

Appendix E: Noise Technical Report

Noise Technical Report

I-93 Exit 4A Technical Report

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New Hampshire Department of Transportation

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ABBREVIATIONS AND ACRONYMS

CFR	Code of Federal Regulations
dBA	Adjusted Decibels
DEIS	Draft Environmental Impact Statement
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
FEIS	Final Environmental Impact Statement
L_{eq}	Equivalent Sound Level
NAC	Noise Abatement Criteria
NEPA	National Environmental Policy Act
NHDES	New Hampshire Department of Environmental Services
NHDOT	New Hampshire Department of Transportation
NSA	Noise Sensitive Area
Project	Exit 4A Project
SDEIS	Supplemental Draft Environmental Impact Statement

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1.0 INTRODUCTION

The I-93 Exit 4A Project (Project) is proposed by the Towns of Derry and Londonderry and the New Hampshire Department of Transportation (NHDOT), in cooperation with the Federal Highway Administration (FHWA). A Supplemental Draft Environmental Impact Statement (SDEIS) is being prepared for the project. The proposed project meets the definition of a Type I project under FHWA's noise regulation (23 CFR 772) because it involves a new interchange and connector roadway. Therefore, a traffic noise study is required to identify noise-sensitive land uses, model traffic noise impacts, and evaluate noise abatement measures for impacted receptors.

As part of this study, the need for and design of noise barriers along the I-93 mainline within the project area has been reevaluated in light of the Exit 4A, specifically for receptors along Trolley Car Lane on the west side of I-93, and along Seasons Lane on the east side of I-93. Noise barriers were designed for these locations as part of the I-93 widening, but these barrier designs do not take into account the location of the Exit 4A ramps and associated fill.

1.1 Project Alternatives

The purpose of the Project is to reduce congestion and improve safety along NH 102, from I-93 east through downtown Derry and to promote economic vitality in the Derry/Londonderry area. Five build alternatives are under consideration as summarized below. Alternative A is the preferred alternative identified in the SDEIS. As shown in Figure 1-1, Alternatives A and B share a common new interchange location approximately 1.5 miles north of Exit 4 (referred to as the southern interchange location), as do Alternatives C and D approximately 2 miles north of Exit 4 (northern interchange location). All the new interchange alternatives (A, B, C and D) involve construction the new connector roadway on a bridge over I-93. For detailed mapping of the alternatives, refer to Chapter 3 of the SDEIS.

Alternative A

Alternative A (the preferred alternative) includes a corridor that is approximately 3.2 miles in length between the new proposed I-93 Exit 4A interchange and eastern Derry. There would be approximately 1 mile of roadway construction on a new alignment, 1.6 miles of existing roadway reconstruction, and 0.6 miles of roadway with no improvements. It would originate from the southern I-93 Exit 4A interchange location and travel northeast along new alignment through a wooded area to Folsom Road, near its intersection with North High Street and Madden Road. This alternative would continue to follow Folsom Road past Ross' Corner (Manchester Road/NH 28) and continue on Tsienneto Road across NH 28 Bypass to its end at NH 102, adjacent to Beaver Lake.

Alternative B

The Alternative B corridor is approximately 3.4 miles in length between the new proposed I-93 Exit 4A interchange and eastern Derry. The entire 3.4-mile corridor would consist of roadway construction on new alignment. It would originate from a new southern I-93 Exit 4A interchange and travel northeast along a new alignment through a wooded area to the intersection of Ashleigh Drive and NH 28. From this intersection, this alternative would extend northeast towards the intersection of London Road and NH 28 Bypass and then continue on new alignment to the intersection of Tsienneto Road and NH 102.

Alternative C

The Alternative C corridor is approximately 3.7 miles in length between the new proposed I-93 Exit 4A interchange and eastern Derry. Approximately 2.9 miles of corridor would be on new alignment, while approximately 0.8 miles would reconstruct existing roadways. The alternative would start from a new northern I-93 Exit 4A interchange and travel east approximately 0.7 miles along a powerline ROW to NH 28. Following NH 28 south to the intersection of Ashleigh Drive, it would follow the same alignment as Alternative B to the intersection of Tsienneto Road and NH 102.

Alternative D

The Alternative D corridor is approximately 3.9 miles in length between the new proposed I-93 Exit 4A interchange and eastern Derry. Within this corridor, approximately 0.8 miles would be on new alignment, 2.5 miles on existing roadways would be reconstructed, and 0.6 miles would have no improvements. The alternative would commence from a new northern I-93 Exit 4A interchange and travel east approximately 0.7 miles along a powerline ROW to NH 28. Following NH 28 south to Ross' Corner, the corridor would then follow the same path as Alternative A to the intersection of Tsienneto Road and NH 102.

Alternative F

Alternative F focuses all improvements along the existing NH 102 corridor between Exit 4 at I-93 and downtown Derry. A two-way, center, left-turn lane would be constructed from Londonderry Road to NH Route 28, and improvements would be made to existing intersections. The majority of existing on-street parking spaces would be lost to accommodate the center turn lane. The corridor would be 1.7 miles long, with the entire corridor consisting of roadway reconstruction (i.e., there is no portion on new alignment).

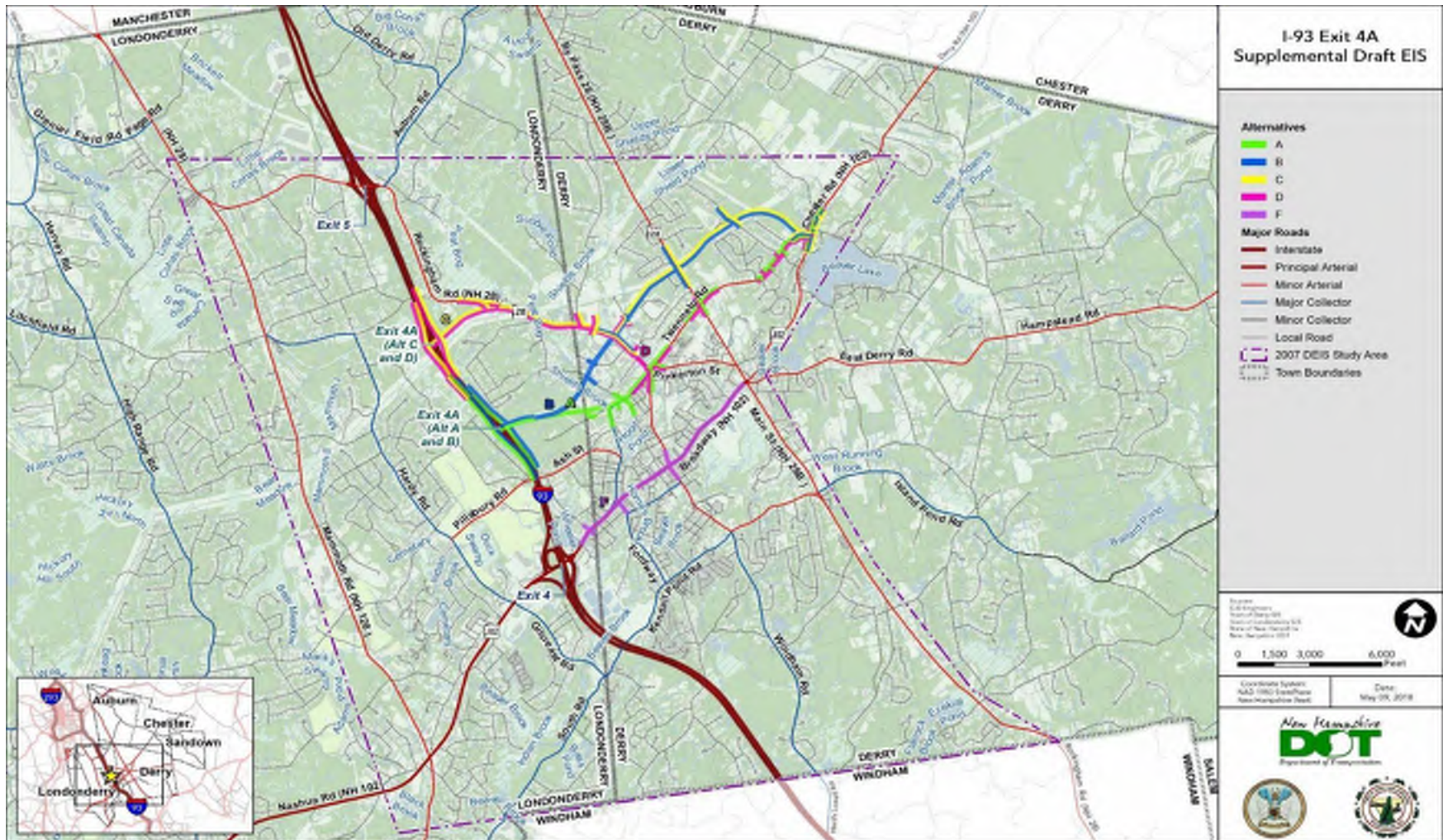


Figure 1-1. Project Location

2.0 BACKGROUND

2.1 Characteristics of Noise

Noise is defined as undesired and disruptive sound. It can be emitted from many sources, including airplanes, factories, railroads, power generation plants, and highway vehicles. Highway noise, or traffic noise, is usually a composite of noises from engine exhaust and tire-roadway interaction.

The magnitude of noise is usually described by its sound pressure. Because the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to some common reference level, usually the decibel.

The A-weighted decibel scale is used almost exclusively in vehicular noise measurements because it reflects the frequency range to which the human ear is most sensitive (1,000–6,000 Hertz). Sound levels measured using an A-weighted decibel scale is generally expressed as adjusted decibels (dBA). For this report, all noise levels are expressed in dBAs. Several examples of noise pressure levels in dBA scale are listed in Figure 2-1, *Comparative Noise Levels*.

Figure 2-1 indicates that most individuals in urbanized areas are exposed to fairly high noise levels from many sources as they go about their daily activities. The degree of disturbance from undesired sound depends essentially on three factors:

- The amount and nature of the intruding noise;
- The relationship between background noise and the intruding noise; and
- The type of activity occurring where the noise is heard.

In considering the first of these factors (i.e., amount and nature of the intruding noise), it is important to note that individuals have different sensitivity to noise. Loud noises bother some individuals more than others, and some patterns of noise also enter into an individual's judgment of whether or not a noise is offensive. For example, noises occurring during sleeping hours are usually considered to be more of a nuisance than the same noises in the daytime.

With regard to the second factor (i.e., the relationship between background noise and the intruding noise), individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (background noise). For instance, the blowing of a car horn at night when background noise levels are typically about 45 dBA would generally be more objectionable than the blowing of a car horn in the afternoon when background noises are likely to be 60 dBA or higher.

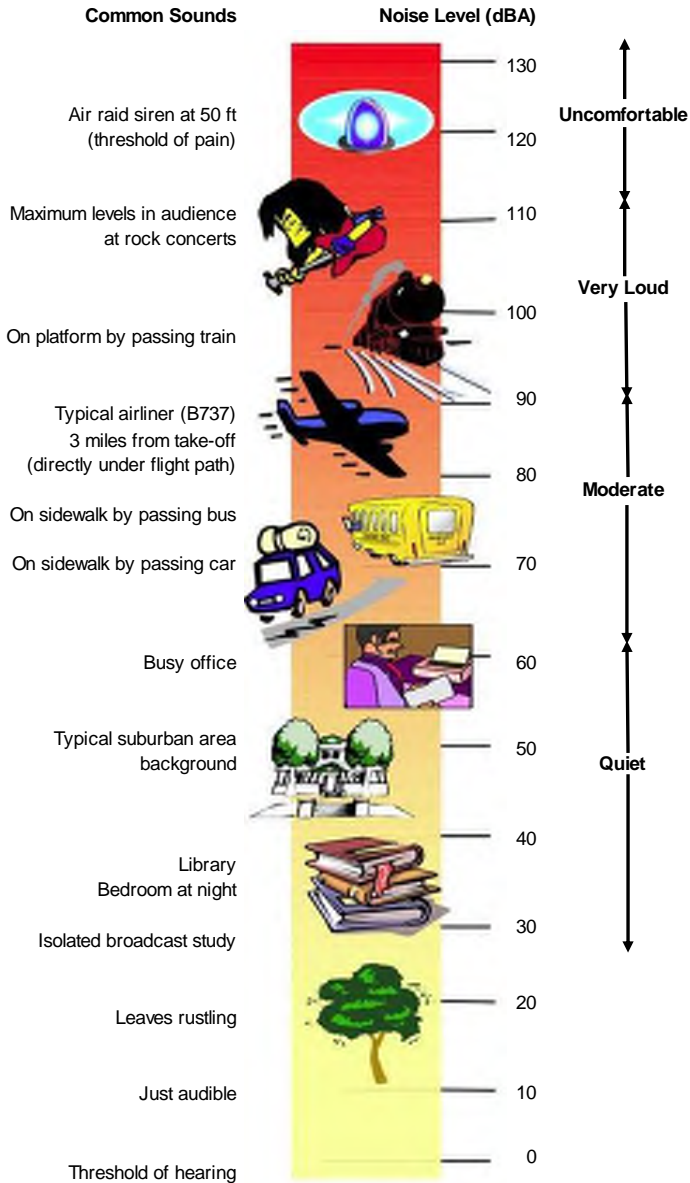


Figure 2-1. Comparative Noise Levels (Source: Cowan, 1994)

The third factor (i.e., the type of activity occurring where the noise is heard) is related to the interference of noises with activities of individuals. In a 60-dBA environment, normal work activities requiring high levels of concentration may be interrupted by loud noises, while activities requiring manual effort may not be interrupted to the same degree.

Since sound is described in logarithmic scale (i.e., dBA), sound levels cannot be added by ordinary arithmetic means. In fact, a doubling of the noise source produces only a 3 dBA increase in the sound pressure (noise) level. Studies have shown that this increase is barely perceptible to the human ear, whereas a change of 5 dBA is readily perceptible. As a general rule, an increase or decrease of 10 dBA in noise level is perceived by an observer to be a doubling or halving of the sound, respectively.

Because the sound pressure level unit of dBA describes a noise level at just one moment and very few noises are constant, other ways of describing noise over more extended periods have been developed. One way of describing fluctuating sound is to describe the fluctuating noise heard over specific periods as if it had been a steady, unchanging sound. For this condition, a descriptor called the equivalent sound level (L_{eq}) can be computed. L_{eq} is the constant sound level that, in a given situation and period (e.g., 1 hour, denoted by $L_{eq(1)}$, or 24 hours, denoted as $L_{eq(24)}$), conveys the same sound energy as the actual time-varying sound.

2.2 Regulatory Framework

2.2.1 FHWA Regulations and NHDOT Policy

Traffic noise impact and abatement analyses were conducted in accordance with the procedures as set forth in the following regulations and policies: FHWA's *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, 23 Code of Federal Regulations (CFR) Part 772; FHWA Highway Traffic Noise: Analysis and Abatement Guidance document issued December 2011; and NHDOT's *Policy and Procedural Guidelines for the Assessment and Abatement of Highway Traffic Noise for Type I & II Highway Projects*, as approved by FHWA on November 30, 2016. The FHWA Noise Abatement Criteria (NAC) in 23 CFR Part 772 and the Noise Abatement Guidelines in the NHDOT policy were used to identify and evaluate noise impacts. The traffic noise level predictions and noise mitigation analyses were performed using FHWA's *Highway Traffic Noise Model 2.5*. The FHWA NAC are presented in Table 2-1.

A traffic noise impact is identified, and consideration of noise abatement is required, when:

- L_{eq} (h) noise levels approach or exceed the FHWA NAC given in Table 2-1, where "approach" means within 1 dBA of the NAC.
- There is a substantial increase in the predicted noise levels over the existing noise levels, regardless of whether or not the NAC level is exceeded. NHDOT's policy defines a substantial increase as future build noise level 15 dBA L_{eq} or higher than existing conditions.

Noise abatement measures must meet the criteria for *feasibility* and *reasonableness*, as presented in NHDOT's Policy.

The *feasibility* of noise abatement primarily relates to engineering and safety considerations for providing mitigation. A minimum of a 5-dBA noise reduction for at least one impacted receiver is required for a proposed noise barrier to be feasible, the design goal is to obtain a 10-dBA or greater insertion loss at the first row receptors. Safety considerations in designing noise barriers could include such factors as maintaining a clear recovery zone, redirection of errant vehicles, adequate sight distance, and fire/emergency vehicle access.

The factors considered when evaluating the *reasonableness* of a noise barrier are as follows:

- **Effectiveness.** The NHDOT's base effectiveness criterion is 1,500 square feet per benefited receptor (defined as all receptors receiving 5 dBA or greater insertion loss from the proposed barrier). For Type I projects, the effectiveness criterion is reduced depending on the percentage of benefited properties permitted for development after November 30, 2017. The effectiveness criterion is increased by 200 square feet (e.g., to a total of 1,700 square feet) for municipalities that have enacted noise compatible

planning requirements to mitigate noise impacts associated with new development near state highways.

- **Noise Reduction Design Goal.** The design goal is to provide 10-dBA insertion loss to the first row of benefited receptors. At a minimum, it must provide 7-dBA noise reduction for one benefited receptor.
- **Views of the Benefited Receptors.** Viewpoints of the affected community are considered through the NEPA public outreach process. If there are objections to a proposed barrier, a voting process is used to make the final reasonableness determination.

Table 2-1. FHWA Noise Abatement Criteria: Hourly A-weighted Sound Level in Decibels (dBA)

Activity Category	NAC Leq (h)	Activity Description
A (Exterior)	57	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 (Exterior)	67	Residential.
C (Exterior)	72	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 (Interior)	52	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 (Exterior)	52	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.

Source: Title 23 Code of Federal Regulations, Part 772.

2.2.2 Local Noise Regulations

The Town of Londonderry adopted a local noise control ordinance on June 7, 2016, as an amendment to their municipal code, Title IV, Chapter XIV, Noise Regulations. Ordinance #2016-03 is intended to control unnecessary and excessively loud noises between the hours of 10 p.m. and 7 a.m. in order to protect the public’s health, safety, and comfort. During these specific hours, noises which are prolonged, unusual, and unnatural in their time and place are prohibited unless an exemption has been obtained. Ordinance #2002-12, relative to municipal code, Title III, Land Use Codes, states that devices to muffle equipment noise, landscape earth berms, screen planting, decorative screen walls, or other barriers or devices shall be installed as necessary to achieve compliance with the Town of Londonderry noise control standards. Noise is expected to not exceed a maximum level of 75 decibels at property lines. Ordinance 97-6, An Amendment to the Zoning Ordinance related to Section VII-Commercial Performance Standards, also states that noise should not exceed 75 decibels at property lines and that all noise, except that generated by normal automobile, truck, or railroad service shall be muffled so as not to be objectionable due to intermittence, beat frequency, or shrillness.

The Town of Derry does not currently possess any local ordinances or regulations specifically pertaining to noise/construction noise.

3.0 EXISTING CONDITIONS NOISE MONITORING

3.1 2007 DEIS Noise Monitoring

Noise monitoring was conducted for the 2007 DEIS at 10 receptor locations in May and July 2006. The 10 monitoring sites are shown on Figure 3-1 as Sites 1 through 10. Table 3-1 presents noise levels from the 2007 DEIS monitoring effort.

Table 3-1. 2007 DEIS Monitoring Locations and Noise Levels

Site Number	Address	Leq (dBA)
1	1 Tsienneto Road	61
2	75 Tsienneto Road	69
3	4 Seasons Lane	63
4	12 Trolley Car Lane	64
5	5 Coteville Road	63
6	1 London Road	61
7	29 Scenic Drive	51
8	112 Franklin Ext	57
9	120 East Broadway ^a	65
10	70 West Broadway ^a	66

^a In the 2007 DEIS, 120 East Broadway was incorrectly identified as 70 East Broadway, and 70 West Broadway was incorrectly identified as 120 West Broadway.

3.2 2016 Noise Monitoring Update

Given the passage of time since the 2007 DEIS, updated noise monitoring was conducted in five locations along the Alternative A corridor in September 2016. The monitoring sites are:

- Site A: 25 Trolley Car Ln
- Site B: 52 Trolley Car Ln
- Site C: 60 Seasons Ln
- Site D: 4 Folsom Rd
- Site E: 71 Tsienneto Rd

Two of these sites, A and D, were chosen because they were monitored in the 2007 DEIS and determined to be impacted receptors. The other three sites, B, C, and E, were selected because they were shown as impacted receptors under Alternative A and were not monitored in the 2007 DEIS. Sites A, B, and C are located in an area where barriers are proposed as part of the I-93 widening, but would need to be modified as a result of the Exit 4A Project.

Figure 3-1 shows the monitoring locations, and monitoring results are summarized in Table 3-2. Short-term noise levels were measured during the AM peak hours (7:00-8:00 AM) and PM peak hours (5:00-6:00 PM) at each location. Traffic counts with vehicle classification were conducted simultaneously with the noise monitoring locations.

A Rion NL-42 Sound Level Meter (SLM) was utilized for field measurements. The SLM meets the requirements set forth in the ANSI S1.4-1983 Standards for Type 2 quality and accuracy. An acoustical calibrator (Norsonic 1251) was used to calibrate the SLM for each measurement interval. Calibration certificates for the equipment are provided in Appendix A.

The SLMs were operated on the A-weighting network and slow-meter response, as FHWA recommends. Measurements were not collected if roadway pavement was wet, or if wind speed exceeded 12 miles per hour. A porous windscreen was used on each SLM during all measurement periods, and measurements were taken by mounting the SLMs about 5 feet above the ground surface at each receptor. This height represents ear level of an average person. Wherever possible, measurement sites were located in open areas away from buildings or other potentially reflective surfaces, but which represented the outdoor use area of a given receptor.

During measurements, important events and site conditions were noted and a sketch was drawn for each receptor location. If an extraneous noise source interrupted the monitoring session, the measurement was then temporarily paused until the noise source was out of range. Noises of this nature, occurring at the time of measurement, included a swimming pool water pump and a lawn mower. No other unusual noises occurred during the morning or evening study hours. Appendix A provides photos of each monitoring location, field monitoring diagrams and traffic counts.

Table 3-2. 2016 Existing Conditions Noise Monitoring Results

Site	Address	Date	Time	L _{eq} (dBA)
A	25 Trolley Car Lane	9/20/2016	7:00 AM	63.8
			5:30 PM	63.0
		9/21/2016	7:00 AM	66.0
			5:08 PM	64.2
B	52 Trolley Car Lane	9/20/2016	7:03 AM	70.5
			5:35 PM	69.1
		9/21/2016	7:00 AM	70.9
			5:08 PM	70.3
C	60 Seasons Lane	9/20/2016	7:45 AM	60.5
			5:00 PM	60.8
		9/22/2016	7:15 AM	62.2
			4:30 PM	60.7
D	4 Folsom Road	9/20/2016	7:43 AM	74.2
			5:03 PM	74.4
		9/21/2016	7:36 AM	73.5
			4:30 PM	75.2
E	71 Tsienneto Road	9/21/2016	7:33 AM	65.1
			4:30 PM	63.5
		9/22/2016	7:16 AM	63.9
			4:30 PM	64.1

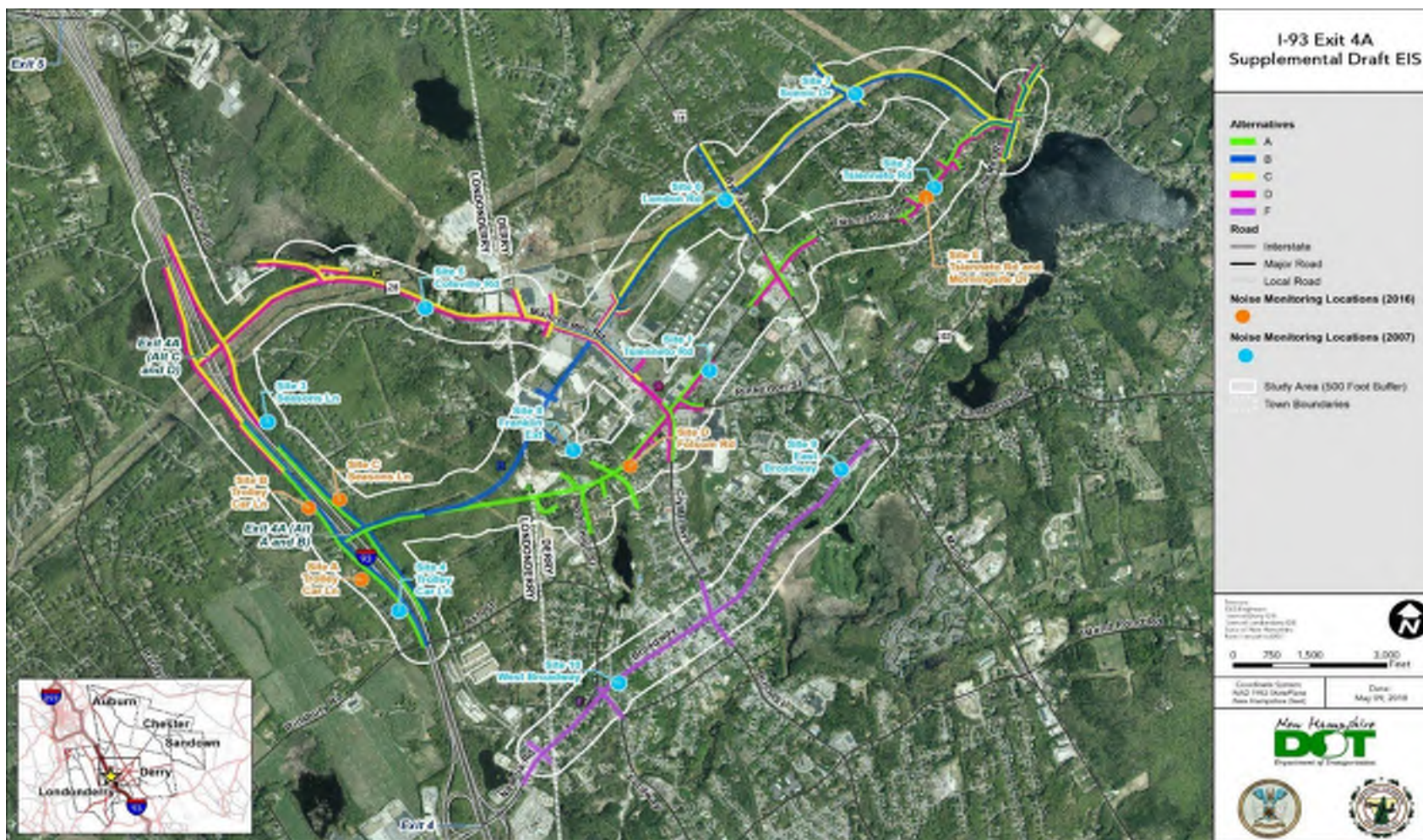


Figure 3-1. 2007 and 2016 Noise Monitoring Locations

4.0 IMPACTS AND MITIGATION

4.1 Traffic Noise Modeling Methodology

Design year 2040 predicted noise levels were determined using Version 2.5 of the FHWA Traffic Noise Model (FHWA TNM). All FHWA TNM computer files are included electronically with this report (Appendix B).

4.1.1 Noise Sensitive Areas and Receptors

The alternatives were divided into 11 noise sensitive areas (NSAs) for traffic noise modeling purposes as shown in Figure 4-1. Within each NSA, sensitive receptors were delineated within approximately 500 feet of the alternative corridors based on detailed land use and building data provided by Derry and Londonderry, with actual building use and location confirmed by aerial imagery.

For multifamily homes, apartments and townhomes, one receptor location was used to represent the multiple units in each building or building section. Multiple receivers were placed for non-residential uses such as parks, cemeteries and schools based on the typical frontage length of nearby residential lots. The placement of residential and community facility receptors was based on a visual assessment of where outdoor use usually takes place on the side of the building closest to the roadway, for example the backyard of a house adjacent to I-93. If no outdoor use on that side of the building was reasonable (no back yard, for example), than the nearest possible outdoor activity area on the property to the roadway was used. Commercial business with outdoor uses received receptors based on the location of the outdoor use, for example, an outdoor seating area at a restaurant. Receiver height was set at the default height of 4.92 feet, to represent a person at ground level.

4.1.2 Roadways and Traffic Data

The No Build Alternative and each Build alternative noise models include the widening of I-93 to four lanes in each direction. The I-93 final design plans were used to reflect the future edge of pavement of this roadway. The updated preliminary engineering plans for each Exit 4A project alternative were used for the proposed roadways. For major roadways (arterials, interstate and select major collectors), each individual traffic lane was modeled as a separate TNM roadway. For minor roadways, a single TNM roadway was used to represent both directions of traffic.

Traffic data for existing conditions (2015) and 2040 was obtained from the Exit 4A Traffic Technical Report. Separate methods to determine the appropriate percentage of traffic in each TNM vehicle class (auto, medium truck, heavy truck, motorcycle and bus) were used for the I-93 mainline vs other roadways. The I-93 vehicle class percentages were based on data from the permanent traffic recorder south of Exit 4, taken in May of 2015. The recorder provided a breakdown of traffic into 13 vehicle classes and included data on lane use of heavy vehicles, allowing the noise model traffic to reflect the actual lane usage by heavy trucks. For arterials and major collectors, the vehicle class percentages were based on a combination of field traffic counts taken during the 2016 noise monitoring along Folsom Rd and Tsienneto Rd, NH DOT vehicle counts, and Synchro data used to create the Exit 4A Traffic Technical Report. The noise monitoring traffic counts were used to determine the breakdown of vehicles into the six TNM

model categories for a typical road type, while the Synchro data was used to modify vehicles within those categories to reflect heavy vehicle percentages for each roadway segment.

4.1.3 Elevation Data Sources

Within the footprint of the Exit 4A project, roadway vertical profiles and proposed contours were available from the SDEIS preliminary engineering effort. Outside the Exit 4A alternatives footprint, the I-93 widening final design plans were used to define elevations near the I-93 corridor. Existing ground elevation data beyond the immediate roadway construction area was obtained from high resolution LIDAR data, which was part of the LiDAR for the North East Project, 2011 Coastal LiDAR Acquisition by the USGS.

4.1.4 Terrain Lines

Terrain lines were placed to define topographic features not already covered by another TNM feature that potentially block line of sight or influence ground cover noise attenuation.

4.1.5 Building Rows

Rather than using the TNM building row function (which assumes a simplified percent building cover to estimate shielding rather than considering the actual geometry of specific buildings and gaps between buildings), buildings providing shielding to other receivers were modeled in greater detail as fixed height barriers. The location and dimensions of each building were based on detailed building GIS data provided by Derry and Londonderry. The height of each building was estimated using Google Street View and classified as either 15 or 25 feet.

4.1.6 Tree Zones and Ground Zones

No tree zones were used given that thick year-round vegetation is required to appreciably reduce noise levels (areas of deciduous trees would not block line of sight in the winter). The default ground zone of lawn was used, no additional special ground zones were used.

4.1.7 I-93 Widening Noise Barriers

Consistent with the inclusion of the I-93 widening in the 2040 No Build condition for the Exit 4A project, the I-93 widening noise barriers were digitized in TNM based on the I-93 final design plans. CAD files were used to determine the location of each barrier post and the height and finished grade elevation were taken from the soundwall post location tables.

Construction of the I-93 noise barriers was assumed as part of the modeling of noise impacts under the No Build Alternative. The barriers were also included in the Build Alternatives, with the exception of the areas where the barriers would conflict with the new interchange ramps. In these cases, the conflicting portion of the barrier was removed from the noise model, but the remaining portions were assumed to be left in place. Figure 4-2 illustrates the location of the I-93 widening barriers for NSA 4 and NSA 5, and the portions of the barriers assumed to be removed under the initial modeling of Alternatives A and B. The purpose of this initial modeling was to determine the total number of noise impacts in each NSA for comparing between alternatives. Determination of potential barrier modifications to account for the new interchange was conducted separately as part of the noise barrier evaluation.

