A. INTRODUCTION

The project site is located on Roosevelt Island in the East River, which has relatively low noise levels due to its limited roadway network and distance from Manhattan and Queens. While the Ed Koch Queensboro Bridge and aircraft traffic overhead contribute to noise levels, it is a moderately quiet area, with predominantly residential and open space land uses.

The noise analysis presented in this chapter focuses on the traffic-generated changes in noise that would result from the operation of the proposed Cornell NYC Tech project once construction is complete, the levels of window/wall attenuation that would be necessary at project buildings to achieve acceptable interior noise levels, the acceptability of ambient noise levels in the publicly accessible open spaces on the project site, and noise generated by the project buildings (e.g., mechanical). Noise effects during construction of the proposed project are analyzed and discussed separately in Chapter 20, "Construction."

As detailed in this chapter, traffic generated by the proposed project would not be expected to result in significant increases in noise levels. To meet *City Environmental Quality Review (CEQR) Technical Manual* (June 2012) interior noise level requirements, the analysis recommends up to 28 A-weighted decibels (dBA) of building attenuation for some project buildings. Noise levels in the newly created open spaces would be greater than the 55 dBA $L_{10(1)}$ level described in the *CEQR Technical Manual*, but would be comparable to other parks in New York City. Mechanical equipment associated with project buildings would be designed to meet all applicable noise regulations, and would therefore not have the potential to create a significant noise impact.

B. ACOUSTICAL FUNDAMENTALS

Sound is a fluctuation in air pressure. Sound pressure levels are measured in units called "decibels" ("dB"). The particular character of the sound that we hear (a whistle compared with a French horn, for example) is determined by the speed, or "frequency," at which the air pressure fluctuates, or "oscillates." Frequency defines the oscillation of sound pressure in terms of cycles per second. One cycle per second is known as 1 Hertz ("Hz"). People can hear over a relatively limited range of sound frequencies, generally between 20 Hz and 20,000 Hz, and the human ear does not perceive all frequencies equally well. High frequencies (e.g., a whistle) are more easily discernable and therefore more intrusive than many of the lower frequencies (e.g., the lower notes on the French horn).

"A"-WEIGHTED SOUND LEVEL (DBA)

In order to establish a uniform noise measurement that simulates people's perception of loudness and annoyance, the decibel measurement is weighted to account for those frequencies most audible to the human ear. This is known as the A-weighted sound level, or "dBA," and it is the descriptor of noise levels most often used for community noise. As shown in **Table 17-1**, the threshold of human hearing is defined as 0 dBA; very quiet conditions (as in a library, for example) are approximately 40 dBA; levels between 50 dBA and 70 dBA define the range of noise levels generated by normal daily activity; levels above 70 dBA would be considered noisy, and then loud, intrusive, and deafening as the scale approaches 130 dBA.

Table 17-1
Common Noise Levels

Sound Source	(dBA)
Military jet, air raid siren	130
Amplified rock music	110
Jet takeoff at 500 meters	100
Freight train at 30 meters	95
Train horn at 30 meters	90
Heavy truck at 15 meters	80–90
Busy city street, loud shout	80
Busy traffic intersection	70–80
Highway traffic at 15 meters, train	70
Predominantly industrial area	60
Light car traffic at 15 meters, city or commercial areas, or residential areas close to industry	50–60
Background noise in an office	50
Suburban areas with medium-density transportation	40–50
Public library	40
Soft whisper at 5 meters	30
Threshold of hearing	0

Note: A 10 dBA increase in level appears to double the loudness, and a 10 dBA decrease halves the apparent loudness.
Sources: Cowan, James P. *Handbook of Environmental Acoustics,* Van Nostrand Reinhold, New York, 1994. Egan, M. David, Architectural Acoustics. McGraw-Hill Book Company, 1988.

COMMUNITY RESPONSE TO CHANGES IN NOISE LEVELS

The average ability of an individual to perceive changes in noise levels is well documented (see **Table 17-2**). Generally, changes in noise levels less than 3 dBA are barely perceptible to most listeners, whereas 10 dBA changes are normally perceived as doublings (or halvings) of noise levels. These guidelines permit direct estimation of an individual's probable perception of changes in noise levels.

Table 17-2
Average Ability to Perceive Changes in Noise Levels

Change (dBA)	Human Perception of Sound
2-3	Barely perceptible
5	Readily noticeable
10	A doubling or halving of the loudness of sound
20	A dramatic change
40	Difference between a faintly audible sound and a very loud sound

Source: Bolt Beranek and Newman, Inc., *Fundamentals and Abatement of Highway Traffic Noise*, Report No. PB-222-703. Prepared for Federal Highway Administration, June 1973.

SOUND LEVEL DESCRIPTORS

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 extended periods have been developed. One way of describing fluctuating sound is to describe the fluctuating noise heard over a specific time period 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 time 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. Statistical sound level descriptors such as L_1, L_{10}, L_{50}, L_{90}, and L_x , are used to indicate noise levels that are exceeded 1, 10, 50, 90 and x percent of the time, respectively.

The relationship between L_{eq} and levels of exceedance is worth noting. Because L_{eq} is defined in energy rather than straight numerical terms, it is not simply related to the levels of exceedance. If the noise fluctuates very little, L_{eq} will approximate L_{50} or the median level. If the noise fluctuates broadly, the L_{eq} will be approximately equal to the L_{10} value. If extreme fluctuations are present, the L_{eq} will exceed L_{90} or the background level by 10 or more decibels. Thus the relationship between L_{eq} and the levels of exceedance will depend on the character of the noise. In community noise measurements, it has been observed that the L_{eq} is generally between L_{10} and L_{50}.

For the analysis presented in this chapter, the maximum 1-hour equivalent sound level ($L_{eq(1)}$) has been selected as the noise descriptor to be used in the noise impact evaluation. $L_{eq(1)}$ is the noise descriptor recommended by the *CEQR Technical Manual* for vehicular traffic noise impact evaluation, and is used to provide an indication of highest expected sound levels. $L_{10(1)}$ is the noise descriptor used in the CEQR noise exposure standards for vehicular traffic noise. Hourly statistical noise levels (particularly L_{10} and L_{eq} levels) were used to characterize the relevant noise sources and their relative importance at each receptor location.

