APPENDIX H

Noise Study

TH 52 SB Improvement Project – Noise Study

Between Cannon Falls and Zumbrota, Minnesota

This study has been prepared for the Minnesota Department of Transportation

SP 2506-83
TKDA Project No.16421.010

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Executive Summary

This report documents the noise analysis conducted for the reconstruction of southbound TH 52 between Cannon Falls and Zumbrota and a new interchange on TH 52 at TH 57/CSAH 8 located in Hader, Minnesota within Goodhue County. This noise analysis was necessary due to the Federal Highway Administration (FHWA) Type I project requirements, which were triggered by the vertical changes to the roadway, as well as the addition of a proposed interchange.

This noise analysis accounted for the traffic on TH 52, CSAH 8, TH 57, TH 60 as well as the projected traffic volumes for the proposed interchange ramps. All noise modeling was performed consistent with Federal Highway Administration Agency Traffic Noise Model (TNM) 2.5 input requirements. The identified 354 noise receptors were within approximately 1,000-ft of the construction limits. Of them, 323 noise receptors were residential and 31 noise receptors were commercial. All 354 noise receptors are included in the discussion of noise impacts. Exhibit 1-37 in Appendix B depicts the project construction limits, locations where monitoring was conducted, barrier name and location, proposed barriers, and where the receptor points were located relative to the project.

Future (2041) Build Condition results in 98 out of 354 receptors approaching or exceeding FHWA Noise Abatement Criteria (NAC). Of those receptors, 89 also approach or exceed the NAC during the Existing (2021) condition. None of the Future (2041) Build receptors exceed existing noise levels by 5.0 dBA or more. Of the 98 receptors which approach or exceed FHWA NAC, all are residential.

Noise barrier mitigation feasibility was analyzed for 38 noise barriers mitigating noise levels at the 98 receptor locations that approach or exceed the NAC. Each of the 38 noise barriers were tailored to maximize noise mitigation. Where noise mitigation met NAC criteria for a 5 dBA noise-reduction feasibility requirement and at least one receptor met 7.0 dBA noise-reduction design goal, further analysis was performed to optimize the barrier and test for cost-effectiveness while maintaining noise-reduction feasibility and design goal.

Of all the noise barriers modeled, only three met both the 5.0 dBA noise-reduction feasibility requirement and 7.0 dBA noise-reduction design goal while also being cost-effective. These noise barriers, Barrier FF, Barrier LL and Barrier QQ, are therefore proposed for construction.

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1.0 Introduction

The purpose of this noise analysis is to evaluate and document the effect of the proposed SB TH 52 improvement and Hader Interchange Project on the surrounding noise levels. This traffic noise analysis was completed consistent with the guidance and requirements of the Minnesota Department of Transportation (MnDOT) Noise Requirements for MnDOT and other Type I Federal Aid projects as per 23 CFR 772, effective July 10, 2017.[1]

1.1 General Project Description

This project is located along TH 52 between Cannon Falls and Zumbrota, in Goodhue County, Minnesota (see Appendix B, Exhibit 1). The proposed project consists of reconstructing approximately 12 miles of the 2 lanes of southbound TH 52; resurfacing 3 miles of pavement for northbound TH 52 from 1.1 miles north of N Jct of TH 60 to 1.3 miles north of CSAH 7; and reconstructing 7 bridges: No. 4762, No. 9414, No. 9483, No. 9659, No. 9660, No. 9662, and No. 91048. It also includes a new bridge at the proposed interchange in Hader, Minnesota, at TH 52 and TH 57/CSAH 8, as well as other access management improvements such as median closures, driveway consolidation, and frontage road extensions. There are also profile adjustments at various locations on SB TH 52, as well as a profile raise at the TH 60 bridge over TH 52 (No. 9662) in Zumbrota, Minnesota. Due to these proposed changes, noise is analyzed collectively to determine the anticipated noise levels at the receptor locations in both the existing and future conditions.

1.2 Background Information on Noise

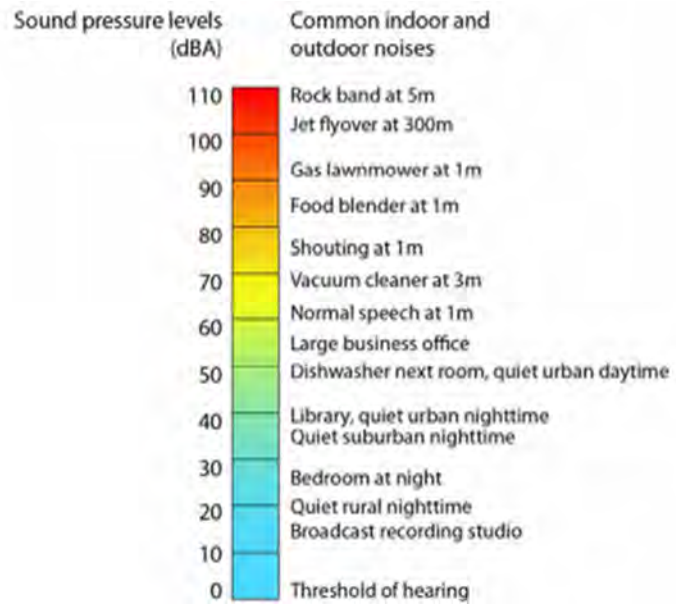
Noise is defined as any unwanted sound. Sound travels in a wave motion and produces a sound pressure level. This sound pressure level is commonly measured in decibels. Decibels (dB) represent the logarithm of the ratio of a sound energy relative to a reference sound energy. For highway traffic noise, an adjustment, or weighting, of the high- and low-pitched sound is made to approximate the way an average person hears sound. The adjusted sound levels are stated in units of “A-weighted decibels” (dBA). A sound increase of 3.0 dBA is barely noticeable by the human ear, a 5.0 dBA increase is clearly noticeable, and a 10.0 dBA increase is heard as twice as loud. For example, if the sound energy is doubled (i.e., the amount of traffic doubles), there is a 3.0 dBA increase in noise, which is just barely noticeable to most people. On the other hand, if traffic increases by a factor of 10 times, the resulting sound level will increase by about 10.0 dBA and will be heard to be twice as loud.

In Minnesota, traffic noise impacts are evaluated by measuring and/or modeling the average traffic noise levels during the hour that has the loudest traffic scenario. These numbers are identified as the L_{eq} levels.

Figure 1 provides a rough comparison of the noise levels of some common noise sources.

[1] The MnDOT Noise Requirements are available online on the MnDOT Office of Environmental Stewardship website at http://www.dot.state.mn.us/environment/noise/pdf/2017-noise-requirements.pdf.

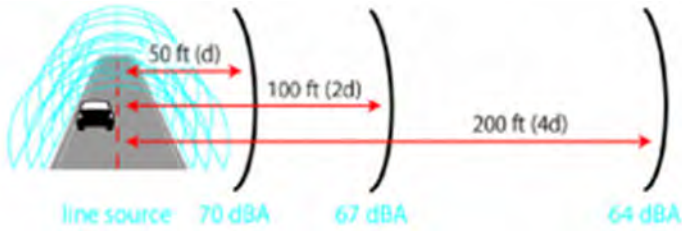
Figure 1 – Decibel Levels of Common Noise Sources



Source: "A Guide to Noise Control in Minnesota," Minnesota Pollution Control Agency, http://www.pca.state.mn.us/index.php/view-document.html?gid=5355

Along with the volume of traffic and other factors (e.g., topography of the area and vehicle speed) that contribute to the loudness of traffic noise, the distance of a receptor from a sound's source is also a key factor. The sound level will decrease as distance from a source increases. In general, it can be said that for a line source (roadway), beyond approximately the first 50 feet, each doubling of distance results in a decrease of 3 dBA over a hard site, and 4.5 dBA over a soft site.

Figure 2 – Line Source Noise Attenuation (over hard ground)



Source: "A Guide to Noise Control in Minnesota," Minnesota Pollution Control Agency
http://www.pca.state.mn.us/index.php/view-document.html?gid=5355

1.3 MnDOT Noise Requirements

The Federal Highway Administration (FHWA) traffic noise regulation is described in 23 Code of Federal Regulations (CFR), Part 772 (Procedures for Abatement of Highway Traffic Noise and Construction Noise). This regulation (23 CFR 772) requires the identification of highway traffic noise impacts and the evaluation of potential noise abatement measures, along with other considerations, in conjunction with the planning and design of a Federal Aid highway project. The MnDOT requirements for implementation of 23 CFR 772 are described in the *Noise Requirements for MnDOT and other Type I Federal Aid Projects* (effective July 10, 2017). In these requirements, if the project qualifies as a Type I project, then a noise analysis is required. Under the expanded definition in the 2017 MnDOT Noise Requirements, this project qualifies for the Type I designation on the basis of the substantial vertical alteration of SB TH 52, the TH 60 Bridge No.9662 over TH 52, and the construction of a new interchange near Hader.

The Minnesota state noise standards are located in Minnesota Rules Chapter 7030. The Minnesota Pollution Control Agency (MPCA) is the state agency responsible for enforcing state noise rules. In 2016, the Commissioners of the MPCA and MnDOT agreed that the traffic noise regulations and mitigation requirements from the FHWA are sufficient to determine reasonable mitigation measures for highway noise. By this agreement, existing and newly constructed segments of highway projects under MnDOT's jurisdiction are statutorily exempt from Minnesota State Noise Standard (MN Rule 7030) if the project applies the FHWA traffic noise requirements. As a result, any required noise analysis will follow FHWA criteria and regulations only, as has been completed for this project. This project is not required to address Minnesota Rule 7030.

Traffic noise impacts are determined based on FHWA Noise Abatement Criteria (NAC) land-use activities and predicted by worst hourly L_{eq} noise levels under future conditions. For residential land uses (Activity Category B), the noise abatement criteria is 67 dBA (L_{eq}). For hotels, offices, and restaurants (Activity Category E), the NAC is 72 dBA (L_{eq}). FHWA Noise Abatement Criteria (L_{eq}) are shown in **Table 1**.

Receptor locations where noise levels are "approaching" or exceeding the FHWA criterion level must be evaluated for noise abatement feasibility and reasonableness. In Minnesota, "approaching" is defined as 1 dBA or less below the FHWA Noise Abatement Criteria.

For example, 66 dBA (L_{eq}) is defined as "approaching" the FHWA Noise Abatement Criteria for residential land uses (Activity Category B).

A noise impact is also defined as a "substantial increase" in the future modeled noise levels over the existing modeled noise levels. A "substantial increase" is defined as an increase of 5 dBA or greater from existing to future conditions.

Table 1 – FHWA Noise Abatement Criteria

Activity Category	Activity Criteria (1) (2) L_{eq}(h) dBA	Evaluation Location	Activity Description
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(3)	67	Exterior	Residential.
C (3)	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 (3)	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.

(1) L_{eq} (h) shall be used for impact assessment
(2) L_{eq} (h) Activity Criteria values are for impact determination only & are not design standards for noise abatement
(3) Includes undeveloped lands permitted for this activity category

2.0 Analysis Methodology

2.1 Affected Environment

The environment for this analysis area is primarily residential plus a few commercial buildings. The area is rural with sparsely spaced receptors, except at Zumbrota, MN where the area is urban with densely spaced receptors. The predominant noise generator in this area is TH 52 and its access roads. TH 52 is located at a similar elevation compared to the surrounding land. The elevation of the proposed interchange at Hader will raise the TH 57/CSAH 8 profiles, potentially causing greater noise impacts to the surrounding environment. The elevation raise for proposed bridge No. 9662 could also cause noise impacts to the surrounding environment.

2.2 Noise Monitoring

2.2.1 Noise Level Monitoring Results

Ambient (existing) Noise level monitoring is performed during a noise study to document existing noise levels and calibrate valid TNM noise models. Three sites representing the area's land uses were monitored for ambient noise levels. The first two sites (M1 and M2) are located in Hader, Minnesota near the proposed interchange, one on the west side of TH 52, and the other on the east side. The third site (M3) is approximately 5.5 miles north of Hader, Minnesota just west of TH 52 on Maple Way. These monitoring locations represent both residential and commercial receptors.

During the field monitoring, each site was monitored for 20 minutes, two separate times. The first monitoring occurred during the morning, and the second occurred during the afternoon. A trained noise monitoring technician was present at each session for the entire monitoring period to ensure the correct operation of the noise meter. The L_{eq} monitoring-results range was from 58.6 dBA to 68.7 dBA.

During ambient noise monitoring at each site, a representative directional vehicle classification count of traffic was collected to aid in validating the model. Traffic volumes were collected on TH 52 and CSAH 8 for site M1; TH 52, TH 57, CSAH 8 and local streets for site M2; and TH 52 and Maple Way for site M3. In addition, distances to nearby landmarks were also recorded for each site to accurately identify exactly where the monitoring sites were located on document drawings and in the noise model. Noise monitoring locations and results are described in **Table 2** below (see also Appendix B, Exhibit 2-19).

The field monitoring for this project was conducted on Tuesday, July 16, and Wednesday, July 17, 2019. Of the six periods of data collection, five were collected on July 16, 2019. The afternoon measurements for site M3 was delayed to July 17 due to approaching rain at the site M3 monitoring location during the afternoon of July 16, 2019.

Table 2 – Field Measurement Summary Table

Receptor ID	Location Description	Measurement Time		Measured Level dBA	Model Results dBA	Difference dBA
		Start	End			
M1	East of TH 52, near Hader	11:50 AM	12:10 PM	68.7	67.8	-0.9
		1:52 PM	2:12 PM	66.5	67.7	1.2
M2	West of TH 52, Hader	10:57 AM	11:17 AM	61.9	62.3	0.4
		2:23 PM	2:43 PM	58.6	60.6	2
M3	Maple Way, West of TH 52	9:58 AM	10:18 AM	63.6	61.9	-1.7
		12:57 PM*	1:17 PM*	64.2	61.7	-2.5

*The PM data collection for Monitor Site 3 was completed on July 17th instead of July 16th due to approaching rain on the afternoon of July 16, 2019. All other data was collected on July 16th.

2.2.2 Noise Monitoring and Predicted Noise Levels

After completion of monitoring at the three field sites, the FHWA TNM 2.5 modeling was performed and compared to the existing noise levels. The model used existing-site geometry and hourly traffic projected from the 20-minute sample count collected during monitoring. The traffic speed modeled along both directions of TH 52 was the observed average driven pace speed of 65 mph. The traffic speeds of TH 57 and CSAH 8 were observed to be 55 mph with local streets at 30 mph. The traffic speeds of TH 60 were modeled at 60 mph west of the bridge and on the bridge, with speeds east of the bridge modeled at 30 mph per the posted speed limits. The ramps at the TH 60 Zumbrota interchange were modeled at 45 mph with segments of the off ramps approaching the intersection denoted as stop controlled to simulate the slowing down of vehicles. See Table 2 for results and comparisons to the monitored levels.

In general, a discrepancy equal to or less than 3.0 dBA between predicted levels and field measurements is considered acceptable for noise model validation. Note that the L_{eq} value at all sites used for validation satisfied this rule. Therefore, the model was considered validated.

2.3 Traffic Noise Modeling

All noise modeling was done using the noise prediction program FHWA TNM 2.5. This model uses traffic volumes, speed, class of vehicle, the characteristics of the roadway being analyzed (e.g., roadway horizontal and vertical alignment), and the features of the surrounding area (e.g., tree zones or hills) to predict future noise levels. This noise model assumes free-flow conditions along TH 52 which was confirmed during our monitoring session.

Traffic data input into the FHWA TNM 2.5 noise model for TH 52, TH 57, CSAH 8, TH 60 and local roads was developed using the following sources. TH 52 traffic volumes and directional distribution was obtained from Automatic Traffic Recording (ATR) Station No. 382, located north of the project on TH 52. TH 52 traffic classification was obtained from MnDOT 24-hour counts from ATR Station No. 382 (June, 2019). The TH 52 and on- and off-ramp traffic volumes for the proposed Hader interchange at TH 52/CSAH 8 were developed using manual counts from Traffic Data Inc. (2018). The TH 60 and on- and off-ramp traffic volumes for the existing interchange in Zumbrota were also developed using manual counts from Traffic Data Inc. (2018). The classification for the ramps was conservatively assumed to be the same as that of TH 52. Linear regression based on historical Annual Average Daily Traffic (AADT) volumes was used to forecast traffic volumes for future conditions.

2.4 Worst Hourly Noise Analysis

Generally, higher traffic volumes, vehicle speeds, and number of heavy trucks increase the loudness of highway traffic noise. The worst hourly traffic noise impact typically occurs when traffic is flowing more freely at, or near, LOS C (1,500 vehicles per lane, per hour for a highway)[2] and when heavy truck volumes are the greatest. This also implies that the road is operating on an unconstrained travel demand (i.e., volumes not limited to what can be handled by the road.) Based on the hourly volumes projected for 2021 and 2041, the road is operating at a higher level of service than LOS C.

By observation of the average directional volume for each day and month of the year, traffic from an average summer weekday contains the peak of all traffic. Several average summer weekday hours were examined with FHWA TNM 2.5 to determine which hour is the worst noise hour. The highest total volume hour, from 5:00 p.m. to 6:00 p.m., was examined, as

[2] US Department of Transportation. Federal Highway Administration. *Highway Traffic Noise: Analysis and Abatement Guidance*. December 2011 (Original June 2010 and Revised December 2010) available at http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/

well as several other hours with higher heavy vehicle percentages. Based on the results, an average summer weekday from 9:00am to 10:00am was used to define the worst noise hour.

In addition to the three monitoring sites (shown in **Table 3** below), the noise level was modeled at all receptor sites for each potential worst noise hour. The 9:00am to 10:00am hour was the worst noise hour for all receptors and had the highest truck percentage. The 5:00pm to 6:00pm hour was never the worst hour or tied for the worst hour despite being the highest overall volume hour. The other two hours modeled fell in between, but were also never the worst hour or tied for the worst hour. Thus, the analysis confirmed a worst-noise hour from 9:00am to 10:00am.

Table 3 – Worst Noise Hour Summary Table

Modeled Noise Level (dBA)			
HOUR	**M1**	**M2**	**M3**
8:00 AM – 9:00 AM	73.2	64.6	64.9
9:00 AM – 10:00 AM *	**73.8**	**65.7**	**66.0**
10:00 AM – 11:00 AM	72.9	64.7	65.0
5:00 PM – 6:00 PM	68.5	62.6	62.6
*Worst Noise Hour			

3.0 Predicted Noise Levels and Noise Impacts

3.1 Noise Receptors

Traffic noise impacts were assessed by modeling noise levels at receptor sites likely to be affected by the proposed project. 354 receptors were identified within approximately 1,000' of the project limits. 323 noise receptors were residential and 31 noise receptors were commercial. All 354 receptors are included in the discussion of noise impacts. The model receptor locations are illustrated in Appendix B, Exhibit 2-19. Land uses and noise levels (Existing, No-Build and Build scenarios) are listed with each modeled receptor location in **Table 4**.

3.2 Noise Modeling Results

Noise level results of the noise-modeling analysis for Existing (2021), Future No Build (2041) and the Future Build (2041) with No Mitigation conditions, are tabulated in **Table 4**. The results of the traffic-noise modeling analysis are summarized below.

Existing modeled (L_{eq}) noise levels at modeled receptor locations range from 49.6 dBA to 76.5 dBA. As a result, in the Existing (2021) condition, 89 receptors approach or exceed FHWA NAC.

In the Future No Build (2041) condition modeled (L_{eq}) noise levels are predicted to range from 50.4 dBA to 77.3 dBA. As a result, in the modeled (2041) No Build condition, 98 receptors approach or exceed FHWA NAC.

