Chapter 12: Noise

A. INTRODUCTION

The purpose of this chapter is to document potential impacts related to noise and vibration due to the operation of the LIRR Expansion Project, along with any potential noise reduction measures that have been included as part of the Proposed Project. The operation of trains results in noise and vibration. Also, when trains approach grade crossings, warning bells and train horns are utilized, temporarily but repeatedly creating significant noise. This chapter assesses the changes to current noise and vibration levels that would result from the Proposed Project. Chapter 13, "Construction," includes an assessment of noise levels resulting from construction activities associated with the Proposed Project.

B. PRINCIPAL CONCLUSIONS AND IMPACTS

The results of the noise and vibration assessment indicate that impacts are not predicted under the Proposed Project as a result of several noise and vibration control measures that are integrated into the proposed track design. In fact, with those measures in place, noise and vibration levels would be significantly reduced in virtually all locations compared to existing conditions and the Future Without the Proposed Project. Although LIRR operations are expected to increase between the Future Without the Proposed Project and the Proposed Project, this increase of 6 percent is insignificant compared to the 19 percent increase in operations expected between the Existing Condition and the Future Without the Proposed Project. Compared to the Future Without the Proposed Project, overall noise under the Proposed Project is predicted to decrease significantly due to several design features. Design features, such as the grade separation at roadway crossings (which would eliminate the required sound of all train warning horns), augmented retaining walls serving as sound attenuation walls, high-speed turnout switches with moveable point frogs and concrete ties, under-^ rail pads^ and resilient fasteners are predicted to decrease noise and vibration levels at virtually all locations compared to existing conditions and to the Future Without the Proposed Project.

C. METHODOLOGY

The operational impacts were evaluated using the guidelines set forth by the FTA's guidance manual on *Transit Noise and Vibration Impact Assessment* (2006). There are no local noise or vibration ordinances that apply to interstate rail operations or facilities from Nassau County or the local municipalities. In general, most local noise ordinances apply to nuisance noises related to disturbances from a variety of source other than interstate rail operations (e.g., loud radios, loud speakers and other objectionable sounds).

FUNDAMENTALS AND DESCRIPTORS

NOISE

Noise is "unwanted sound" and by this definition, the perception of noise is a subjective process. Several factors affect the actual level and quality of sound (or noise) as perceived by the human ear and can generally be described in terms of loudness, pitch (or frequency), and time variation. The loudness, or magnitude, of noise determines its intensity and is measured in decibels (dB) that can range from below 40 dB (e.g., the rustling of leaves) to more than 100 dB (e.g., a rock concert). Pitch describes the character and frequency content of noise, such as the very low "rumbling" noise of stereo subwoofers or the very high-pitched noise of a piercing whistle. Finally, the time variation of noise sources can be characterized as continuous, such as with a building ventilation fan; intermittent, such as for trains passing by; or impulsive, such as pile-driving activities during construction.

Various sound levels are used to quantify noise from transit sources, including a sound's loudness, duration, and tonal character. For example, the A-weighted decibel (dBA) is commonly used to describe the overall noise level because it more closely matches the human ear's response to audible frequencies. Since the A-weighted decibel scale is logarithmic, a 10 dBA increase in a noise level is generally perceived as a doubling of loudness, while a 3 dBA increase in a noise level is just barely perceptible to the human ear. Typical A-weighted sound levels from transit and other common sources are documented in the FTA's guidance manual on *Transit Noise and Vibration Impact Assessment* (2006), as shown on **Figure 12-1**.

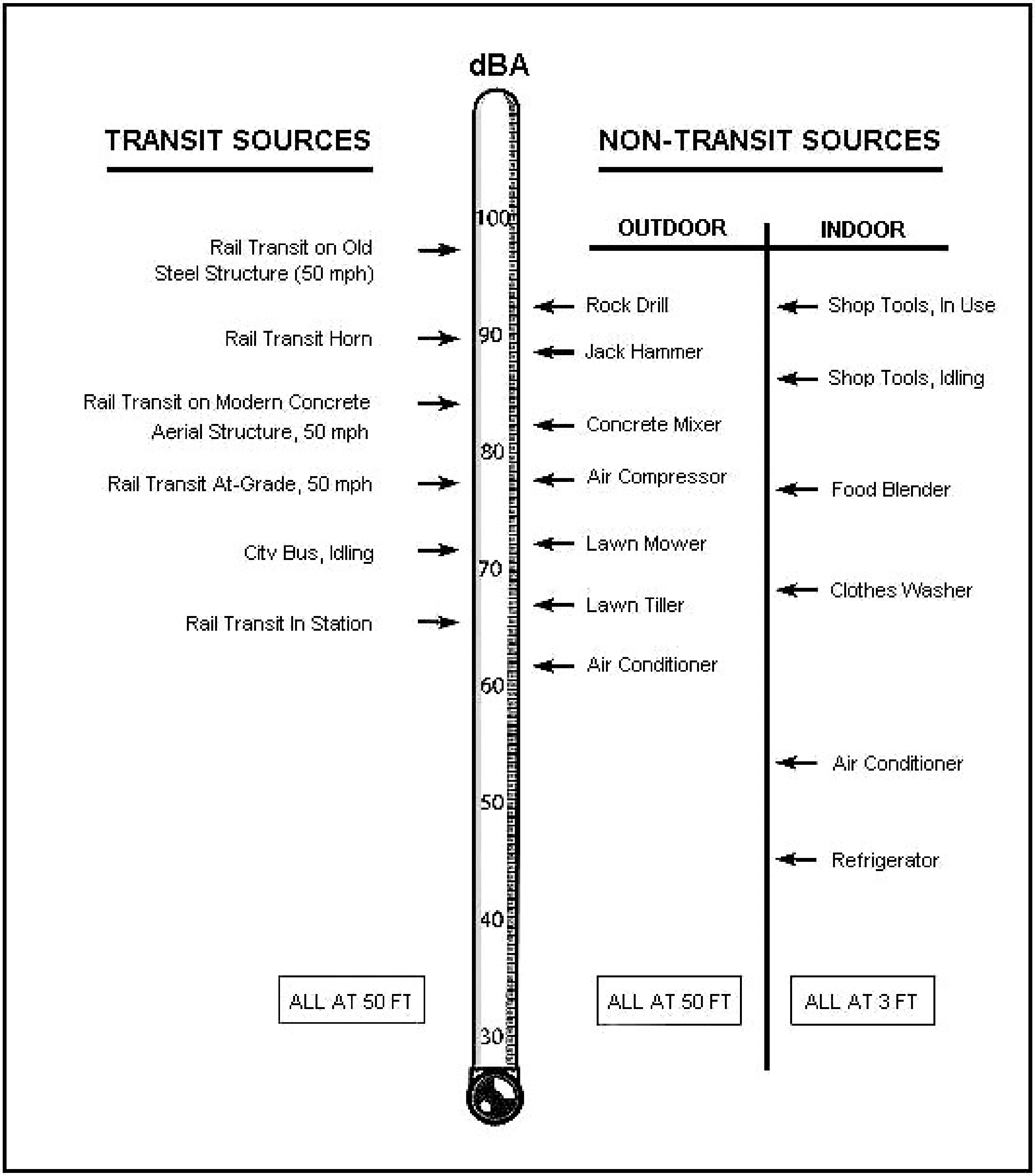
Several A-weighted noise descriptors are used to determine impacts from stationary and transit-related sources, including:

- **Maximum Noise Levels (Lmax):** represents the maximum noise level that occurs during an event such as a bus or train pass-by
- **Average Hourly Equivalent Noise Level (Leq):** represents a level of constant noise with the same acoustical energy as the fluctuating noise levels observed during a given interval, such as one hour (Leq(h))
- **Average 24-hour Day-night Noise Level (Ldn):** includes a 10-decibel penalty for all nighttime activity between 10:00 p.m. and 7:00 a.m.