C. NOISE STANDARDS AND CRITERIA

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION

The New York City Department of Environmental Protection (NYCDEP) has set external noise exposure standards; these standards are shown in **Table 17-3**. Noise exposure is classified into four categories: acceptable, marginally acceptable, marginally unacceptable, and clearly unacceptable.

NEW YORK CEQR NOISE CRITERIA

The *CEQR Technical Manual* defines attenuation requirements for buildings based on exterior noise level (see **Table 17-4**, "Required Attenuation Values to Achieve Acceptable Interior Noise Levels"). Recommended noise attenuation values for buildings are designed to maintain interior noise levels of 45 dBA or lower for residential, hotel, and academic uses and 50 dBA or lower for commercial uses. These attenuation values are determined based on exterior $L_{10(1)}$ noise levels.

Table 17-3
Noise Exposure Guidelines
For Use in City Environmental Impact Review[1]

Receptor Type	Time Period	Acceptable General External Exposure	Airport[3] Exposure	Marginally Acceptable General External Exposure	Airport[3] Exposure	Marginally Unacceptable General External Exposure	Airport[3] Exposure	Clearly Unacceptable General External Exposure	Airport[3] Exposure
1. Outdoor area requiring serenity and quiet[2]		$L_{10} \leq 55$ dBA	---------- $Ldn \leq 60$ dBA ----------						
2. Hospital, Nursing Home		$L_{10} \leq 55$ dBA		$55 < L_{10} \leq 65$ dBA	---------- $60 < Ldn \leq 65$ dBA ----------	$65 < L_{10} \leq 80$ dBA	(I) $65 < Ldn \leq 70$ dBA, (II) $70 \leq Ldn$	$L_{10} > 80$ dBA	---------- $Ldn \leq 75$ dBA ----------
3. Residence, residential hotel or motel	7 AM to 10 PM	$L_{10} \leq 65$ dBA		$65 < L_{10} \leq 70$ dBA		$70 < L_{10} \leq 80$ dBA		$L_{10} > 80$ dBA	
	10 PM to 7 AM	$L_{10} \leq 55$ dBA		$55 < L_{10} \leq 70$ dBA		$70 < L_{10} \leq 80$ dBA		$L_{10} > 80$ dBA	
4. School, museum, library, court, house of worship, transient hotel or motel, public meeting room, auditorium, out-patient public health facility		Same as Residential Day (7 AM-10 PM)		Same as Residential Day (7 AM-10 PM)		Same as Residential Day (7 AM-10 PM)		Same as Residential Day (7 AM-10 PM)	
5. Commercial or office		Same as Residential Day (7 AM-10 PM)		Same as Residential Day (7 AM-10 PM)		Same as Residential Day (7 AM-10 PM)		Same as Residential Day (7 AM-10 PM)	
6. Industrial, public areas only[4]	Note 4	Note 4		Note 4		Note 4		Note 4	

Notes:

(i) In addition, any new activity shall not increase the ambient noise level by 3 dBA or more;

[1] Measurements and projections of noise exposures are to be made at appropriate heights above site boundaries as given by American National Standards Institute (ANSI) Standards; all values are for the worst hour in the time period.

[2] Tracts of land where serenity and quiet are extraordinarily important and serve an important public need and where the preservation of these qualities is essential for the area to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks or open spaces dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet. Examples are grounds for ambulatory hospital patients and patients and residents of sanitariums and old-age homes.

[3] One may use the FAA-approved L_{dn} contours supplied by the Port Authority, or the noise contours may be computed from the federally approved INM Computer Model using flight data supplied by the Port Authority of New York and New Jersey.

[4] External Noise Exposure standards for industrial areas of sounds produced by industrial operations other than operating motor vehicles or other transportation facilities are spelled out in the New York City Zoning Resolution, Sections 42-20 and 42-21. The referenced standards apply to M1, M2, and M3 manufacturing districts and to adjoining residence districts (performance standards are octave band standards).

Source: New York City Department of Environmental Protection (adopted policy 1983).

Table 17-4
Required Attenuation Values to Achieve Acceptable Interior Noise Levels

	Marginally Unacceptable				Clearly Unacceptable
Noise Level With Proposed Project	$70 < L_{10} \leq 73$	$73 < L_{10} \leq 76$	$76 < L_{10} \leq 78$	$78 < L_{10} \leq 80$	$80 < L_{10}$
Attenuation[A]	(I) 28 dB(A)	(II) 31 dB(A)	(III) 33 dB(A)	(IV) 35 dB(A)	$36 + (L_{10} - 80)^{B}$ dB(A)

Note:

[A] The above composite window-wall attenuation values are for residential, hotel, and academic uses. Commercial office spaces and meeting rooms would be 5 dB(A) less in each category. All the above categories require a closed window situation and hence an alternate means of ventilation.

[B] Required attenuation values increase by 1 dB(A) increments for L_{10} values greater than 80 dBA.

Source: New York City Department of Environmental Protection

IMPACT DEFINITION

As recommended in the *CEQR Technical Manual*, this study uses the following criteria to define a significant adverse noise impact:

- Whether the project would result in an increase of 5 dBA or more in With Action $L_{eq(1)}$ noise levels at sensitive receptors (including residences, play areas, parks, schools, libraries, and houses of worship) over those calculated for the No-Action condition, if the No-Action levels are less than 60 dBA $L_{eq(1)}$ and the analysis period is not a nighttime period.
- Whether the project would result in an increase of 4 dBA or more in With Action $L_{eq(1)}$ noise levels at sensitive receptors over those calculated for the No-Action condition, if the No-Action levels are 61 dBA $L_{eq(1)}$ and the analysis period is not a nighttime period.
- Whether the project would result in an increase of 3 dBA or more in With Action $L_{eq(1)}$ noise levels at sensitive receptors over those calculated for the No-Action condition, if the No-Action levels are greater than 62 dBA $L_{eq(1)}$ and the analysis period is not a nighttime period.
- Whether the project would result in an increase of 3 dBA or more in With Action $L_{eq(1)}$ noise levels at sensitive receptors over those calculated for the No-Action condition, if the analysis period is a nighttime period (defined by the *CEQR Technical Manual* criteria as being between 10 PM and 7 AM).