Finally, in the Future Build with No Mitigation (2041) condition, modeled (L_{eq}) noise levels are predicted to range from 50.4 dBA to 77.3 dBA. As a result, in the modeled (2041) Build with No Mitigation (2041) condition, 98 receptors approach or exceed FHWA NAC.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R1: Residence (R)(1)	**72.1**	**72.8**	0.7	**72.8**	0.7
R2: Residence (R)(1)	60.6	61.3	0.7	61.3	0.7
R3: Residence (R)(1)	62.5	63.3	0.8	63.3	0.8
R4: Residence (R)(1)	65.6	**66.4**	0.8	**66.4**	0.8
R5: Residence (R)(1)	**70.5**	**71.3**	0.8	**71.3**	0.8
R6: Residence (R)(1)	**72.9**	**73.6**	0.7	**73.6**	0.7
R7: Residence (R)(1)	57.6	58.3	0.7	58.3	0.7
R8: Residence (R)(1)	**68.0**	**68.7**	0.7	**68.7**	0.7
R9: Residence (R)(1)	64.4	65.2	0.8	65.2	0.8
R10: Residence (R)(1)	63.4	64.2	0.8	64.2	0.8
R11: Residence (R)(1)	**70.0**	**70.7**	0.7	**70.7**	0.7
R12: Residence (R)(1)	63.4	64.1	0.7	64.1	0.7
R13: Residence (R)(1)	61.3	62.0	0.7	62.0	0.7
R14: Residence (R)(1)	58.7	59.5	0.8	59.5	0.8
R15: Residence (R)(1)	56.3	57.0	0.7	57.0	0.7
R16: Residence (R)(1)	57.7	58.4	0.7	58.4	0.7
R17: Residence (R)(1)	65.0	65.8	0.8	65.8	0.8
R18: Residence (R)(1)	62.6	63.4	0.8	63.4	0.8
R19: Residence (R)(1)	64.5	65.2	0.7	65.2	0.7
R20: Residence (R)(1)	51.7	52.4	0.7	52.4	0.7
R21: Residence (R)(1)	**70.2**	**70.9**	0.7	**70.9**	0.7
R22: Residence (R)(1)	63.7	64.5	0.8	64.4	0.7
R23: Residence (R)(1)	57.2	58.0	0.8	58.0	0.8
R24: Residence (R)(1)	61.5	62.2	0.7	62.2	0.7
R25: Residence (R)(1)	59.4	60.1	0.7	60.1	0.7
R26: Residence (R)(1)	59.2	59.9	0.7	59.9	0.7
R27: Residence (R)(1)	58.8	59.5	0.7	60.2	1.4
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R28: Residence (R)(1)	63.2	63.9	0.7	64.1	0.9
R29: Residence (R)(1)	**66.3**	**67.1**	0.8	**67.3**	1.0
R30: Residence (R)(1)	**66.2**	**66.9**	0.7	**66.8**	0.6
R31: Residence (R)(1)	**72.9**	**73.6**	0.7	**73.6**	0.7
R32: Residence (R)(1)	**69.8**	**70.5**	0.7	**70.5**	0.7
R33: Residence (R)(1)	64.5	65.2	0.7	65.3	0.8
R34: Residence (R)(1)	**70.2**	**70.9**	0.7	**70.9**	0.7
R35: Residence (R)(1)	62.6	63.3	0.7	63.5	0.9
R36: Residence (R)(1)	64.7	65.4	0.7	65.5	0.8
R37: Residence (R)(1)	**72.4**	**73.2**	0.8	**73.2**	0.8
R38: Residence (R)(1)	**66.8**	**67.6**	0.8	**67.8**	1.0
R39: Residence (R)(1)	**70.7**	**71.4**	0.7	**71.4**	0.7
R40: Residence (R)(1)	**70.1**	**70.9**	0.8	**71.0**	0.9
R41: Residence (R)(1)	**67.3**	**68.1**	0.8	**67.8**	0.5
R42: Residence (R)(1)	**69.1**	**69.8**	0.7	**69.8**	0.7
R43: Residence (R)(1)	**68.9**	**69.7**	0.8	**69.7**	0.8
R44: Residence (R)(1)	**70.1**	**70.9**	0.8	**70.9**	0.8
R45: Residence (R)(1)	**68.2**	**68.9**	0.7	**68.9**	0.7
R46: Residence (R)(1)	**71.6**	**72.4**	0.8	**72.4**	0.8
R47: Residence (R)(1)	**69.8**	**70.6**	0.8	**70.6**	0.8
R48: Residence (R)(1)	63.8	64.6	0.8	64.6	0.8
R49: Residence (R)(1)	57.9	58.6	0.7	58.6	0.7
R50: Residence (R)(1)	**70.8**	**71.6**	0.8	**71.6**	0.8
R51: Residence (R)(1)	60.3	61.1	0.8	61.1	0.8
R52: Residence (R)(1)	58.6	59.3	0.7	59.3	0.7
R53: Residence (R)(1)	61.2	62.0	0.8	62.0	0.8
R54: Residence (R)(1)	56.6	57.4	0.8	57.4	0.8
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R55: Residence (R)(1)	**69.4**	**70.2**	0.8	**70.2**	0.8
R56: Residence (R)(1)	56.7	57.5	0.8	57.5	0.8
R57: Residence (R)(1)	**67.6**	**68.3**	0.7	**68.3**	0.7
R58: Residence (R)(1)	**66.9**	**67.7**	0.8	**67.7**	0.8
R59: Residence (R)(1)	58.5	59.2	0.7	59.2	0.7
R60: Residence (R)(1)	**72.0**	**72.8**	0.8	**72.8**	0.8
R61: Residence (R)(1)	**68.4**	**69.1**	0.7	**69.1**	0.7
R62: Residence (R)(1)	62.3	63.0	0.7	62.9	0.6
R63: Residence (R)(1)	64.6	65.4	0.8	65.4	0.8
R64: Residence (R)(1)	61.9	62.7	0.8	62.2	0.3
R65: Residence (R)(1)	58.6	59.4	0.8	59.5	0.9
R66: Residence (R)(1)	61.7	62.4	0.7	63.9	2.2
R67: Residence (R)(1)	62.1	62.8	0.7	62.5	0.4
R68: Residence (R)(1)	58.1	58.8	0.7	58.4	0.3
R69: Residence (R)(1)	57.0	57.8	0.8	57.0	0.0
R70: Residence (R)(1)	**71.0**	**71.7**	0.7	**71.7**	0.7
R71: Residence (R)(1)	**70.4**	**71.2**	0.8	**71.2**	0.8
R72: Residence (R)(1)	60.6	61.3	0.7	61.3	0.7
R73: Residence (R)(1)	61.3	62.1	0.8	62.1	0.8
R74: Residence (R)(1)	**70.7**	**71.4**	0.7	**71.4**	0.7
R75: Residence (R)(1)	**68.5**	**69.2**	0.7	**69.2**	0.7
R76: Residence (R)(1)	63.7	64.4	0.7	64.4	0.7
R77: Residence (R)(1)	**69.7**	**70.4**	0.7	**70.4**	0.7
R78: Residence (R)(1)	**68.2**	**68.9**	0.7	**69.0**	0.8
R79: Residence (R)(1)	64.1	64.8	0.7	64.8	0.7
R80: Residence (R)(1)	53.8	54.6	0.8	54.5	0.7
R81: Residence (R)(1)	60.0	60.7	0.7	60.8	0.8
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R82: Residence (R)(1)	61.5	62.2	0.7	62.2	0.7
R83: Residence (R)(1)	62.9	63.6	0.7	63.6	0.7
R84: Residence (R)(1)	**66.1**	**66.8**	0.7	**66.9**	0.8
R85: Residence (R)(1)	**72.0**	**72.8**	0.8	**72.7**	0.7
R86: Residence (R)(1)	59.8	60.6	0.8	60.6	0.8
R87: Avalon Express (C)(1)	65.7	66.4	0.7	66.4	0.7
R88: Professional Truck & Auto Accs (C)(1)	66.5	67.3	0.8	67.3	0.8
R89: Olson Group (C)(1)	63.2	63.9	0.7	63.9	0.7
R90: E Z Transmission Repair (C)(1)	62.2	62.9	0.7	62.9	0.7
R91: Dales Automotive (C)(1)	65.6	66.3	0.7	66.3	0.7
R92: Anderson Trucking Rock & Lime (C)(1)	62.0	62.7	0.7	62.7	0.7
R93: Johnson Logging (C)(1)	67.6	68.3	0.7	68.3	0.7
R94: Midwest Transmission Center (C)(1)	60.2	61.0	0.8	61.0	0.8
R95: Rochester Horror: FRIGHT at the FARM (C)(1)	67.8	68.5	0.7	68.5	0.7
R96: Residence (R)(1)	62.7	63.5	0.8	63.4	0.7
R97: Residence (R)(1)	60.3	61.1	0.8	61.1	0.8
R98: Residence (R)(1)	63.1	63.8	0.7	63.9	0.8
R99: Residence (R)(1)	62.7	63.5	0.8	63.4	0.7
R100: Residence (R)(1)	62.0	62.7	0.7	62.8	0.8
R101: Residence (R)(1)	61.5	62.3	0.8	62.2	0.7
R102: Residence (R)(1)	61.8	62.5	0.7	62.6	0.8
R103: Residence (R)(1)	**66.3**	**67.1**	0.8	**67.1**	0.8
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R104: Residence (R)(1)	62.4	63.1	0.7	63.2	0.8
R105: Residence (R)(1)	63.8	64.6	0.8	64.5	0.7
R106: Residence (R)(1)	**67.0**	**67.7**	0.7	**67.7**	0.7
R107: Residence (R)(1)	**70.1**	**70.8**	0.7	**70.8**	0.7
R108: Residence (R)(1)	**67.5**	**68.2**	0.7	**68.2**	0.7
R109: Residence (R)(1)	65.0	65.8	0.8	65.8	0.8
R110: Residence (R)(1)	63.0	63.7	0.7	63.7	0.7
R111: Residence (R)(1)	61.5	62.3	0.8	62.3	0.8
R112: Residence (R)(1)	60.2	60.9	0.7	61.0	0.8
R113: Residence (R)(1)	**68.2**	**69.0**	0.8	**68.9**	0.7
R114: Residence (R)(1)	65.6	**66.4**	0.8	**66.4**	0.8
R115: Residence (R)(1)	64.4	65.2	0.8	65.1	0.7
R116: Residence (R)(1)	62.8	63.5	0.7	63.5	0.7
R117: Residence (R)(1)	61.1	61.9	0.8	61.8	0.7
R118: Residence (R)(1)	59.8	60.5	0.7	60.5	0.7
R119: Residence (R)(1)	57.6	58.3	0.7	58.3	0.7
R120: Residence (R)(1)	**67.6**	**68.3**	0.7	**68.4**	0.8
R121: Residence (R)(1)	64.5	65.3	0.8	65.3	0.8
R122: Residence (R)(1)	62.4	63.1	0.7	63.1	0.7
R123: Residence (R)(1)	60.9	61.7	0.8	61.7	0.8
R124: Residence (R)(1)	60.1	60.9	0.8	60.8	0.7
R125: Residence (R)(1)	57.9	58.6	0.7	58.7	0.8
R126: Residence (R)(1)	57.9	58.6	0.7	58.7	0.8
R127: Residence (R)(1)	65.5	**66.3**	0.8	**66.2**	0.7
R128: Residence (R)(1)	64.5	65.3	0.8	65.3	0.8
R129: Residence (R)(1)	63.0	63.8	0.8	63.7	0.7
R130: Residence (R)(1)	60.8	61.6	0.8	61.5	0.7
R131: Residence (R)(1)	60.1	60.9	0.8	60.9	0.8
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R132: Residence (R)(1)	58.3	59.1	0.8	59.0	0.7
R133: Residence (R)(1)	58.4	59.2	0.8	59.1	0.7
R134: Residence (R)(1)	61.5	62.2	0.7	62.3	0.8
R135: Residence (R)(1)	60.3	61.1	0.8	61.1	0.8
R136: Residence (R)(1)	57.5	58.2	0.7	58.3	0.8
R137: Residence (R)(1)	57.1	57.9	0.8	57.9	0.8
R138: Residence (R)(1)	56.4	57.1	0.7	57.2	0.8
R139: Residence (R)(1)	56.2	56.9	0.7	57.0	0.8
R140: Residence (R)(1)	61.7	62.4	0.7	62.5	0.8
R141: Residence (R)(1)	60.2	60.9	0.7	60.9	0.7
R142: Residence (R)(1)	59.8	60.5	0.7	60.6	0.8
R143: Residence (R)(1)	60.8	61.5	0.7	61.6	0.8
R144: Residence (R)(1)	60.2	61.0	0.8	60.9	0.7
R145: Residence (R)(1)	57.5	58.2	0.7	58.2	0.7
R146: Residence (R)(1)	56.1	56.9	0.8	56.8	0.7
R147: Residence (R)(1)	62.8	63.6	0.8	63.5	0.7
R148: Residence (R)(1)	58.2	58.9	0.7	59.0	0.8
R149: Residence (R)(1)	**67.2**	**67.9**	0.7	**68.0**	0.8
R150: Residence (R)(1)	61.9	62.7	0.8	62.7	0.8
R151: Residence (R)(1)	58.9	59.6	0.7	59.7	0.8
R152: Residence (R)(1)	**67.2**	**68.0**	0.8	**67.9**	0.7
R153: Residence (R)(1)	65.0	65.8	0.8	65.7	0.7
R154: Residence (R)(1)	62.8	63.6	0.8	63.5	0.7
R155: Residence (R)(1)	61.3	62.1	0.8	62.0	0.7
R156: Residence (R)(1)	**67.0**	**67.8**	0.8	**67.8**	0.8
R157: Residence (R)(1)	63.1	63.9	0.8	63.8	0.7
R158: Residence (R)(1)	**68.8**	**69.5**	0.7	**69.5**	0.7
R159: Residence (R)(1)	**69.8**	**70.5**	0.7	**70.5**	0.7
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R160: Residence (R)(1)	**66.3**	**67.0**	0.7	**67.0**	0.7
R161: Residence (R)(1)	**70.8**	**71.6**	0.8	**71.5**	0.7
R162: Residence (R)(1)	65.9	**66.7**	0.8	**66.7**	0.8
R163: MnDOT Bldg. (C)(1)	67.0	67.8	0.8	67.7	0.7
R164: Residence (R)(1)	65.8	**66.5**	0.7	**66.5**	0.7
R165: Residence (R)(1)	**69.7**	**70.4**	0.7	**70.4**	0.7
R166: Residence (R)(1)	**76.5**	**77.3**	0.8	**77.3**	0.8
R167: Residence (R)(1)	**72.7**	**73.4**	0.7	**73.4**	0.7
R168: Americold (C)(1)	68.0	68.7	0.7	68.7	0.7
R169: Schwan's Home Services (C)(1)	68.3	69.1	0.8	69.1	0.8
R170: Residence (R)(1)	62.4	63.1	0.7	63.1	0.7
R171: J&S Repair Inc of Zumbrota (C)(1)	69.6	70.3	0.7	70.3	0.7
R172: Residence (R)(1)	58.8	59.6	0.8	59.5	0.7
R173: Covered Bridge (C)(1)	69.8	70.5	0.7	70.5	0.7
R174: America's Best Value Inn (C)(1)	69.6	70.3	0.7	70.4	0.8
R175: Goodhue County Co-Op Electric (C)(1)	59.0	59.7	0.7	59.8	0.8
R176: Three Rivers Comm Action (C)(1)	60.6	61.3	0.7	61.4	0.8
R177: Commercial (C)(1)	61.4	62.1	0.7	62.2	0.8
R178: DairiConcepts (C)(1)	64.8	65.6	0.8	65.5	0.7
R179: Residence (R)(1)	59.7	60.5	0.8	60.5	0.8
R180: Residence (R)(1)	64.1	64.9	0.8	64.8	0.7
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R181: Residence (R)(1)	63.4	64.1	0.7	64.1	0.7
R182: Residence (R)(1)	**66.0**	**66.8**	0.8	**66.8**	0.8
R183: Residence (R)(1)	62.1	62.9	0.8	62.8	0.7
R184: Residence (R)(1)	65.1	65.8	0.7	65.8	0.7
R185: Residence (R)(1)	61.3	62.0	0.7	62.1	0.8
R186: Residence (R)(1)	63.7	64.5	0.8	64.4	0.7
R187: Residence (R)(1)	61.4	62.2	0.8	62.1	0.7
R188: Residence (R)(1)	60.6	61.3	0.7	61.3	0.7
R189: Residence (R)(1)	59.0	59.8	0.8	59.8	0.8
R190: Residence (R)(1)	57.8	58.5	0.7	58.6	0.8
R191: Residence (R)(1)	56.6	57.4	0.8	57.4	0.8
R192: Residence (R)(1)	56.6	57.3	0.7	57.4	0.8
R193: Residence (R)(1)	57.0	57.7	0.7	57.8	0.8
R194: Residence (R)(1)	57.4	58.1	0.7	58.2	0.8
R195: Residence (R)(1)	57.3	58.0	0.7	58.1	0.8
R196: Residence (R)(1)	57.6	58.3	0.7	58.3	0.7
R197: Residence (R)(1)	58.0	58.7	0.7	58.7	0.7
R198: Residence (R)(1)	62.8	63.6	0.8	63.5	0.7
R199: Residence (R)(1)	61.8	62.5	0.7	62.5	0.7
R200: Residence (R)(1)	61.6	62.3	0.7	62.3	0.7
R201: Residence (R)(1)	**75.3**	**76.1**	0.8	**76.1**	0.8
R203: Residence (R)(1)	63.8	64.6	0.8	64.6	0.8
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

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* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R204: Residence (R)(1)	62.6	63.3	0.7	63.3	0.7
R205: Residence (R)(1)	61.7	62.4	0.7	62.5	0.8
R206: Residence (R)(1)	59.7	60.5	0.8	60.5	0.8
R207: Residence (R)(1)	58.2	59.0	0.8	59.0	0.8
R208: Residence (R)(1)	57.0	57.8	0.8	57.8	0.8
R209: Residence (R)(1)	56.7	57.4	0.7	57.5	0.8
R210: Residence (R)(1)	58.0	58.8	0.8	58.7	0.7
R211: Residence (R)(1)	60.4	61.2	0.8	61.2	0.8
R212: Residence (R)(1)	60.7	61.4	0.7	61.5	0.8
R213: Residence (R)(1)	63.1	63.9	0.8	63.9	0.8
R214: Residence (R)(1)	64.5	65.2	0.7	65.3	0.8
R215: Residence (R)(1)	**70.7**	**71.5**	0.8	**71.4**	0.7
R216: Residence (R)(1)	**67.1**	**67.9**	0.8	**67.9**	0.8
R217: Residence (R)(1)	**66.1**	**66.9**	0.8	**66.8**	0.7
R218: Residence (R)(1)	64.8	65.6	0.8	65.6	0.8
R219: Residence (R)(1)	**71.2**	**72.0**	0.8	**72.0**	0.8
R220: Residence (R)(1)	**71.2**	**71.9**	0.7	**71.9**	0.7
R221: Residence (R)(1)	**71.4**	**72.1**	0.7	**72.1**	0.7
R222: Residence (R)(1)	**71.2**	**72.0**	0.8	**71.9**	0.7
R223: Residence (R)(1)	65.2	**66.0**	0.8	**66.0**	0.8
R224: Residence (R)(1)	65.0	65.7	0.7	65.7	0.7
R225: Residence (R)(1)	58.4	59.2	0.8	59.2	0.8
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
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Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
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R226: Residence (R)(1)	60.2	60.9	0.7	60.9	0.7
R227: Residence (R)(1)	61.7	62.4	0.7	62.4	0.7
R228: Residence (R)(1)	62.7	63.4	0.7	63.4	0.7
R229: Residence (R)(1)	60.1	60.9	0.8	60.9	0.8
R230: Residence (R)(1)	62.2	63.0	0.8	62.9	0.7
R231: Residence (R)(1)	63.2	64.0	0.8	64.0	0.8
R232: Residence (R)(1)	57.3	58.1	0.8	58.1	0.8
R233: Residence (R)(1)	57.2	58.0	0.8	58.0	0.8
R234: Residence (R)(1)	56.7	57.4	0.7	57.6	0.9
R235: Residence (R)(1)	57.6	58.3	0.7	58.4	0.8
R236: Residence (R)(1)	**70.9**	**71.7**	0.8	**71.7**	0.8
R237: Residence (R)(1)	**68.6**	**69.3**	0.7	**69.3**	0.7
R238: Residence (R)(1)	**66.2**	**66.9**	0.7	**66.9**	0.7
R239: Residence (R)(1)	64.2	64.9	0.7	64.9	0.7
R240: Residence (R)(1)	60.9	61.7	0.8	61.7	0.8
R241: Residence (R)(1)	**69.8**	**70.5**	0.7	**70.5**	0.7
R242: Residence (R)(1)	65.5	**66.3**	0.8	**66.2**	0.7
R243: Residence (R)(1)	59.1	59.9	0.8	59.9	0.8
R244: Residence (R)(1)	**69.6**	**70.3**	0.7	**70.4**	0.8
R245: Residence (R)(1)	**73.6**	**74.3**	0.7	**74.3**	0.7
R246: Residence (R)(1)	**70.8**	**71.5**	0.7	**71.5**	0.7
R247: Residence (R)(1)	**67.2**	**68.0**	0.8	**67.9**	0.7
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
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Table 4 – TH 52 SB Improvement Project Noise Model Results

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	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R248: Residence (R)(1)	65.7	**66.4**	0.7	**66.5**	0.8
R249: Residence (R)(1)	63.6	64.4	0.8	64.4	0.8
R250: Residence (R)(1)	62.4	63.2	0.8	63.2	0.8
R251: Commercial (C)(1)	68.2	68.9	0.7	68.9	0.7
R252: Residence (R)(1)	59.8	60.5	0.7	60.6	0.8
R253: Residence (R)(1)	57.6	58.3	0.7	58.4	0.8
R254: Zumbrota Area Ambulance (C)(1)	65.9	66.6	0.7	66.6	0.7
R255: Residence (R)(1)	60.0	60.8	0.8	60.8	0.8
R256: Zumbrota Fire Department (C)(1)	66.9	67.7	0.8	67.6	0.7
R257: Residence (R)(1)	55.6	56.3	0.7	56.6	1.0
R258: Residence (R)(1)	57.0	57.8	0.8	57.9	0.9
R259: Grover Auto Co (C)(1)	62.9	63.6	0.7	63.6	0.7
R260: Page's Welding & Trailer Sales (C)(1)	64.1	64.9	0.8	64.9	0.8
R261: 52 Truck Center (C)(1)	63.1	63.9	0.8	63.9	0.8
R262: Alco (C)(1)	61.0	61.8	0.8	61.8	0.8
R263: Residence (R)(1)	64.0	64.7	0.7	64.8	0.8
R264: Zumbrota Ford (C)(1)	49.6	50.4	0.8	50.4	0.8
R265: Route 58 Motor (C)(1)	60.6	61.4	0.8	61.6	1.0
R266: Residence (R)(1)	57.3	58.0	0.7	58.5	1.2
R267: Kwik Trip (C)(1)	59.4	60.2	0.8	60.1	0.7
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R268: Speedway (C)(1)	66.3	67.0	0.7	67.1	0.8
R269: Dairy Queen (C)(1)	68.0	68.7	0.7	68.8	0.8
R270: Residence (R)(1)	56.0	56.7	0.7	56.7	0.7
R271: Residence (R)(1)	55.8	56.5	0.7	56.6	0.8
R272: Residence (R)(1)	56.8	57.6	0.8	57.5	0.7
R273: Residence (R)(1)	56.1	56.9	0.8	56.9	0.8
R274: Residence (R)(1)	56.6	57.4	0.8	57.3	0.7
R275: Residence (R)(1)	56.9	57.7	0.8	57.7	0.8
R276: Residence (R)(1)	57.6	58.4	0.8	58.3	0.7
R277: Residence (R)(1)	57.4	58.1	0.7	58.1	0.7
R278: Residence (R)(1)	57.7	58.5	0.8	58.5	0.8
R279: Residence (R)(1)	58.3	59.0	0.7	59.1	0.8
R280: Residence (R)(1)	58.1	58.8	0.7	58.8	0.7
R281: Residence (R)(1)	56.2	56.9	0.7	57.0	0.8
R282: Residence (R)(1)	56.7	57.4	0.7	57.5	0.8
R283: Residence (R)(1)	57.9	58.6	0.7	58.6	0.7
R284: Residence (R)(1)	57.8	58.5	0.7	58.5	0.7
R285: Residence (R)(1)	57.0	57.7	0.7	57.7	0.7
R286: Residence (R)(1)	56.1	56.8	0.7	56.8	0.7
R287: Residence (R)(1)	55.5	56.2	0.7	56.2	0.7
R288: Residence (R)(1)	55.2	55.9	0.7	56.0	0.8
R289: Residence (R)(1)	55.3	56.1	0.8	56.1	0.8
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R290: Residence (R)(1)	55.3	56.1	0.8	56.0	0.7
R291: Residence (R)(1)	57.9	58.6	0.7	58.6	0.7
R292: Residence (R)(1)	57.4	58.2	0.8	58.1	0.7
R293: Residence (R)(1)	57.2	58.0	0.8	57.9	0.7
R294: Residence (R)(1)	57.0	57.8	0.8	57.8	0.8
R295: Residence (R)(1)	56.9	57.6	0.7	57.7	0.8
R296: Residence (R)(1)	56.9	57.6	0.7	57.6	0.7
R297: Residence (R)(1)	56.6	57.3	0.7	57.3	0.7
R298: Residence (R)(1)	56.3	57.0	0.7	57.0	0.7
R299: Residence (R)(1)	56.1	56.9	0.8	56.9	0.8
R300: Residence (R)(1)	57.6	58.3	0.7	58.4	0.8
R301: Residence (R)(1)	57.3	58.0	0.7	58.0	0.7
R302: Residence (R)(1)	57.7	58.5	0.8	58.4	0.7
R303: Residence (R)(1)	57.9	58.6	0.7	58.6	0.7
R304: Residence (R)(1)	58.1	58.9	0.8	58.8	0.7
R305: Residence (R)(1)	57.9	58.7	0.8	58.6	0.7
R306: Residence (R)(1)	57.8	58.6	0.8	58.6	0.8
R307: Residence (R)(1)	57.6	58.3	0.7	58.3	0.7
R308: Residence (R)(1)	61.7	62.4	0.7	62.5	0.8
R309: Residence (R)(1)	63.2	64.0	0.8	63.9	0.7
R310: Residence (R)(1)	**69.3**	**70.0**	0.7	**70.0**	0.7
R311: Residence (R)(1)	**70.8**	**71.6**	0.8	**71.5**	0.7
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R312: Residence (R)(1)	**69.5**	**70.3**	0.8	**70.2**	0.7
R313: Residence (R)(1)	**68.0**	**68.7**	0.7	**68.8**	0.8
R314: Residence (R)(1)	**66.8**	**67.6**	0.8	**67.6**	0.8
R315: Residence (R)(1)	57.0	57.7	0.7	57.7	0.7
R316: Residence (R)(1)	60.6	61.4	0.8	61.3	0.7
R317: Residence (R)(1)	59.7	60.5	0.8	60.5	0.8
R318: Residence (R)(1)	59.0	59.8	0.8	59.7	0.7
R319: Residence (R)(1)	58.2	59.0	0.8	59.0	0.8
R320: Residence (R)(1)	57.4	58.2	0.8	58.2	0.8
R321: Residence (R)(1)	58.8	59.6	0.8	59.6	0.8
R322: Residence (R)(1)	**71.0**	**71.8**	0.8	**71.8**	0.8
R323: Residence (R)(1)	**69.2**	**69.9**	0.7	**69.9**	0.7
R324: Residence (R)(1)	65.5	**66.2**	0.7	**66.3**	0.8
R325: Residence (R)(1)	63.1	63.8	0.7	63.9	0.8
R326: Residence (R)(1)	61.1	61.8	0.7	61.9	0.8
R327: Residence (R)(1)	59.5	60.2	0.7	60.3	0.8
R328: Residence (R)(1)	57.8	58.6	0.8	58.6	0.8
R329: Residence (R)(1)	64.9	65.7	0.8	65.6	0.7
R330: Residence (R)(1)	57.1	57.9	0.8	58.0	0.9
R331: Residence (R)(1)	55.6	56.4	0.8	56.5	0.9
R332: Residence (R)(1)	56.3	57.0	0.7	57.2	0.9
R333: Residence (R)(1)	57.8	58.5	0.7	58.6	0.8
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

Table 4 – TH 52 SB Improvement Project Noise Model Results

Receptor*	Modeled Noise Level (dBA) (9:00 AM TO 10:00 AM)				
	Existing (2021) Leq	Future No Build (2041) Leq	Difference Between Existing (2021) & No Build (2041)	Future Build (2041) with No Mitigation	Difference Between Existing (2021) & Future Build with No Mitigation (2041)
R334: Residence (R)(1)	56.8	57.6	0.8	57.7	0.9
R335: Residence (R)(1)	58.4	59.2	0.8	59.3	0.9
R336: Residence (R)(1)	57.1	57.9	0.8	58.0	0.9
R337: Residence (R)(1)	**70.6**	**71.4**	0.8	**71.4**	0.8
R339: Residence (R)(1)	59.0	59.7	0.7	59.7	0.7
R340: Residence (R)(1)	**70.2**	**71.0**	0.8	**71.0**	0.8
R341: Residence (R)(1)	**71.2**	**71.9**	0.7	**71.9**	0.7
R342: Residence (R)(1)	**66.4**	**67.2**	0.8	**67.2**	0.8
R343: Residence (R)(1)	**74.2**	**75.0**	0.8	**75.0**	0.8
R344: Residence (R)(1)	**74.5**	**75.3**	0.8	**75.3**	0.8
R345: Residence (R)(1)	**74.9**	**75.7**	0.8	**75.7**	0.8
R346: Residence (R)(1)	**75.5**	**76.3**	0.8	**76.3**	0.8
R347: Residence (R)(1)	**75.8**	**76.6**	0.8	**76.6**	0.8
R348: Residence (R)(1)	**67.0**	**67.8**	0.8	**67.8**	0.8
R349: Residence (R)(1)	65.6	**66.4**	0.8	**66.4**	0.8
R350: Residence (R)(1)	64.7	65.5	0.8	65.5	0.8
R351: Residence (R)(1)	64.2	65.0	0.8	65.0	0.8
R352: Residence (R)(1)	63.9	64.7	0.8	64.7	0.8
R353: Residence (R)(1)	**75.6**	**76.4**	0.8	**76.4**	0.8
R354: Residence (R)(1)	**69.3**	**70.1**	0.8	**70.1**	0.8
R355: Residence (R)(1)	58.6	59.4	0.8	59.4	0.8
R356: Residence (R)(1)	58.9	59.9	0.8	59.7	0.8
FHWA NAC (Activity Category B & C)	67	67	--	67	--
FHWA NAC (Activity Category E)	72	72	--	72	--

Bold numbers approach or exceed FHWA Noise Abatement Criteria (NAC).
(R) – Residential; (C) – Commercial
* Number, in parentheses, in the "receptor" column is the number of receptors represented by each modeled receptor location.

