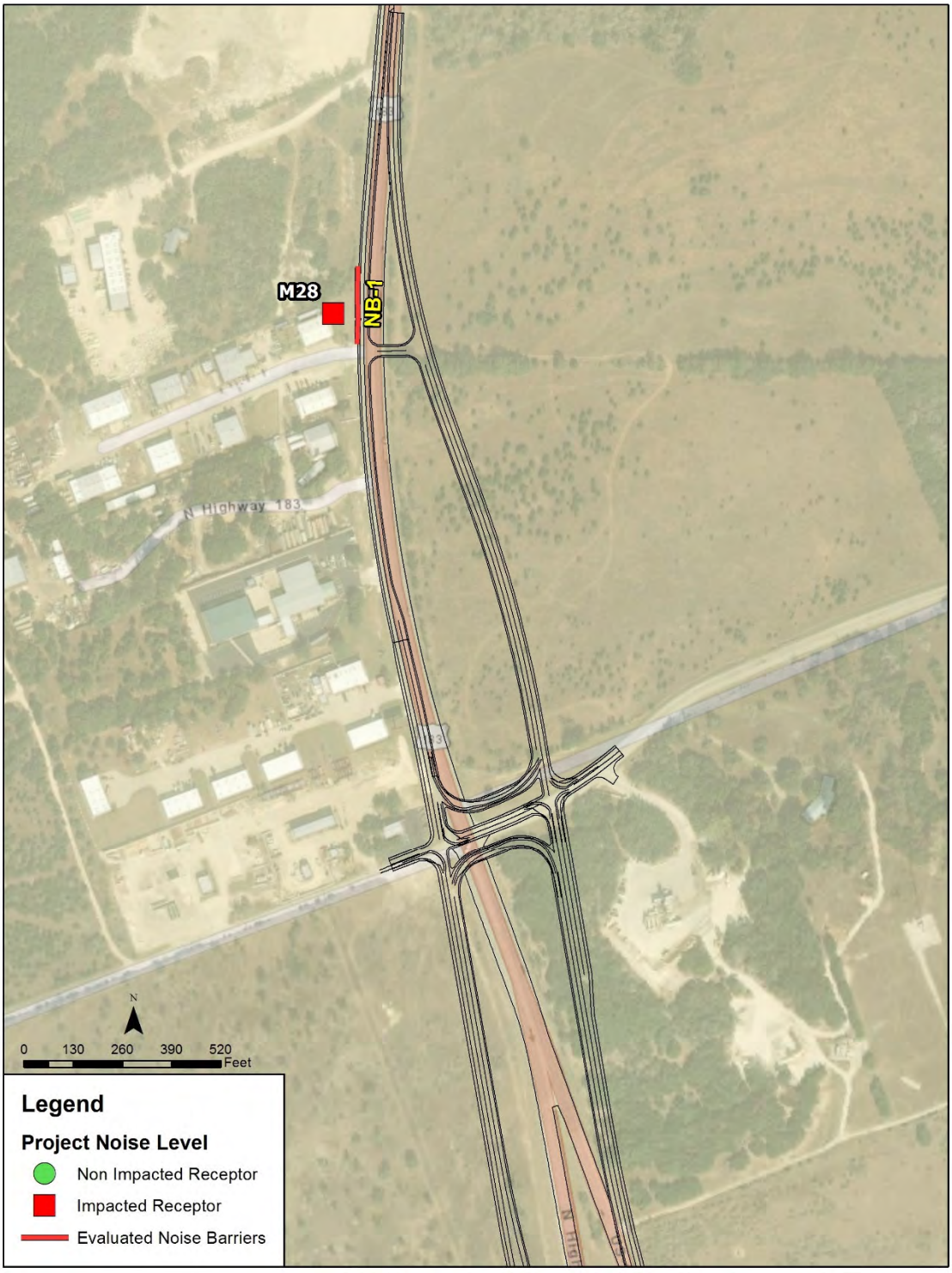


Exhibit 4 Evaluated Noise Barrier Locations (Continued)

