roadways, and scheduling construction to minimize the amount and duration of exposed earth.

- The Towns would require that contractors involved with the construction of the Project include Tier 4 standard engines or best available retrofit technology on heavy diesel construction equipment in accordance with applicable state and federal laws at the time of construction.

4.5 Noise

Transportation projects may affect ambient noise levels both directly and indirectly. Direct noise effects may include introducing a new roadway segment, and indirect effects may include the increase or decrease of traffic on an existing roadway due to the modification of a nearby roadway. The study area for noise is a 500-foot buffer of the Build Alternative alignments (Figure 4.5-1).

To provide a baseline for assessing potential noise impacts, locations within noise sensitive areas (NSAs) were selected where monitored noise would be representative of conditions along the proposed alignment. Generally, NSAs should correspond to existing or future planned noise sensitive developments (or groups of noise sensitive receptors as defined in 23 CFR Part 772), which are likely to be affected by changes in traffic volumes and where roadway, ramp, and interchange improvements are proposed. Figure 4.5-1 shows the five monitoring locations: Sites A, B, C, D, and E.

To establish existing noise conditions in the Project corridor, existing A-weighted noise levels were measured in 2016 during mid-week AM and PM peak hours in general accordance with FHWA requirements (FHWA, 1996). Measurements were taken at 20-minute intervals at each noise measurement location site to establish the baseline noise environment of the Project area. Detailed information regarding the noise monitoring methods and results is provided in the Noise Technical Report.

The receptors most sensitive to noise along the corridor are categorized as FHWA Noise Abatement Criteria (NAC) Activity B,[10] and the FHWA NAC are presented in Table 4.5-1. For Activity B receptors, outdoor noise levels that approach or exceed 67 a-weighted decibel (dBA) Leq (h) would require consideration of some form of noise abatement or mitigation measure. Leq (h) is the equivalent of a continuous sound level which, in a stated time period (1 hour) and at a stated location, has the same A-weighted sound energy as the time-varying sound.

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

Leq (h) noise levels approach or exceed the FHWA NAC given in Table 4.5-1, where "approach" means within 1 dBA of the NAC (i.e., at an absolute noise level of 67 dBA for Activity B land uses).

A substantial increase in the predicted noise levels occurs over the existing noise levels, regardless of whether or not the NAC level is exceeded. Because the FHWA NAC does not specifically define the increased noise level of an affected receptor, the increase of 15 dBA from

[10] These noise abatement criteria are identical to those presented in NHDOT's *Policy and Procedural Guidelines for the Assessment and Abatement of Highway Traffic Noise for Type I and Type II Highway Projects.*

existing conditions, as defined in NHDOT's noise policy, was used in the analysis for this study (NHDOT, 2016d).

Therefore, based on the above criteria, any receptor(s) experiencing at least a 15 dBA increase over the existing outdoor noise level, regardless of absolute noise level, is eligible for noise abatement. In addition, any Activity B land uses experiencing a post-project outdoor noise level of 67 dBA or greater are also eligible for noise abatement (NHDOT, 2016d).

Table 4.5-1. FHWA Noise Abatement Criteria: Hourly A-weighted Sound Level in Decibels

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)	67	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)	72	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 CFR, Part 772.

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

4.5.1 Affected Environment

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 4.5-1 as Sites 1 through 10. Table 4.5-4 presents noise levels from the 2007 DEIS monitoring effort.

Table 4.5-2. 2007 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.

2016 Noise Monitoring Update

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

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

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 the preferred alternative 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 4.5-1 shows the monitoring locations, and monitoring results are summarized in Table 4.5-3. 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. Additional information regarding the methodology for noise monitoring is provided in Appendix E, *Noise Technical Report*.

Table 4.5-3. 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**

Site	Address	Date	Time	L_{eq} (dBA)
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**

Alternative A

The area of the new interchange under the preferred alternative is wooded, and noise receptors consist of scattered residences (NAC Activity B) along the east of I-93, and along the west side of I-93 near the proposed interchange. As Table 4.5-4 shows, noise levels in the residential areas near the proposed interchange ranged from 60.5 dBA Leq to 70.9 dBA Leq in the AM peak traffic period, and from 60.7 dBA Leq to 70.3 dBA Leq in the PM peak traffic period.

The western portion of the connector road is through wooded and unoccupied land. Approaching the eastern end of the connector, land use includes commercial and industrial (NAC Activity F), giving over to residential near N. High Street.