D. NOISE PREDICTION METHODOLOGY

STUDY AREA

The study area for the noise analysis includes the project site and its immediately surrounding areas on the southern portion of Roosevelt Island. The study area also includes locations along roadways leading to and from the project site. Specifically, the mobile source screening analysis includes all of the intersections analyzed in the traffic studies presented in Chapter 14, "Transportation," both on the Island and in Queens, while the more detailed mobile source noise analysis focused on roadways on the Island closer to the project site that would have more potential to be affected by project generated traffic. Locations on Roosevelt Island north of the Roosevelt Island Bridge were not included in the study area because all vehicular traffic traveling to and from the project site would enter and leave the Island via that bridge and travel only on Main Street and West Road between the project site and the bridge. The building attenuation analysis focuses on the project site itself.

BASELINE NOISE MONITORING (EXISTING CONDITIONS)

SELECTION OF NOISE RECEPTOR LOCATIONS

Noise monitoring locations (i.e., receptor sites) were selected to obtain baseline noise measurements, as follows:

- Locations of noise-sensitive land uses (e.g., residences, churches, schools) on the anticipated traffic routes that project-generated traffic would use to travel to and from the project site.
- Locations adjacent to and on the project site to determine the appropriate level of building attenuation required to satisfy CEQR interior noise level criteria and to compare noise levels at the proposed project's newly created open spaces with CEQR guidelines.

A total of eight receptor sites were selected (see **Figure 17-1**). **Table 17-5** lists the location of each noise receptor site, the existing and proposed land use at that receptor site, and the analysis or analyses with which each site is associated.

Table 17-5
Noise Receptor Locations

Receptor	Location	Associated Land Use	Purpose
1	North Loop Road between East and West Loop Roads (elevated, 3rd story rooftop)	Future Academic Future Residential	Building Attenuation Analysis
2	East Loop Road between North Loop Road and South Loop Road (waterfront promenade)	Open Space / Future Academic / Future Residential	Building Attenuation Analysis Impact Assessment Future Open Space Analysis
3	South Loop Road between East and West Loop Roads	Open Space / Future Academic / Future Residential	Building Attenuation Analysis Impact Assessment
4	North Loop Road between East and West Loop Roads	Future Academic / Future Residential	Building Attenuation Analysis
5	West Road north of Tramway Plaza	Residential	Impact Assessment
6	West Road north of Subway Station	Residential	Impact Assessment
7	Main Street north of Tramway Plaza	Residential	Impact Assessment
8	Main Street south of Roosevelt Island Bridge	Residential / School	Impact Assessment

The receptor sites include representative noise-sensitive locations, principally locations with residential, open space, and institutional land uses, and locations where maximum project impacts would be expected. At other locations, particularly locations outside the study area, project-generated traffic would be less and/or would constitute a small portion of the existing and/or No-Action traffic volumes, and consequently would not have the potential to result in a significant increase in noise levels.