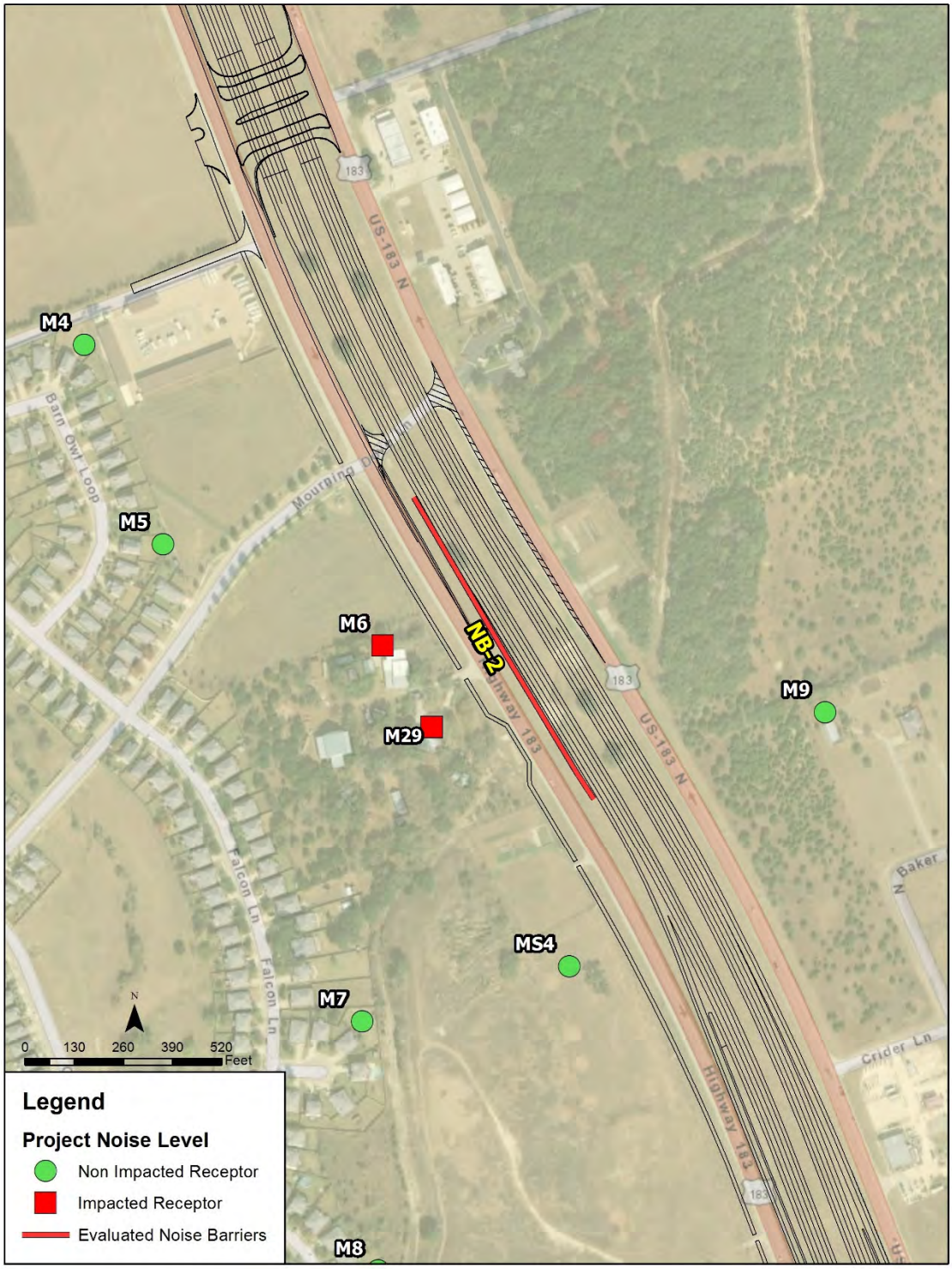


Exhibit 4 Evaluated Noise Barrier Locations (Continued)