Land use along both sides of Folsom Road and Tsienneto Road includes residential interspersed with commercial uses. As Table 4.5-3 shows, noise levels in the residential areas along Folsom Road ranged from 73.5 dBA Leq to 74.2 dBA Leq in the AM peak traffic period, and from 74.4 dBA Leq to 75.2 dBA Leq in the PM peak traffic period. Noise levels along Tsienneto Road ranged from 63.9 dBA Leq to 65.1 dBA Leq in the AM peak traffic period, and from 63.5 dBA Leq to 64.1 dBA Leq in the PM peak.

Alternative B

The interchange area land use and noise levels for Alternative B are the same as described above for the preferred alternative. The western portion of the connector road is through wooded and unoccupied land. Approaching the central portion of the connector, land use includes commercial and industrial (NAC Activity F) in the areas of Franklin Street Extension and NH 28. Approaching N. Main Street, and east of N. Main Street to the intersection of Tsienneto Road and NH 102, land is characterized by residential uses (NAC Activity B). Noise monitoring was conducted at two locations in the residential areas along Alternative B in 2007 (Figure 4.5-1, sites 6 and 7). The results show noise levels in the range of 51 to 61 dBA Leq.

Alternative C

The area of the new interchange under Alternative C is wooded, and noise receptors consist of scattered residences south and east of the proposed interchange, and commercial uses occupy land northeast of the proposed interchange. Noise monitoring near the interchange area in 2007 (site 3, Seasons Lane) determined the existing noise level was 63 dBA Leq. Similar monitoring of the Seasons Lane neighborhood near I-93 to the south confirms a similar noise level in 2016 (site C, 61-62 dBA).

Commercial and residential uses are located on either side of the Alternative C alignment along NH 28. From the NH 28 Bypass to NH 102, the corridor extends through commercial land use,

then changes to residential land use toward the eastern end. Noise monitoring was conducted in this area in 2007, refer to Alternative B for a summary of the results for sites 6 and 7.

Alternative D

The interchange area land uses and existing noise levels for Alternative D are the same as Alternative C. Along Tsienneto Road, land uses and noise levels are the same as described for Alternative A.

Alternative F

Noise receptors along the Alternative F corridor through downtown Derry include residential, recreational, and commercial. Existing conditions noise monitoring conducted in 2007 (Figure 4.5-1, sites 9 and 10) showed noise levels in the range of 65-66 dBA, and current noise levels would be expected to be of a similar magnitude.

In accordance with FHWA requirements and NHDOT's noise policy, the Traffic Noise Model (TNM) 2.5 noise model for the Project was validated by modeling traffic volumes recorded during noise monitoring fieldwork. Table 4.5-4 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 4.5-4. 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

Monitoring Location	Date/Time Period	Measured Leq, dBA	Modeled Leq, dBA	Difference
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.

4.5.2 Environmental Consequences

Design year 2040 predicted noise levels were determined using Version 2.5 of the FHWA TNM. The alternatives were divided into 11 NSAs for traffic noise modeling purposes as shown in Figure 4.5-2. 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. The *Noise Technical Report* (Appendix E) includes detailed modeling methodology and FHWA TNM files.

Table 4.5-5 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 4.5-2. 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's noise 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 4.5-5. Detailed tables and figures for the modeling results are provided in Appendix E.

It is important to note that the results in Table 4.5-5 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 of the *Noise Technical Report* (Appendix E) 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 in Table 4.5-5 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 the preferred alternative 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 4.5.2.1.

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 Alternatives 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

The preferred alternative 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. The preferred Alternative 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 the preferred alternative (before considering mitigation).