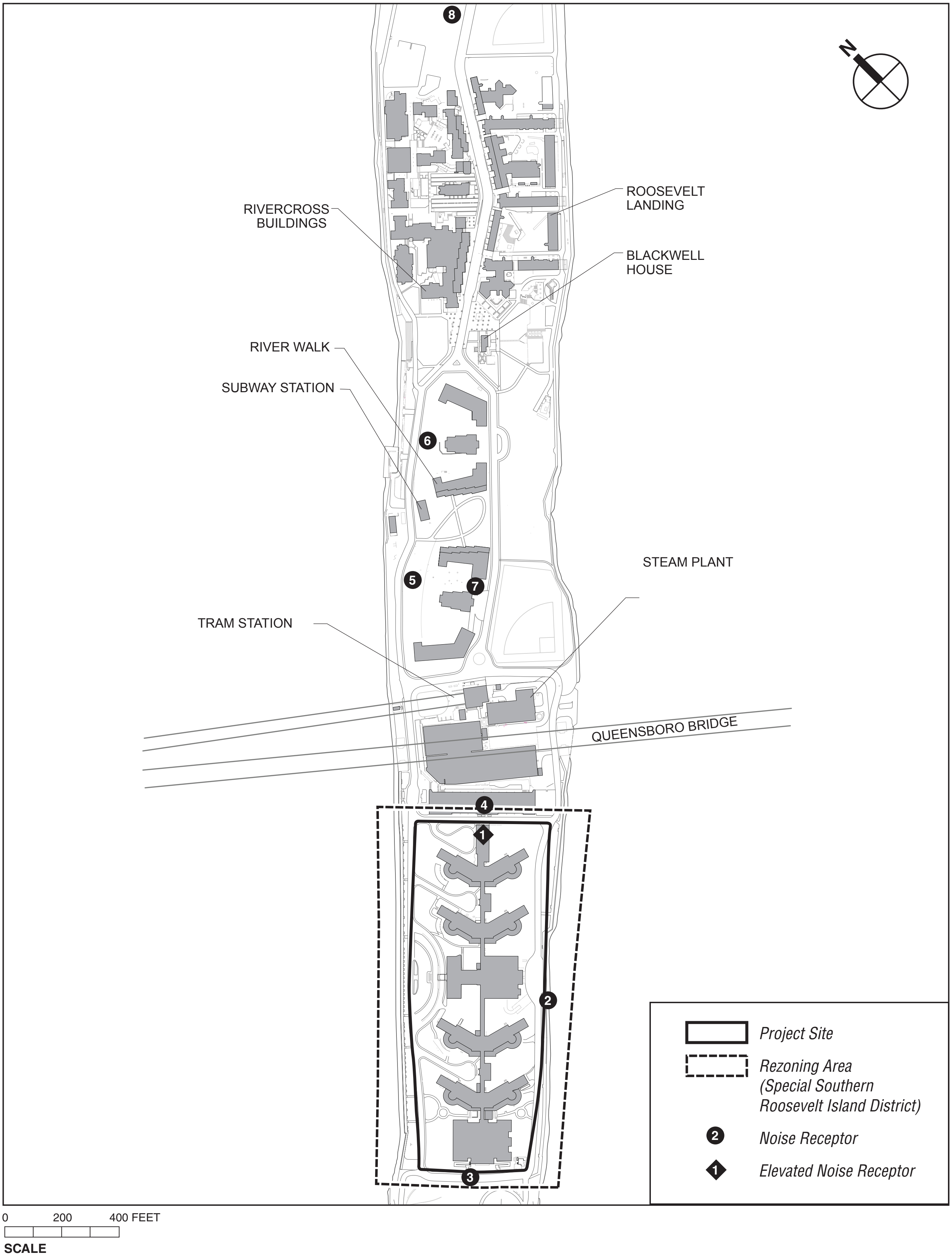
SELECTION OF ANALYSIS TIME PERIODS

Three weekday time periods—AM (7 to 9 AM), midday (Noon to 2 PM), and PM (4 to 6 PM) – were selected for analysis since these are the time periods when the proposed project would be expected to have maximum traffic generation and/or the maximum potential for significant adverse noise impacts based on the traffic studies presented in Chapter 14, “Transportation.”

NOISE MONITORING

Existing noise levels were determined at the receptor sites for each analysis time period, by performing field measurements. At receptor sites 2 through 8, 20-minute noise measurements were made for three weekday time periods to determine existing noise levels. At receptor 1, noise levels were measured continuously between 7:40 AM and 7 PM. Measurements were taken on October 25, 2011; June 12, 2012; June 13, 2012; and June 14, 2012.

Measurements were performed using Brüel & Kjær Sound Level Meters (SLMs) Type 2260, Brüel & Kjær Sound Level Calibrators Type 4231, and Brüel & Kjær ½-inch microphones Type 4189. The Brüel & Kjær meters are Type 1 Sound Level Meters. The SLMs had factory



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Noise Receptor Location

Figure 17-1

calibration dates within one year of the dates of the measurements. The instruments were mounted on a tripod at a height of 5 feet above the ground, except for site 1. The meters were calibrated before and after readings using Brüel & Kjær Type 4231 sound level calibrators with the appropriate adaptors. The data were digitally recorded by the SLMs and displayed at the end of the measurement period in units of dBA.

Measured quantities included L_{eq}, L_1, L_{10}, L_{50}, and L_{90}. Windscreens were used during all sound measurements except for calibration. All measurement procedures were based on the guidelines listed in ANSI Standard S1.13-2005. During the noise measurements, meteorological data was also noted, with wind speeds not exceeding 12 mph, humidity not exceeding 80 percent, no precipitation, and temperatures between -10 degrees Celsius and 50 degrees Celsius.

RESULTS OF BASELINE NOISE MONITORING

At all of the receptor sites in the study area, the dominant operational noise sources were observed to be vehicular traffic on adjacent and nearby streets and roadways, along with vehicular traffic on the Queensboro Bridge. Noise from the FDR Drive also contributed to measured noise levels. Noise from other sources, such as nearby industrial or institutional uses, are limited and do not contribute significantly to local ambient noise levels. Details of the baseline measurements are provided in Section E "Existing Conditions," below.

DETERMINATION OF FUTURE NOISE LEVELS

Future noise levels were calculated using either a proportional modeling technique or the Federal Highway Administration (FHWA) *Traffic Noise Model* (TNM) Version 2.5. The proportional modeling technique was used as a screening tool to estimate changes in noise levels. At locations where proportional modeling screening indicated the potential for significant adverse noise impacts, the TNM was used to obtain more detailed results. Both the proportional modeling screening technique and the TNM are analysis methodologies recommended in the *CEQR Technical Manual*. Specifically, future noise levels at the receptor locations were determined as follows:

- Using the results of the traffic studies presented in Chapter 14, "Transportation," a screening analysis was performed using the proportional model to identify locations with the potential to experience a significant increase in noise levels between the No-Action and With Action conditions in each analysis year (i.e., 2018 and 2038).
- At locations where the screening analysis indicated the potential for a significant increase in noise levels during any of the analysis years, existing traffic noise levels were calculated for each analysis time period using the TNM and traffic data for existing conditions. At these locations, the calculated TNM existing traffic noise level for each analysis time period was logarithmically subtracted from the measured existing noise level. The difference between the two reflects the contribution of noise sources other than traffic on Roosevelt Island to the existing noise levels at these sites, primarily noise generated by traffic on the Queensboro Bridge. This contribution from the Queensboro Bridge was assumed to remain constant in the No-Action and With Action conditions. Future noise levels were then calculated for the No-Action and With Action scenarios using TNM for each of these receptor sites during each analysis time period. The TNM-calculated traffic noise levels were combined with the previously calculated noise contribution from the Queensboro Bridge to determine the future noise level in each scenario.

- Future noise levels calculated using proportional modeling or TNM were compared to CEQR noise impact criteria.

PROPORTIONAL MODELING

Proportional modeling was used to determine locations which had the potential for having significant noise impacts and to quantify the magnitude of those potential impacts.

