16.0 INTRODUCTION

The number of vehicle trips generated by the Proposed Actions would be lower than the threshold that would require any detailed analysis. Consequently, it is not expected that the Proposed Actions would generate sufficient traffic to have the potential to cause a significant noise impact (i.e., it would not result in a doubling of noise passenger car equivalents [Noise PCEs] which would be necessary to cause a 3 dBA increase in noise levels). The Proposed Actions would not result in additional watercraft trips in proximity to any noise receptors and consequently would not have the potential to result in increased noise levels as a result of watercraft. However, as described in Chapter 1, "Purpose and Need and Alternatives," Alternatives 2 and 3 would include a proposed community Water Hub. Potential Location 1 would be in the vicinity of the southern terminus of Page Avenue (involving the construction of a new structure). Potential Location 2 would be in the north-western portion of Conference House Park (involving the rehabilitation and adaptive reuse of an existing NYC Parks building). Subsequent to the issuance of the DEIS, an additional Water Hub location has been included for consideration. Potential Location 3 would involve a "floating" Water Hub—a vessel that would visit the breakwater project area (approximately once per week from April through November for student-based teaching events, and community events approximately twice per month) and would operate out of existing facilities in the City. No additional parking facilities would be required with this option. Potential Location 3 would not involve a permanent on-shore facility near residential receptors. Its operation (constituting no more than a single in or out trip in a given hour) would not constitute a doubling of boat operations at the marina, and would therefore not have the potential to result in a 3 dBA increase in noise from boat operations. As such, operation of the floating Water Hub would not have the potential to result in a significant impact at any receptors near its dock facility. Further, the off-shore Water Hub's operations near the project site would be located adjacent to the proposed breakwater system, at least 1,000 feet from any existing noise-sensitive buildings (e.g., residences, schools, etc.), and at distances between 800 and 1,500 feet from the waterfront open spaces along the Tottenville shoreline. Operation of the floating Water Hub would be consistent with existing maritime operations in the area. Consequently, Potential Location 3 would not have the potential to result in a significant noise impact at any receptors near the project site.

Mechanical systems associated with a proposed on-shore Water Hub would be subject to New York City noise regulations limiting noise emissions as discussed below. The Proposed Actions, once operational, would not include any other noise-producing elements. The effect of ambient noise (i.e., noise vehicular traffic) is addressed in the following section and an analysis is presented which determines the level of building attenuation necessary to ensure that the proposed Water Hub building's interior noise levels satisfy applicable interior noise criteria. Additionally, noise exposure at Potential Location 3 is considered for uses within the proposed floating Water Hub.

An analysis of noise and vibration resulting from construction associated with the Proposed Actions is presented in Chapter 17, "Construction."

16.1 PRINCIPAL CONCLUSIONS

The Proposed Actions, once operational, would not have the potential to result in perceptible increases in noise level at any noise receptor locations resulting from either vehicular traffic associated with the Proposed Actions or mechanical equipment serving the proposed Water Hub included in Alternatives 2 and 3. Additionally, the proposed Water Hub included in Alternatives 2 and 3, whether it would be located on-shore at Potential Location 1 or Potential Location 2, would be located in an area where noise levels would be in the "acceptable" range according to United States Department of Housing and Urban Development (HUD) or 2014 *City Environmental Quality Review (CEQR) Technical Manual* noise exposure guidance and consequently would not have the potential to experience a significant adverse noise impact. Alternative 4 would not include any newly introduced noise receptors subject to noise. Consequently, the Proposed Actions would not have the potential to result in any significant adverse noise impacts.

16.2 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).

16.2.1 "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 16-1**, 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.

In considering these values, it is important to note that the dBA scale is logarithmic, meaning that each increase of 10 dBA describes a doubling of perceived loudness. Thus, the background noise in an office, at 50 dBA, is perceived as twice as loud as a library at 40 dBA. For most people to perceive an increase in noise, it must be at least 3 dBA. At 5 dBA, the change will be readily noticeable.

Table 16-1
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.

16.2.2 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 that fluctuates over extended periods have been developed. One way is to describe the fluctuating sound 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 by $L_{eq(24)}$), 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}.

