4.11 Noise

This section describes the existing noise conditions of the 123 Independence Drive Residential Project (project) site and vicinity, identifies associated regulatory requirements, evaluates potential impacts, and identifies mitigation measures related to implementation of the project.

As discussed in Chapter 2, Introduction, and Section 4.0, Environmental Analysis, two Notices of Preparation (NOPs) were circulated for this environmental impact report (EIR), one in January and February 2021, and one in September and October 2021. The Sequoia Union High School District submitted a comment letter raising concern about possible traffic noise impacts to local schools. Both NOPs and the comments received in response to them are provided in Appendix A of this EIR.

The primary sources reviewed to prepare this section include the ConnectMenlo General Plan Update (City of Menlo Park 2016a), the ConnectMenlo General Plan Update Draft EIR (City of Menlo Park 2016b), the ConnectMenlo General Plan Update Final EIR (City of Menlo Park 2016c), and the Noise Calculations and Specifications prepared by Dudek in September 2022 (Appendix G).

4.11.1 Environmental Setting

Characteristics of Environmental Noise

Fundamentals of Acoustics

Noise is generally defined as loud, unpleasant, unexpected, or undesired sound that disrupts or interferes with normal human activities. Although exposure to high noise levels over an extended period has been demonstrated to cause hearing loss, the principal human response to noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise, the perceived importance of the noise, its appropriateness in the setting, the time of day, the type of activity during which the noise occurs, and the sensitivity of the individual.

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Sound is generally characterized by a number of variables including frequency and level. Frequency describes the sound's pitch and is measured in Hertz (Hz), while intensity describes the sound's loudness and is measured in decibels (dB). Decibels are measured using a logarithmic scale. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above approximately 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels. The minimum change in the sound level of individual events that an average human ear can detect is approximately 3 dB. An increase (or decrease) in sound level of approximately 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness, this relation holds true for loud sounds and for quieter sounds.

Because of the logarithmic nature of the decibel unit, sound levels cannot be added or subtracted directly and are somewhat cumbersome to handle mathematically. However, some simple rules of thumb are useful in dealing with sound levels. First, if a sound's source is doubled, the sound level increases by 3 dB, regardless of the initial sound level. Thus, for example:

60 dB + 60 dB = 63 dB, and
80 dB + 80 dB = 83 dB

Hertz is a measure of how many times each second the crest of a sound pressure wave passes a fixed point. For example, when a drummer beats a drum, the skin of the drum vibrates a number of times per second. A particular tone that makes the drum vibrate 100 times per second generates a sound pressure wave that is oscillating at 100 Hz; this pressure oscillation is perceived as a tonal pitch of 100 Hz. Sound frequencies between 20 Hz and 20,000 Hz are within the range of sensitivity of the human ear.

Sound from a tuning fork (a pure tone) contains a single frequency. In contrast, most sounds one hears in the environment consist of a broad band of frequencies differing in sound level. The method commonly used to quantify environmental sounds consists of evaluating all of the frequencies of a sound according to a weighting system that reflects the fact that human hearing is less sensitive at low frequencies and extremely high frequencies than at the mid-range frequencies. This is called "A" weighting, and the decibel level measured is called the A-weighted sound level (dBA). In practice, the level of a noise source is conveniently measured using a sound level meter that includes a filter corresponding to the dBA curve, which de-emphasizes low and high frequencies of sound in a manner similar to the human ear.

Although the A-weighted sound level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from several sources that creates a relatively steady background noise in which no particular source is identifiable. A single descriptor called the equivalent sound level (L_{eq}) represents the "equivalent" constant sound level that would have to be produced by a given source to equal the fluctuating level measured. L_{eq} is the mean A-weighted sound level during a measured time interval. In addition, it is often desirable to know the acoustic range of the noise source being measured. This is accomplished through the L_{max} and L_{min} indicators. They represent the maximum and minimum noise levels measured.

To describe the time-varying character of environmental noise, the statistical noise descriptors L_{10}, L_{50}, and L_{90} are commonly used. They are the noise levels equaled or exceeded during 10 percent, 50 percent, and 90 percent of a stated time. Sound levels associated with the L_{10} typically describe transient or short-term events, while levels associated with the L_{90} describe the steady-state (or most prevalent) noise conditions.

Another sound measure known as the day/night average noise level (L_{dn}) is defined as the A-weighted average sound level for a 24-hour day. It is calculated by adding a 10 dBA penalty to sound levels in the night (10 p.m. to 7 a.m.) to compensate for the increased sensitivity to noise during the quieter evening and nighttime hours. The L_{dn} measure is used by agencies such as the U.S. Department of Housing and Urban Development and the State of California to define acceptable land use compatibility with respect to noise.

Community Noise

Community noise is commonly described in terms of the "ambient" noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}), over a given time period (usually 1 hour). The L_{eq} is the foundation of the day/night average noise descriptor (L_{dn})and shows very good correlation with community response to noise for the average person.

The L_{dn} is based on the average noise level over a 24-hour day, with a +10 dB weighting applied to noise occurring during nighttime (10 p.m. to 7 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment. Where short-term noise sources are an issue, noise impacts may be assessed in terms of maximum noise levels, hourly averages, or other statistical descriptors.

Perception of Loudness

The perceived loudness of sounds and corresponding reactions to noise are dependent on many factors, including sound pressure level, duration of intrusive sound, frequency of occurrence, time of occurrence, and frequency content. As mentioned above, however, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighing the frequency response of a sound level meter by means of the standardized A-weighing network. Table 4.11-1 shows examples of noise levels for several common noise sources and environments.

Table 4.11-1. Typical Sound Levels in the Environment and Industry

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
—	110	Rock band
Jet flyover at 300 meters (1,000 feet)	100	—
Gas lawn mower at 1 meter (3 feet)	90	—
Diesel truck at 15 meters (50 feet), at 80 kph (50 mph)	80	Food blender at 1 meter (3 feet) Garbage disposal at 1 meter (3 feet)
Noisy urban area, daytime gas lawn mower at 30 meters (100 feet)	70	Vacuum cleaner at 3 meters (10 feet)
Commercial area, heavy traffic at 90 meters (300 feet)	60	Normal speech at 1 meter (3 feet)
Quiet urban daytime	50	Large business office Dishwasher, next room
Quiet urban nighttime	40	Theater, large conference room (background)
Quiet suburban nighttime	30	Library
Quiet rural night time	20	Bedroom at night, concert hall (background)
—	10	Broadcast/recording studio
Lowest threshold of human hearing	0	Lowest threshold of human hearing

Source: Caltrans 2013.
Notes: dBA = A-weighted decibels; kph = kilometers per hour; mph = miles per hour.

Sound Propagation

It is commonly understood that sound decreases with distance. However, the propagation of sound is dependent on considerably more variables than distance alone. Those variables include the type of noise source (point, moving point, or line sources), the directionality of the noise source, the frequency content of the source (low frequency sound is absorbed in the atmosphere at a slower rate than high-frequency sound and therefore carries farther), atmospheric conditions (wind, temperature, humidity, gradients), ground type (e.g., dirt, grass fields, concrete), shielding (structures, noise barriers, topography), and vegetation.

For the purposes of assessing noise sources within the project site, traffic on public roadways is considered a "moving point" source. The sound level decay rate for this type of source is 4.5 dB per doubling of distance from the source.

Psychological and Physiological Effects of Noise

Human reactions to noise can vary based on the setting, time of day, and sound level. At lower sound levels, noise that is perceived as excessive can cause annoyance and interference with typical activities, such as conversation, using radio or television, and sleeping. At higher sound levels, physiological effects can occur. Specifically, prolonged noise exposure in excess of 75 dBA increases body tensions which can affect blood pressure and functions of the heart and nervous system. Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA, and extended periods of noise exposure above 90 dBA results in permanent cell damage. This is the primary reason for federal and state regulations for employee hearing protection in the workplace.

Vibration

According to the Federal Transit Administration's (FTA's) Noise and Vibration Impact Assessment Guidelines (FTA 2018), groundborne vibration can be a serious concern for nearby neighbors of a transit system route or maintenance facility, causing buildings to shake and rumbling sounds to be heard. Some common sources of groundborne vibration are trains, buses on rough roads, and construction activities such as blasting, pile driving, and operating heavy earth-moving equipment.

The effects of groundborne vibration include "feelable" movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by only a small margin. A vibration level that causes annoyance will be well below the damage threshold for normal buildings.

Vibration can be described in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration measures in terms of peak particle velocities (PPV) (inches/second). Table 4.11-2 shows expected responses to different levels of groundborne vibration.

Table 4.11-2. Effects of Various Vibration Levels on Buildings

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.20	0.10
Historic and some old buildings	0.50	0.25
Older residential structures	0.50	0.30
New residential structures	1.00	0.50
Modern industrial/commercial buildings	2.00	0.50

Source: Caltrans 2013.
Notes: PPV = peak particle velocity; in/sec = inches per second.

Noise and Vibration Sensitive Receptors

Certain land uses are particularly sensitive to noise and vibration, including residential, school, and open space/recreation areas where quiet environments are necessary for enjoyment, public health, and safety. Sensitive receptors in the vicinity of the project site include Hotel Nia, located directly south of the project site, and TIDE Academy, approximately 0.2 miles to the east.