Using this technique, the prediction of future noise levels, where traffic is the dominant noise source, is based on a calculation using measured existing noise levels and predicted changes in traffic volumes to determine No Action and future with the proposed project (With Action) levels. Vehicular traffic volumes are converted into Noise Passenger Car Equivalent (Noise PCE) values, for which one medium-duty truck (having a gross weight between 9,900 and 26,400 pounds) is assumed to generate the noise equivalent of 13 cars, one heavy-duty truck (having a gross weight of more than 26,400 pounds) is assumed to generate the noise equivalent of 47 cars, and one bus (vehicles designed to carry more than nine passengers) is assumed to generate the noise equivalent of 18 cars. Future noise levels are calculated using the following equation:

FB NL - FNA NL = 10 * $\log_{10}$ (FB PCE / FNB PCE)

where:

FB NL = Future With Action Noise Level

FNA NL = Future No Action Noise Level

FB PCE = Future With Action PCEs

FNA PCE = Future No Action PCEs

Sound levels are measured in decibels and therefore increase logarithmically with sound source strength. In this case, the sound source is traffic volumes measured in Noise PCEs. For example, assume that traffic is the dominant noise source at a particular location. If the existing traffic volume on a street is 100 Noise PCE and if the future traffic volume were increased by 50 Noise PCE to a total of 150 Noise PCE, the noise level would increase by 1.8 dBA. Similarly, if the future traffic were increased by 100 Noise PCE, or doubled to a total of 200 Noise PCE, the noise level would increase by 3.0 dBA.

TRAFFIC NOISE MODEL (TNM)

The TNM is a computerized model developed for the FHWA that calculates the noise contribution of each roadway segment to a given noise receptor. The noise from each vehicle type is determined as a function of the reference energy-mean emission level, corrected for vehicle volume, speed, roadway grade, roadway segment length, and source-receptor distance. Further considerations reflected in the modeling of the propagation path included identifying any shielding provided by rows of buildings, and analyzing the effects of any intervening noise barriers. The TNM was used for sites where the proportional modeling screening technique showed the potential for significant adverse noise impacts.

DETERMINATION OF BUILDING ATTENUATION REQUIREMENTS

The level of building attenuation to satisfy *CEQR Technical Manual* requirements was determined for the proposed project’s buildings using measured noise levels or projected noise levels calculated using either the proportional model or the TNM approach described above.

DETERMINATION OF NOISE LEVELS IN PROJECT CREATED OPEN SPACES

Noise levels were predicted for project-generated open spaces using either the proportional model or the TNM approach described above and compared to levels recommended in the *CEQR Technical Manual*.

MECHANICAL EQUIPMENT

The buildings' mechanical systems (i.e., heating, ventilation, and air conditioning systems) would be designed to meet all applicable noise regulations (i.e., Subchapter 5, §24-227 of the New York City Noise Control Code addressing circulation devices and the New York City Department of Buildings and Mechanical Codes) to avoid producing levels that would result in any significant increase in ambient noise levels; therefore, the proposed project's building mechanical systems are not discussed further in this chapter.

E. EXISTING CONDITIONS

Table 17-6 summarizes the results of the baseline measurements for the Weekday AM, midday, and PM analysis hours at receptor sites 2 through 8. **Table 17-7** summarizes the results of the baseline measurements at receptor site 1 between 7:40 AM and 7 PM. At receptor sites 2, 3, 5, 6, 7, and 8, the dominant noise source was traffic on the immediately adjacent roadways along with contribution from traffic on the Queensboro Bridge. At receptor sites 1 and 4, the dominant noise source was traffic on the Queensboro Bridge. In general, noise levels are moderate and reflect the level of vehicular activity on the adjacent streets and the Queensboro Bridge.

Table 17-6
Existing Noise Levels at Noise Receptor Sites 2 through 8
(in dBA)

Site	Measurement Location	Day	Time	L_{eq}	L_1	L_{10}	L_{50}	L_{90}
2	East Loop Road between North Loop Road and South Loop Road	Weekday	AM	63.1	72.5	64.5	58.3	56.5
			MD	62.4	71.5	62.9	60.9	59.5
			PM	59.3	70.0	59.9	56.0	55.0
3	South Loop Road between East and West Loop Roads	Weekday	AM	63.4	72.8	66.2	59.8	57.8
			MD	62.2	72.4	62.1	59.0	57.4
			PM	60.0	71.8	60.3	55.2	54.1
4	North Loop Road between East and West Loop Roads	Weekday	AM	66.8	76.9	67.4	65.0	63.8
			MD	69.1	73.4	70.3	68.8	67.5
			PM	65.5	74.1	65.7	63.6	62.6
5	West Road north of Tramway Plaza	Weekday	AM	64.8	72.9	66.3	63.1	61.6
			MD	65.5	70.2	66.6	65.0	64.1
			PM	65.1	72.3	66.2	64.1	63.1
6	West Road north of Subway Station	Weekday	AM	64.3	74.4	65.4	62.7	61.3
			MD	66.6	77.7	65.9	62.9	62.0
			PM	63.9	74.4	65.4	61.6	60.4
7	Main Street north of Tramway Plaza	Weekday	AM	64.7	70.6	66.3	64.1	62.5
			MD	66.5	70.5	67.6	66.1	64.9
			PM	63.1	69.4	64.6	62.1	60.6
8	Main Street south of Roosevelt Island Bridge	Weekday	AM	70.5	81.8	72.9	65.4	59.5
			MD	71.3	81.4	71.7	63.3	58.3
			PM	69.4	80.3	72.1	66.2	61.5

Notes: Field measurements were performed by AKRF, Inc. on October 25, 2011, June 12, June 13, and June 14, 2012.
Refer to Figure 17-1 for noise monitoring locations.