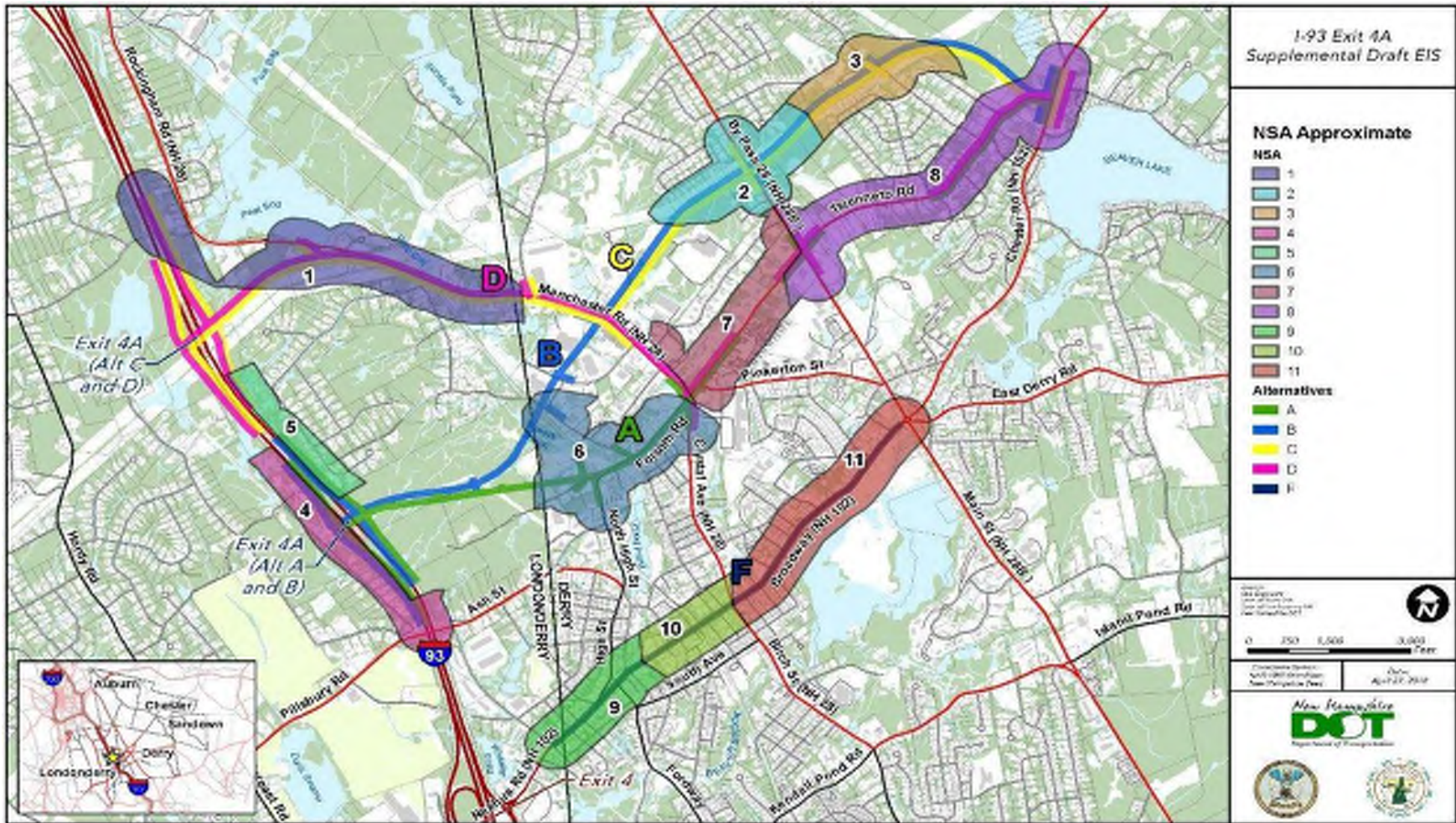


Figure 4-1. Noise Sensitive Areas Overview



Figure 4-2. I-93 Widening Final Design Noise Barriers in NSA 4 and 5

4.1.8 Noise Model Validation

Noise model validation refers to the FHWA requirement that traffic noise analyses demonstrate that the model is capable of predicting the field measured noise levels within 3 dBA. This is accomplished by modeling the same traffic volumes and vehicle mix counted simultaneously with the noise monitoring. Table 4-1 summarizes noise model validation results, showing that the modeled noise levels differ from the measured values by less than the required 3 dBA threshold.

Table 4-1. Traffic Noise Model Validation Summary

Monitoring Location	Date/Time Period	Measured Leq, dBA	Modeled Leq, dBA	Difference
A	Sept. 20- AM	63.8	66.2	2.4
	Sept. 20- PM	63.0	64.9	1.9
	Sept. 21- AM	66.0	66.0	0.0
	Sept. 21- PM	64.2	65.6	1.4
B	Sept. 20- AM	70.5	68.8	-1.7
	Sept. 20- PM	69.1	67.5	-1.6
	Sept. 21- AM	70.9	68.5	-2.4
	Sept. 21- PM	70.3	68.2	-2.1
C	Sept. 20- AM	60.5	62.3	1.8
	Sept. 20- PM	60.8	61.8	1.0
	Sept. 22- AM	62.2	63.1	0.9
	Sept. 22- PM	60.7	62.0	1.3
D	Sept. 20- AM	74.2	71.8	-2.4
	Sept. 20- PM	74.4	73.8	-0.6
	Sept. 21- PM ^a	75.2	73.3	-1.9
E	Sept. 21- PM ^a	63.5	62.9	-0.6
	Sept. 22- AM	63.9	61.5	-2.4
	Sept. 22-PM	64.1	63.7	-0.4

^a AM Time period not validated due to lack of traffic count data during the noise monitoring for that particular location/time period. Additional monitoring was not necessary since AM peak bi-directional traffic counts with classification were available from the second day of monitoring at each site

4.2 Impacts

4.2.1 Noise Impact Summary

Table 4-2 summarizes the initial noise modeling results for existing conditions, the No Build Alternative, and Build Alternatives A, B, C, D, and F in terms of impacted receptor points. The approximate boundaries of the NSAs shown in the table are mapped in Figure 4-1. Noise impacts were identified considering both the absolute predicted hourly Leq in comparison to the NAC. The incremental increase in noise relative to existing conditions was also evaluated to identify

receptors potentially experiencing a substantial increase (defined by NHDOT policy as an increase of 15 dBA or greater over existing conditions). AM and PM peak hour traffic was modeled separately for each Alternative, and the worst result for each receptor was used for purposes of the impact summary shown in Table 4-2.

It is important to note that the results in Table 4-2 include construction of noise barriers as part of the I-93 widening project under the No Build Alternative (and the Build alternatives, where the barrier is not in conflict with the particular alternative). As a result, the number of impacted receptors in each NSA is different from the detailed noise barrier evaluations presented in Section 4.3 where a true “no barrier” condition is evaluated for purposes of determining cost reasonableness of modified barrier configurations.

The single family residential and multi-family residential receptors correspond to FHWA Noise Abatement Criteria Activity Category B. The community facility and parkland receptors identified in the study area are all considered Activity Category C for purposes of the corridor-wide comparison of alternatives (further detailed investigation of receptors impacted by Alternative A was conducted as part of the mitigation analysis). The Commercial with outdoor use land use type corresponds to Activity Category E. Category G (undeveloped lands that are not permitted) is addressed in Section 4.4.

Table 4-2. Traffic Noise Impacts Summary

Noise Sensitive Area	Land Use	Existing	No Build Alt. (2040)	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
1 (NH 28 Corridor, I-93 to Scobie Pond Rd.)	Single-Family	3	5	4	3	7	7	6
	Multi-Family/Apartment	1	1	1	0	1	1	1
	Community Facility/Park	0	0	0	0	1	0	0
	<i>NSA Subtotal</i>	4	6	5	3	9	8	7
2 (Alts. B and C connector near Olde Coach Rd, and Bypass 28)	Single-Family	9	5	5	2 exceed NAC + 1 substantial increase	2	5	4
	<i>NSA Subtotal</i>	9	5	5	3	2	5	4
3 (Alts. B and C connector near Barkland Dr., and Scenic Dr.)	Single-Family	0	0	0	2 exceed NAC + 8 substantial increase	2 exceed NAC + 7 substantial increase	0	0
	<i>NSA Subtotal</i>	0	0	0	10	9	0	0
4 (I-93 at Alts. A and B interchange, Trolley Car Lane)	Single-Family	14	1	10	11	1	1	2
	<i>NSA Subtotal</i>	14	1	10	11	1	1	2
5 I-93 at Alts. A and B interchange, Seasons Lane	Single-Family	8	1	3	3	1	1	1
	<i>NSA Subtotal</i>	8	1	3	3	1	1	1
6 (Alts. A and B Connector from Derry Town Line to NH 28, Folsom Rd.)	Single-Family	11	11	13 (includes one recep. impacted due to both NAC and substantial increase)	6	12	11	11
	Multi-Family/Apartment	0	2	2	0	0	0	2
	<i>NSA Subtotal</i>	12	13	15	6	12	11	13
7 (Tsienneto Rd from NH 28 to Bypass 28)	Single-Family	0	0	0	0	0	0	0
	Multi-Family/ Apartment	3	4	4	0	1	2	4

Noise Sensitive Area	Land Use	Existing	No Build Alt. (2040)	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
	Community Facility/Park	0	0	1	0	0	0	0
	<i>NSA Subtotal</i>	3	4	5	0	1	2	4
8 (Tsienneto Rd. from Bypass 28 to NH 102)	Single-Family	5	9	13	4	4	13	9
	Multi-Family/Apartment	0	2	1	1	0	0	0
	<i>NSA Subtotal</i>	5	11	14	5	4	13	9
9 (NH 102, Exit 4 to Griffin St.)	Single-Family	20	20	19	15	13	15	17
	Multi-Family/Apartment	12	12	12	11	11	11	12
	Community Facility/Park	1	1	1	1	1	1	1
	Commercial w/outdoor use	0	0	0	0	0	0	1
	<i>NSA Subtotal</i>	33	33	32	27	25	27	31
10 (NH 102, Griffin St. to NH 28)	Single-Family	1	1	1	1	1	1	1
	Multi-Family/Apartment	11	9	11	11	11	11	11
	Community Facility/Park	5	5	5	5	5	5	6
	<i>NSA Subtotal</i>	17	15	17	17	17	17	18
11 (NH 102, NH 28 to Bypass 28)	Single-Family	12	13	15	4	6	13	15
	Multi-Family/Apartment	13	11	13	10	10	13	12
	Community Facility/Park	4	4	4	2	2	4	4
	<i>NSA Subtotal</i>	29	28	32	16	18	30	31
Total Impacts	Single-Family	83	66	83	60	56	67	66
	Multi-Family/Apartment	40	41	44	33	34	38	42
	Community Facility/Park	10	10	11	8	9	10	11
	Commercial w/outdoor use	0	0	0	0	0	0	1
	<i>Grand Total</i>	133	117	138	101	99	115	120

Note: Results account for I-93 widening barriers, except sections of barriers in conflict with the alternatives (see Figure 4-2)

No Build

In the majority of NSAs, noise impacts under the No Build Alternative would be similar to those predicted under existing conditions. In some cases, the number of No Build impacts would increase relative to existing conditions as a result of future growth in traffic volumes, such as along Tsienneto Road where the No Build Alternative would result in five additional impacted single-family homes and three additional multi-family/apartment receptor impacts (NSAs 7 and 8). The No Build Alternative noise levels at these Tsienneto Road receptors would be in the 66–68 dBA range.

In the vicinity of the proposed Exit 4A under Alternative A and B interchange (Trolley Car Lane and Seasons Lane, NSA 4 and 5), the number of impacted receptors would decrease substantially relative to existing conditions because the No Build Alternative model includes the noise barriers proposed as part of the I-93 widening project. Overall, the total study area noise impacts under the No Build Alternative would decrease to 117, compared to 133 under existing conditions.

Alternative A

Alternative A would conflict with portions of the I-93 widening noise walls in the new interchange area, resulting in 10 single family receptors impacted at NSA 4 and three impacted in NSA 5. The conflicting noise walls were assumed to be not constructed for the initial impact analysis. I-93 improvements proposed noise walls not in conflict with the new ramps were assumed to be in place. The majority of the impacted receptors at the interchange area would be in the 66 to 69 Leq, dBA range. Alternative A would also increase noise impacts on portions of Folsom Road (NSA 6) and Tsienneto Road (NSA 8) due to increased traffic volumes on these roadways. Overall, the number of impacted receptors would increase from 117 under the No Build Alternative to 138 under Alternative A (before considering mitigation).

Alternative B

Similar to Alternative A, Alternative B would conflict with portions of noise walls planned for the I-93 widening project, increasing the number of impacted receptors at NSA 4 and 5 (Trolley Car Lane and Seasons Lane). Alternative B would cause traffic diversions that would reduce the number of noise impacts on portions of Tsienneto Road relative to the No Build Alternative (see for example NSA 8). Alternative B related traffic reductions on NH 102 in Derry would reduce the number of impacted receptors in NSA 11 (NH 28 to Bypass 28) relative to the No Build Alternative. However, Alternative B would impact residential areas along the new connector road alignment through Derry, including neighborhoods at Old Coach Road and Bypass 28 (NSA 2) and Barkland Drive and Scenic Drive (NSA 3). Overall, the total number of impacted receptors in the study area (101) would be less than the No Build Alternative. This result is consistent with Alternative B being located more on new alignment (in areas with fewer sensitive receptors) relative to the existing roadway corridor used by much of Alternative A (e.g., Folsom Rd. and Tsienneto Rd).

Alternative C

Alternative C would result in nine impacted receptors in the vicinity of the new interchange location and along NH 28 (NSA 1). Impacts along the new alignment portion of the connector road through Derry would be similar to Alternative B (NSA 2 and 3). Also similar to Alternative

B, noise impacts would be reduced on portions of Tsienneto Road (NSA 8 and 11 most notably). Overall, the total number of impacted receptors in the study area would decrease relative to the No Build Alternative to 99.

Alternative D

Alternative D would result in eight impacted receptors in the vicinity the new interchange location and along NH 28 (NSA 1). Impacts along Tsienneto Road from increased traffic volumes would similar to Alternative A (NSA 8 and 9). Overall, the total number of impacted receptors in the study area (115) would be similar to the No Build Alternative.

Alternative F

Noise impacts under Alternative F (120) would be similar to the No Build Alternative. Although traffic in downtown Derry would increase, it would not increase to an extent that would result in a substantial increase in newly impacted receptors. Noise levels would increase at receptors already considered affected in the No Build Alternative.

4.2.2 NSA Receptor Locations and Modeling Results

The following section presents the figures and tables for each NSA receptor. The tables with the modeling results (Tables 4-3 through 4-12) are presented first followed by the figures for each NSA (Figures 4-3 through 4-17). Shading on the tables is used to indicate the receptors considered impacted under each alternative (whether due to approach or exceedance of the NAC or a substantial increase over existing conditions). Both the AM and PM peak hour traffic were modeled and the maximum hourly Leq for each receptor based on this data is reported in the tables.

Table 4-3. Noise Modeling Results for NSA 1 (Worst-Case Peak Hour, Leq, dBA)

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Rockingham 28 12 CF	Community Facility	62.6	61.7	59.3	58	66.1	65.3	62.3
Rockingham 28 11 MF	Multi-Family	69.2	68.2	65.7	64.5	71.8	71.7	68.8
Rockingham 28 9	SFR	68.1	67.6	64.6	63.6	71.3	71.2	67.9
Rockingham 28 9 CF	Community Facility	59.9	59	56.6	55.4	64	63.4	59.4
Coteville 1	SFR	64.2	63.3	60.9	59.6	67.6	67.2	63.9
Coteville 2	SFR	56.2	55.2	53	51.7	59.3	59	55.7
Seasons 18	SFR	56.8	55.8	53.7	52.5	59.7	59.7	56.3
Seasons 13	SFR	66.4	65.5	63.1	61.8	68.7	69.3	66
Seasons 14	SFR	55.2	54	52.5	51.1	57.6	57.9	54.4
Seasons 15	SFR	51.5	50.6	49.6	48.7	54	54.6	51
Seasons 16	SFR	48.6	47.8	45.6	44.8	50.7	51.2	48.1
Seasons 17	SFR	51.6	50.7	49.5	48.6	54.1	54.2	51.2
Rockingham 28 8A COD	Commercial w/Outdoor Use	58	56.9	54.8	53.5	61.7	61.1	57.4
Rockingham 28 8	SFR	65.3	64.7	61.9	60.7	68.6	68.2	65
Rockingham 28 7	SFR	53.5	54	53.8	53.5	63	63.3	54.5
Rockingham 28 6	SFR	64.3	66.3	66.8	66.7	66.6	66.6	66.6
Rockingham 28 4	SFR	61.1	62.1	62.1	61.9	61.8	61.7	62.4
Rockingham 28 3	SFR	63	63.9	64.1	63.9	63.9	63.8	64.1
Rockingham 28 5	SFR	63.6	65.3	65.6	65.4	65.3	65.3	65.6
Rockingham 28 1	SFR	64.4	65.8	66.1	65.9	65.8	65.8	66.1
Rockingham 28 2	SFR	66.1	67.8	68.3	68.3	68.4	68.3	68.1
Rockingham 28 13 CF	Community Facility	52.2	51.3	49.6	49.3	55.7	54.8	51.8

Note: Shading indicates impacted receptors based on NAC or substantial increase over existing conditions. For purposes of determining impacts, results were rounded to the nearest whole number (e.g., 65.6 dBA rounds to 66 and is considered an impact for a residential land use).

SFR - Single-Family Residence

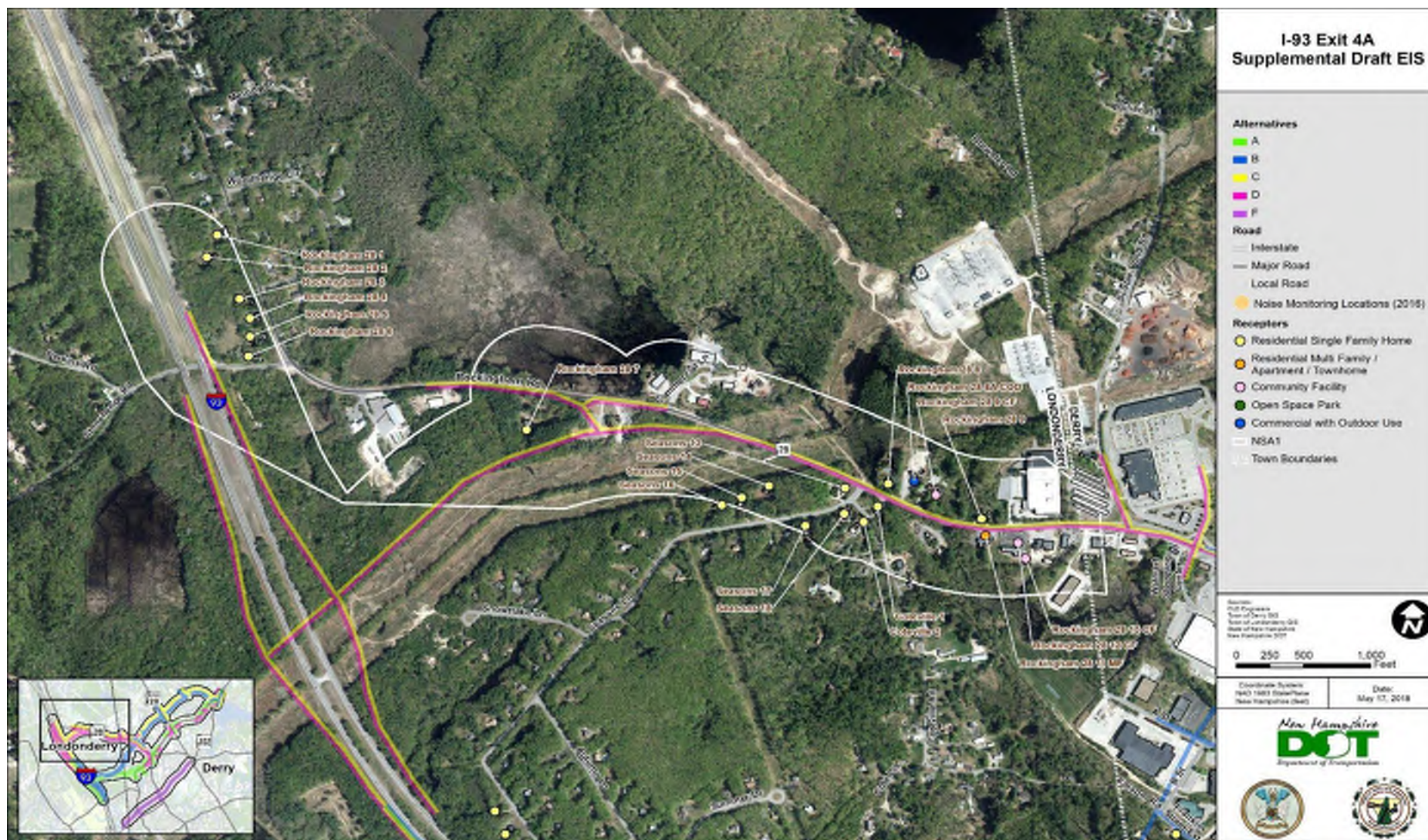


Figure 4-3. NSA 1 Receptors

Table 4-4. Noise Modeling Results for NSA 2 (Worst-Case Peak Hour, Leq, dBA)

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
By Pass 28 1	SFR	66.5	63.6	63.8	60.8	60.1	62.5	63.1
By Pass 28 10"	SFR	68.6	66.1	65.9	64.2	64.2	65.5	65.3
By Pass 28 11"	SFR	70.6	68	67.9	66.5	66.5	67.3	67.3
By Pass 28 12"	SFR	67.2	64.6	64.5	63	63	64	63.9
By Pass 28 13"	SFR	57.9	55	55.1	55.3	55.3	53.9	54.5
By Pass 28 14"	SFR	58	55.1	55.3	55.5	55.5	54.1	54.6
By Pass 28 15"	SFR	56	53.1	53.2	53.4	53.4	52.1	52.6
By Pass 28 16"	SFR	57.4	54.5	54.6	54.5	54.8	53.5	54
By Pass 28 17"	SFR	58.5	55.7	55.7	56.9	56.9	54.7	55.1
By Pass 28 2"	SFR	71.2	68.3	68.4	64.1	63.3	67.2	67.8
By Pass 28 3"	SFR	51.9	48.8	49	46.8	46	48.1	48.4
By Pass 28 4"	SFR	57.1	54.3	54.3	50.9	50.2	53.7	53.7
By Pass 28 6"	SFR	66	63.4	63.3	61	60.1	62.7	62.7
By Pass 28 7"	SFR	66.3	63.7	63.5	61.4	60.5	63	63
By Pass 28 8"	SFR	69.1	66.5	66.4	65.8	66.6	65.8	65.8
By Pass 28 9"	SFR	69.1	66.5	66.3	65.1	65.3	65.8	65.7
Driftwood 1"	SFR	52.1	49.4	49.3	48.7	48.8	48.6	48.7
Driftwood 2"	SFR	51.3	48.5	48.5	48.5	48.6	47.8	47.9
Driftwood 3"	SFR	48.2	45.3	45.3	46.4	46.2	44.5	44.7
Driftwood 4"	SFR	47	44.3	44	47.9	47.3	43.8	43.5
London Rd 1"	SFR	60.8	58.3	58	N/A	N/A	57.7	57.5
London Rd 2"	SFR	52.9	50.4	50.1	N/A	N/A	49.8	49.5
London Rd 3"	SFR	47.7	45	44.7	N/A	N/A	44.5	44.2
London Rd 4"	SFR	46.7	43.8	43.6	N/A	N/A	43.4	43.1
London Rd 5"	SFR	43.7	40.4	40.1	N/A	N/A	40.2	39.7
London Rd 6"	SFR	60.5	57.8	57.7	62.8	62.2	57.2	57.1
London Rd 7"	SFR	49.8	47	46.9	62.1	61.6	46.3	46.4
London Rd 8"	SFR	45.7	42.7	42.5	60.7	59.9	42.3	42
Olde Coach 1"	SFR	45.7	42.9	42.6	50.9	50.2	42.4	42.1
Olde Coach 10"	SFR	39.6	33.3	32.4	49.6	49	35.7	33

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Olde Coach 11"	SFR	40.8	37.2	37	46.3	45.9	37	36.7
Olde Coach 12"	SFR	54	51.6	51.3	51.2	50.9	51	50.7
Olde Coach 2"	SFR	45.2	42.2	42	50.8	50.1	41.8	41.5
Olde Coach 3"	SFR	44.9	41.7	41.5	51.6	51	41.5	41.1
Olde Coach 4"	SFR	43.5	40.1	39.8	51.3	50.7	40.1	39.5
Olde Coach 5"	SFR	42.8	39.2	38.8	51.7	51.1	39.2	38.6
Olde Coach 6"	SFR	41	36.6	36.1	52	51.5	37.1	36.1
Olde Coach 7"	SFR	40.3	35.4	34.8	51.3	50.7	36.3	34.9
Olde Coach 8"	SFR	40.1	34.8	34.2	52.4	51.8	35.9	34.4
Olde Coach 9"	SFR	39.7	33.3	32.5	50.4	49.8	36.6	32.9
Oxford 1"	SFR	49.1	44.9	45.3	45.7	45.9	46.3	45.5
Oxford 2"	SFR	51.1	47.6	47.7	47	46.8	48.1	47.7
Oxford 3"	SFR	57.9	55.2	55.1	53.5	52.7	54.5	54.5
Oxford 4"	SFR	57.9	55.3	55.1	54.3	53.4	54.7	54.6
Oxford 5"	SFR	49.2	46.3	46.2	48.5	48.1	45.8	45.7
Rider 1"	SFR	47.8	44.6	44.7	52.7	52.2	43.7	44.2
Rider 2"	SFR	44.1	40.8	40.7	54.5	54.1	41.2	40.3
Thames 1"	SFR	43.7	39.6	39.4	48	47.6	40.6	39.2
Thames 2"	SFR	42.7	39.5	39.2	50.8	50.2	39.1	38.8
Thames 3"	SFR	45.5	42.7	42.3	59.5	58.7	42.1	41.9
Thames 4"	SFR	47.4	44.6	44.5	52.2	51.7	44.2	44
Thames 5"	SFR	47.7	44.6	44.6	49.8	49.2	44.3	44.1

Note: Shading indicates impacted receptors based on NAC or substantial increase over existing conditions. For purposes of determining impacts, results were rounded to the nearest whole number (e.g., 65.6 dBA rounds to 66 and is considered an impact for a residential land use).

N/A - Not applicable, property is full acquisition

SFR - Single-Family Residence



Figure 4-4. NSA 2 Receptors

Table 4-5. Noise Modeling Results for NSA 3 (Worst-Case Peak Hour, Leq, dBA)

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Barka Elementary School 1 CF	Community Facility	34	33.4	33.6	46.9	46.5	33.1	33
Barka Elementary School 2 CF	Community Facility	34.1	34.1	34.4	48.3	47.9	33.9	33.8
Barka Elementary School 3 CF	Community Facility	35	34.7	35	48.9	48.5	34.5	34.4
Barka Elementary School 4 CF	Community Facility	33.7	32.7	32.8	47.4	47	32.3	32.4
Barka Elementary School 5 CF	Community Facility	37.9	37.7	37.7	51.6	51.2	37.5	37.5
Barka Elementary School 6 CF	Community Facility	36.5	36.7	36.8	48.1	47.7	36.6	36.6
Barka Elementary School 7 CF	Community Facility	37.5	37.8	37.9	46.7	46.4	37.8	37.7
Barkland 1	SFR	35.6	35.8	35.9	52.9**	52.5**	35.8	35.7
Barkland 10	SFR	36.9	37.7	38.1	46.2	45.9	37.7	37.5
Barkland 11	SFR	36.8	37.6	38.1	45.7	45.4	37.6	37.4
Barkland 12	SFR	34.2	33.9	34	49.4**	49**	33.9	33.9
Barkland 2	SFR	34.8	35.6	35.9	51.9**	51.5**	35.6	35.4
Barkland 3	SFR	32	31.5	31.5	52.1**	51.7**	31.4	31.3
Barkland 4	SFR	30.5	30.1	30.2	51.3**	50.9**	30	30
Barkland 5	SFR	33.9	34.2	34.4	51.5**	51.1**	33.9	34
Barkland 6	SFR	34.2	34.5	34.8	52.8**	52.4**	34.4	34.2
Barkland 7	SFR	35.4	36	36.4	49.5	49.1	35.9	35.7
Barkland 8	SFR	36.1	36.7	37	43	42.8	36.5	36.4
Barkland 9	SFR	36.2	37.1	37.6	46.8	46.4	37.1	36.9
Birchwood 1	SFR	40.7	41.3	41.5	46.2	45.8	41.4	41.2
Birchwood 2	SFR	39.5	39.7	39.8	46.9	46.5	39.6	39.6
Birchwood 3	SFR	39.9	40.3	40.5	51.1	50.7	40.4	40.2
Birchwood 4	SFR	38.8	39.8	40.2	47	46.7	39.9	39.6
Brookview 1	SFR	37	37.8	38.3	46	45.7	37.8	37.6
Eastgate 1	SFR	35.8	35.1	35.2	47.4	47	34.8	34.7

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Eastgate 2	SFR	33.1	33.2	33.6	47.6**	47.2	33.2	32.9
Hummingbird 1	SFR	39.3	39.7	39.9	N/A	N/A	39.7	39.6
Hummingbird 2	SFR	37.4	38	38.4	N/A	N/A	38.1	37.9
Hummingbird 3	SFR	36.1	36.9	37.4	N/A	N/A	37	36.7
Hummingbird 4	SFR	36	36.4	36.8	N/A	N/A	36.4	36.2
Hummingbird 5	SFR	35.6	35.5	35.7	N/A	N/A	35.2	35.2
Jeff 1 MF	Multi-Family	40.5	40.9	41.1	47.8	47.5	41	40.9
Jeff 2	SFR	37.3	38.3	38.7	48.6	48.2	38.4	38.2
Jeff 3	SFR	37.6	38.9	39.4	46.7	46.4	39	38.7
Scenic 1	SFR	51.7	51.8	51.8	N/A	N/A	51.8	51.8
Scenic 10	SFR	57	57	57	57.2	57.2	57	57
Scenic 11	SFR	58.3	58.3	58.4	58.4	58.4	58.3	58.3
Scenic 12	SFR	57	57	57	57.2	57.2	57	57
Scenic 13	SFR	44.9	45.1	45.2	48	47.8	45.1	45.1
Scenic 14	SFR	48.5	48.6	48.7	51.6	51.4	48.6	48.6
Scenic 15	SFR	43.6	43.6	43.7	52.7	52.3	43.6	43.6
Scenic 2	SFR	52.3	52.3	52.4	56.3	56	52.3	52.3
Scenic 3	SFR	39.3	39.5	39.6	48.9	48.6	39.5	39.4
Scenic 4	SFR	46.9	46.9	46.9	48.9	48.8	46.9	46.9
Scenic 5	SFR	57.9	57.9	57.9	58.1	58	57.9	57.9
Scenic 6	SFR	54.8	54.8	54.8	55.6	55.5	54.8	54.8
Scenic 7	SFR	56.9	56.9	56.9	60.6	60.3	56.9	56.9
Scenic 8	SFR	41.8	41.9	41.9	N/A	N/A	41.9	41.9
Scenic 9	SFR	56.2	56.2	56.2	56.8	56.7	56.2	56.2

Note: Shading indicates impacted receptors based on NAC or substantial increase over existing conditions. For purposes of determining impacts, results were rounded to the nearest whole number (e.g., 65.6 dBA rounds to 66 and is considered an impact for a residential land use).

N/A: Not applicable, property is full acquisition

** Substantial increase over existing conditions

SFR: Single-family residence



Figure 4-5. NSA 3 Receptors

Table 4-6. Noise Modeling Results for NSA 4 (Worst-Case Peak Hour, Leq, dBA)

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Hovey 1	SFR	66.9	66.2	67.1	67.3	65.9	65.8	66.5
Trolley Car 1	SFR	65.7	65.3	65.4	65.6	64.8	64.7	65.5
Trolley Car 10	SFR	64.5	60.4	62.6	62.7	60.3	60.2	60.8
Trolley Car 11	SFR	66.6	60.8	61.9	62	60.7	60.6	61.2
Trolley Car 12	SFR	67.2	60.4	N/A	N/A	60.3	60.2	60.7
Trolley Car 13	SFR	67.8	60.4	N/A	N/A	60.4	60.2	60.8
Trolley Car 14	SFR	69	59.6	N/A	N/A	59.5	59.5	60
Trolley Car 15	SFR	60.1	56.2	61.5	61.6	56.3	56.2	56.7
Trolley Car 16	SFR	61.3	58.1	62.7	62.7	58	58	58.5
Trolley Car 17	SFR	69.6	60.2	68.2	68.2	60.1	60	60.6
Trolley Car 18	SFR	73.1	63.2	74.1	74	63	63	63.5
Trolley Car 19	SFR	62.5	58.5	62.5	62.4	58.5	58.4	58.9
Trolley Car 2	SFR	63.5	61.7	65.5	65.6	61.5	61.4	62
Trolley Car 3	SFR	69.7	64.6	67.8	68	64.3	64.2	64.8
Trolley Car 4	SFR	69.4	64	69.2	69.3	63.7	63.8	64.3
Trolley Car 5	SFR	67.7	62.7	68.3	68.4	62.5	62.5	63
Trolley Car 6	SFR	67.9	62.4	68.1	68.2	62.2	62.2	62.7
Trolley Car 7	SFR	66.3	61.1	66.5	66.6	61	60.9	61.5
Trolley Car 8	SFR	66.8	61.6	66.7	66.8	61.5	61.4	61.9
Trolley Car 9	SFR	64.9	60.6	64.1	64.1	60.5	60.4	61

Note: Shading indicates impacted receptors based on NAC or substantial increase over existing conditions. For purposes of determining impacts, results were rounded to the nearest whole number (e.g., 65.6 dBA rounds to 66 and is considered an impact for a residential land use).