A descriptor for cumulative 24-hour sound levels is the day-night sound level, abbreviated as L_{dn} and also referred to as the day-night average noise level (DNL). This is a 24-hour measure that accounts for the moment-to-moment fluctuations in A-weighted noise levels due to all sound

sources during 24 hours, combined. Mathematically, the L_{dn} noise level is the energy average of all $L_{eq(1)}$ noise levels over a 24-hour period, where nighttime noise levels (10 PM to 7 AM) are increased by 10 dBA before averaging.

For purposes of the proposed project, the L_{10} and L_{dn} descriptors have been selected as the noise descriptors to be used to satisfy applicable interior noise criteria. The 1-hour L_{10} is the noise descriptor used in the *CEQR Technical Manual* noise exposure guidelines for City environmental impact review classification, and the L_{dn} is the noise descriptor used in the federal attenuation requirements.

16.3 REGULATORY CONTEXT

16.3.1 NEW YORK CEQR NOISE CRITERIA

The *CEQR Technical Manual* sets external noise exposure standards; these standards are shown in **Table 16-2**. Noise exposure is classified into four categories: acceptable, marginally acceptable, marginally unacceptable, and clearly unacceptable. The noise level specified for outdoor areas requiring serenity and quiet is 55 dBA $L_{10(1h)}$.

Table 16-2
Noise Exposure Guidelines For Use in City Environmental Impact Review

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
Outdoor area requiring serenity and quiet[2]		$L_{10} \leq 55$ dBA	---------- Ldn ≤ 60 dBA ----------	**NA**	---------- 60 < Ldn ≤ 65 dBA ----------	**NA**	(i) 65 < Ldn ≤ 70 dBA, (II) 70 ≤ Ldn	**NA**	---------- Ldn ≤ 75 dBA ----------
Hospital, nursing home		$L_{10} \leq 55$ dBA		55 < $L_{10} \leq$ 65 dBA		65 < $L_{10} \leq$ 80 dBA		$L_{10} > 80$ dBA	
Residence, residential hotel, or motel	7 AM–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–7 AM	$L_{10} \leq 55$ dBA		55 < $L_{10} \leq$ 70 dBA		70 < $L_{10} \leq$ 80 dBA		$L_{10} > 80$ dBA	
School, museum, library, court, house of worship, transient hotel or motel, public meeting room, auditorium, outpatient 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)	
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)	
Industrial, public areas only[4]	Note 4	Note 4		Note 4		Note 4		Note 4	

Note:
(i) In addition, any new activity shall not increase the ambient noise level by 3 dBA or more; (ii) *CEQR Technical Manual* noise criteria for train noise are similar to the above aircraft noise standards: the noise category for train noise is found by taking the L_{dn} value for such train noise to be an L_{dn} (L_{dn} contour) value.

Table Notes:
[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.
[3] One may use 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).

The *CEQR Technical Manual* defines attenuation requirements for buildings based on exterior noise level (see **Table 16-3**). Recommended noise attenuation values for buildings are determined based on exterior $L_{10(1)}$ noise levels and are designed to maintain interior noise levels of 45 dBA or lower for noise-sensitive uses such as classrooms and interior noise levels of 50 dBA or lower for less sensitive uses such as laboratory, office, lounge, exhibition, and retail uses.

Table 16-3
Required Attenuation Values to Achieve Acceptable Interior Noise Levels

	Marginally Unacceptable				Clearly Unacceptable
Noise Level with Proposed Action	$70 < L_{10} \leq 73$	$73 < L_{10} \leq 76$	$76 < L_{10} \leq 78$	$78 < L_{10} \leq 80$	$80 < L_{10}$
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)

Notes:
[A] The above composite window-wall attenuation values are for classroom spaces. Laboratory/office/lounge/exhibition/retail uses 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.

16.3.2 FEDERAL DEVELOPMENT GUIDELINES

HUD regulates noise for HUD-funded residential housing projects in accordance with 24 CFR Part 51, Subpart B. The intent of HUD's noise rules is to evaluate the noise compatibility of sites where HUD-funded housing developments are proposed. The Proposed Project is not a housing project. In addition, per 24 CFR § 51.101(a)(3), HUD's noise policy does not apply to actions under disaster assistance provisions or appropriations that are provided to save lives, protect property, and protect public health and safety. Therefore, HUD's noise rules would not apply to the Proposed Project. However, the noise levels at the Water Hub project site was compared to the HUD noise exposure guidelines for informational purposes.