Existing Noise Sources

The Bayfront Area is developed with commercial, light industrial and some institutional land uses. Noise sources within the Bayfront Area include heating, ventilation, and air conditioning systems, loading docks, trash compactors, and machinery required for manufacturing or other industrial processes.

The project site is exposed to noise from major roadways within and surrounding the Bayfront Area, including US 101, State Route 84 (Bayfront Expressway), and Marsh Road. It is also exposed to noise from the adjacent streets, Independence Drive, Constitution Drive, and Chrysler Drive, which carry truck traffic associated with commercial and industrial land uses in the Bayfront Area.

Although there are several airports and airfields in the communities surrounding the City, none of these facilities are located within 2 miles of the project site, and the site does not fall within the airport land use planning areas, runway protection zones, or the 55 dBA community noise equivalent level (CNEL) noise contours of any of these facilities.

Existing Ambient Noise Levels

Sound level measurements were conducted from November 16, 2021, to November 17, 2021, to document the existing noise environment adjacent to the project area to establish baseline noise conditions against which to compare proposed project noise levels. Specific consideration was given to document noise levels in the vicinity of nearby noise-sensitive receptors and existing periodic noise source levels. All noise measurements were performed in accordance with American National Standards Institute (ANSI) and American Standards for Testing and Measurement (ASTM) guidelines, at three locations in proposed project area, as shown on Figure 4.11.1.

Noise measurements were performed using SoftdB Picollo II, Type 2 integrating sound level meters (SLMs). Field calibrations were performed on the SLMs with an acoustic calibrator before and after the measurements. All instrumentation components, including microphones, preamplifiers and field calibrators have laboratory certified calibrations traceable to the National Institute of Standards and Technology. The equipment used meets all pertinent specifications of the ANSI for Type 2 SLMs (ANSI S1.4-1983 [R2006]). Meteorological conditions during the monitoring periods were fair with temperatures ranging from 59 to 63 degrees Fahrenheit (F), light winds were 0 to 7 mph, and partly cloudy skies during the November 16th short-term monitoring surveys. During the November 16th through 17th, long-term monitoring period temperatures ranged from approximately 46 to 68 degrees F, with winds from 0 to 8 mph, and partly cloudy skies. No precipitation was experienced during the monitoring periods.

Long-term noise monitoring (24 hour) was performed at one location in the project area, from November 16, 2021, to November 17, 2021, adjacent to the project boundary. The long-term noise monitoring equipment was configured to operate in a continuous manner, cataloging all noise metrics pertinent to identification and evaluation of noise levels (i.e., L_{eq}, L_{max}, Ln, etc.) in the project vicinity.

Short-term noise monitoring was conducted at two locations to characterize noise levels generated from traffic and to provide additional insight into the existing ambient noise environment. Site ST-1 was located at the approximate setback distance of the Hotel Nia pool area from Highway 101. Site ST-2 was located at the northern corner of the TIDE Academy, Sequoia Union Highschool. Short-term monitoring at location ST-1 included concurrent manual traffic counts and vehicle classification during the measurement period to aid in quantifying traffic noise levels. Monitoring equipment was configured to catalog pertinent noise metrics as identified above. Ambient noise levels recorded at the noise monitoring locations are presented in Table 4.11 3 and shown in Figure 4.11-1.

Table 4.11-3. Existing Noise Measurements

Site	Location	Date/ Time[1]	L_{dn}	Measured Noise Levels (dBA)					
				Daytime			Nighttime		
				L_{eq}	L_{max}	L90	L_{eq}	L_{max}	L90
LT-1	Southwestern portion of the project, adjacent to Independence Dr.	11/16/21 2:00 p.m.	68.0	62.9	75.8	60.3	61.3	74.4	57.6
ST-1	Approximate setback of Hotel Nia pool area	11/16/21 2:05 p.m.	69.7[2]	64.1	68.7	62.7	–	–	–
ST-2	Northern corner of the TIDE Academy, Sequoia Union Highschool	11/16/21 3:50 p.m.	59.9[2]	58.2	70.5	51.9	–	–	–

Source: Collected by Dudek 2021.
Note: dBA = A-weighted decibel; L_{dn} = Day/night average sound level.
1 Long-term measurement was for a duration of 24-hours, Short-term measurements were performed for a duration of 15-minutes.
2 L_{dn} values for short-term measurement locations are calculated based on the offset from the long-term data.

The primary noise source affecting the long-term noise monitoring location was vehicular traffic on the regional roadway network (e.g., Hwy 101, SR 84). Additional noise sources experienced during noise-monitoring included emergency vehicles, pedestrians conversing, and distant aircraft overflights. Ambient noise level exposure at the long-term monitoring location was dependent on the relative distance from nearby roadways to noise measurement location and shielding provided by nearby existing structures. During the long-term noise monitoring, the average day-night (L_{dn}) noise level was approximately 68 dBA L_{dn}. The existing ambient noise levels at the long-term monitoring location was found to exceed the City of Menlo Park General Plan "normally acceptable" land use noise compatibility guidelines and fall within the "conditionally acceptable" noise exposure for residential land uses.

Short-term noise levels measured at location ST-1 experienced average noise levels of approximately 69.7 dBA L_{eq}, with background ambient (L90) noise levels of approximately 62.7 dBA L90 and maximum noise levels of 68.7 dBA Lmax. Noise level exposure at site ST-1 was primarily driven by vehicular traffic on Highway 101, with distant aircraft and vehicles accessing the hotel parking lot contributing to a lesser degree.

Short-term noise levels measured at location ST-2 experienced average noise levels of approximately 58.2 dBA L_{eq}, with background ambient (L90) noise levels of approximately 51.9 dBA L90 and maximum noise levels of 70.5 dBA Lmax. Noise level exposure at site ST-2 was also primarily driven by vehicular traffic on Highway 101, but experiences substantial shielding provided by surrounding buildings, with pedestrians and distant aircraft contributing to a lesser degree.

Existing Traffic Noise

Existing traffic noise levels were modeled for roadway segments in the project vicinity based on the Federal Highway Administration (FHWA) Highway Traffic Noise Model 2.5 (TNM 2.5) prediction methodologies (FHWA

2004), and traffic data provided in the traffic analysis prepared for the project (Appendix J1) and the most recent California Department of Transportation traffic count data. The FHWA TNM 2.5 incorporates state-of-the-art sound emissions and sound propagation algorithms, based on well-established theory and accepted international standards. The acoustical algorithms contained within the FHWA TNM 2.5 have been validated with respect to carefully conducted noise measurement programs and show excellent agreement in most cases for sites with and without noise barriers. The noise modeling accounted for factors such as vehicle volume, speed, vehicle type, roadway configuration, distance to the receiver, and propagation over different types of ground (acoustically soft and hard ground).

Modeled existing traffic noise levels are summarized in Table 4.11-4, at the building facades and the outdoor activity area of noise-sensitive receptors in proximity to the respective roadway segment. The extent to which existing land uses in the project vicinity are affected by existing traffic noise depends on their respective proximity to the roadways, shielding provided by intervening objects and their individual sensitivity to noise. As shown in Table 4.11-5, existing traffic noise levels within outdoor activity areas of noise-sensitive land uses adjacent to major roadway segments in the project vicinity ranged from approximately 47 to 64 dBA L_{dn}.

Table 4.11-4. Modeled Existing Traffic Noise Levels

No.	Description	Modeled Noise Levels (dBA)	
		L_{eq}	L_{dn}
P1	LT1 – Western project site	63.8	66.3
P2	ST1 – Adjacent to Hotel Nia Western Façade and Pool Area	71.2	73.7
P3	ST2 – TIDE Academy, Sequoia Union Highschool	62.5	65.0
P4	Hotel Nia Pool Area (within barrier)	62.4	64.9
P5	Hotel Nia Northeastern Façade	55.5	58.0
P6	Elan Apartments Western Façade	66.5	69.0
P7	Elan Outdoor Activity Area	50.0	52.5
P8	Menlo Portal Eastern Façade	59.1	61.6
P9	Menlo Portal Eastern Outdoor Activity Area	59.1	61.6

Source: Collected by Dudek 2022.
Note: dBA = A-weighted decibel; L_{eq} = equivalent hourly average noise level; L_{dn} = Day/night average sound level.
1 Receiver locations are shown on Figure 4.11-2.

Existing Vibration

The existing vibration environment, similar to that of the noise environment, is dominated by transportation-related vibration from roadways adjacent to the proposed project area. Heavy truck traffic can generate groundborne vibration, which varies considerably depending on vehicle type, weight, and pavement conditions. However, groundborne vibration levels generated from vehicular traffic are not typically perceptible outside of the roadway right-of-way.

4.11.2 Regulatory Framework

Federal Regulations

Federal Noise Control Act

The U.S. Environmental Protection Agency (EPA) Office of Noise Abatement and Control was originally established to coordinate federal noise control activities. After its inception, the EPA Office of Noise Abatement and Control issued the Federal Noise Control Act of 1972, establishing programs and guidelines to identify and address the effects of noise on public health, welfare, and the environment. In 1981, EPA administrators determined that subjective issues such as noise would be better addressed at more local levels of government and responsibilities for regulating noise control policies were transferred to state and local governments. Thus, there are no federal noise regulations directly applicable to the proposed project.