4.0 Consideration of Noise Abatement

4.1 Noise Abatement Measures

The construction of the TH 52 SB Improvement Project is considered a Type I project for the purposes of traffic noise analysis (23 CFR 772.5). The 23 CFR 772.15(c) describes noise abatement measures to be considered when a traffic noise impact has been identified with a Type I highway project. These noise abatement measures include:

- Construction of noise barriers, including acquisition of property rights, either within or outside the highway right-of-way. Landscaping is not a viable noise abatement measure.
- Traffic management measures, including, but not limited to, traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, modified speed limits, and exclusive lane designations.
- Alteration of horizontal and vertical alignments.
- Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise.
- Noise insulation of Activity Category D land use facilities listed in Table 1 (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).

4.2 Noise Barrier Evaluation

MnDOT's requirements and procedures for evaluating noise barrier feasibility and reasonableness are set forth in Chapter 5 of the *Noise Requirements for MnDOT and other Type I Federal Aid Projects* (Analysis of Noise Abatement Measures). The factors for determining noise barrier feasibility and reasonableness as described in the MnDOT noise requirements are summarized below.

4.2.1 Noise Barrier Feasibility

Noise barrier feasibility is determined based on a consideration of two factors: 1) acoustic feasibility, and 2) engineering feasibility.

- **Acoustic Feasibility:** For a noise barrier to be considered acoustically effective, it must achieve a noise-reduction of at least 5.0 dBA at the impacted receptors for those receptors to be considered benefited by a noise barrier. Not every impacted receptor must receive this minimum 5.0 dBA reduction; however, at least one impacted receptor must meet the minimum 5.0 dBA reduction for a noise barrier to achieve acoustic feasibility.
- **Engineering Feasibility:** Engineering feasibility addresses whether or not it is possible to design and construct a proposed noise abatement measure. A sample of potential constructability considerations includes safety, topography, drainage, utilities, and maintenance considerations. Engineering considerations are also taken into consideration in determining noise barrier height. MnDOT has established a maximum noise barrier height of 20 feet above the finished ground line at the noise barrier. In addition, MnDOT has established a maximum noise barrier height of ten feet above the bridge deck when it is necessary for a noise barrier to be attached to a bridge structure.

The feasibility of noise barrier construction is sometimes dependent on design details that are not known until the final design phase of the project. For the purpose of this traffic noise analysis, it was assumed that noise barriers were feasible with respect to engineering feasibility/constructability considerations. It was also assumed that utilities located within the existing right-of-way could be relocated to accommodate modeled noise barriers, and existing and proposed drainage could be maintained. All modeled noise barriers were located within existing and/or proposed right-of-way limits.

4.2.2 Noise Barrier Reasonableness

Noise barrier reasonableness decisions are based on a consideration of three reasonableness factors:

1) Noise-reduction design goal, 2) cost-effectiveness, and 3) the viewpoint of benefited residents and property owners.

- **Noise-reduction design goal:** A minimum 7.0 dBA reduction must be achieved for at least one benefited receptor behind the noise barrier to meet noise-reduction design goals.
- **Cost-effectiveness:** To be considered cost-effective, the cost-per-individual benefited receptor (i.e., residence, commercial entity, industrial entity) should be equal to, or less than $78,500. In order to assess cost-effectiveness, at least one benefited receptor behind the noise barrier must meet the noise-reduction design goal described above. The following formula is used to determine the cost-effectiveness of the barrier:

The cost-effectiveness index is equal to the cost of the noise barrier divided by the number of individual benefited receptors (i.e., residences, commercial entities, industrial entities) that are predicted to experience noise level reductions of 5.0 dBA or more. Only those receptors that experience a 5.0 dBA or greater decibel decrease are considered in this formula. The result is a cost-per-benefited receptor value (residence, commercial entity, or industrial entity represented by each modeled receptor). The cost of a noise barrier is calculated using $36 per-square-foot of barrier, based on historical data. To be considered cost-effective, the cost-per-individual benefited receptor must be equal to or less than $78,500 per receptor.

There are several steps to assessing the cost-effectiveness of noise barriers. First, the cost-effective noise barrier height is determined for each segment of the project area, beginning with the evaluation of a 20-foot-tall noise barrier (MnDOT maximum height; see discussion of engineering feasibility above). If a 20-foot-tall noise barrier meets the reasonableness criteria and is feasible, it would be proposed for construction. If the 20-foot-tall barrier meets the noise-reduction design goal, but does not meet the cost-effectiveness criteria, then noise barrier heights less than 20 feet are studied (i.e., 15-foot or 10-foot). If a noise barrier height less than 20 feet meets the reasonableness criteria and is feasible, it would then be proposed for construction. Noise barrier cost-effectiveness is studied up to the point where a modeled barrier does not meet the noise-reduction design goal of a minimum 7.0 dBA reduction for at least one benefited receptor.

- **Viewpoint of benefited residents and property owners**: The third criterion in determining noise barrier reasonableness is the viewpoint of benefited residents and property owners. A benefited property is defined as a receptor adjacent to a proposed noise abatement measure that receives a noise-reduction equal to or greater than 5 dBA. If benefited residents and property owners indicate that a proposed noise barrier is not desired, then the noise barrier is removed from further consideration and would not be constructed with the project.

There are two steps in determining the desires of the benefited property owners and residents regarding the construction of a proposed noise abatement measures. First, the viewpoint of benefited property owners and residents is solicited through a public involvement process (e.g., open house meeting, direct mailing of a solicitation form). Second, the input received from benefited property owners and residents through this public involvement process is expressed in a vote that is weighted as follows:

For benefitted residential properties abutting the highway right-of-way of the proposed project, the property owner will receive **4 points** for each benefited receptor unit regardless if it is or isn't occupied. Residents will receive **2 points** for each benefited receptor unit. An owner/resident would receive **6 points**. For additional clarification of what an abutting property is, see MnDOT's noise website. For properties which are benefitted but not abutting

the highway right-of-way, the property owner will receive **2 points** for each benefitted receptor unit regardless if it is occupied or not, and the resident will receive **1 point** for each benefited receptor unit. An owner/resident of a non-abutting benefited receptor would receive **3 points**. This standard applies to single unit homes and multi-unit homes (duplexes and townhomes) as well as manufactured home parks.

Any single benefitted receptor that is not a residence such as a business condo or dentist office will only be able to vote yes or no. Votes may not be split.

For multi-family residential buildings such as apartment buildings, only those individual units that are considered to be benefitted receptors (a 5.0 dBA reduction) have a vote regardless of which floor they are on. However, due to the variety of different association structures that exist, benefitted receptors that are part of an association with common land will be weighed on a case-by-case basis in consultation with MnDOT noise staff and the FHWA.

For properties and receptors that fall into categories C and E, they shall be reviewed by MnDOT noise staff. See the MnDOT noise requirements for guidance on assigning receptor units to non-residential land uses like playgrounds, campgrounds, sports areas, etc.

Receptors in the general area that do not show that they are benefitted by a proposed noise barrier will not have a vote and would receive 0 points.

In general, if 50 percent or greater of all possible voting points are received, then a simple majority will determine if a proposed barrier is constructed. If a benefitted receptor chooses not to vote, that choice will not be counted for or against the proposed barrier. If less than 25 percent of the possible points for a barrier are received after a second solicitation, then the barrier will not be constructed. It is also noted that the balloting procedures may need to be adjusted to meet the environment the project is in. Any adjustment proposed by a specific project must be done with MnDOT and FHWA approval as appropriate.

Only those benefited property owners and residents, including individual units of multi-family residential buildings that are considered to be benefited receptors, regardless of floor location (e.g., first floor, second floor, etc.), have a vote according to the point system described above. Non-benefiting receptors do not receive points. A simple majority (greater than 50 percent) of all possible voting points for each of the proposed noise barriers must vote “down” the proposed abatement measure in order for it to be removed from further consideration.

4.3 Noise Barrier Analysis Results

Noise barriers were evaluated to reduce noise levels at modeled receptor locations that are predicted to approach or exceed the FHWA noise abatement criteria, or experience a substantial increase in noise levels from existing to future conditions under the Future (2041) Build alternative. For this project, no receptors experienced a substantial increase in noise levels from existing to future conditions. The locations of modeled noise barriers are shown in Appendix B, Exhibits 2-19.

Tabulations of the noise barrier cost-effectiveness results are located in Appendix A of this report. Multiple noise-barrier configurations were evaluated (barrier lengths and heights) for some receptors. In cases where the maximum length and height of a barrier did not meet the minimum 7.0 dBA noise-reduction design goal, no further analysis was performed. In cases where the minimum noise-reduction design goal was met, an alternative was modeled at a cost-effective length and height. The results presented below represent the most acoustically-effective and/or cost-effective noise barrier configuration.

4.3.1 Barrier A: Receptor R1

Receptor R1 is the only receptor associated with Barrier A (see Exhibit 20). Receptor R1 is located 160 feet east of NB TH 52 along 65th Avenue which runs parallel to NB TH 52. It is approximately at Sta. 181+87. Receptor R1 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier A is located east of NB TH 52 and west of 65th Avenue. It varies from 60 to 85 feet east of NB TH 52, and is approximately 103 feet west of Receptor R1. The center of the barrier is approximately at Sta. 181+87 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier A was first modeled at 20 feet high, with a length of 640 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 8.3 dBA (see Table A-1a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Barrier A was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 12 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 5.9 dBA (see Table A-1b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.2 Barrier B: Receptor R5

Receptor R5 is the only receptor associated with Barrier B (see Exhibit 21). It is located 181 feet east of NB TH 52 approximately at Sta. 223+29. Receptor R5 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier B is located 68 feet east of NB TH 52 and 125 feet west of Receptor R5. The center of the barrier is approximately at Sta. 223+29 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier B was first modeled at 20 feet high, with a length of 724 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 8.0 dBA (see Table A-2a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Barrier B was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 16 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 6.1 dBA (see Table A-2b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.3 Barrier C: Receptor R6

Receptor R6 is the only receptor associated with Barrier C (see Exhibit 21). It is located 102 feet west of SB TH 52 approximately at Sta. 238+70. Receptor R6 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier C is located 79 feet west of SB TH 52 and 32 feet east of Receptor R6. The center of the barrier is approximately at Sta. 259+02 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier C was first modeled at 20 feet high, with a length of 408 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 13.2 dBA (see Table A-3a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Barrier C was then modeled at additional heights below 20 feet, in 2 foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 8 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 5.9 dBA (see Table A-3b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.4 Barrier D: Receptor R8

Receptor R8 is the only receptor associated with Barrier D (see Exhibit 21). It is located 298 feet east of NB TH 52 approximately at Sta. 261+31. Receptor R8 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier D is located 50 feet east of NB TH 52 and 258 feet west of Receptor R8. The center of the barrier is approximately at Sta. 261+31 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier D was modeled at 20 feet high, with a length of 1,192 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 3.4 dBA (see Table A-4 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.5 Barrier E: Receptor R11

Receptor R11 is the only receptor associated with Barrier E (see Exhibit 22). It is located 200 feet east of NB TH 52 approximately at Sta. 287+54. Receptor R11 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier E is located 50 feet east of NB TH 52 and 145 feet west of Receptor R11. The center of the barrier is approximately at Sta. 287+54 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with Skunk Hollow Trail.

Barrier E was modeled at 20 feet high, with a length of 800 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 4.6 dBA (see Table A-5 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.6 Barrier F: Receptor R21

Receptor R21 is the only receptor associated with Barrier F (see Exhibit 22). It is located 212 feet east of NB TH 52 approximately at Sta. 327+20. Receptor R21 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier F is located 60 to 86 feet east of NB TH 52 and 158 feet west of Receptor R21. The center of the barrier is approximately at Sta. 327+20 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier F was modeled at 20 feet high, with a length of 851 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 5.0 dBA (see Table A-6 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.7 Barrier G: Receptor R29

Receptor R29 is the only receptor associated with Barrier G (see Exhibit 23). It is located 367 feet east of NB TH 52 approximately at Sta. 363+77. Receptor R29 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier G is located 50 feet east of NB TH 52 and 325 feet west of Receptor R29. The center of the barrier is approximately at Sta. 363+77 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier G was modeled at 20 feet high, with a length of 1468 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 2.1 dBA (see Table A-7 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.8 Barrier H: Receptor R31

Receptor R31 is the only receptor associated with Barrier H (see Exhibit 23). It is located 136 feet west of SB TH 52 approximately at Sta. 369+30. Receptor R31 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier H is located 73 feet west of SB TH 52 and 77 feet east of Receptor R31. The center of the barrier is approximately at Sta. 369+30 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with 75th Avenue Way.

Barrier H was modeled at 20 feet high, with a length of 544 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 5.9 dBA (see Table A-8 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.9 Barrier I: Receptors R30, R32, R33, and R34

Receptors R30, R32, R33, and R34 are the only receptors associated with Barrier I (see Exhibit 23). They are located 493 feet, 221 feet, 495 feet, and 202 feet east of NB TH 52 approximately at Sta. 372+70, Sta. 379+52, Sta. 380+90 and Sta. 381+38, respectively. Receptors R30, R32, and R34 are projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier I is located 73 feet east of NB TH 52 and 442 west of Receptor R30, 180 feet west of Receptor R32, 440 feet west of Receptor R33, and 161 feet west of Receptor R34. The center of the barrier is approximately at Sta. 380+54 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the access point for Receptors R32, R33 and R34.

Barrier I was modeled at 20 feet high, with a length of 885 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 0.0 dBA, 0.3 dBA, 0.2 dBA, 0.08 dBA for Receptors R30, R32, R33, and R34, respectively (see Table A-9 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.10 Barrier J: Receptor R37

Receptor R37 is the only receptor associated with Barrier J (see Exhibit 23). It is located 97 feet west of SB TH 52 approximately at Sta. 381+89. Receptor R37 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier J is located 69 feet west of SB TH 52 and 37 feet east of Receptor R37. The center of the barrier is approximately at Sta. 381+89 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the TH 52 access point for the receptor.

Barrier J was modeled at 20 feet high, with a length of 390 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 2.5 dBA (see Table A-10 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.11 Barrier K: Receptor R38

Receptor R38 is the only receptor associated with Barrier K (see Exhibit 23). It is located 232 feet east of NB TH 52 approximately at Sta. 394+06. Receptor R38 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier K is located 63 feet east of NB TH 52 and 169 feet west of Receptor R38. The center of the barrier is approximately at Sta. 394+06 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier K was modeled at 20 feet high, with a length of 946 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 5.1 dBA (see Table A-11 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.12 Barrier L: Receptor R39

Receptor R39 is the only receptor associated with Barrier L (see Exhibit 23). It is located 155 feet west of SB TH 52 approximately at Sta. 393+58. Receptor R39 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier L is located 67 feet west of SB TH 52 and 88 feet east of Receptor 39. The center of the barrier is approximately at Sta. 393+58 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier L was first modeled at 20 feet high, with a length of 625 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 9.3 dBA (see Table A-12a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Barrier L was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 14 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 6.3 dBA (see Table A-12b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.13 Barrier M: Receptors R40, R41, R42

Receptors R40, R41, and R42 are the receptors associated with Barrier M (see Exhibit 23). They are located 215 feet, 327 feet, and 320 feet east of NB TH 52 approximately at Sta. 405+58, Sta. 409+88, and Sta. 413+25, respectively. Receptors R40, R41, and R42 are all projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier M is located 63 feet east of NB TH 52 and 167 feet, 260 feet, and 250 feet west of Receptors R40, R41, and R42, respectively. The center of the barrier is approximately at Sta. 394+06 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier M was modeled at 20 feet high, with a length of 2,015 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 6.8 dBA, 4.6 dBA and 2.9 dBA for the three receptors (see Table A-13 in Appendix A). None of these met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.14 Barrier N: Receptors R43, R44, R45

Receptors R43, R44, and R45 are the receptors associated with Barrier N (see Exhibit 23). They are located 220 feet, 179 feet, and 236 feet west of SB TH 52 approximately at Sta. 403+01, Sta. 411+63, and Sta. 412+38, respectively. Receptors R43, R44, and R45 are all projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier N is located 77 feet west of SB TH 52 and 143 feet, 102 feet, and 159 feet east of Receptors R43, R44, and R45, respectively. The center of the barrier is approximately at Sta. 407+78 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

The barrier was also split into 2 segments due to a conflict with the TH 52 access point for the receptors.

Barrier N was modeled at 20 feet high, with a length of 1,825 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 3.6 dBA, 8.2 dBA, and 7.1 dBA for the three receptors (see Table A-14a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing more than the allowable $78,500 per benefited receptor.

Barrier N was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 16 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 1.1 dBA, 6.7 dBA and 5.5 dBA for the respective receptors (see Table A-14b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Next, Barrier N was modeled at a total length of 912 feet, half the previous length. This option consisted of 2 segments. Both segments were modeled at a length of 456 feet starting at a height of 20 feet and decreasing in 2-foot increments, while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 18 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 3.8 dBA, 6.7 dBA and 5.2 dBA for the respective receptors (see Table A-14c in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.15 Barrier O: Receptor R46

Receptor R46 is the only receptor associated with Barrier O (see Exhibit 24). It is located 131 feet west of SB TH 52 approximately at Sta. 437+57. Receptor R46 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier O is located 71 feet west of SB TH 52 and 68 feet east of Receptor R46. The center of the barrier is approximately at Sta. 437+57 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the TH 52 access point for the receptor.

Barrier O was modeled at 20 feet high, with a length of 524 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 6.7 dBA (see Table A-15 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.16 Barrier P: Receptor R47

Receptor R47 is the only receptor associated with Barrier P (see Exhibit 24). It is located 150 feet west of SB TH 52 approximately at Sta. 449+39. Receptor R47 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier P is located 65 feet west of SB TH 52 and 85 feet east of Receptor R47. The center of the barrier is approximately at Sta. 449+39 and has been modeled in the specified location to

stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the TH 52 access point for the receptor.

Barrier P was modeled at 20 feet high, with a length of 599 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 6.9 dBA (see Table A-16 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.17 Barrier Q: Receptor R50

Receptor R50 is the only receptor associated with Barrier Q (see Exhibit 26). It is located 158 feet west of SB TH 52 approximately at Sta. 496+70. Receptor R50 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier Q is located 79 feet west of SB TH 52 and 79 feet east of Receptor R50. The center of the barrier is approximately at Sta. 496+70 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier Q was modeled at 20 feet high, with a length of 632 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 9.2 dBA (see Table A-17a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However it was not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Barrier Q was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 14 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 5.8 dBA (see Table A-17b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.18 Barrier R: Receptor R55

Receptor R55 is the only receptor associated with Barrier R (see Exhibit 26). It is located 224 feet east of NB TH 52 approximately at Sta. 566+23. Receptor R55 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier R is located 74 feet east of NB TH 52 and 150 feet west of Receptor R55. The center of the barrier is approximately at Sta. 566+23 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier R was modeled at 20 feet high, with a length of 894 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 8.2 dBA (see Table A-18a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Barrier R was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of

the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 16 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 6.4 dBA (see Table A-18b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.19 Barrier S: Receptor R57

Receptor R57 is the only receptor associated with Barrier S (see Exhibit 25). It is located 284 feet east of NB TH 52 approximately at Sta. 620+11. Receptor R57 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier S is located 79 feet east of NB TH 52 and 205 feet west of Receptor R57. The center of the barrier is approximately at Sta. 620+11 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the TH 52 access point for the receptor.

Barrier S was modeled at 20 feet high, with a length of 1,136 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 4.9 dBA (see Table A-19 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.20 Barrier T: Receptor R58

Receptor R58 is the only receptor associated with Barrier T (see Exhibit 25). It is located 287 feet west of SB TH 52 approximately at Sta. 620+48. Receptor R58 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier T is located 73 feet west of SB TH 52 and 214 feet east of Receptor R58. The center of the barrier is approximately at Sta. 620+48 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the TH 52 access point for the receptor.

Barrier T was modeled at 20 feet high, with a length of 1,147 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 5.1 dBA (see Table A-20 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.21 Barrier U: Receptors R60, R61

Receptors R60 and R61 are the only receptors associated with Barrier U (see Exhibit 28). They are located 116 feet and 222 feet west of SB TH 52 approximately at Sta. 648+29 and Sta. 651+34, respectively. Receptors R60 and R61 are projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier U is located 76 feet west of SB TH 52 and 40 feet east of Receptor R60, and 147 feet west of Receptor 61. The center of the barrier is approximately at Sta. 650+65 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the access point for these 2 receptors.

Barrier U was modeled at 20 feet high, with a length of 1,224 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 5.5 dBA and 7.3 dBA for Receptors 60 and 61, respectively (see Table A-21a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Barrier U was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 18 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 5.3 dBA and 6.8 dBA for the respective receptors (see Table A-21b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Next, Barrier U was modeled at a total length of 612 feet, half the previous length. This option was modeled starting at a height of 20 feet and decreasing in 2-foot increments, while meeting the minimum 7.0 dBA noise-reduction design goal. At 20 foot height, the maximum reduction in modeled traffic noise level of 9.5 dBA and 5.3 dBA for the respective receptors (see Table A-21c in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This same length at 18 foot height provided a maximum reduction in modeled traffic noise level of 8.6 dBA and 4.5 dBA for the respective receptors (see Table A-21d in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable for receptor R60 but no longer met the minimum 5 dBA requirement for all other associated receptors. Upon testing other heights at this same length, none of the heights resulted in a cost effective barrier, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.22 Barrier V: Receptor R70

Receptor R70 is the only receptor associated with Barrier V (see Exhibit 27). It is located 178 feet east of NB TH 52 approximately at Sta. 760+45. Receptor R70 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier V is located 77 feet east of NB TH 52 and 101 feet west of Receptor R70. The center of the barrier is approximately at Sta. 760+45 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the TH 52 access point for the receptor.