The *HUD Noise Guidebook* sets exterior noise standards for housing construction projects based on Day-Night Sound Level (i.e., L_{dn}) values (see **Table 16-4**, HUD Exterior Noise Standards). The L_{dn} refers to a 24-hour average noise level with a 10 dB penalty applied to the noise levels during the hours between 10 PM and 7 AM, due to increased sensitivity to noise levels during these hours. If the exterior noise level is 65 L_{dn} to 70 L_{dn}, 25 dBA of noise attenuation must be provided; if the exterior noise level is 70 L_{dn} to 75 L_{dn}, 30 dBA of noise attenuation is required; and if the exterior noise level exceeds 75 L_{dn}, sufficient attenuation must be provided to bring interior levels down to 45 L_{dn} or lower for residential uses.

Table 16-4
HUD Exterior Noise Standards

	Acceptable	Normally Unacceptable	Unacceptable
Noise Level with Proposed Actions	$L_{dn} \leq 65$	$65 < L_{dn} \leq 75$	$75 < L_{dn}$
Source: U.S. Department of Housing and Urban Development			

16.4 EXISTING NOISE LEVELS

Existing noise levels were measured at Potential Location 1 proposed for the Water Hub (as mentioned above, the proposed Water Hub is associated with Alternatives 2 and 3 only).[1] The location of Receptor site 1 is shown on **Figure 16-1**. Existing condition noise levels at this receptor are also representative of those at Potential Location 2 for the proposed Water Hub, since Potential Location 2 is also near the shoreline and at the end of a lightly trafficked dead-end roadway. Consequently, the measured noise levels at Receptor site 1 were used to evaluate noise exposure at both potential on-shore Water Hub locations.

16.4.1 EQUIPMENT USED DURING NOISE MONITORING

Measurements were performed using a Brüel & Kjær Sound Level Meter (SLM) Type 2250, a Brüel & Kjær ½ inch microphone Type 4189, and a Brüel & Kjær Sound Level Calibrator Type 4231. The Brüel & Kjær SLM is a Type 1 instrument according to ANSI Standard S1.4-1983 (R2006). The SLM has a laboratory calibration date within one year of the date of the measurements, as is standard practice. At the receptor site, the microphone was mounted at a height of approximately 6 feet above the ground. The microphone was mounted away from any large reflecting surfaces that could affect the sound level measurements. The SLM was calibrated before and after readings with a Brüel & Kjær Type 4231 Sound Level Calibrator using the appropriate adaptor. Measurements at the location were made on the A-scale (dBA). The data were digitally recorded by the SLM 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}. A windscreen was used during all sound measurements except for calibration. All measurement procedures were based on the guidelines outlined in ANSI Standard S1.13-2005.