However, noise control guidelines and regulations contained in the EPA rulings in prior years are still adhered to by designated federal agencies where relevant and are often relied upon in noise impact analyses conducted in California. This includes EPA guidelines regarding noise levels identified as a requisite to protect public health and welfare related to noise in its document entitled “Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.” This document notes that the guidance provided therein was based on the best available information at the time, and that more investigations and analysis was needed. Additional research has been conducted since that document was prepared. Current guidance from the National Institutes of Health provides that “sounds of less than 75 decibels, even after long exposure, are unlikely to cause hearing loss. However, long or repeated exposure to sounds at or above 85 decibels can cause hearing loss” (NIH 2016).

Federal Interagency Committee on Noise

In order to determine a significant increase in noise exposure from the existing conditions to existing plus project condition or cumulative to cumulative plus project, the values in Table 4.11-5 are used as recommendations based on studies by the Federal Interagency Committee on Noise (FICON). The FICON studies assessed the annoyance effects of changes in ambient noise levels resulting from aircraft operations. The 2000 FICON findings provide some guidance as to the significance of changes in ambient noise levels due to transportation noise sources. The FICON recommendations are based on studies that relate aircraft and traffic noise levels to the percentage of persons highly annoyed by the noise. Annoyance is a summary measure of the general adverse reaction of people to noise that interferes with speech and conversation, sleep, or the desire for a tranquil environment.

The rationale for the FICON recommendations is that it is possible to consistently describe the annoyance of people exposed to transportation noise in terms of L_{dn}. The changes in noise exposure relative to existing noise levels, as shown in Table 4.11-5, are considered to be changes that are sufficient to cause annoyance and potentially to interfere with normal activities at sensitive land uses. Although the FICON recommendations were specifically developed to address aircraft noise impacts, they are used in this analysis for traffic noise described in terms of L_{dn}.

As shown in Table 4.11-5, an increase in noise from similar sources of 5 dB or more would be noticeable where the ambient level is less than 60 dBA. Where the ambient level is between 60 and 65 dBA, an increase in noise of 3 dB or more would be noticeable, and an increase of 1.5 dB or more would be noticeable where the ambient noise level exceeds 65 dBA L_{dn}. The rationale for the criteria shown in Table 4.11-5 is that, as ambient noise levels increase, a smaller increase in noise resulting from a project would be noticeable.

Table 4.11-5. Measures of Substantial Increase for Transportation Noise Exposure

Ambient Noise Level Without Project	Significant Impact Occurs if the Project Increases Ambient Noise Levels by:
<60 dBA	+ 5 dB or more
<60–65 dBA	+ 3 dB or more
>65 dBA	+ 1.5 dB or more

Source: FICON 2000.
Notes: dBA = A-weighted decibel; dB = decibel.

State Regulations

California Noise Control Act of 1973

Sections 46000 through 46080 of the California Health and Safety Code, known as the California Noise Control Act of 1973, declares that excessive noise is a serious hazard to the public health and welfare and that exposure to certain levels of noise can result in physiological, psychological, and economic damage. It also identifies a continuous and increasing bombardment of noise in the urban, suburban, and rural areas. The California Noise Control Act declares that the State of California has a responsibility to protect the health and welfare of its citizens by the control, prevention, and abatement of noise. It is the policy of the state to provide an environment for all Californians free from noise that jeopardizes their health or welfare.

Governor's Office of Planning and Research General Plan Guidelines

The Governor's Office of Planning and Research published the State of California General Plan Guidelines (OPR 2003), which provides guidance for the acceptable noise level exposure for various types of land uses, as summarized in Table 4.11-6. The guidelines also present adjustment factors that may be used to help craft noise acceptability standards that reflect the noise control goals of the community, the particular community's sensitivity to noise, and the community's assessment of the relative importance of noise pollution.

Table 4.11-6. Summary of Land Use Noise Compatibility Guidelines

	Community Noise Exposure (dBA L_{dn})			
Land Use Category	Normally Acceptable[1]	Conditionally Acceptable[2]	Normally Unacceptable[3]	Clearly Unacceptable[4]
Residential—Low-Density Single-Family, Duplex, Mobile Home	<60	55–70	70–75	75+
Residential—Multifamily	<65	60–70	70–75	75+
Transient Lodging—Motel, Hotel	<65	60–70	70–80	80+
Schools, Libraries, Churches, Hospitals, Nursing Homes	<70	60–70	70–80	80+
Auditoriums, Concert Halls, Amphitheaters	—	<70	65+	—
Sports Arena, Outdoor Spectator Sports	—	<75	70+	—
Playgrounds, Neighborhood Parks	<70	—	67.5–75	72.5+
Golf Courses, Riding Stables, Water Recreation, Cemeteries	<75	—	70–80	80+

Table 4.11-6. Summary of Land Use Noise Compatibility Guidelines

Land Use Category	Community Noise Exposure (dBA L_{dn})			
	Normally Acceptable[1]	Conditionally Acceptable[2]	Normally Unacceptable[3]	Clearly Unacceptable[4]
Office Building, Business Commercial, and Professional	<70	67.5–77.5	75+	—
Industrial, Manufacturing, Utilities, Agriculture	<75	70–80	75+	—

Source: OPR 2003.
Notes: dBA = A-weighted decibels; L_{dn} = day-night average noise level.
1 Specified land use is satisfactory, based on the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
2 New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.
3 New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design. Outdoor areas must be shielded.
4 New construction or development should generally not be undertaken.

Generally, residential uses are considered to be acceptable in areas where exterior noise levels do not exceed 60 dBA L_{dn}. Residential uses are normally unacceptable in areas exceeding 70 dBA L_{dn} and conditionally acceptable within 55 to 70 dBA L_{dn}. Schools are normally acceptable in areas up to 70 dBA L_{dn} and normally unacceptable in areas exceeding 70 dBA L_{dn}. Commercial uses are normally acceptable in areas up to 70 dBA L_{dn}. Between 67.5 and 77.5 dBA L_{dn}, commercial uses are conditionally acceptable, depending on the noise insulation features and the noise reduction requirements.

Caltrans Guideline– Vibration Damage Potential Threshold Criteria

There are no state standards for vibration; however, California Department of Transportation (Caltrans) compiled a synthesis of research on the effects of vibration with thresholds ranging from 0.08 in/sec PPV to 4.0 in/sec PPV for “fragile historic buildings” and “structures of substantial construction,” respectively. Based on the synthesis of research, Caltrans developed recommendations for guideline threshold criteria of 0.3 in/sec PPV for older residential structures and 0.25 in/sec PPV for historic buildings and some old buildings exposed to continuous/frequent intermittent sources. For extremely fragile historic buildings, ruins, and ancient monuments, Caltrans recommends a threshold of 0.08 in/sec PPV (Caltrans 2020).

State of California Building Code

The California Building Code (CBC), which is located in Part 2 of Title 24 of the California Code of Regulations (CCR), provides standards for building design, including noise insultation standards. The CBC is updated every 3 years. The 2019 CBC has been adopted for use by the City of Menlo Park, according to Section 12.04.010 of the City’s Municipal Code. For new residential dwellings, the CBC defines the acceptable interior noise limit as 45 dBA CNEL or L_{dn}. Where buildings would be exposed to more than 60 dBA CNEL, the CBC requires that an acoustical study be completed to demonstrate that the structure has been designed with sufficient noise control measures to limit interior noise in habitable rooms to acceptable noise levels.

California Department of Transportation – Vibration

There are no state standards or regulations for vibration; however, the California Department of Transportation (Caltrans) has developed a compendium of research to use as the basis for recommendations that can serve as a quantified standard in the absence of such limits at the local jurisdictional level. In the Transportation and Construction Vibration Guidance Manual, Caltrans recommends a vibration velocity threshold of 0.2 in/sec PPV for assessing "annoying" vibration impacts to occupants of residential structures. For the protection from structural damage Caltrans recommends a threshold of 0.3 in/sec PPV for older residential structures and 0.25 in/sec PPV for historic building and some old buildings (Caltrans 2020).

Regional and Local Regulations

City of Menlo Park General Plan

The City's General Plan Noise Element contains the following goals and policies related to the evaluation of the project's noise impacts.

Goal N-1: Achieve acceptable noise levels.

> Policy N-1.1: Compliance with Noise Standards. Consider the compatibility of proposed land uses with the noise environment when preparing or revising community and/or specific plans. Require new projects to comply with the noise standards of local, regional, and building code regulations, including but not limited to the City's Municipal Code, Title 24 of the California Code of Regulations, and subdivision and zoning codes.

> Policy N-1.2: Land Use Compatibility Noise Standards. Protect people in new development from excessive noise by applying the City's Land Use Compatibility Noise Standards for New Development[1] to the siting and required mitigation for new uses in existing noise environments.