Barrier V was modeled at 20 feet high, with a length of 711 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 5.7 dBA (see Table A-22 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.23 Barrier W: Receptor R71

Receptor R71 is the only receptor associated with Barrier W (see Exhibit 27). It is located 147 feet west of SB TH 52 approximately at Sta. 775+15. Receptor R71 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier W is located 43 feet west of SB TH 52 and 104 feet east of Receptor R71. The center of the barrier is approximately at Sta. 775+15 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier W was modeled at 20 feet high, with a length of 587 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 8.5 dBA (see Table A-23a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Barrier W was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 14 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 6.7 dBA (see Table A-23b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.24 Barrier X: Receptor R74

Receptor R74 is the only receptor associated with Barrier X (see Exhibit 29). It is located 172 feet east of NB TH 52 approximately at Sta. 806+15. Receptor R74 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier X is located 68 feet east of NB TH 52 and 104 feet west of Receptor R74. The center of the barrier is approximately at Sta. 806+15 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier X was modeled at 20 feet high, with a length of 687 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 8.2 dBA (see Table A-24a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Barrier X was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 16 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 6.9 dBA (see Table A-24b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.25 Barrier Y: Receptor R75

Receptor R75 is the only receptor associated with Barrier Y (see Exhibit 29). It is located 234 feet east of NB TH 52 approximately at Sta. 830+80. Receptor R75 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier Y is located 71 feet east of NB TH 52 and 163 feet west of Receptor R75. The center of the barrier is approximately at Sta. 830+80 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the TH 52 access point for the receptor.

Barrier Y was modeled at 20 feet high, with a length of 936 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 5.2 dBA (see Table A-25 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.26 Barrier Z: Receptors R77, R78

Receptors R77 and R78 are the only receptors associated with Barrier Z (see Exhibit 29). They are located 160 feet and 205 feet west of SB TH 52 approximately at Sta. 857+81 and Sta. 860+23, respectively. Receptors R77 and R78 are projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier Z is located 50 to 77 feet west of SB TH 52 and 107 feet east of Receptor R77, and 160 feet east of Receptor R78. The center of the barrier is approximately at Sta. 858+09 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier Z was modeled at 20 feet high, with a length of 821 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 8.0 dBA and 5.8 dBA for Receptors R77 and R78, respectively (see Table A-26a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Barrier Z was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 14 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 6.2 dBA and 4.2 dBA for the respective receptors (see Table A-26b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.27 Barrier AA: Receptor R85

Receptor R85 is the only receptor associated with Barrier AA (see Exhibit 37). It is located 133 feet west of SB TH 52 approximately 1/4 south of the TH 52 and TH 60 interchange. Receptors R85 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier AA is located 75 feet west of SB TH 52 and 60 feet east of Receptor R85. The center of the barrier is approximately 1/4 south of the TH 52 and TH 60 interchange and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the TH 52 access point for the receptor.

Barrier AA was modeled at 20 feet high, with a length of 916 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 8.1 dBA (see Table A-27a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Barrier AA was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced

to 18 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 6.8 dBA (see Table A-27b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.28 Barrier BB: Receptors R2, R3, and R4

Receptors R2, R3, and R4 are the receptors associated with Barrier BB (see Exhibit 21). They are located 676 feet, 563 feet, and 370 feet east of NB TH 52 approximately at Sta. 200+30, Sta. 202+50, and Sta. 202+70, respectively. Receptor R4 are all projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier BB is located 75 feet east of NB TH 52 and 601 feet, 487 feet, and 293 feet west of Receptors R2, R3, and R4, respectively. The center of the barrier is approximately at Sta. 202+40 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier BB was modeled at 20 feet high, with a length of 1,480 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 1.3 dBA, 2.0 dBA and 4.1 dBA for the three receptors (see Table A-28 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.29 Barrier CC: Receptor R84

Receptor R84 is the only receptor associated with Barrier CC (see Exhibit 21). It is located 346 feet east of NB TH 52 approximately at Sta. 989+95. Receptor R84 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier CC is located 73 feet east of NB TH 52 and 276 feet west of Receptor R84. The center of the barrier is approximately at Sta. 990+85 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the adjacent North Fork Zumbro River.

Barrier CC was modeled at 20 feet high, with a length of 1,384 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 0.2 dBA (see Table A-29 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.30 Barrier DD: Receptors R96-R106 and R180-R188

Receptors R96-R106 and R180-R188 are associated with Barrier DD (see Exhibit 33). It is located 45 feet to 245 feet west of SB TH 52 approximately at Sta. 1095+50. Receptors R103, R106, and R182 are projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier DD is located 45 feet to 245 feet west of SB TH 52 and 40 feet east of Receptor R106. The center of the barrier is approximately at Sta. 1095+50 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier DD was modeled at 20 feet high, with a length of 1,350 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the

barrier. This provided a maximum reduction in modeled traffic noise level of 5.3 dBA and 6.4 dBA for receptors R103 and R106 (see Table A-30a in Appendix A). This barrier did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. All other receptors did not meet the minimum 5.0 dBA to be considered benefited.

A second option for Barrier DD was modeled at 20 feet high, with a length of 840 feet. This provided a maximum reduction in modeled traffic noise level of 6.1 dBA for receptor R106 (see Table A-30b in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. All other receptors did not meet the minimum 5.0 dBA to be considered benefited. It was also not cost effect, costing higher than the allowable $78,500 per benefited receptor. Therefore, the analyzed barrier is not proposed.

4.3.31 Barrier EE: Receptors R107-R148 and R189-R191

Receptors R107-R148 and R189-R191 are associated with Barrier EE (see Exhibit 33). Receptors R107, R108, R113, and R120 are projected to exceed FHWA NAC under the Future (2041) Build Alternative. They are located 236 feet, 325 feet, 287 feet, and 273 feet east of NB TH 52 approximately at Sta. 1096+29, Sta. 1096+65, Sta. 1098+73, and Sta. 1099+83, respectively.

Barrier EE is located 76 feet to 256 feet east of NB TH 52 and 161 feet, 249 feet, 169 feet, and 121 feet west of Receptors R107, R108, R113, and R120 respectively. The center of the barrier is approximately at Sta. 1095+00 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier EE was modeled at 20 feet high, with a length of 2,223 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 6.0 dBA for receptor R120 (see Table A-31 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. All other receptors did not meet the minimum 5.0 dBA to be considered benefited. It was also not cost effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, the analyzed barrier is not proposed.

4.3.32 Barrier FF: Receptors R149-R163

Receptors R149-R163 are the receptors associated with Barrier FF (see Exhibit 33). Receptors R149, R152, R156, R158, R159, R160, R161, and R162 are projected to exceed FHWA NAC under the Future (2041) Build Alternative. They are located 328 feet, 309 feet, 290 feet, 264 feet, 241 feet, 361 feet, 221 feet, and 384 feet east of NB TH 52 approximately at Sta. 1107+50, Sta. 1108+15, Sta. 1108+91, Sta. 1109+69, Sta. 1110+31, Sta. 1110+60, Sta. 1111+31, and Sta. 1111+70, respectively.

Barrier FF is located 85 feet to 238 feet east of NB TH 52 and 80 feet, 83 feet, 88 feet, 88 feet, 88 feet, 208 feet, 100 feet, and 267 feet west of Receptors R149, R152, R156, R158, R159, R160, R161, and R162 respectively. The center of the barrier is approximately at Sta. 1110+30 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier FF was modeled at 20 feet high, with a length of 834 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 1.9 dBA, 4.8 dBA, 8.1 dBA, 8.6 dBA, 9.1 dBA, 5.8 dBA. 9.3 dBA and 6.1 dBA for the eight receptors (see Table A-32a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, not enough receptors met the minimum 5.0 dBA to be cost effective, with the barrier costing higher than the allowable $78,500 per benefited receptor. Therefore, the analyzed barrier is not proposed.

A second option for Barrier FF was modeled at 20 feet high, with a length of 469 feet. This provided a maximum reduction in modeled traffic noise level of 1.9 dBA, 4.5 dBA, 6.8 dBA, 7.2 dBA, 7.0 dBA, 3.5 dBA. 5.2 dBA and 2.2 dBA for the eight receptors (see Table A-32b in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal while being cost-effective, which is considered reasonable. Furthermore, enough receptors met the minimum 5.0 dBA to be considered benefited and to make it cost-effective. Therefore, Barrier FF at 469 feet long and 20 feet high with end tapers stepping down from 20 feet to 8 feet at 2-foot increments over a total of 48 feet on each end is proposed. See exhibit 33 for the proposed option of barrier FF.

4.3.33 Barrier GG: Receptor R165

Receptor R165 is the only receptor associated with Barrier GG (see Exhibit 31). It is located 189 feet west of SB TH 52 along 165th Avenue. It is approximately at Sta. 1007+32 of TH 52. Receptor R165 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier GG is located west of SB TH 52 and east of 165th Avenue. It is approximately 59 feet west of SB TH 52, and 130 feet east of Receptor R165. The center of the barrier is approximately at Sta. 1007+32 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier GG was first modeled at 20 feet high, with a length of 716 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 7.6 dBA (see Table A-33a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing higher than the allowable $78,500 per benefited receptor.

Barrier GG was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 16 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 6.2 dBA (see Table A-33b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.34 Barrier HH: Receptor R166

Receptor R166 is the only receptor associated with Barrier HH (see Exhibit 31). It is located 105 feet east of NB TH 52, approximately at Sta. 1020+60 of TH 52. Receptor R166 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier HH is located east of NB TH 52. It is approximately 70 feet east of NB TH 52, and 35 feet west of Receptor R166. The center of the barrier is approximately at Sta. 1020+60 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier HH was first modeled at 20 feet high, with a length of 356 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 11.9 dBA (see Table A-34a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, it was not cost-effective, costing more than the allowable $78,500 per benefited receptor.

Barrier HH was then modeled at additional heights below 20 feet, in 2-foot increments, holding the length constant while meeting the minimum 7.0 dBA noise-reduction design goal. None of the reduced heights resulted in a cost effective barrier. Once the barrier was reduced to 14 feet high it no longer met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. This height and length provided a maximum reduction in modeled traffic noise level of 4.8 dBA (see Table A-34b in Appendix A). This was also not cost-effective, costing higher than the allowable $78,500 per benefited receptor. Therefore, none of the analyzed barrier options are proposed.

4.3.35 Barrier II: Receptor R167

Receptor R167 is the only receptor associated with Barrier II (see Exhibit 32). It is located 161 feet east of NB TH 52, approximately at Sta. 1032+93 of TH 52. Receptor R167 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier II is located east of NB TH 52. It is approximately 65 feet east of NB TH 52, and 96 feet west of Receptor R167. The center of the barrier is approximately at Sta. 1032+93 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the TH 52 access point for the receptor.

Barrier II was first modeled at 20 feet high, with a length of 588 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 6.7 dBA (see Table A-35 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.36 Barrier JJ: Receptor R164

Receptor R164 is the only receptor associated with Barrier JJ (see Exhibit 32). It is located 328 feet west of NB TH 52, approximately at Sta. 976+70 of TH 52. Receptor R164 is projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier JJ is located east of NB TH 52. It is approximately 45 feet to 80 feet west of NB TH 52, and 249 feet east of Receptor R164. The center of the barrier is approximately at Sta. 976+70 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. The barrier was also split into 2 segments due to a conflict with the TH 52 access point for the receptor.

Barrier JJ was first modeled at 20 feet high, with a length of 1,312 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 3.2 dBA (see Table A-36 in Appendix A). This did not meet the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. Therefore, the analyzed barrier is not proposed.

4.3.37 Barrier LL: Receptors R163, R192-R201, R203-R258, R264, R330-R337, and R343-R354

Receptors R163, R192-R201, R203-R258, R264, R330-R337, and R343-R354 are associated with Barrier LL (see Exhibit 34-35). They are located between 147 feet and 382 feet east of NB TH 52. Receptors R163, R201, R215, R216, R217, R219, R220, R221, R222, R223, R236, R237, R238, R241, R242, R244, R245, R246, R247, R248, R251, R254, R256, R337, R343, R344, R345, R346, R347, R348, R349, R353 and R354 are projected to exceed FHWA NAC under the Future (2041) Build Alternative.

Barrier LL is located 70 feet east of NB TH 52 and is between 77 feet and 312 feet west of the associated receptors. The center of the barrier is approximately at Sta. 1128+00 and has

been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines. Several iterations were tested at various heights and lengths for Barrier LL to determine if an option would be both acoustically effective and cost-effective. The following are the two options that came the closest to meeting the requirements for both acoustic-effectiveness and cost-effectiveness.

Barrier LL was modeled at 20 feet high, with a length of 4630 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level shown in Table A-37a in Appendix A. This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, not enough receptors met the minimum 5.0 dBA to be cost effective, with the barrier costing higher than the allowable $78,500 per benefited receptor. Therefore, this barrier is not being proposed.

A second barrier LL option was then modeled at 20 feet high, with a length of 3,318 feet. This provided a maximum reduction in modeled traffic noise level shown in Table A-37b in Appendix A. This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, not enough receptors met the minimum 5.0 dBA to be cost effective, with the barrier costing higher than the allowable $78,500 per benefited receptor. Therefore, this barrier is not being proposed.

A third barrier LL option was modeled at 20 feet high, with a length of 2,035 feet. One change to this option from the previous was that the location shifted horizontally as it pertains to the offset from right-of-way in order to reduce conflicts with utilities that are parallel with right-of-way. The barrier is also shorter in overall length than the second barrier LL option, but was shifted so that it extends farther to the north than the second option. This barrier was modeled at this specified length and height such that it would avoid conflicts with existing ditches, wetlands and reduce conflicts with utilities. However, the wall conflicts with three overhead utility line crossings. The result of this barrier option provided a maximum reduction in modeled traffic noise level shown in Table A-37c in Appendix A. According to Table A-37c, the number of benefited receptors increased from the second option (Table A-37b in Appendix A) despite being shorter in length. This was due to the location shift of the barrier to the north such that extra receptors were benefited making the overall number of benefited receptors increase from the second option. The results of this third option met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable and had enough receptors meet the minimum 5.0 dBA to be considered benefited. The barrier itself is cost-effective, costing under the allowable $78,500 per benefited receptor (see Table A-37c in Appendix A). However, since there are conflicts with overhead utility lines that would need to be raised with the addition of Wall LL, there is an estimated additional cost of $500,000 required to do so. Factoring this into the overall cost of the wall still results in the wall being cost-effective as it would presumably be $57,088.47 per benefited receptors, which is still lower than the allowable $78,500 per benefited receptor. Therefore, Barrier LL at 2,035 feet long and 20 feet high with end tapers stepping down from 20 feet to 8 feet at 2-foot increments over a total of 48 feet on each end is proposed. See exhibits 33-34 for the proposed option of barrier LL.

4.3.38 Barrier QQ: Receptors R267-R328 and R339-R342

Receptors R267-R328 and R339-R342 are associated with Barrier QQ (see Exhibit 35-36). Receptors R310, R311, R312, R313, R314, R322, R323, R324, R 340, R 341, and R342 are projected to exceed FHWA NAC under the Future (2041) Build Alternative. They are located 248 feet, 211 feet, 246 feet, 292 feet, 337 feet, 209 feet, 261 feet, 403 feet, 225 feet, 204 feet, and 360 feet east of TH 52 NB approximately at Sta. 1178+73, Sta. 1181+73, Sta. 1182+28, Sta. 1182+72, Sta. 1183+02, Sta. 1186+54, Sta. 1186+92, Sta. 1186+60, Sta. 1179+10, Sta. 1181+10, and Sta. 1182+15 respectively.

Barrier QQ is located 85 feet east of NB TH 52 and 163 feet west of Receptor R310, 126 feet west of Receptor R311, 161 feet west of Receptor R312, 207 feet west of Receptor R313, 252 feet west of Receptor R314, 124 feet west of Receptor R322, and 176 feet west of Receptor R323, 313 feet west of Receptor R324, 137 feet west of Receptor R340, 115 feet west of Receptor R341, and 270 feet west of Receptor R342. The center of the barrier is approximately at Sta. 1181+46 and has been modeled in the specified location to stay within right-of-way and to avoid conflicts with the roadside ditch and all adjacent underground and overhead utility lines.

Barrier QQ was modeled at 20 feet high, with a length of 2,848 feet, which is beyond the last receptor by approximately 4 times the perpendicular distance of the last receptor to the barrier. This provided a maximum reduction in modeled traffic noise level of 9.8 dBA, 9.5 dBA, 8.8 dBA, 7.9 dBA, 7.4 dBA, 5.0 dBA, 6.7 dBA, 6.0 dBA, 5.0 dBA, 9.0 dBA, 9.8 dBA and 7.1 dBA for receptors R310, R311, R312, R313, R314, R316, R322, R323, R339, R340, R341, and R342 respectively (see Table A-38a in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, not enough receptors met the minimum 5.0 dBA to be cost effective, with the barrier costing higher than the allowable $78,500 per benefited receptor. Therefore, this barrier is not being proposed.

A second Barrier QQ was modeled at 20 feet high, with a length of 1,802 feet. This provided a maximum reduction in modeled traffic noise level of 9.3 dBA, 9.2 dBA, 8.4 dBA, 7.3 dBA, 6.6 dBA, 6.0 dBA, 5.5 dBA, 8.6 dBA, 9.5 dBA and 6.4 dBA for receptors R310, R311, R312, R313, R314, R322, R323, R340, R341, and R342 respectively (see Table A-38b in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable. However, not enough receptors met the minimum 5.0 dBA to be cost effective, with the barrier costing higher than the allowable $78,500 per benefited receptor. Therefore, this barrier is not being proposed.

A third Barrier QQ option was modeled at 20 feet high, with a length of 900 feet. This option was moved horizontally from right-of-way to reduce conflicts with utilities. This provided a maximum reduction in modeled traffic noise level of 6.4 dBA, 8.2 dBA, 7.1 dBA, 6.0 dBA, 5.1 dBA, 7.5 dBA, 8.6 dBA, and 5.2 dBA for receptors R310, R311, R312, R313, R314, R340, R341, and R342 respectively, with receptors R308 and R309 no longer being benefited with this option (see Table A-38c in Appendix A). This met the minimum 7.0 dBA noise-reduction design goal to be considered reasonable and had enough receptors meet the minimum 5.0 dBA to be considered benefited and to make it cost-effective (see Table A-38c in Appendix A). Therefore, Barrier QQ at 1,340 feet long and 20 feet high with end tapers stepping down from 20 feet to 8 feet at 2-foot increments over a total of 48 feet on each end is proposed. See exhibit 36 for the proposed option of barrier QQ.

4.4 Other Noise Mitigation Techniques

Noise abatement measures other than noise barriers were considered for the proposed project. These measures are summarized below.

- Traffic Management Measures: These measures include such items as prohibition of certain vehicle types and time-use restrictions for certain vehicle types. These traffic management measures are not reasonable for this project since such measures are inconsistent with the purpose of the expressway roadway and interchange.
- Modified Speed Limits: Existing posted speed limits on TH 52 are set at 65 mph in accordance with state law. Reducing the speed limit here would be contrary to the primary mission of the road to move traffic quickly, efficiently, and safely with the least disruption.
- Vertical and Horizontal Alignment: Horizontal and vertical alignment changes are not practical as a mitigation technique because of required vertical profile adjustments for design speed and snowdrift mitigation.

- Landscaping/Natural Noise Screening: There is not enough space available, given roadside ditches and right-or-way constraints, to develop any vegetation in sufficient quantity to be of any benefit to the points that exceed the FHWA NAC.
- Exclusive Land Use Designations: Adding buffer zones would not be practical on this site since affected receptors are sparsely populated, and thus any buffer zone addition would be less effective.
- Noise Insulation of Activity Category D Land Use Facilities: Under 23 CFR 772.15(c) and MnDOT requirements, only non-residential buildings such as schools, hospitals, and places of worship (Activity Category D, see Table 1) should be considered for acoustical insulation if there are no exterior areas of frequent human use associated with the property. This does not apply to this case since there are no studied noise receptors of this type and the points to mitigate are all exterior.

5.0 Considerations of Construction Noise

5.1 Construction Noise

The construction activities associated with implementation of the proposed project will result in increased noise levels relative to existing conditions. These impacts will primarily be associated with construction equipment and pile driving.

The following table (**Table 5**) shows peak noise levels monitored at 50 feet from various types of construction equipment. This equipment is primarily associated with site grading/site preparation, which is generally the roadway construction phase associated with the greatest noise levels.

Table 5– Typical Construction Equipment Noise Levels at 50 Feet

Equipment Type	Manufacturers Sampled	Total Number of Models in Sample	Peak Noise Level (dBA)	
			Range	Average
Backhoes	5	6	74-92	83
Front Loaders	5	30	75-96	85
Dozers	8	41	65-95	85
Graders	3	15	72-92	84
Scrapers	2	27	76-98	87
Pile Drivers	N/A	N/A	95-105	101

Elevated noise levels are, to a degree, unavoidable for this type of project. The Minnesota Department of Transportation (MnDOT) will require that construction equipment be properly muffled and in proper working order. While MnDOT and its contractor(s) are exempt from local noise ordinances, it is the practice to require contractor(s) to comply with applicable local noise restrictions and ordinances to the extent that is reasonable. Advanced notice will be provided to affected communities of any planned abnormally loud construction activities. It is anticipated that night construction will sometimes be required to minimize traffic impacts and to improve safety. However, construction will be limited to daytime hours as much as possible. This project is expected to be under construction for two construction seasons. If necessary, a detailed nighttime construction mitigation plan will be developed during the project's final design stage.

Any associated high-impact equipment noise, such as pile driving, pavement sawing, or jack hammering, will be unavoidable with construction of the proposed project. Pile-driving noise is associated with any bridge construction and sheet piling is necessary for retaining wall construction. While pile-driving equipment results in the highest peak noise level, as shown in **Table 5**, it is limited in duration to the activities noted above (e.g., bridge construction).

The use of pile drivers, jack hammers, and pavement sawing equipment will be prohibited during nighttime hours.

6.0 Conclusions and Recommendations

6.1 Summary of Noise Model Results

As noted earlier in this report, it was determined that the worst-noise hour of traffic was the 9:00am to 10:00am hour on a summer weekday.

Using the above, the 2021 projected existing L_{eq} noise levels would range from 49.6 dBA to 76.5 dBA.

Under the Future (2041) No Build scenario during the same worst hours of projected traffic, L_{eq} noise level results range from 50.4 dBA to 77.3 dBA.

Under the Future (2041) Build with No Mitigation alternative during the same worst hours of projected traffic, and accounting for the impact of the project, the L_{eq} noise levels range from 50.4 dBA to 77.3 dBA.

The results of this analysis show 98 receptor locations within 1,000-ft of the project area approach FHWA NAC.

6.2 Recommendations

From analysis of the Build condition, 98 receptors approach or exceed FHWA Noise Abatement Criteria (NAC). Noise barrier mitigation cost-effectiveness was analyzed for 38 barriers mitigating noise levels at each of the 98 affected receptors along TH 52, at the TH 60 Zumbrota interchange, and near the proposed Hader interchange at TH 52 and TH 57/CSAH 8.

Three noise barrier locations met the 7.0 dBA noise-reduction design goal without exceeding the maximum $78,500 cost-per-individual benefited receptor. All other modeled barriers either only met one of the requirements or none of the requirements. Barrier FF, Barrier LL and Barrier QQ were the only barriers to meet all requirements and are the only proposed barriers from this report. Construction of Barrier FF, Barrier LL and Barrier QQ will be subject to the viewpoint of benefited receptors and final design considerations as well as the relocation of utilities that are in conflict with the south end of barrier LL.

6.3 Statement of Likelihood

The preliminary indications are based on the analysis of the current design; therefore, there are three abatement measures required. Final mitigation decisions will be subject to final design considerations. If conditions substantially change during final design such that there are further noise impacts associated with the project, then additional noise abatement measures may be required. Decisions to substantially modify the design may require this analysis to be revisited and approved by MnDOT and the FHWA Minnesota Division Office. Affected receptors and local officials would be notified of plans to substantially modify the design prior to the completion of the final design process. This notification will explain changes in site conditions (if any), additional site information, any design changes implemented during the final design process, and an explanation of noise barrier feasibility and reasonableness. If no significant design changes are done, then only the three abatement measures would be anticipated.