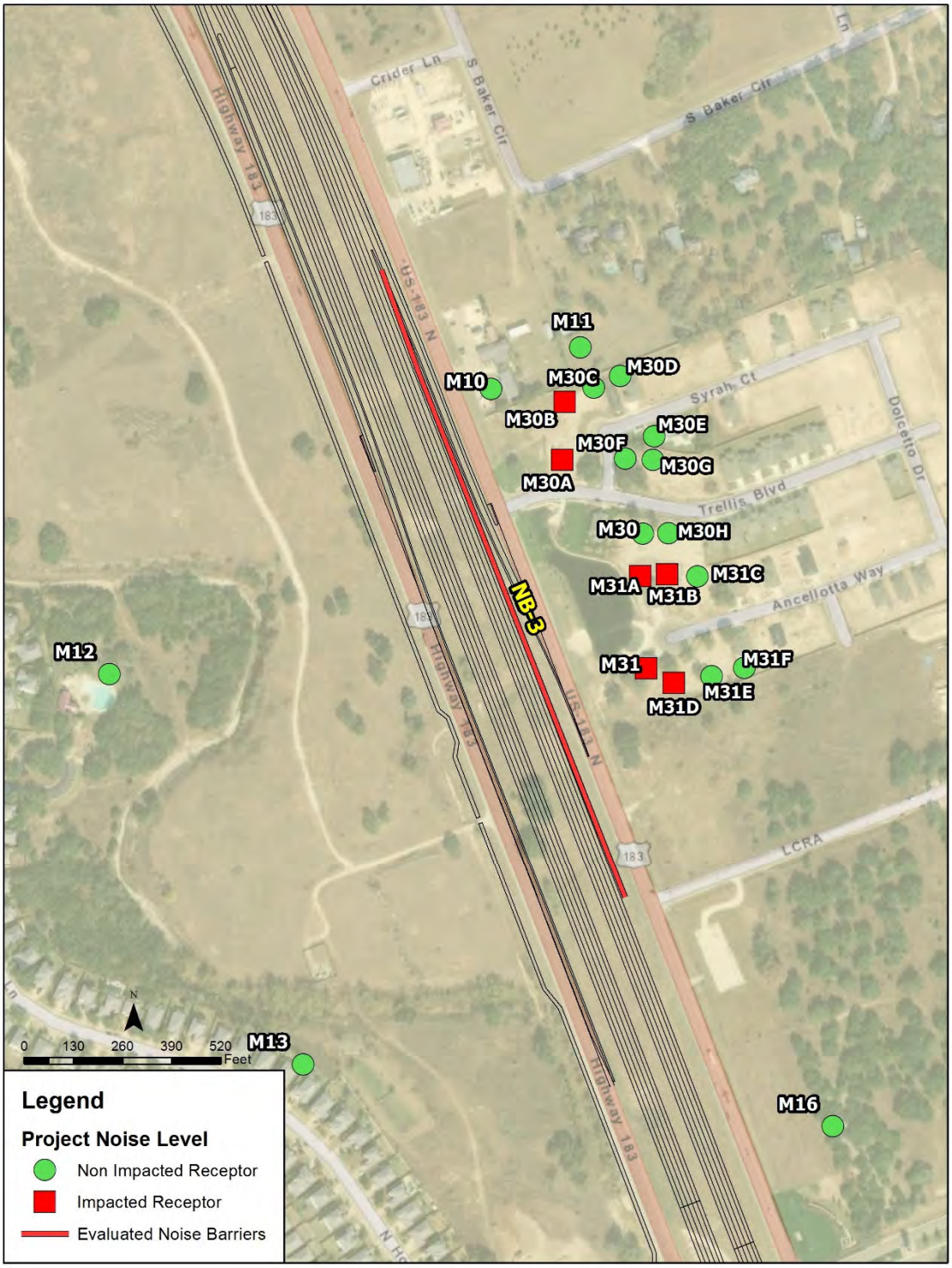


Exhibit 4 Evaluated Noise Barrier Locations (Continued)