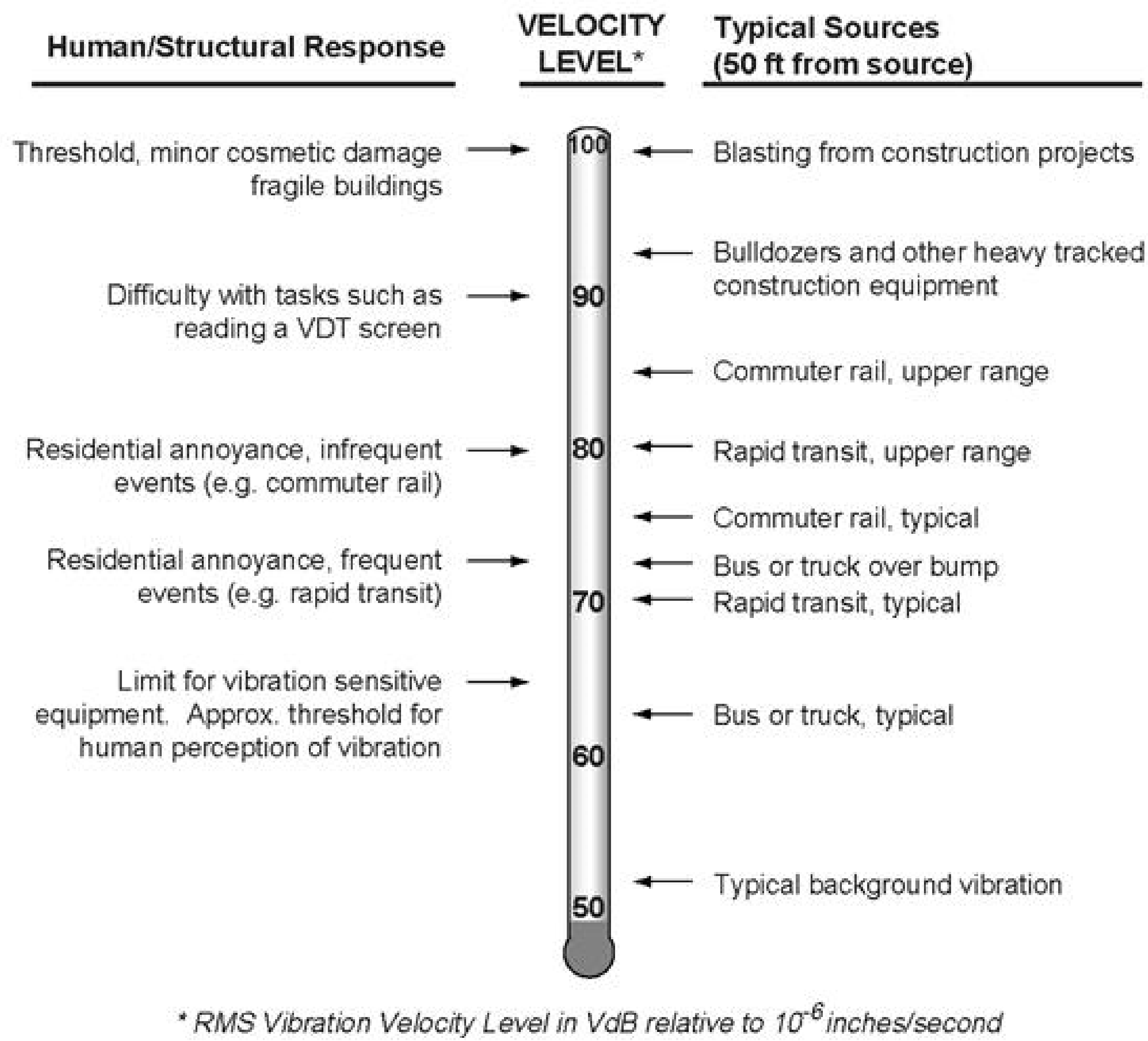
VIBRATION

Ground-borne vibration associated with vehicle movements is usually the result of uneven interactions between wheels and the road or rail surfaces. Examples of such interactions (and subsequent vibrations) include train wheels over a jointed rail, an untrue rail car wheel with "flats," and a motor vehicle wheel hitting a pothole, a manhole cover, or any other uneven surface. Typical ground-borne vibration levels from transit and other common sources are shown on **Figure 12-2**.

Unlike noise, which travels in air, transit vibration typically travels along the surface of the ground. Depending on the geological properties of the surrounding terrain and the type of building structure exposed to transit vibration, vibration propagation can be more or less efficient. Buildings with a solid foundation set in bedrock are "coupled" more efficiently to the surrounding ground and experience relatively higher vibration levels than buildings located in sandier soil. Heavier buildings (such as masonry structures) are less susceptible to vibration than wood-frame buildings because they absorb more vibration energy.



Typical A-Weighted Noise Levels
Figure 12-1



Typical Ground-Borne Vibration Levels
Figure 12-2

Vibration induced by passing vehicles can generally be discussed in terms of displacement, velocity, or acceleration. However, human responses and responses by monitoring instruments and other objects are most accurately described with velocity. Therefore, the vibration velocity level is used to assess vibration impacts from transit projects.

To describe the human response to vibration, the average vibration amplitude (called the root mean square [RMS] amplitude) is used to assess impacts. The RMS velocity level is expressed in inches per second (ips) or vibration velocity levels in decibels (VdB). All VdB vibration levels are referenced to one micro-inch per second (μips). Similar to noise decibels, vibration decibels are dimensionless because they are referenced to (i.e., divided by) a standard level (such as 1×10^{-6} ips in the United States). This convention allows compression of the scale over which vibration occurs, such as 40 to 100 VdB rather than 0.0001 ips to 0.1 ips.

EVALUATION CRITERIA

OPERATIONAL NOISE CRITERIA

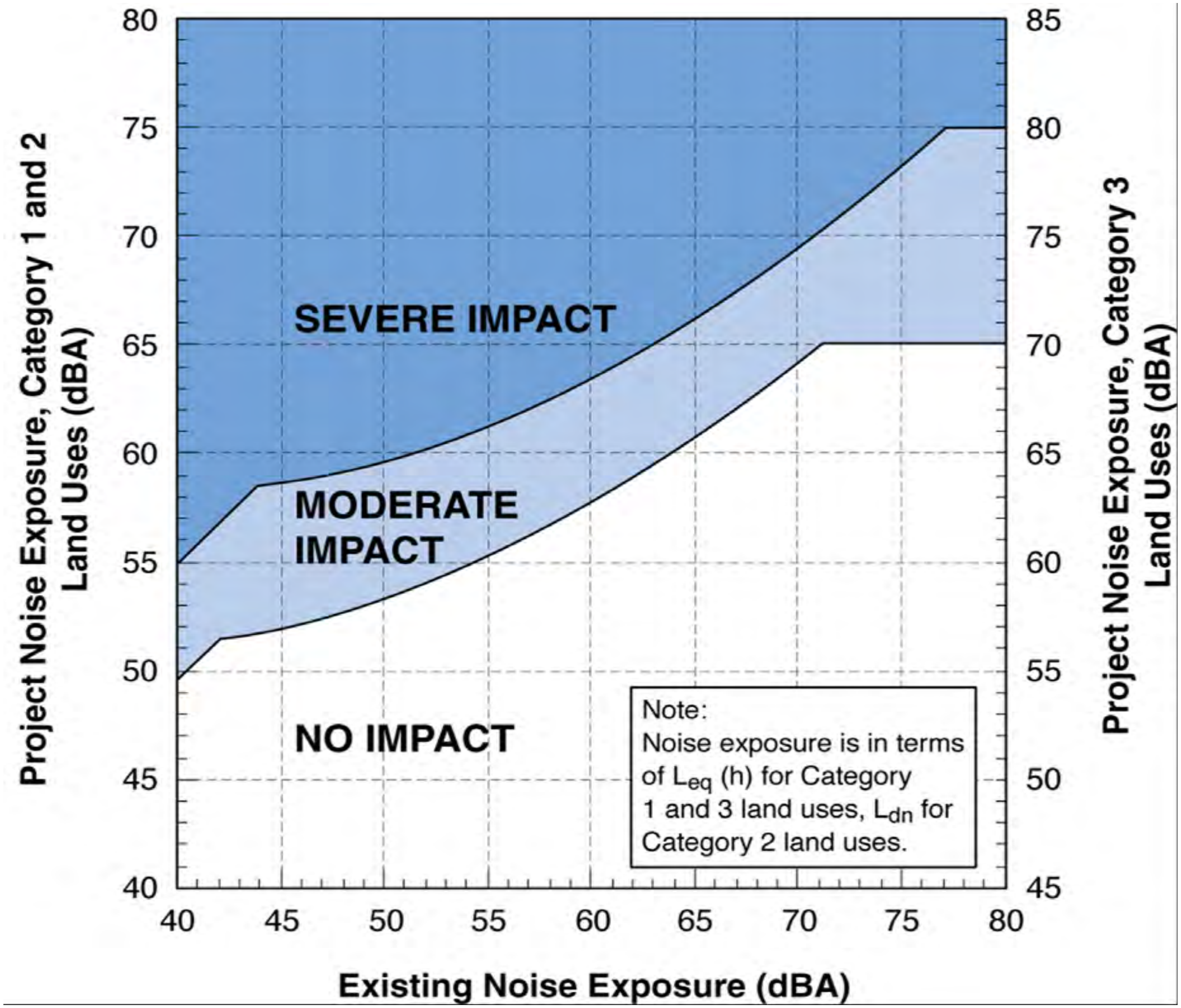
The FTA's guidance manual on *Transit Noise and Vibration Impact Assessment* (2006) presents the basic concepts, methods, and procedures for evaluating the extent and severity of noise impacts from transit projects. Transit noise impacts are assessed based on land-use categories and sensitivity to noise from transit sources under the FTA guidelines. The FTA land-use categories and required noise metrics are shown in **Table 12-1**.