> Policy N-1.4: Noise Sensitive Uses. Protect existing residential neighborhoods and noise sensitive uses from unacceptable noise levels and vibration impacts. Noise sensitive uses include, but are not limited to, hospitals, schools, religious facilities, convalescent homes and businesses with highly sensitive equipment. Discourage the siting of noise-sensitive uses in areas in excess of 65 dBA CNEL without appropriate mitigation and locate noise sensitive uses away from noise sources unless mitigation measures are included in development plans.

> Policy N-1.6: Noise Reduction Measures. Encourage the use of construction methods, state-of-the-art noise abating materials and technology and creative site design including, but not limited to, open space, earthen berms, parking, accessory buildings, and landscaping to buffer new and existing development from noise and to reduce potential conflicts between ambient noise levels and noise-sensitive land uses. Use sound walls only when other methods are not practical or when recommended by an acoustical expert.

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1 Menlo Park General Plan Land Use Compatibility Noise Standards chart is consistent with the California OPR land use compatibility noise standards presented in Table 4.11-5.

Policy N-1.8: Potential Annoying or Harmful Noise. Preclude the generation of annoying or harmful noise on stationary noise sources, such as construction and property maintenance activity and mechanical equipment.

Policy N-1.10: Nuisance Noise. Minimize impacts from noise levels that exceed community sound levels through enforcement of the City's Noise Ordinance. Control unnecessary, excessive and annoying noises within the City where not preempted by Federal and State control through implementation and updating of the Noise Ordinance.

Policy N-1.D: Minimize Construction Activity Noise. Minimize the exposure of nearby properties to excessive noise levels from construction-related activity through CEQA [California Environmental Quality Act] review, conditions of approval and enforcement of the City's Noise Ordinance.

City of Menlo Park Municipal Code

Chapter 8.06 of the City's Municipal Code contains noise limitations and exclusions for land uses within the City. This Chapter concerns noise limits that constitute a noise disturbance, measured primarily at residential land uses. It also specifies standard procedures for conducting noise measurements, with specifications for sound-meter settings and placement. In addition, Municipal Code Chapter 16, Zoning, regulates noise associated with roof-mounted equipment. The following Municipal Code sections govern the analysis of the project's potential noise impacts.

8.06.030 Noise Limitations

Except as otherwise permitted in this chapter, any source of sound in excess of the sound-level limits set forth in Section 8.06.030 shall constitute a noise disturbance. For purposes of determining sound levels from any source of sound, sound level measurements shall be made at a point on the receiving property nearest where the sound source at issue generates the highest sound level.

1. For all sources of sound measured from any residential property:
   a. "Nighttime" hours (10:00 p.m. to 7:00 a.m.) – 50 dBA
   b. "Daytime" hours (7:00 a.m. to 10:00 p.m.) – 60 dBA

8.06.040 Exceptions

a. Construction Activities
   1. Construction activities between the hours 8:00 a.m. and 6:00 p.m. Monday through Friday.
   2. Notwithstanding any other provisions set forth above, all powered equipment shall comply with the limits set forth in Section 8.06.040 (b).

b. Powered Equipment
   1. Powered equipment used on a temporary, occasional, or infrequent basis operated between the hours of 8:00 a.m. and 6:00 p.m. Monday through Friday. No piece of equipment shall generate noise in excess of 85 dBA at 50 feet.

c. Deliveries
   1. Deliveries to food retailers and restaurants.

2. Deliveries to other commercial and industrial businesses between the hours of 7:00 a.m. and 6:00 p.m. Monday through Friday and 9:00 a.m. to 5:00 p.m. Saturdays, Sundays, and holidays.

8.06.050 Exemptions

a. Sound Generated by Motor Vehicles. Sound generated by motor vehicles, trucks, and operated on streets and highways; aircraft, trains; and other public transportation.
   1. This exemption shall not apply to the operation of any vehicle (such as attached refrigeration and/or heating units or any attached auxiliary equipment) for a period in excess of 10 minutes in any hour while the vehicle is stationary, for reasons other than traffic congestion.

16.08.095 Roof-mounted equipment.

Mechanical equipment, such as air-conditioning equipment, ventilation fans, vents, ducting, or similar equipment, may be placed on the roof of a building, provided that such equipment is screened from view as observed at an eye level horizontal to the top of the roof-mounted equipment, except for the SP-ECR/D district, which has unique screening requirements, and all sounds emitted by such equipment shall not exceed fifty (50) decibels at a distance of fifty (50) feet from such equipment (Ord. 979, Section 3 (part), 2012: Ord.819 Section 1 (part), 1991).

4.11.3 Thresholds of Significance

The significance criteria used to evaluate the project impacts related to noise are based on Appendix G and Section 15130 of the CEQA Guidelines. A significant impact related to noise would occur if the project would:

A. Result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
B. Result in generation of excessive groundborne vibration or groundborne noise levels.
C. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels.
D. Result in cumulatively considerable noise impacts.

Methods of Analysis

Construction Noise

Construction-related noise effects were assessed with respect to nearby noise-sensitive receptors and their relative exposure (accounting for intervening topography, or barriers), based on application of FHWA Roadway Construction Noise Model and FTA reference noise level data, usage-factors and calculation methods. Construction noise was modeled for the various construction stages, based on information provided by the project proponent on the equipment that is anticipated to be used during a given stage of construction. Combining the noise level from the two or three loudest pieces of equipment and assuming they are all operating very close to one another and very near the closest offsite sensitive receptor results in a reasonably representative worst-case combined noise level.

Construction noise taking place from 8:00 a.m. to 6:00 p.m. is considered exempt from the general quantitative noise standards of the City, except for the noise limit on individual powered equipment of 85 dBA at 50 feet. An analysis to determine if equipment proposed for project construction would comply with this threshold is also included. In addition, despite the exemption for daytime construction noise, construction activities that are exempt from specified noise limitations in the Menlo Park Municipal Code could still result in a significant physical impact on the environment. Therefore, construction noise generated during daytime hours is compared to the existing ambient noise level to estimate temporary increases in noise over the existing ambient level. An evaluation is conducted to determine if a 10 dB increase over the existing ambient noise, perceived as a doubling of loudness, would be expected to occur at nearby noise-sensitive land uses.

Traffic Noise Impact Assessment

Traffic noise modeling involved the calculation of baseline and cumulative traffic noise levels along roadway segments where the proposed project elements would contribute additional vehicle trips, based on traffic data developed as part of the traffic analysis prepared for the project (Appendix J1). Traffic noise levels were calculated based on the FHWA TNM 2.5 prediction algorithms (FHWA 2004). Traffic noise levels were modeled for Existing No Project (2022) and Existing Plus-Project conditions (2022). Modeling outputs for the Plus Project scenario were evaluated against the existing (2022) conditions to determine the potential for an increase of traffic noise levels and exceedance of applicable noise level criteria and impact thresholds.

To determine existing L_{dn} traffic noise levels in the project vicinity, the average daily traffic volumes for roadways in the immediate vicinity of the project site were used as inputs to the noise model. Traffic data was provided directly in the form of segment volumes and in the form of "peak-hour" intersection turning movement volumes (Appendix J1). Standard assumptions were used and inputs to the model were made to reflect diurnal traffic patterns and vehicle classifications (i.e., small automobiles, medium trucks, heavy trucks, motorcycles and buses).

Other Operational Noise Sources

Groundborne vibration impacts were qualitatively assessed based on existing reference documentation (e.g., vibration levels produced by specific construction equipment operations), through the application of Caltrans methodology outlined within the Transportation- and Construction- Induced Vibration Guidance Manual and the relative distance to potentially sensitive receptors from a given vibration source.

Threshold Significance Criteria Not Applicable to the Proposed Project

Private Airstrip or Public Airport

Although there are several airports and airfields in the communities surrounding the City, none of these facilities are located within 2 miles of the project site, and the site does not fall within the airport land use planning areas, runway protection zones, or the 55 dBA community noise equivalent level (CNEL) noise contours of any of these facilities.

The topic of aircraft noise from public use airports and private airstrips was discussed in the ConnectMenlo EIR as Impact NOISE-5 (page 4.10-38) and Impact NOISE-6 (page 4.10-38). It was determined that there would be no impact related to aircraft noise (City of Menlo Park 2016b).

4.11.4 Impacts and Mitigation Measures

Impact 4.11-1 Would the project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Construction Noise

The proposed project would generate noise associated with the operation of heavy construction equipment and construction related activities in the vicinity of the project area. Construction noise levels in the vicinity of the project area would fluctuate depending on the particular type, number, and duration of usage for the various pieces of equipment, as well as the relative exposure and distance between the source and receptors.

The effects of construction noise depend largely on the types of construction activities occurring on any given day, noise levels generated by those activities, distances to noise-sensitive receptors, and the existing ambient noise environment in the vicinity of the receiver. The City defines ambient noise as the average of the predominant noise source in the environment. Here, ambient noise is dependent on the average traffic noise, which is the primary contributor to the noise environment in the area of the proposed project. Construction generally occurs in several discrete stages, with each stage varying the equipment mix and the associated noise. These stages alter the characteristics of the noise environment on the project site and in the surrounding community for the duration of construction. The proposed project is anticipated to include demolition, site preparation, grading, building construction, paving and architectural coating.