16.4.2 MEASURED EXISTING NOISE LEVELS

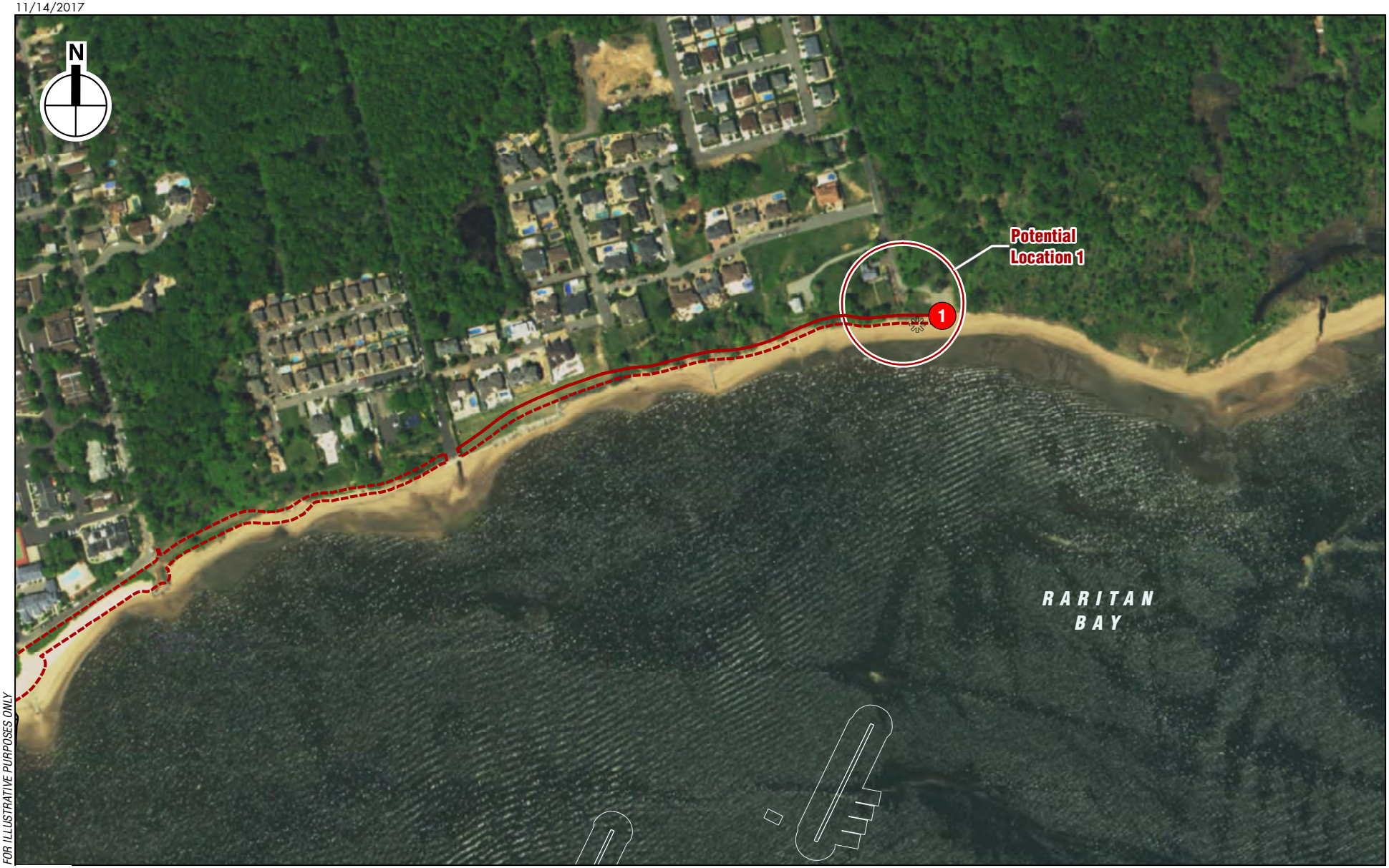
The results of the peak-hour existing noise level measurements are summarized in **Table 16-5**.

At the receptor site, vehicular traffic was the dominant noise source with wave action also contributing to noise levels. Measured levels are relatively low and reflect the low level of vehicular activity on the adjacent roadways. In terms of the CEQR criteria, the measured existing noise levels at the project site are in the "acceptable" category.

The measured L_{dn} noise level at the project site was 59.1 dBA. In terms of the HUD criteria, the measured existing noise levels at the project site are also in the "acceptable" category.

[1] At the receptor site, existing noise levels were measured continuously for a 24-hour period on August 9-10, 2016).

11/14/2017



FOR ILLUSTRATIVE PURPOSES ONLY

Proposed Breakwater Features

Proposed Shoreline Project Elements

Proposed Floating Dock (associated with Water Hub Potential Locations 1 and 2 only)

Potential Location of Proposed Water Hub (exact location to be determined)

Potential Water Access

Proposed Shoreline Restoration Area

1 *24-hour Continuous Noise Survey Location*

0 500 FEET

Coastal and Social Resiliency Initiatives for Tottenville Shoreline

Noise Survey Location

Figure 16-1

Table 16-5
Measured Noise Levels (in dBA) at Project Site (in dBA)