Table 12-1
FTA Land-Use Categories and Noise Metrics

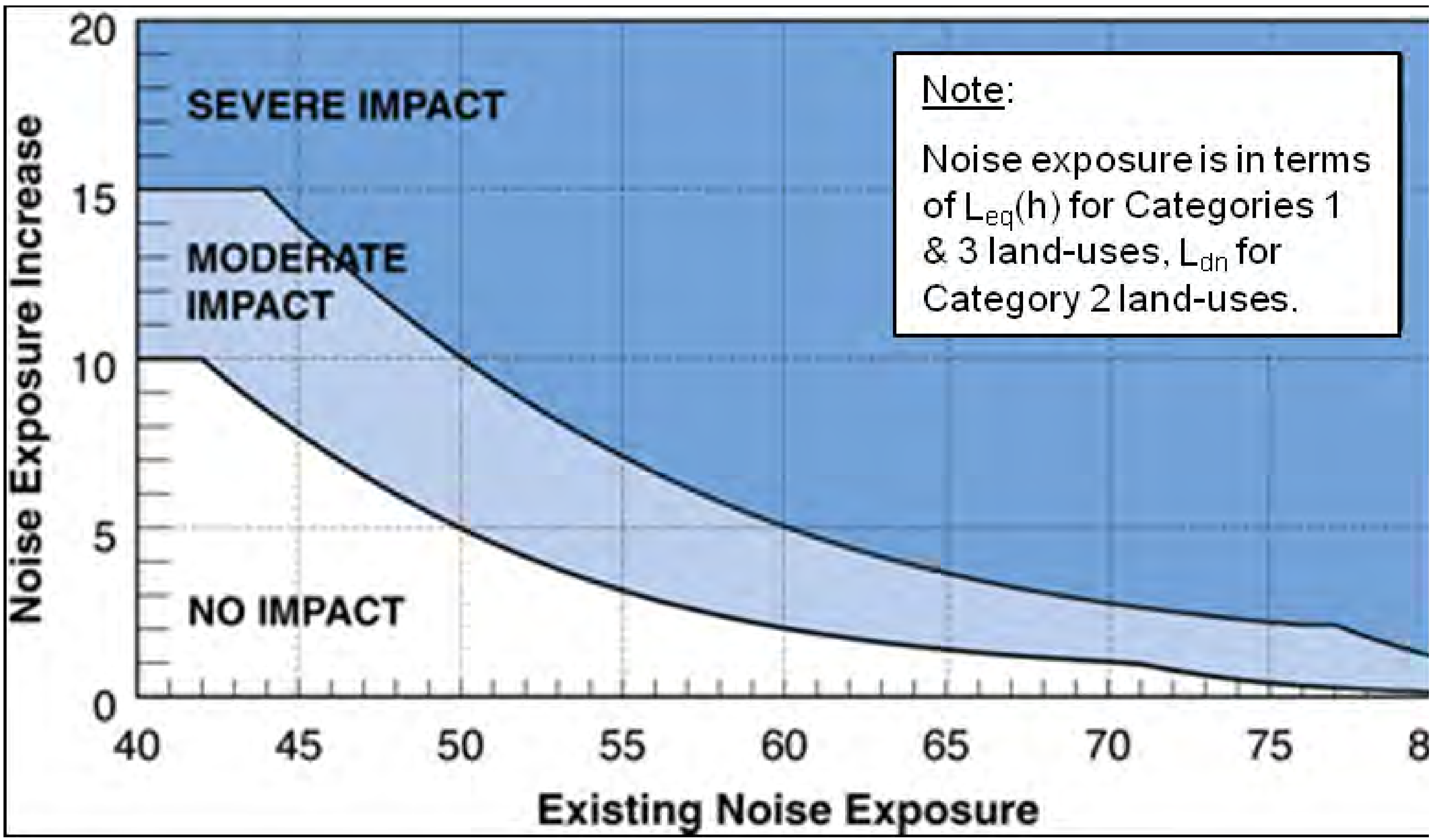
Land Use Category	Noise Metric	Description
1	$L_{eq(h)}$	Tracts of land set aside for serenity and quiet, such as outdoor amphitheaters, concert pavilions, and historic landmarks
2	L_{dn}	Buildings used for sleeping such as residences, hospitals, hotels, and other areas where nighttime sensitivity to noise is of utmost importance
3	$L_{eq(h)}$	Institutional land uses with primarily daytime and evening uses including schools, libraries, churches, museums, cemeteries, historic sites, and parks, and certain recreational facilities used for study or meditation
Source: FTA 2006		

As shown in **Figure 12-3**, the FTA noise impact criteria are defined by two curves that allow increasing project noise levels as existing noise increases up to a point, beyond which impact is determined based on project noise alone. For projects where changes are proposed to an existing transit system (such as the LIRR Expansion Project), FTA uses a cumulative form of the noise criteria shown in **Figure 12-4**.

The FTA noise impacts are delineated into two categories: *moderate* and *severe* impact (see **Figures 12-3 and 12-4**). The *moderate* impact threshold defines areas where the change in noise is noticeable, but may not be sufficient to cause a strong, adverse community reaction. The *severe* impact threshold defines the noise limits above which a substantial percentage of the population would be highly annoyed by new noise. The level of impact at any specific site can be established by comparing the predicted future Project Corridor noise level to the existing noise level at the site. The FTA noise impact criteria for all three FTA land-use categories are also shown on **Figures 12-3 and 12-4**.



FTA Project Noise Impact Criteria
Figure 12-3



FTA Increase in Cumulative Noise Levels Allowed by Criteria
Figure 12-4

As shown in **Table 12-1**, the average day-night noise level over a 24-hour period (or L_{dn}) is used to characterize noise exposure for residential areas (FTA Land-Use Category 2). The L_{dn} descriptor describes a receiver's cumulative noise exposure from all events over a full 24 hours, with events between 10:00 p.m. and 7:00 a.m. increased by 10 decibels to account for greater nighttime sensitivity to noise. For other noise sensitive land uses, such as schools and libraries (FTA Land-Use Category 3) and outdoor amphitheaters (FTA Land-Use Category 1), the average hourly equivalent noise level (or $L_{eq(h)}$) is used to represent the facility's peak operating period.

Along the existing Main Line rail corridor, the existing noise sources (e.g., LIRR and freight rail operations) change as a result of the project (i.e., LIRR operations are increased slightly and new track would be added in the Study Area), so project noise cannot be defined separately from existing noise. In this case, the existing noise can be determined and a new future noise with and without the project can be calculated in accordance with FTA guidance. Consequently, the baseline noise levels used for comparison along the Project Corridor were predicted using existing train schedules. Therefore, the computed Existing Condition was compared with the calculated future noise for the Proposed Project using the cumulative form of the noise criteria shown in **Figure 12-4**.

For disclosure purposes, the noise impacts due to the Future Without the Proposed Project were also quantified and compared to the Proposed Project to assess the relative effects of East Side Access in 2022.

OPERATIONAL VIBRATION CRITERIA

The FTA vibration criteria for evaluating ground-borne vibration impacts from train pass-bys at nearby sensitive receptors are shown in **Table 12-2**. These vibration criteria are related to ground-borne vibration levels that are expected to result in human annoyance, and are based on RMS velocity levels expressed in VdB referenced to 1 μips. The FTA's experience with community response to ground-borne vibration indicates that when there are only a few train events per day, it would take higher vibration levels to evoke the same community response that would be expected from more frequent events. This is taken into account in the FTA criteria by distinguishing between projects with *frequent*, *occasional*, and *infrequent* events, where the *frequent* events category is defined as more than 70 events per day. Similarly, the *occasional* events category is defined as between 30 and 70 events per day, while the *infrequent* events category is defined as less than 30 events per day. To be conservative, the FTA ^ *frequent* criteria were used to assess ground-borne vibration impacts along the Project Study Area.

The vibration criteria levels shown in **Table 12-2** are defined in terms of human annoyance for different land use categories such as high sensitivity (Category 1), residential (Category 2), and institutional (Category 3). In general, the vibration threshold of human perceptibility is approximately 65 VdB.

For at-grade (i.e., ground level) or above-grade (i.e., elevated) transit systems, the airborne noise is usually a more serious problem than the ground-borne vibration. As a result, ground-borne noise was only evaluated for buildings that have sensitive interior spaces (such as concert halls that are well insulated from exterior noise). In general, airborne noise masks ground-borne noise for above ground transit systems.

Table 12-2
Ground-Borne RMS Vibration and Noise Impact Criteria for Annoyance during Operations and Construction (VdB)

Receptor Land Use		RMS Vibration Levels (VdB)			A-Weighted Noise Levels (VdB)		
Category	Description	Frequent Events	Occasional Events	Infrequent Events	Frequent Events	Occasional Events	Infrequent Events
1	Buildings where low vibration is essential for interior operations	65	65	65	NA[1]	NA	NA
2	Residences and buildings where people normally sleep	72	75	80	35	38	43
3	Daytime institutional and office use	75	78	83	40	43	48
Specific Buildings	TV/Recording Studios/Concert Halls	65	65	65	25	25	25
	Auditoriums	72	80	80	30	38	38
	Theaters	72	80	80	35	43	43

SCREENING ASSESSMENT

The FTA default screening distances of 375 feet for intervening buildings and 750 feet without intervening buildings were utilized to identify noise-sensitive receptors along the proposed project alignments and commuter rail stations. Over 4,000 noise- and vibration-sensitive receptors (such as residences, schools and parks) were identified using this approach. Noise impacts were evaluated using the FTA's "Detailed Assessment" guidelines to more accurately reflect the type of input data available.

Operational vibration impacts were also predicted using the FTA's "Detailed Assessment" guidelines to reflect actual ground conditions along the Project Corridor. Actual ground-propagation measurements were utilized with other reasonable but worst-case assumptions to evaluate the potential for impacts.

BASELINE NOISE MONITORING

To determine the existing background noise levels at sensitive receptors near the proposed Project Corridor, a noise-monitoring program was conducted at 12 representative locations shown on **Figure 12-5**. Noise levels were measured from May 24 to June 7, 2016 during various periods of the day in accordance with FTA guidelines to determine the average ambient conditions on a typical weekday.

The noise measurements documented existing noise sources along the Project Corridor, including current LIRR rail operations, warning horn use, freight rail operations and local traffic effects. The 24-hour day-night noise level (or Ldn) is used to describe existing noise at residences and other FTA Category 2 land uses. Similarly, peak-hour equivalent noise levels (Leq) are reported for non-residential or institutional receptors, such as schools, libraries, churches and parks. All noise levels are reported in A-weighted decibels (or dBA) for comparison to the FTA criteria.

LIRR Expansion Project
Floral Park to Hicksville

Noise-Monitoring Sites along Project Corridor
Figure 12-5

NOISE MODELING ASSUMPTIONS

The various noise modeling assumptions, noise levels for each of the proposed noise sources (including train pass-bys, wheel squeal, etc.), and other operating characteristics (such as average duration times, source heights, etc.) are described below. These data are based on default FTA data, as well as operational information provided by the project team. The LIRR rail operations data are summarized in **Table 12-3** for various peak and off-peak periods of the day.