N/A: Not applicable, property is full acquisition

** Substantial increase over existing conditions

SFR: Single-family residence

Table 4-7. Noise Modeling Results for NSA 5 (Worst-Case Peak Hour, Leq, dBA)

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Seasons 1	SFR	58.3	62.3	62.3	62.3	62.3	62.1	62.5
Seasons 10	SFR	65.8	60.6	61.2	61.2	61.1	61	60.9
Seasons 11	SFR	66.1	61.1	61.7	61.7	61.8	61.7	61.4
Seasons 12	SFR	64.7	59.7	60.3	60.3	61.3	61.3	60.1
Seasons 2	SFR	67.7	63.6	74.1	74.1	63.6	63.5	63.9
Seasons 3	SFR	59.4	60	62.8	62.8	60	59.8	60.2
Seasons 4	SFR	68.1	59.6	67.2	67.3	59.7	59.6	60
Seasons 5	SFR	58.8	57.2	59.3	59.3	57.1	57.1	57.5
Seasons 6	SFR	67.1	60	63.2	63.2	60	59.9	60.3
Seasons 7	SFR	66.9	60.7	62.4	62.4	60.7	60.7	61.1
Seasons 8	SFR	66.7	60.8	61.5	61.5	60.9	60.9	61.1
Seasons 9	SFR	66.5	60.9	61.5	61.5	61.1	61.1	61.2
Buyck 1	SFR	64.9	68.4	68.4	68.6	68.2	68.1	68.6
Seasons_E" (SFR)		58.2	58.4	58.8	58.9	Not analyzed- receptors included for purposes of evaluating benefits of the Seasons Lane barrier only.		
Seasons_D" (SFR)		58.7	58.8	59.2	59.4			
Seasons_C" (SFR)		55.8	57	57.4	57.6			
Seasons_B" (SFR)		54	55.2	55.6	55.8			
Seasons_F" (SFR)		62.3	60.8	61.2	61.2			
Seasons_G" (SFR)		61.8	60.7	61.1	61.1			
Seasons_H" (SFR)		61.2	60.1	60.5	60.5			
Seasons_I" (SFR)		61.1	59.4	59.9	59.9			
Seasons_J" (SFR)		60.3	58.5	59.2	59.2			
Seasons_K" (SFR)		62	59.6	60.8	60.9			
Seasons_L" (SFR)		57.9	57.3	59.7	59.7			

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Seasons_N" (SFR)		55.3	58.8	59	59.1			
Seasons_M" (SFR)		54.6	56.9	57.5	57.6			
Seasons_A" (SFR)		52.8	55.5	56.6	56.7			

Note: Shading indicates impacted receptors based on NAC or substantial increase over existing conditions. For purposes of determining impacts, results were rounded to the nearest whole number (e.g., 65.6 dBA rounds to 66 and is considered an impact for a residential land use).

N/A: Not applicable, property is full acquisition

** Substantial increase over existing conditions

SFR: Single-family residence

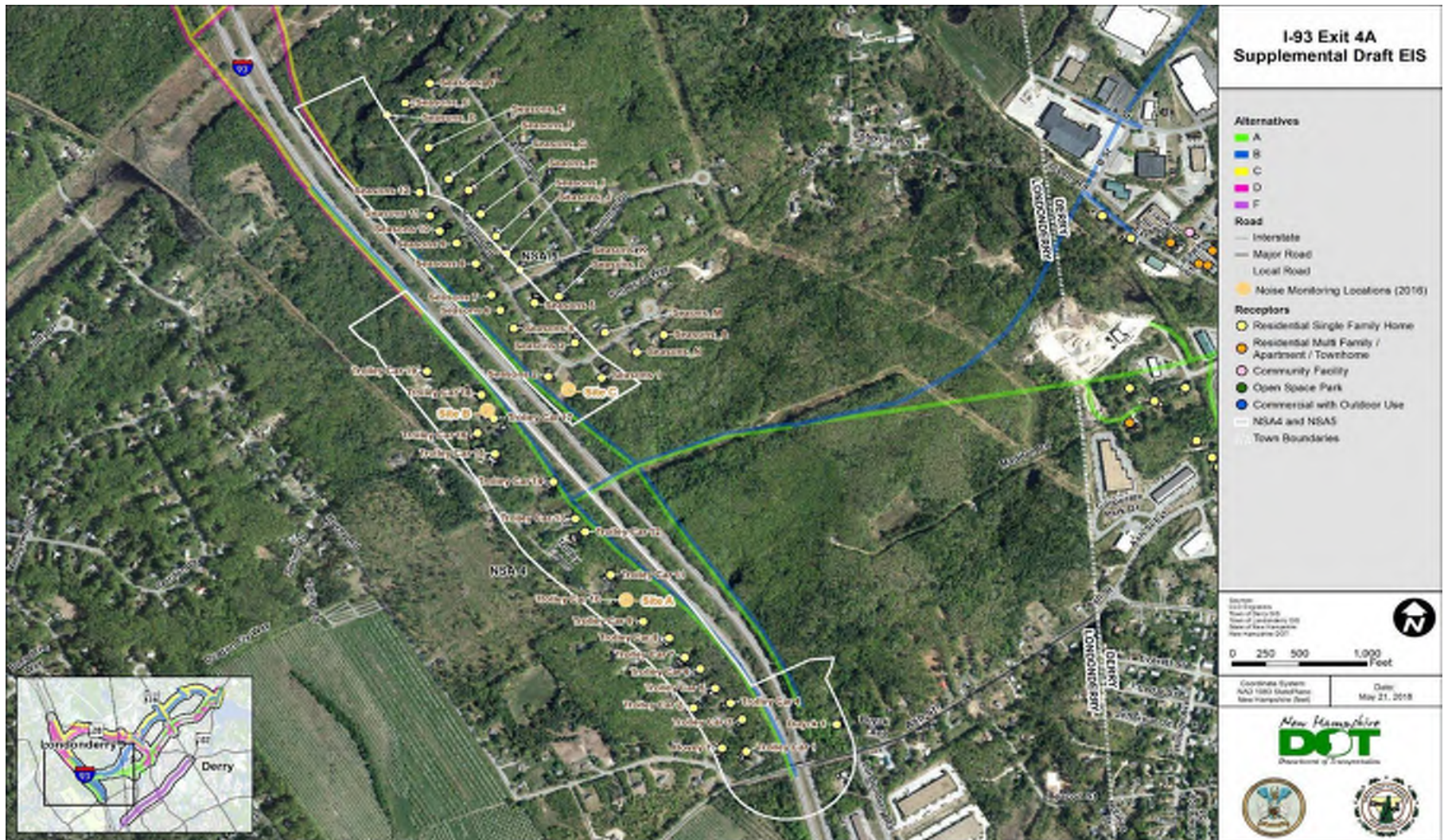


Figure 4-6. NSA 4 and NSA 5 Receptors

Table 4-8. Noise Modeling Results for NSA 6 (Worst-Case Peak Hour, Leq, dBA)

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Claremont 1	SFR	66.5	66.1	68.3	64.7	67.3	67.3	66.6
Claremont 2"	SFR	55.2	54.8	58.8	53.3	55.5	54.2	55.2
Claremont 3"	SFR	48.8	48.7	53.4	48.6	50.3	49.7	49.2
Claremont 4"	SFR	48.5	48.3	52.2	48.7	49.7	50.2	48.9
Claremont 5"	SFR	47.9	47.8	51.5	48.7	49.4	50.8	48.7
Claremont 6"	SFR	50.9	50.7	53.2	51.4	53.5	53.1	51.6
Claremont 7"	SFR	49.8	49.7	53.4	49.5	51.4	51.2	50.2
Claremont 8"	SFR	52	51.7	56.5	50.7	52.7	52.6	52.1
Concord 1"	SFR	49.1	48.7	55.2	50	50.4	50.1	49.4
Concord 2"	SFR	53.2	53	57.9	51.3	53.5	52.9	53.3
Concord 4"	SFR	48	48.1	52.2	47.2	47.5	46.8	48.4
Concord 3"	SFR	49.5	49.4	54.5	48.4	49.4	49.3	49.7
Covey Run 1 APT TH"	Apartment/Townhome	54.2	56.2	55.9	53.8	54.8	54.7	55.3
Covey Run 10 APT TH"	Apartment/Townhome	44.4	45.8	49.7	44.6	44.9	45	45.1
Covey Run 11 APT TH"	Apartment/Townhome	44.7	46.4	49.9	44.9	45.2	45.4	45.6
Covey Run 12 APT TH"	Apartment/Townhome	46.1	47.8	51.9	46.4	46.6	46.8	47
Covey Run 2 APT TH"	Apartment/Townhome	57.7	59.7	59.3	57.2	58.2	58.2	58.7
Covey Run 3 APT TH"	Apartment/Townhome	62.6	64.8	64.7	61.8	62.7	63.4	63.6
Covey Run 4 APT TH"	Apartment/Townhome	62.8	65.1	65	62.1	63	63.7	63.9
Covey Run 5 APT TH"	Apartment/Townhome	63.1	65.4	65.2	62.3	63.2	63.9	64.1
Covey Run 6 APT TH"	Apartment/Townhome	42.5	43.7	48.2	42.7	43.1	43.2	43.1
Covey Run 7 APT TH"	Apartment/Townhome	43	44.4	48.6	43.1	43.7	43.8	43.8
Covey Run 8 APT TH"	Apartment/Townhome	49.7	51.5	54.3	49.4	50.1	50.2	50.6
Covey Run 9 APT TH"	Apartment/Townhome	42.5	43.8	48.1	42.6	43	43.2	43.2
Exeter 1"	SFR	51.1	50.1	58.1	53.5	53.9	51.3	51.5
Exeter 2"	SFR	47.7	47.6	54.4	48.9	48.9	47.8	48.1

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Exeter 3"	SFR	47.3	47.3	53	48	48.2	47.1	47.7
Exeter 4"	SFR	47.8	47.8	52.2	47.1	48	47.7	48.1
Exeter 5"	SFR	47.4	47.4	52.5	47.7	48.4	48.5	47.8
Exeter 6"	SFR	47.2	47.3	51.6	47.2	47.6	47.5	47.7
Ferland 1"	SFR	58.5	60.2	0	57.9	58.8	59.2	59.5
Ferland 2"	SFR	50.9	52.6	58.2	50.7	51.5	51.6	51.9
Ferland 3 MF"	Multi-Family	47.3	48.9	54.1	47.4	48	47.9	48.2
Ferland 4"	SFR	49.3	51.3	54	49.1	49.8	50	50.3
Ferland 5 MF"	Multi-Family	47.5	49.2	52.9	47.4	47.9	48.1	48.4
Ferland 6 MF"	Multi-Family	47.4	48.7	54.4	47	48.2	48.1	48.2
Folsom 1"	SFR	68	67.8	68.5	66.4	68.9	68.6	68.1
Folsom 10"	SFR	67.2	66.7	N/A	65.1	67.7	67.5	67.2
Folsom 11 CF"	Community Facility	59.4	59	N/A	57.4	60	60.1	59.4
Folsom 2"	SFR	67.6	67.4	67	65.9	68.6	68.3	67.8
Folsom 3"	SFR	62.5	63.2	N/A	62.5	63.6	63.2	63.2
Folsom 4"	SFR	62.1	62.1	N/A	60.4	62.7	62.4	62.3
Folsom 5"	SFR	68.5	68.2	67.1	66.8	69.5	69.2	68.6
Folsom 5A"	SFR	52.9	53.2	N/A	52.1	53.8	53.5	53.3
Folsom 6"	SFR	66.7	66.3	N/A	64.7	67.2	66.9	66.7
Folsom 7"	SFR	67.8	67.4	N/A	65.7	68.3	68.1	67.8
Folsom 8"	SFR	66.1	65.7	N/A	64.1	66.6	66.1	66.1
Folsom 9"	SFR	66.5	66.2	70.4	64.7	67.4	67.9	66.6
Franklin 1"	SFR	62.3	62.8	67.3	62.3	64.1	62.8	62.9
Franklin 10 APT TH"	Apartment/Townhome	46.3	46.1	53.4	48.5	48.5	46.4	46.8
Franklin 11 APT TH"	Apartment/Townhome	46.1	45.9	53.1	48.2	48.2	46.2	46.6
Franklin 12"	SFR	67.9	67.9	70.4	66.6	68.9	68.6	68.2
Franklin 13 MF"	Multi-Family	51.2	50.8	57.1	50.8	52.3	51.3	51.4
Franklin 14"	SFR	50.6	48.9	57.5	53.5	53.5	50.4	50.9
Franklin 15"	SFR	47.3	46.5	54.1	49.9	50.3	47.4	47.8
Franklin 2 APT TH"	Apartment/Townhome	64.5	66.3	69.6	63.8	64.7	65.3	65.5
Franklin 3 APT TH"	Apartment/Townhome	64.6	66.3	70	63.9	64.8	65.4	65.5
Franklin 4 APT TH"	Apartment/Townhome	55	54.7	61.4	56.3	57.5	55	55.4
Franklin Ext 4 CF"	Community Facility	43.2	43.5	48.1	48.4	42.7	44.5	44
Franklin 5 APT TH"	Apartment/Townhome	52.9	51.9	59.5	54.9	55.8	52.9	53.3
Franklin 6 APT TH"	Apartment/Townhome	50.8	49.6	57.9	53.3	53.7	50.6	51.2
Franklin 7 APT TH"	Apartment/Townhome	49.5	48.4	56.7	51.9	52.2	49.3	49.8
Franklin 8 APT TH"	Apartment/Townhome	47.4	47.4	54.7	49.3	49.4	47.6	48
Franklin 9 APT TH"	Apartment/Townhome	47	47.3	54	48.4	48.6	47.3	47.6
Franklin Ext 1"	SFR	57.5	57.9	59	62.8	40.7	59.8	59.5

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Franklin Ext 10 APT TH"	Apartment/Townhome	48	49	57.3	48.8	49.4	49.2	49
Franklin Ext 11 APT TH"	Apartment/Townhome	48	48.9	57.1	48.5	49.2	49.1	48.8
Franklin Ext 12 APT TH"	Apartment/Townhome	47.9	48.8	57.1	48.3	49.1	48.9	48.7
Franklin Ext 13 APT TH"	Apartment/Townhome	45.8	46.1	55.1	47.2	46.7	46.5	46.1
Franklin Ext 14 APT TH"	Apartment/Townhome	45.5	45.8	54.8	47.9	46.7	46.4	45.9
Franklin Ext 15 APT TH"	Apartment/Townhome	45	45	54.3	47.5	46.2	46	45.3
Franklin Ext 17"	SFR	59.9	60.9	66.6	61.5	61.7	61.2	61.1
Franklin Ext 2"	SFR	57.6	58.1	59.3	62.9	43.2	59.9	59.7
Franklin Ext 3 MF"	Multi-Family	50.8	51.2	53.3	55.9	39.6	53.1	52.8
Franklin Ext 4 APT TH"	Apartment/Townhome	58.4	58.9	60.8	62.7	61.9	60.5	60.3
Franklin Ext 5 APT TH"	Apartment/Townhome	57.9	58.4	61	62.1	61.4	60	59.8
Franklin Ext 6 APT TH"	Apartment/Townhome	50.8	51.8	58.8	53.3	53.1	52.5	52.3
Franklin Ext 7 APT TH"	Apartment/Townhome	49.7	50.7	58.3	51.9	51.8	51.4	51.1
Franklin Ext 8 APT TH"	Apartment/Townhome	48.9	49.9	57.9	50.6	50.7	50.4	50.1
Franklin Ext 9 APT TH"	Apartment/Townhome	48.4	49.4	57.5	49.6	50	49.7	49.5
Franklin Ext 16"	SFR	57.1	57.9	62.7	60.4	59.9	58.8	58.7
Laconia 1"	SFR	51.2	50.9	54.4	51.1	52.7	53.2	51.5
Laconia 1A COD"	Commercial w/Outdoor Use	65.4	64.9	66.1	65.4	66.6	66.8	65.8
Laconia 2"	SFR	51.2	50.9	56.6	50.1	52.2	52	51.4
Laconia 3"	SFR	60.8	60.4	65.9	59	61.6	62	60.9
Madden 1"	SFR	44.1	45.4	67.9	48	44.7	45	44.7
Madden 2 MF"	Multi-Family	44.6	49.5	57	47.3	47.2	47.3	47.1
Madden 3"	SFR	49.3	57.2	61	50.3	54.1	54.4	54.2
Madden 4"	SFR	56.1	58.3	65.8	55.6	56.6	57.1	57.3
Manchester 1"	SFR	64.8	64.5	65.4	63	65.7	65.2	64.9
Manchester 10"	SFR	48.1	48	51.8	48.7	49.4	49.4	48.7
Manchester 2"	SFR	52.4	52.1	57.3	50.9	52.9	52.5	52.4
Manchester 3"	SFR	47.6	47.5	53.9	47.2	48.5	48.2	47.9
Manchester 4"	SFR	47.1	47	51.3	47.6	48.4	48.1	47.5

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Manchester 5"	SFR	63.9	63.6	66.8	62.1	64.7	64.3	64
Manchester 6"	SFR	53.5	53.1	57.3	51.7	53.9	53.1	53.5
Manchester 7"	SFR	48.6	48.3	53.3	47.8	49.4	49.1	48.8
Manchester 8 MF"	Multi-Family	48.1	48	53.6	47.9	49.1	49.1	48.5
Manchester 9 MF"	Multi-Family	47.6	47.5	52.4	48	48.8	49	48
North High 1"	SFR	54.5	56.8	58	53.8	54.6	55.4	55.5
North High 2"	SFR	55.8	58.1	57.9	55.1	55.9	56.7	56.9
North High 3"	SFR	62.2	64.3	64.2	61.5	62.6	62.9	63.3
North High 4"	SFR	57.6	59.6	60.3	57.2	58.2	58.2	58.7
North High 5"	SFR	60.3	62.2	62.2	59.8	60.8	61	61.4
North High 6"	SFR	68.2	70	71.7	67.4	68.3	68.9	69.2
Laraway_1"	SFR	50.5	51	53.4	55.3	52.1	53	52.5
Laraway_2"	SFR	45.4	46.4	53.1	48.2	47.4	47	46.8
Laraway_3"	SFR	42.3	42.3	46.7	46.9	43.1	43.7	42.4
Laraway_4"	SFR	43.5	44	49.5	46.9	44.9	45.3	44.7
Laraway_4"	SFR	53.6	54.1	56.6	58	54.6	55.8	55.6

Note: Shading indicates impacted receptors based on NAC or substantial increase over existing conditions. For purposes of determining impacts, results were rounded to the nearest whole number (e.g., 65.6 dBA rounds to 66 and is considered an impact for a residential land use).

N/A: Not applicable, property is full acquisition

** Substantial increase over existing conditions

SFR: Single-family residence



Figure 4-7. NSA 6 Receptors

Table 4-9. Noise Modeling Results for NSA 7 (Worst-Case Peak Hour, Leq, dBA)

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Bittersweet 1 APT TH	Apartment/Townhome	45.5	45.7	46.2	43.3	44.4	45.8	45.2
Bittersweet 10 APT TH	Apartment/Townhome	45.2	45.1	45.7	43.4	44.1	45.2	44.6
Bittersweet 11 APT TH	Apartment/Townhome	45	44.9	45.8	43.2	44.1	45.3	44.4
Bittersweet 12 APT TH	Apartment/Townhome	44.9	44.8	45.9	43.1	44	45.3	44.4
Bittersweet 2 APT TH	Apartment/Townhome	44.3	44.3	45.1	42.2	43	44.8	43.8
Bittersweet 3 APT TH	Apartment/Townhome	42.9	42.7	43.4	40.9	41.8	43	42.2
Bittersweet 4 APT TH	Apartment/Townhome	41.3	40.8	41.6	39.6	40.3	41.1	40.4
Bittersweet 5 APT TH	Apartment/Townhome	41.9	41.6	42	40	40.9	41.4	41.1
Bittersweet 6 APT TH	Apartment/Townhome	41.2	40.6	41.5	39.4	40.2	41	40.2
Bittersweet 7 APT TH	Apartment/Townhome	40.8	40.1	41	39	39.8	40.5	39.7
Bittersweet 8 APT TH	Apartment/Townhome	42.9	43	42.8	41	41.9	42.3	42.5
Bittersweet 9 APT TH	Apartment/Townhome	43.6	43.5	43.5	41.6	42.3	43.1	43.1
Energy 1 APT TH	Apartment/Townhome	56.6	55.9	57.8	56.9	57.5	57.7	55.6
Energy 10 APT TH	Apartment/Townhome	45.4	45.1	46.2	44.8	45.5	46.2	44.7
Energy 11 APT TH	Apartment/Townhome	45.5	45.2	46.2	44.9	45.6	46.2	44.7
Energy 12 APT TH	Apartment/Townhome	45.4	45.1	46.1	44.9	45.5	46.2	44.7
Energy 13 APT TH	Apartment/Townhome	45.8	45.5	46.6	45	45.6	46.2	45.1
Energy 14 APT TH	Apartment/Townhome	46.2	46	47	45.5	46.1	46.7	45.6
Energy 15 APT TH	Apartment/Townhome	49.6	49.3	50.5	48.9	49.4	50.5	48.8
Energy 16 APT TH	Apartment/Townhome	50	49.4	51	49.6	50.2	50.8	49
Energy 17 APT TH	Apartment/Townhome	50.2	49.6	51.4	50	50.6	51.2	49.2
Energy 18 APT TH	Apartment/Townhome	50.6	50	51.9	50.7	51.3	51.7	49.7
Energy 19 APT TH	Apartment/Townhome	51	50.4	52.3	51.1	51.7	52.1	50.1
Energy 2 APT TH	Apartment/Townhome	51.4	50.7	52.8	51.6	52.2	52.5	50.5
Energy 20 APT TH	Apartment/Townhome	51.7	51.1	53.1	51.9	52.5	52.9	50.8
Energy 3 APT TH	Apartment/Townhome	48.5	47.8	49.1	48.1	48.6	49	47.4
Energy 4 APT TH	Apartment/Townhome	48.6	47.8	49.3	48.2	48.8	49.2	47.4
Energy 5 APT TH	Apartment/Townhome	48.2	47.7	49.2	48	48.6	49.1	47.3
Energy 6 APT TH	Apartment/Townhome	46.7	46.7	47.5	45.6	46.3	47.5	46.2

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Energy 7 APT TH	Apartment/Townhome	46.3	46.2	46.9	45.3	46.1	47	45.8
Energy 8 APT TH	Apartment/Townhome	46	45.9	46.8	45.2	45.9	46.8	45.4
Energy 9 APT TH	Apartment/Townhome	45.6	45.3	46.4	45	45.6	46.4	44.9
Linlew 1 APT TH	Apartment/Townhome	49.5	49.6	49.8	48.4	48.5	50.4	48.4
Linlew 2 APT TH	Apartment/Townhome	47.7	46.3	46.3	44.6	44.8	45.8	45.8
Linlew 3 APT TH	Apartment/Townhome	53.9	51.5	52.2	47.9	47.5	50.6	51
Linlew 4 APT TH	Apartment/Townhome	63	60.2	61.4	53.7	53.1	59	59.7
Linlew 5 APT TH	Apartment/Townhome	54	51.5	52.5	47.4	47	50.5	51
Pinkerton 1 APT TH	Apartment/Townhome	57.8	57.4	60	58.5	59.2	59.8	57
Pinkerton 2 APT TH	Apartment/Townhome	56.6	56.4	58.9	57	57.5	58.4	56.1
Pinkerton 3 APT TH	Apartment/Townhome	55.9	55.8	58.2	55.7	56.5	57.4	55.6
Solar 1 APT TH	Apartment/Townhome	66.9	67.7	67.8	64.5	65.9	67.2	67.1
Solar 10 APT TH	Apartment/Townhome	51.8	52.2	52.2	49.3	50.2	51.8	51.6
Solar 11 APT TH	Apartment/Townhome	51.6	51.9	52	49.3	50	51.6	51.4
Solar 12 APT TH	Apartment/Townhome	51.1	51.4	51.2	49.1	49.4	50.9	50.8
Solar 13 APT TH	Apartment/Townhome	53.2	53.5	54.5	51.4	51.4	54.7	52.9
Solar 14 APT TH	Apartment/Townhome	51.7	51.9	53.2	49.7	49.9	53.5	51.3
Solar 15 APT TH	Apartment/Townhome	50.1	50.3	51.5	48.1	48.2	51.7	49.7
Solar 16 APT TH	Apartment/Townhome	49.3	49.4	50.4	47.2	47.3	50.5	48.8
Solar 17 APT TH	Apartment/Townhome	48.3	48.4	49.3	46.3	46.5	49.4	47.9
Solar 18 APT TH	Apartment/Townhome	47.6	47.6	48.4	45.5	45.7	48.4	47.1
Solar 2 APT TH	Apartment/Townhome	65.7	66.5	66.2	63.4	64.7	65.6	65.9
Solar 3 APT TH	Apartment/Townhome	64.5	65.2	64.8	62.2	63.4	64.3	64.7
Solar 4 APT TH	Apartment/Townhome	63.1	63.8	63.4	60.8	61.9	63	63.2
Solar 5 APT TH	Apartment/Townhome	61.4	62	61.8	59.2	60	61.5	61.4
Solar 6 APT TH	Apartment/Townhome	59.9	60.4	60.4	57.9	58.4	60.2	59.9
Solar 7 APT TH	Apartment/Townhome	55.7	56.2	56.2	53.7	54.2	55.9	55.6
Solar 8 APT TH	Apartment/Townhome	54	54.5	54.5	51.7	52.4	54.2	53.9
Solar 9 APT TH	Apartment/Townhome	52.9	53.4	53.5	50.6	51.4	53.2	52.8
Squire 1 APT TH	Apartment/Townhome	44.9	45	44.8	43.1	43.2	44.3	44.4
Squire 10 APT TH	Apartment/Townhome	45.7	45.7	45.9	43.6	43.7	45.7	45.1
Squire 11 APT TH	Apartment/Townhome	46.7	47.1	47.3	44.3	45.3	46.9	46.5

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Squire 12 APT TH	Apartment/Townhome	46.1	46.5	46.6	43.7	44.8	46.2	46
Squire 13 APT TH	Apartment/Townhome	49.2	49.7	49.5	46.8	47.8	49.2	49.1
Squire 14 APT TH	Apartment/Townhome	51.2	51.7	51	48.4	49.7	50.6	51.1
Squire 15 APT TH	Apartment/Townhome	53.1	53.6	52.4	51	51.5	52	53
Squire 16 APT TH	Apartment/Townhome	56.1	56.5	55.2	53.4	54.5	54.9	56
Squire 17 APT TH	Apartment/Townhome	58.6	59.2	57.9	56	57.2	57.4	58.6
Squire 18 APT TH	Apartment/Townhome	62.9	63.6	62.1	60.4	61.7	61.3	63.1
Squire 19 APT TH	Apartment/Townhome	65.7	66.5	65.3	63.4	64.7	64.7	65.9
Squire 2 APT TH	Apartment/Townhome	42.4	42.6	43	40.1	40.9	42.7	42
Squire 20 APT TH	Apartment/Townhome	64.5	65.3	63.7	62.3	63.5	63	64.7
Squire 21 APT TH	Apartment/Townhome	63.5	64.3	62.7	61.2	62.5	62	63.7
Squire 22 APT TH	Apartment/Townhome	62.3	63.1	61.8	60.1	61.3	61.1	62.5
Squire 23 APT TH	Apartment/Townhome	60.8	61.6	60.7	58.6	59.9	60	61
Squire 24 APT TH	Apartment/Townhome	52.6	53.2	52.9	50.3	51.3	52.4	52.6
Squire 25 APT TH	Apartment/Townhome	49.1	49.6	49.6	46.7	47.7	49.2	49
Squire 26 APT TH	Apartment/Townhome	46.6	47	47.2	44.2	45.2	46.9	46.4
Squire 27 APT TH	Apartment/Townhome	47.4	47.9	47.8	44.8	46	47.4	47.3
Squire 28 APT TH	Apartment/Townhome	48.8	49.3	49.5	46.2	47.5	49	48.8
Squire 29 APT TH	Apartment/Townhome	51.9	52.5	52.4	49.2	50.6	51.9	51.9
Squire 3 APT TH	Apartment/Townhome	41.6	41.7	42.1	39.3	40	41.8	41.1
Squire 30 APT TH	Apartment/Townhome	54.7	55.3	55.1	52.1	53.5	54.5	54.8
Squire 31 APT TH	Apartment/Townhome	58.6	59.2	58.7	56.1	57.3	58.1	58.6
Squire 32 APT TH	Apartment/Townhome	61.7	62.4	61.6	59.3	60.5	61	61.8
Squire 33 APT TH	Apartment/Townhome	62.1	62.8	62.4	59.9	60.9	62	62.2
Squire 34 APT TH	Apartment/Townhome	58.9	59.5	59.5	56.7	57.5	59.2	58.9
Squire 35 APT TH	Apartment/Townhome	56.9	57.3	57.3	54.9	55.3	57	56.8
Squire 36 APT TH	Apartment/Townhome	53.2	53.7	54.4	50.7	51.8	54.1	53.1
Squire 37 APT TH	Apartment/Townhome	51.5	51.9	52.6	48.9	50	52.4	51.4
Squire 38 APT TH	Apartment/Townhome	49.6	50	50.7	47.1	48.1	50.4	49.4
Squire 4 APT TH	Apartment/Townhome	40.5	40.5	41.8	38.1	39	41.5	39.9
Squire 5 APT TH	Apartment/Townhome	43.1	43.3	43.3	40.8	41.5	43	42.7
Squire 6 APT TH	Apartment/Townhome	42.6	42.7	42.7	40.2	40.9	42.3	42.1

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Squire 7 APT TH	Apartment/Townhome	43.1	43.3	43.1	40.6	41.4	42.8	42.7
Squire 8 APT TH	Apartment/Townhome	44.4	44.3	43.8	41.8	42.3	43.5	43.8
Squire 9 APT TH	Apartment/Townhome	45.1	45.1	45.1	42.8	43.2	44.8	44.5
Sunview 1 APT TH	Apartment/Townhome	62.5	63.2	63.8	60.3	61.4	63.4	62.7
Sunview 10 APT TH	Apartment/Townhome	48.6	48.7	49.6	47	47.5	49.1	48.1
Sunview 11 APT TH	Apartment/Townhome	48.2	48.2	49.2	46.7	47.3	48.9	47.6
Sunview 12 APT TH	Apartment/Townhome	45.8	45.6	46.6	45	45.6	46.2	45.2
Sunview 13 APT TH	Apartment/Townhome	46	45.8	46.7	45.2	45.8	46.4	45.4
Sunview 14 APT TH	Apartment/Townhome	44.1	43.8	45	42.8	43.6	44.6	43.4
Sunview 15 APT TH	Apartment/Townhome	44.3	44.1	45.2	43	43.8	44.8	43.6
Sunview 16 APT TH	Apartment/Townhome	44.7	44.5	45.6	43.5	44.3	45.1	44.1
Sunview 17 APT TH	Apartment/Townhome	43.9	43.6	44.7	42.6	43.4	44.3	43.2
Sunview 18 APT TH	Apartment/Townhome	44.4	44.1	45.2	43.1	43.9	44.7	43.7
Sunview 19 APT TH	Apartment/Townhome	45.1	44.9	46	43.9	44.6	45.5	44.5
Sunview 2 APT TH	Apartment/Townhome	62	62.8	63.5	59.8	60.9	63	62.2
Sunview 20 APT TH	Apartment/Townhome	44.7	44.7	45	42.9	43.8	44.6	44.2
Sunview 21 APT TH	Apartment/Townhome	44.6	44.5	45.2	42.8	43.6	44.8	44
Sunview 22 APT TH	Apartment/Townhome	45	44.9	45.5	43.3	44.1	45.1	44.4
Sunview 23 APT TH	Apartment/Townhome	44.9	44.8	45.5	43.2	44	45	44.3
Sunview 24 APT TH	Apartment/Townhome	65.3	66.1	65.9	63.1	64.3	64.8	65.5
Sunview 25 APT TH	Apartment/Townhome	64.2	64.9	63.5	61.9	63	62.7	64.3
Sunview 26 APT TH	Apartment/Townhome	53.6	54.3	54.4	51.2	52.5	53.8	53.7
Sunview 27 APT TH	Apartment/Townhome	52.8	53.1	53.6	51.3	51.4	53.1	52.6
Sunview 28 APT TH	Apartment/Townhome	48.7	49	49.3	46.3	47.3	49.2	48.4
Sunview 29 CF	Community Facility	44.7	45	45.1	42.4	43.3	44.6	44.4
Sunview 3 APT TH	Apartment/Townhome	63.5	64.3	65.6	61.6	62.9	64.9	63.8
Sunview 4 APT TH	Apartment/Townhome	50.9	51	52.5	49.7	50.2	51.4	50.6
Sunview 5 APT TH	Apartment/Townhome	50.6	51	52	49.2	49.7	50.9	50.5
Sunview 6 APT TH	Apartment/Townhome	50.9	51.2	52.3	49.5	49.9	51.4	50.7
Sunview 7 APT TH	Apartment/Townhome	50.7	51	52.3	49.1	49.7	51.6	50.5
Sunview 8 APT TH	Apartment/Townhome	49.8	50	51	48.3	48.8	50.4	49.5
Sunview 9 APT TH	Apartment/Townhome	49.3	49.5	50.6	47.7	48.3	50	48.9

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Tsienneto 10 CF	Community Facility	61.3	61.6	61.8	58.6	59.3	61.5	61.1
Tsienneto 11 CF	Community Facility	60.1	60.5	61.1	57.1	58.3	60.7	59.9
Tsienneto 12 CF	Community Facility	48.9	49.1	49.1	46.5	47.6	48.5	48.5
Tsienneto 8 CF	Community Facility	62.2	62.9	62.7	59.9	61	62.2	62.3
Tsienneto 9 CF	Community Facility	64.7	65	65.6	62.9	62.8	65.4	64.5

Note: Shading indicates impacted receptors based on NAC or substantial increase over existing conditions. For purposes of determining impacts, results were rounded to the nearest whole number (e.g., 65.6 dBA rounds to 66 and is considered an impact for a residential land use).