To assess noise levels associated with the various equipment types and operations, construction equipment can be considered to operate in two modes, mobile and stationary. Mobile equipment sources move around a construction site performing tasks in a recurring manner (e.g., loaders, graders, dozers). Stationary equipment operates in a given location for an extended period of time to perform continuous or periodic operations (e.g., compressor or generator). Thus, it is necessary to determine the location of stationary sources during specific stages of construction, and the effective acoustical center of operations for mobile equipment during various stages of the construction process. The effective acoustical center is the idealized point from which the energy sum of all construction activity noise near and far would appear to originate. As one increases the distance between equipment and/or between areas with simultaneous construction activity, dispersion and distance attenuation reduce the effects of separate noise sources added together.

Operational characteristics of heavy construction equipment are additionally typified by short periods of full-power operation followed by periods of operation at lower power, idling, or powered-off conditions. These characteristics are accounted for through the application of typical usage factors (operational percentage) applied to the FHWA and FTA reference maximum noise levels, usage factors and resulting L_{eq}. Noise levels from various types of construction equipment is provided in Table 4.11-7.

Table 4.11-7. Noise Levels from Construction Equipment

Equipment Type	Usage Factor (%)	Noise Levels, (dBA) at 50 feet	
		L_{max}	L_{eq}
Air Compressor	40	80	76
Backhoe	40	80	76

Table 4.11-7. Noise Levels from Construction Equipment

Equipment Type	Usage Factor (%)	Noise Levels, (dBA) at 50 feet	
		L_{max}	L_{eq}
Compactor	20	80	73
Concrete Pump	20	82	75
Concrete Saw	20	90	83
Crane, Mobile	16	85	77
Dozer	40	85	81
Forklift	40	85	81
Front-End Loader	40	80	76
Generator	50	82	79
Grader	40	85	81
Mounted Impact Hammer (Hoe Ram)	20	90	83
Paver	50	85	82
Pneumatic Tools	50	85	82
Rock Drill	20	85	78
Roller	20	85	78
Scraper	40	85	81
Trucks (Flatbed)	40	84	80
Water Pump	50	77	74
Welder	40	73	69

Source: DOT 2008, FTA 2018.
Notes: dBA = A-weighted decibels; Lmax = day-night average noise level.
All equipment fitted with a properly maintained and operational noise control device, per manufacturer specifications.

The Menlo Park Municipal Code Section 8.06.040 subsections (a) and (b) addresses construction noise and states that individual pieces of construction equipment shall not exceed 85 dBA L_{eq} at a distance of 50 feet from the source. As shown in Table 4.11-7, noise from the individual pieces of equipment associated with project construction would not be expected to exceed the 85 dBA L_{eq}, 50-foot threshold. Because individual power equipment proposed for project construction would comply with this limit, impacts related to individual equipment noise exceedances would **be less than significant.**

Although specific building design and construction requirements for buildout of the project are currently unknown, it is anticipated that development of the various project elements would incorporate the use of typical construction sources such as backhoes, compressors, bulldozers, excavators, loaders and other related equipment based on assumptions provided by the project proponent. The project is not anticipated to require the use of blasting or driven piles, and where additional foundational support is necessary displacement auger cast piles will be used. Based on the reference noise levels, usage rates, and operational characteristics discussed above, overall hourly average noise levels attributable to project construction activities were calculated by construction stage and are provided in Table 4.11-8. Construction noise levels presented in Table 4.11–8 for the nearby noise sensitive receptors, based on the representative distance from the acoustical center of the proposed project construction activities to the property line of the receptor.

Table 4.11-8. Construction Noise Levels at Representative Receptor Locations

Receiver [1]		Construction Noise Level, L_{eq} dBA (increase over ambient), increase over threshold					
No.	Description	Demolition	Site Prep.	Grading	Building Const.	Paving	Arch. Coating
P2	Hotel Nia Western Façade and Pool Area, ST1 (494 feet[2])	61 (0), 0	65 (0), 0	66 (0), 0	60 (0), 0	63 (0), 0	58 (0), 0
P3	TIDE Academy, Sequoia Union Highschool, ST2 (856 feet[2])	56 (0), 0	60 (0), 0	61 (0), 0	56 (0), 0	59 (0), 0	53 (0), 0
P4	Hotel Nia Pool Area (within barrier) (441 feet[2])	62 (0), 0	66 (3.6), 0	67 (4.6), 0	61 (0), 0	64 (1.6), 0	59 (0), 0
P5	Hotel Nia Northeastern Façade (314 feet[2])	65 (9.5), 0	68 (**12.5**) 2.5	70 (**14.5**), 4.5	64 (8.5), 0	67 (**11.5**), 1.5	62 (6.5), 0
P6	Elan Apartments Western Façade (1,674 feet[2])	50 (0), 0	54 (0), 0	55 (0), 0	50 (0), 0	53 (0), 0	47 (0), 0
P7	Elan Outdoor Activity Area (1,774 feet[2])	50 (0), 0	53 (3), 0	55 (5), 0	49 (0), 0	52 (2), 0	47 (0), 0
P8	Menlo Portal Eastern Façade (124 feet[2])	73 (**14**), 4	77 (**18**), 8	78 (**19**), 9	72 (**14**), 4	75 (**16**), 6	70 (**11**), 1
P9	Menlo Portal Eastern Outdoor Activity Area (352 feet[2])	49 (0), 0	52 (0), 0	54 (0), 0	48 (0), 0	51 (0), 0	46 (0), 0

Source: Appendix H.
Notes:
dBA = A-weighted decibels; L_{eq} = equivalent hourly average noise level.
1 Receiver locations are shown on Figure 4.11-2.
2 Approximate distance from acoustical center of construction site to the noise sensitive land use (NSLU).
3 Bold indicates a noise level that will increase ambient conditions by more than 10 dBA.

As indicated in Table 4.11-8, noise levels for project construction activity are predicted to generate noise levels ranging from approximately 47 to 78 dBA L_{eq} at the nearest noise-sensitive receptors surrounding the project. The construction noise modeling indicates that the grading stage of the proposed project would have the potential to produce the highest sound levels, ranging from 55 to 78 dBA L_{eq} at nearby sensitive receptors. The Municipal Code provides an exception for construction activities performed between the hours of 8:00 a.m. and 6:00 p.m. Monday through Friday. The ConnectMenlo EIR found that construction noise effects would be less than significant when these construction hours are maintained and other typical construction noise control measures are implemented, as required under ConnectMenlo EIR Mitigation Measure (MM) NOISE-1b. However, while the majority of the construction activities are anticipated to be performed during these exempt hours, it is unknown what construction activities may be necessary during non-exempt time periods. Noise levels generated during these non-exempt hours would be subject to the Menlo Park Municipal Code noise limits of 60 dBA L_{eq} threshold during the hours of 7:00 a.m. to 10:00 p.m. and 50 dBA L_{eq} threshold during the hours of 10:00 p.m. to 7:00 a.m. As the modeled construction noise levels would exceed the City of Menlo Park exterior noise level standards during non-exempt time periods, construction noise impacts would be **potentially significant**.

In addition to the Municipal Code absolute noise level thresholds, the construction activities must be evaluated to determine if they would result in a significant increase over the ambient noise levels. This analysis is performed by comparing the modeled construction noise levels at the nearby noise-sensitive receivers to the estimated existing ambient noise levels at the respective receivers. The increase resulting from the modeled construction noise levels over the ambient is provided in Table 4.11-8, in parathesis for each receiver location and construction stage. As shown, the construction activities are calculated to result in increases over ambient ranging from 0 to 19 dBA.

As described previously, human sound perception is such that a change in sound level 3 dB is barely noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as doubling or halving the sound level as it increases or decreases, respectively. Therefore, an increase in noise of 10 dB or more would be considered substantial. The outdoor activity areas of the nearby noise-sensitive receptors would experience changes of 0 to 5 dB and would not result in a significant increase due to construction noise associated with the proposed project. Project construction operations could result in an increase up to approximately 15 dBA over ambient at the building façade of Hotel Nia and up to 19 dBA over ambient at the eastern building façade of the proposed Menlo Portal project. It should be noted that these larger increases in temporary ambient noise exposure would occur at the exterior of the building facades and would be reduced by 15 to 25 dB or more, depending on building construction and if windows are open or closed. Depending on the construction of the individual buildings and their respective interior background noise levels, changes experienced within the occupied units may be consistent with the presented calculations or minimized in comparison to the calculated increases presented in Table 4.11-8. Despite such potential reductions, temporary increases in noise from project construction activities would be considered **potentially significant.**

Mitigation Measures

Compliance with ConnectMenlo EIR Mitigation Measure (MM) NOISE-1c would help to ensure that construction activity associated with the proposed project would comply with the Menlo Park Municipal Code and regulations pertaining to construction noise. However, ConnectMenlo EIR MM NOISE-1c precludes any construction activity from occurring outside of daytime hours; and the proposed project may deviate from those hour restrictions, which could result in a potentially significant impact. ConnectMenlo EIR MM NOISE-1c is included below as MM 4.11a but has been modified to omit the daytime hour construction restriction. Mitigation Measure 4.11b is also required to ensure that construction activities would comply with the applicable construction noise requirements of the City. Specifically, construction noise during daytime hours would be limited such that a 10 dB increase over the ambient noise level would not occur at the nearest sensitive land uses (i.e., Hotel Nia). Construction occurring outside ordinary daytime construction hours (i.e., 8:00 a.m. to 6:00 p.m. weekdays) would either not be allowed or would be required to result in an increase no greater than 10 dB over the ambient level and quantitative limits of 60 dBA L_{eq} between 7:00 a.m. and 10:00 p.m., and 50 dBA L_{eq} between 10:00 p.m. and 7:00 a.m. at the nearby noise-sensitive land uses during specified days and times.