Appendix A

Barrier Cost-Effectiveness Results

Table A-1a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier A

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R1 (R)	72.8	64.5	8.3	1	1	1	640	12128	$436,608	$436,608

Table A-1b. Noise Mitigation Effectiveness Results (12-Foot-High Barrier) Modeled Barrier A

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R1 (R)	72.8	66.9	5.9	1	1	0	640	7010	$252,360	$252,360

Table A-2a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier B

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R5 (R)	71.3	63.3	8	1	1	1	724	13808	$497,088	$497,088

Table A-2b. Noise Mitigation Effectiveness Results (16-Foot-High Barrier) Modeled Barrier B

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R5 (R)	71.3	65.9	6.1	1	1	0	724	10912	$392,832	$392,832

(R) Residential
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-3a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier C

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R6 (R)	73.6	60.4	13.2	1	1	1	408	7488	$269,568	$269,568

Table A-3b. Noise Mitigation Effectiveness Results (8-Foot-High Barrier) Modeled Barrier C

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R6 (R)	73.6	67.7	5.9	1	1	0	408	3264	$117,504	$117,504

Table A-4. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier D

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R8 (R)	68.7	65.3	3.4	1	0	0	1192	23168	$834,048	NA

Table A-5. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier E

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R11 (R)	70.7	66.1	4.6	1	0	0	800	15328	$551,808	NA

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-6. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier F

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R21 (R)	70.9	65.9	5	1	1	0	851	16348	$588,528	$588,528

Table A-7. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier G

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R29 (R)	67.3	65.2	2.1	1	0	0	1468	28688	$1,032,768	NA

Table A-8. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier H

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R31 (R)	73.6	67.7	5.9	1	1	0	544	10208	$367,488	$367,488

Table A-9. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier I

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R30 (R)	66.8	66.8	0.0	1	0	0	1532	29968	$1,078,848	NA
R32 (R)	70.5	70.2	0.3	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-9. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier I CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R33 (R)	65.3	65.1	0.2	1	0	0				
R34 (R)	70.9	70.1	0.8	1	0	0				

Table A-10. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier J

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R37 (R)	73.2	70.7	2.5	1	0	0	390	7128	$256,608	NA

Table A-11. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier K

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R38 (R)	67.8	62.7	5.1	1	1	0	946	18248	$656,928	$656,928

Table A-12a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier L

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R39 (R)	71.4	62.1	9.3	1	1	1	625	11828	$425,808	$425,808

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-12b. Noise Mitigation Effectiveness Results (14-Foot-High Barrier) Modeled Barrier L

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R39 (R)	71.4	65.1	6.3	1	1	0	625	8078	$290,808	$290,808

Table A-13. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier M

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R40 (R)	71.0	64.2	6.8	1	1	0	2015	39628	$1,426,608	$1,426,608
R41 (R)	67.8	63.2	4.6	1	0	0				
R42 (R)	69.8	66.9	2.9	1	0	0				

Table A-14a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier N

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R43 (R)	69.7	66.1	3.6	1	0	0	1825	35828	$1,289,808	$644,904
R44 (R)	70.9	62.7	8.2	1	1	1				
R45 (R)	68.9	61.8	7.1	1	1	1				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-14b. Noise Mitigation Effectiveness Results (16-Foot-High Barrier) Modeled Barrier N

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R43 (R)	69.7	68.6	1.1	1	0	0	1825	28528	$1,027,008	$513,504
R44 (R)	70.9	64.2	6.7	1	1	0				
R45 (R)	68.9	63.4	5.5	1	1	0				

Table A-14c. Noise Mitigation Effectiveness Results (18-Foot-High Barrier) Modeled Barrier N

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
REC 43 (R)	69.7	65.9	3.8	1	0	0	456	7536	$271,296	$135,648
REC 44 (R)	70.9	64.2	6.7	1	1	0				
REC 45 (R)	68.9	63.7	5.2	1	1	0				

Table A-15. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier O

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R46 (R)	72.4	65.7	6.7	1	1	0	524	9808	$353,088	$353,088

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[(1)] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[(2)] Area includes taper.

Table A-16. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier P

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R47 (R)	70.6	63.7	6.9	1	1	0	599	11308	$407,088	$407,088

Table A-17a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier Q

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R50 (R)	71.6	62.4	9.2	1	1	1	632	11968	$430,848	$430,848

Table A-17b. Noise Mitigation Effectiveness Results (14-Foot-High Barrier) Modeled Barrier Q

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R50 (R)	71.6	65.8	5.8	1	1	0	632	8176	$294,336	$294,336

Table A-18a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier R

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R55 (R)	70.2	62	8.2	1	1	1	894	17208	$619,488	$619,488

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[(1)] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[(2)] Area includes taper.

Table A-18b. Noise Mitigation Effectiveness Results (16-Foot-High Barrier) Modeled Barrier R

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R55 (R)	70.2	63.8	6.4	1	1	0	894	13632	$490,752	$490,752

Table A-19. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier S

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R57 (R)	68.3	63.4	4.9	1	0	0	1136	22048	$793,728	NA

Table A-20. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier T

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R58 (R)	67.7	62.6	5.1	1	1	0	1147	22268	$801,648	$801,648

Table A-21a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier U

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R60 (R)	72.8	67.3	5.5	1	1	0	1224	23808	$857,088	$428,544
R61 (R)	69.1	61.8	7.3	1	1	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[(1)] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[(2)] Area includes taper.

Table A-21b. Noise Mitigation Effectiveness Results (18-Foot-High Barrier) Modeled Barrier U

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R60 (R)	72.8	67.5	5.3	1	1	0	1224	21360	$768,960	$384,480
R61 (R)	69.1	62.3	6.8	1	1	0				

Table A-21c. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier U

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R60 (R)	72.8	63.3	9.5	1	1	1	612	11568	$416,448	$208,224
R61 (R)	69.1	63.8	5.3	1	1	1				

Table A-21d. Noise Mitigation Effectiveness Results (16-Foot-High Barrier) Modeled Barrier U

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R60 (R)	72.8	64.2	8.6	1	1	1	612	9120	$328,320	$328,320
R61 (R)	69.1	64.6	4.5	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-22. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier V

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R70 (R)	71.7	66	5.7	1	1	0	711	13548	$487,728	$487,728

Table A-23a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier W

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R71 (R)	71.2	62.7	8.5	1	1	1	587	11068	$398,448	$398,448

Table A-23b. Noise Mitigation Effectiveness Results (14-Foot-High Barrier) Modeled Barrier W

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R71 (R)	71.2	64.5	6.7	1	1	0	587	7546	$271,656	$271,656

Table A-24a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier X

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R74 (R)	71.4	63.2	8.2	1	1	1	687	13068	$470,448	$470,448

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[(1)] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[(2)] Area includes taper.

Table A-24b. Noise Mitigation Effectiveness Results (16-Foot-High Barrier) Modeled Barrier X

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R74 (R)	71.4	64.5	6.9	1	1	0	687	10320	$371,520	$371,520

Table A-25. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier Y

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R75 (R)	69.2	64	5.2	1	1	0	936	18048	$649,728	$649,728

Table A-26a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier Z

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2041 (No Barrier)	Build Year 2041 (With Barrier)								
R77 (R)	70.4	62.4	8	1	1	1	821	15748	$566,928	$283,464
R78 (R)	69.0	63.2	5.8	1	1	0				

Table A-26b. Noise Mitigation Effectiveness Results (14-Foot-High Barrier) Modeled Barrier Z

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R77 (R)	70.4	64.2	6.2	1	1	0	821	10822	$389,592	$389,592
R78 (R)	69.0	64.8	4.2	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-27a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier AA

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R85 (R)	72.7	64.6	8.1	1	1	1	492	9168	$330,048	$330,048

Table A-27b. Noise Mitigation Effectiveness Results (18-Foot-High Barrier) Modeled Barrier AA

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R85 (R)	72.7	65.9	6.8	1	1	0	492	8184	$294,624	$294,624

Table A-28. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier BB

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R2 (R)	61.3	60	1.3	1	0	0	1480	28928	$1,041,408	NA
R3 (R)	63.3	61.3	2.0	1	0	0				
R4 (R)	66.4	62.3	4.1	1	0	0				

Table A-29. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier CC

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R84 (R)	66.9	66.7	0.2	1	0	0	1384	27008	$972,288	NA

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[(1)] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[(2)] Area includes taper.

Table A-30a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier DD

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R96 (R)	63.4	60	3.4	1	0	0	1350	26328	$947,808	$473,904
R97 (R)	61.1	58.7	2.4	1	0	0				
R98 (R)	63.9	60.5	3.4	1	0	0				
R99 (R)	63.4	60.5	2.9	1	0	0				
R100 (R)	62.8	62.3	0.5	1	0	0				
R101 (R)	62.2	61.2	1	1	0	0				
R102 (R)	62.6	60.6	2	1	0	0				
R103 (R)	67.1	61.8	5.3	1	1	0				
R104 (R)	63.2	62	1.2	1	0	0				
R105 (R)	64.5	62.1	2.4	1	0	0				
R106 (R)	67.7	61.3	6.4	1	1	0				
R180 (R)	64.8	63.8	1	1	0	0				
R181 (R)	64.1	61.4	2.7	1	0	0				
R182 (R)	66.8	62.5	4.3	1	0	0				
R183 (R)	62.8	60	2.8	1	0	0				
R184 (R)	65.8	61.3	4.5	1	0	0				
R185 (R)	62.1	59.1	3	1	0	0				
R186 (R)	64.4	60.4	4	1	0	0				
R187 (R)	62.1	59	3.1	1	0	0				
R188 (R)	61.3	58.4	2.9	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-30b. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier DD

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R96 (R)	63.4	62.3	1.1	1	0	0	840	16128	$580,608	$580,608
R97 (R)	61.1	60	1.1	1	0	0				
R98 (R)	63.9	62.1	1.8	1	0	0				
R99 (R)	63.4	61.4	2	1	0	0				
R100 (R)	62.8	62.5	0.3	1	0	0				
R101 (R)	62.2	61.6	0.6	1	0	0				
R102 (R)	62.6	61.2	1.4	1	0	0				
R103 (R)	67.1	62.2	4.9	1	0	0				
R104 (R)	63.2	62.3	0.9	1	0	0				
R105 (R)	64.5	62.4	2.1	1	0	0				
R106 (R)	67.7	61.6	6.1	1	1	0				
R180 (R)	64.8	64.8	0	1	0	0				
R181 (R)	64.1	63.9	0.2	1	0	0				
R182 (R)	66.8	66.6	0.2	1	0	0				
R183 (R)	62.8	62.5	0.3	1	0	0				
R184 (R)	65.8	65.6	0.2	1	0	0				
R185 (R)	62.1	61.6	0.5	1	0	0				
R186 (R)	64.4	63.6	0.8	1	0	0				
R187 (R)	62.1	61.4	0.7	1	0	0				
R188 (R)	61.3	60.5	0.8	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-31. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier EE

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R107 (R)	70.8	68.9	1.9	1	0	0				
R108 (R)	68.2	65.7	2.5	1	0	0				
R109 (R)	65.8	63.9	1.9	1	0	0				
R110 (R)	63.7	62.1	1.6	1	0	0				
R111 (R)	62.3	60.9	1.4	1	0	0				
R112 (R)	61	59.7	1.3	1	0	0				
R113 (R)	68.9	64	4.9	1	0	0				
R114 (R)	66.4	62.6	3.8	1	0	0				
R115 (R)	65.1	62.1	3	1	0	0				
R116 (R)	63.5	61.2	2.3	1	0	0				
R117 (R)	61.8	59.9	1.9	1	0	0				
R118 (R)	60.5	58.9	1.6	1	0	0	2223	43788	$1,576,368	$1,576,368
R119 (R)	58.3	57.2	1.1	1	0	0				
R120 (R)	68.4	62.4	6	1	1	0				
R121 (R)	65.3	61.5	3.8	1	0	0				
R122 (R)	63.1	60.4	2.7	1	0	0				
R123 (R)	61.7	59.5	2.2	1	0	0				
R124 (R)	60.8	58.9	1.9	1	0	0				
R125 (R)	58.7	57.5	1.2	1	0	0				
R126 (R)	58.7	57.4	1.3	1	0	0				
R127 (R)	66.2	61.3	4.9	1	0	0				
R128 (R)	65.3	61.3	4	1	0	0				
R129 (R)	63.7	60.5	3.2	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-31. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier EE CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R130 (R)	61.5	59.4	2.1	1	0	0				
R131 (R)	60.9	59	1.9	1	0	0				
R132 (R)	59	57.7	1.3	1	0	0				
R133 (R)	59.1	57.8	1.3	1	0	0				
R134 (R)	62.3	60.3	2	1	0	0				
R135 (R)	61.1	59.8	1.3	1	0	0				
R136 (R)	58.3	57.5	0.8	1	0	0				
R137 (R)	57.9	57.2	0.7	1	0	0				
R138 (R)	57.2	56.6	0.6	1	0	0				
R139 (R)	57	56.5	0.5	1	0	0				
R140 (R)	62.5	61.7	0.8	1	0	0				
R141 (R)	60.9	60.1	0.8	1	0	0				
R142 (R)	60.6	60	0.6	1	0	0				
R143 (R)	61.6	61.3	0.3	1	0	0				
R144 (R)	60.9	60.6	0.3	1	0	0				
R145 (R)	58.2	57.8	0.4	1	0	0				
R146 (R)	56.8	56.4	0.4	1	0	0				
R147 (R)	63.5	63.4	0.1	1	0	0				
R148 (R)	59	58.7	0.3	1	0	0				
R189 (R)	59.8	58.8	1	1	0	0				
R190 (R)	58.6	57.9	0.7	1	0	0				
R191 (R)	57.4	56.8	0.6	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-32a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier FF

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R149 (R)	68	66.1	1.9	1	0	0				
R150 (R)	62.7	61.5	1.2	1	0	0				
R151 (R)	59.7	58.2	1.5	1	0	0				
R152 (R)	67.9	63.1	4.8	1	0	0				
R153 (R)	65.7	62.1	3.6	1	0	0				
R154 (R)	63.5	61.1	2.4	1	0	0				
R155 (R)	62	60.4	1.6	1	0	0				
R156 (R)	67.8	59.7	8.1	1	1	1	834	16008	$576,288	$82,327
R157 (R)	63.8	60.8	3	1	0	0				
R158 (R)	69.5	60.9	8.6	1	1	1				
R159 (R)	70.5	61.4	9.1	1	1	1				
R160 (R)	67	61.2	5.8	1	1	0				
R161 (R)	71.5	62.2	9.3	1	1	1				
R162 (R)	66.7	60.6	6.1	1	1	0				
R163 (R)	67.7	62.5	5.2	1	1	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-32b. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier FF

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R149 (R)	68	66.1	1.9	1	0	0				
R150 (R)	62.7	62	0.7	1	0	0				
R151 (R)	59.7	59	0.7	1	0	0				
R152 (R)	67.9	63.4	4.5	1	0	0				
R153 (R)	65.7	62.6	3.1	1	0	0				
R154 (R)	63.5	62.2	1.3	1	0	0				
R155 (R)	62	61.2	0.8	1	0	0				
R156 (R)	67.8	61	6.8	1	1	0	469	8708	$313,488	$78,372
R157 (R)	63.8	62.6	1.2	1	0	0				
R158 (R)	69.5	62.3	7.2	1	1	1				
R159 (R)	70.5	63.5	7	1	1	0				
R160 (R)	67	63.5	3.5	1	0	0				
R161 (R)	71.5	66.3	5.2	1	1	0				
R162 (R)	66.7	64.5	2.2	1	0	0				
R163 (R)	67.7	66.9	0.8	1	0	0				

Table A-33a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier GG

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R165 (R)	70.4	62.8	7.6	1	1	1	716	13648	$491,328	$491,328

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-33b. Noise Mitigation Effectiveness Results (16-Foot-High Barrier) Modeled Barrier GG

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R165 (R)	70.4	64.2	6.2	1	1	0	716	10784	$388,224	$388,224

Table A-34a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier HH

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R166 (R)	77.3	65.4	11.9	1	1	1	356	6448	$232,128	$232,128

Table A-34b. Noise Mitigation Effectiveness Results (14-Foot-High Barrier) Modeled Barrier HH

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R166 (R)	77.3	72.5	4.8	1	0	1	356	4312	$155,232	NA

Table A-35. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier II

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[(1)]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [(2)]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R167 (R)	73.4	66.7	6.7	1	1	-0.3	588	11088	$399,168	$399,168

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[(1)] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[(2)] Area includes taper.

Table A-36. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier JJ

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R164 (R)	66.5	63.3	3.2	1	0	0	1312	25568	$920,448	NA