Table 4.5-5. 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 Road)	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
	NSA Subtotal	*4*	*6*	*5*	*3*	*9*	*8*	*7*
2 (Alts. B and C connector near Olde Coach Road and Bypass 28)	Single-Family	9	5	5	2 exceed NAC + 1 substantial increase	2	5	4
	NSA Subtotal	*9*	*5*	*5*	*3*	*2*	*5*	*4*
3 (Alts. B and C connector near Barkland Drive, and Scenic Drive)	Single-Family	0	0	0	2 exceed NAC + 8 substantial increase	2 exceed NAC + 7 substantial increase	0	0
	NSA Subtotal	*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
	NSA Subtotal	*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*
	NSA Subtotal	*8*	*1*	*3*	*3*	*1*	*1*	*1*
6 (Alts. A and B Connector from Derry Town Line to NH 28, Folsom Road)	Single-Family	11	11	13 (includes one receptor impacted due to both NAC and substantial increase)	6	12	11	11
	Multi-Family/Apartment	0	2	2	0	0	0	2
	NSA Subtotal	*12*	*13*	*15*	*6*	*12*	*11*	*13*
7 (Tsienneto Road 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
	NSA Subtotal	*3*	*4*	*5*	*0*	*1*	*2*	*4*
8 (Tsienneto Road 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
	NSA Subtotal	*5*	*11*	*14*	*5*	*4*	*13*	*9*
9 (NH 102, Exit 4 to Griffin Street)	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
	NSA Subtotal	*33*	*33*	*32*	*27*	*25*	*27*	*31*
10 (NH 102, Griffin Street 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
	NSA Subtotal	*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
	NSA Subtotal	*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
	Grand Total	*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 4.5-2).

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 NH 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 Road and Tsienneto Road).

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.

Undeveloped Lands 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 a PUD 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, as shown in Figure 4.5-3. For additional information on the methodology used to generate the future noise contours, see Appendix E.

4.5.3 Mitigation

Mitigation was considered for areas along the preferred alternative alignment where noise impacts were predicted for the 2040 analysis year. Detailed noise barrier evaluations were completed for Trolley Car Lane (NSA 4), and Seasons Lane (NSA 5), two neighborhoods where barriers planned as part of the I-93 widening project would be affected by the new interchange ramps under the preferred alternative. Noise barrier evaluations were also conducted along Folsom Road/Tsienneto Road (NSA 6, 7, and 8). For detailed technical information on the mitigation analyses, see Appendix E. A summary of the noise mitigation analysis conclusions is provided in the following section.

NSA 4 Trolley Car Lane

A noise barrier was recommended for Trolley Car Lane in the 2004 I-93 widening FEIS (FHWA, 2005). During the I-93 final design process, the recommended barrier was revised to be 12–18 feet in height (with 10 feet of the height on berm) and 4,450 feet long. With Exit 4A, this barrier cannot be constructed as originally designed because of conflicts with the interchange ramps. Therefore, a new barrier analysis was conducted accounting for Exit 4A.

Trolley Car Lane was divided into two separate areas for purposes of the Exit 4A noise barrier evaluation (Trolley Car Lane North and Trolley Car Lane South), separated by three single-family homes that would be total acquisitions under the preferred alternative (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 would not be logical for this location.

Multiple barrier configurations were evaluated for Trolley Car Lane North and Trolley Car Lane South, as documented in Appendix E. 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 NHDOT 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.

- Trolley Car Lane North Option 1 (Figure 4.5-4). This barrier would be approximately 1,161 feet in length, between 4 and 16 feet in height (average height of 10.8 feet), and benefit three residential receptor units.
- Trolley Car Lane South Option 1 (Figure 4.5-5). This barrier would be approximately 1,535 feet in length, between 12 and 20 feet in height (average height of 15.6 feet) and benefit 10 residential receptor units.

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 4,200 feet and an average height of approximately 14.8 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.

NSA 5 Seasons Lane

A noise barrier was recommended for Seasons Lane in the 2004 I-93 widening FEIS (FHWA, 2005). During the I-93 final design process, the recommended barrier was revised to be 14–18 feet in height (with 10 feet of the height on berm) and 3,050 feet long.

Multiple barrier configurations were evaluated for Seasons Lane, as documented in Appendix E. 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 ROW line to avoid conflict with the preferred alternative northbound on-ramp and to take advantage of the terrain.

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 NHDOT noise policy effectiveness criterion. The recommended barrier option for further evaluation during final design is Option 1:

- Seasons Lane Option 1 (Figure 4.5-6). This barrier would be 2,983 feet in length, between 10 and 22 feet in height (average height of 18.1 feet) and benefit 16 residential receptor units.

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 along northbound I-93 in the proposed Exit 4A interchange area, 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.

Folsom/Tsienneto Road

Noise barriers were evaluated in 13 locations along Folsom/Tsienneto Road where noise impacts were predicted to occur under the preferred alternative. Each potential barrier was developed to include breaks as necessary to not directly conflict with driveways. Multiple heights were

modeled (10, 12, 14, and 16 feet) and 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

Mapping of the evaluated barrier options is provided in Appendix E. 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 resources, 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.