As indicated in MM 4.11b, the effectiveness of noise attenuation measures shall be monitored by taking noise measurements at nearby noise-sensitive land uses during construction. As such, MM 4.11b requires that the noise increase would not exceed 10 dB at Tide Academy. In addition, construction occurring outside ordinary daytime construction hours (i.e., 8:00 a.m. to 6:00 p.m. weekdays) would either not be allowed or required to comply with the applicable noise threshold of an increase no greater than 10 dB over the ambient level and quantitative limits of 60 dBA L_{eq} between 7:00 a.m. and 10:00 p.m., and 50 dBA L_{eq} between 10:00 p.m. and 7:00 a.m. at the nearest sensitive land use during specified days and times.

With implementation of MMs 4.11a (ConnectMenlo Mitigation Measure NOISE-1c) and 4.11b, project construction would not be expected to violate relevant requirements related to construction noise in Menlo Park. Impacts related to construction noise would be less than significant with mitigation.

MM 4.11a Project applicants shall minimize the exposure of nearby properties to excessive noise levels from construction related activity through CEQA review, conditions of approval and/or enforcement of the City's Noise Ordinance. Prior to issuance of demolition, grading, and/or building permits for development projects, a note shall be provided on development plans indicating that during ongoing grading, demolition, and construction, the property owner/developer shall be responsible for requiring contractors to implement the following measures to limit construction related noise:

- All internal combustion engines on construction equipment and trucks are fitted with properly maintained mufflers, air intake silencers, and/or engine shrouds that are no less effective than as originally equipped by the manufacturer.
- Stationary equipment such as generators and air compressors shall be located as far as feasible from nearby noise-sensitive uses.
- Stockpiling is located as far as feasible from nearby noise-sensitive receptors.
- Limit unnecessary engine idling to the extent feasible.
- Limit the use of public address systems.
- Construction traffic shall be limited to the haul routes established by the City of Menlo Park.

(Modified ConnectMenlo MM NOISE-1c)

MM 4.11b Construction Noise Control Plan. The project sponsor shall develop a noise control plan for construction at the project site. The plan shall require compliance with Section 8.06 of the Menlo Park Municipal Code and include measures to ensure compliance with the 60 dBA L_{eq} limit during the hours of 7:00 a.m. to 8:00 a.m. and the 50 dBA L_{eq} limit during the hours of 10:00 p.m. to 7:00 a.m. In addition, the plan shall include measures to ensure that construction noise will not result in a 10 dB increase over the ambient noise level at nearby sensitive receptors.

The plan shall specify the noise-reducing construction practices that will be employed to reduce noise from construction activities in Menlo Park and shall demonstrate that compliance with these standards will be achievable. The measures specified by the Project Sponsor shall be reviewed and approved by the City prior to issuance of building permits. Measures to reduce noise may include, but are not limited to, the following:

- The noise control plan shall demonstrate that noise levels during construction on the project site will meet the standards of this mitigation measure at sensitive receptors while those receptors are in use.
- The noise control plan shall demonstrate that any construction activities taking place outside of normal construction hours of 8:00 a.m. to 6:00 p.m. Monday through Friday shall comply with the 60 dBA L_{eq} limit during the hours of 7:00 a.m. to 8:00 a.m. and the 50 dBA L_{eq} limit during the hours of 10:00 p.m. to 7:00 a.m.
- The plan shall demonstrate that that combined construction noise would not result in a 10 dBA increase over the ambient noise level at nearby sensitive receptors.
- The contractor shall ensure that construction equipment will be equipped with mufflers. In addition, construction equipment must use the best available noise control techniques (e.g., improved mufflers, intake silencers, ducts, engine enclosures, acoustically attenuating shields, shrouds) on equipment and trucks used for Project construction.

- All construction activities shall be conducted only at an adequate distance, or otherwise shielded with sound barriers, as determined in the noise control plan, from noise- sensitive receptors when working outside the normal construction hours of 8:00 a.m. to 6:00 p.m. Monday through Friday to ensure compliance with the Menlo Park Municipal Code and this mitigation measure.
- Stationary construction noise source with the potential to generate noise levels exceeding the applicable thresholds, shall be located at an adequate distance, or otherwise shielded with temporary sound barriers, from sensitive receptors to ensure compliance with the Menlo Park Municipal Code and this mitigation measure.
- Temporary noise barriers (height to be determined) shall be installed around construction on the Project site to reduce construction noise from equipment used outside the normal construction hours of 8:00 a.m. to 6:00 p.m. on weekdays. The installation of barriers would help reduce overall construction noise to less than 50 dBA L_{eq} for work occurring between 6:00 a.m. and 7:00 a.m. and 60 dBA L_{eq} for work occurring between 7:00 a.m. and 8:00 a.m., as measured at the applicable property lines of the adjacent uses, such that a 10 dB increase over ambient would not occur at nearby sensitive land uses. However, confirmation of the noise reduction would be required (per the last bullet of this measure, below). If the Project Sponsor can demonstrate, through an acoustical analysis, that construction noise would not exceed the allowable limits during non-exempt hours, as measured at the applicable property lines of the adjacent uses without barriers, then temporary noise barriers shall not be required.
- The effectiveness of noise attenuation measures shall be monitored by taking noise measurements at nearby noise-sensitive land uses during construction activities to ensure that the project is not causing an increase over ambient levels greater than 10 dB and compliance with the 50 and 60 dBA L_{eq} standards, which apply outside the construction exception hours of 8:00 a.m. and 6:00 p.m. Monday through Friday.

Long-Term/Operational Noise

Traffic Noise

The topic of potential traffic noise effects was discussed in the ConnectMenlo EIR as Impact NOISE-3. It was determined that implementation of ConnectMenlo would not result in a substantial permanent increase in ambient noise on any of the identified roadway segments. No mitigation measures were recommended.

The proposed project would result in the creation of additional vehicle trips on local roadways in the vicinity of the project (e.g., Independence Drive, Constitution Drive, Chrysler Drive, etc.), which could result in increased traffic noise levels at noise-sensitive land uses adjacent to area roadways. Potential off-site noise impacts resulting from the increase in vehicular traffic on the local roadway network, associated with long-term operations of the proposed project, were evaluated under Existing (2022) no Project and plus Project scenarios. Traffic volumes and the distribution of those volumes were obtained from the Transportation Impact Analysis prepared for the project (Appendix J1) and Caltrans traffic volume counts. Average vehicle speeds on local area roadways were assumed to be consistent with posted speed limits and remain as such with or without implementation of the proposed project.

Table 4.11-9 summarizes modeled L_{dn} traffic noise levels for the Existing (2022) scenarios, at prediction receiver locations representing the outdoor activity areas of noise-sensitive land-uses adjacent to roadway segments in the project vicinity. The table also presents the relative traffic noise level increase (net change) resulting from development of the proposed project. Actual traffic noise exposure levels at noise-sensitive receptors in the project vicinity would vary depending on a combination of factors such as variations in daily traffic volumes, relative distances between sources and receiver locations, shielding provided by existing and proposed structures, and meteorological conditions. Refer to Appendix H for modeling inputs and results.

Table 4.11-9. Modeled Existing (2022) No Project and Plus Project Traffic

Receiver		Traffic Noise Level, L_{dn} dBA				Project Impact?
No.	Description	Existing (2022)	Existing Plus Project	Increase Threshold	Net Change	
P1	LT1 – Western project site	63.8	63.8	+3 dB	<1	No
P2	ST1 – Adjacent to Hotel Nia Western Façade and Pool Area	71.2	71.2	+1.5 dB	<1	No
P3	ST2 – TIDE Academy, Sequoia Union Highschool	62.5	62.5	+3 dB	<1	No
P4	Hotel Nia Pool Area (within barrier)	62.4	62.4	+3 dB	<1	No
P5	Hotel Nia Northeastern Façade	55.5	55.5	+5 dB	<1	No
P6	Elan Apartments Western Façade	**66.5**	**66.5**	+1.5 dB	<1	No
P7	Elan Outdoor Activity Area	50.0	50.0	+5 dB	<1	No
P8	Menlo Portal Eastern Façade	59.9	59.9	+3 dB	<1	No
P9	Menlo Portal Eastern Outdoor Activity Area (within barrier)	55.2	55.2	+5 dB	<1	No

Source: Appendix H.
Notes: dBA = A-weighted decibels; L_{dn} = Day/Night average noise level
Bold – Noise level exceeding City threshold for transportation noise levels at residential receptors.
* Traffic noise levels are predicted at prediction receiver locations representing the distance to the outdoor activity areas and building facades of noise-sensitive land uses adjacent to major roadway segments in the project vicinity.