Table A-37a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R163 (R)	67.7	63.5	4.2	1	0	0	4630	91928	$3,309,408	$87,090
R192 (R)	57.4	55.3	2.1	1	0	0				
R193 (R)	57.8	55.7	2.1	1	0	0				
R194 (R)	58.2	55.8	2.4	1	0	0				
R195 (R)	58.1	55.3	2.8	1	0	0				
R196 (R)	58.3	55.2	3.1	1	0	0				
R197 (R)	58.7	55.5	3.2	1	0	0				
R198 (R)	63.5	58.6	4.9	1	0	0				
R199 (R)	62.5	57.9	4.6	1	0	0				
R200 (R)	62.3	57.8	4.5	1	0	0				
R201 (R)	76.1	60.7	15.4	1	1	1				
R203 (R)	64.6	59.5	5.1	1	1	0				
R204 (R)	63.3	60.6	2.7	1	0	0				
R205 (R)	62.5	58.7	3.8	1	0	0				
R206 (R)	60.5	57.3	3.2	1	0	0				
R207 (R)	59	56.8	2.2	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-37a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R208 (R)	57.8	55.8	2	1	0	0				
R209 (R)	57.5	56.5	1	1	0	0				
R210 (R)	58.7	56.1	2.6	1	0	0				
R211 (R)	61.2	57.6	3.6	1	0	0				
R212 (R)	61.5	57.4	4.1	1	0	0				
R213 (R)	63.9	58.8	5.1	1	1	0				
R214 (R)	65.3	59.6	5.7	1	1	0				
R215 (R)	71.4	61.7	9.7	1	1	1				
R216 (R)	67.9	61.4	6.5	1	1	0				
R217 (R)	66.8	61.2	5.6	1	1	0				
R218 (R)	65.6	60.8	4.8	1	0	0				
R219 (R)	72	61.7	10.3	1	1	1				
R220 (R)	71.9	61.8	10.1	1	1	1				
R221 (R)	72.1	61.8	10.3	1	1	1				
R222 (R)	71.9	62.1	9.8	1	1	1				
R223 (R)	66	59.5	6.5	1	1	0				
R224 (R)	65.7	60.2	5.5	1	1	0				
R225 (R)	59.2	56.4	2.8	1	0	0				
R226 (R)	60.9	57.3	3.6	1	0	0				
R227 (R)	62.4	58.3	4.1	1	0	0				
R228 (R)	63.4	59.5	3.9	1	0	0				
R229 (R)	60.9	57.5	3.4	1	0	0				
R230 (R)	62.9	59.6	3.3	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-37a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R231 (R)	64	60.3	3.7	1	0	0				
R232 (R)	58.1	55.3	2.8	1	0	0				
R233 (R)	58	55.4	2.6	1	0	0				
R234 (R)	57.6	55.3	2.3	1	0	0				
R235 (R)	58.4	56	2.4	1	0	0				
R236 (R)	71.7	62.5	9.2	1	1	1				
R237 (R)	69.3	62.3	7	1	1	0				
R238 (R)	66.9	61.4	5.5	1	1	0				
R239 (R)	64.9	60.8	4.1	1	0	0				
R240 (R)	61.7	58.5	3.2	1	0	0				
R241 (R)	70.5	62.3	8.2	1	1	1				
R242 (R)	66.2	62	4.2	1	0	0				
R243 (R)	59.9	57.6	2.3	1	0	0				
R244 (R)	70.4	62	8.4	1	1	1				
R245 (R)	74.3	63.1	11.2	1	1	1				
R246 (R)	71.5	63.2	8.3	1	1	1				
R247 (R)	67.9	62.6	5.3	1	1	0				
R248 (R)	66.5	62.4	4.1	1	0	0				
R249 (R)	64.4	61.5	2.9	1	0	0				
R250 (R)	63.2	60.9	2.3	1	0	0				
R251 (R)	68.9	63.2	5.7	1	1	0				
R252 (R)	60.6	59.4	1.2	8	0	0				
R253 (R)	58.4	56.8	1.6	8	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-37a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R254 (R)	66.6	63.3	3.3	1	0	0				
R255 (R)	60.8	58.6	2.2	1	0	0				
R256 (R)	67.6	62.5	5.1	1	1	0				
R257 (R)	56.6	55.1	1.5	1	0	0				
R258 (R)	57.9	56.4	1.5	1	0	0				
R264 (R)	50.4	50.2	0.2	1	0	0				
R330 (R)	58	56	2	1	0	0				
R331 (R)	56.5	54.8	1.7	1	0	0				
R332 (R)	57.2	55.3	1.9	1	0	0				
R333 (R)	58.6	56.5	2.1	1	0	0				
R334 (R)	57.7	55.8	1.9	1	0	0				
R335 (R)	59.3	57	2.3	1	0	0				
R336 (R)	58	56.1	1.9	1	0	0				
R337 (R)	71.4	62.2	9.2	1	1	1				
R343 (R)	75	60.9	14.1	1	1	1				
R344 (R)	75.3	60.9	14.4	1	1	1				
R345 (R)	75.7	60.6	15.1	1	1	1				
R346 (R)	76.3	61.3	15	1	1	1				
R347 (R)	76.6	61	15.6	1	1	1				
R348 (R)	67.8	60.3	7.5	1	1	1				
R349 (R)	66.4	59.6	6.8	1	1	0				
R350 (R)	65.5	59	6.5	1	1	0				
R351 (R)	65	58.9	6.1	1	1	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-37a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R352 (R)	64.7	58.7	6	1	1	0				
R353 (R)	76.4	61.4	15	2	2	2				
R354 (R)	70.1	61	9.1	2	2	2				
R355 (R)	59.4	57.8	1.6	1	0	0				
R356 (R)	59.7	58.3	1.4	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-37b. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R163 (R)	67.7	67.7	0	1	0	0				
R192 (R)	57.4	57	0.4	1	0	0				
R193 (R)	57.8	57.4	0.4	1	0	0				
R194 (R)	58.2	57.6	0.6	1	0	0				
R195 (R)	58.1	57.4	0.7	1	0	0				
R196 (R)	58.3	57.4	0.9	1	0	0				
R197 (R)	58.7	57.5	1.2	1	0	0				
R198 (R)	63.5	62.3	1.2	1	0	0				
R199 (R)	62.5	60.6	1.9	1	0	0				
R200 (R)	62.3	59.9	2.4	1	0	0				
R201 (R)	76.1	62.1	14	1	1	1				
R203 (R)	64.6	60.3	4.3	1	0	0	3318	65688	$2,364,768	$81,544
R204 (R)	63.3	59.5	3.8	1	0	0				
R205 (R)	62.5	59.2	3.3	1	0	0				
R206 (R)	60.5	57.9	2.6	1	0	0				
R207 (R)	59	57.1	1.9	1	0	0				
R208 (R)	57.8	56.3	1.5	1	0	0				
R209 (R)	57.5	56.8	0.7	1	0	0				
R210 (R)	58.7	56.3	2.4	1	0	0				
R211 (R)	61.2	57.8	3.4	1	0	0				
R212 (R)	61.5	57.6	3.9	1	0	0				
R213 (R)	63.9	59.2	4.7	1	0	0				
R214 (R)	65.3	60	5.3	1	1	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-37b. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R215 (R)	71.4	61.9	9.5	1	1	1				
R216 (R)	67.9	61.5	6.4	1	1	0				
R217 (R)	66.8	61.3	5.5	1	1	0				
R218 (R)	65.6	60.8	4.8	1	0	0				
R219 (R)	72	61.8	10.2	1	1	1				
R220 (R)	71.9	61.8	10.1	1	1	1				
R221 (R)	72.1	61.9	10.2	1	1	1				
R222 (R)	71.9	62.2	9.7	1	1	1				
R223 (R)	66	59.6	6.4	1	1	0				
R224 (R)	65.7	60.3	5.4	1	1	0				
R225 (R)	59.2	56.4	2.8	1	0	0				
R226 (R)	60.9	57.3	3.6	1	0	0				
R227 (R)	62.4	58.3	4.1	1	0	0				
R228 (R)	63.4	59.5	3.9	1	0	0				
R229 (R)	60.9	57.6	3.3	1	0	0				
R230 (R)	62.9	59.6	3.3	1	0	0				
R231 (R)	64	60.3	3.7	1	0	0				
R232 (R)	58.1	55.5	2.6	1	0	0				
R233 (R)	58	55.5	2.5	1	0	0				
R234 (R)	57.6	55.4	2.2	1	0	0				
R235 (R)	58.4	56.1	2.3	1	0	0				
R236 (R)	71.7	62.5	9.2	1	1	1				
R237 (R)	69.3	62.3	7	1	1	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-37b. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R238 (R)	66.9	61.4	5.5	1	1	0				
R239 (R)	64.9	60.8	4.1	1	0	0				
R240 (R)	61.7	58.5	3.2	1	0	0				
R241 (R)	70.5	62.3	8.2	1	1	1				
R242 (R)	66.2	62.1	4.1	1	0	0				
R243 (R)	59.9	57.7	2.2	1	0	0				
R244 (R)	70.4	62	8.4	1	1	1				
R245 (R)	74.3	63.1	11.2	1	1	1				
R246 (R)	71.5	63.2	8.3	1	1	1				
R247 (R)	67.9	62.6	5.3	1	1	0				
R248 (R)	66.5	62.5	4	1	0	0				
R249 (R)	64.4	61.5	2.9	1	0	0				
R250 (R)	63.2	61	2.2	1	0	0				
R251 (R)	68.9	63.2	5.7	1	1	0				
R252 (R)	60.6	59.7	0.9	8	0	0				
R253 (R)	58.4	57.4	1	8	0	0				
R254 (R)	66.6	63.6	3	1	0	0				
R255 (R)	60.8	59.6	1.2	1	0	0				
R256 (R)	67.6	63.5	4.1	1	0	0				
R257 (R)	56.6	56.3	0.3	1	0	0				
R258 (R)	57.9	57.7	0.2	1	0	0				
R264 (R)	50.4	50.2	0.2	1	0	0				
R330 (R)	58	57.2	0.8	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-37b. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R331 (R)	56.5	55.7	0.8	1	0	0				
R332 (R)	57.2	56.4	0.8	1	0	0				
R333 (R)	58.6	57.8	0.8	1	0	0				
R334 (R)	57.7	57.1	0.6	1	0	0				
R335 (R)	59.3	58.7	0.6	1	0	0				
R336 (R)	58	57.6	0.4	1	0	0				
R337 (R)	71.4	67.1	4.3	1	0	0				
R343 (R)	75	64.8	10.2	1	1	1				
R344 (R)	75.3	63.9	11.4	1	1	1				
R345 (R)	75.7	62.8	12.9	1	1	1				
R346 (R)	76.3	62.2	14.1	1	1	1				
R347 (R)	76.6	61.7	14.9	1	1	1				
R348 (R)	67.8	64.6	3.2	1	0	0				
R349 (R)	66.4	63.3	3.1	1	0	0				
R350 (R)	65.5	62.2	3.3	1	0	0				
R351 (R)	65	61.4	3.6	1	0	0				
R352 (R)	64.7	60.9	3.8	1	0	0				
R353 (R)	76.4	61.7	14.7	2	2	2				
R354 (R)	70.1	61.3	8.8	2	2	2				
R355 (R)	59.4	58.7	0.7	1	0	0				
R356 (R)	59.7	58.8	0.9	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-37c. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R163 (R)	67.7	67.6	0.1	1	0	0				
R192 (R)	57.4	56.7	0.7	1	0	0				
R193 (R)	57.8	57	0.8	1	0	0				
R194 (R)	58.2	57.3	0.9	1	0	0				
R195 (R)	58.1	56.9	1.2	1	0	0				
R196 (R)	58.3	56.8	1.5	1	0	0				
R197 (R)	58.7	56.9	1.8	1	0	0				
R198 (R)	63.5	60.3	3.2	1	0	0				
R199 (R)	62.5	59.3	3.2	1	0	0				
R200 (R)	62.3	58.9	3.4	1	0	0				
R201 (R)	76.1	61.7	14.4	1	1	1				
R203 (R)	64.6	59.8	4.8	1	0	0	2035	40028	$1,441,008	$42,383
R204 (R)	63.3	59.6	3.7	1	0	0				
R205 (R)	62.5	58.5	4.0	1	0	0				
R206 (R)	60.5	57.7	2.8	1	0	0				
R207 (R)	59.0	57	2.0	1	0	0				
R208 (R)	57.8	56	1.8	1	0	0				
R209 (R)	57.5	56.5	1.0	1	0	0				
R210 (R)	58.7	56.1	2.6	1	0	0				
R211 (R)	61.2	57.7	3.5	1	0	0				
R212 (R)	61.5	57.5	4.0	1	0	0				
R213 (R)	63.9	59	4.9	1	0	0				
R214 (R)	65.3	59.8	5.5	1	1	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-37c. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R215 (R)	71.4	61.9	9.5	1	1	1				
R216 (R)	67.9	61.7	6.2	1	1	0				
R217 (R)	66.8	61.2	5.6	1	1	0				
R218 (R)	65.6	60.5	5.1	1	1	0				
R219 (R)	72.0	61.8	10.2	1	1	1				
R220 (R)	71.9	61.8	10.1	1	1	1				
R221 (R)	72.1	62.1	10.0	1	1	1				
R222 (R)	71.9	62.2	9.7	1	1	1				
R223 (R)	66.0	59.8	6.2	1	1	0				
R224 (R)	65.7	60.2	5.5	1	1	0				
R225 (R)	59.2	56.2	3.0	1	0	0				
R226 (R)	60.9	57.1	3.8	1	0	0				
R227 (R)	62.4	58.2	4.2	1	0	0				
R228 (R)	63.4	59.0	4.4	1	0	0				
R229 (R)	60.9	57.6	3.3	1	0	0				
R230 (R)	62.9	59.3	3.6	1	0	0				
R231 (R)	64.0	60.3	3.7	1	0	0				
R232 (R)	58.1	55.4	2.7	1	0	0				
R233 (R)	58.0	55.6	2.4	1	0	0				
R234 (R)	57.6	55.6	2.0	1	0	0				
R235 (R)	58.4	56.2	2.2	1	0	0				
R236 (R)	71.7	62.6	9.1	1	1	1				
R237 (R)	69.3	62.7	6.6	1	1	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-37c. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R238 (R)	66.9	61.7	5.2	1	1	0				
R239 (R)	64.9	60.9	4.0	1	0	0				
R240 (R)	61.7	58.6	3.1	1	0	0				
R241 (R)	70.5	62.9	7.6	1	1	1				
R242 (R)	66.2	62.2	4.0	1	0	0				
R243 (R)	59.9	57.9	2.0	1	0	0				
R244 (R)	70.4	63.0	7.4	1	1	1				
R245 (R)	74.3	64.9	9.4	1	1	1				
R246 (R)	71.5	65.0	6.5	1	1	0				
R247 (R)	67.9	63.4	4.5	1	0	0				
R248 (R)	66.5	62.6	3.9	1	0	0				
R249 (R)	64.4	61.7	2.7	1	0	0				
R250 (R)	63.2	61.2	2.0	1	0	0				
R251 (R)	68.9	68.9	0.0	1	0	0				
R252 (R)	60.6	60.5	0.1	8	0	0				
R253 (R)	58.4	58.3	0.1	8	0	0				
R254 (R)	66.6	66.6	0.0	1	0	0				
R255 (R)	60.8	60.7	0.1	1	0	0				
R256 (R)	67.6	67.6	0.0	1	0	0				
R257 (R)	56.6	56.6	0.0	1	0	0				
R258 (R)	57.9	57.9	0.0	1	0	0				
R264 (R)	50.4	50.4	0.0	1	0	0				
R330 (R)	58.0	57.9	0.1	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-37c. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier LL CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R331 (R)	56.5	56.4	0.1	1	0	0				
R332 (R)	57.2	57.1	0.1	1	0	0				
R333 (R)	58.6	58.6	0.0	1	0	0				
R334 (R)	57.7	57.6	0.1	1	0	0				
R335 (R)	59.3	59.3	0.0	1	0	0				
R336 (R)	58.0	58.0	0.0	1	0	0				
R337 (R)	71.4	63.5	7.9	1	1	1				
R343 (R)	75.0	61.9	13.1	1	1	1				
R344 (R)	75.3	61.7	13.6	1	1	1				
R345 (R)	75.7	61.6	14.1	1	1	1				
R346 (R)	76.3	62.1	14.2	1	1	1				
R347 (R)	76.6	62.1	14.5	1	1	1				
R348 (R)	67.8	61.2	6.6	1	1	0				
R349 (R)	66.4	59.9	6.5	1	1	0				
R350 (R)	65.5	59.4	6.1	1	1	0				
R351 (R)	65	59.2	5.8	1	1	0				
R352 (R)	64.7	59.1	5.6	1	1	0				
R353 (R)	76.4	61.8	14.6	2	2	2				
R354 (R)	70.1	61.4	8.7	2	2	2				
R355 (R)	59.4	58.3	1.1	1	0	0				
R356 (R)	59.7	58.2	1.5	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-38a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier QQ

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R267 (C)	60.1	59.1	1	1	0	0				
R268 (C)	67.1	60.3	6.8	1	1	0				
R269 (C)	68.8	59.8	9	1	1	1				
R270 (R)	56.7	55.7	1	1	0	0				
R271 (R)	56.6	55.5	1.1	1	0	0				
R272 (R)	57.5	56.4	1.1	1	0	0				
R273 (R)	56.9	55.8	1.1	1	0	0				
R174 (R)	57.3	56.2	1.1	1	0	0				
R275 (R)	57.7	56.4	1.3	1	0	0				
R276 (R)	58.3	57	1.3	1	0	0				
R277 (R)	58.1	56.8	1.3	1	0	0				
R278 (R)	58.5	57.1	1.4	1	0	0	2848	56288	$2,026,368	$106,651
R279 (R)	59.1	57.7	1.4	1	0	0				
R280 (R)	58.8	57.6	1.2	1	0	0				
R281 (R)	57	55.8	1.2	1	0	0				
R282 (R)	57.5	56.1	1.4	1	0	0				
R283 (R)	58.6	57.1	1.5	1	0	0				
R284 (R)	58.5	57	1.5	1	0	0				
R285 (R)	57.7	55.9	1.8	1	0	0				
R286 (R)	56.8	54.5	2.3	1	0	0				
R287 (R)	56.2	54.7	1.5	1	0	0				
R288 (R)	56	54.4	1.6	1	0	0				
R289 (R)	56.1	54.2	1.9	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-38a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier QQ CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R290 (R)	56	53.5	2.5	1	0	0				
R291 (R)	58.6	54.2	4.4	2	0	0				
R292 (R)	58.1	53.9	4.2	1	0	0				
R293 (R)	57.9	53.7	4.2	1	0	0				
R294 (R)	57.8	53.7	4.1	1	0	0				
R295 (R)	57.7	53.7	4	1	0	0				
R296 (R)	57.6	53.7	3.9	1	0	0				
R297 (R)	57.3	53.4	3.9	1	0	0				
R298 (R)	57	53.3	3.7	1	0	0				
R299 (R)	56.9	53.3	3.6	1	0	0				
R300 (R)	58.4	53.9	4.5	1	0	0				
R301 (R)	58	53.8	4.2	1	0	0				
R302 (R)	58.4	53.8	4.6	1	0	0				
R303 (R)	58.6	54	4.6	1	0	0				
R304 (R)	58.8	54.1	4.7	1	0	0				
R305 (R)	58.6	54.1	4.5	1	0	0				
R306 (R)	58.6	54.3	4.3	1	0	0				
R307 (R)	58.3	54.2	4.1	1	0	0				
R308 (R)	62.5	55.8	6.7	2	2	0				
R309 (R)	63.9	56.6	7.3	2	2	2				
R310 (R)	70	60.2	9.8	1	1	1				
R311 (R)	71.5	62	9.5	1	1	1				
R312 (R)	70.2	61.4	8.8	1	1	1				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-38a. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier QQ CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R313 (R)	68.8	60.9	7.9	1	1	1				
R314 (R)	67.6	60.2	7.4	1	1	1				
R315 (R)	57.7	53.9	3.8	1	0	0				
R316 (R)	61.3	56.3	5	1	1	0				
R317 (R)	60.5	55.9	4.6	1	0	0				
R318 (R)	59.7	55.3	4.4	1	0	0				
R319 (R)	59	54.9	4.1	1	0	0				
R320 (R)	58.2	54.4	3.8	1	0	0				
R321 (R)	59.6	56.1	3.5	1	0	0				
R322 (R)	71.8	65.1	6.7	1	1	0				
R323 (R)	69.9	63.9	6	1	1	0				
R324 (R)	66.3	61.5	4.8	1	0	0				
R325 (R)	63.9	59.7	4.2	1	0	0				
R326 (R)	61.9	58.3	3.6	1	0	0				
R327 (R)	60.3	57.2	3.1	1	0	0				
R328 (R)	58.6	55.9	2.7	1	0	0				
R339 (R)	59.7	54.7	5	2	2	0				
R340 (R)	71	62	9	1	1	1				
R341 (R)	71.9	62.1	9.8	1	1	1				
R342 (R)	67.2	60.1	7.1	1	1	1				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-38b. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier QQ

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R267 (C)	60.1	59.5	0.6	1	0	0				
R268 (C)	67.1	65.5	1.6	1	0	0				
R269 (C)	68.8	67.5	1.3	1	0	0				
R270 (R)	56.7	56	0.7	1	0	0				
R271 (R)	56.6	55.8	0.8	1	0	0				
R272 (R)	57.5	56.8	0.7	1	0	0				
R273 (R)	56.9	56.1	0.8	1	0	0				
R174 (R)	57.3	56.5	0.8	1	0	0				
R275 (R)	57.7	57	0.7	1	0	0				
R276 (R)	58.3	57.5	0.8	1	0	0				
R277 (R)	58.1	57.4	0.7	1	0	0				
R278 (R)	58.5	57.7	0.8	1	0	0	1802	35368	$1,273,248	$90,946
R279 (R)	59.1	58.3	0.8	1	0	0				
R280 (R)	58.8	58.1	0.7	1	0	0				
R281 (R)	57	56.1	0.9	1	0	0				
R282 (R)	57.5	56.6	0.9	1	0	0				
R283 (R)	58.6	57.7	0.9	1	0	0				
R284 (R)	58.5	57.6	0.9	1	0	0				
R285 (R)	57.7	56.6	1.1	1	0	0				
R286 (R)	56.8	55.4	1.4	1	0	0				
R287 (R)	56.2	55.2	1	1	0	0				
R288 (R)	56	55.1	0.9	1	0	0				
R289 (R)	56.1	55.1	1	1	0	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-38b. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier QQ CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R290 (R)	56	54.7	1.3	1	0	0				
R291 (R)	58.6	56.9	1.7	2	0	0				
R292 (R)	58.1	55.5	2.6	1	0	0				
R293 (R)	57.9	55.3	2.6	1	0	0				
R294 (R)	57.8	55.1	2.7	1	0	0				
R295 (R)	57.7	54.8	2.9	1	0	0				
R296 (R)	57.6	54.6	3	1	0	0				
R297 (R)	57.3	54.2	3.1	1	0	0				
R298 (R)	57	54	3	1	0	0				
R299 (R)	56.9	54	2.9	1	0	0				
R300 (R)	58.4	54.6	3.8	1	0	0				
R301 (R)	58	54.5	3.5	1	0	0				
R302 (R)	58.4	54.6	3.8	1	0	0				
R303 (R)	58.6	54.8	3.8	1	0	0				
R304 (R)	58.8	54.9	3.9	1	0	0				
R305 (R)	58.6	54.9	3.7	1	0	0				
R306 (R)	58.6	55.1	3.5	1	0	0				
R307 (R)	58.3	55	3.3	1	0	0				
R308 (R)	62.5	56.8	5.7	2	2	0				
R309 (R)	63.9	57.6	6.3	2	2	0				
R310 (R)	70	60.7	9.3	1	1	1				
R311 (R)	71.5	62.3	9.2	1	1	1				
R312 (R)	70.2	61.8	8.4	1	1	1				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-38b. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier QQ CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R313 (R)	68.8	61.5	7.3	1	1	1				
R314 (R)	67.6	61	6.6	1	1	0				
R315 (R)	57.7	54.7	3	1	0	0				
R316 (R)	61.3	57	4.3	1	0	0				
R317 (R)	60.5	56.7	3.8	1	0	0				
R318 (R)	59.7	56.2	3.5	1	0	0				
R319 (R)	59	55.7	3.3	1	0	0				
R320 (R)	58.2	55.3	2.9	1	0	0				
R321 (R)	59.6	57.5	2.1	1	0	0				
R322 (R)	71.8	65.8	6	1	1	0				
R323 (R)	69.9	64.4	5.5	1	1	0				
R324 (R)	66.3	62.1	4.2	1	0	0				
R325 (R)	63.9	60.6	3.3	1	0	0				
R326 (R)	61.9	59.3	2.6	1	0	0				
R327 (R)	60.3	58.2	2.1	1	0	0				
R328 (R)	58.6	56.9	1.7	1	0	0				
R339 (R)	59.7	57.8	1.9	2	0	0				
R340 (R)	71	62.4	8.6	1	1	1				
R341 (R)	71.9	62.4	9.5	1	1	1				
R342 (R)	67.2	60.8	6.4	1	1	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-38c. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier QQ

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R291 (R)	58.6	58.0	0.6	2	0	0				
R292 (R)	58.1	57.0	1.1	1	0	0				
R293 (R)	57.9	56.7	1.2	1	0	0				
R294 (R)	57.8	56.5	1.3	1	0	0				
R295 (R)	57.7	56.2	1.5	1	0	0				
R296 (R)	57.6	56.1	1.5	1	0	0				
R297 (R)	57.3	55.8	1.5	1	0	0				
R298 (R)	57.0	55.5	1.5	1	0	0				
R299 (R)	56.9	55.4	1.5	1	0	0				
R300 (R)	58.4	56.7	1.7	1	0	0				
R301 (R)	58.0	56.3	1.7	1	0	0				
R302 (R)	58.4	56.4	2.0	1	0	0	900	17328	$623,808	$77,976
R303 (R)	58.6	56.5	2.1	1	0	0				
R304 (R)	58.8	56.7	2.1	1	0	0				
R305 (R)	58.6	56.5	2.1	1	0	0				
R306 (R)	58.6	56.5	2.1	1	0	0				
R307 (R)	58.3	56.4	1.9	1	0	0				
R308 (R)	62.5	60.1	2.4	2	0	0				
R309 (R)	63.9	60.8	3.1	2	0	0				
R310 (R)	70.0	63.6	6.4	1	1	0				
R311 (R)	71.5	63.3	8.2	1	1	1				
R312 (R)	70.2	63.1	7.1	1	1	1				
R313 (R)	68.8	62.8	6.0	1	1	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Table A-38c. Noise Mitigation Effectiveness Results (20-Foot-High Barrier) Modeled Barrier QQ CONTINUED

Receptors	L_{eq} Noise Level (dBA)		Reduction (in dBA) With Barrier	Number of Receptors	Number of Benefited Receptors	Number of Receptors Meeting Design Goal Reduction ≥7 dBA[1]	Length of Barrier (Feet)	Barrier Area (Sq Ft) [2]	Total Cost of Barrier ($36/Sq Ft)	Cost/ Benefited Receptor
	Build Year 2039 (No Barrier)	Build Year 2039 (With Barrier)								
R314 (R)	67.6	62.5	5.1	1	1	0				
R315 (R)	57.7	55.8	1.9	1	0	0				
R316 (R)	61.3	58.4	2.9	1	0	0				
R317 (R)	60.5	58.0	2.5	1	0	0				
R318 (R)	59.7	57.4	2.3	1	0	0				
R319 (R)	59.0	57.0	2.0	1	0	0				
R320 (R)	58.2	56.3	1.9	1	0	0				
R321 (R)	59.6	58.2	1.4	1	0	0				
R322 (R)	71.8	70.9	0.9	1	0	0				
R323 (R)	69.9	69.0	0.9	1	0	0				
R324 (R)	66.3	65.1	1.2	1	0	0				
R325 (R)	63.9	62.8	1.1	1	0	0				
R326 (R)	61.9	60.9	1.0	1	0	0				
R327 (R)	60.3	59.3	1.0	1	0	0				
R328 (R)	58.6	57.8	0.8	1	0	0				
R339 (R)	59.7	59.1	0.6	2	0	0				
R340 (R)	71.0	63.5	7.5	1	1	1				
R341 (R)	71.9	63.3	8.6	1	1	1				
R342 (R)	67.2	62.0	5.2	1	1	0				

(R) Residential; (C) Commercial
NA = not applicable because none of the receptors adjacent to the modeled barrier meet the noise-reduction design goal of at least 7 dBA.
[1] Noise barrier must meet MnDOT's noise-reduction design goal of at least 7 dBA at a minimum of one benefited receptor behind each noise barrier.
[2] Area includes taper.