Table 17-7
Existing Noise Levels at Receptor 1

Start Time	dBA						
	L_{eq}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	$L_{(min)}$	$L_{(max)}$
7:40 AM	69.7	80.8	71.5	65.8	64.8	64.0	84.3
8:00 AM	67.7	79.0	67.9	65.3	64.3	62.8	84.0
9:00 AM	65.8	73.5	66.6	64.9	63.9	62.4	80.1
10:00 AM	67.0	73.2	68.2	66.5	65.2	62.5	80.3
11:00 AM	68.5	72.1	69.7	68.3	66.7	64.3	82.4
12:00 PM	69.3	76.7	70.2	68.5	67.2	65.3	82.4
1:00 PM	69.1	74.9	70.0	68.5	67.3	65.2	83.8
2:00 PM	68.9	76.0	69.2	67.9	66.8	64.9	89.7
3:00 PM	67.6	74.4	68.3	66.9	65.5	63.1	85.9
4:00 PM	66.3	75.0	66.4	64.8	63.7	61.1	84.1
5:00 PM	65.7	76.1	65.6	63.2	62.2	60.5	84.0
6:00 PM	65.5	70.8	66.5	65.0	63.8	61.2	81.5

Notes: Field measurements were performed by AKRF, Inc. on October 25, 2011.
Refer to Figure 17-1 for noise monitoring locations.

In terms of CEQR noise exposure guidelines (shown in Table 17-3), during the hour with the highest measured noise levels, existing noise levels at receptor 2 are in the "acceptable" category, exiting noise levels at receptors 3, 5, 6, and 7 are in the "marginally acceptable" category, and existing noise levels at receptors 1, 4, and 8 are in the "marginally unacceptable" category. These categories are based on the measured L_{10} values.

F. FUTURE WITHOUT THE PROPOSED PROJECT

2018 ANALYSIS YEAR

Using the methodology previously described, future noise levels in the 2018 No-Action condition were calculated for the three analysis periods. **Table 17-8** shows the calculated noise levels.

Comparing 2018 No-Action noise levels with existing noise levels, the changes in $L_{eq(1)}$ noise level would be between 0.0 and -3.2 dBA. Noise levels would be expected to decrease as compared to the existing conditions at almost all receptor locations due to the decrease in traffic on roadways on Roosevelt Island associated with the closing of Goldwater Hospital.

As noted above, noise levels at sites 1 and 4, which were used solely for the building attenuation analysis, are dominated by the Queensboro Bridge, and would consequently not be expected to change in the future conditions.

In terms of CEQR noise exposure guidelines, during the hour with the highest measured noise levels, 2018 No-Action noise levels at site 2 would remain in the "acceptable" category, 2018 No-Action noise levels at sites 3, 5, 6, and 7 would remain in the "marginally acceptable" category, and 2018 No-Action noise levels at sites 1, 4, and 8 would remain in the "marginally unacceptable" category.

Table 17-8
2018 No-Action Noise Levels (in dBA)

Noise Receptor Site[1]	Day	Time	Existing $L_{eq(1)}$	2018 No-Action $L_{eq(1)}$	Change	2018 No-Action $L_{10(1)}$
2[2]	Weekday	AM	63.1	62.2	-0.9	63.6
		MD	62.4	62.1	-0.3	62.6
		PM	59.3	56.1	-3.2	56.7
3	Weekday	AM	63.4	63.4	0.0	66.2
		MD	62.2	62.2	0.0	62.1
		PM	60.0	60.0	0.0	60.3
5[2]	Weekday	AM	64.8	64.4	-0.4	65.9
		MD	65.5	65.3	-0.2	66.4
		PM	65.1	64.4	-0.7	65.5
6[2]	Weekday	AM	64.3	~~63.9~~64.0	~~-0.4~~-0.3	~~65.0~~65.1
		MD	66.6	66.5	-0.1	65.8
		PM	63.9	63.2	-0.7	64.7
7	Weekday	AM	64.7	62.4	-2.3	64.0
		MD	66.5	65.9	-0.6	67.0
		PM	63.1	61.1	-2.0	62.6
8	Weekday	AM	70.5	69.3	-1.2	71.7
		MD	71.3	70.8	-0.5	71.2
		PM	69.4	67.4	-2.0	70.1

Notes:
[1] Noise levels at sites 1 and 4, which were used solely for the building attenuation analysis, are dominated by the Queensboro Bridge, and would consequently not be expected to change in the future condition. They are therefore not shown in the calculation results.
[2] Noise levels at these receptor sites were calculated using TNM because the proportional modeling screening analysis showed the potential for impact at these locations.

2038 ANALYSIS YEAR

Using the methodology previously described, future noise levels in the 2038 No-Action condition were calculated for the three analysis periods. **Table 17-9** shows the calculated noise levels.

Comparing future 2038 No-Action noise levels with existing noise levels, the changes in $L_{eq(1)}$ noise level would be between 0.0 and -3.2 dBA. Noise levels would be expected to decrease as compared to the existing conditions at almost all receptor locations due to the decrease in traffic on roadways on Roosevelt Island associated with the closing of Goldwater Hospital.

As noted above, noise levels at sites 1 and 4, which were used solely for the building attenuation analysis, are dominated by the Queensboro Bridge, and would consequently not be expected to change in the future conditions.

In terms of CEQR noise exposure guidelines, during the hour with the highest measured noise levels, 2038 No-Action noise levels at receptor 2 would remain in the "acceptable" category, 2038 No-Action noise levels at receptors 3, 5, 6, and 7 would remain in the "marginally acceptable" category, and 2038 No-Action noise levels at receptors 1, 4, and 8 would remain in the "marginally unacceptable" category.

Table 17-9
2038 No-Action Noise Levels (in dBA)

Noise Receptor Site[1]	Day	Time	Existing $L_{eq(1)}$	2038 No-Action $L_{eq(1)}$	Change	2038 No-Action $L_{10(1)}$
2[2]	Weekday	AM	63.1	62.3	-0.8	63.7
		MD	62.4	62.1	-0.3	62.6
		PM	59.3	56.1	-3.2	56.7
3	Weekday	AM	63.4	63.4	0.0	66.2
		MD	62.2	62.2	0.0	62.1
		PM	60.0	60.0	0.0	60.3
5[2]	Weekday	AM	64.8	64.5	-0.3	66.0
		MD	65.5	65.4	-0.1	66.5
		PM	65.1	64.4	-0.7	65.5
6[2]	Weekday	AM	64.3	64.1	-0.2	65.2
		MD	66.6	66.6	0.0	65.9
		PM	63.9	63.2	-0.7	64.7
7	Weekday	AM	64.7	62.9	-1.8	64.5
		MD	66.5	66.2	-0.3	67.3
		PM	63.1	61.4	-1.7	62.9
8	Weekday	AM	70.5	69.7	-0.8	72.1
		MD	71.3	71.1	-0.2	71.5
		PM	69.4	67.8	-1.6	70.5

Notes:
[1] Noise levels at sites 1 and 4, which were used solely for the building attenuation analysis, are dominated by the Queensboro Bridge, and would consequently not be expected to change in the future condition. They are therefore not shown in the calculation results.
[2] Noise levels at these receptor sites were calculated using TNM because the proportional modeling screening analysis showed the potential for impact at these locations.