Table 12-3
Existing and Future LIRR Rail Operations (No. of Trains)

Segment	2016 Existing			2040 Build			2040 No Build		
	Day	Night	Peak Hrs.	Day	Night	Peak Hrs.	Day	Night	Peak Hrs.
Hicksville Station*	161	60	31	217	83	35	201	82	35
Mineola-Hicksville	157	58	31	201	78	35	185	77	35
Oyster Bay Line	28	9	5	29	9	4	29	9	4
Floral Park Wye to Mineola	185	67	36	230	87	39	214	86	39
Hempstead Branch**	50	20	6	44	14	6	44	14	6

Source: LIRR, October 2016
Day is defined as 7:00 AM to 10:00 PM; Night is defined as 10:00 PM to 7:00 AM
***** Includes Port Jefferson diesel trains that turn at Hicksville Station
****** Reduction in number of trains on the Hempstead Branch is entirely due to operating fewer non-revenue trains on the Branch. There is no reduction in revenue service to the Hempstead Branch.

This schedule is representative of a typical weekday, which includes an operating period between 4:00 PM and 2:00 AM the following day. The schedule was used to predict future noise levels under the Proposed Project. The detailed noise modeling assumptions that follow are described separately for each source:

LIRR ROLLING STOCK

- Noise impacts were evaluated from rail vehicles operating along the Project Corridor include self-propelled electric multiple unit (EMU) railcars, diesel locomotives and non-powered railcars.
- LIRR operations are summarized in **Table 12-3**. The future operations under the Proposed Project vary by segment of the corridor, due to the combination of different rail lines merging with the Project Corridor, revenue-service trains and “dead-head” or non-revenue service trains.
- LIRR EMU trains were modeled using an average 12-car consist during the peak-hour periods and 10-car consists during all other times. LIRR diesel-powered train consists include two locomotives and eight railcars for all time periods.
- Potential impacts due to EMU and diesel-pulled railcars were evaluated using the default FTA reference noise level of 80 dBA Lmax (or 82 dBA SEL) at 50 feet, a source height of 2 feet, and a reference speed of 50 miles per hour. The default FTA reference noise levels are well-established and represent a conservative estimate of future levels from the proposed railcar operations. [FTA Guidance, Table 6-3]
- Potential impacts due to diesel locomotives were evaluated using the default FTA reference noise level of 90 dBA Lmax (or 92 dBA SEL) at 50 feet, a source height of 8 feet, and a reference speed of 50 miles per hour. The default FTA reference noise levels are well-established and represent a conservative estimate of future levels from the proposed

locomotive operations [FTA Guidance, Table 6-3]. Diesel locomotives originate from the Oyster Bay Line and the Huntington Line (via Hicksville).

- Except at stations, maximum train operating speeds of 80 miles per hour were applied everywhere as a conservative modeling assumption. Upon approach and departing stations, however, train speeds decreased to a minimum speed of 35 miles per hour at the station midpoint.
- Both the railcar and locomotive reference noise levels were adjusted to account for speed, track switches, receptor distances and acoustically "soft" ground to reflect yards and lawns.

WARNING HORNS

- According to the Federal Railroad Administration's (FRA) horn rule, onboard warning horns must be sounded within one-quarter mile of all active grade crossings.
- As a result, potential impacts due to onboard warning horns were evaluated using the default FTA reference noise level of 110 dBA Lmax (or 113 dBA SEL) at 50 feet and a source height of 10 feet.
- Similarly, potential impacts due to onboard warning horns for EMU trains were evaluated using the default FTA reference noise level of 90 dBA L_{max} (or 93 dBA SEL) at 50 feet and a source height of 10 feet.
- Warning horn usage at grade crossings was applied for the Existing Condition only since all grade crossing in the Study Area would be eliminated (i.e., grade separated) as part of the Proposed Project.

CROSSING BELLS

- Similarly, noise from stationary crossing bells would also ring at the seven grade crossings located within the Study Area.
- Crossing bell usage was applied for the Existing Condition only since all grade crossing in the Study Area would be eliminated (i.e., grade separated) as part of the Proposed Project.
- As a result, potential impacts due to crossing bells under the Existing Condition were evaluated using the default FTA reference noise level of 73 dBA Lmax (or 109 dBA SEL) at 50 feet, a duration of 30 seconds per train event, and a source height of 10 feet.

LOCOMOTIVE IDLING AT STATIONS

- Idling noise from diesel locomotives that stop at the stations was also included in the analysis for analysis conditions.
- Potential impacts due to idling locomotives at passenger stations were evaluated using the default FTA reference noise level of 73 dBA Lmax (or 109 dBA SEL) at 50 feet and a source height of 10 feet.

INTERLOCKING AND TURNOUT SWITCHES

- Several track switches were identified along the Proposed Project alignment particularly at interlockings and crossover connections with the new third track and the new track sidings.
- Proposed turnout switches include both standard AREMA type and high-speed moveable point frogs (e.g., type No. 24).

- As a result, potential impacts due to track switches and other special track work were evaluated using the default FTA reference noise level of 90 dBA Lmax (or 100 dBA SEL) at 50 feet with a duration of 2 seconds per railcar.
- No additional impacts were evaluated for the high-speed movable point frogs since they do not include any gaps.

^ *FREIGHT OPERATIONS*

- Freight operations for the New York and Atlantic Railway (NY&A) include three round-trip trains through the Main Line corridor today. There are three daytime moves and three nighttime moves. The average train length includes 21 railcars and assumes one engine. For both scenarios in 2040 (build and no-build), the analysis conservatively estimates the addition of one round-trip train, one additional engine per train, and an increase in train length to 30 cars. Since freight utilizes the same tracks as the LIRR, the potential impacts with relocating freight operations closer to residences was also evaluated.
- Potential impacts due to diesel locomotives were evaluated using the default FTA reference noise level of 90 dBA Lmax (or 92 dBA SEL) at 50 feet, a source height of 8 feet, and a reference speed of 50 miles per hour.
- Potential impacts due to diesel-pulled railcars were evaluated using the default FTA reference noise level of 80 dBA Lmax (or 82 dBA SEL) at 50 feet, a source height of 2 feet, and a reference speed of 50 miles per hour.
- Maximum freight train operating speeds of 35 miles per hour were applied everywhere as a conservative modeling assumption.
- Freight train warning horn usage at grade crossings was also applied for the Existing Condition only since all grade crossing in the Study Area would be eliminated (i.e., grade separated) as part of the Proposed Project.

OTHER NOISE SOURCES NOT INCLUDED IN THE PROPOSED PROJECT

- Warning Horns at Stations: although express trains that do not stop at some stations could sound their horns, this is not considered standard LIRR practice. Therefore, warning horn usage for express trains at stations was not included in the modeling analysis for the Existing Condition. Under the Proposed Project, express trains would utilize the center tracks away from the side platforms.
- Wheel Squeal: For larger and heavier commuter vehicles, the FTA generally identifies wheel squeal to occur along curved track with radii of less than 1,000 feet or approximately 5° 43′ 0". However, all of the proposed rail curves along the Project Corridor are designed to fall within this limit. As a result, wheel squeal was not included in the analysis because no occurrences or impacts due to wheel squeal are expected anywhere under the Proposed Project.
- Parking: The addition of new parking facilities is not expected to significantly change ambient noise levels as the dominant noise source in the Study Area is from railroad operations.

VIBRATION MODELING ASSUMPTIONS

Projected ground-borne vibration levels from passenger and freight rail operations were predicted using the project-specific ground-surface vibration curves that were developed using the FTA's "Detailed Vibration Analysis" guidance. As shown in **Figure 12-6**, ground-borne vibration levels were developed. These curves represent average ground-borne vibration levels as a function of distance, normalized to a train speed of 50 mph, for locations with and without crossovers.

The results for locations without crossovers fall just below the FTA generalized ground surface vibration curve for locomotive powered trains. Similarly, for locations with crossovers, the results indicate vibration levels that are 5 VdB higher due to the wheel impacts at switches associated with track turnouts. With adjustments for train speed, the curves in **Figure 12-6** were used to predict ground-borne vibration from train operations in the Study Area.

As part of the Proposed Project, resilient fasteners, rail pads, and concrete ties are proposed for the new third track. The proposed rail connection system is expected to reduce vibration approximately 5 VdB compared to standard rail fastening systems. Additionally, the LIRR has proposed to accelerate its track tie replacement program for existing Tracks 1 and 2 to utilize the same vibration-reducing system as is proposed for Track 3. Therefore, the vibration benefits proposed as a result of using the resilient fasteners, rail pads, and concrete ties were applied everywhere along the Project Corridor as part of the modeling impact assessment.

No adjustments were applied for corrugated rail, wheel flats or other unmaintained rolling stock. It is assumed that the Proposed Project sponsor maintains a rigorous rail-grinding and wheel-trueing program to maximize track life and to minimize adverse vibration in the community. Finally, no adjustments were applied for different receptor building construction types (i.e., masonry versus timber).

The potential vibration impacts of the Proposed Project are related to the planned addition of a new track and to changes in operations along a heavily-used rail corridor where the existing train vibration levels already exceed the FTA vibration impact criteria at locations within several hundred feet of the tracks. Thus, in accordance with FTA guidance, new vibration impact is assessed only where the project results in an exceedance of the "frequent" threshold (e.g., 72 VdB for residences) and more than a 3 VdB increase in vibration level.