Start Time	L_{eq}	L_1	L_{10}	L_{50}	L_{90}
12:00 PM	50.0	60.6	52.3	46.5	44.2
1:00 PM	51.0	56.4	52.7	50.5	48.1
2:00 PM	53.3	58.4	53.6	51.9	50.3
3:00 PM	52.1	56.1	53.4	51.9	50.2
4:00 PM	52.0	56.4	53.3	51.7	50.3
5:00 PM	52.7	61.1	54.1	50.7	49.7
6:00 PM	52.8	58.8	54.6	51.8	50.3
7:00 PM	51.1	56.3	52.2	50.4	49.4
8:00 PM	52.5	58.0	56.4	50.6	49.1
9:00 PM	54.5	59.6	54.0	52.3	51.4
10:00 PM	55.7	61.0	53.9	51.8	50.9
11:00 PM	53.0	58.4	54.1	52.9	49.4
12:00 AM	52.4	57.4	55.3	51.4	49.9
1:00 AM	51.8	56.9	53.4	51.0	49.0
2:00 AM	52.3	54.3	53.3	52.3	51.1
3:00 AM	53.6	55.9	54.6	53.5	52.4
4:00 AM	52.5	54.2	53.6	52.6	50.7
5:00 AM	51.5	52.7	52.1	51.5	50.7
6:00 AM	51.1	57.5	52.4	50.2	49.5
7:00 AM	49.5	55.2	50.6	48.9	47.7
8:00 AM	49.2	54.3	50.1	48.5	47.8
9:00 AM	49.4	54.4	50.5	49.0	47.3
10:00 AM	50.1	58.0	51.0	48.9	47.4
11:00 AM	47.8	54.8	48.9	47.0	45.6

Note: Measurements were conducted by AKRF's Acoustics Department on August 9 and 10, 2016.

16.5 NOISE ATTENUATION MEASURES

As shown in **Table 16-3** above, the *CEQR Technical Manual* has set noise attenuation quantities for buildings based on exterior $L_{10(1)}$ noise levels in order to maintain interior noise levels of 45 dBA or lower for noise-sensitive uses such as classrooms and interior noise levels of 50 dBA or lower for less sensitive uses such as laboratory, office, lounge, exhibition, and retail uses. The *HUD Noise Guidebook* recommends that buildings should provide sufficient window/wall attenuation to result in L_{dn} values of 45 dBA or less.

The highest hourly L_{10} value measured at the receptor site of 56.4 dBA was used to evaluate the CEQR noise exposure for the proposed Water Hub building's façade, and the measured L_{dn} of 59.1 dBA was used to evaluate the HUD noise assessment criteria. The measured noise levels are in the "acceptable" range for both CEQR and HUD noise criteria and below the levels that result in a specific requirement for the level of window/wall attenuation based on either CEQR or HUD guidance.

The proposed Water Hub in Potential Location 1 would be constructed using standard construction methods, including insulated glass windows and air conditioning (a means of alternate ventilation). The proposed building's façades, including these elements, would be expected to provide sufficient attenuation to achieve both the CEQR and the HUD interior noise level requirements.

The proposed Water Hub in Potential Location 2 would include the adaptive re-use of either the Biddle House or Rutan-Beckett House. These buildings have monolithic glass windows and window A/C units as a means of alternate ventilation. With these measures, the building façades would be expected to provide sufficient attenuation to achieve both the CEQR and HUD interior noise level requirements.

The proposed Water Hub in Potential Location 3 would be housed within a watercraft constructed using standard maritime construction methods. Noise levels at its off-shore location would be comparable to or lower than the noise levels measured at the on-shore noise receptor site (i.e., in the "acceptable" range according to both CEQR and HUD noise criteria). Consequently, the noise exposure at the proposed Water Hub in Potential Location 3 would not be expected to interfere with its intended educational uses and would consequently not constitute a significant adverse noise impact.

16.6 MECHANICAL SYSTEM

The building 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 and the New York City Department of Buildings Code) and to avoid producing levels that would result in any significant increase in ambient noise levels.

16.7 MINIMIZATION AND MITIGATION OF IMPACTS

The Proposed Actions would not result in significant adverse operational noise impacts. Therefore, no mitigation with respect to operational noise is required. ✷