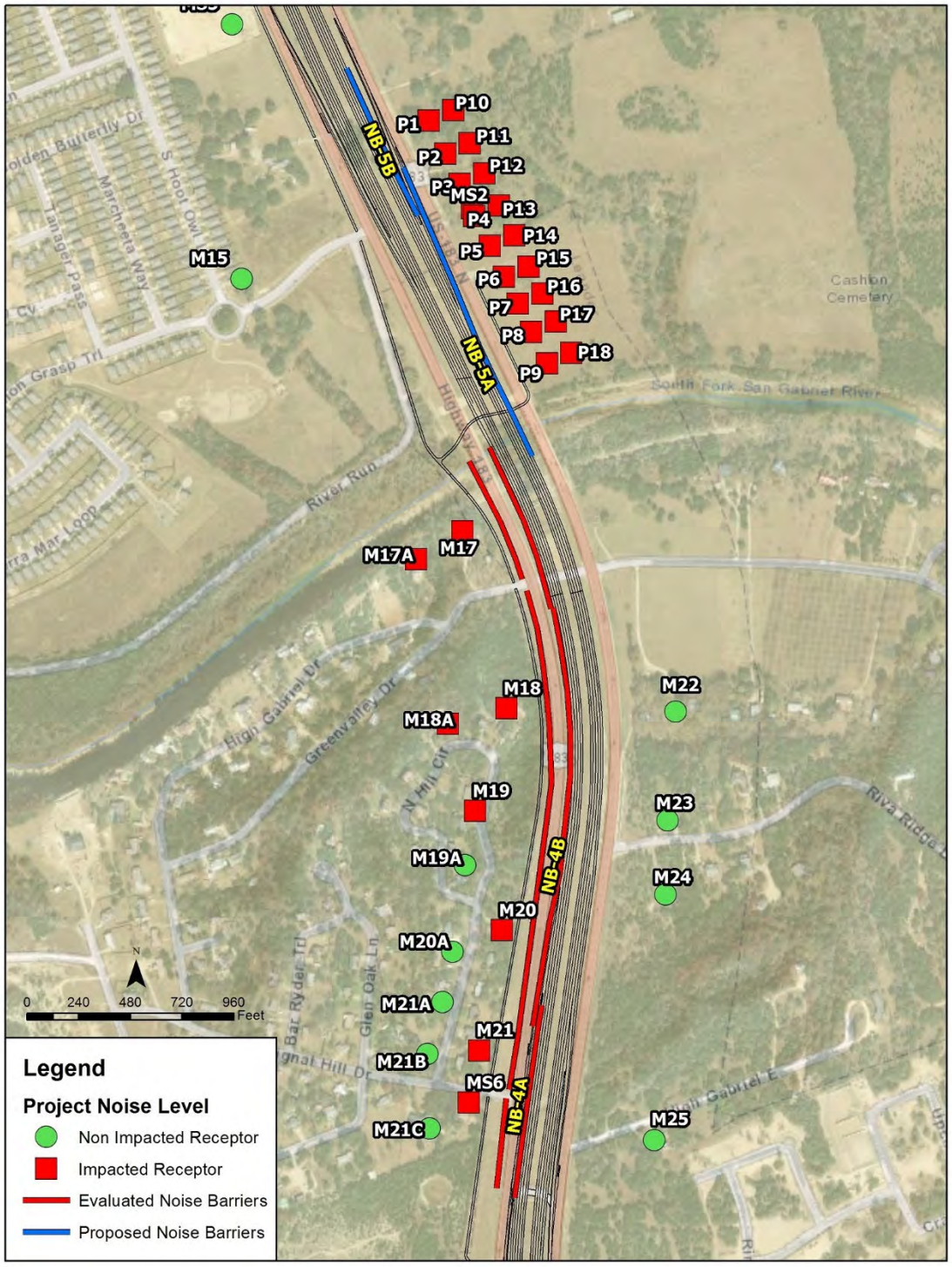