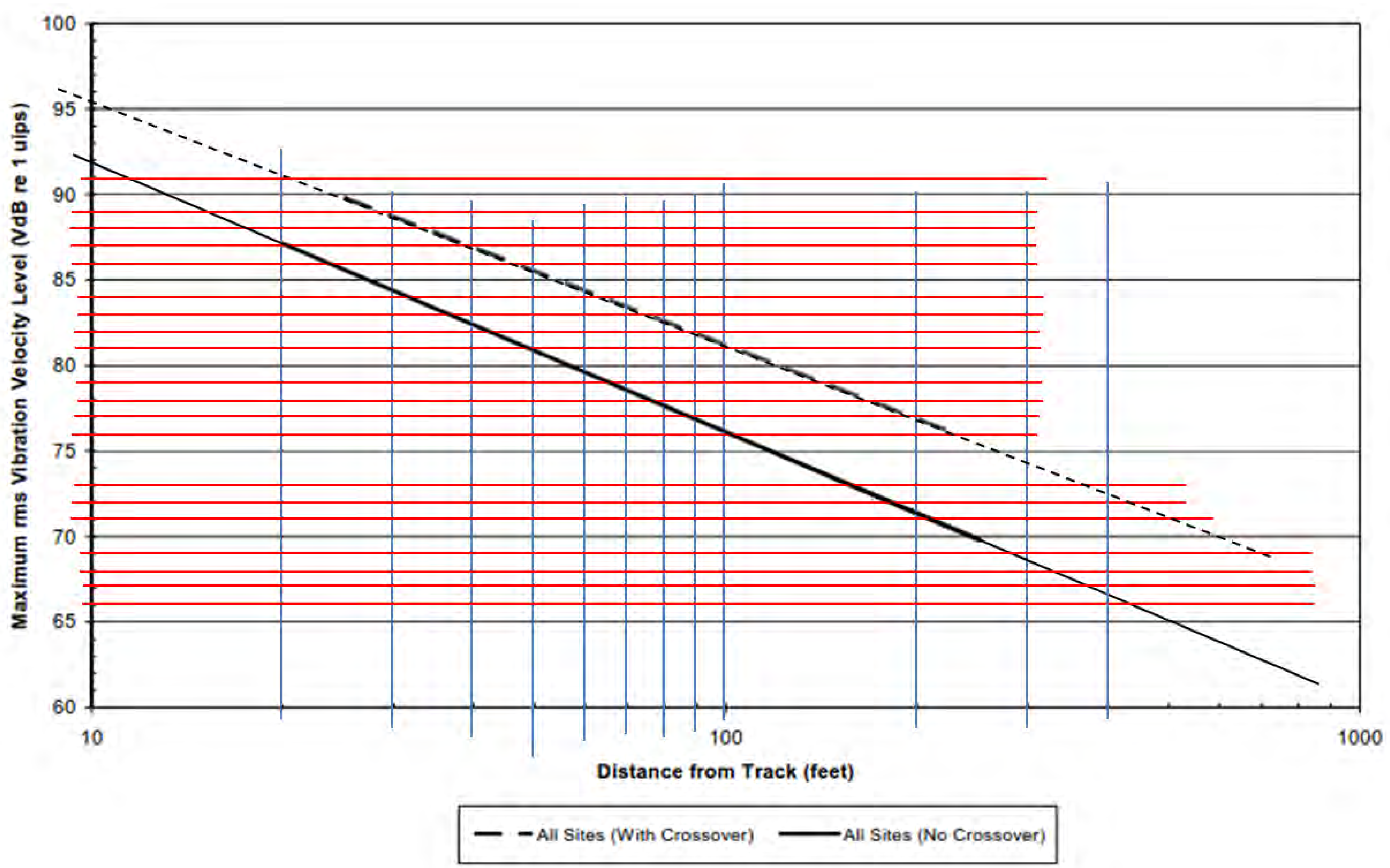
D. EXISTING CONDITIONS

A noise-monitoring program was conducted to document existing conditions at sensitive receptors in the project Study Area.

EXISTING MEASURED NOISE

As summarized below in **Table 12-4**, the measured day-night noise levels (average over 24 hours) in the Study Area range from 63 dBA at Receptor M12 (a residence along Holman Boulevard in Hicksville) to 80 dBA at Receptor M3 (a residence along 5th Avenue in New Hyde Park). In general, the lower noise levels are representative of land uses somewhat shielded from the rail corridor while the higher levels are reflective of residences immediately adjacent to the rail corridor.

Similarly, peak-hour noise levels (time-weighted over one hour) measured along the Project Corridor range from 62 dBA at Receptor M10 (a residence along Costar Street in New Cassel) to 75 dBA at Receptor M3 (a residence along 5th Avenue in New Hyde Park). These levels are reflective of the current noise exposures observed along the Project Corridor.



Measured LIRR Locomotive Ground-Surface Vibration Curves
Figure 12-6

Table 12-4
Baseline Noise Monitoring Results (dBA)

ID	Receptor Description	Community	FTA Land Use Category	Leq(1)	Ldn
M1	TPSS, Plainfield Av	Floral Park Village	2	68	72
M2	Res., 50 Charles St.	Floral Park	2	68	73
M3	Res., 515 5th Av	New Hyde Park	2	75	80
M4	Res., 92 Atlantic Av	New Hyde Park/Garden City	2	68	73
M5	Res., 377 De Mott St	Mineola	2	71	77
M6	Res., 66 Albertson Pl	Mineola	2	71	77
M7	Res., 115 Atlantic Av	Carle Place	2	67	72
M8	Res., 84 Earl St	Westbury Village	2	66	72
M9	TPSS, Union Av at Sullivan Ln	New Cassel	2	66	70
M10	Res., 205 Costar St	New Cassel	2	62	67
M11	TPSS, Broadway at Bond St	New Cassel	2	72	78
M12	Res., Holman Blvd at Keats Pl	Hicksville	2	66	63

Note: $L_{eq(1)}$ is the one-hour time-weighted average noise level representing a level of constant noise with the same acoustical energy as the fluctuating noise levels observed during a one hour interval.
L_{dn} is the average 24-hour Day-night Noise Level and includes a 10-decibel penalty for all nighttime activity between 10:00 p.m. and 7:00 a.m.
Source: AECOM, September 2016

The sound-level meters that were used to measure current noise conditions (Brüel & Kjær Model 2236 and Larson Davis Model 820) meet or exceed the American National Standards Institute (ANSI) standards for Type I accuracy and quality. The sound-level meters were calibrated using a Brüel & Kjær Model 4231 before and after each measurement. All measurements were conducted according to ANSI Standard S1.13-2005, *Measurement of Sound Pressure Levels in Air* [2010]. All noise levels are reported in dBA, which best approximates the sensitivity of human hearing.

EXISTING PREDICTED NOISE

A predictive noise and vibration model was developed based on the baseline noise monitoring results shown in Table 12-4 and the noise modeling assumptions described in Section C, "Methodology." The predicted noise and vibration levels are generally equivalent to what was measured in the field, thereby providing good calibration for the calculations of predicted noise and vibration levels in the Future Without the Proposed Project and the Future With the Proposed Project.

As summarized in **Table 12-5**^ , the predicted day-night noise levels along the Project Corridor range from ^ 74 dBA at Receptor ^ M1 (a residence along ^ Terrace Avenue near the LIRR substation in ^ Floral Park) to ^ 92 dBA at Receptor M3 (a residence along 5th Avenue in New Hyde Park). The predicted levels are generally equivalent to what was measured in the field. For example, current rail operations include warning horn use within one quarter mile of all grade crossings as mandated by the Federal Railroad Administration (FRA). The noise levels predicted for the Existing Condition were used as the basis of comparison for the future Proposed Project. In other words, the change in noise between the modeled Existing Condition and the future Proposed Project forms the basis for the FTA's impact assessment using the relative increase criteria specific to this project.

EXISTING PREDICTED VIBRATION

Existing vibration along the Project Corridor is currently affected by LIRR operations and freight rail activity along the same tracks. Based on field measurements, both existing and future rail operations may be predicted using corridor-specific ground-propagation curves shown in **Figure 12-6**. As summarized in **Table 12-6** of Section E, the predicted ground-borne vibration levels under the Existing Condition along the Project Corridor range from ^ 79 VdB at Receptor ^ M4 (a residence along ^ Atlantic Avenue in ^ New Hyde Park) to ^ 93 VdB at Receptor ^ M5 (a residence along ^ DeMott Street in ^ Mineola). The predictions represent maximum vibration levels from rail operations along the existing rail corridor. Similar to noise, these existing levels are used as a basis of the FTA impact assessment using the relative increase criteria by comparing the predicted or modeled vibration levels for the Existing Condition with those for the future Proposed Project.

Table 12-5
Predicted Noise Levels at Select Receptors under the Proposed Project (dBA)

Receptor				Noise Levels (dBA)[1]				FTA Criteria	
No.	**Description**	**Community**	**FTA Cat.**	**Existing**	**Future**	**Project**	**Existing Change**	**MOD**	**SEV**
1	^ Res., 14 Terrace Av near the LIRR substation	Floral Park Village	2	^ 74	^ 75	^ 71	-^ 3	0.^ 5	^ 2.3
2	Res., 50 Charles St.	Floral Park	2	78^	79^	^ 71	-^ 7	0.2	1.6
3	Res., 515 5th Av	New Hyde Park	2	^ 92	93^	^ 77	-^ 15	0.0	0.1
4	Res., 92 Atlantic Av	New Hyde Park/Garden City	2	74^	75^	74^	-0.1	0.5	2.^ 2
5	Res., 377 De Mott St	Mineola	2	86^	87^	86^	-0.2	0.0	0.3
6	Res., 66 Albertson Pl	Mineola	2	90^	91^	^ 81	-^ 9	0.0	0.1
7	Res., 115 Atlantic Av	Carle Place	2	74^	75^	^ 71	-^ 3	0.5	2.^ 3
8	Res., 84 Earl St	Westbury Village	2	77^	78^	^ 66	-^ 11	0.2	^ 2.0
9	^ LIRR substation, Union Av at Sullivan Ln	New Cassel	2	^ 91	^ 92	^ 76	-15^	0.0	0.^ 1
10	Res., 205 Costar St	New Cassel	2	76^	77^	^ 68	-^ 8	0.3	2.^ 1
11	^ LIRR substation, Broadway at Bond St	New Cassel	2	^ 88	^ 89	82^	-^ 6	0.^ 0	0.^ 2
12	Res., Holman Blvd at Keats Pl	Hicksville	2	^ 78	79^	^ 74	-^ 4	0.^ 2	^ 1.7

^ Source: AECOM, ^ March 2017.