Appendix B

Additional Exhibits

Document Path: K:\g-m\MnDOT\1642101010\04_Production\01_CAD\GIS\Noise Exhibits\Figure 1 Project Location.mxd

Project Limits

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

EXHIBIT 1: PROJECT LOCATION

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 1/22/2020
Check: JAH 1/22/2020

0 1 2 4 6 8 Miles

1 inch = 2 miles

N W E S

TKDA

Document Path: K:\g-m\MnDOT\1642101\04_Production\01_CAD\GIS\Noise Exhibits\Exhibits 2-19 Existing Conditions.mxd

County Hwy 24

Cannon Falls

Approx. 1000'

R1

R87

R88

R89

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbu

EXHIBIT 2: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

Document Path: K:\g-mlMnDOT\1642101\04_Production\01_CADIGIS\Noise Exhibits\Exhibits 2-19 Existing Conditions.mxd

EXHIBIT 3: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

Approx. 1000'

R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R92

52

County Hwy 14

Approx. 1000'

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS

EXHIBIT 4: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

TKDA

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County Hwy 1

Approx. 1000'

R26 R27 R28 R29 R30 R31 R32 R33 R34 R35 R36 R37 R38 R39 R40 R41 R42 R43 R44 R45 R93

M3

52

R86

Approx. 1000'

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

EXHIBIT 5: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

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County Hwy 1

Approx. 1000'

R48

R46

R47

52

Approx. 1000'

County Hwy 1

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and

EXHIBIT 6: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

Approx. 1000'

R49

R55

R50

R51

R52

R53

R54

Approx. 1000'

County Hwy 9

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and

EXHIBIT 7: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

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EXHIBIT 8: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

Approx. 1000'

Approx. 1000'

County Hwy 8

County Hwy 8

R60

R61

R62

R63

M1

R64

M2

R66

R67

R94

R65

R68

R69

52

52

57

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and

EXHIBIT 9: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

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Approx. 1000'

R73

R70

52

R71

R72

Approx. 1000'

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and

EXHIBIT 10: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

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Approx. 1000'

County Rd 50

R74

R75

R76

R77

R78

52

795 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 205 210

Approx. 1000'

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

EXHIBIT 11: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

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Approx. 1000'

R81

R79

R82

Approx. 1000'

R80

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, a

EXHIBIT 12: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

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EXHIBIT 13: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E W S

TKDA

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County Hwy 68

Approx. 1000'

Zumbrota

R166 R167 R168 R169 R170 R171 R172 R173 R174 R175 R176 R177 R178 R179 R180 R181 R182 R183 R184 R185 R186 R187

1015 1020 1025 1030 1035 1040 1045 1050 1055 1060 1065 1070 1075 1080 1085 1090

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, I

EXHIBIT 14: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

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Zumbrota

Approx. 1000'

R191 R190 R189 R112 R111 R110 R109 R108 R107 R115 R114 R113 R116 R117 R118 R119 R120 R121 R122 R123 R124 R125 R126 R127 R128 R129 R130 R131 R132 R133 R134 R135 R136 R137 R138 R139 R140 R141 R142 R143 R144 R145 R146 R147 R148 R149 R150 R151 R152 R153 R154 R155 R156 R157 R158 R159 R160 R161 R162 R163 R192 R193

R180 R182 R184 R181 R183 R186 R185 R187 R96 R98 R99 R188 R97 R102 R104 R101 R100 R103 R106 R105

1090 1090 1095 1095 1100 1100 1105 1105 1110 1110 1115 1115 1620 1625 1630 1635

52 52 60 860A

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS U-

EXHIBIT 15: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 100 200 400 600 800 Feet

1 inch = 200 feet

N E S W

TKDA

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Zumbrota

Approx. 1000'

R192 R193 R194 R195 R196 R197 R198 R199 R200 R201 R203 R204 R205 R206 R207 R208 R209 R210 R211 R212 R213 R214 R215 R216 R217 R218 R219 R220 R221 R222 R223 R224 R225 R226 R227 R228 R229 R230 R231 R232 R233 R234 R235 R236 R237 R238 R239 R240 R241 R242 R243 R244 R245 R246 R247 R248 R249 R250 R337 R343 R344 R345 R346 R347 R348 R349 R350 R351 R352 R353 R354 R355 R356

1120 1125 1130 1135 1140

52

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, a

EXHIBIT 16: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 75 150 300 450 600 Feet

1 inch = 150 feet

N E S W

TKDA

Approx. 1000'

R331 R332 R330 R334 R333 R336 R335 R257 R258 R266 R253 R252 R255 R265 R267 R270 R271 R273 R272 R274 R275 R277 R276 R278 R279 R280 R281 R282 R287 R288 R289 R290 R286 R283 R284 R285 R291 R339 R264 R268 R269 R254 R256 R251

Zumbrota

1145 1150 1155 1160 1165 1170

1145 1150 1155 1160 1165 1170

County Hwy 10

R260 R259 R261 R262 R263

Legend

- Monitor
- Receptor (No Impact)
- Receptor (Impacted)
- Construction Limit
- 1000' Noise Buffer Approx.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, a

EXHIBIT 17: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 100 200 400 600 800 Feet

1 inch = 200 feet

N E S W

TKDA

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EXHIBIT 18: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 100 200 400 600 800 Feet

1 inch = 200 feet

N E S W

TKDA

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EXHIBIT 19: EXISTING CONDITION (2021)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 4/28/2020
Check: JAH 4/28/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

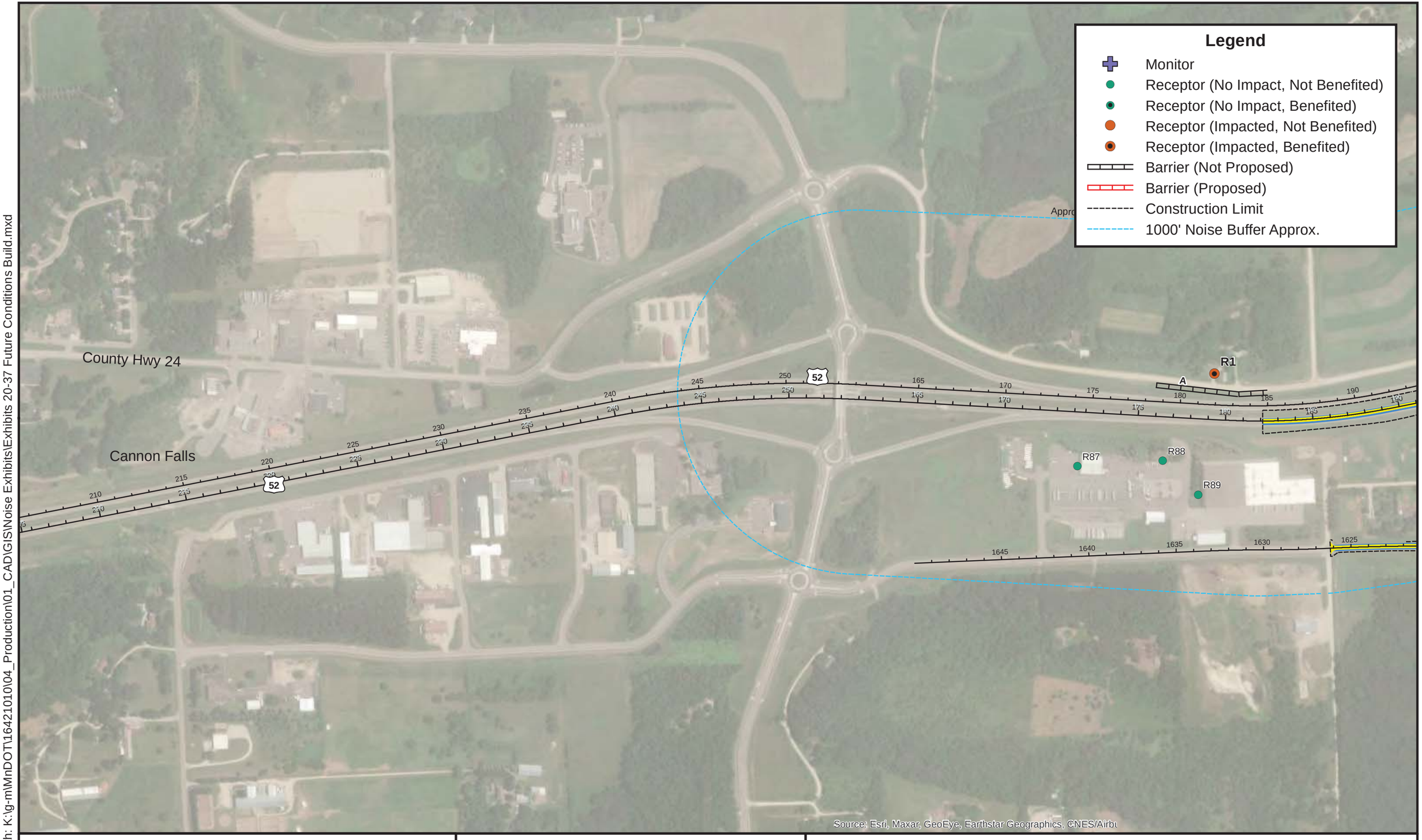

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EXHIBIT 20: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/19/2020
Check: JAH 8/19/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N W E S

TKDA

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Legend

- Monitor
- Receptor (No Impact, Not Benefited)
- Receptor (No Impact, Benefited)
- Receptor (Impacted, Not Benefited)
- Receptor (Impacted, Benefited)
- Barrier (Not Proposed)
- Barrier (Proposed)
- Construction Limit
- 1000' Noise Buffer Approx.

Approx. 1000'

R2 R3 R4 R5 R6 R7 R8 R90 R91

BB B C D

52

EXHIBIT 21: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/19/2020
Check: JAH 8/19/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

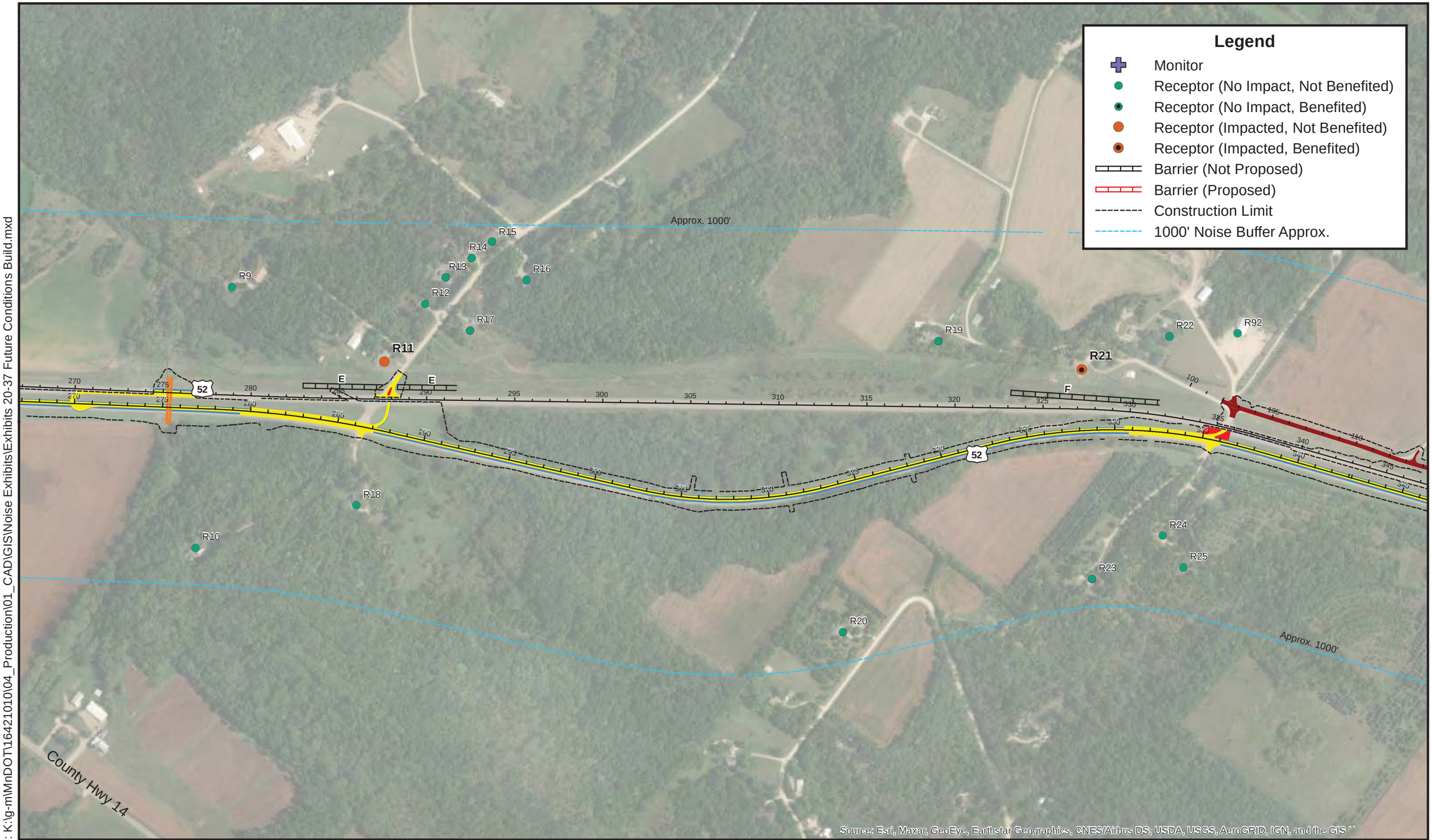

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EXHIBIT 22: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/19/2020
Check: JAH 8/19/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

TKDA

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EXHIBIT 23: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/19/2020
Check: JAH 8/19/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

TKDA

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EXHIBIT 24: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/19/2020
Check: JAH 8/19/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

TKDA

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EXHIBIT 25: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/19/2020
Check: JAH 8/19/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E W S

TKDA

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EXHIBIT 26: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/19/2020
Check: JAH 8/19/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

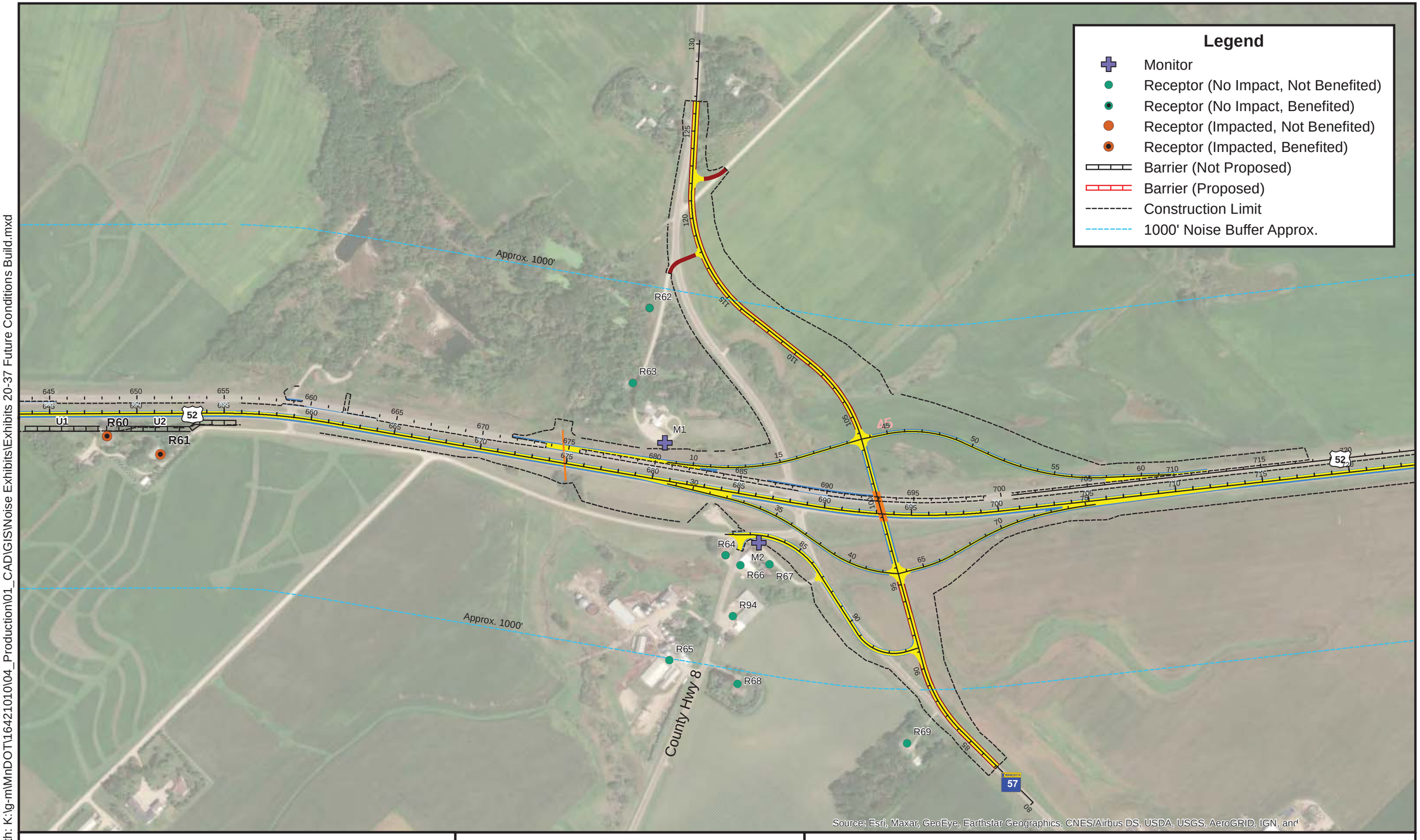

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EXHIBIT 27: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/19/2020
Check: JAH 8/19/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

TKDA

EXHIBIT 28: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/19/2020
Check: JAH 8/19/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

TKDA

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EXHIBIT 29: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/19/2020
Check: JAH 8/19/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

TKDA

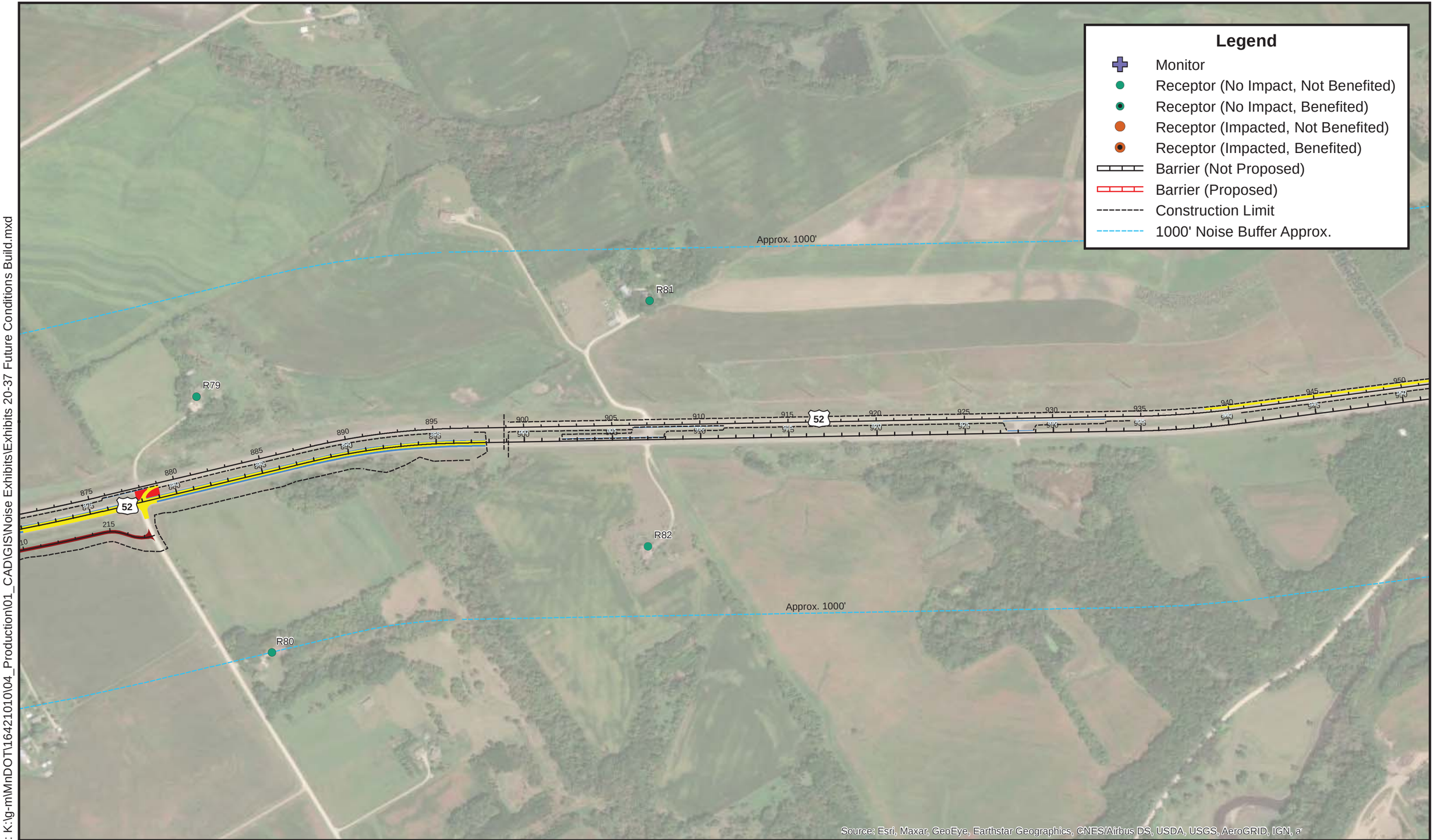

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EXHIBIT 30: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

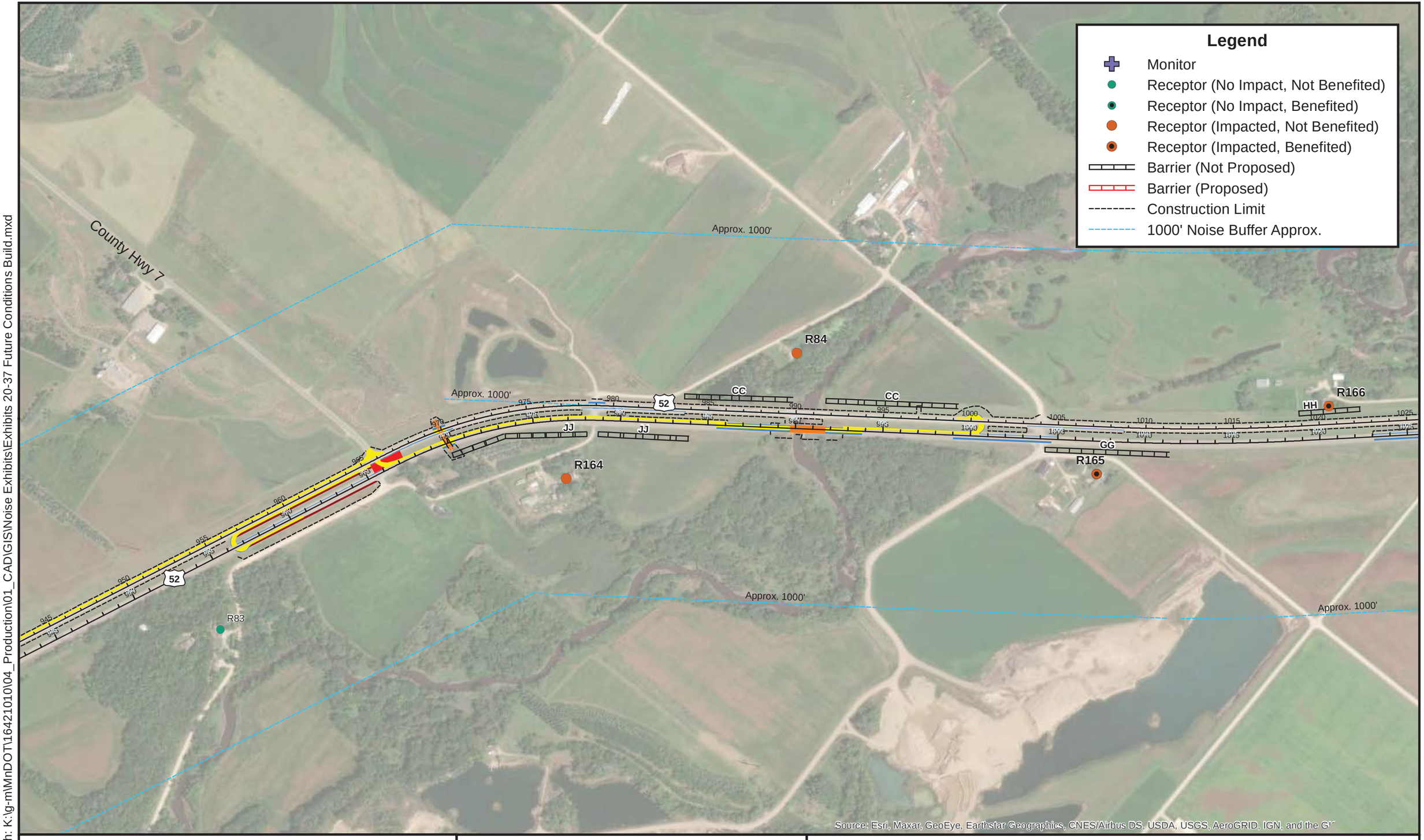
Drawn: RJR 8/19/2020
Check: JAH 8/19/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the G

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EXHIBIT 31: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/20/2020
Check: JAH 8/20/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