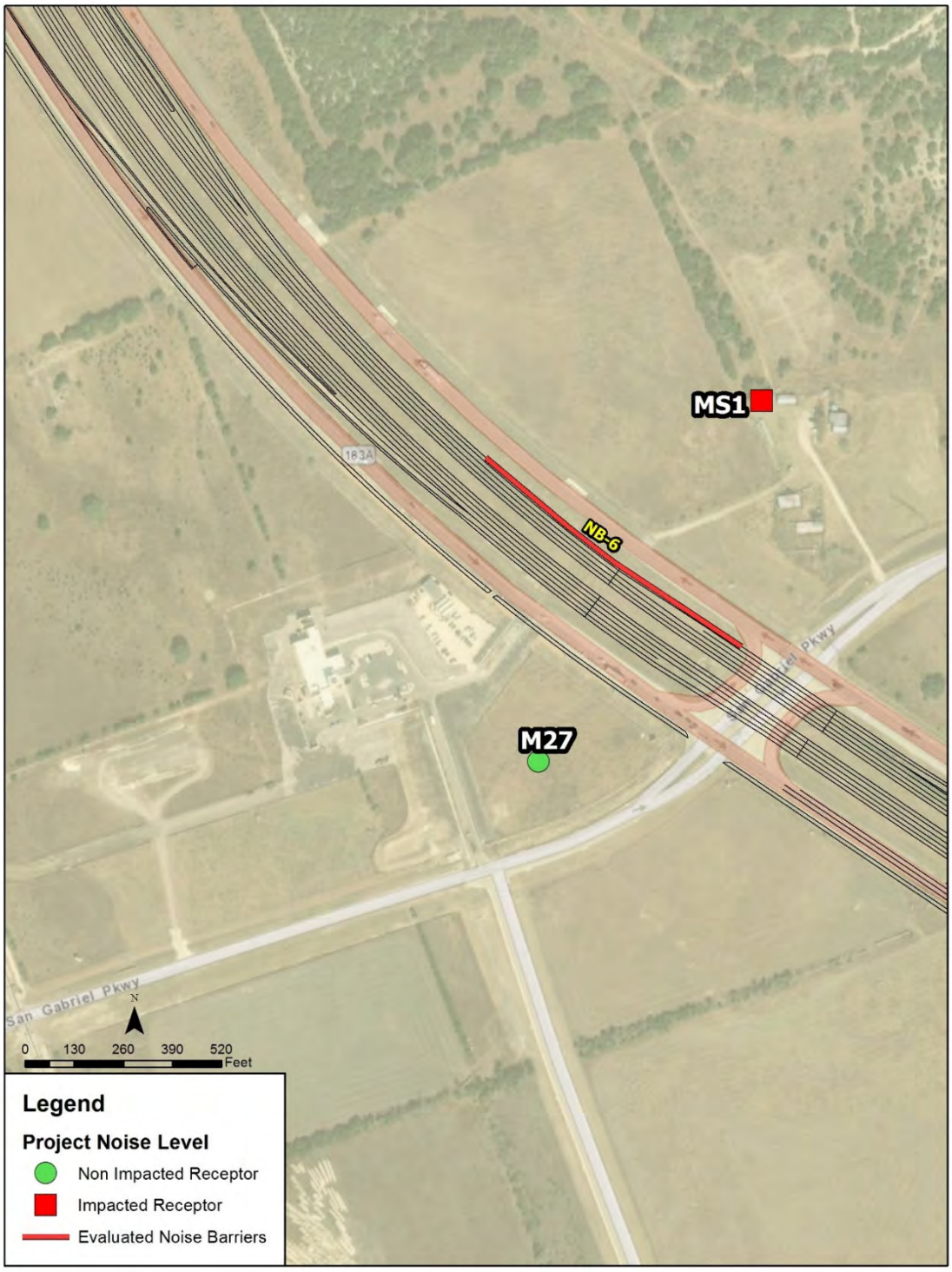