N/A: Not applicable, property is full acquisition

** Substantial increase over existing conditions

SFR: Single-family residence



Figure 4-8. NSA 7 Receptors South



Figure 4-9. NSA 7 Receptors North

Table 4-10. Noise Modeling Results for NSA 8 (Worst-Case Peak Hour, Leq, dBA)

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Barkland 1	SFR		49.8	50	46.5	47	49.4	49.5
Barkland 2"	SFR	45.5	48.1	48.6	45.3	45.7	48.1	47.8
Barkland 3"	SFR	45.2	47.8	48.3	45	45.5	47.8	47.5
Barkland 4"	SFR	45.8	48.4	48.9	45.4	45.9	48.3	48
Barkland 5"	SFR	45.3	47.7	48	45	45.4	47.4	47.4
Barkland 6"	SFR	44	46.3	47	43.9	44.4	46.4	45.9
Beaver 1"	SFR	59.1	61.9	62.6	58.6	59	62.1	61.7
Beaver 2"	SFR	49	51.2	51.8	49.2	49.4	51.3	51.1
Beaver 3"	SFR	48.5	50.5	51	48.9	48.9	50.6	50.4
Beaver 4"	SFR	45.1	46.8	47.2	45.1	45.2	46.7	46.6
Beaver 5"	SFR	47.5	49.4	50	47.8	47.7	49.6	49.3
Beaver 6"	SFR	55.1	57.4	57.5	55	55.1	57	57.5
Beaver 7"	SFR	45.4	47.5	48.1	45.7	45.8	47.6	47.3
By Pass 28 5"	SFR	61.9	59.3	59.2	56	54.7	58.6	58.6
Chester 1"	SFR	67.6	68.5	68.2	68.5	69	68.3	68.5
Chester 10"	SFR	67.8	66.9	66.3	64.5	65.1	66.5	66.8
Chester 2"	SFR	50.6	52	52.6	52.9	52.9	52.2	51.5
Chester 3"	SFR	54.3	55.5	57.1	56.8	56.8	56.2	55
Chester 4 MF"	Multi-Family	63.2	63.7	66.1	65.8	65.4	65.2	64
Chester 5"	SFR	66.8	67.5	68.3	67.9	68.3	67.5	67.3
Chester 6"	SFR	59	60	62.3	62.3	62.7	61.8	59.9
Chester 7"	SFR	58.5	57.6	58.4	56.5	57.8	58.3	57.5
Chester 8"	SFR	57	56	55.7	53.8	54.8	55.8	55.9
Chester 9"	SFR	66.2	65.3	57.6	55.6	56.8	57.4	65.3
Country 1"	SFR	45.8	46.8	46.6	44.9	45.2	46.1	46.5
English Range 1"	SFR	60	59.9	59.6	62.9	59.6	59.4	59.7
English Range 2"	SFR	57.3	55.5	55.3	56.4	55.1	55.1	55.1
Fieldston 2 MF"	Multi-Family	42.7	45	45.9	42.3	42.8	45.4	44.8
Fieldston 4"	SFR	42.7	45	45.9	42.2	42.5	45.4	44.7
Fieldstone 1 MF"	Multi-Family	45.4	47.8	48.5	45.1	45.5	48	47.6

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Fieldstone 3 MF"	Multi-Family	42.8	45.2	46	42.4	42.9	45.5	44.9
Horseshoe 1"	SFR	59.2	62	61.3	58.7	59	60.8	61.8
Horseshoe 2"	SFR	46.7	49.7	49.7	46.2	46.7	49.1	49.3
Horseshoe 3"	SFR	45.7	48.1	48.5	46	46.1	48	47.9
Horseshoe 4"	SFR	47.5	50.1	50.3	47.4	47.8	49.7	49.8
Horseshoe 5"	SFR	46.7	49.3	49.7	46.9	47.2	49.1	49
Horseshoe 6"	SFR	47.5	49.9	50.9	47.8	48	50.4	49.6
Horseshoe 7"	SFR	46.8	49.1	50.1	47.4	47.4	49.5	48.8
Lake Shore 1"	SFR	43.4	44.1	45	45.5	45.8	44.5	43.8
Main 28B 1 CF"	Community Facility	56.9	54.1	55.3	53.2	53.6	53.3	53.8
Main 28B 2 CF"	Community Facility	51.6	49.5	50.3	48.3	48.3	48.6	48.6
Main 28B 3 CF"	Community Facility	62.4	63.4	64.8	60	60.6	64.3	63
Main 28B 4 CF"	Community Facility	54	52.2	53.2	50.8	51.2	52	51.8
Main 28B 5 CF"	Community Facility	55.7	53.8	54.6	52.3	52.7	53.5	53.4
McKinley 1"	SFR	50.4	51.8	52.9	53.1	53.3	52.6	51.2
McKinley 2"	SFR	50	51.7	53.3	51.8	52.2	52.9	51.1
McKinley 3"	SFR	46.7	47.7	49.2	50.4	50.9	48.9	47.2
McKinley 4"	SFR	45.6	46.5	47.7	48.9	49.3	47.3	46.1
McKinley 5"	SFR	46	46.9	48.3	49.6	50	47.8	46.5
McKinley 6"	SFR	44.7	45.4	46.4	47.2	47.6	45.9	45.1
McKinley 7"	SFR	45.3	46	47.3	48.1	48.5	46.8	45.7
McKinley 8"	SFR	44.8	45.7	45.9	47.4	47.9	45.5	45.4
Morningside 1 MF"	Multi-Family	61	64	64.3	60.1	60.7	63.7	63.7
Morningside 2 MF"	Multi-Family	47.3	50.1	50.8	46.9	47.5	50.2	49.8
Morningside 3 MF"	Multi-Family	43.7	46.2	47.4	43.5	44.1	46.8	45.9
Morningside 4 MF"	Multi-Family	44.5	47	47.7	44.3	44.7	47.2	46.8
N Shore 1"	SFR	61.4	62.4	64.2	64.1	64	63.5	62
N Shore 2"	SFR	51.9	53.5	53.4	53.5	53.3	53	52.3

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
N Shore 3"	SFR	53	54.7	53.4	53.7	53.3	53.2	53.1
N Shore 4"	SFR	51.9	53.5	52.6	53	52.6	52.3	52
N Shore 5"	SFR	59.1	60.9	59.5	59.9	59.5	59.4	59.2
Private near Lake Shore 1"	SFR	51.1	51.1	52.6	52.3	53.3	52.6	50.8
Private near Lake Shore 2"	SFR	56.4	56.2	58.4	57.7	58.7	58	56.1
Scenic 17"	SFR	50.2	52.3	53.1	50.8	50.2	52.7	52
Scenic 18"	SFR	49.9	50.7	52.1	51.5	49.8	51.9	50.6
Scenic 19"	SFR	53.8	54	55.8	55.6	53.5	55.8	54
Scenic 20"	SFR	52	52.4	54.1	53.8	51.8	54	52.4
Scenic 21"	SFR	50.4	51.5	52.7	51.8	50.1	52.5	51.3
Tsienneto 1"	SFR	63.1	65.3	66.2	67.1	68.1	65.8	65.1
Tsienneto 12A"	SFR	58.1	60.6	62.3	57.2	57.8	61.5	60.3
Tsienneto 13"	SFR	50.4	50.6	51.8	48.1	48	51.1	50.4
Tsienneto 14"	SFR	60.6	63.1	65.1	60.1	60.3	64.7	63
Tsienneto 15 MF"	Multi-Family	62.7	65.7	64.9	61.8	62.5	64.3	65.4
Tsienneto 16"	SFR	62.5	65	65.9	62.2	62.3	65.7	64.9
Tsienneto 17"	SFR	54.3	56.8	57.3	53.4	54.1	56.7	56.5
Tsienneto 18 MF"	Multi-Family	61.4	64.4	63.6	60.5	61.3	63	64.1
Tsienneto 19"	SFR	58.5	61.2	62.8	58	58.4	62.2	61
Tsienneto 2"	SFR	60.9	63.5	64	0	0	63.5	63.4
Tsienneto 20 MF"	Multi-Family	62.6	65.6	65	61.6	62.4	64.3	65.3
Tsienneto 21 MF"	Multi-Family	50.6	53.3	54	49.6	50.3	53.4	52.9
Tsienneto 22 CF"	Community Facility	62	64.6	65.1	61.7	61.8	64.6	64.5
Tsienneto 23"	SFR	59.6	62.3	63.4	59.1	59.9	62.9	62.1
Tsienneto 24"	SFR	57.8	60.4	60	57.3	57.9	59.4	60.2
Tsienneto 25"	SFR	56.1	58.1	58	55.8	56.2	57.6	58.5
Tsienneto 25A"	SFR	45.2	46.2	46.8	43.7	44	46.3	45.9
Tsienneto 26"	SFR	53.5	56.4	56.3	52.5	53.3	55.7	56.1
Tsienneto 27"	SFR	50.9	53.7	53.7	50.1	50.9	53.2	53.4

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Tsienneto 28 MF"	Multi-Family	57	59.1	59.4	56.7	56.9	59.2	59.4
Tsienneto 29 MF"	Multi-Family	57.6	59.9	60.3	57.4	57.6	59.9	60
Tsienneto 3"	SFR	63.4	66	66.6	63	63.1	66.1	65.9
Tsienneto 30"	SFR	58.9	61.9	62.7	58	58.7	62.1	61.6
Tsienneto 31"	SFR	62.8	65.3	66.6	62.5	62.6	66.1	65.2
Tsienneto 32"	SFR	58	60.5	60.7	57.8	58	60.2	60.4
Tsienneto 33"	SFR	64.3	67.3	67.9	63.4	64.1	67.3	67
Tsienneto 34 MF"	Multi-Family	54.6	57.8	58	53.6	54.4	57.5	57.4
Tsienneto 35"	SFR	59.4	62.3	63.2	58.8	59.1	62.6	62.1
Tsienneto 36"	SFR	51.1	53.2	53.3	50.9	51	52.8	53.5
Tsienneto 37 MF"	Multi-Family	58.5	61.3	61.7	57.9	58.3	61.2	61.1
Tsienneto 38 CF"	Community Facility	46	47.3	48.5	44.8	45.2	47.9	46.9
Tsienneto 38 MF"	Multi-Family	60.4	63.3	64	59.7	60.1	63.5	63.1
Tsienneto 39 CF"	Community Facility	46.2	47.2	48.4	44.7	44.9	47.7	46.7
Tsienneto 39 MF"	Multi-Family	57	60.4	61.4	55.7	56.9	60.8	60
Tsienneto 4"	SFR	49.1	52	51.7	49.7	50.1	51.2	51.6
Tsienneto 40 CF"	Community Facility	46.8	47.6	48.9	45	45.2	48.2	47.1
Tsienneto 40 MF"	Multi-Family	54.3	57.5	58.6	53.2	54.2	58.1	57.1
Tsienneto 41"	SFR	62.7	65.3	66.5	62.4	62.4	66	65.2
Tsienneto 42 MF"	Multi-Family	53.6	56.7	58.3	52.6	53.6	57.8	56.3
Tsienneto 43 MF"	Multi-Family	54	57	58.7	53	53.9	58.1	56.7
Tsienneto 44"	SFR	58.7	61.7	62.2	57.9	58.3	61.6	61.4
Tsienneto 45"	SFR	59.4	62.4	63.5	58.7	59.2	63	62.1
Tsienneto 47"	SFR	60	62.9	64	59.3	59.7	63.5	62.6
Tsienneto 48"	SFR	61.3	64.2	64	60.6	61.2	63.4	64
Tsienneto 49"	SFR	59.5	62.4	63.5	58.9	59.3	62.9	62.2
Tsienneto 5"	SFR	59.9	62.8	63.1	59.4	59.8	62.6	62.5
Tsienneto 50"	SFR	59.9	62.8	63	59.3	59.8	62.4	62.5
Tsienneto 51"	SFR	61.2	63.8	64.4	60.9	60.9	63.9	63.6

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Tsienneto 52"	SFR	64.9	67.5	68.2	64.6	64.9	67.7	67.4
Tsienneto 53"	SFR	57.1	60	60.8	56.4	57.2	60.3	59.7
Tsienneto 54"	SFR	65.8	68.3	69.5	65.5	65.8	69	68.2
Tsienneto 55 MF"	Multi-Family	54.9	57.2	57.1	54.8	55.2	56.6	57.2
Tsienneto 6"	SFR	64.3	67.4	68.4	64.3	64.9	67.9	67.1
Tsienneto 7"	SFR	63.7	66.8	67.2	62	63	66.6	66.4

Note: Shading indicates impacted receptors based on NAC or substantial increase over existing conditions. For purposes of determining impacts, results were rounded to the nearest whole number (e.g., 65.6 dBA rounds to 66 and is considered an impact for a residential land use).

N/A: Not applicable, property is full acquisition

** Substantial increase over existing conditions

SFR: Single-family residence



Figure 4-10. NSA 8 South



Figure 4-11. NSA 8 Receptors North

Table 4-11. Noise Modeling Results for NSA 9 (Worst-Case Peak Hour, Leq, dBA)

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Aiken 1	SFR	59.6	56	61.1	60	60	60.1	60.8
Aiken 10	SFR	45.3	45.1	44.3	43.9	43.9	44.3	44.8
Aiken 11	SFR	46	45.8	45.2	44.8	44.7	45.1	45.2
Aiken 12	SFR	50.9	50.6	50.8	50.1	50	50.3	47.9
Aiken 13	SFR	55.3	55	55.3	54.6	54.5	54.7	53
Aiken 14	SFR	61.6	61.3	61.7	61.1	61	61.1	59.1
Aiken 15	SFR	42.6	42.5	41.9	41.2	41.5	41.9	42
Aiken 16	SFR	44.3	44.1	43.5	43	43	43.4	43.5
Aiken 17	SFR	45.2	45.1	44.7	44	44.2	44.6	44.1
Aiken 18	SFR	46.1	45.9	45.8	45.2	45.1	45.5	44.6
Aiken 19	SFR	46.9	46.7	46.9	46.1	46.1	46.4	44.7
Aiken 2	SFR	51.9	51.9	53	52.4	52.3	52.7	54.1
Aiken 20	SFR	52.7	52.4	52.6	52	51.9	52.1	51.4
Aiken 21	SFR	60.1	59.8	60.2	59.6	59.5	59.6	58.4
Aiken 3	SFR	51.6	51.9	50.4	50.3	50.1	50.5	52.6
Aiken 4	SFR	48.1	48.8	46.8	46.8	46.7	47.1	49.7
Aiken 5	SFR	49.2	49.7	48.2	48.1	47.8	48.3	48.5
Aiken 6	SFR	48.8	49.2	47.6	47.6	47.3	47.7	48.3
Aiken 7	SFR	48	48.3	46.4	46.3	46.3	46.7	48.2
Aiken 8	SFR	48.1	48.3	46.5	46.4	46.3	46.7	48.5
Aiken 9 MF	Multi-Family	44.7	44.4	43.3	42.9	43	43.4	44.3
Broadway 102 1	SFR	70.4	71.2	69.6	69.6	69.3	69.7	72.6
Broadway 102 10 APT TH	Apartment/Townhome	62.6	63.1	61.3	61.3	61	61.4	61.9
Broadway 102 11 APT TH	Apartment/Townhome	70	70.7	69.2	69.1	68.8	69.2	72
Broadway 102 12 MF	Multi-Family	71.3	72	70.5	70.5	70.1	70.6	74
Broadway 102 13 APT TH	Apartment/Townhome	66	66.7	65.2	65.1	64.8	65.3	67.2
Broadway 102 14	SFR	68.4	68.7	69	67.6	67.4	67.8	69.1
Broadway 102 15 MF	Multi-Family	67.6	68.1	67.8	66.8	66.7	67.4	68.7
Broadway 102 16	SFR	66.5	67	66.8	65.7	65.7	65.8	67.6

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Broadway 102 17	SFR	68.2	68.5	68.8	67.4	67.2	67.6	68.7
Broadway 102 2 COD	Commercial w/Outdoor Use	69.4	70.3	68	68.1	68.1	68.5	70.5
Broadway 102 3	SFR	69.9	70.8	68.4	68.5	68.6	69	70.8
Broadway 102 4 MF	Multi-Family	67.8	68.6	67	67	66.7	67.1	68.6
Broadway 102 5	SFR	69.5	70.3	68.8	68.7	68.4	68.8	70.3
Broadway 102 6	SFR	69.2	70.1	67.7	67.9	67.9	68.3	70.1
Broadway 102 7	SFR	69.4	70.2	67.9	68	68.1	68.5	70.3
Broadway 102 8	SFR	69.3	70.1	68.5	68.4	68.1	68.6	70.1
Broadway 102 9 CF	Community Facility	68.9	69.5	68	67.9	67.6	68	69.6
Clark 1 MF	Multi-Family	68.1	69	67.4	67.3	67	67.5	68.7
Clark 2 MF	Multi-Family	53.6	53.8	52.2	52.2	51.9	52.3	54
Clark 3	SFR	48.3	48.4	47	46.9	46.6	47.1	48.6
Clark 4 MF	Multi-Family	52.1	52.4	50.4	50.4	50.4	50.8	52.3
Clark 5	SFR	51.8	51.8	49.8	49.8	49.9	50.3	51.2
Clark 6	SFR	47.2	46.7	45.2	45.1	45.1	45.5	46.7
Clark 7	SFR	49	49.1	47.7	47.6	47.3	47.7	49.3
Clark 8	SFR	46.5	46.8	45.4	45.3	45	45.5	46.3
Desmarais 1	SFR	47.4	47.3	47.7	46.6	46.9	47.5	47.8
Desmarais 2	SFR	48.6	48.8	49.1	47.9	47.9	48.8	49.4
Desmarais 3	SFR	46.2	46.6	47	45.5	45.9	46.6	47.4
Dickey 1	SFR	57	57.8	56.3	56.2	55.8	56.3	56.3
Dickey 2	SFR	51.3	51.4	49.2	49.4	49	49.7	51.5
Dickey 3	SFR	49.4	49.1	46.7	47	46.5	47.4	48.5
Dickey 4	SFR	48.4	48.3	46.2	46.3	45.9	46.7	48.3
Dickey 5	SFR	48.9	48.9	46.8	46.9	46.5	47.2	49.3
Dickey 6	SFR	51	51.3	49.4	49.4	49.1	49.7	51.6
Ela 1	SFR	54.6	56.6	53.5	53.8	54	54.4	57.3
Ela 2	SFR	52	54	51.1	51.3	51.4	51.9	54.6
Ela 3	SFR	50.4	52.1	50.3	50.3	50.4	50.8	53.5
Ela 4	SFR	51.7	53.4	51.5	51.5	51.6	52.1	55.1
Ela 5	SFR	55.4	57.5	54.3	54.6	54.8	55.3	58.4

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Elm 1	SFR	67.7	68.2	67.9	66.9	66.8	67.4	68.9
Elm 10 MF	Multi-Family	49.6	49.8	50.1	48.7	48.4	49.2	50.6
Elm 11	SFR	49.1	49.4	49.7	48.2	48.2	49.1	50.3
Elm 12 APT TH	Apartment/Townhome	47.7	48.4	49.9	47.4	47.3	47.9	48.9
Elm 13 MF	Multi-Family	43.7	44.7	46.3	43.5	43.6	44	45.1
Elm 2 MF	Multi-Family	57	57.3	57.5	56.2	56.1	55.9	57
Elm 3 MF	Multi-Family	48.2	49.5	52.6	49	48.7	48.7	49.1
Elm 4 MF	Multi-Family	48.2	49.7	52.8	49.1	48.8	48.8	49.3
Elm 5 MF	Multi-Family	47.1	48.7	51.8	48	47.9	47.9	48.3
Elm 6 MF	Multi-Family	45.1	47.8	51.8	47.3	47.1	47	47.4
Elm 7 MF	Multi-Family	44.6	46.8	50	45.9	45.9	46.1	46.7
Elm 8	SFR	56.6	56.8	57.1	55.7	54.7	55.7	56.1
Elm 9 MF	Multi-Family	52.5	52.7	53.1	51.6	51.2	51.8	52.8
Fordway 1 MF	Multi-Family	68.7	69.4	68.1	67.9	67.6	68	70
Fordway 2 MF	Multi-Family	62.5	62.1	62.5	61.9	61.8	61.9	61.3
Fordway 3	SFR	66.2	65.9	66.2	65.7	65.6	65.7	67.1
Fordway 4	SFR	65.8	65.5	65.9	65.3	65.2	65.3	66.7
Fordway 5	SFR	66	65.7	66.1	65.5	65.4	65.5	67
Fordway 6	SFR	65.7	65.4	65.8	65.3	65.1	65.2	66.6
Fordway 7	SFR	60.1	59.8	60.2	59.6	59.5	59.6	59.1
Fordway 8 MF	Multi-Family	63.8	63.5	64	63.4	63.3	63.3	61
Griffin 1 APT TH	Apartment/Townhome	69.2	69.5	69.8	68.4	68.2	68.8	70.2
Griffin 10	SFR	49.9	50	50.1	49.1	49.2	50.2	50.7
Griffin 11	SFR	49.1	49.1	49.3	48.3	48.5	49.2	49.7
Griffin 12	SFR	48	47.9	48.3	47.3	47.5	48.1	48.6
Griffin 13	SFR	47.8	47.4	48	47.1	47.2	47.8	48.1
Griffin 2	SFR	56	56.5	56.3	55.2	54.6	56.2	55.6
Griffin 3 MF	Multi-Family	52.5	52.6	52.5	51.7	51.2	52.3	52.8
Griffin 4	SFR	51	50.8	51.1	50.3	50	50.8	51.6
Griffin 5 MF	Multi-Family	50.7	50.1	50.9	50	49.8	50.3	50.4
Griffin 6	SFR	50.1	49.5	50.3	49.4	49.2	49.8	49.9
Griffin 7 MF	Multi-Family	49.1	48.6	49.2	48.4	48.3	48.9	49.1

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Griffin 8 MF	Multi-Family	48.5	48.1	48.6	47.7	47.7	48.3	48.5
Griffin 9	SFR	51.3	51.4	51.4	50.4	50.5	51.6	51.9
High 1	SFR	68.4	69.3	67.2	67.5	67.2	67.4	68.8
High 10	SFR	65.4	65.8	65	64.4	64.4	64.6	65.2
High 11	SFR	56.3	61.4	66.3	61.4	60.4	60.2	59.7
High 12	SFR	55.3	61.1	66.4	61.1	60.2	60	59.3
High 13 MF	Multi-Family	55.2	61.6	66.9	61.5	60.6	60.4	59.6
High 14	SFR	54.5	60.9	66.2	60.9	59.9	59.7	58.9
High 15	SFR	52.4	58.8	64.1	58.8	57.8	57.7	56.8
High 16	SFR	59	59.1	59.7	58.2	58.1	58.1	58.4
High 17	SFR	55.4	57	60.1	56.5	56.1	55.8	55.9
High 18 MF	Multi-Family	53.7	56.7	60.9	56.6	55.9	55.5	55.7
High 19 MF	Multi-Family	51.5	53.9	57.7	53.6	53	52.8	53.2
High 2	SFR	60.5	61.7	60.6	61	59.7	59.7	60.8
High 20	SFR	50.5	55.1	59.9	55	54.2	54	53.7
High 21	SFR	49.6	54.7	59.8	54.7	53.8	53.6	53.1
High 22	SFR	49	54.3	59.4	54.3	53.4	53.2	52.7
High 23 MF	Multi-Family	49.2	54.8	59.9	54.7	53.8	53.6	53
High 24 MF	Multi-Family	45.4	50.1	55.1	49.9	49.4	49.2	48.9
High 3 MF	Multi-Family	56.5	58.4	57.8	58.7	56.5	56.1	57.7
High 4	SFR	56.1	57.5	57.6	58.1	56.2	55.7	57.1
High 5	SFR	58.3	60.4	63.3	61.2	59.5	58.8	59.6
High 6 MF	Multi-Family	72.1	72.9	70.6	70.8	70.8	71.1	72.9
High 7 MF	Multi-Family	68.3	69.1	66.7	66.9	67	67.3	68.7
High 8	SFR	65.7	66.4	64.4	64.5	64.5	64.8	65.5
High 9 MF	Multi-Family	69	69.8	67.7	67.7	67.8	68.2	69.6
Lawrence_10	SFR	50.4	51.4	53	50.7	50.2	50.2	51
Linden 1	SFR	47.9	48.1	47.1	46.4	46.2	46.7	48.5
Linden 2	SFR	49.5	50.1	49.5	48.4	48.3	48.7	49.9
Linden 3	SFR	49.3	49.9	49.9	48.4	48.4	48.6	49.9
Linwood 1	SFR	56.8	57.7	56.2	56.1	55.8	56.2	55.6
Linwood 2	SFR	47.9	47.9	46	45.9	45.6	46.2	48.1

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Linwood 3 APT TH	Apartment/Townhome	48.7	48.9	47.2	46.9	46.8	47.3	49.4
Linwood 4	SFR	50.7	50.9	49.4	49.3	48.9	49.4	50.9
Linwood 5	SFR	62.6	63.3	61.7	61.7	61.4	61.8	61.7
Londonderry 1	SFR	66.4	65.8	59.9	63.4	60.8	63.5	60.1
Londonderry 2	SFR	66.9	66.3	60.4	63.9	61.3	64	60.5
Londonderry 3	SFR	69.2	68.5	62.7	66.1	63.5	66.3	62.8
Londonderry 4	SFR	57.4	58.2	55.2	56	55.3	56.3	57.4
South 1 MF	Multi-Family	54.3	53.9	54.4	53.7	53.6	53.8	52.7
St Charles 1	SFR	61.5	60.7	62.7	62	61.9	62.2	63.3
St Charles 2	SFR	57.9	55.9	59.3	58.2	58.2	58.4	59.5
St Charles 3	SFR	55.4	51.9	57	55.9	55.9	56	56.8
St Charles 4	SFR	57.4	50.4	59.2	57.9	57.9	57.9	58.3
St Charles 5	SFR	57.4	51.9	59.2	57.9	57.9	58	58.4
Valley 1 MF	Multi-Family	70	70.9	69.3	69.3	69	69.4	72
Valley 2	SFR	52.4	52.5	50.6	50.7	50.4	50.8	52.3
Valley 3	SFR	51.9	52	50.3	50.3	50	50.4	51.9
Valley 4	SFR	47.6	48.4	46.7	46.6	46.5	47	49.4
Valley 5	SFR	47.6	48	46	46	45.9	46.3	48.5
West Everett 1	SFR	68.9	69.2	69.4	68.1	67.9	68.4	69.7
West Everett 2	SFR	53.6	54.1	53.9	52.8	52.7	53.1	53.2
West Everett 3	SFR	54	53.6	54.1	53.4	53.3	53.6	54.3
West Everett 4	SFR	56.1	55.8	56.2	55.6	55.5	55.7	56.2
Wyman 1 APT TH	Apartment/Townhome	52.5	52.9	51.3	51.2	50.9	51.4	52.4
Wyman 2	SFR	47.8	48	46.4	46.1	45.9	46.4	48.1
Wyman 3	SFR	47.3	47.4	46.1	45.6	45.4	45.9	48
Wyman 4 MF	Multi-Family	51.1	51.5	50	49.9	49.5	50	50.6

Note: Shading indicates impacted receptors based on NAC or substantial increase over existing conditions. For purposes of determining impacts, results were rounded to the nearest whole number (e.g., 65.6 dBA rounds to 66 and is considered an impact for a residential land use).