G. THE FUTURE WITH THE PROPOSED PROJECT

2018 ANALYSIS YEAR (PHASE 1)

Using the methodology previously described, noise levels in the 2018 With Action condition were calculated for the three analysis periods. **Table 17-10** shows the calculated noise levels.

Comparing future 2018 With Action noise levels with future 2018 No-Action noise levels, the changes in $L_{eq(1)}$ noise level would be between 0.0 and 1.8 dBA. Increases of this magnitude would be imperceptible, and based upon *CEQR Technical Manual* impact criteria (as described above under “Impact Definition”) would not be significant.

As noted above, noise levels at sites 1 and 4, which were used solely for the building attenuation analysis, are dominated by the Queensboro Bridge, and would consequently not be expected to change in the future conditions.

In terms of *CEQR Technical Manual* noise exposure guidelines, during the hour with the highest measured noise levels, 2018 With Action noise levels at receptor 2 would remain in the “acceptable” category, 2018 With Action noise levels at receptors 3, 5, 6, and 7 would remain in the “marginally acceptable” category, and 2018 With Action noise levels at receptors 1, 4, and 8 would remain in the “marginally unacceptable” category.

Table 17-10
Phase 1 (2018) With Action Noise Levels (in dBA)

Noise Receptor Site[1]	Day	Time	2018 No-Action $L_{eq(1)}$	2018 With Action $L_{eq(1)}$	Change	2018 With Action $L_{10(1)}$
2[2]	Weekday	AM	62.2	62.7	~~0.3~~0.5	64.1
		MD	62.1	~~63.9~~62.6	~~1.8~~0.5	~~64.4~~63.1
		PM	56.1	56.6	0.5	57.2
3	Weekday	AM	63.4	63.4	0.0	66.2
		MD	62.2	62.2	0.0	62.1
		PM	60.0	60.0	0.0	60.3
5[2]	Weekday	AM	64.4	64.8	0.4	66.3
		MD	65.3	~~65.7~~65.9	~~0.4~~0.6	~~66.8~~67.0
		PM	64.4	64.6	0.2	65.7
6[2]	Weekday	AM	63.9	64.3	0.4	65.4
		MD	66.5	66.8	~~0.4~~0.3	66.1
		PM	63.2	63.4	0.2	64.9
7	Weekday	AM	62.4	63.6	1.2	65.2
		MD	65.9	67.4	1.5	68.5
		PM	61.1	62.0	~~1.0~~0.9	63.5
8	Weekday	AM	69.3	70.1	0.8	72.5
		MD	70.8	72.1	1.3	72.5
		PM	67.4	68.4	1.0	71.1

Notes:
[1] Noise levels at sites 1 and 4, which were used solely for the building attenuation analysis, are dominated by the Queensboro Bridge, and would consequently not be expected to change in the future condition. They are therefore not shown in the calculation results.
[2] Noise levels at these receptor sites were calculated using TNM because the proportional modeling screening analysis showed the potential for impact at these locations.

2038 ANALYSIS YEAR (FULL BUILD)

Using the methodology previously described, noise levels in the 2038 With Action condition were calculated for the three analysis periods. **Table 17-11** shows the calculated noise levels.

Comparing future 2038 With Action noise levels with future 2038 No-Action noise levels, the changes in $L_{eq(1)}$ noise level would be between 0.0 and 2.6 dBA. Increases of this magnitude would be barely perceptible, and based upon *CEQR Technical Manual* impact criteria (as described above under "Impact Definition") would not be significant.

As noted above, noise levels at sites 1 and 4, which were used solely for the building attenuation analysis, are dominated by the Queensboro Bridge, and would consequently not be expected to change in the future conditions.

In terms of CEQR noise exposure guidelines, during the hour with the highest measured noise levels, 2038 With Action noise levels at receptor 2 would remain in the "acceptable" category, 2038 With Action noise levels at receptors 3, 5, 6, and 7 would remain in the "marginally acceptable" category, and 2038 With Action noise levels at receptors 1, 4, and 8 would remain in the "marginally unacceptable" category.

Consequently, the proposed project would not have the potential to result in any significant adverse noise impacts as a result of increased traffic traveling to and from the project site.

Table 17-11
Full Build (2038) With Action Noise Levels (in dBA)

Noise Receptor Site[1]	Day	Time	2038 No-Action $L_{eq(1)}$	2038 With Action $L_{eq(1)}$	Change	2038 With Action $L_{10(1)}$
2[2]	Weekday	AM	62.3	63.2	0.9	59.9
		MD	62.1	63.2	1.1	62.0
		PM	56.1	57.6	1.5	56.8
3	Weekday	AM	63.4	63.4	0.0	66.2
		MD	62.2	62.2	0.0	62.1
		PM	60.0	60.0	0.0	60.3
5[2]	Weekday	AM	64.5	65.4	0.9	66.2
		MD	65.4	66.4	1.0	66.7
		PM	64.4	65.2	0.8	63.7
6[2]	Weekday	AM	64.1	64.9	0.8	~~65.2~~65.9
		MD	66.6	67.2	0.6	65.7
		PM	63.2	64.0	~~0.7~~0.8	62.8
7	Weekday	AM	62.9	65.5	2.6	66.6
		MD	66.2	68.8	2.6	69.7
		PM	61.4	63.1	1.7	64.2
8	Weekday	AM	69.7	71.3	~~1.7~~1.6	73.4
		MD	71.1	73.5	2.4	73.6
		PM	67.8	69.8	~~1.9~~2.0	72.1

Notes:
[1] Noise levels at sites 1 and 4, which were used solely for the building attenuation analysis, are dominated by the Queensboro Bridge, and would consequently not be expected to change in the future condition. They are therefore not shown in the calculation results.
[2] Noise levels at these receptor sites were calculated using TNM because the proportional modeling screening analysis showed the potential for impact at these locations.