E. FUTURE WITHOUT THE PROPOSED PROJECT

NOISE

The Project Study Area is characterized by a mix of both suburban residential and mixed-use retail-commercial land-uses whose noise exposure is currently dominated by rail operations along the Project Corridor. Overall, LIRR rail operations in the Future Without the Proposed Project are expected to increase approximately 19 percent in the Project Study Area between 2016 and 2040 to reflect the East Side Access service.

As shown in **Table 12-5**, maximum day-night project noise levels under the Future Without the Proposed Project ("Future" column head) are predicted to range from 75 dBA at Receptor Site ^ 1 (a residence along ^ Terrace Avenue near the LIRR substation in ^ Floral Park^), for example, to 93 dBA at Receptor Site 3 (a residence along 5th Avenue in New Hyde Park). Overall, corridor wide noise levels are expected to increase approximately 1 dBA on average, which reflects the 19 percent increase in operations attributed to the East Side Access Project. Although the noise levels for the Future Without the Proposed Project are reported for disclosure purposes only, these noise levels would be associated with an FTA *moderate* noise impact. Therefore, as predicted in the 2001 East Side Access EIS, noise impacts are expected at all residences immediately adjacent to the Project Corridor under the Future Without the Proposed Project Alternative. However, the FTA determined that "no feasible and prudent alternative to the adverse environmental effects" of the noise impacts existed and no mitigation was included in the 2001 FEIS (2001 ROD ESA Project, p. 11).

VIBRATION

Projected vibration levels under the Future Without the Proposed Project Alternative are expected to be similar to those currently experienced under existing conditions. Traffic, including heavy trucks and buses, rarely creates perceptible ground-borne vibration unless vehicles are operating very close to buildings or there are irregularities in the road, such as potholes or expansion joints. The pneumatic tires and suspension systems of automobiles, trucks, and buses eliminate most ground-borne vibration. Similarly, vibration levels from existing LIRR and freight train service along the Project Corridor is expected to be the dominant source of vibration in the area, which is not expected to change from the Existing Condition. As a result, there would be no vibration impacts associated with the Future Without the Proposed Project Alternative since no Project Corridor elements would be built.

F. POTENTIAL IMPACTS OF THE PROPOSED PROJECT

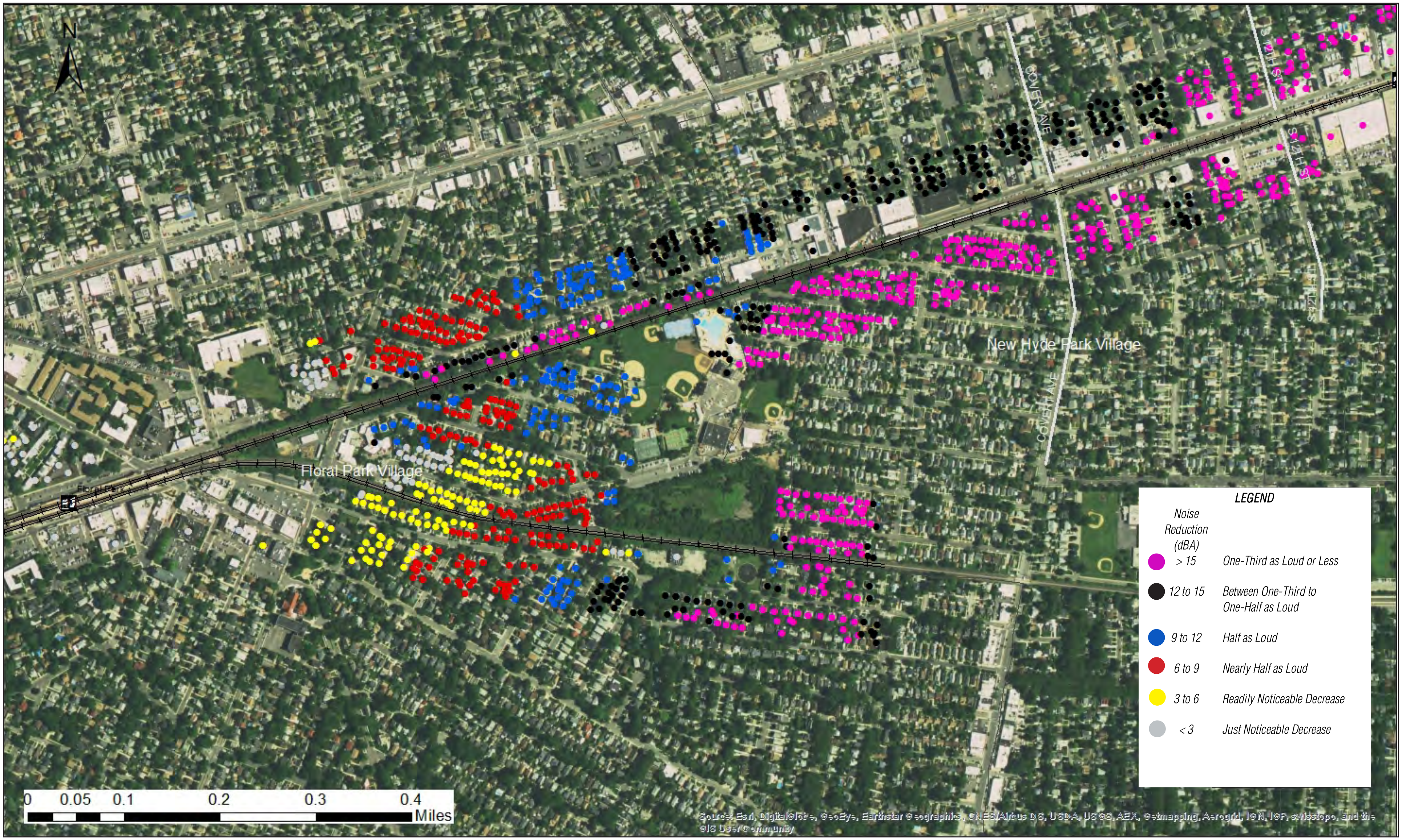
The results of the operational noise and vibration findings are described in the following subsections. Potential impacts to noise due to construction of the Proposed Project are assessed in Chapter 13, "Construction."

NOISE

To gauge the level of impact from the Proposed Project, noise levels are reported for the same discrete receptors where baseline noise measurements were collected. As shown in **Table 12-5**, maximum day-night project noise levels under the Proposed Project are predicted to range from ^ 66 dBA at Receptor Site ^ 8 (a residence along ^ Earl Street in ^ Westbury) to 86 dBA at Receptor Site 5 (a residence along De Mott Street in Mineola). In the Future Without the Proposed Project, noise levels are predicted to increase approximately 1 dBA above the Existing Condition. This is due to the increase of trains associated with East Side Access. However, with the Proposed Project, noise levels are predicted to decrease throughout the Project Corridor approximately 10 dBA from the Existing Condition^ (see **Figure 12-7**). This overall decrease in noise is due to several design features included as part of the Proposed Project. For example, grade separation at the street crossings would eliminate the need to sound warning horns thereby reducing operation train noise levels up to 15 dBA within a quarter mile of all existing crossings. Furthermore, high-speed specialized turnout switches^ that eliminate the impact noise caused by the gap or rail discontinuity are proposed in the vicinity of residences. Finally, retaining walls would be supplemented with sound attenuation walls in areas where residential neighborhoods are located immediately adjacent to the rail corridor.

Therefore, as a result of these noise-reduction design features, there are no corridor wide exceedances of the FTA *severe* impact criteria or *moderate* impact criteria predicted at any FTA Category 2 land uses under the Proposed Project. Similarly, there are also no exceedances predicted at any institutional receptors (or FTA Category 3 land uses). Finally, no exceedances