N/A: Not applicable, property is full acquisition

** Substantial increase over existing conditions

SFR: Single-family residence

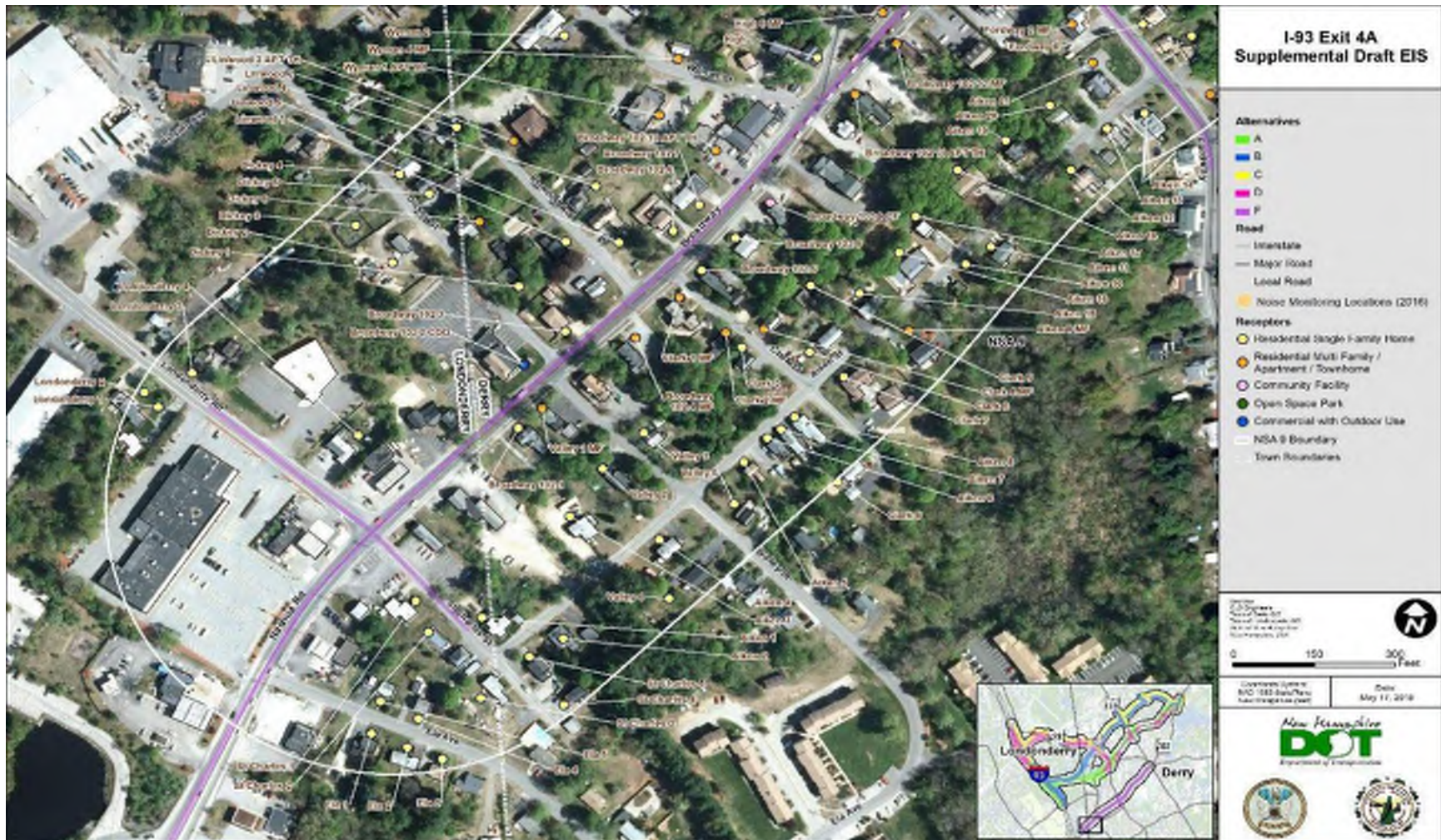


Figure 4-12. NSA 9 Receptors South



Figure 4-13. NSA 9 Receptors North

Table 4-12. Noise Modeling Results for NSA 10 (Worst-Case Peak Hour, Leq, dBA)

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Birch 1 CF	Community Facility	66	64.9	66.2	65.8	66.2	66.3	66.7
Birch 2 MF	Multi-Family	66.1	65	66.2	65.8	66.2	66.4	66.4
Birch 3 MF	Multi-Family	66.1	65.1	66.3	66	66.4	66.5	66.3
Birch 4	SFR	66.5	65.5	66.7	66.4	66.8	66.9	66.4
Broadway 102 18 APT TH	Apartment/Townhome	67.1	67.5	67.4	66.3	66.2	66.7	68.1
Broadway 102 19 APT TH	Apartment/Townhome	69.5	69.6	70.1	68.6	68.4	69	69.8
Broadway 102 20 CF	Community Facility	61.7	61.9	62.2	60.8	60.6	61.1	61.1
Broadway 102 21 APT TH	Apartment/Townhome	66.7	67.2	67	65.9	65.8	66.4	67.6
Broadway 102 22 APT TH	Apartment/Townhome	67.5	67.9	67.8	66.7	66.6	67.3	68.4
Broadway 102 23 APT TH	Apartment/Townhome	69.4	69.5	70	68.5	68.3	68.9	70.5
Broadway 102 24 COD	Commercial w/Outdoor Use	68.4	68.5	69	67.5	67.3	67.9	69.4
Broadway 102 25 COD	Commercial w/Outdoor Use	69.2	69.3	69.8	68.3	68.1	69	70.3
Broadway 102 26 CF	Community Facility	66.4	66.8	66.6	65.6	65.5	66.2	67
Broadway 102 27 COD	Commercial w/Outdoor Use	62.9	63.1	63.5	62	61.9	62.4	61.7
Broadway 102 28 APT TH	Apartment/Townhome	69.7	70.3	69.9	69	68.9	69.7	71.1
Broadway 102 29 APT TH	Apartment/Townhome	68	68.1	68.5	67.1	66.9	67.5	68.6
Broadway 102 30 APT TH	Apartment/Townhome	69.6	70.1	69.8	68.8	68.7	69.7	71.4
Broadway 102 31 APT TH	Apartment/Townhome	68.3	68.4	68.8	67.4	67.2	67.9	68.9
Broadway 102 34 CF	Community Facility	67.6	67.5	68.2	66.7	66.5	66.9	68.6
Broadway 102 35 CF	Community Facility	68.2	67.6	68.3	67.2	67.3	68	70.3
Broadway 32 PARK	Park	65.3	65.8	65.4	64.5	64.4	64.2	66
Broadway 33 COD	Commercial w/Outdoor Use	63.9	64.1	64.5	63	62.8	62.9	63.5
Central 1 APT TH	Apartment/Townhome	54.6	54.8	55	53.7	53.5	54.4	52.1
Central 2 CF	Community Facility	47.5	47.6	47.8	46.5	46.4	47.4	47.5
Central 3 APT TH	Apartment/Townhome	44.6	44.8	44.9	43.6	43.6	44.3	45.4
Central 4 MF	Multi-Family	51.8	52.2	52	51	50.9	51.6	51.3
Central 5 APT TH	Apartment/Townhome	45.4	45.7	45.6	44.5	44.5	44.9	45.6
Crystal 1 CF	Community Facility	66.7	65.7	65.9	66	67.3	67.3	66.7
Franklin 1 MF	Multi-Family	50.9	49.8	51.5	49.9	50.4	50.7	50.6

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Franklin 2 MF	Multi-Family	51.4	50.4	52.1	50.6	51.2	51.5	51.1
Franklin 3	SFR	48.9	47.9	49	48.1	48.8	49	48.6
Franklin 4 APT TH	Apartment/Townhome	54.7	53.6	55.3	53.7	54	54.3	53.7
Franklin 5	SFR	55.4	54.3	56.1	54.7	55.1	55.4	54.8
Franklin 6 MF	Multi-Family	52.6	51.6	53.3	51.8	52.3	52.7	52.5
Manning 1 APT TH	Apartment/Townhome	54.1	54.2	54.7	53.2	53	52.9	53.6
Maple 1 APT TH	Apartment/Townhome	52	52.3	52.4	51.1	51	51.2	51.4
Maple 2	SFR	47.4	47.7	47.7	46.3	46.4	46.9	48.1
Maple 3	SFR	45.7	45.9	46.3	44.7	44.8	45.3	46.4
Maple 4 APT TH	Apartment/Townhome	51.5	51.8	51.9	50.6	50.5	50.8	50.7
Maple 5 MF	Multi-Family	51.1	51.4	51.5	50.2	50.1	50.5	50.8
Maple 6 MF	Multi-Family	49.7	49.8	50.3	48.8	48.7	49.1	49.4
Maple 7 APT TH	Apartment/Townhome	48.6	48.8	49.2	47.7	47.6	48	48.2
Maple 8	SFR	45	45.1	45.5	43.9	44	44.4	45.3
Merchants 1 PARK	Park	48.3	48.4	48.3	47.4	47.3	47.8	48.6
Pearl 1	SFR	52.5	51.5	53.1	51.7	52.3	52.6	52.3
Pearl 2 MF	Multi-Family	51.3	50.4	51.8	50.5	51	51.3	51.1
Pillsbury 1 MF	Multi-Family	49	49.2	49.4	48	47.9	48.2	48.6
Pillsbury 2 MF	Multi-Family	48.4	48.6	48.8	47.4	47.3	47.8	48.1
Pillsbury 3 MF	Multi-Family	48	48.1	48.5	47	47	47.6	48.3
Pillsbury 4	SFR	49	49.1	49.6	48.1	48	48.5	48.5
Pillsbury 5	SFR	49.7	49.8	50.2	48.8	48.6	49.1	49
Railroad 1 APT TH	Apartment/Townhome	47.4	47.3	47.5	46.7	46.6	47.1	47.3
Railroad 2 CF	Community Facility	50.9	51.1	51.1	49.9	49.8	50.4	51.3
Railroad 3 APT TH	Apartment/Townhome	48.9	48.9	49.1	48.1	48	48.6	49.4
Railroad 4 CF	Community Facility	46.5	46.3	46.5	45.7	45.6	46.1	46.8
Sawyer 1 MF	Multi-Family	47	47	47.4	46.1	45.9	46.9	46.8
Sawyer 2 APT TH	Apartment/Townhome	47.3	47.3	47.7	46.3	46.2	47.2	47.3
Storer 1 MF	Multi-Family	50.4	50.6	50.8	49.5	49.4	50.3	49.6
Storer 2 MF	Multi-Family	47.6	47.7	48.1	46.7	46.6	47.4	47.6
Storer 3 APT TH	Apartment/Townhome	47.1	47.3	47.4	46.2	46.1	46.8	47.6
Walker 1	SFR	46.9	47.4	47.2	45.9	46	46.4	47.4

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Walker 2 MF	Multi-Family	46.2	46.6	46.8	45.2	45.4	45.7	47
Wall 1 MF	Multi-Family	54.4	53.5	54.5	54.1	54.5	54.3	55.5
Wall 2 MF	Multi-Family	51.6	50.6	51.7	51.1	51.3	51.4	52.8
Wall 3 MF	Multi-Family	54.2	53.1	54.4	53.9	54.4	54.2	54.9
Wall 4 MF	Multi-Family	51.5	50.4	51.7	51	51.3	51.4	52.2

Note: Shading indicates impacted receptors based on NAC or substantial increase over existing conditions. For purposes of determining impacts, results were rounded to the nearest whole number (e.g., 65.6 dBA rounds to 66 and is considered an impact for a residential land use).

N/A: Not applicable, property is full acquisition

** Substantial increase over existing conditions

SFR: Single-family residence



Figure 4-14. NSA 10 Receptors

Table 4-13. Noise Modeling Results for NSA 3 (Worst-Case Peak Hour, Leq, dBA)

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Abbott 1 APT TH	Apartment/Townhome	43.6	43.3	43.8	41.8	41.9	43.5	43.8
Abbott 10 MF	Multi-Family	45.3	44.9	45.4	43.5	43.6	45.1	45.5
Abbott 2 MF	Multi-Family	54.4	54.7	54.9	53.1	52.9	54	55
Abbott 3 MF	Multi-Family	49.2	49	49.6	47.6	47.6	49	49.6
Abbott 4 MF	Multi-Family	47.9	47.5	48.1	46.3	46.3	47.7	48.1
Abbott 5 MF	Multi-Family	47.2	46.8	47.3	45.6	45.6	47	47.4
Abbott 6	SFR	45.4	44.9	45.3	43.7	43.8	45.1	45.6
Abbott 7 APT TH	Apartment/Townhome	55.6	55.8	56.1	54.2	54.1	55.3	56.2
Abbott 8	SFR	48.4	48.2	48.8	46.8	46.8	48.3	48.8
Abbott 9 MF	Multi-Family	47.1	46.8	47.3	45.5	45.5	46.9	47.4
Birch 5 MF	Multi-Family	66.4	65.4	66.6	66.4	66.7	66.8	66.4
Broadway 102 75G	Community Facility	60.2	60.2	60.8	58.8	58.6	60.4	60.8
Boyd 1 CF	Community Facility	51.8	51.6	52.1	50.2	50.1	51.6	52.2
Boyd 2	SFR	50.1	49.8	50.4	48.5	48.5	50	50.4
Boyd 3	SFR	48.9	48.4	48.8	47.2	47.6	48.7	48.9
Boyd 4	SFR	47.1	46.4	46.9	45.5	45.8	46.7	46.8
Brandywine 1	SFR	44.9	44.7	45.3	43	43.2	45.1	45.2
Brandywine 2	SFR	45.1	44.7	45.3	43.4	43.3	45	45.3
Brandywine 3	SFR	44.1	43.8	44.4	42.2	42.3	44.2	44.4
Broadway 102 36 CF	Community Facility	67.7	68	68.3	66.3	66.3	68	69.4
Broadway 102 37 CF	Community Facility	67.7	68	68.3	66.4	66.4	68.1	69.3
Broadway 102 38 CF	Community Facility	66.5	66.5	67.1	64.7	65.2	67.3	67.5
Broadway 102 39 CF	Community Facility	66.2	66.2	66.8	64.4	64.7	66.4	66.7
Broadway 102 40	SFR	66.7	66.8	67.2	65.2	65.2	66.8	67.2
Broadway 102 41	SFR	53.4	53.2	53.8	51.5	51.6	54	53.7
Broadway 102 42 APT TH	Apartment/Townhome	67.6	67.7	68.1	66.1	66	67.7	68.1
Broadway 102 43 APT TH	Apartment/Townhome	60.6	60.6	61.2	59	59	59.7	61.2
Broadway 102 44 Park	Park	63.9	63.8	64.4	62.1	62.2	63.9	64.3
Broadway 102 45 Park	Park	63.9	63.9	64.5	62.1	62.3	64	64.4

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Broadway 102 46 MF	Multi-Family	68.5	68.8	69.1	67.2	67.1	68.6	69.1
Broadway 102 47	SFR	64.8	64.8	65.4	63.1	63.2	64.8	65.4
Broadway 102 48	SFR	67.6	67.9	68.3	66.3	66.2	67.7	68.3
Broadway 102 49 MF	Multi-Family	62.7	62.7	63.3	61.1	61.1	62.8	63.3
Broadway 102 50	SFR	68.1	68.4	68.7	66.8	66.7	68.2	68.7
Broadway 102 51 APT TH	Apartment/Townhome	67.2	67.5	67.8	65.9	65.8	67.3	67.8
Broadway 102 52 MF	Multi-Family	65.8	66.1	66.4	64.5	64.4	65.5	66.4
Broadway 102 53 APT TH	Apartment/Townhome	67	67.3	67.6	65.7	65.6	67.1	67.6
Broadway 102 54	SFR	67.3	67.6	67.9	65.9	65.9	67.4	67.9
Broadway 102 55 MF	Multi-Family	61.9	62	62.4	60.4	60.3	61.7	62.4
Broadway 102 56 MF	Multi-Family	62.2	62.1	62.7	60.5	60.5	62	62.7
Broadway 102 57 MF	Multi-Family	62.2	62.1	62.7	60.5	60.5	62.1	62.7
Broadway 102 58 MF	Multi-Family	63.8	63.9	64.4	62.2	62.2	63.1	64.4
Broadway 102 59 MF	Multi-Family	66.6	66.5	67.2	64.8	64.9	66.6	67.1
Broadway 102 60 APT TH	Apartment/Townhome	68.5	68.5	69.1	66.7	66.9	68.9	69.1
Broadway 102 61 MF	Multi-Family	64.8	64.8	65.5	63.2	63.3	64.8	65.4
Broadway 102 62	SFR	65.8	65.8	66.4	64.1	64.2	65.8	66.4
Broadway 102 63	SFR	66.7	66.7	67.4	65	65.1	66.9	67.3
Broadway 102 64	SFR	62.7	62.8	63.4	61.2	61.2	62.7	63.3
Broadway 102 65	SFR	64.7	64.8	65.4	63	63.1	64.8	65.3
Broadway 102 66	SFR	68.3	68.3	68.9	66.5	66.7	68.6	68.9
Broadway 102 67	SFR	66.1	66.1	66.8	64.4	64.5	66.1	66.7
Broadway 102 68	SFR	64.6	64.6	65.2	62.9	63	64.7	65.2
Broadway 102 69	SFR	62.2	62.3	62.9	60.6	60.7	62.4	62.8
Broadway 102 70 MF	Multi-Family	65.8	65.8	66.4	64.1	64.2	65.8	66.4
Broadway 102 71 MF	Multi-Family	49.3	49	49.7	47.6	47.6	49.7	49.7
Broadway 102 72 MF	Multi-Family	64.4	64.4	65	62.6	62.7	64.6	64.9
Broadway 102 73	SFR	64.9	64.9	65.5	63.2	63.3	65	65.5
Broadway 102 74	SFR	63.9	63.9	64.5	62.2	62.3	64	64.5
Broadway 102 75	SFR	65.3	65.3	65.9	63.6	63.7	65.3	65.9
Broadway 102 75 CF	Community Facility	57	57	57.6	55.2	55.4	57.6	57.6
Broadway 102 75A	Community Facility	60.3	60.6	60.8	59	58.8	60.2	60.9

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Broadway 102 75B	Community Facility	60.9	61.3	61.4	59.7	59.4	60.8	61.5
Broadway 102 75C	Community Facility	61.8	62.4	62.4	60.8	60.5	61.5	62.5
Broadway 102 75D	Community Facility	62.9	63.1	63.6	61.4	61.4	62.7	63.5
Broadway 102 75E	Community Facility	60.8	61.1	61.4	59.5	59.3	60.9	61.4
Broadway 102 75F	Community Facility	60.6	60.7	61.1	59.1	59	60.6	61.2
Broadway 102 76	SFR	65.9	65.9	66.5	64.1	64.2	65.8	66.4
Broadway 102 77	SFR	66.3	66.3	66.9	64.6	64.7	66.3	66.9
Broadway 102 78	SFR	63	62.9	63.4	61.3	61.4	62.8	63.4
Broadway 102 79 CF	Community Facility	64.2	64	64.5	62.5	62.7	63.9	64.5
Bypass 28 1A PARK	Park	52.9	51.9	51.9	51.2	51.3	52	52
Bypass 28 1B PARK	Park	55.9	54.9	54.9	54.5	54.7	55	55
Bypass 28 3 MF	Multi-Family	68.9	67.7	67.7	67.8	67.9	68.2	67.8
Bypass 28 4 MF	Multi-Family	58.4	57.3	57.3	57.3	57.3	57.6	57.1
Bypass 28 5 MF	Multi-Family	68.6	67.4	67.4	67.5	67.6	67.9	67.4
Bypass 28 6 MF	Multi-Family	66.6	65.3	65.3	65.5	65.6	65.9	65.4
Bypass 28 7 CF	Community Facility	50	48.6	48.6	48.5	48.5	48.9	48.6
Bypass 28 8 COD	Commercial w/Outdoor Use	61.2	59.4	59.9	59.7	59.8	59.7	59.7
Bypass 28 9	SFR	58.5	56.7	57.3	57.1	57.2	57.1	57.1
Chester 1 COD	Commercial w/Outdoor Use	67.5	65.1	65.2	63.4	64.4	65.3	65
Crescent 1	SFR	48.6	48.5	48.9	47.1	47	48.3	49
Crescent 2	SFR	47.7	47.3	47.7	46.1	46	47.2	47.7
Crescent 3	SFR	48.7	47.7	47.9	46.8	46.9	47.8	47.9
Crescent 4	SFR	48.3	47.4	47.5	46.5	46.8	47.5	47.5
Crescent 5 APT TH	Apartment/Townhome	46.9	45.9	46.1	45.2	45.5	46.1	46.1
Crescent 6 MF	Multi-Family	52.4	51.7	51.8	50.6	50.5	51.6	51.9
Crescent 7	SFR	49.6	48.5	48.5	47.7	47.9	48.5	48.5
Crescent 8	SFR	49.2	48.8	48.8	48	48.5	48.6	48.9
Crescent 9	SFR	48.5	48	48	47.3	47.8	48	48.1
Fenway 1 MF	Multi-Family	60	60	60.6	58.4	58.4	59.5	60.6
Fenway 10	SFR	44.8	44.4	45.1	43	43.1	44.7	45
Fenway 2 MF	Multi-Family	52.4	52.3	52.9	50.5	50.7	52.2	52.9
Fenway 3	SFR	48.1	47.8	48.5	46.2	46.4	47.4	48.3

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Fenway 4	SFR	47.5	47.1	47.7	45.7	45.7	47	47.7
Fenway 5	SFR	47.5	47.1	47.8	45.8	45.9	47.3	47.8
Fenway 6	SFR	46.4	46	46.6	44.7	44.9	46.2	46.6
Fenway 7	SFR	48.1	47.9	48.5	46.2	46.4	47.8	48.4
Fenway 8	SFR	46.7	46.4	47.1	44.8	45	46.4	46.9
Fenway 9	SFR	45.5	45.1	45.8	43.7	43.8	45.4	45.7
Hardy 1 MF	Multi-Family	47.8	47.4	47.8	46.3	46.5	47.6	47.9
Hood 1	SFR	51.2	51.4	51.7	49.8	49.6	50.9	51.7
Hood 2	SFR	45.1	44.8	45.4	43.4	43.4	45	45.5
Hood 3CF	Community Facility	47.7	47.5	48.1	46.2	46.1	47.6	48.2
Hood 4 CF	Community Facility	44.8	44.5	45.1	43.2	43.1	44.6	45.2
Hoodcroft 1 MF	Multi-Family	48.6	48.4	49	46.9	46.9	48.9	49
Hoodcroft 2	SFR	49.4	49.2	49.7	47.9	47.7	49.1	49.7
Hoodcroft 3	SFR	45.1	44.4	45	43.4	43.3	44.7	45
Hoodcroft 4	SFR	48.8	48.5	49	47.3	47.2	48.5	48.9
Hoodcroft 5	SFR	46.9	46.2	46.8	45.3	45.3	46.4	46.7
Lenox 1	SFR	43.8	43.5	44.1	42.1	42.1	43.6	44.1
Marlboro 1 MF	Multi-Family	51.2	51	51.4	49.8	50.2	51.4	51.4
Marlboro 10	SFR	47.7	46.7	47.5	46.3	46.9	47.3	47.2
Marlboro 2 MF	Multi-Family	50.7	50.1	50.6	49.2	49.6	50.7	51
Marlboro 3 MF	Multi-Family	49.9	49.1	49.6	48.3	48.9	49.7	49.9
Marlboro 4	SFR	50.2	49.2	50.1	49.2	49.9	50.2	50.3
Marlboro 5	SFR	50.9	49.9	51	50.1	50.9	51.1	50.8
Marlboro 6	SFR	50.7	49.7	50.8	49.9	50.7	50.9	50.6
Marlboro 7 MF	Multi-Family	49.2	48.6	49	47.6	48.1	48.7	48.9
Marlboro 8	SFR	49.2	48.5	49	47.7	48.3	48.7	48.9
Marlboro 9 MF	Multi-Family	48.7	47.8	48.5	47.2	47.9	48.3	48.1
Mt Pleasant 1	SFR	54	53.8	54.4	52.3	52.3	54.2	54.4
Mt Pleasant 2 MF	Multi-Family	45.5	45.2	45.8	43.8	43.8	45.7	45.8
Mt Pleasant 3 MF	Multi-Family	45.4	45	45.6	43.5	43.6	45.4	45.6
Mt Pleasant 4	SFR	43.7	43.3	43.9	42	42	43.6	44
Mt Pleasant 5	SFR	39.8	39.3	39.9	38	38	39.6	40

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Mt Pleasant 6	SFR	42.6	42.3	42.9	41	40.9	42.6	43
Mt Pleasant 7 MF	Multi-Family	44.3	43.9	44.5	42.6	42.5	44.1	44.6
Mt Pleasant 8	SFR	43.2	42.8	43.4	41.5	41.5	42.9	43.5
Mt Washington 1	SFR	65.9	65.9	66.6	64.2	64.3	65.9	66.5
Mt Washington 2	SFR	53.3	53.6	53.8	52	51.8	53	53.9
Mt Washington 3	SFR	49.8	49.6	50.2	48.3	48.2	49.7	50.3
Mt Washington 4	SFR	46.4	46.1	46.6	44.7	44.7	46.2	46.7
Mt Washington 5	SFR	44.1	43.7	44.2	42.4	42.4	43.9	44.3
Mt Washington 6 MF	Multi-Family	62.5	62.6	63.1	61	61	62.4	63.1
Mt Washington 7 MF	Multi-Family	51.4	51.6	51.9	50	49.8	51.2	51.9
Mt Washington 8	SFR	45.8	45.5	46.1	44.1	44.1	45.6	46.2
Mt Washington 9	SFR	44.2	43.9	44.4	42.4	42.5	44.2	44.5
Oak 1 MF	Multi-Family	52	51.6	52.2	50.9	51	52.1	52.8
Oak 2 MF	Multi-Family	50.7	50	50.6	49.9	50	50.6	52.5
Oak 3 APT TH	Apartment/Townhome	53.2	52.2	53.3	52.8	53	53.1	55.4
Oak 4 MF	Multi-Family	52.5	51.5	52.6	52.1	52.3	52.4	54
Oak 5 MF	Multi-Family	48.4	48.1	48.7	46.6	45.8	48.6	47.3
Oak 6 MF	Multi-Family	46.9	46.4	47.1	45.9	45.4	46.9	47.4
Oak 7	SFR	46.2	45.5	46.2	45.2	45.6	46	47.3
Oak 8	SFR	47	46.4	47	46.1	45.8	46.6	47.8
Park 1 CF	Community Facility	50.4	50.2	50.8	48.5	48.9	50.8	50.4
Park 10	SFR	45	44.6	45.3	43.4	43.5	44.7	46
Park 2 MF	Multi-Family	45.2	44.7	45.2	44	43.7	45	45.6
Park 3 MF	Multi-Family	45.7	45.1	45.7	44.6	44.2	45.5	46.4
Park 4	SFR	44.8	44.2	44.9	43.7	43.6	44.9	46.2
Park 5	SFR	45.2	44.6	45.2	44	44	45.1	46.3
Park 6 MF	Multi-Family	66.9	67.1	67.5	65.5	65.5	67.1	67.5
Park 7	SFR	49	48.8	49.4	47.1	47.2	49	49.1
Park 8	SFR	45.6	45.1	45.7	43.8	43.9	45.1	45.9
Park 9	SFR	45.3	44.9	45.5	43.6	43.7	44.8	46
Perley 1	SFR	44.2	43.8	44.4	42.5	42.4	44.2	44.4
Perley 2	SFR	45.2	44.8	45.4	43.5	43.5	45.3	45.4

Receiver ID	Land Use Type	Existing	2040 No Build	Alt. A	Alt. B	Alt. C	Alt. D	Alt. F
Perley 3	SFR	45.7	45.3	46	44	43.9	45.9	46
Perley 4	SFR	45.8	45.5	46.1	44.1	44.1	46.1	46.1
Perley 5	SFR	45.8	45.4	46	44.2	44.1	45.8	46
Thornton 1 MF	Multi-Family	63	60.5	60.5	58.6	59.8	60.5	60.4
Thornton 2	SFR	69.6	67	67	65.1	66.1	67.1	66.8
Thornton 3	SFR	55	53.5	53.6	52.9	53.3	53.6	53.4
Thornton 4	SFR	54.7	53.4	53.4	52.9	53.2	53.5	53.2
Thornton 5	SFR	54.6	53.1	53.1	52.9	53.3	53.5	53
Thornton 6	SFR	58	56.8	56.8	55.6	56.8	56.9	56.8
Thornton 7	SFR	65.1	65.5	65.5	65	65.7	65.7	65.9
Thornton 8 MF	Multi-Family	57.5	57.5	57.5	57.1	57.8	57.7	57.8

Note: Shading indicates impacted receptors based on NAC or substantial increase over existing conditions. For purposes of determining impacts, results were rounded to the nearest whole number (e.g., 65.6 dBA rounds to 66 and is considered an impact for a residential land use).

N/A: Not applicable, property is full acquisition

** Substantial increase over existing conditions

SFR: Single-family residence



Figure 4-15. NSA 11 Receptors—South



Figure 4-16. NSA 11 Receptors—Central



Figure 4-17. NSA 11 Receptors—North

4.3 Mitigation

This section evaluates noise mitigation options for two locations where barriers were proposed as part of the I-93 widening project, as well as additional barriers along the proposed connector road where traffic noise impacts are predicted.

4.3.1 NSA 4 Trolley Car Lane

Previous Analysis

The 2004 I-93 widening FEIS presented the Trolley Car Lane neighborhood (“Location 23”) as having 23 impacted receptors. A 12-foot barrier (6-foot wall and 6-foot berm) of 5,000 feet in length was proposed for an estimated cost of \$900,000. The analysis estimated 28 receptors would be benefited, resulting in a cost of \$32,100 per benefited receptor. Although the cost effectiveness criterion was slightly exceeded, the barrier was still recommended.

In 2008, the I-93 widening final design noise analysis recommended a 12–18 foot barrier (with 10 feet of the height on berm) 4,450 feet long. The barrier was estimated to benefit 28 receptors, cost \$1,068,000, and have a cost per benefited receptor of \$38,000. Although this exceeded the \$30,000 threshold, the barrier continued to be recommended. The final barrier design did not anticipate the Exit 4A interchange ramps.

For purposes of comparing the benefit of new barrier options with the benefits provided by the I-93 widening barrier, the I-93 widening barriers were evaluated for the 2040 No Build condition. Table 4-14 summarizes the I-93 barrier performance results for each receptor based on the updated TNM models. This analysis excluded the I-93 widening barrier berms from the terrain data to evaluate the full benefit of the noise barriers.

Table 4-14. Trolley Car Lane: I-93 Widening Barrier Benefits, 2040 No Build

Receptor Unit ID- Shading Indicates Impacted Receptor Units	Number of Receptor Units	2016 Noise Levels	2040 (No Barrier and no berm)- shading indicates impact		I-93 Southbound Widening Barrier	
			Noise Levels	Increase Over Existing	Noise Levels	I.L.
Buyck 1	1	65	68	4	68	0
Hovey 1"	1	67	69	2	66	3
Trolley Car 1"	1	66	67	2	65	2
Trolley Car 10"	1	64	65	0	61	4
Trolley Car 11"	1	67	67	0	61	6
Trolley Car 12"	2	67	67	0	61	7
Trolley Car 13"	2	68	68	1	61	8
Trolley Car 14"	2	69	68	0	60	8
Trolley Car 15"	1	60	60	0	57	4
Trolley Car 16"	1	61	63	2	59	5
Trolley Car 17"	1	69	71	2	60	11
Trolley Car 18"	1	73	75	2	63	12
Trolley Car 19"	1	62	65	3	59	6

Receptor Unit ID- Shading Indicates Impacted Receptor Units	Number of Receptor Units	2016 Noise Levels	2040 (No Barrier and no berm)- shading indicates impact		I-93 Southbound Widening Barrier	
			Noise Levels	Increase Over Existing	Noise Levels	I.L.
Trolley Car 2"	1	64	66	3	62	5
Trolley Car 3"	1	70	70	0	65	5
Trolley Car 4"	1	69	70	1	64	6
Trolley Car 5"	1	68	67	0	63	5
Trolley Car 6"	1	68	67	-1	62	5
Trolley Car 7"	1	66	65	-1	61	4
Trolley Car 8"	1	67	66	-1	62	4
Trolley Car 9"	2	65	64	-1	61	4
Hovey 2"	1	64	66	3	66	1
Hovey 3"	2	65	68	3	66	2
Trolley Car 20"	1	61	64	2	59	4
Trolley Car 21"	1	62	65	3	62	3
Trolley Car 22"	1	59	62	3	59	3
Trolley Car 23"	2	58	60	2	57	3
Trolley Car 24"	2	57	60	3	57	3
Trolley Car 26"	1	60	63	3	58	6
Trolley Car 27"	1	61	63	3	58	6
Trolley Car 28"	1	58	61	3	57	4
Noise Abatement Details and Evaluation Criteria						
Barrier Area (square feet)					65,527	
Effectiveness Criterion					1,500	
Total Number of Impacted Receptor Units					21	
Number of Impacted Receptor Units Receiving ≥ 10 dBA I.L.					2	
Percent of Impacted Receptor Units Receiving ≥ 10 dBA I.L.					10%	
Number of Impacted Receptor Units Receiving I.L. ≥ 5 dBA but < 10 dBA					12	
Total Number of Impacted Receptor Units Benefited					14	
Percent of Impacted Receptor Units Benefited					67%	
Number of Non-Impacted Receptor Units Benefited (I.L. ≥ 5 dBA)					4	
Total Number of Benefited Receptor Units					18	
Square Feet per Receptor Unit Benefited					3,640	
Barrier Reasonable from a Square Foot/Receptor Unit Standpoint?					No	
Total Barrier Length (feet)					4,360	
Barrier Height Range (feet)					7.35 to 26.09	
Average Barrier Height (feet)					15.03	

Notes:

All values represent hourly Leq in dBA
dBA = Decibels on the A-weighted
scale



Impacted Receptor Units (Build noise levels > 66 dBA)

Impacted Receptor Units Receiving I.L. ≥ 10 dBA

Receptor Unit ID- Shading Indicates Impacted Receptor Units	Number of Receptor Units	2016 Noise Levels	2040 (No Barrier and no berm)- shading indicates impact		I-93 Southbound Widening Barrier	
			Noise Levels	Increase Over Existing	Noise Levels	I.L.
Leq = Equivalent noise level I.L. = Insertion Loss				Impacted Receptor Units Receiving I.L. ≥ 5 dBA but <10 dBA		
				Non-Impacted Receptor Units Receiving ≥ 5 dBA		

Updated Analysis

Trolley Car Lane was divided into two separate areas for purposes of the Exit 4A noise barrier evaluation (Trolley Car Lane and Trolley Car Lane south), separated by three single-family homes that would be total acquisitions under Alternative A (receptors Trolley Car 12, 13 and 14). As a result of these acquisitions and the placement of fill for the Exit 4A ramps shielding certain receivers in the center of the neighborhood from I-93 mainline traffic noise, a continuous noise barrier is no longer logical for this location.