H. BUILDING ATTENUATION FOR PROJECT BUILDINGS

As discussed in section C, "Noise Standards and Criteria," the *CEQR Technical Manual* recommends an analysis of the effect of introducing a sensitive use, such as a residential building, into an urban environment. As shown in Table 17-4 earlier in this chapter, the *CEQR Technical Manual* has set noise attenuation values for new buildings based on exterior noise levels. Recommended noise attenuation values for residential, Executive Education Center (i.e., hotel), and academic buildings are designed to maintain interior noise levels of 45 dBA $L_{10(1)}$ (50 dBA $L_{10(1)}$ for commercial uses) or lower and are determined based on exterior $L_{10(1)}$ noise levels.

Table 17-12 shows the highest calculated or measured $L_{10(1)}$ noise levels (for any time period) at proposed buildings within the project site and the minimum amount of building attenuation that would be required to achieve acceptable interior noise levels at each location. The measured or calculated $L_{10(1)}$ noise levels are based on measurements or calculations at receptor sites 1 through 4, which are located adjacent to the project site. At buildings not listed in Table 17-12, the projected exterior $L_{10(1)}$ noise levels are below the range that requires specific levels of building attenuation according to CEQR criteria.

Table 17-12
Minimum Required Building Attenuation at Project Buildings

Building	Applicable Noise Receptor Site(s)	Maximum $L_{10(1)}$ (dBA)[2]	Required Building Attenuation (dBA)[1]
Phase 1 Residential Building	1,2,4	71.5	28 on north, northwest and northeast facades
Phase 1 Executive Education Center (Hotel)	1,2,4	71.5	28 on north, northwest and northeast facades
Phase 1 Academic Building	1,2,4	71.5	28 on north, northwest and northeast facades

Notes:
[1] Required attenuation values shown are for residential and academic uses. Commercial uses would require 5 dBA less attenuation.
[2] These facades having incident L_{10} values of 70 dBA or less would not require specific window/wall attenuation measures.

The attenuation of a composite structure is a function of the attenuation provided by each of its component parts and how much of the area is made up of each part. Normally, a building façade is composed of the wall, glazing, and any vents or louvers for HVAC/air conditioning units in various ratios of area. The proposed design for all project buildings includes the use of well-sealed double-glazed windows and air conditioning units. The proposed buildings' façades, including these elements, would be designed to provide a composite Outdoor-Indoor Transmission Class (OITC) rating greater than or equal to the attenuation requirements listed in Table 17-12 and provide an interior $L_{10(1)}$ level not in excess of 45 dBA for residential, hotel, or academic uses or 50 dBA for commercial uses. The OITC classification is defined by the American Society of Testing and Materials (ASTM E1332-90 [Reapproved 2003]) and provides a single-number rating that is used for designing a building façade including walls, doors, glazing, and combinations thereof. The OITC rating is designed to evaluate building elements by their ability to reduce the overall loudness of ground and air transportation noise. By adhering to these design requirements, the proposed buildings would provide sufficient attenuation to achieve the CEQR interior noise level guideline of 45 dBA L_{10} for residential uses and 50 dBA L_{10} for commercial uses.

I. NOISE LEVELS AT OPEN SPACE AREAS

Noise levels within the new open space areas created on-site as part of the proposed project would be as high as 66.2 dBA $L_{10(1)}$ in the 2018 and 2038 With Action conditions as well as the existing and No-Action conditions, according to measured and calculated values at receptor sites 2 and 3. These levels would exceed the 55 dBA $L_{10(1)}$ noise level recommended for outdoor areas requiring serenity and quiet by the *CEQR Technical Manual* noise exposure guidelines (see Table 17-3). However, while the 55 dBA $L_{10(1)}$ guideline is a worthwhile goal for outdoor areas requiring serenity and quiet, due to the level of activity present at most New York City open space areas and parks (except for areas far away from traffic and other typical urban activities) this relatively low noise level is often not achieved. For example, existing noise levels at the waterfront promenade and South Point Park are already above the 55 dBA $L_{10(1)}$ guideline due to noise from vehicular traffic on the Queensboro Bridge and on the FDR Drive. To achieve noise levels that would meet the 55 dBA $L_{10(1)}$ guideline, measures would need to be implemented to control noise from the Queensboro Bridge; the implementation of barriers on the bridge would not be possible because of the bridge's landmarked status. Noise levels within the new open spaces would be comparable to noise levels at public areas elsewhere on Roosevelt Island and would be comparable to or less than noise levels in a number of open space areas located adjacent to heavily trafficked roadways, including Brooklyn Bridge Park, Prospect Park, Fort Greene Park, and other urban open space areas.

J. CONCLUSIONS

As detailed in this chapter, traffic generated by the proposed project would not be expected to result in any significant increases in noise levels in either analysis year at any nearby sensitive receptors. To meet CEQR interior noise level requirements, the analysis recommends up to 28 dBA of building attenuation for certain project buildings (the Phase 1 academic building, the Phase 1 residential building, and the Executive Education Center [hotel]). Noise levels in the newly created open spaces would be greater than the 55 dBA $L_{10(1)}$ recommended by CEQR criteria, but would be comparable to other parks on Roosevelt Island and elsewhere in New York City. Mechanical equipment associated with project buildings would be designed to meet all applicable noise regulations, and would therefore not have the potential to result in a significant noise impact. ✷