4.6.17

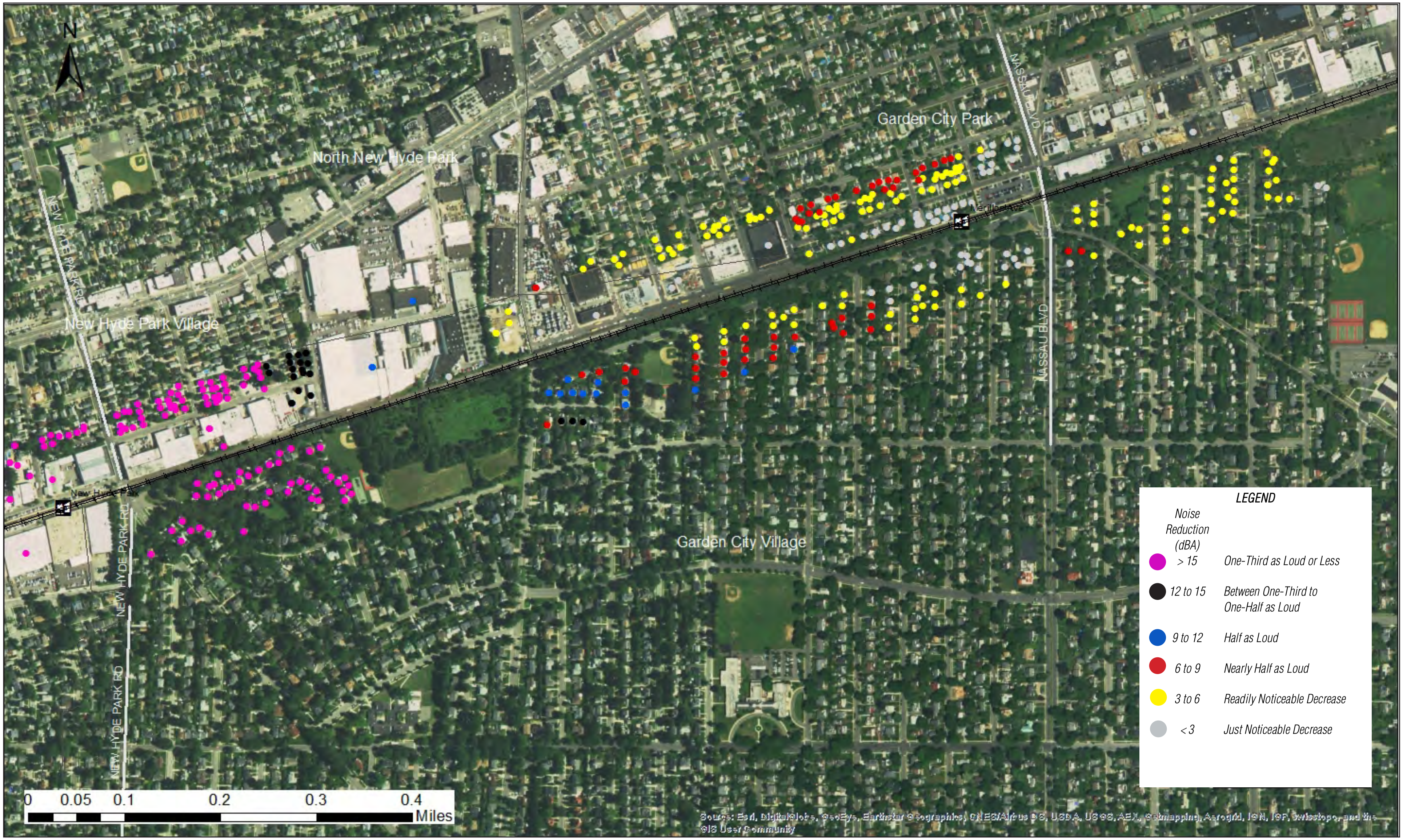


Source: AECOM

Noise Reduction, Operations (dBA):
Existing - Mitigated Build
Figure 12-7a

LIRR Expansion Project
Floral Park to Hicksville

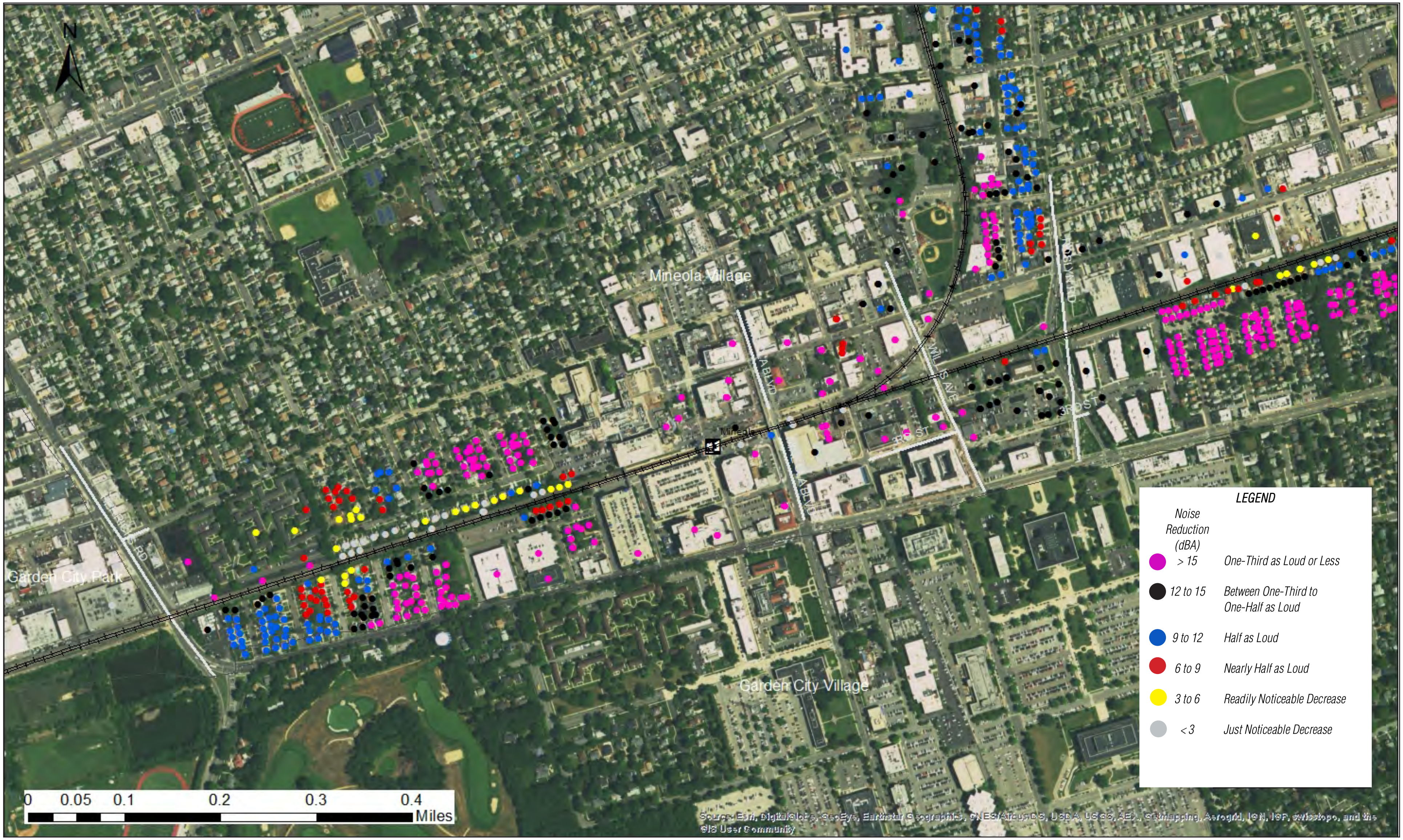
4.6.17



Source: *AECOM*

LIRR Expansion Project
Floral Park to Hicksville

Noise Reduction, Operations (dBA):
Existing - Mitigated Build
Figure 12-7b

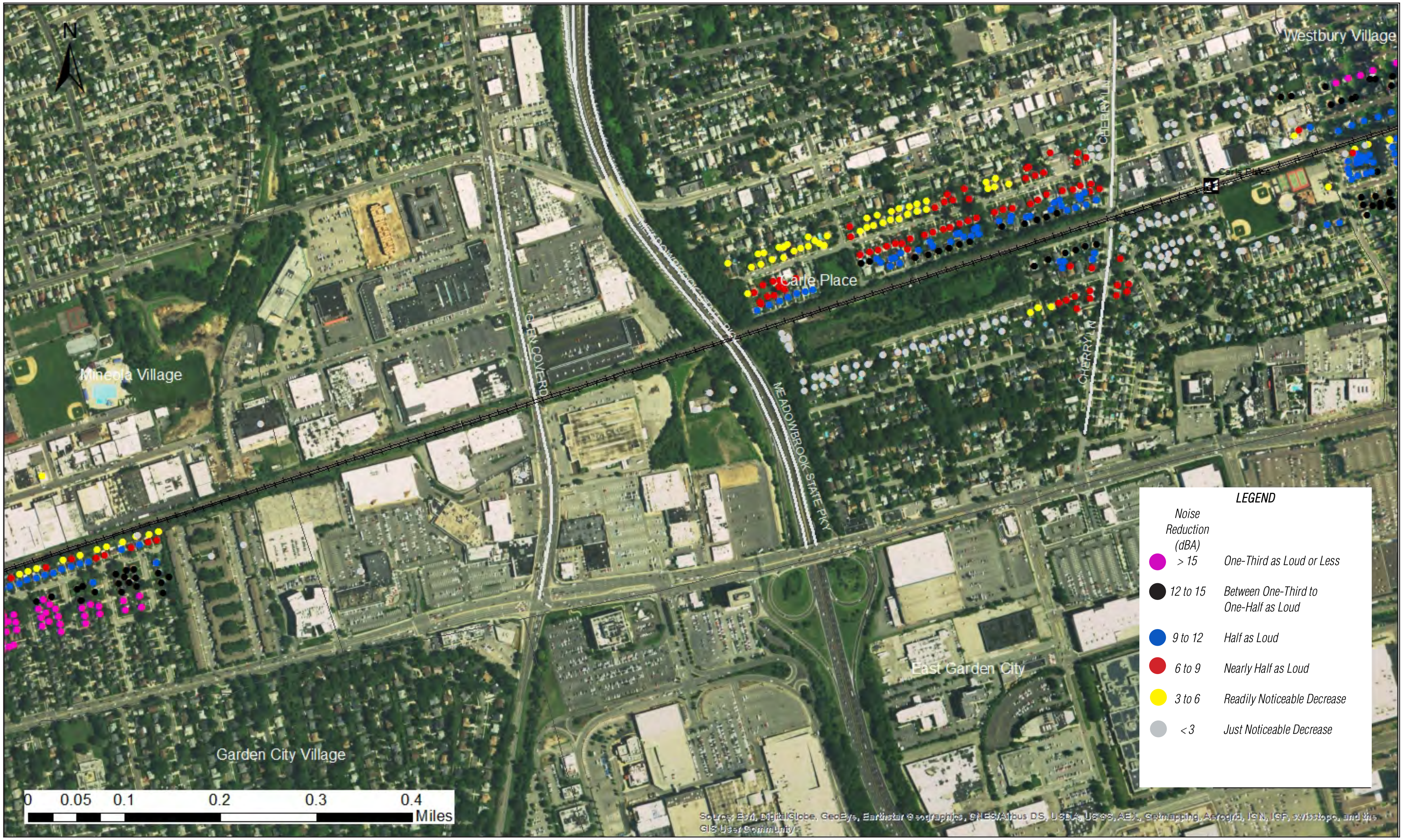


Source: *AECOM*

LIRR Expansion Project
Floral Park to Hicksville

Noise Reduction, Operations (dBA):
Existing - Mitigated Build
Figure 12-7c

4.6.17



Source: *AECOM*

Noise Reduction, Operations (dBA):
Existing - Mitigated Build
Figure 12-7d

LIRR Expansion Project
Floral Park to Hicksville

Source: *AECOM*

Noise Reduction, Operations (dBA):
Existing - Mitigated Build
Figure 12-7e

4.6.17

Source: *AECOM*

LIRR Expansion Project
Floral Park to Hicksville

Noise Reduction, Operations (dBA):
Existing - Mitigated Build
Figure 12-7f

Source: *AECOM*

Noise Reduction, Operations (dBA):
Existing - Mitigated Build
Figure 12-7g

of the FTA Category 1 land-uses (highly sensitive receptors) are predicted under the Proposed Project.