Trolley Car Lane North

Trolley Car Lane north consists of the remaining residences near the proposed southbound off-ramp. Based on the 2040 Build traffic projections, two receptors would experience traffic noise impacts with no barrier in place (Trolley Car 17 and Trolley Car 18).

Two barrier options were evaluated for Trolley Car Lane North as shown in Figures 4-18 and 4-19. The horizontal barrier alignment for the Trolley Car Lane north area was kept the same as the I-93 widening final design barrier alignment, from station 3701+10 at the northern end to station 3696. From station 3696 to 3685+50, the barrier alignment was modified to follow near the off-ramp edge of pavement, which allows the barrier to take advantage of being on fill required for the ramps.

The Trolley Car Lane North Barrier analysis (Table 4-15) shows there are insufficient receptors in the area for a barrier to be cost effective. The barrier design option closest to meeting the criterion (Option 2) would focus on protecting the two affected receptors only and would be about 10 feet high and 586 feet long. The square feet per receptor unit benefited would be 2,890, which exceeds NHDOT’s criterion. A barrier option attempting to benefit more receptors would similarly not be cost reasonable.

Trolley Car Lane South

Trolley Car Lane south consists of the residences near the proposed southbound on-ramp and south to Pillsbury Rd. Based on the 2040 Build traffic projections, nine receptors would experience traffic noise impacts with no barrier in place (Trolley Car 1, 2, 3, 4, 6, Hovey 1, Hovey 2, and Hovey 3). Hovey 3 is a duplex that counts as two receptor units. It is important to note that the five northernmost receptors in this area are not considered impacted under Alternative A (Trolley Car 7, 8, 9, 10, 11). These receptors are below the elevation of the on-ramp, which serves to shield them from the full I-93 mainline traffic. This effect is illustrated by the “increase over existing” column in Table 4-16, which shows Alternative A would *reduce* noise at a majority of the receptors in this area by 3 to 5 dBA.

Figures 4-20 through 4-22 show the three Trolley Car Lane South barriers considered. The barrier was extended further south than the I-93 widening proposed barrier (to approx. station 3656+50), to study if this segment would provide any benefit to barrier performance. The horizontal barrier alignment for the Trolley Car Lane south area was kept the same as the I-93 widening final design barrier alignment from station 3657+50 to station 3661. From station 3661 to 3668+50, the barrier alignment was shifted west by 5 feet or less to remain on the berm proposed in the I-93 final design plans. The northern end of the barrier near station 3671+75 would begin to follow the on ramp embankment. The barrier was not extended farther north because the receptors north of Trolley Car 6 are not impacted.

As shown in Table 4-16, the Trolley Car Lane South barrier analysis results demonstrate there are insufficient receptors in the area for a barrier to be cost effective. The option closest to meeting the criterion (Option 2) would focus on protecting the central portion of the NSA and would have an average height of 11.6 feet and would be 1,080 feet in length. The square feet per receptor unit benefited would be 2,089, which exceeds NHDOT's criterion.

Conclusion

Table 4-17 provides an overall summary of the Trolley Car Lane barrier analyses in comparison to the I-93 widening barrier analyses, including cost information based on recent NHDOT bid prices (\$38 per square foot).

The selection of a preferred option by NHDOT and FHWA was based on consideration of which option would provide a benefit to impacted receptors comparable to the benefit that would be provided if the I-93 widening barriers were built without Exit 4A. NHDOT and FHWA are committed to providing noise barriers in these locations by the I-93 widening 2005 ROD and 2010 Supplemental ROD, regardless of whether the options meet the current noise policy effectiveness criterion. For both Trolley Car Lane North and South, the recommended barrier option for further evaluation during final design is Option 1.

Based on the studies so far completed, NHDOT is committed to the construction of feasible and reasonable noise abatement measures at Trolley Car Lane (North and South). These preliminary indications of likely abatement measures are based upon preliminary design for two discontinuous barriers with a combined length of approximately 2,700 feet and an average height of approximately 13.5 feet, that would reduce the noise level by at least 5dB(A) for 13 residents. If it is subsequently found during final design that these conditions have substantially changed, the abatement measure(s) might not be provided. A final decision on the installation of the abatement measure(s) would be made during the final design process following the completion of public involvement.





Table 4-15. NSA 4 Barrier Analysis, Trolley Car Lane North, 2040 PM Peak Hour Traffic

Receptor Unit ID- Shading Indicates Impacted Receptor Units	Number of Receptor Units	2016 Noise Levels	2040 (No Barrier)- shading indicates impact		Barrier Option 1		Barrier Option 2	
			Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.
Trolley Car 15	1	60	62	1	60	2	61	1
Trolley Car 16"	1	61	63	2	60	3	61	2
Trolley Car 17"	1	69	68	-1	63	6	63	5
Trolley Car 18"	1	73	74	1	65	9	67	8
Trolley Car 19"	1	62	63	1	59	5	61	2
Trolley Car 26"	1	60	62	2	61	2	62	1
Trolley Car 27"	1	61	63	2	60	3	62	1
Trolley Car 28"	1	58	61	3	59	2	59	1
Noise Abatement Details and Evaluation Criteria								
Barrier Area (square feet)					12,513		5,779	
Effectiveness Criterion					1,500		1,500	
Total Number of Impacted Receptor Units					2		2	
Number of Impacted Receptor Units Receiving ≥ 10 dBA I.L.					0		0	
Percent of Impacted Receptor Units Receiving ≥ 10 dBA I.L.					0%		0%	
Number of Impacted Receptor Units Receiving I.L. ≥ 5 dBA but < 10 dBA					2		2	
Total Number of Impacted Receptor Units Benefited					2		2	
Percent of Impacted Receptor Units Benefited					100%		100%	
Number of Non-Impacted Receptor Units Benefited (I.L. ≥ 5 dBA)					1		0	
Total Number of Benefited Receptor Units					3		2	
Square Feet per Receptor Unit Benefited					4,171		2,890	
Barrier Reasonable from a Square Foot/Receptor Unit Standpoint?					No		No	
Total Barrier Length (feet)					1,161		586	

Barrier Height Range (feet)	4 to 16	8 to 10
Average Barrier Height (feet)	10.78	9.86

Notes:

All values represent hourly Leq in dBA
 dBA = Decibels on the A-weighted scale
 Leq = Equivalent noise level
 I.L. = Insertion Loss

	Impacted Receptor Units (Build noise levels > 66 dBA)
	Impacted Receptor Units Receiving I.L. ≥ 10 dBA
	Impacted Receptor Units Receiving I.L. ≥ 5 dBA but <10 dBA
	Non-Impacted Receptor Units Receiving ≥ 5 dBA

Note: The “2040 No Barrier” results include the Exit 4A project infrastructure and grading, and the constructed I-93 widening berms.





Table 4-16. NSA 4 Barrier Analysis, Trolley Car Lane South, 2040 PM Peak Hour Traffic

Receptor Unit ID- Shading Indicates Impacted Receptor Units	Number of Receptor Units	2016 Noise Levels	2040 (No Barrier)- shading indicates impact		Barrier Option 1		Barrier Option 2		Barrier Option 3	
			Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.
Hovey 1	1	67	69	2	64	5	66	2	63.8	5
Trolley Car 1"	1	66	66	1	62	5	65	2	61.8	5
Trolley Car 10"	1	64	62	-3	61	1	61	1	61.3	1
Trolley Car 11"	1	67	61	-5	61	1	61	0	61	0
Trolley Car 2"	1	64	66	2	59	6	61	5	60	6
Trolley Car 3"	1	70	68	-2	62	6	63	5	61.5	7
Trolley Car 4"	1	69	68	-1	61	7	62	7	61.1	7
Trolley Car 5"	1	68	65	-3	60	5	61	5	60	5
Trolley Car 6"	1	68	66	-2	60	6	61	5	60.2	6
Trolley Car 7"	1	66	64	-2	59	5	61	3	59.8	4
Trolley Car 8"	1	67	65	-2	60	5	62	2	61.9	3
Trolley Car 9"	2	65	63	-2	61	2	62	1	61.7	1
Hovey 2"	1	64	66	2	64	2	65	1	63.7	2
Hovey 3"	2	65	67	2	64	3	65	2	63.8	3
Trolley Car 20"	1	61	63	2	57	6	59	5	57.6	6
Trolley Car 21"	1	62	65	2	61	4	63	2	61.9	3
Trolley Car 22"	1	59	62	2	58	3	60	2	59.4	2
Trolley Car 23"	2	58	59	2	57	2	58	1	58.2	1
Trolley Car 24"	2	57	59	2	58	2	58	1	58.2	1
Noise Abatement Details and Evaluation Criteria										
Barrier Area (square feet)					23,948		12,536		19,680	
Effectiveness Criterion					1,500		1,500		1,500	
Total Number of Impacted Receptor Units					9		9		9	

Number of Impacted Receptor Units Receiving ≥ 10 dBA I.L.	0	0	0
Percent of Impacted Receptor Units Receiving ≥ 10 dBA I.L.	0%	0%	0%
Number of Impacted Receptor Units Receiving I.L. ≥ 5 dBA but < 10 dBA	6	4	6
Total Number of Impacted Receptor Units Benefited	6	4	6
Percent of Impacted Receptor Units Benefited	67%	44%	67%
Number of Non-Impacted Receptor Units Benefited (I.L. ≥ 5 dBA)	4	2	2
Total Number of Benefited Receptor Units	10	6	8
Square Feet per Receptor Unit Benefited	2,395	2,089	2,460
Barrier Reasonable from a Square Foot/Receptor Unit Standpoint?	No	No	No
Total Barrier Length (feet)	1,535	1,080	1,260
Barrier Height Range (feet)	12 to 20	6 to 16	12 to 20
Average Barrier Height (feet)	15.6	11.61	15.61

Notes:

All values represent hourly Leq in dBA
 dBA = Decibels on the A-weighted scale
 Leq = Equivalent noise level
 I.L. = Insertion Loss

	Impacted Receptor Units (Build noise levels > 66 dBA)
	Impacted Receptor Units Receiving I.L. ≥ 10 dBA
	Impacted Receptor Units Receiving I.L. ≥ 5 dBA but < 10 dBA
	Non-Impacted Receptor Units Receiving ≥ 5 dBA

Note: The “2040 No Barrier” results include the Exit 4A project infrastructure and grading, and the constructed I-93 widening berms.

Table 4-17. NSA 4 Barrier Analysis Summary

	I-93 Improvements Salem to Manchester		Exit 4A SDEIS					
	2004 FEIS	2008 Final Design Noise Analysis	<i>North Option 1 + South Option 1 Combined</i>	Trolley Car North Option 1	Trolley Car North Option 2	Trolley Car South Option 1	Trolley Car South Option 2	Trolley Car South Option 3
Barrier Square Feet	60,000	75,250	25,049	12,513	5,779	23,948	12,536	19,680
Barrier Height (feet)	12 (6 feet wall, 6 feet berm)	12-18 (10 feet as berm)	4-20	4-16 (11 ave)	8-10 (10 ave)	12-20 (16 ave)	6-16 (12 ave)	12 -20 (16 ave)
Length (feet)	5,000	4,450	2,696	1,161	586	1,535	1,080	2,460
No. of Impacted Receptors	23	Not reported	11	2	2	9	9	9
No. of Benefited Receptors	28	28	13	3	2	10	6	8
Square Feet Per Benefited Receptor	2,143	2,688	1,927	4,171	2,890	2,395	2,089	2,460
Cost (at time of original analysis)	\$900,000	\$1,068,000	NA	NA	NA	NA	NA	NA
Cost Per Benefited Receptor (at time of original analysis)	\$32,143	\$38,143	NA	NA	NA	NA	NA	NA
Implied Cost Per Square Foot (at time of original analysis)	\$15.00	\$14.19	NA	NA	NA	NA	NA	NA
Current Cost Per SF	\$38.00	\$38.00	\$38.00	\$38.00	\$38.00	\$38.00	\$38.00	\$38.00
Current Cost Barrier Cost (no berm discount)	\$2,280,000	\$2,859,500	\$951,862	\$475,494	\$219,602	\$910,024	\$476,368	\$747,840
Current Cost Per Benefited Receptor	\$81,428.57	\$102,125.00	\$73,220.15	\$158,498.00	\$109,801.00	\$91,002.40	\$79,394.67	\$93,480.00



Figure 4-18. Trolley Car Lane North- Option 1 Barrier



Figure 4-19. Trolley Car Lane North- Option 2 Barrier



Figure 4-20. Trolley Car Lane South- Option 1 Barrier



Figure 4-21. Trolley Car Lane South- Option 2 Barrier



Figure 4-22. Trolley Car Lane South- Option 3 Barrier

4.3.2 NSA 5 Seasons Lane

Previous Analysis

The 2004 I-93 widening FEIS presented the Seasons Lane neighborhood (“Location 24”) as having 10 impacted receptors. A 14-foot barrier (8-foot wall and 6-foot berm) of 2,500 feet in length was proposed for an estimated cost of \$550,000. The analysis estimated 19 receptors would be benefited, resulting in a cost of \$29,000 per benefited receptor. The cost criterion at that time (1996 policy) was \$30,000 per benefited receptor, so based on this information a barrier was recommended.

In 2008, the I-93 widening final design noise analysis recommended a 14–18 foot barrier (with 10 feet of the height on berm) of 3,050 feet in length. The barrier was estimated to benefit 21 receptors, cost \$738,000 and have a cost per benefited receptor of \$35,000. Although this exceeded the \$30,000 threshold, the barrier continued to be recommended.

For purposes of comparing the benefit of new barrier options with the benefits provided by the I-93 widening barrier, the I-93 widening barriers were evaluated for the No Build condition. Table 4-18 summarizes the I-93 barrier performance results for each receptor based on the updated TNM models. This analysis excluded the I-93 widening barrier berms from the terrain data to evaluate the full benefit of the noise barriers. The “barrier height” was calculated based on the top of barrier profile from the final design plans in comparison to pre-I-93 widening construction topography.

Table 4-18. Seasons Lane: I-93 Widening Barrier Benefits, 2040 No Build

Receptor Unit ID- Shading Indicates Impacted Receptor Units	Number of Receptor Units	2016 Noise Levels	2040 (No Barrier and no berm)- shading indicates impact		I-93 Widening Barrier Northbound	
			Noise Levels	Increase Over Existing	Noise Levels	I.L.
Seasons 1"	1	58	63	5	62	1
Seasons 10"	1	66	71	5	61	10
Seasons 11"	1	66	71	5	61	10
Seasons 12"	1	65	69	4	60	9
Seasons 2"	1	68	72	4	64	8
Seasons 3"	1	59	64	4	60	4
Seasons 4"	1	68	71	3	60	11
Seasons 5"	1	59	63	5	57	6
Seasons 6"	1	67	70	3	60	10
Seasons 7"	1	67	71	4	61	10
Seasons 8"	1	67	71	4	61	10
Seasons 9"	1	67	71	4	61	10
Seasons_E"	1	58	63	5	59	5

Receptor Unit ID- Shading Indicates Impacted Receptor Units	Number of Receptor Units	2016 Noise Levels	2040 (No Barrier and no berm)- shading indicates impact		I-93 Widening Barrier Northbound	
			Noise Levels	Increase Over Existing		
Seasons_D"	1	59	63	4	59	4
Seasons_C"	1	56	60	4	57	3
Seasons_B"	1	54	57	3	56	2
Seasons_F"	1	62	66	4	61	5
Seasons_G"	1	62	66	4	61	5
Seasons_H"	1	61	65	4	60	5
Seasons_I"	1	61	65	4	60	6
Seasons_J"	1	60	65	4	59	6
Seasons_K"	1	62	66	4	60	6
Seasons_L"	1	58	62	4	57	5
Seasons_N"	1	55	59	4	59	0
Seasons_M"	1	55	58	3	57	1
Seasons_A"	1	53	56	3	56	1
Seasons_back_1"	1	52	55	3	55	1
Seasons_back_2"	1	54	56	3	56	1
Summer_back_1"	1	57	61	4	57	4
Autumn_back_1"	1	59	63	4	59	4
Autumn_back_2"	1	58	62	4	59	4
Autumn_back_3"	1	59	62	4	59	3
Autumn_back_4"	1	59	63	4	59	3
Autumn_back_5"	1	59	63	4	60	3
Autumn_back_6"	1	61	65	4	61	4
Autumn_back_7"	1	61	64	4	61	3
Seasons_back_3"	1	53	57	3	55	2
Noise Abatement Details and Evaluation Criteria						
Barrier Area (square feet)						75,237
Effectiveness Criterion						1,500
Total Number of Impacted Receptor Units						12
Number of Impacted Receptor Units Receiving ≥ 10 dBA I.L.						7
Percent of Impacted Receptor Units Receiving ≥ 10 dBA I.L.						58%
Number of Impacted Receptor Units Receiving I.L. ≥ 5 dBA but < 10 dBA						5
Total Number of Impacted Receptor Units Benefited						12
Percent of Impacted Receptor Units Benefited						100%
Number of Non-Impacted Receptor Units Benefited (I.L. ≥ 5 dBA)						6
Total Number of Benefited Receptor Units						18

Receptor Unit ID- Shading Indicates Impacted Receptor Units	Number of Receptor Units	2016 Noise Levels	2040 (No Barrier and no berm)- shading indicates impact		I-93 Widening Barrier Northbound
			Noise Levels	Increase Over Existing	
Square Feet per Receptor Unit Benefited					4,180
Barrier Reasonable from a Square Foot/Receptor Unit Standpoint?					No
Total Barrier Length (feet)					3,136
Barrier Height Range (feet)					7.11 to 35.94
Average Barrier Height (feet)					23.99

Notes:

All values represent hourly Leq in dBA
 dBA = Decibels on the A-weighted scale
 Leq = Equivalent noise level
 I.L. = Insertion Loss

	Impacted Receptor Units (Build noise levels > 66 dBA)
	Impacted Receptor Units Receiving I.L. ≥ 10 dBA
	Impacted Receptor Units Receiving I.L. ≥ 5 dBA but <10 dBA
	Non-Impacted Receptor Units Receiving ≥ 5 dBA

Updated Analysis

The updated analysis for Exit 4A shows substantially fewer Seasons Lane receptors would be impacted than was predicted previously (12 receptors based on 2040 traffic and no barriers). The receptors are located on hill above the elevation of I-93.

Four barrier options were considered for Seasons Lane as shown in Figures 4-23 through 4-26. The horizontal barrier alignment for the Seasons Lane area was kept the same as the I-93 widening final design barrier alignment, from station 1717+50 at the northern end to station 1694. From station 1694 to 1687+25, the barrier alignment was shifted east to follow the right-of-way line in order to avoid conflict with the Alternative A northbound on-ramp and to take advantage of the terrain.

As shown in Table 4-19, Option 1 evaluated the barrier necessary to achieve 10 dB insertion loss at the majority of the first-row impacted receptors (the design goal per the November 2016 NHDOT Traffic Noise Policy). The option 1 barrier would be similar in total dimensions to the barrier recommended in the I-93 widening final design, totaling 2,983 feet in length and with an average height of 18 feet. In total, 16 receptor units would be benefited by the option 1 barrier, resulting in 3,367 square feet per receptor unit benefited, which exceeds the effectiveness criterion of 1,500 square feet per benefited receptor.

Barrier options that would provide less insertion loss or only protect a portion of the NSA were also considered, but similarly would not be able to meet the effectiveness criterion. Option 2 would be closest to meeting the criterion at 2,706 square feet per benefited receptor for a barrier with an average height 16.2 feet.

Conclusion

Table 4-20 provides an overall summary of the Seasons Lane barrier analyses in comparison to the I-93 widening barrier analyses, including cost information based on recent NHDOT bid prices (\$38 per square foot).

The selection of a preferred option by NHDOT and FHWA was based on consideration of which option would provide a benefit to impacted receptors comparable to the benefit that would be provided if the I-93 widening barriers were built without Exit 4A. NHDOT and FHWA are committed to providing noise barriers in these locations by the I-93 widening 2005 ROD and 2010 Supplemental ROD, regardless of whether the options meet the current noise policy effectiveness criterion. The recommended barrier option for further evaluation during final design is Option 1.

Based on the studies so far completed, NHDOT is committed to the construction of feasible and reasonable noise abatement measures at Seasons Lane. These preliminary indications of likely abatement measures are based upon preliminary design for a barrier with a length of about 3,000 feet and an average height of approximately 18.1 feet, that will reduce the noise level by at least 5dB(A) for 16 residents. If it is subsequently found during final design that these conditions have substantially changed, the abatement measure(s) might not be provided. A final decision on the installation of the abatement measure(s) will be made during the final design process following the completion of public involvement.

Table 4-19. NSA 5 Barrier Analysis, Seasons Lane, 2040 PM Peak Hour Traffic

Receptor Unit ID- Shading Indicates Impacted Receptor Units	Number of Receptor Units	2016 Noise Levels	2040 (No Barrier)- shading indicates impact		Barrier Option 1		Barrier Option 2		Barrier Option 3		Barrier Option 4	
			Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.
Seasons 1"	1	58	62.3	4	62	0	62.1	0	62.1	0	62.1	0
Seasons 10" (first row)	1	66	70.6	5	60.5	10	61.2	9	63.5	7	61.8	9
Seasons 11 (first row)	1	66	70.9	5	60.9	10	61.4	10	63.8	7	62.4	9
Seasons 12" (first row)	1	65	67	2	59.7	7	59.9	7	62.5	5	61.8	5
Seasons 2" (first row)	1	68	74.1	6	63.8	10	68.4	6	68.5	6	68.4	6
Seasons 3"	1	59	63.8	4	60.6	3	61.6	2	62.1	2	61.6	2
Seasons 4" (first row)	1	68	69.4	1	60.2	9	61.3	8	62.8	7	61.4	8
Seasons 5"	1	59	63.3	5	57.5	6	58.4	5	59.8	4	58.5	5
Seasons 6" (first row)	1	67	70.1	3	60.2	10	61.8	8	63.6	6	61.8	8
Seasons 7" (first row)	1	67	70.5	4	61	10	62.6	8	65	6	62.7	8
Seasons 8" (first row)	1	67	70.4	4	60.8	10	62.1	8	65	5	62.4	8
Seasons 9" (first row)	1	67	70.8	4	60.8	10	61.7	9	64.3	7	62.1	9
Seasons_E"	1	58	63.1	5	58.9	4	58.6	5	61.1	2	60.9	2
Seasons_D"	1	59	61.7	3	59.5	2	59.3	2	60.4	1	60.3	1
Seasons_C"	1	56	59.3	4	57.6	2	57.5	2	58.4	1	58.3	1
Seasons_B"	1	54	57.8	4	55.8	2	55.8	2	56.4	1	56.3	2
Seasons_F"	1	62	66.4	4	61.1	5	60.7	6	63	3	62.1	4
Seasons_G"	1	62	65.8	4	60.7	5	60.8	5	62.9	3	61.6	4
Seasons_H"	1	61	65.2	4	60	5	60.4	5	62.4	3	60.9	4
Seasons_I"	1	61	65	4	59.5	6	60.3	5	62.5	3	60.8	4
Seasons_J"	1	60	64.6	4	58.8	6	59.7	5	61.9	3	60	5
Seasons_K"	1	62	65.7	4	59.8	6	61.1	5	63.5	2	61.3	4
Seasons_L"	1	58	62.4	5	58	4	58.6	4	59.7	3	58.8	4
Seasons_N"	1	55	59.2	4	59	0	59.1	0	59.1	0	59.1	0

Receptor Unit ID- Shading Indicates Impacted Receptor Units	Number of Receptor Units	2016 Noise Levels	2040 (No Barrier)- shading indicates impact		Barrier Option 1		Barrier Option 2		Barrier Option 3		Barrier Option 4	
			Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.
Seasons_M"	1	55	58.1	4	57.3	1	57.6	1	57.8	0	57.6	1
Seasons_A"	1	53	56.8	4	56.5	0	56.6	0	56.6	0	56.6	0
Seasons_back_1"	1	52	55.8	4	55.5	0	55.5	0	55.6	0	55.6	0
Seasons_back_2"	1	54	56.4	3	55.9	1	56.1	0	56.2	0	56.1	0
Summer_back_1"	1	57	61.3	4	57.9	3	58.5	3	59.7	2	58.7	3
Autumn_back_1"	1	59	62.7	4	58.9	4	59.6	3	61.2	2	60	3
Autumn_back_2"	1	58	62.4	4	58.9	4	59.5	3	61.1	1	59.9	3
Autumn_back_3"	1	59	62.3	4	59.1	3	59.5	3	60.8	2	60	2
Autumn_back_4"	1	59	62.7	4	59.4	3	59.7	3	61.1	2	60.2	3
Autumn_back_5"	1	59	63.3	4	59.9	3	59.9	3	61.5	2	60.7	3
Autumn_back_6"	1	61	64.9	4	61.1	4	61	4	63	2	62.1	3
Autumn_back_7"	1	61	64.4	4	61.1	3	60.6	4	62.7	2	62.1	2
Seasons_back_3"	1	53	56.4	3	55	1	54.9	2	55.6	1	55.5	1
Noise Abatement Details and Evaluation Criteria												
Barrier Area (square feet)					53,871		45,994		27,903		36,890	
Effectiveness Criterion					1,500		1,500		1,500		1,500	
Total Number of Impacted Receptor Units					12		12		12		12	
Number of Impacted Receptor Units Receiving ≥ 10 dBA I.L.					7		1		0		0	
Percent of Impacted Receptor Units Receiving ≥ 10 dBA I.L.					58%		8%		0%		0%	
Number of Impacted Receptor Units Receiving I.L.≥ 5 dBA but < 10 dBA					5		11		9		9	
Total Number of Impacted Receptor Units Benefited					12		12		9		9	
Percent of Impacted Receptor Units Benefited					100%		100%		75%		75%	
Number of Non-Impacted Receptor Units Benefited (I.L.≥ 5 dBA)					4		5		0		2	
Total Number of Benefited Receptor Units					16		17		9		11	
Square Feet per Receptor Unit Benefited					3,367		2,706		3,100		3,354	

Receptor Unit ID- Shading Indicates Impacted Receptor Units	Number of Receptor Units	2016 Noise Levels	2040 (No Barrier)- shading indicates impact		Barrier Option 1		Barrier Option 2		Barrier Option 3		Barrier Option 4	
			Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.
Barrier Reasonable from a Square Foot/Receptor Unit Standpoint?					No		No		No		No	
Total Barrier Length (feet)					2,983		2,833		2,221		2,221	
Barrier Height Range (feet)					10 to 22		12 to 18		10 to 14		12 to 18	
Average Barrier Height (feet)					18.06		16.23		12.56		16.61	

Notes:

All values represent hourly Leq
in dBA

dBA = Decibels on the A-
weighted scale

Leq = Equivalent
noise level

I.L. = Insertion Loss



Impacted Receptor Units (Build noise levels > 66 dBA)

Impacted Receptor Units Receiving I.L. ≥ 10 dBA

Impacted Receptor Units Receiving I.L. ≥ 5 dBA but <10
dBA

Non-Impacted Receptor Units Receiving ≥ 5 dBA

Note: The “2040 No Barrier” results include the Exit 4A project infrastructure and grading, and the constructed I-93 widening berms.

Table 4-20. NSA 5 Barrier Analysis Summary

	I-93 Improvements Salem to Manchester		Exit 4A SDEIS			
	2004 FEIS	2008 Final Design Noise Analysis	Option 1	Option 2	Option 3	Option 4
Barrier Square Feet	35,000	52,100	53,871	45,994	27,903	36,890
Average Barrier Height (feet)	14 (8 feet wall, 6 feet berm)	14- 18 (10 feet as berm)	10-22 (18 feet ave)	12-18 (16 feet ave.)	10-14 (13 feet ave.)	12-18 (17 ave.)
Length (feet)	2,500	3,050	2,983	2,833	2,221	2,211
No. of Impacted Receptors	10	Not reported	12	12	12	12
No. of Benefited Receptors	19	21	16	17	9	11
Square Feet Per Benefited Receptor	1,842	2,481	3,367	2,706	3,100	3,354
Cost (at time of original analysis)	\$550,000	\$738,000	NA	NA	NA	NA
Cost Per Benefited Receptor (at time of original analysis)	\$28,947	\$35,143	NA	NA	NA	NA
Implied Cost Per Square Foot (at time of original analysis)	\$15.71	\$14.17	NA	NA	NA	NA
Current Cost Per SF	\$38.00	\$38.00	\$38.00	\$38.00	\$38.00	\$38.00
Current Cost Barrier Cost (no berm discount)	\$1,330,000	\$1,979,800	\$2,047,098	\$1,747,772	\$1,060,314	\$1,401,820
Current Cost Per Benefited Receptor	\$70,000.00	\$94,276.19	\$127,943.63	\$102,810.12	\$117,812.67	\$127,438.18



Figure 4-23. Seasons Lane- Option 1 Barrier



Figure 4-24. Seasons Lane- Option 2 Barrier



Figure 4-25. Seasons Lane- Option 3 Barrier



Figure 4-26. Seasons Lane- Option 4 Barrier

4.3.3 Folsom Rd./ Tsienneto Rd. Barrier Analyses

Noise barriers were evaluated in 13 locations along Folsom/Tsienneto Road where noise impacts were predicted to occur under Alternative A. Each potential barrier was developed to include breaks as necessary to not directly conflict with driveways (see Figures 4-27 through 4-34). Multiple heights were modeled (10, 12, 14, and 16 feet) for each barrier and the best performing option identified as shown in Table 4-21. The barriers were compared to NHDOT's minimum acoustic criteria (7 dBA insertion loss for at least one benefited receptor, and 5 dBA insertion loss for at least one impacted receptor).

Barriers that met these acoustic criteria were then evaluated in comparison to the NHDOT effectiveness criterion of 1,500 square feet per benefited receptor. Three potential barriers met the effectiveness criterion:

- Barrier 3, located on the south side of the connector road between Ferland Drive and Franklin Street
- Barrier 5, located on the south side of Tsienneto Road east of Pinkerton Street
- Barrier 10, located on the north side of Tsienneto Road between Jeff Lane and Scenic Drive

The three barriers that were potentially reasonable and feasible based on acoustic performance and the effectiveness criterion were advanced for further evaluation of engineering, environmental, and safety issues. The engineering/environmental feasibility evaluations are as follows:

- **Barrier 3:** To provide adequate clear zones, the barrier would need to be located 6 feet offset from the sidewalk (or 4 feet behind a guardrail), which would result in an unacceptable slope limit encroachment into the entrance of the apartment building at 99 North High Street. In addition, this barrier could require extending the Shields Brook Bridge and additional costs of constructing the barrier on the structure.
- **Barrier 5:** There is insufficient space for construction of a sidewalk and barrier in several sections of this area without resulting in additional property acquisitions or construction of retaining walls that would make the barrier not feasible in terms of cost effectiveness. Existing retaining walls would also be impacted, as well as existing driveways. The eastern end of this proposed barrier would increase wetland impacts.
- **Barrier 10:** Construction of the noise barrier would necessitate the removal of mature trees in the front yard of two historic properties, which would likely constitute an adverse effect to the setting of these historic resources. There is also a sight distance issue at the intersection of Tsienneto Road and Scenic Drive that would necessitate locating the barrier almost to the front of the historic home at 72 Tsienneto Road to provide clear sight lines for the 35 mph design speed.

In conclusion, barriers 3, 5, and 10 would not be feasible from an engineering/environmental perspective and are not recommended for further consideration. The other 10 barriers evaluated for Tsienneto Road/Folsom Road are either not feasible based on acoustic considerations or not reasonable because they would not meet the NHDOT effectiveness criterion.