Existing (2022) traffic noise levels presented in 4.11-8 indicate that existing traffic noise levels in the project vicinity currently range from approximately 50 to 62 dBA L_{dn} at the outdoor activity areas of existing noise-sensitive receptors nearest the proposed project (P4 and P7), 62.5 dBA L_{dn} at the TIDE Academy (P3) and range from approximately 56 to 71 dBA L_{dn} at receivers representing nearby noise-sensitive building facades (P2, P5, and P6). Of the noise prediction receivers representing the noise-sensitive receptor locations, only the western façade of the Elan Apartments was calculated to exceed the applicable Menlo Park land use compatibility “normally acceptable” threshold for the respective category, residential – multifamily. This exceedance is the result of existing no project traffic and is not the contributed to substantially by the proposed project traffic.

To further evaluate effects of the proposed project, the potential for project traffic to increase the ambient noise level in the project’s vicinity is also analyzed. According to the presented industry research and potential annoyance from transportation noise sources, an incremental increase in ambient noise levels would be considered significant if the project were to result in an increase of +5 dB for areas with existing ambient levels lower than 60 dBA L_{dn}, +3 dB for existing ambient levels between 60 and 65 dBA L_{dn}, and +1.5 for existing ambient level greater than 70 dBA L_{dn}, when compared to the no project scenario. Development of the proposed project under the Existing (2022) scenario is calculated to result in marginal increases in the project study area, with all traffic noise increases being less than 1 dBA. Traffic noise level increases associated with the proposed project would be less than the acceptable increase thresholds. Therefore, the proposed project is anticipated to result in increases of traffic noise levels that would result in a **less-than-significant** impact.

Mitigation Measures

No mitigation measures are required.

Parking Garage and Surface Parking

The proposed project includes a subterranean and surface level parking garage, internal to the apartment building, along with private garages and surface parking for the townhomes. The apartment garage will include 336 total parking spaces, with a single ingress and egress access on the northern façade of the building, accessed from Constitution Drive. The townhome portion of the project includes 217 private tuck-under spaces within garages and 36 surface parking spaces for guests.

Empirical sound level emission data for enclosed parking garages similar to the apartment garage indicates that traffic associated with the proposed surface and sub-surface parking areas noise would not be of sufficient level or occurrence to exceed community noise standards based on a time-averaged scale such as CNEL or L_{eq}. This is attributable to the sporadic and instantaneous nature of sound levels generated by a car door slamming, an engine starting up, cars pass-by or tire squeal near the parking garage ingress and egress point. These noise sources associated with parking activities are short-term or instantaneous rather than steady noise levels and include sample Lmax value ranges at a distance of 50 feet as follows: door slamming (60–70 dBA); engine ignition (60–70 dBA); and car pass-bys (55–70 dBA) (Mestre Greve Associates 2011). While audible under the certain conditions near the entrance, their contribution to the outdoor ambient sound environment would be akin to similar infrequent noises produced by vehicles starting up or parking on nearby streets. Moreover, with the access to the garage located on the northern façade of the apartment building, parking garage sound levels would not affect nearby noise-sensitive receptors.

Parking activities associated with the private garages are orientated towards the proposed project's interior drives. Noise levels generated in association with parking activities at the private garages would be shielded from nearby noise-sensitive receptors.

Mitigation Measures

No mitigation measures are required.

Building Mechanical, Heating, Ventilation, and Air Conditioning

Mechanical equipment associated with the long-term operation of the proposed project includes heating, ventilation, and air-conditioning (HVAC) equipment, an emergency generator, various fans, pumps, and compressors that can potentially be significant noise sources. HVAC equipment associated with the proposed project will be mounted on building rooftops, shielded by mechanical screens and rooftop parapets or on dedicated decks for the outdoor units at the second and third floors of the affordable townhomes. Noise levels generated by HVAC equipment vary significantly depending on unit size, efficiency, location, type of rotating or reciprocating components, and orientation of openings. The exact sizes, efficiencies, models, etc. of the proposed HVAC systems are unknown at the time of this analysis. The proposed project is known to utilize individual outdoor air conditioning condenser units (ACCUs) for each residential unit, similar to the Trane TTX 2-ton units. The manufacturer's general data sheet for the Trane TTX ACCUs are shown to have an A-weighted sound power level (dBA Lw) of 72 dBA (~61 to 64 dBA at 1 meter).

Based on the plan set provided (Appendix B), the outdoor HVAC equipment for the apartment portion of the project would be centrally located on the rooftop of each of the building sections, distributed in banks of 20 outdoor condenser units, with a total of 340 units. Not accounting for the shielding provided by the rooftop screens/parapets or the duty cycle of the individual units, and assuming a standard point source attenuation rate of 6 dB per doubling of distance, the 340 units would result in a combined noise level of approximately 45 dBA L_{eq} at the property boundary of the nearest receptor, Hotel Nia (480 feet), and approximately 39 dBA L_{eq} at the TIDE Academy (1,025 feet).

HVAC outdoor condenser units for the townhomes would be located within second and third floor decks for the affordable townhomes, dedicated to the mechanical equipment, with the market-rate townhomes having rooftop mounted units. The largest number of individual units that the nearest receptor could be exposed to would be the units associated with the market-rate Buildings 21 and 22. Not accounting for the shielding provided by the rooftop screens/parapets or the duty cycle of the individual units, and assuming a standard point source attenuation rate of 6 dB per doubling of distance, the 9 units would result in a combined noise level of approximately 39 dBA L_{eq} at the property boundary of the nearest receptor, Hotel Nia (480 feet). The TIDE Academy could be exposed to a total of 12 units associated with the market-rate buildings 15, 17, and 20, which would result in a combined noise level of approximately 30 dBA L_{eq}.

Combined HVAC noise levels at Hotel Nia from both the apartment building and the townhomes would result in noise level of approximately 46 dBA L_{eq}. Combined HVAC noise levels at the TIDE Academy from both the apartment building and the townhomes would result in noise level of approximately 40 dBA L_{eq}. Shielding from the mechanical screens or parapets that would break line of site to the units, consistent with the Menlo Park Municipal Code, would provide an additional noise level reduction of at least 5 dB.

Menlo Park Municipal Code Section 16.08.095 requires roof-mounted mechanical equipment not exceed a threshold of 50 dBA at a distance of 50 feet. Based on the rooftop mechanical equipment sound power level of 72 dBA Lw, the outdoor condenser units would be approximately 39.6 dBA L_{eq} at a distance of 50 feet. The proposed mounting location for the affordable townhomes would locate the units within a dedicated mechanical deck incorporating a mechanical screen, and the market-rate townhomes would locate the units on the rooftop, both of which would provide additional attenuation of the mechanical equipment noise levels.

Rooftop mechanical equipment for the apartment building would be at a height of at least 52 feet above ground level and setback a minimum of 18 feet from the edge of the roof. Performing a measurement of the rooftop mechanical units atop the apartment building at a diagonal (slant) distance of 50 feet would result in a noise level of 49.6 dBA L_{eq} for one grouping of 20 units, or approximately 53 dBA L_{eq} for 3 sets of 20 rooftop condensing units. However, due to the shielding that would be provided by the location of the units on the roof and the edge of the roof intervening in the path of the sound, the rooftop mechanical equipment would be attenuated more than 8 dB, not accounting for the additional shielding provided by the rooftop mechanical screen or parapet or the reduction provided by the duty cycle of individual units. Therefore, the rooftop mechanical is calculated to comply with the Menlo Park Municipal Code threshold of 50 dBA L_{eq} at 50 feet.

Additional building mechanical equipment necessary for the long-term operation of the proposed project, and more specifically the apartment building, would incorporate an emergency generator, electrical rooms, fan rooms, trash rooms and equipment rooms. All of these potentially noise generating sources associated with the apartment building would be enclosed within the building and not result in substantial noise levels in the surrounding area.

Based on the combined noise levels of the rooftop mechanical equipment at nearby noise-sensitive receptors, and the location and nature of the building mechanical equipment being enclosed within the structure, mechanical noise levels are not anticipated to contribute to an increase in ambient noise levels in the project area. The rooftop mechanical equipment would also comply with the Municipal Code 50 dBA L_{eq} at 50 feet threshold. Therefore, noise generated from the building mechanical equipment would be a **less that significant** impact.

Mitigation Measures

No mitigation measures are required.

Impact 4.11-2 Would the project result in generation of excessive groundborne vibration or groundborne noise levels?

Construction activities on the project site may result in varying degrees of temporary groundborne vibration or noise, depending on the specific construction equipment used and operations involved. Representative groundborne vibration levels for various types of construction equipment, developed by FTA, are summarized in Table 4.11-10. As previously mentioned, pile driving, and blasting is not currently expected to be utilized in project construction. Where more substantial shoring and foundation is necessary, the project proponent has stated that displacement auger cast piles are anticipated.