VIBRATION

To gauge the level of impact from the Proposed Project, ground-borne vibration levels are reported for the same discrete receptors utilized for the noise assessment. As shown in **Table 12-6**, project vibration levels with the Proposed Project are predicted to range from 74 VdB at Site 4 (a residence along Atlantic Avenue in New Hyde Park) to 89 VdB at Site 6 (a residence along Albertson Place in Mineola). The highest predicted vibration levels along the Project Corridor would occur at receptors immediately adjacent to the rail corridor especially closest to the proposed third track.

Table 12-6
Predicted Vibration Levels at Select Receptors under the Existing Condition and the Proposed Project (VdB)

Receptor				Vibration Levels (VdB)[1]			
No.	Description	Community	FTA Cat.	Existing[2]	Project	^ Change[4]	FTA Criteria[3]
1	TPSS, Plainfield Av	Floral Park Village	2	85	78	-7	72 & 3
2	Res., 50 Charles St.	Floral Park	2	85	80	-5	72 & 3
3	Res., 515 5th Av	New Hyde Park	2	83	79	-4	72 & 3
4	Res., 92 Atlantic Av	New Hyde Park/Garden City	2	79	74	-5	72 & 3
5	Res., 377 De Mott St	Mineola	2	93	88	-5	72 & 3
6	Res., 66 Albertson Pl	Mineola	2	89	89	0	72 & 3
7	Res., 115 Atlantic Av	Carle Place	2	81	77	-4	72 & 3
8	Res., 84 Earl St	Westbury Village	2	84	80	-4	72 & 3
9	TPSS, Union Av at Sullivan Ln	New Cassel	2	83	76	-7	72 & 3
10	Res., 205 Costar St	New Cassel	2	80	^ 77	-^ 3	72 & 3
11	TPSS, Broadway at Bond St	New Cassel	2	^ 87	84	-^ 3	72 & 3
12	Res., Holman Blvd at Keats Pl	Hicksville	2	86	82	-4	72 & 3

Notes
1. The FTA vibration impact criteria used to assess impact reflect the "frequent" event activity level (i.e., 70 or more events per day).
2. The vibration levels are the same for both the Existing Condition and the Future Without the Proposed Project.
3. For conditions with baseline levels above 72 VdB, the FTA impact criteria is an increase of 3 VdB.
4. The change from Existing to Project values reflects implementation of an on-going tie-replacement program on Main Line 1 and Main Line 2 that is being accelerated as part of the Proposed Project to take advantage of track-outages planned as part of the construction of the Proposed Project.

Source: AECOM, October 2016

Overall, vibration levels are expected to decrease approximately 6 VdB due to design features proposed as part of the Proposed Project. For example, design features proposed to reduce vibration along the Project Corridor include high-speed turnout switches ^ that eliminate the rail gap compared to standard AREMA type switches. Other vibration-reducing design features include resilient fasteners^ , rail pads, and new concrete ties. High-speed turnout switches could include moveable point frogs or other devices that eliminate the impact caused by the gap or rail discontinuity. Additionally, resilient fasteners combined with rail pads (which decouple the vibration source from the track support structure) are proposed ^ throughout the^ Project ^ Corridor.

Therefore, as a result of these vibration-reducing design features, vibration levels are predicted to decrease everywhere compared to Existing Condition and no corridor-wide exceedances of the FTA *frequent* impact criteria are predicted at any FTA Category 2 land uses under the

Proposed Project. There are also no exceedances predicted at any institutional receptors (or FTA Category 3 land uses). Finally, no exceedances of the FTA Category 1 land-uses (highly sensitive receptors) are predicted under the Proposed Project.

NOISE AND VIBRATION REDUCING FEATURES OF THE PROPOSED PROJECT

Since several design features are proposed as part of the Proposed Project to eliminate noise and vibration impacts at residential communities, no impacts are predicted. As a result of the following noise and vibration-reducing design features, no mitigation is required.

NOISE

- Warning Horn Elimination – grade separation at the street crossings would eliminate the need to sound warning horns thereby reducing operation train noise levels up to 15 dBA within a quarter mile of all existing crossings. Warning horns would be eliminated at the following grade crossings:
  - Covert Avenue, South 12th Street and New Hyde Park Road in New Hyde Park
  - Main and Willis Streets in Mineola
  - School Street and Willis Avenue in New Cassel
- High-speed turnout switches – ^ switches and frogs that eliminate the impact noise caused by the gap or rail discontinuity are proposed as part of the Proposed Project design.
- Sound Attenuation Walls – retaining walls would be supplemented with sound attenuation walls in areas where residential neighborhoods are located immediately adjacent to the rail corridor. The locations and dimensions of the sound attenuation walls are summarized in **Table 12-7**.

Further,^ sound attenuation measures would be implemented at the Dryden Street School near School Street in Westbury.

With the incorporation of these design measures, no noise impacts are predicted under the Proposed Project.

VIBRATION

Since operational vibration impacts currently exceed the FTA impact thresholds for both the Existing Condition and the Future Without the Proposed Project, several vibration control measures are proposed for inclusion in the proposed track design as part of the Proposed Project. To minimize vibration along the Project Corridor and to reduce vibrations below Existing Condition levels as well as FTA guidelines, the following vibration control measures may be included in the track design for the Proposed Project:

- ^ Resilient rail fasteners and rail pads – resilient fasteners and rail pads placed between the rail and the new concrete ties are proposed to attenuate vibration levels 5 VdB from train pass-bys by decoupling the rail source from the underlying track structure.
- High-speed turnouts with^ frogs that reduce vibration caused by the gap or rail discontinuity are proposed as part of the Proposed Project design throughout the Project Corridor.

^ Vibration control measures that "decouple" the track from the ground are recommended for inclusion in the proposed track design.

Table 12-7
Sound Attenuation Walls Included in the Proposed Project

Municipality	Track Side	Location (approximate)	Length	With Retaining Wall
Floral Park / New Hyde Park	South	Plainfield Ave^ to ^ Covert Ave	4,^ 060 ft	Yes
Floral Park / New Hyde Park	South	Covert Ave to South 9th St	530 ft	Yes
Floral Park / New Hyde Park	North	Plainfield Ave^ to Lewis Ave^	2,^ 305 ft	No
Garden City	South	^ New Hyde Park Rd^ to Hudson Rd	1,^ 375 ft	Yes
Garden City	South	Tanners Pond Rd to Meadbrook Rd	1,845 ft	No
Garden City / Garden City Park	South	^ Nassau Blvd to Brompton Rd	^ 1,360 ft	No
Garden City^	North	5th Ave^ to Merillon Ave Station / Corbin Ave^	1,^ 020 ft	No
Mineola	South	Herricks Rd^ to 5th Ave^	2,^ 420 ft	^ Yes from 264+50 – 278+00
Mineola	North	Herricks Rd^ to Fleet Pl^	2,^ 230 ft	No
Mineola	South	^ Geranium Ave^ to ^ Laurel Dr	^ 2,300 ft	Yes
Carle Place	North	Meadowbrook State ^ Pkwy to Cherry Ln^	2,^ 145 ft	Yes
Carle Place	South	^ Hollie Pl to ^ Cherry Ln	^ 530 ft	No
Carle Place / Westbury	South	^ Carle Rd to Ellison Ave^	^ 1,940 ft	^ Yes from 405+50 – 412+00
Carle Place / Westbury	North	Carle Rd to Ellison Ave^	^ 1,925 ft	^ Yes
Westbury	North	^ Tremont St to Post Ave^	2,100 ft	No
Westbury	South	^ Manor Ave^ to Post Ave^	^ 2,040 ft	^ Yes from 429+50 – 439+50
New Cassel	South	Grant St to Hicks St	600 ft	Yes
New Cassel	North	Grand Blvd to Garden St	2,175 ft	Yes
New Cassel	North	^ Urban Ave to just west of Wantagh ^ State Pkwy (Catherine St)	^ 2,380 ft	Yes

Note: The sound attenuation walls were evaluated at a height of 4 feet above top-of-rail. Sound attenuation walls on retaining walls in fill sections will ^ be 4 feet above top of rail. Stand-alone sound attenuation walls will ^ be ^ 8 feet high.
Source: AECOM, Gannett Fleming and MTA, ^ March 2017

^ With the incorporation of these design measures, no significant adverse vibration impacts are predicted as a result of the Proposed Project.

G. REFERENCES

ANSI American National Standard S12.9-1992/Part 2. Quantities and Procedures for Description and Measurement of Environmental Sound. Part 2: Measurement of Long-term, Wide-Area Sound. Standards Secretariat, Acoustical Society of America, New York, NY.

ANSI American National Standard S12.9-1993/Part 3. Quantities and Procedures for Description and Measurement of Environmental Sound. Part 3: Short-Term Measurements with an Observer Present. Standards Secretariat, Acoustical Society of America, New York, NY.

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