Table 4-21. Folsom Rd./ Tsienneto Rd. Barrier Analysis- Initial Evaluation of Acoustic Performance and Effectiveness Criterion

Barrier No.	Approx. Location	Number of Noise Impacted Receptors in Vicinity	Total Length (feet, accounting for breaks due to driveways)	7 dBA I.L. for at least one benefited receptor?	5 dBA I.L. for at least one impacted receptor?	Option with lowest SF/benefited receptor <u>and</u> meeting I.L. criteria	SF of option	No. Benefited Receptors	SF/benefited receptor	Conclusion
1	Connector Road South Side, Madden Rd.	2	571	Yes	Yes	16 feet	9,138	1	9,138	Barrier is not reasonable based on effectiveness criterion
2	Connector Road South Side, North High St. to Ferland Dr.	1	519	No	Yes	N/A	N/A	N/A	N/A	Not feasible because no option can provide at least 7 dBA I.L.
3	Connector Road South Side, Ferland Dr. to Franklin St.	5	247	Yes	Yes	10 feet	2,473	4	618	Barrier is feasible and reasonable based on acoustic and effectiveness criterion. Advanced for evaluation of engineering/ environmental issues
4	Folsom Rd. South Side, Franklin St. to NH 28	9	911	Yes	Yes	14 feet	12,759	6	2,127	Barrier is not reasonable based on effectiveness criterion

Barrier No.	Approx. Location	Number of Noise Impacted Receptors in Vicinity	Total Length (feet, accounting for breaks due to driveways)	7 dBA I.L. for at least one benefited receptor?	5 dBA I.L. for at least one impacted receptor?	Option with lowest SF/benefited receptor and meeting I.L. criteria	SF of option	No. Benefited Receptors	SF/benefited receptor	Conclusion
5	Tsienneto Rd South Side, East of Pinkerton St.	10	1,478	Yes	Yes	12 feet	17,732	80	222	Barrier is feasible and reasonable based on acoustic and effectiveness criterion. Advanced for evaluation of engineering/ environmental issues
6	Bypass 28, East Side, Liniew Dr. to London Rd	1	521	No	No	N/A	N/A	N/A	N/A	Not feasible because no option can provide at least 7 dBA I.L., and impacted receiver does not receive at least 5 dBA I.L.
7	Tsienneto Rd, North Side, East of Bypass 28	1	943	Yes	Yes	14 feet	13,186	5	2,637	Barrier is not reasonable based on effectiveness criterion
8	Tsienneto Rd, north side, west of Barkland Dr.	1	753	Yes	Yes	10 feet	7,530	3	2,510	Barrier is not reasonable based on effectiveness criterion
9	Tsienneto Rd, South Side, west of Fieldstone Dr.	2	970	Yes	Yes	16 feet	15,518	6	2,586	Barrier is not reasonable based on effectiveness criterion

Barrier No.	Approx. Location	Number of Noise Impacted Receptors in Vicinity	Total Length (feet, accounting for breaks due to driveways)	7 dBA I.L. for at least one benefited receptor?	5 dBA I.L. for at least one impacted receptor?	Option with lowest SF/benefited receptor and meeting I.L. criteria	SF of option	No. Benefited Receptors	SF/benefited receptor	Conclusion
10	Tsienneto Rd, north side, Jeff Ln to Scenic Dr.	2	384	Yes	Yes	10 feet	3,841	3	1,280	Barrier is feasible and reasonable based on acoustic and effectiveness criterion. Advanced for evaluation of engineering/ environmental issues
11	Tsienneto Rd, north side, East of Jeff Ln	2	685	Yes	Yes	10 feet	6,844	2	3,422	Barrier is not reasonable based on effectiveness criterion
12	NH 102, Tsienneto Rd. to English Range Rd	2	859	No	Yes	N/A	N/A	N/A	N/A	Not feasible because no option can provide at least 7 dBA I.L.
13	NH 102, north of North Shore Rd.	3	468	Yes	Yes	10 feet	4,682	3	1,561	Barrier is not reasonable based on effectiveness criterion



Figure 4-27. Potential Barriers 1, 2 and 3

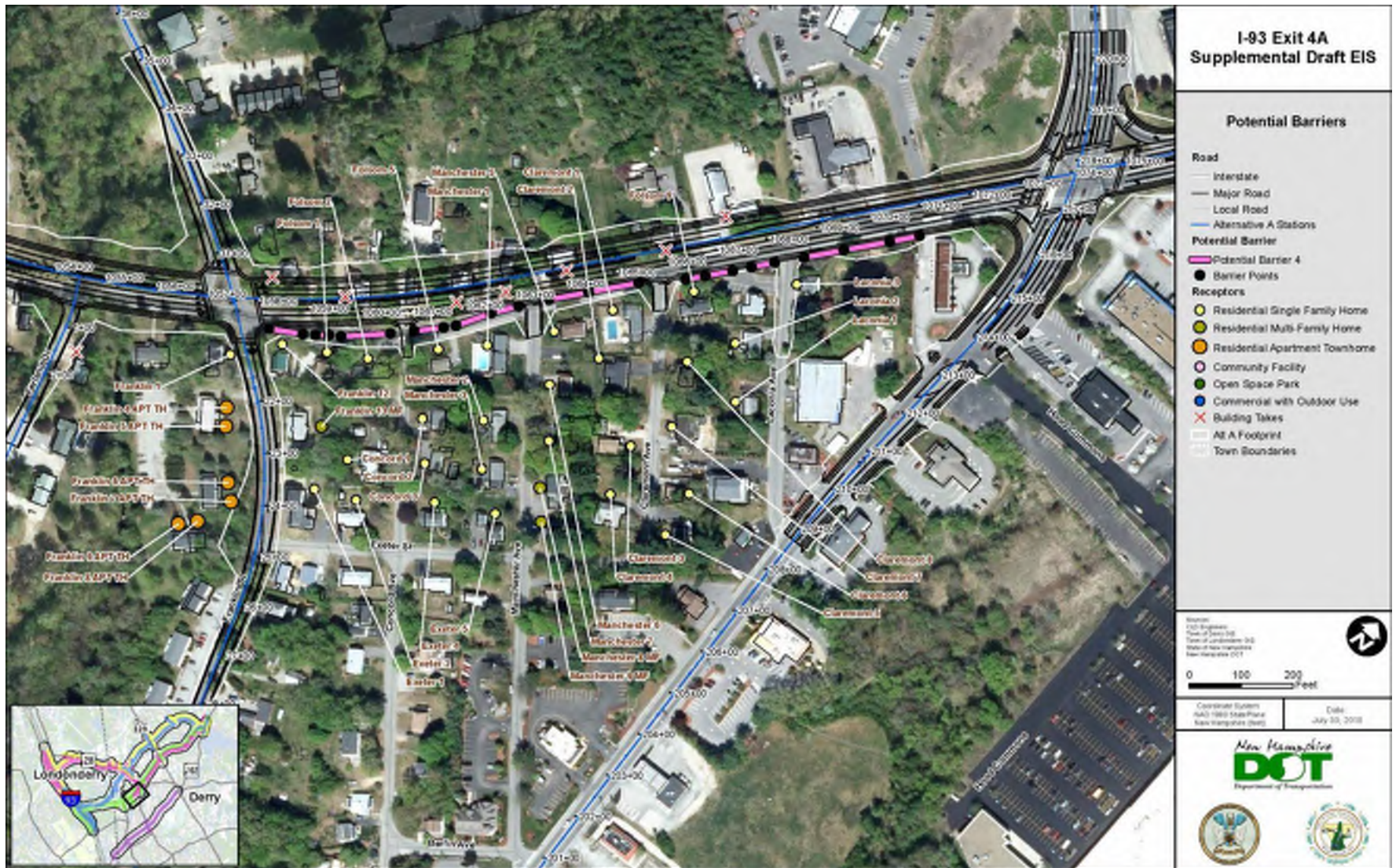


Figure 4-28. Potential Barrier 4



Figure 4-29. Potential Barrier 5



Figure 4-30. Potential Barrier 6



Figure 4-31. Potential Barrier 7



Figure 4-32. Potential Barriers 8 and 9

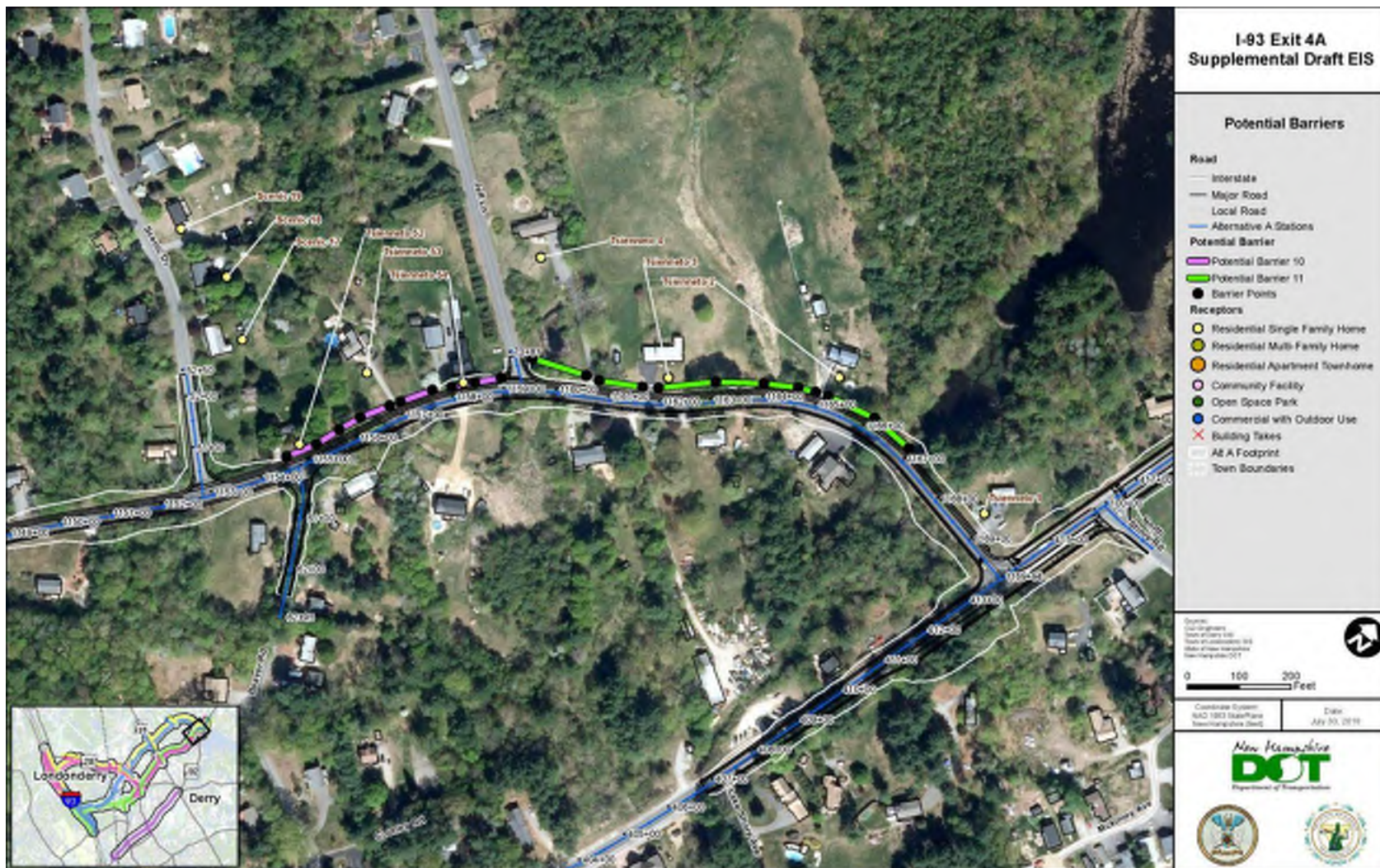


Figure 4-33. Potential Barriers 10 and 11

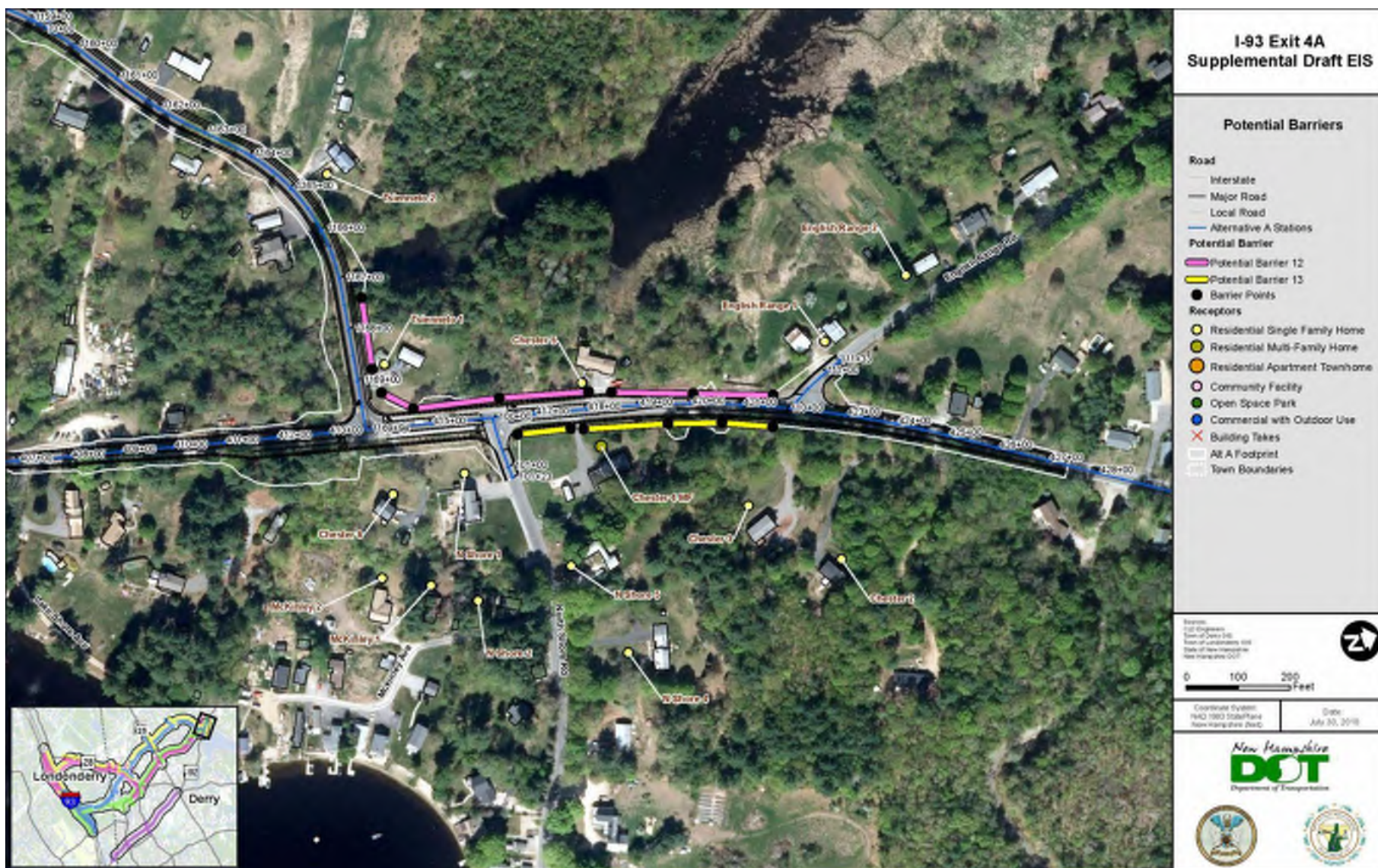


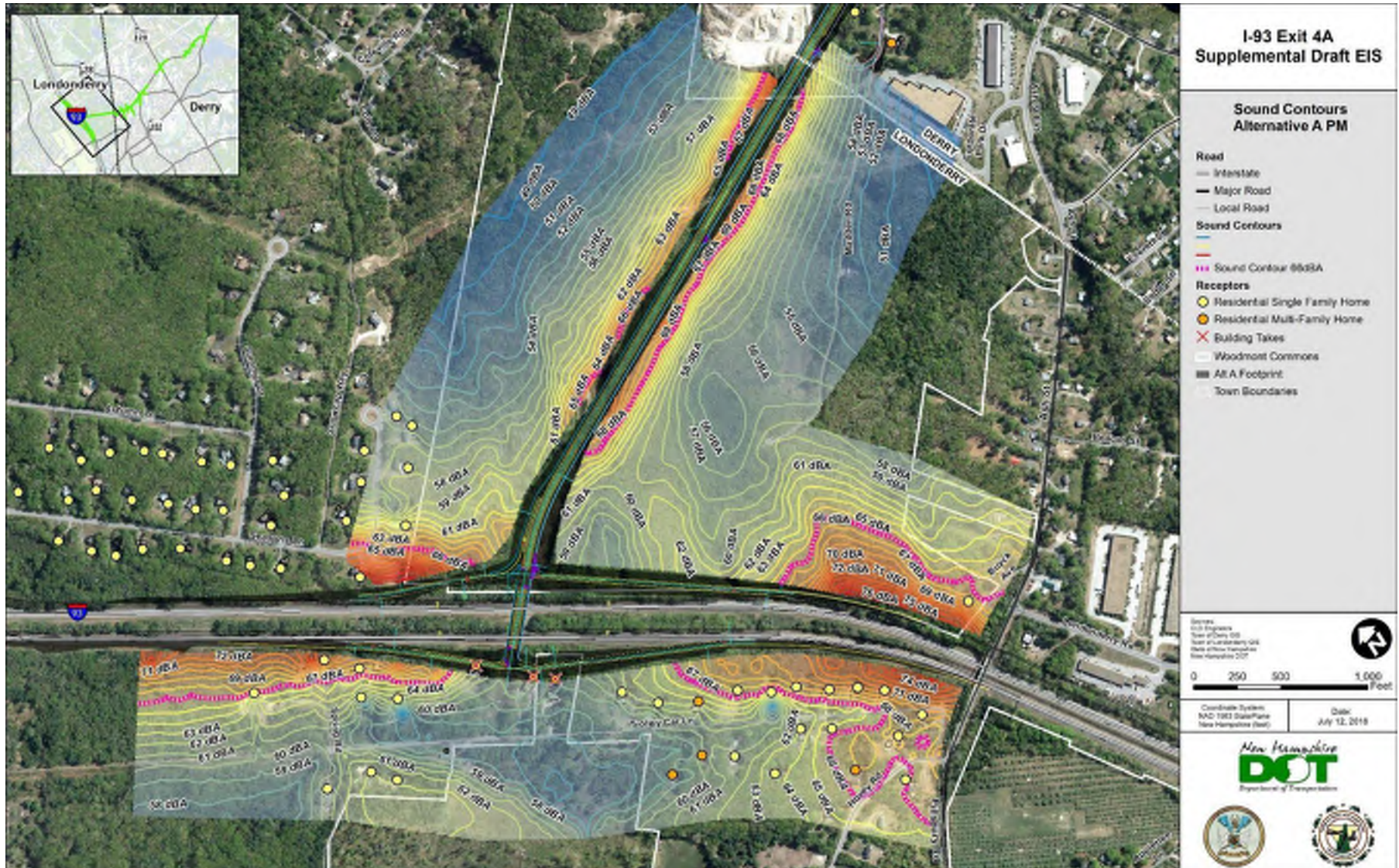
Figure 4-34. Potential Barriers 12 and 13

4.4 Undeveloped Lands Noise Analysis for Future Land Use Planning

In addition to identifying impacts to existing land uses, FHWA's traffic noise regulations require consideration of "undeveloped lands for which development is planned, designed and programmed, which may be affected by noise from the highway." For this project, the primary undeveloped lands are the site of Woodmont Commons on the east and west side of I-93.

Woodmont Commons is Planned Unit Development approved by the Town of Londonderry in 2013. Additional site plan review and local approvals are required for each portion of the plan to advance to construction—as of July 2018 no specific development proposal has been submitted for the portions of Woodmont Commons East and West closest to the interchange area (the areas of Woodmont East under construction are closer to Exit 4 and outside the study area). Although no building permit has been issued that would require detailed analysis of impacts and mitigation, noise contours were developed to aid the Town of Londonderry in future land use planning decisions in this area. The contours were developed by analyzing a dense receptor grid and TNM and interpolating contours using ArcGIS. The receptors were assigned elevations based on LIDAR data so that the noise contours accurately reflect existing terrain. Figure 4-27 shows the Alternative A 2040 PM peak hour noise contours for the immediate interchange area. The contours show the effects of terrain shielding provided by portions of the connector road ramps and that the size of the 66 dBA contour zone along the connector road is much smaller than the 66 dBA contour zone along the I-93 mainline, which is consistent with the I-93 volumes being substantially higher than the connector road.

Figure 4-35. Undeveloped Lands Noise Contours



4.5 Construction Noise Impacts and Mitigation

Construction noise differs from traffic noise in length, type, and duration of noise events. Construction noise is of a fixed duration and ceases at the completion of the construction phase. Construction noise, usually limited to daylight hours, differs from normal vehicular traffic noise, which continues throughout the day- and night-time hours. Additionally, construction-related noise is responsible for a variety of impulsive, discontinuous noise sources, such as jack-hammer and/or vibratory rollers. Traffic noise, although varying in level, is more continuous as a noise source. Temporary increase in noise levels will occur during the time period that construction takes place. Noise levels due to construction, although temporary, can impact areas adjacent to the proposed project.

Impacts due to construction noise are dependent upon the following criteria:

- Time and duration of construction activities;
- Equipment types; and
- Equipment usage cycle.

Typical construction phases for the proposed project may involve the following construction activities:

- **Demolition:** Removal of structures within the right-of-way.
- **Clearing and Grubbing:** Existing landscaping, along with unwanted earth and rock.
- **General Earthwork:** Site topography will be altered in order to prepare the area for the roadway design. Earth moving operations will be required to prepare the roadbed. Trenches will be excavated for drainage materials.
- **Foundations:** Preparation for, and construction of, foundation support systems for both bridge and other primary foundation structures.
- **Paving Operations:** Preparation of the base layer, such as roadbed compaction and the laying of substrata material as well as surface paving operations.
- **Finishing:** Cleanup and landscaping.

Equipment such as bulldozers, scrapers, pavers, backhoe, graders, loaders, cranes, trucks, compressors, vibratory compactors, generators, and pile driving operations are typically utilized during construction.

Mitigation measures will be incorporated into the contract documents to lessen potential construction noise impacts. The following mitigation strategies will be employed to the extent practicable to limit the potential impact of noise:

- Source Control
 - All exhaust systems in good working order, also using properly designed engine enclosures, and intake silencers.
 - Regular equipment maintenance.
- Site Control

- Placement of stationary equipment as far away from sensitive receptors as possible (i.e., pumps, compressors, aggregate crushers, AC plants, operators, etc.).
- Choice of disposal sites and haul routes thereto.
- Employing shielding where possible.
- Time and Activity Constraints
 - Schedule of operations to coincide with periods when people would least likely be affected.
 - Limiting working hours and work days to least noise sensitive times.
- Community Awareness
 - Public notification of construction operations.
 - Methods to handle complaints.

5.0 REFERENCES

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Appendix A: Noise Measurement Field Data Sheets, Photos, and Noise Meter Calibration Certificates

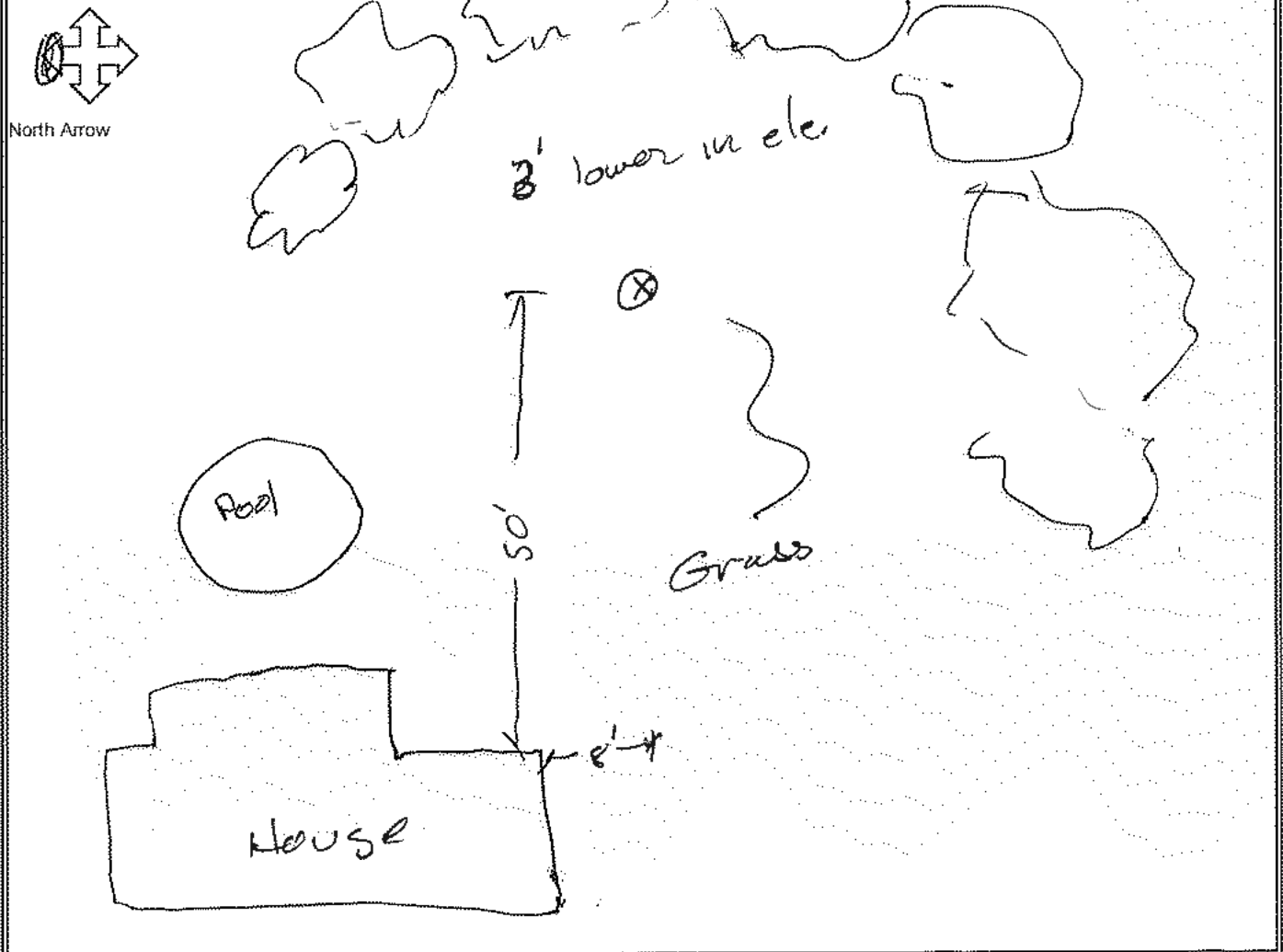
MONITORING LOCATIONS – SKETCHES AND FIELD DATA

Noise Monitoring Fieldwork - Site Diagram

The Louis Berger Group, Inc.

Receptor / Site # Site A	Date	Site Address / Location 24 Trolley Car Ln	Observer DP
Lane / Traffic Direction	Receptor / Site Surface (Grass, Lawn, Sidewalk, etc.) Grass Trees		Nearby Landmark
Grade (At, Level, Below, Slope)	Roadway Pavement Type (Dirt Road, Asphalt, Concrete, Wet, etc.)	Distance to Landmark	
Meteorological Condition (Clear, Sunny, Overcast, etc.)	Temperature (degrees)	Wind Condition/Speed (Mild, Breezy, Gusty, etc.)	Equipment Check List
			Noise Meter Model
			Noise Meter, Calibrator, Windscreen, Tripod

Plan View (Bird's Eye View - Indicate: site location, meter location, distance (ft) to landmarks, roadway & travel lane direction, geographical objects - trees, water, buildings & signs, store names, hydrants, telephone poles, manholes, etc.)



Elevation View (Ground Plane/Cross-section view - Indicate terrain, roadway, height and location of receptor, meter, walls/barriers, buildings, etc.)

* Not to scale!

SHORT TERM NOISE MEASUREMENT RESULTS (20 MINUTES)

SITE A

Address 25 Trolley Car Ln

Time Periods	Date	Starting Time	Duration	PARAMETERS (dBA)						Rec #
				Leq	L10	L50	L90	MaxL	MinL	
AM Peak 7:00 Am - 8:00 AM	9/20	7:00	20	63.8	65.7	63.5	60.7	68.9	54	30
PM Peak 5:00 PM - 6:00 PM	9/20	5:30	20	63.0	64.9	62.8	60.0	67.3	54.7	33
Photo				Diagram				Meter		

Note Ambient and Unusual Noises (e.g. helicopter, airplane, ambulance, motorcycle, police, ambulance, fire truck, garbage truck, people yelling/shouting, barking dog, etc.)

Calm, overcast

		M	Car	PU	MT	HT	B
AM	NB	2	774	164	28	44	0
	SB	2	794	209	32	41	1
	NB	2	870	163	13	19	4
	SB	13	791	112	12	10	4

SHORT TERM NOISE MEASUREMENT RESULTS (20 MINUTES)

SITE A

Address 25 Trolley Car Ln

Time Periods	Date	Starting Time	Duration	PARAMETERS (dBA)						Rec #
				Leq	L10	L50	L90	MaxL	MinL	
AM Peak 7:00 Am - 8:00 AM	9/21	7:00	20	66.0	67.7	65.8	63.4	71.7	59.3	34
PM Peak 5:00 PM - 6:00 PM	9/21	5:08	20	64.2	65.6	64.2	62.0	67.9	58.8	37
Photo				Diagram				Meter		

Note Ambient and Unusual Noises (e.g., helicopter, airplane, ambulance, motorcycle, police, ambulance, fire truck, garbage truck, people yelling/shouting, barking dog, etc.)

Calm Clear

AM	m	Con	DU	MT	HT	B
NB	1	728	141	38	36	0
SB	6	844	176	30	31	1

PM	NB	SB	8	969	164	21	15	2
<i>Calm Clear</i>	SB	5	880	157	20	22	3	

PM Small water pump for swimming pool supply running; may add to overall levels
 PUMP STOPPED @ ~ 7:50 into 20:00 run

Noise Monitoring Fieldwork - Site Diagram

The Louis Berger Group, Inc.

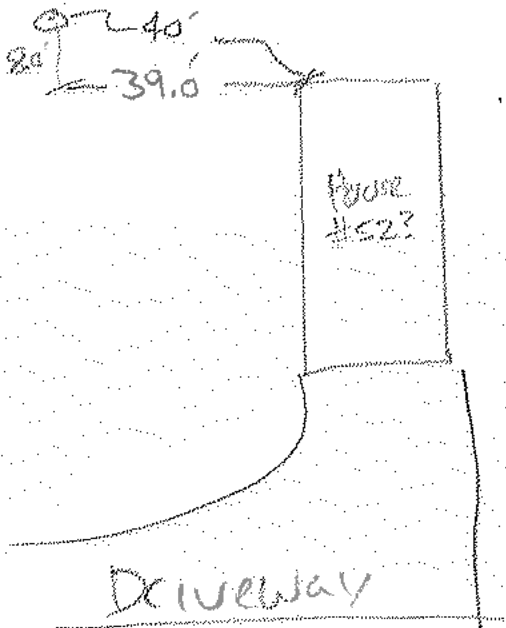
Receptor / Site # <i>B/am</i>	Date <i>9/20/16</i>	Site Address / Location <i>52 Trolley Car Lane</i>	Observer <i>MEF</i>
Lane / Traffic Direction <i>South</i>	Receptor / Site Surface (Grass, Lawn, Sidewalk, etc.) <i>Grass</i>		Nearby Landmark <i>House</i>
Grade (At, Level, Below, Slope) <i>Level</i>	Roadway Pavement Type (Dirt Road, Asphalt, Concrete, Wet, etc.) <i>Asphalt</i>	Distance to Landmark <i>40'</i>	
Meteorological Condition (Clear, Sunny, Overcast, etc.) <i>overcast</i>	Temperature (degrees) <i>70°</i>	Wind Condition/Speed (Mild, Breezy, Gusty, etc.) <i>Mild</i>	Equipment Check List <i>Noise Meter, Calibrator, Windscreen, Tripod</i>
			Noise Meter Model <i>Rion NL-42</i>

Plan View (Bird's Eye View - Indicate: site location, meter location, distance (ft) to landmarks, roadway & travel lane direction, geographical objects - trees, water, buildings & signs, store names, hydrants, telephone poles, manholes, etc.)



North Arrow

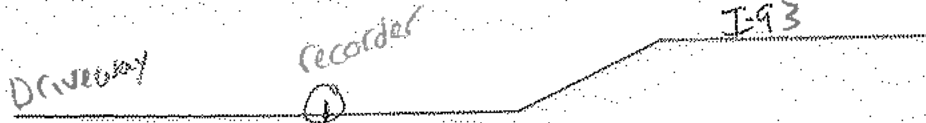
I 93 Southbound →



Legend
⊙ recorder

Elevation View (Ground Plane/Cross-section view - Indicate terrain, roadway, height and location of receptor, meter, walls/barriers, buildings, etc.)

* Not to scale!