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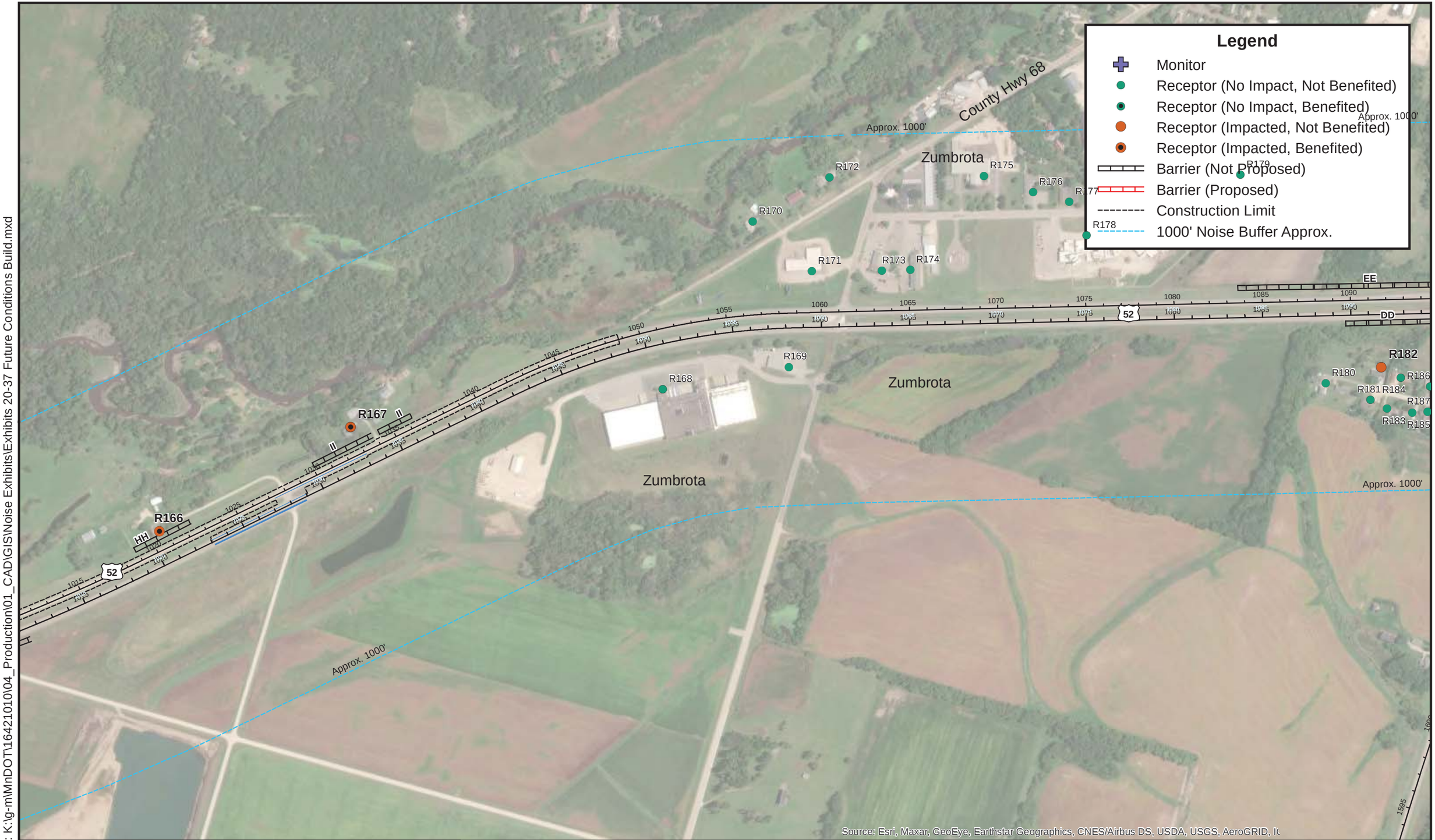

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, I

EXHIBIT 32: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/20/2020
Check: JAH 8/20/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

TKDA

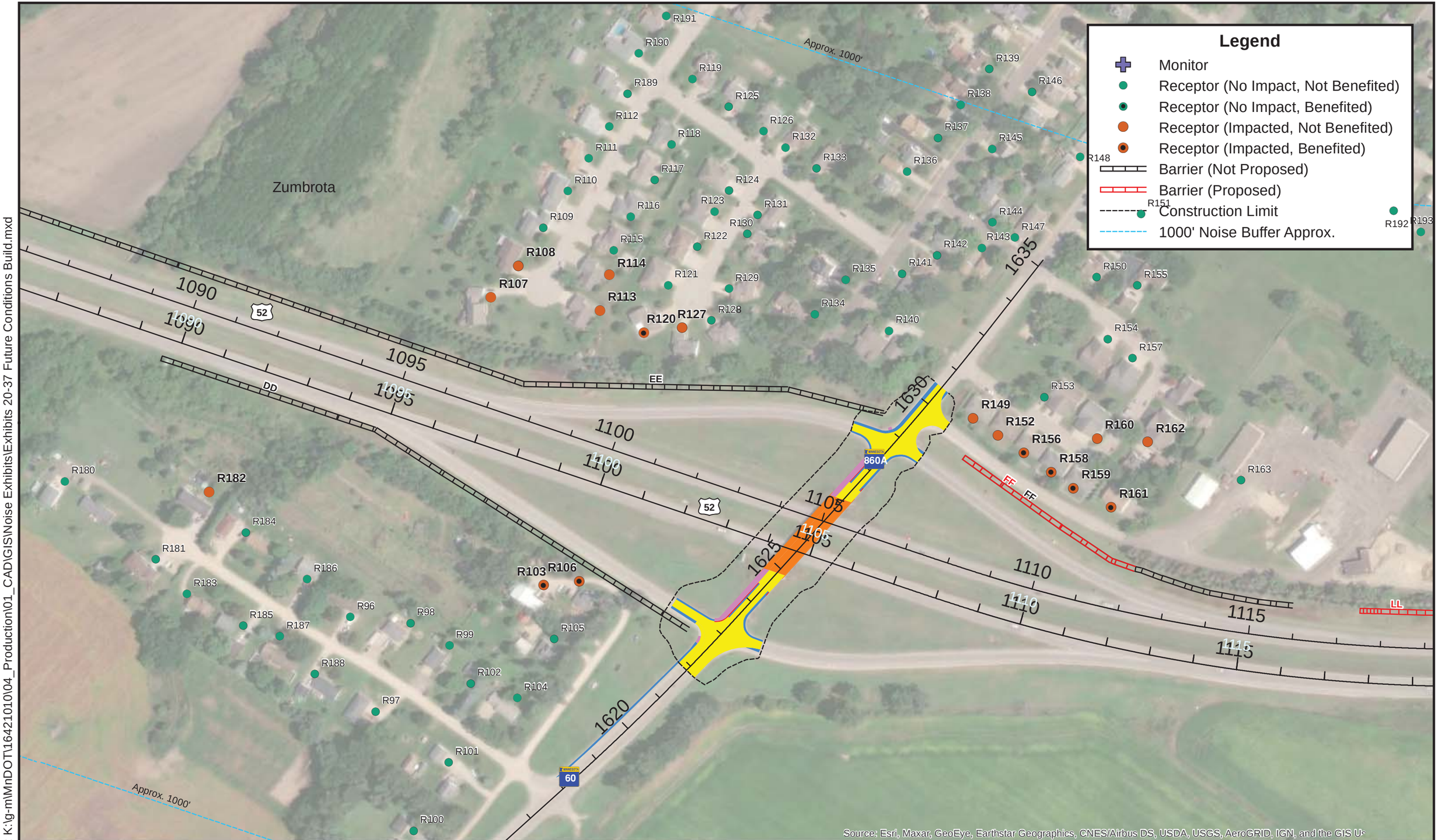

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EXHIBIT 33: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/20/2020
Check: JAH 8/20/2020

0 100 200 400 600 800 Feet

1 inch = 200 feet

TKDA

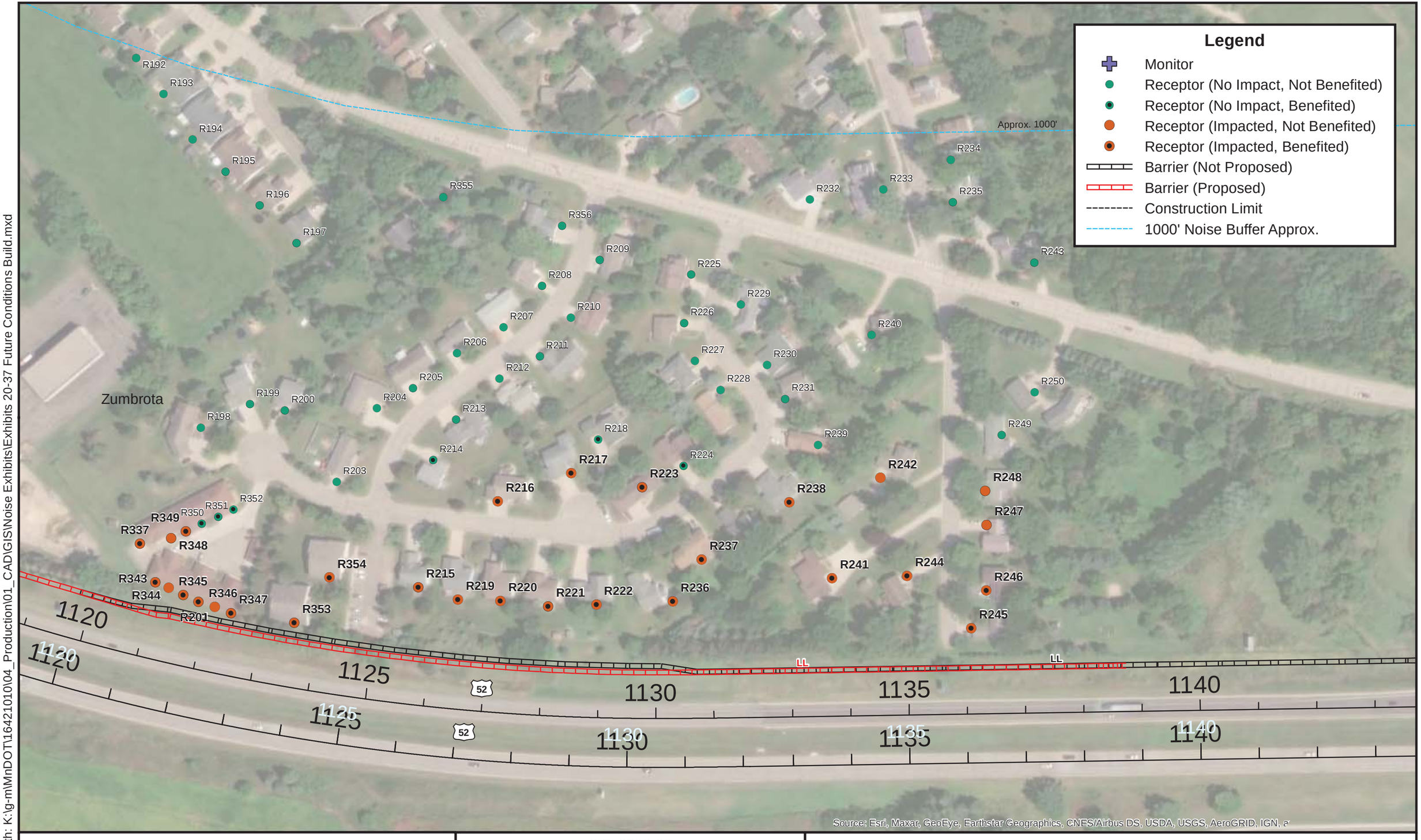

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EXHIBIT 34: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/20/2020
Check: JAH 8/20/2020

0 75 150 300 450 600 Feet

1 inch = 150 feet

N E S W

TKDA

Approx. 1000'

R331
R332
R330
R253
R334
R333
R336
R335
R257
R266
R258
R267
R252
R255
R265
R264
R254
R256
R251
R268
R269
R263
R260
R261
R259
R262

Zumbrota

County Hwy 10

LL

52

1145 1150 1155 1160 1165 1170

Legend

- Monitor
- Receptor (No Impact, Not Benefited)
- Receptor (No Impact, Benefited)
- Receptor (Impacted, Not Benefited)
- Receptor (Impacted, Benefited)
- Barrier (Not Proposed)
- Barrier (Proposed)
- Construction Limit
- 1000' Noise Buffer Approx.

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, a

EXHIBIT 35: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/20/2020
Check: JAH 8/20/2020

0 100 200 400 600 800 Feet

1 inch = 200 feet

N E S W

TKDA

Document Path: K:\g-m\MnDOT\16421010\04_Production\01_CAD\GIS\Noise Exhibits\Exhibits 20-37 Future Conditions Build.mxd

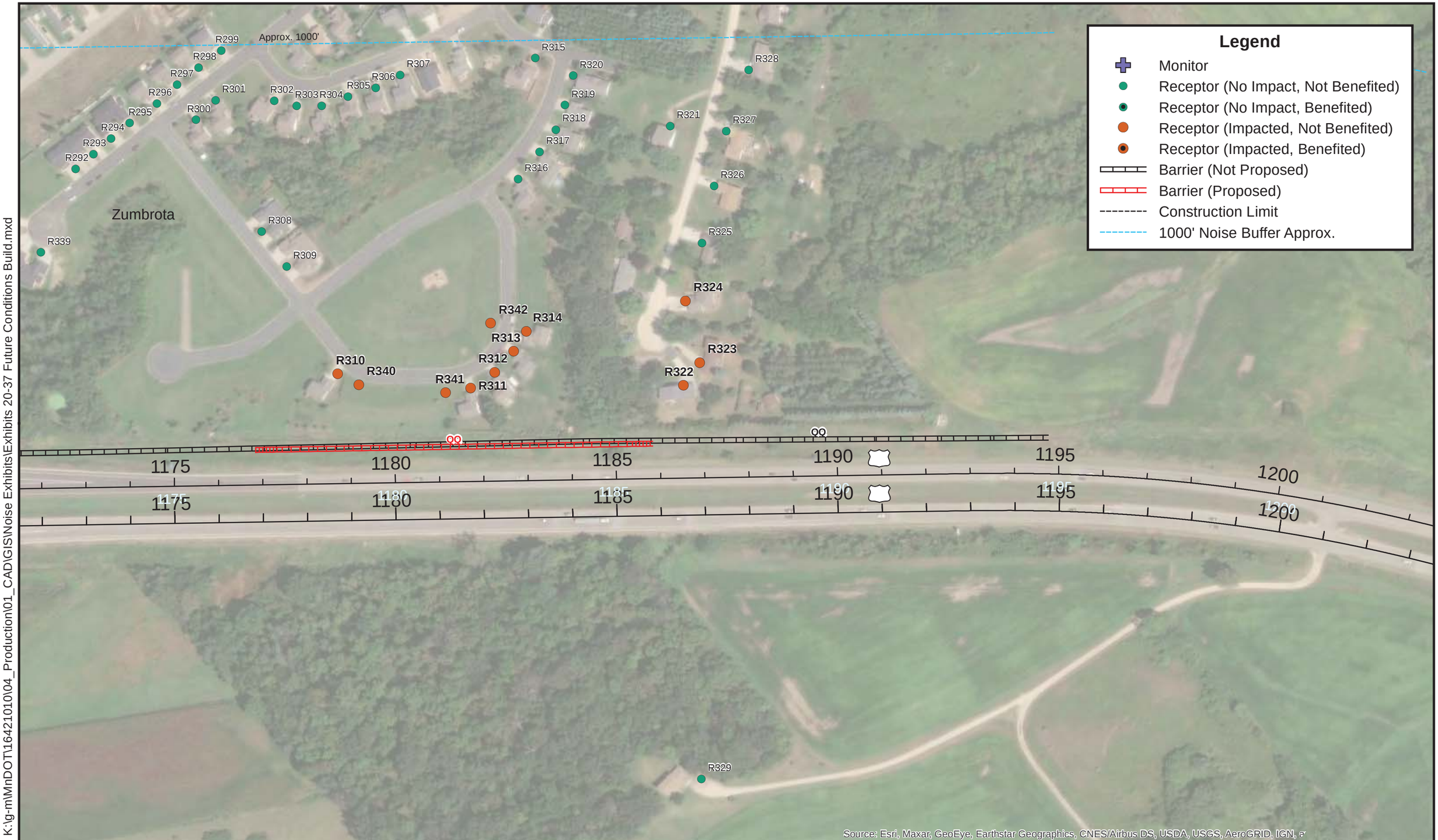

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EXHIBIT 36: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/20/2020
Check: JAH 8/20/2020

0 100 200 400 600 800 Feet

1 inch = 200 feet

TKDA

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EXHIBIT 37: FUTURE BUILD (2041)

TH 52 Near Cannon Falls and Hader

S.P. 2506-83
TKDA Project Number 16421.010

Drawn: RJR 8/20/2020
Check: JAH 8/20/2020

0 250 500 1,000 1,500 2,000 Feet

1 inch = 500 feet

N E S W

TKDA

Appendix C

Noise Monitoring Data Sheets

NOISE Survey Data Sheet

INVESTIGATOR: LINDSAY GAINES & Team TKDA DATE: 7/16/2019

MONITOR

Noise Monitor Manufacturer and Model: Larson Davis Model LxT1 Serial No.: 0005554

CALIBRATOR

Calibrator Manufacturer and Model: Larson Davis CAL 200

Calibrator Frequency: 1000 Hz 114 dB Serial No.: 16593

Initial Calibration (dBA): 0.04 Final Calibration (dBA): -0.07 dB

WEATHER

Temperature: 80°F Humidity: 69% Cloud Cover: Partly Cloudy

Wind Speed: 3MPH Wind Direction: WSW Source: Weather.com

SITE IDENTIFICATION

SITE DESCRIPTION: 54' from gravel driveway, 32' from bush (along gravel)

MONITOR LOCATION: #1 AT edge of gravel nearest TH 52, in line with NB giant power poles

SITE NUMBER: #1 TERRAIN CONDITION: field grass & gravel

GPS LATITUDE: GPS LONGITUDE:

RECORDED RESULTS

START TIME: 11:50

END TIME: 12:10

SOUND LEVELS

LAF MAX 83.1 Dba

LAF MIN 50.4 Dba

LAF EQ 68.7 Dba

	~~EB~~ SB TH 52	WB NB TH 52	~~TH 52~~ CSAH 8		
AUTOS:	168	197	8		
Med Trucks:	8	13			
Heavy Trucks:	42	34			

Stored Data File Name: TH52_1am

Photo Log:

Notes:

NOISE Survey Data Sheet

INVESTIGATOR: LINDSAY GAINES & TEAM TKDA DATE: 7/16/2019

MONITOR

Noise Monitor Manufacturer and Model: Larson Davis Model LxT1 Serial No.: 0005554

CALIBRATOR

Calibrator Manufacturer and Model: Larson Davis CAL 200

Calibrator Frequency: 1000 Hz 114 dB Serial No.: 16593

Initial Calibration (dBA): 0.03dB Final Calibration (dBA): -0.02 dB

WEATHER

Temperature: 80°F Humidity: 69% Cloud Cover: Cloudy

Wind Speed: 3mph Wind Direction: SE Source: Weather.com

SITE IDENTIFICATION

SITE DESCRIPTION: At edge of gravel cul-de-sac nearest TH52, in line with large power poles to the north, 54' from gravel driveway,

MONITOR LOCATION: #1 32' from edge of bush, measuring along edge of gravel.

SITE NUMBER: #1 TERRAIN CONDITION: Field grass & gravel

GPS LATITUDE: GPS LONGITUDE:

RECORDED RESULTS

START TIME: 1:52

END TIME: 2:12

SOUND LEVELS

LAF MAX 81.0 Dba

LAF MIN 45.4 Dba

LAF EQ 66.5 Dba

	EB TH 52	~~WB~~ NB TH 52	~~TH 57~~ CSAH 8		
AUTOS:	208	206	8		
Med Trucks:	11	11	0		
Heavy Trucks:	27	35	0		

Stored Data File Name: TH52_1pm

Photo Log:

Notes:

NOISE Survey Data Sheet

INVESTIGATOR: LINDSAY GAINES & Team TKDA DATE: 7/16/2019

MONITOR

Noise Monitor Manufacturer and Model: Larson Davis Model LxT1 Serial No.: 0005554

CALIBRATOR

Calibrator Manufacturer and Model: Larson Davis CAL 200

Calibrator Frequency: 1000 Hz 114 dB Serial No.: 16593

Initial Calibration (dBA): -0.01 dB Final Calibration (dBA): 0.10 dB

WEATHER

Temperature: 78 °F Humidity: 73% Cloud Cover: Partly Cloudy

Wind Speed: 5mpH Wind Direction: WSW Source: weather.com

SITE IDENTIFICATION

SITE DESCRIPTION: Near 114th Ave & Co 8 Blvd, 53' from Co 8 Blvd & adjacent to edge of 114th Ave nearest to TH 57.

MONITOR LOCATION:

SITE NUMBER: #2 TERRAIN CONDITION: field grass, gravel road

GPS LATITUDE: GPS LONGITUDE:

RECORDED RESULTS

START TIME: 10:57

END TIME: 11:17

SOUND LEVELS

LAF MAX 81.1 Dba

LAF MIN 48.1 Dba

LAF EQ 61.9 Dba

	SB EB TH 52	NB WB TH 52	TH 57	CSAH 8	Hader Trail	114th Ave
AUTOS:	206	217	25	3	1	—
Med Trucks:	8	9	1	0	—	1
Heavy Trucks:	29	29	4	3	—	—

Stored Data File Name: TH52 - 2am

Photo Log:

Notes: Small Bob-cat like vehicle did some work about 1-2 blocks away.

NOISE Survey Data Sheet

INVESTIGATOR: LINDSAY GAINES & TEAM TKDA DATE: 7/16/2019

MONITOR

Noise Monitor Manufacturer and Model: Larson Davis Model LxT1 Serial No.: 0005554

CALIBRATOR

Calibrator Manufacturer and Model: Larson Davis CAL 200

Calibrator Frequency: 1000 Hz 114 dB Serial No.: 16593

Initial Calibration (dBA): -0.06 Final Calibration (dBA): 0.05

WEATHER

Temperature: 80°F Humidity: 68% Cloud Cover: Cloudy

Wind Speed: 2mph Wind Direction: SSE Source: weather.com

SITE IDENTIFICATION

SITE DESCRIPTION: On 114th Ave Near 114th Ave & Co 8 Blvd, 53' From Co 8 Blvd adjacent to edge of 114th nearest to TH 57

MONITOR LOCATION: #2

SITE NUMBER: #2 TERRAIN CONDITION:

GPS LATITUDE: GPS LONGITUDE:

RECORDED RESULTS

START TIME: 2:23 PM

END TIME: 2:43 PM

SOUND LEVELS

LAF MAX 45.3 Dba

LAF MIN 70.1 Dba

LAF EQ 58.6 Dba

	SB EB TH 52	NB WB TH 52	TH 57	Co 8 Blvd	
AUTOS:	198	236	20	6	
Med Trucks:	7	14	3	0	
Heavy Trucks:	25	24	4	0	

Stored Data File Name: TH52 - 2pm

Photo Log:

Notes:

NOISE Survey Data Sheet

INVESTIGATOR: LINDSAY GAINES & TEAM TKDA DATE: 7/16/2019

MONITOR

Noise Monitor Manufacturer and Model: Larson Davis Model LxT1 Serial No.: 0005554

CALIBRATOR

Calibrator Manufacturer and Model: Larson Davis CAL 200

Calibrator Frequency: 1000 Hz 114 dB Serial No.: 16593

Initial Calibration (dBA): -0.02 dB Final Calibration (dBA): 0.01 dB

WEATHER

Temperature: 76° Humidity: 77% Cloud Cover: Mostly cloudy

Wind Speed: 7 mph Wind Direction: WSW Source: Weather.com

SITE IDENTIFICATION

SITE DESCRIPTION: Heavily wooded, gravel road, 200' from edge of traveled way

MONITOR LOCATION: #3

SITE NUMBER: #3 TERRAIN CONDITION: Wooded south edge of gravel road

GPS LATITUDE: GPS LONGITUDE:

RECORDED RESULTS

START TIME: 9:58

END TIME: 10:18

SOUND LEVELS

LAF MAX 77.2 Dba

LAF MIN 44.6 Dba

LAF EQ 63.6 Dba

	EB TH 52 (SB)	WB TH 52	TH 57	MAPLEWAY	
AUTOS:	206	186		1	
Med Trucks:	10	9			
Heavy Trucks:	38	37			

Stored Data File Name: TH52 - 3am

Photo Log:

Notes: ATV drove by on Maple Way

NOISE Survey Data Sheet

INVESTIGATOR: LINDSAY GAINES & TEAM TKDA DATE: ~~7/16/2019~~ 7/17/2019

MONITOR

Noise Monitor Manufacturer and Model: Larson Davis Model LxT1 Serial No.: 0005554

CALIBRATOR

Calibrator Manufacturer and Model: Larson Davis CAL 200

Calibrator Frequency: 1000 Hz 114 dB Serial No.: 16593

Initial Calibration (dBA): 0.00 dB Final Calibration (dBA): 0.01 dB

WEATHER

Temperature: 77°F Humidity: 84% Cloud Cover: Cloudy

Wind Speed: 5mpH Wind Direction: SSE Source: Weather.com

SITE IDENTIFICATION

SITE DESCRIPTION: Heavily wooded, gravel road, 200' from edge of traveled way.

MONITOR LOCATION: #3 Adjacent to south edge of gravel road.

SITE NUMBER: #3 TERRAIN CONDITION: Wooded

GPS LATITUDE: GPS LONGITUDE:

RECORDED RESULTS

START TIME: 12:57

END TIME: 1:17

SOUND LEVELS

LAF MAX 77.1 Dba

LAF MIN 50.6 Dba

LAF EQ 64.2 Dba

	SB EB TH 52	NB WB TH 52	TH 57		
AUTOS:	191	206			
Med Trucks:	8	15			
Heavy Trucks:	33	43			

Stored Data File Name: TH 52 - 3pm

Photo Log:

Notes: