3.12 NOISE

3.12.1 Introduction

This Section describes the methodology used to determine the potential noise impacts of the construction of the Shaft 33B project and associated water mains. The assessment evaluates potential impacts that the project could have on ambient noise conditions at noise-sensitive locations in the vicinity of the potential project sites.

A mobile source noise impact assessment was not conducted for construction because a maximum of five trucks in the peak hour would be anticipated to travel to and from the Shaft Site and fewer to staging areas for water main construction. As described in the *CEQR Technical Manual*, a doubling of the passenger car equivalents (PCEs) would indicate the need for a detailed mobile source impact analysis. The level of traffic anticipated during construction would not represent a doubling of PCEs. Therefore, no further assessment of potential mobile source noise impacts is warranted.

Activation and operation of the shaft and water mains would not generate significant noise impacts. Shaft activation would occur for a very short period of time (approximately one month), would not include the use of pumps or other noise-generating equipment, and would require a maximum of one delivery per day for a period of approximately three to five days. Due to these short-term and temporary effects, shaft activation would not have the potential to significantly impact noise within the Study Area. All equipment, including pumps and movable valves, associated with operation of the shaft would be located below ground and the facility would be unmanned. Maintenance activities would occur intermittently and generally for not more than a few hours per week. The water main connections would not have noise generating equipment and would not require regular maintenance. Therefore, operation of the shaft and water mains would not generate significant stationary or mobile source noise impacts and noise effects are discussed qualitatively.

3.12.2 Noise Impact Thresholds

Perception of Noise

Several factors affect the perception of sound. These factors include the intensity of the sound (or noise), the frequencies involved, the period of exposure to the noise, and changes or fluctuations in the noise levels during exposure. Noise levels are measured in units called decibels. These measurements are adjusted or weighted to correspond to the frequency response of the human ear. The “A-weighted sound level” or “dBA,” is used for impact assessment purposes in view of its widespread recognition and its close correlation with human perception of noise. Table 3.12-1 lists noise levels from common sources.

Table 3.12-1
Utility Noise Levels of Common Sources

Sound Source	Sound Pressure Level (dBA)
Air Raid Siren at 50 feet	120
Maximum Levels at Rock Concerts (Rear Seats)	110
On Platform by Passing Subway Train	100
On Sidewalk by Passing Heavy Truck or Bus	90
On Sidewalk by Typical Highway	80
On sidewalk by Passing Automobile with Mufflers	70
Typical Urban Area	60-70
Typical Suburban Area	50-60
Quiet Suburban Area at Night	40-50
Typical Rural Area at Night	30-40
Isolated Broadcast Studio	20
Audiometric (Hearing Testing) Booth	10
Threshold of Hearing	0

Note: A change of 3 dBA is a just noticeable change in Sound Pressure Level (SPL). A change in 10 dBA is perceived as doubling or halving in SPL.

Source: *CEQR Technical Manual*, Table 3R-1

The average ability of an individual to perceive changes in noise levels is well documented (see Table 3.12-2). Generally, most people cannot perceive changes in noise levels less than 2 to 3 dBA, changes of 3 to 5 dBA are marginally noticeable, changes of 5 to 10 dBA are readily noticeable, a change in 10 dBA is normally perceived as doubling (or halving) of loudness, and a change of 20 dBA is a dramatic change in sound.

Noise Descriptors

To describe fluctuating noise over a specific period, statistical noise descriptors are used. The Leq noise descriptor was selected since it most accurately evaluates stationary source noise. The Leq is the equivalent steady-state noise level that, in a stated period of time, contains the same acoustic energy as the time-varying sound level during the same time period; it accounts for both the duration and the magnitude of noise. For this project, the one-hour average sound level, $Leq_{(1)}$, was used for impact assessment.

Table 3.12-2
Average Ability to Perceive Changes in Noise Levels

Change	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 the Federal Highway Administration, June 1973.

Applicable Noise Criteria

The *CEQR Technical Manual* provides detailed methodologies for assessing noise impacts for projects within New York City. Impact thresholds for daytime and nighttime periods have been developed for projects under CEQR review. During daytime hours (7:00 a.m. to 10:00 p.m.), a noise level of 65 dBA $Leq_{(1)}$ should not be significantly exceeded. For example, if the existing (ambient) noise level is 60 dBA $Leq_{(1)}$ or less, a 5 dBA or greater change above ambient could be considered significant if that noise were persistent. If the existing noise level is 62 dBA $Leq_{(1)}$ or more, a 3 dBA change could be considered significant if that noise were persistent. Further, the guidance stipulates that during night-time hours (10:00 p.m. to 7:00 a.m.), an incremental increase of 3 dBA over the ambient level should be considered a significant impact.

3.12.3 Existing Conditions Methodology

To evaluate potential impacts, the existing baseline conditions in the vicinity of the potential Shaft Sites and water main routes were established. Survey locations near the project sites were selected to be representative of sensitive receptors within the area potentially impacted by noise. The survey locations were identified using land use maps (see Section 3.2, "Land Use, Community Facilities, Zoning, and Public Policy") and field visits. Several monitoring locations were selected in the vicinity of each project site based on their proximity to sensitive receptors (e.g., residences, schools). In general, areas near the closest sensitive receptors were selected as ambient noise monitoring locations. When applicable, noise monitoring locations were selected to best represent a cluster of receptors. Elevated noise monitoring locations were also selected to assist in assessing ambient noise conditions at receptors above ground level. The specific monitoring locations are discussed in the noise assessment section for each potential Shaft Site and water main route.

Noise levels were measured over a two-day period at each potential project site. The measured sound levels were averaged over a one-minute period and stored in the memory of Larson Davis 700 and 712 automated sound monitors. Data were downloaded from the monitors and one-minute time histories and one-hour statistical noise summaries were plotted. The one-minute A-weighted data were used to calculate the hourly average sound levels ($Leq_{(1)}$). The monitors were calibrated at the start and finish of each two-day measurement session. Meteorological data were also monitored to assure that wind speeds greater than 12 miles per hour (mph) and rain conditions did not affect the data.

3.12.4 Future Conditions Without the Project Methodology

This assessment presents whether there are any foreseeable changes in noise levels in the area where there could be potential noise impacts surrounding the potential Shaft Sites and water main routes. This information is based on the land use at each project site (see the "Land Use, Community Facilities, Zoning, and Public Policy" Sections within the relevant Chapters) that describes future changes in the Study Area without the project.

3.12.5 Future Conditions With the Project Methodology

Blasting

Noise levels associated with blasting are site-specific and are dependent on the amount of explosive used, the distance to the sensitive receptors, and the below-surface elevation where blasting would occur. Blasting below the surface would produce lower noise levels at a receptor due to additional attenuation provided by distance and transmission through bedrock and soil. Blasting has an instantaneous effect. Under the project, blasting procedures would be dictated by site-specific conditions as determined by the construction contractor prior to construction and through monitoring during construction. Therefore, a quantitative assessment of potential noise impacts from blasting is not provided. Rather, blasting is discussed in the context of protective measures that will be put in place to minimize adverse impacts.

Other Construction Activities

To determine potential impacts of the project's other construction activities, estimates of changes in noise levels due to project construction are predicted at various sensitive receptors in the vicinity of each potential Shaft Site and water main route. Total noise levels were derived by adding project-generated construction equipment noise to background noise levels. The incremental difference between total noise levels with construction and noise levels without construction at each receptor site were compared to the CEQR impact thresholds described above to determine the potential for significant impacts. The specific methodologies used in the assessment are discussed below.

Scenarios Analyzed—Potential Shaft Sites

As described in the "Project Description" Sections for each potential Shaft Site (Sections 4.1, 6.1, 7.1, and 8.1) construction of the shaft would occur in stages representing specific construction activities and equipment on the sites. Potential noise impacts from construction activities are analyzed for the entire construction period. Each stage of construction was modeled separately.

Construction of Shaft 33B is expected to occur over two shifts—from 7:00 a.m. to 3:00 p.m. and from 3:00 p.m. to 11:00 p.m. Therefore, an analysis was performed for each shift for each stage of construction. The difference between the two assessments is the background noise levels, which are typically lower during the second shift. All other assumptions regarding the intensity of construction activity are the same for the two shifts; this is a conservative impact assessment approach as nighttime construction activities are typically less intensive than those conducted during the day. Raise bore excavation of the shaft, which would be a 24-hour operation for less than three months, would have minimal noise impacts since this activity takes place below ground and minimal surface activities are associated with the raise bore operation.

In addition, an average and reasonable worst-case peak period analysis was performed for each stage of construction. The average period analysis is based on average equipment utilization rates over an average 8-hour shift. The peak period analysis is based on a smaller mix of equipment that would typically operate for a greater percentage of time during one or more hours of a shift. (See “Equipment Utilization Rates” below for more information on these analysis periods).

The average and peak period analyses are performed for each shift, for a total of 4 scenarios per stage at each potential Shaft Site.

At the alternative Shaft Sites, there is the potential that shaft construction would be undertaken using the surface excavation method, rather than the raise bore method (see Chapter 2, “Purpose and Need and Project Overview” for a discussion of these methods). The differences between the two methods in relation to potential noise impacts are discussed in the noise sections of each of the alternative Shaft Site chapters.

Scenarios Analyzed—Potential Water Main Routes

As described in Section 5.1, water main construction would occur in a segmented, cut-and-cover fashion, where the same four stages of construction would be expected to occur within each segment of construction. Each stage of water main construction was modeled separately. The assessment of noise impacts from water main construction was also performed for the 8-hour average and peak period conditions for each water main construction stage.

Reasonable Worst Case—First Avenue Route

For the First Avenue route, potential noise impacts were examined for three prototypical cases of water main construction: water main construction along an avenue, water main construction along a side street, and water main and venturi chamber construction along an avenue.

For construction along an avenue, it was assumed that two teams would work at non-adjoining segments of an avenue simultaneously. In this three-block construction alignment, the first and third blocks are under construction while the second (middle) block has no construction activities. For example, for the First Avenue route, construction could occur between E. 55^{th} Street and E. 56^{th} Street and between E. 57^{th} Street and E. 58^{th} Street during the same period, with no construction between E. 56^{th} Street and E. 57^{th} Street. With each block at approximately 250 feet, a total of 500 feet of street width would be under construction at one time.

For construction along a cross street, one block between First Avenue and Second Avenue would be under construction (e.g., E. 55th Street between First and Second Avenues). The total length of approximately 500 feet would have two construction crews, each working on one half of the block (a 250 foot section) at different times. Construction was modeled assuming one crew operating at a time, but the entire duration of construction activity and impacts on the block is discussed.

Construction along the water main route is expected to occur during one shift. Although this work is expected to occur during a weekday daytime shift, there is a possibility that such work could occur during evening or weekend periods to avoid peak traffic periods. Therefore, two weekday shifts and two weekend shifts were analyzed for the reasonable worst case First Avenue route.

Other Representative Routes – Sutton Place Route and E. 59th Street/E. 61st Street Route

Several of the scenarios modeled for the First Avenue route are largely representative of those for the Sutton Place and E. 59th Street/E. 61st Street routes—cross streets, avenue with venturi chamber, and a cumulative water main with venturi chamber and shaft construction analysis. However, additional baseline monitoring was conducted during weekday and weekend Shift 1 and Shift 2 time periods along Sutton Place and along E. 59th Street and E. 61st Street and these data were used in the modeling for portions of these routes.

Scenarios Analyzed—Potential Shaft Sites with Water Main Routes

Lastly, a cumulative water main with venturi chamber and shaft construction analysis was conducted to determine the cumulative effects if these were to be constructed simultaneously.

Sensitive Receptors

Receptors were selected at ground floor and elevated (upper floors) locations in the immediate vicinity of the potential Shaft Sites to assess potential construction noise impacts. For the potential water main routes, one or more receptors were selected to represent conditions along the routes. In general, sensitive receptors such as residences, schools, and public areas were selected. These receptors are considered to be representative of other sensitive uses in the area. The specific receptor locations are discussed in the noise assessment section for each potential Shaft Site and water main route.

The Model

The CadnaA computational sound model was used to calculate the expected noise levels at sensitive receptors from construction activities and equipment located at the potential Shaft Sites and the water main routes during each construction stage. CadnaA is based on the acoustic propagation standards promulgated in International Standard ISO 9613-2. This standard is currently under review for adoption by the American National Standards Institute as an American Standard. Geographic input data used with the CadnaA computational sound model include digitized aerial photographs and maps defining site work areas, adjacent building footprints and heights, locations of streets, and locations of sensitive receptors.

Execution of the CadnaA model included the determination of relevant x, y, and z coordinate grid points at construction noise sources and sensitive receptor locations. In addition, reflections and shielding by adjacent buildings were accounted for in the model. At each sensitive receptor location, the A-weighted sound levels were determined for each construction noise source (separately and combined) during each stage. For each construction stage, a different equipment layout was input into the model based on the construction activities and equipment used during the stage.

Sound Levels for Construction Equipment

A list of construction equipment expected to be used at the potential Shaft Sites and water main routes and the noise levels assumed in the modeling for each piece of equipment are provided in Tables 3.12-3 and 3.12-4.

Table 3.12-3
Shaft Site Construction Equipment and Noise Levels

Equipment Name	50 Foot Noise Level Leq (dBA)
Rock Drill	90
Concrete Truck	85
Pneumatic hammer	83
Jackhammer	83
Rock Drill (Jack)	83
Backhoe	81
Pile Drilling Rig	81
Excavator	80
FE Loader	79
Dump Truck at Idle	76
Flatbed Truck at Idle	76
Derrick Crane	75
Telescoping Crane	82
Compactor	73
Welder	70
Saw, electric	70
Compressor, NYC	60
Raise Bore Machine	54
Concrete Pump	53

Table 3.12-4
Water Main Construction
Equipment and Noise Levels

Equipment Name	50 Foot Noise Level Leq (dBA)
Pavement Cutter	93
Jackhammer	83
Compressor, NYC	60
Paver	84
Excavator	81
Dump Truck at Idle	76
Dewatering Pump	73
Flatbed Truck at Idle	76
Concrete Truck	85
Payloader	79
Soil Compactor	73
Telescoping Crane	82
Welder	70
Saw, gas	72
Pavement Cutter	93

The method used to develop these noise levels is detailed in a number of sources.[1] Equipment noise levels were derived by obtaining the maximum sound level expected during full throttle operation and the amount of time the equipment is typically operated at full throttle.

In addition to the equipment listed above, pavement cutters and pavers would be used for only a few days during shaft construction. Although this equipment produces high noise levels, due to the very short duration that they would be used, they are discussed qualitatively.

Equipment Utilization Rates

Another input parameter in the CadnaA model is equipment utilization factor (percentage of time equipment is used). At each project site, a utilization factor was developed for each piece of equipment operating during each construction stage.

As discussed above, an 8-hour average period and a reasonable worst -case peak period were analyzed for each stage of construction and different equipment utilization rates were assumed for each. The average period analysis conservatively assumes that all the equipment to be used during a given stage would be used for some amount of time over an 8-hour shift. The peak period analysis is based on a smaller mix of equipment that would typically operate at the same

[1] Bolt, Beranek and Newman, Inc. 1976. *Prediction of Noise From Power Plant Construction*. Prepared for Empire State Electric Energy Research Corporation.

United States Environmental Protection Agency. 1971. *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances*. Prepared by Bolt, Beranek and Newman, Inc.

time over one or more peak hours of a shift. The equipment utilization rate for each piece of equipment in the peak period is assumed to be 75 percent (i.e. would be operating 75 percent of the time or 45 minutes of the hour). The only exception is the raise bore machine; the utilization rate for this equipment was assumed to be 80 percent based on the more continuous operation of the equipment. See Appendix 12 for equipment utilization rates assumed in the average and peak period analyses.

To illustrate the differences between the two utilization rates, assume an excavator is expected to be operating for two hours of each 8-hour shift during Stage 1. The average period analysis assumes a 25 percent equipment utilization rate of the shift. The peak period analysis assumes that during the two hours the excavator is operating, it operates 75 percent of the time in each hour.

Operation

As discussed above, during operation of the shaft, noise generating equipment including pumps and motorized valves would be below ground and would not generate significant above-ground noise emissions during normal operations. Activation would involve minimal noise-generating activity for a short time period (approximately one month). Therefore, no quantitative analysis for the operation of the shaft is warranted and the operational condition is discussed qualitatively.

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