SHORT TERM NOISE MEASUREMENT RESULTS (20 MINUTES)

store pt. 1000

SITE B

Address 52 Trolley Car Ln

Time Periods	Date	Starting Time	Duration	PARAMETERS (dBA)						Rec #
				Leq	L10	L50	L90	MaxL	MinL	
AM Peak 7:00 AM - 8:00 AM	9/20/16	7:03 AM	20 min	70.5	72.9	70.0	65.4	77.9	60.2	0001
PM Peak 5:00 PM - 6:00 PM	9/20/16	5:35 PM	20 min	69.1	71.3	68.7	64.6	75.1	56.7	0005
Photo				Diagram			Meter			

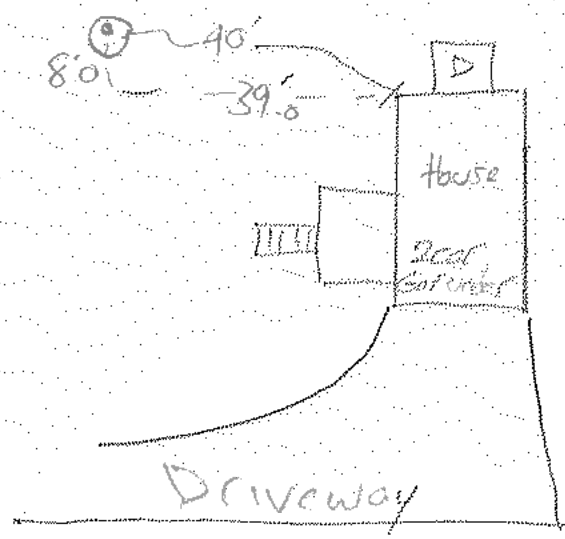
Note Ambient and Unusual Noises (e.g. helicopter, airplane, ambulance, motorcycle, police, ambulance, fire truck, garbage truck, people yelling/shouting, barking dog, etc.)

AM Peak: no unusual noises to report

PM Peak: Lawn mower in neighboring lot at start - to 2 min elapsed.

* Traffic counts on back of sheet

I-93 South bound →



@ Recorder

Morning B

	<u>NB</u>	<u>SB</u>
Motorcycle	2	2
passenger	774	794
pick up	164	209
med truck	28	32
heavy truck	44	41
Buses	0	1

Afternoon B

	NB	SB
Motorcycle	2	13
passenger	870	791
pick up	163	112
med truck	13	12
heavy	19	10
Buses	4	4

SHORT TERM NOISE MEASUREMENT RESULTS (20 MINUTES)

street 1000

SITE B

Address 52 Trolley Car Ln

	Time Periods	Date	Starting Time	Duration	PARAMETERS (dBA)						Rec #
					Leq	L10	L50	L90	MaxL	MinL	
AM Peak	7:00 AM - 8:00 AM	9/21/16	7:00 AM	20 min	70.9	73.2	70.4	66.3	77.0	59.9	0006
PM Peak	5:00 PM - 6:00 PM	9/21/16	5:08 PM	20 min	71.3	72.1	70.2	66.6	77.1	60.0	015
	Photo				Diagram				Meter		

Note Ambient and Unusual Noises (e.g. helicopter, airplanes, ambulance, motorcycle, police, ambulance, fire truck, garbage truck, people yelling/shouting, barking dog, etc.)

car counts

AM

PM

	SB	NB	SB	NB
Motorcycle	6	1	5	8
passenger	844	728	880	969
pick up	176	141	157	164
med truck 4 axle	30	38	20	21
Tractor trailer 5 axle	31	36	22	15
Bus	1	0	3	2

Noise Monitoring Fieldwork - Site Diagram

The Louis Berger Group, Inc.

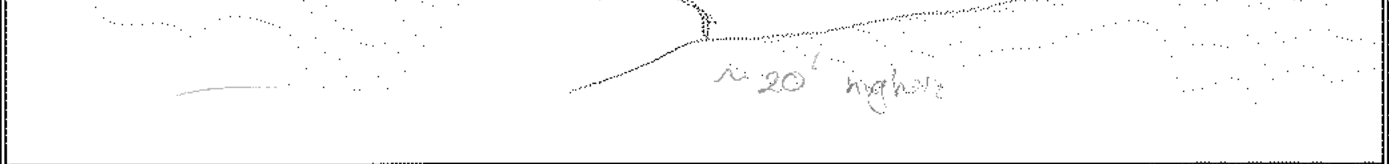
Receptor / Site # <i>Site C</i>	Date	Site Address / Location <i>60 Seasons Ln</i>	Observer <i>JF</i>
Lane / Traffic Direction	Receptor / Site Surface (Grass, Lawn, Sidewalk, etc.) <i>Grass / Trees</i>	Nearby Landmark <i>Pos / T93</i>	
Grade (At, Level, Below, Slope)	Roadway Pavement Type (Dirt Road, Asphalt, Concrete, Wet, etc.)	Distance to Landmark	
Meteorological Condition (Clear, Sunny, Overcast, etc.)	Temperature (degrees)	Wind Condition/Speed (Mild, Breezy, Gusty, etc.)	Equipment Check List Noise Meter, Calibrator, Windscreen, Tripod
			Noise Meter Model

Plan View (Bird's Eye View - Indicate: site -location, meter -location, distance (ft) to landmarks, roadway & travel lane direction, geographical objects - trees, water, buildings & signs, store names, hydrants, telephone poles, manholes, etc.)



Elevation View (Ground Plane/Cross-section view - Indicate terrain, roadway, height and location of receptor, meter, walls/barriers, buildings, etc.)

* Not to scale!



SHORT TERM NOISE MEASUREMENT RESULTS (20 MINUTES)

SITE C

Address 60 Seasons Ln

Time Periods	Date	Starting Time	Duration	PARAMETERS (dBA)						Rec #
				Leq	L10	L50	L90	MaxL	MinL	
AM Peak 7:00 Am - 8:00 AM	9/20	7:45	20	60.5	62.1	60.3	58.3	65.8	51.9	31
PM Peak 5:00 PM - 6:00 PM	9/20	5:00	20	60.8	62.1	60.6	59.1	65.7	56.2	32
Photo				Diagram			Meter			

Note Ambient and Unusual Noises (e.g. helicopter, airplane, ambulance, motorcycle, police, ambulance, fire truck, garbage truck, people yelling/shouting, barking dog, etc.)

Calm, overcast

AM NB 0 746 120 24 27 2

SB 1 806 164 36 32 1

PM Calm - clear

NB 4 921 220 23 18 4

SB 6 836 153 22 10 2

SHORT TERM NOISE MEASUREMENT RESULTS (20 MINUTES)

SITE C

Address 60 Seasons Ln

Time Periods	Date	Starting Time	Duration	PARAMETERS (dBA)						Rec #
				Leq	L10	L50	L90	MaxL	MinL	
AM Peak 7:00 Am - 8:00 AM	9/22	7:15	20	62.2	63.4	62.2	60.2	65.9	58.0	38
PM Peak 5:00 PM - 6:00 PM	9/22	4:30	20	60.7	61.9	60.7	58.9	83.1	55.9	39
Photo				Diagram			Meter			

Note Ambient and Unusual Noises (e.g. helicopter, airplane, ambulance, motorcycle, police, ambulance, fire truck, garbage truck, people yelling/shouting, barking dog, etc.)

Calm Clear M Car PO MT HT B
 NB 7 890 174 34 42 2
 SB 9 854 196 45 26 2

Calm, Clear
 NB 5 887 223 21 13 2
 SB 9 778 139 35 21 4

Noise Monitoring Fieldwork - Site Diagram

The Louis Berger Group, Inc.

Receptor / Site # <i>D / am</i>	Date <i>9/20/12</i>	Site Address / Location <i>6 Folsom Rd / at Concord Ave</i>	Observer <i>MSF</i>
Lane / Traffic Direction <i>East & West</i>	Receptor / Site Surface (Grass, Lawn, Sidewalk, etc.) <i>Sidewalk</i>	Nearby Landmark <i>Utility Pole</i>	
Grade (At, Level, Below, Slope) <i>Level</i>	Roadway Pavement Type (Dirt Road, Asphalt, Concrete, Wet, etc.) <i>Asphalt</i>	Distance to Landmark <i>5'</i>	
Meteorological Condition (Clear, Sunny, Overcast, etc.) <i>overcast</i>	Temperature (degrees) <i>75°</i>	Wind Condition/Speed (Mild, Breezy, Gusty, etc.) <i>Mild</i>	Equipment Check List Noise Meter, Calibrator, Windscreen, Tripod
			Noise Meter Model <i>PLM 02</i>

Plan View (Bird's Eye View - Indicate: site location, meter location, distance (ft) to landmarks, roadway & travel lane direction, geographical objects - trees, water, buildings & signs, store names, hydrants, telephone poles, manholes, etc.)

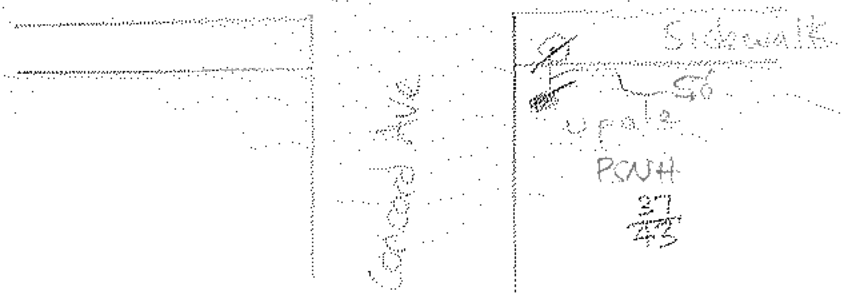


North Arrow

#2 Folsom Rd *#6 Folsom Rd*

Folsom Rd

Legend
⊙ Receptor



Elevation View (Ground Plane/Cross-section view - Indicate terrain, roadway, height and location of receptor, meter, walls/barriers, buildings, etc.)

* Not to scale!



SHORT TERM NOISE MEASUREMENT RESULTS (20 MINUTES)

State pt. 1000

SITE D

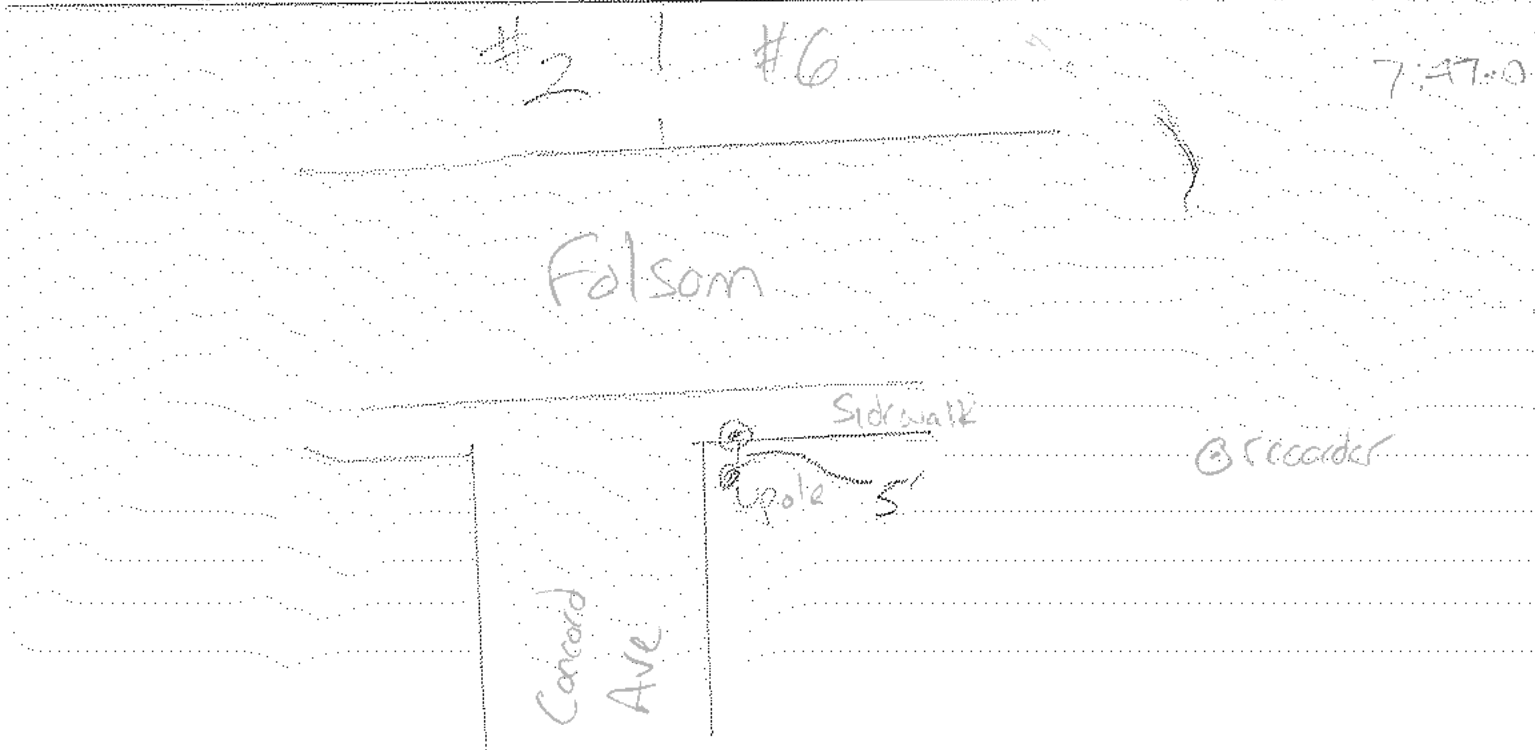
Address 4 Folsom Rd

Time Periods	Date	Starting Time	Duration	PARAMETERS (dBA)						Rec #
				Leq	L10	L50	L90	MaxL	MinL	
AM Peak 7:15 Am - 8:15 AM	9/20/16	7:43 _{am}	20min	74.2	77.5	71.6	63.3	88.2	52.6	0003
PM Peak 4:30 PM - 5:30 PM	9/20/16	5:03 _{pm}	20min	74.4	77.8	72.7	65.0	85.3	53.4	0004
Photo				Diagram				Meter		

Note Ambient and Unusual Noises (e.g. helicopter, airplane, ambulance, motorcycle, police, ambulance, fire truck, garbage truck, people yelling/shouting, barking dog, etc.)

Direction	Count	Notes
Morning Traffic West	131	
Motorcycle	1	
Passenger car	102	
Pick up	29	* See back of sheet for pm traffic
Med truck & axle	4	
Tractor Trailer	1	

AM Peak: No unusual noises to report



PM Traffic - D 9/20/16

SITE

East

West

Motorcycle 1

3

Passenger cars 174

131

Pickup 65

45

Med truck 8

0

Large 0

0

SHORT TERM NOISE MEASUREMENT RESULTS (20 MINUTES)

State pt 1000

SITE D

Address 4 Folsom Rd

	Time Periods	Date	Starting Time	Duration	PARAMETERS (dBA)					Rec #	
					Leq	L10	L50	L90	MaxL		MinL
AM Peak	7:15 Am - 8:15 AM	9/21/16	7:36am	20min	73.5	77.1	70.3	61.5	89.6	51.7	0007
PM Peak	4:30 PM - 5:30 PM	9/21/16	4:30am	20min	75.2	78.4	73.1	64.9	88.3	57.3	0010
	Photo				Diagram				Meter		

Note Ambient and Unusual Noises (e.g. helicopter, airplane, ambulance, motorcycle, police, ambulance, fire truck, garbage truck, people yelling/shouting, barking dog, etc.)

Traffic count

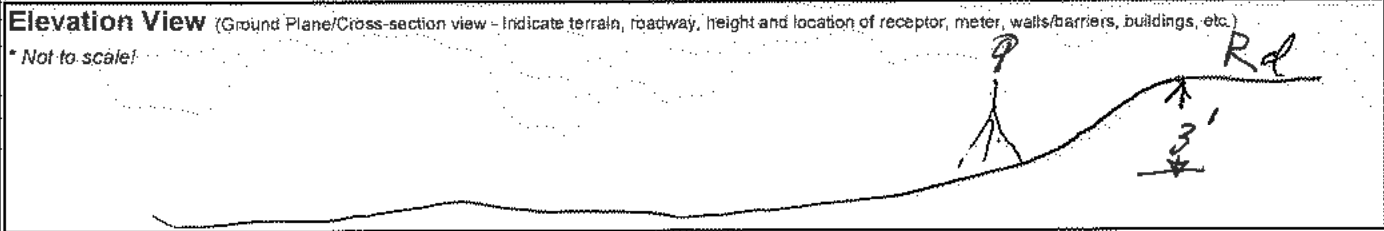
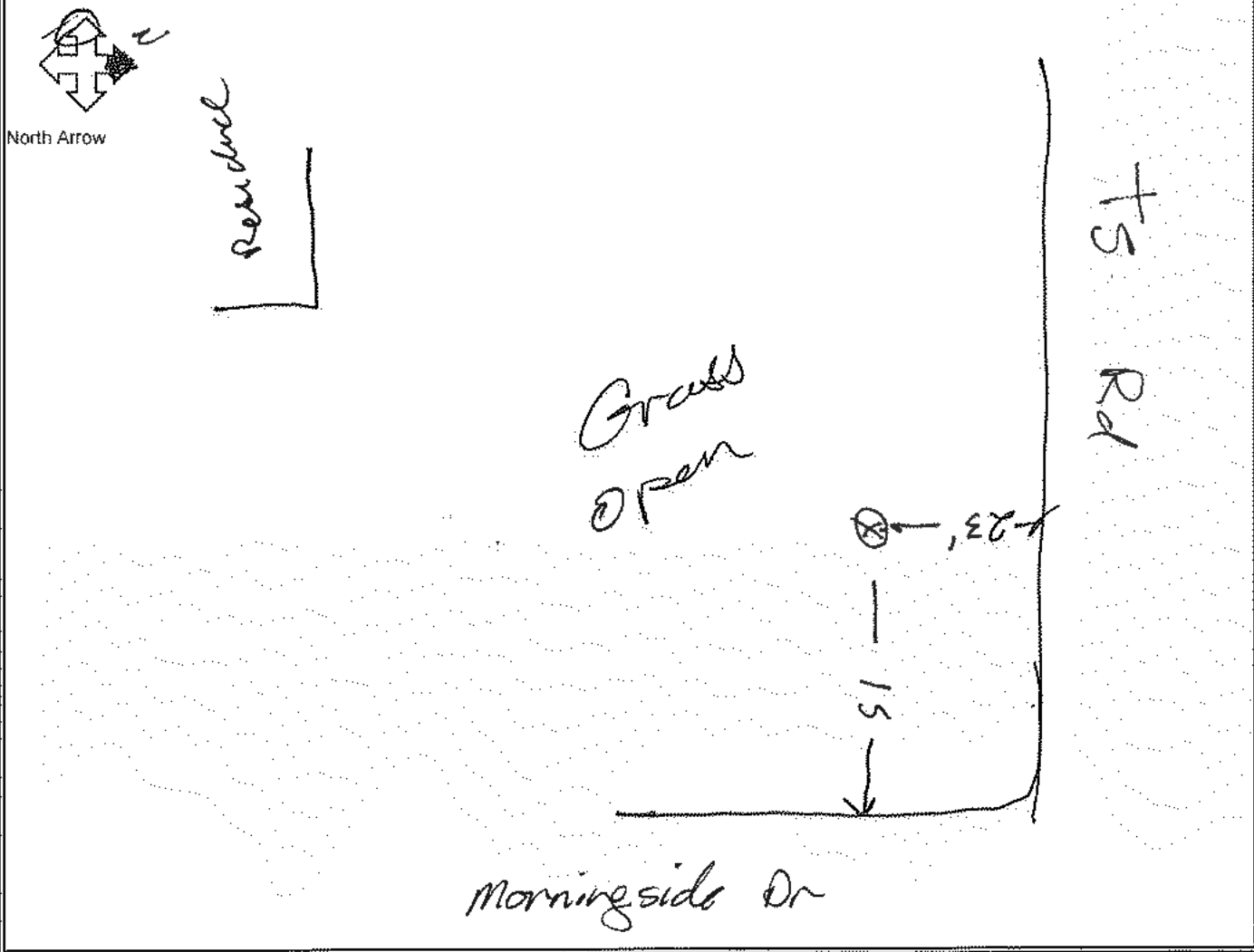
	AM		PM	
	E	W	E	W
Motorcycle	Totals 2		4	0
passenger	207		185	125
pickup	49		33	22
Med truck	7		1	6
tractor trailer	0		1	0
Bus	1		0	0

Noise Monitoring Fieldwork - Site Diagram

The Louis Berger Group, Inc.

Receptor / Site # Site F	Date	Site Address / Location 71 Tsienneto Rd	Observer DP
Lane / Traffic Direction	Receptor / Site Surface (Grass, Lawn, Sidewalk, etc.) Grass	Nearby Landmark Rd	
Grade (At, Level, Below, Slope)	Roadway Pavement Type (Dirt Road, Asphalt, Concrete, Wet, etc.)	Distance to Landmark	
Meteorological Condition (Clear, Sunny, Overcast, etc.)	Temperature (degrees)	Wind Condition/Speed (Mild, Breezy, Gusty, etc.)	Equipment Check List Noise Meter, Calibrator, Windscreen, Tripod
Noise Meter Model			

Plan View (Bird's Eye View - Indicate: site location, meter location, distance (ft) to landmarks, roadway & travel lane direction, geographical objects - trees, water, buildings & signs, store names, hydrants, telephone poles, manholes, etc.)



SHORT TERM NOISE MEASUREMENT RESULTS (20 MINUTES)

SITE E

Address 71 Tsienneto Rd

Time Periods	Date	Starting Time	Duration	PARAMETERS (dBA)						Rec #
				Leq	L10	L50	L90	MaxL	MinL	
AM Peak 7:15 Am - 8:15 AM	9/21	7:33	20	65.1	68.3	60.7	48.8	82.3	40.8	35
PM Peak 4:30 PM - 5:30 PM	9/21	4:30	20	63.5	67.6	59.9	46.2	79.1	39.4	36
Photo				Diagram				Meter		

Note Ambient and Unusual Noises (e.g. helicopter, airplane, ambulance, motorcycle, police, ambulance, fire truck, garbage truck, people yelling/shouting, barking dog, etc.)

Notes	m	Car	PU	MT	HT	B
Calm Clear						
AM (EB WB)	1	147	31	5	0	3
PM EB	1	95	31	0	0	0
WB	3	57	18	1	0	0

SHORT TERM NOISE MEASUREMENT RESULTS (20 MINUTES)

Store pt 1000

SITE E

Address 71 Tsienneto Rd

	Time Periods	Date	Starting Time	Duration	PARAMETERS (dBA)					Rec #	
					Leq	L10	L50	L90	MaxL		MinL
AM Peak	7:15 Am - 8:15 AM	9/22/16	7:16am	20min	63.9	67.5	58.2	48.0	82.8	44.3	0016
PM Peak	4:30 PM - 5:30 PM	9/22/16	4:30pm	20min	64.1	68.1	60.1	48.2	78.4	44.4	0017
	Photo				Diagram				Meter		

Note Ambient and Unusual Noises (e.g. helicopter, airplane, ambulances, motorcycle, police, ambulance, fire truck, garbage truck, people yelling/shouting, barking dog, etc)

	AM		PM	
	E	W	E	W
Mabregale	1	2	1	Ø
passenger car	28	Ø	107	86
pickup	12	37	17	16
med truck	1	2	Ø	Ø
Heavy truck	Ø	Ø	1	Ø
Bus	Ø	Ø	Ø	Ø

MONITORING LOCATIONS – TRAFFIC CLASSIFICATION DATA

Tue. 20 Sep. AM

Site/Record	A/30		B/01		C/38		D/03	
Time	7:00 - 7:20		7:00 - 7:20		7:40 - 8:00		7:40 - 8:00	
Direction/Road	NB I-93	SB I-93	NB I-93	SB I-93	NB I-93	SB I-93	WB Fol. Rd	EB Fol. Rd
Motorcycles	2	2	2	2	7	9	1	0
Cars	774	794	774	794	890	854	131	102
Pick-Up	164	209	164	209	174	196	29	20
Med. Truck	28	32	28	32	34	45	4	4
Heavy Trk.	44	41	44	41	42	26	0	1
Bus	0	1	0	1	2	2	0	0

Tue. 20 Sep. PM

Site/Record	A/33		B/05		C/32		D/04	
Time	17:30 - 17:50		17:30 - 17:50		16:30 - 16:50		7:40 - 8:00	
Direction/Road	NB I-93	SB I-93	NB I-93	SB I-93	NB I-93	SB I-93	WB Fol. Rd	EB Fol. Rd
Motorcycles	2	13	3	13	4	6	3	1
Cars	870	791	870	791	921	936	131	174
Pick-Up	163	112	163	112	220	153	45	65
Med. Truck	13	12	13	12	23	22	0	8
Heavy Trk.	19	10	19	10	18	10	0	0
Bus	4	4	4	4	4	2	0	0

Wed. 21 Sep. AM

Site/Record	A/34		B/06		D/07		E/35	
Time	7:00 - 7:20		7:00 - 7:20		7:30 - 7:50		7:30 - 7:50	
Direction/Road	NB I-93	SB I-93	NB I-93	SB I-93	WB Fol. Rd	EB Fol. Rd	WB Tsi Rd	EB Tsi Rd
Motorcycles	1	6	1	6			2	1
Cars	728	844	728	844			207	147
Pick-Up	141	176	141	176			49	31
Med. Truck	38	30	38	30			7	5
Heavy Trk.	36	31	36	31			0	0
Bus	0	1	0	1			1	3

Wed. 21 Sep. PM

Site/Record	A/37		B/15		D/10		E/36	
Time	17:00 - 17:20		17:00 - 17:20		16:30 - 16:50		16:30 - 16:50	
Direction/Road	NB I-93	SB I-93	NB I-93	SB I-93	WB Fol. Rd	EB Fol. Rd	WB Tsi Rd	EB Tsi Rd
Motorcycles	8	5	8	5	4	0	1	3
Cars	969	880	969	880	185	125	147	57
Pick-Up	164	157	164	157	33	22	31	18
Med. Truck	21	20	21	20	1	6	5	1
Heavy Trk.	15	22	15	22	1	0	0	0
Bus	2	3	2	3	0	0	3	0

Thu. 22 Sep. AM

Site/Record	C/38		E/16	
Time	7:15 - 7:35		7:15 - 7:35	
Direction/Road	NB I-93	SB I-93	WB Tsi Rd	EB Tsi Rd
Motorcycles	7	9	2	1
Cars	890	854	87	28
Pick-Up	174	196	73	12
Med. Truck	34	45	2	1
Heavy Trk.	42	26	0	0
Bus	2	2	0	0

Thu. 22 Sep. PM

Site/Record	C/39		E/17	
Time	16:30 - 16:50		16:30 - 16:50	
Direction/Road	NB I-93	SB I-93	WB Tsi Rd	EB Tsi Rd
Motorcycles	5	9	0	1
Cars	887	778	86	107
Pick-Up	223	139	16	17
Med. Truck	21	35	3	3
Heavy Trk.	13	21	0	1
Bus	2	4	0	0

MONITORING LOCATIONS – PHOTOGRAPHS



Location A: 24 Trolley Car Lane, Looking East



Location A: 24 Trolley Car Lane, Looking North



Location B: 52 Trolley Car Lane, Looking Southeast



Location B: 52 Trolley Car Lane, Looking North



Location C: 60 Seasons Lane, Looking South



Location C: 60 Seasons Lane, Looking Northeast



Location D:6 Folsom Road, Looking East



Location D:6 Folsom Road, Looking Southwest



Location E: 71 Tsienneto Road, Looking North



Location E: 71 Tsienneto Road, Looking West

Calibration Certificates

Scantek, Inc.

CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)



NVLAP Lab Code: 200625-0

Calibration Certificate No. 36572

Instrument: Sound Level Meter
Model: NL42
Manufacturer: Rion
Serial number: 00133002
Tested with: Microphone UC52 s/n 144581
Preamplifier NH24 s/n 23049
Type (class): 2
Customer: Scantek, Inc.
Tel/Fax: 410-290-7726 / -9167

Date Calibrated: 7/7/2016 **Cal Due:** 7/7/2017

Status:	Received	Sent
----------------	-----------------	-------------

In tolerance:	X	X
----------------------	---	---

Out of tolerance:		
--------------------------	--	--

See comments:

Contains non-accredited tests: ___ Yes X No

Calibration service: ___ Basic X Standard

Address: 6430 Dobbin Road, Suite C
Columbia, MD 21045

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence	Cal. Due
				Cal. Lab / Accreditation	
4838-Norsonic	SME Cal Unit	25747	Jul 6, 2016	Scantek, Inc./ NVLAP	Jul 6, 2017
DS-360-SRS	Function Generator	61646	Aug 12, 2015	ACR Env. / A2LA	Aug 12, 2017
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Aug 13, 2015	ACR Env. / A2LA	Aug 13, 2016
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 18, 2014	ACR Env. / A2LA	Nov 18, 2016
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Oct 1, 2015	ACR Env. / A2LA	Apr 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
4226-Brüel&Kjær	Multifunction calibrator	2305103	Jul 24, 2015	Scantek, Inc./ NVLAP	Jul 24, 2016

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.6	99.65	44.0

Calibrated by:	Jeremy Gotwalt	Authorized signatory:	Valentin Buzduga
Signature		Signature	
Date	7/7/16	Date	7/07/2016

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory. This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.
Document stored Z:\Calibration Lab\SLM 2016\RIONL42_00133002_M1.doc

Scantek, Inc.

CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1

ACCREDITED by NVLAP (an ILAC MRA signatory)



NVLAP Lab Code: 200625-0

Calibration Certificate No.35807

Instrument: Acoustical Calibrator
Model: 1251
Manufacturer: Norsonic
Serial number: 22770
Class (IEC 60942): 1
Barometer type:
Barometer s/n:

Date Calibrated: 3/16/2016 Cal Due: 3/16/2017

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		
Contains non-accredited tests:	___ Yes <u>X</u> No	

Customer: Scantek, Inc.
Tel/Fax: 410-290-7726 / 410-290-9167

Address: 6430 Dobbin Rd., Suite C,
Columbia MD, 21045

Tested in accordance with the following procedures and standards:

Calibration of Acoustical Calibrators, Scantek Inc., Rev. 1/16/2015

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence	Cal. Due
				Cal. Lab / Accreditation	
483B-Norsonic	SME Cal Unit	31061	Jul 20, 2015	Scantek, Inc./ NVLAP	Jul 20, 2016
DS-360-SRS	Function Generator	88077	Sep 9, 2014	ACR Env./ A2LA	Sep 9, 2016
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 24, 2015	ACR Env./ A2LA	Sep 24, 2016
HM30-Thommen	Meteo Station	1040170/39633	Oct 23, 2015	ACR Env./ A2LA	Oct 23, 2016
140 Norsonic	Real Time Analyzer	1403978	Mar 19, 2015	Scantek, inc. / NVLAP	Mar 19, 2016
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	
4192-Brüel&Kjaer	Microphone	2854675	Nov 11, 2015	Scantek, Inc. / NVLAP	Nov 11, 2016
1203-Norsonic	Preamplifier	92268	Oct 14, 2015	Scantek, Inc./ NVLAP	Oct 14, 2016

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by:	Jeremy Gotwalt	Authorized signatory:	Valentin Buzariga
Signature		Signature	
Date	3/16/16	Date	3/16/2016

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory. This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

Document stored as: Z:\Calibration Lab\Cal 2016\NOR1251_22770_M1.doc

Scantek, Inc.

CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)



NVLAP Lab Code: 200625-0

Calibration Certificate No. 36955

Instrument: Sound Level Meter
Model: NL42
Manufacturer: Rion
Serial number: 00321503
Tested with: Microphone UC52 s/n 139853
Preamplifier NH24 s/n 11523
Type (class): 2
Customer: Scantek, Inc.
Tel/Fax: 410-290-7726 / 410-290-9167

Date Calibrated: 9/8/2016 **Cal Due:** 9/8/2017

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		

See comments:
Contains non-accredited tests: ___ Yes X No
Calibration service: ___ Basic X Standard
Address: 6430 Dobbin Road, Suite C
Columbia, MD 21045

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/22/2012
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence	Cal. Due
				Cal. Lab / Accreditation	
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 9, 2014	ACR Env./ A2LA	Sep 9, 2016
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 24, 2015	ACR Env./ A2LA	Sep 24, 2016
HM30-Thommen	Meteo Station	1040170/39633	Oct 23, 2015	ACR Env./ A2LA	Oct 23, 2016
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
4226-Brüel&Kjær	Multifunction calibrator	2305103	Jul 25, 2016	Scantek, Inc./ NVLAP	Jul 25, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.0	99.95	58.8

Calibrated by:	Jeremy Gotwalt	Authorized signatory:	Valentin Buzduga
Signature		Signature	
Date	9/8/16	Date	9/09/2016

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This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST,
or any agency of the federal government.

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