Exhibit 4 Evaluated Noise Barrier Locations (Continued)



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APPENDIX A

Existing and 2042 Peak Hour Volumes

Existing Peak Hour Volumes

Segment	SB US 183/183A (DHV)	NB US 183/183A (DHV)
North End to CR 213/258	840	760
CR 213/258 to SH 29	850	770
SH 29 to CR 263	1,716	1,672
CR 263 to Mourning Dove Lane	1,738	1,639
Mourning Dove Ln to Whitewing Dr	1,760	1,639
Whitewing Dr to Green Valley Dr	1,811	1,771
Green Valley Dr to US 183/Bryson	1,914	1,804
US 183 to San Gabriel Parkway	1,221	1,221
San Gabriel Parkway to Toll Ramp	1,463	1,419
Toll Ramp	1,110	1,056
Toll Ramp to Hero Way	352	363

2042 Build Peak Hour Volumes – Southbound 183A Toll Lanes

Segment	DHV
SB 183A Toll	2,552
SB 183A RSB1 On to RSB2 On	2,002
SB 183A Toll SB On Ramp 2 - RSB2	2,486
SB 183A Out RSB2 On to RSB3 Off	4,488
SB 183A Off Ramp 3_Frontage - RSB3	132
SB 183A Mid RSB3 to RSB4	4,356
SB 183A On Ramp 4 - RSB4	308
SB 183A Mid On RSB4 to Off RSB5	4,664
SB 183A SB Off Ramp - RSB5	2,002
SB 183A Out - Off RSB5 to On RSB6	2,662
SB 183A SB On Ramp - RSB6	429
SB 183A Out - On RSB6 to Off RSB7	3,091
SB Off Ramp RSB7	429
SB 183A Out - Off RSB7 to On RSB8	2,662
SB On Ramp RSB8	616

2042 Build Peak Hour Volumes – Southbound US 183 & 183A Frontage Roads

Segment	DHV
North End to CR 213/258	2,280
CR 213/258 to SH 29	500
SB Front-In SH 29 to Toll On Ramp - RSB2	2,706
SB Front-Out Toll On Ramp 2 to Seward Jct Lp	220
SB Front-In Seward Jct Lp to Mourning Dove	198
SB Front-Out Mourning Dove to Toll Off Ramp 3	330
SB Toll Off Ramp 3 to Whitewing Drive	462
Whitewing Drive to SB Toll On Ramp 4	770
SB Front-In On Ramp 4 to Green Valley Drive	462
Green Valley Drive to SB Toll Off Ramp 5	561
SB Toll Off Ramp 5 to US 183	2,563
US 183 to SB Toll On Ramp 6	902
SB Toll On Ramp 6 to San Gabriel Parkway	473
San Gabriel Parkway to SB Toll Off Ramp 7	1,144
SB Toll On Ramp 8 to Hero Way	957

2042 Build Peak Hour Volumes – Northbound 183A Toll Lanes

Segment	DHV
NB Off Ramp to San Gabriel Pkwy-RNB8	319
NB 183A Toll-Hero Way to On Ramp 7	3,102
NB On Ramp RNB7	484
NB 183A Toll RNB7 to RNB6	3,278
NB Off Ramp RNB6	330
NB 183A Toll – Off Ramp 6 to On Ramp 5	2,937
NB 183A On Ramp 5 – RNB5	1,474
NB 183A Toll – On Ramp 5 to Off Ramp 4	4,411
NB 183A Off Ramp 4 – RNB4	605
NB 183A Toll – Off Ramp 4 to On Ramp 3	3,806
NB 183A On Ramp 3 From Frontage	132
NB 183A Toll – On Ramp 3 to Off Ramp 2	3,927
NB 183A Off Ramp 2	2,068
NB 183A Toll – Off Ramp 2 – RNB1 Merge	1,870
NB 183A RNB1 Merge to Frontage 2 lanes	1,870
NB 183A RNB1 Merge to Frontage 1 lane	1,870
Frontage 3 lanes	2,310

2042 Build Peak Hour Volumes – Northbound US 183 & 183A Frontage Roads

Segment	DHV
NB US 183 Outside to Off Ramp 8 – RNB8	1,001
NB Front Off Ramp 8 to On Ramp 7	1,320
NB Front – In Ramp 7 to San Gabriel Pkwy	836
NB Front – San Gabriel to Bryson Ridge Tr	297
NB Front – Bryson Ridge Tr On Ramp 5	627
NB Front – On Ramp 5 to Green Valley Dr	517
NB Front – Green Valley Dr to Off Ramp 4	407
NB Front – Off Ramp 4 to Whitewing Dr	1,012
NB Front – Whitewing Dr to On Ramp 3	682
NB Front – On Ramp 3 to Mourning Dove	550
NB Front – Mourning Dove to Seward Jct	550
NB Front – Seward Jct Loop to Off Ramp 2	638
NB Front – Off Ramp 2 to SH 29	2,706
NB Front – SH 29 to Merge	440
Merge North	2,310