The topic of construction vibration was analyzed in the ConnectMenlo EIR as Impact NOISE-2. The impact was determined to be potentially significant and would be reduced to a less-than-significant level with implementation of MMs NOISE-2a and NOISE-2b. Consistent with ConnectMenlo EIR MM NOISE-2a, this impact discussion presents the results of a project-specific vibration analysis. Further, this analysis demonstrates that vibration levels associated with project construction would remain below the vibration thresholds established in ConnectMenlo EIR MM NOISE-2a. Specifically, MM NOISE-2a requires that vibration levels must be limited to a maximum PPV of 0.2 in/sec and to the following thresholds for specific types of sensitive receptors: 0.126 in/sec at the nearest workshop, 0.063 in/sec at the nearest office, and 0.032 in/sec at the nearest residence during daytime hours and 0.016 in/sec at the nearest residence during nighttime hours. Additionally, ConnectMenlo EIR MM NOISE-2b requires the City to ensure through the project approval process that projects implement best management practices to minimize vibration. The analysis concluded that, overall, vibration impacts related to construction would be short term, temporary, and generally restricted to areas in the immediate vicinity of construction activity.

Table 4.11-10. Groundborne Vibration Thresholds

Location to be Applied	Vibration Threshold, in./sec.	
	PPV	RMS
Nearest Structure (Architectural Damage)	0.2	—
Workshop (Annoyance)	0.5	0.126
Office (Annoyance)	0.25	0.063
Residence – Daytime (Annoyance)	0.128	0.032
Residence – Nighttime (Annoyance)	0.064	0.016

Source: City of Menlo Park 2016b.

Table 4.11-11. Representative Vibration Levels for Construction Equipment

Equipment	in/sec PPV[1]				
	25 feet[2]	15 feet	8 feet	13 feet	20 feet
Hoe Ram	0.089	0.191	0.492	0.237	0.124
Large Bulldozer	0.089	0.191	0.492	0.237	0.124
Caisson Drilling	0.089	0.191	0.492	0.237	0.124
Heavy-duty Trucks (Loaded)	0.076	0.164	0.420	0.203	0.106
Jackhammer	0.035	0.075	0.193	0.093	0.049
Small Bulldozer	0.003	0.006	0.017	0.008	0.004

Source: FHWA 2018.
Notes:
1 Where PPV is the peak particle velocity.
2 Vibration levels can be approximated at other locations and distances using the above 25-feet reference levels and the following equation: PPVequip = PPVref (25/D)1.5 (in/sec); where "PPV ref" is the given value in the above table, "D" is the distance for the equipment to the new receiver in feet.

As shown in 4.11-11, heavier pieces of typical construction equipment, such as a bulldozer, have been documented to generate peak particle velocities of approximately 0.089 in./sec. PPV or less at a reference distance of 25 feet (FTA 2018). The ConnectMenlo EIR MM NOISE-2a threshold distances were calculated based on these propagation characteristics and the FTA and Caltrans propagation formulas. As can be seen in Table 4.11-11, architectural damage would not be anticipated unless the machinery was operating at distances less than 15 feet from a nearby structure and would not reach the annoyance thresholds unless operating at distances less than 20 feet. Given the operational characteristics of the machinery, the setback distances and the transportation rights-of-way, the proposed project is not expected to exceed the City's vibration thresholds. Therefore, construction vibration impacts associated with the proposed project are considered **less than significant.**

ConnectMenlo EIR MM NOISE-2b serves to reduce long-term vibration impacts at existing or potential future sensitive uses through the application of best management practices. The proposed project is not located in the vicinity of vibration generating sources; nor does the proposed project incorporate long-term operation sources of groundborne vibration. Therefore, ConnectMenlo MM NOISE-2b is not applicable to the proposed project and this impact would be **less than significant.**

Mitigation Measures

No mitigation measures are required.

Cumulative Impacts

The analysis of cumulative noise impacts considers noise conditions within the Bayfront Area because noise attenuates as distance from the noise source increases. The development scenario for the analysis of potential cumulative impacts associated with construction noise considers specific current and pending development projects in the immediate vicinity of the project site because construction noise is a localized impact. The development scenario for the analysis of potential cumulative nose impacts associated with project operation considers buildout of the ConnectMenlo General Plan Update.

Impact 4.11-3 Would the project result in cumulatively considerable noise impacts?

Construction Noise

The nearest projects to the 123 Independence project site that have the potential to be constructed concurrently with the proposed project are the Commonwealth Building 3 Project located at 162 and 164 Jefferson Drive, Menlo Flats located at 165 Jefferson Drive, Menlo Uptown located at 141 Jefferson Drive. In addition, construction at TIDE Academy, located at 150 Jefferson Drive, is currently under way and could still be under construction during construction of the proposed project.

As discussed in Impact 4.11-1, most construction activities for the proposed project and the cumulative projects would occur during the exempt daytime hours of 8:00 a.m. to 6:00 p.m. Monday through Friday, and thus would not be subject to the daytime noise limitations set forth in Municipal Code Section 8.06.040(a). However, some project construction activities could occur during weekday hours outside of the exempt daytime hours or on weekends.

Construction of individual projects that occurs during daytime hours could result in a 10 dB increase over the ambient noise level at nearby receptors before mitigation, and construction of multiple projects at one time could combine to expose a given receptor to greater noise levels than those that would be experienced from construction of one project alone. Similarly, construction of individual projects during non-exempt weekday hours and during weekends could exceed the allowable daytime (i.e., 7:00 a.m. to 10:00 p.m.) noise level of 60 dBA at nearby noise-sensitive land uses, the allowable nighttime (i.e., 10:00 p.m. to 7:00 a.m.) noise level of 50 dBA at nearby sensitive land uses, or the allowable threshold (10 dB increase over ambient). Thus, there is a **potentially significant** cumulative impact associated with construction noise. As discussed in Impact 4.11-1 and shown in Table 4.11-7, construction of the proposed project could result in a noise level increase up to approximately 19 dBA over ambient at Menlo Portal, located immediately south of the project site. Further, noise associated with project construction could combine with construction noise from other nearby projects to result in noise level increases of 10 dB over ambient at other nearby sensitive receptors during daytime exempt hours as well as during non-exempt hours and could result in noise levels that exceed the City's standards. Therefore, the project's contribution to the cumulative construction noise impact could be cumulatively considerable.

All projects would be required to implement ConnectMenlo EIR MM NOISE-1c to help ensure that construction activity complies with the Menlo Park Municipal Code and other City regulations pertaining to construction noise. ConnectMenlo EIR MM NOISE-1c is included in this EIR as MM 4.11a. As discussed in Impact 4.11-1, construction noise impacts for some projects (including the proposed project) may not be reduced to less-than-significant levels with implementation of this mitigation measure alone because there would be a potential for construction noise outside of the daytime exempt hours to exceed the City's thresholds and since the certification of the ConnectMenlo EIR, the City has adopted a new construction noise threshold of 10 dBA over ambient. Thus, the proposed project would also be required to implement MM 4.11b, which requires monitoring the effectiveness of noise attenuation measures and use of additional attenuation measures where necessary to ensure compliance with the City's thresholds. With implementation of both 4.11a and 4.11b, construction noise levels associated with the project would be in compliance with the allowable limits during both daytime and non-daytime hours. Therefore, implementation of MMs 4.11a and 4.11b as presented in Impact 4.11-1 would ensure that the proposed project would make a less than cumulatively considerable contribution to the potentially significant cumulative impact. No additional mitigation measures are required.

Operational Noise

Buildout of the land uses anticipated under the ConnectMenlo General Plan Update would increase traffic in the Bayfront Area, which could result in increased traffic noise and exposure of sensitive receptors to unacceptable noise levels. The ConnectMenlo EIR found that there would be no roadway segments that would experience a substantial permanent increase in ambient noise levels and that General Plan Policies N-1.6 and N-1.9 and General Plan Programs N-1.B and N-1.C would reduce noise from vehicles at the source and to otherwise shield uses from excessive noise. The ConnectMenlo EIR concluded that industrial uses and existing and future residential uses would not be exposed to noise levels that exceed the City's land use compatibility criteria and cumulative transportation noise impacts would be less than significant. Thus, the ConnectMenlo EIR did not identify a significant cumulative operational noise impact to which the project could contribute.

As discussed in Section 4.14, Transportation, the proposed project would generate 870 new vehicle trips per day. As shown in Table 4.11-9, the traffic generated by the project would have no measurable effect on roadway noise levels at any of the monitoring locations under existing plus project conditions. Traffic volumes on local roadways are expected to increase over time due to buildout of the ConnectMenlo General Plan Update and from regional development and population growth. The background (no project) traffic noise levels would increase over time, which would lessen the relative contribution of the proposed project to total traffic volumes and associated noise levels. Given that the project-generated traffic would have no measurable effect on roadway noise under existing plus project conditions and non-project traffic would continue to increase over time, the project-generated traffic would also have no measurable effect on cumulative transportation noise levels. Thus, the project would not create or contribute to any significant cumulative transportation noise impacts, consistent with the findings of the ConnectMenlo EIR.

Mitigation Measures

Construction Noise

As noted above, implementation of MMs 4.11a and 4.11b as presented in Impact 4.11-1 would ensure that the proposed project would make a less than cumulatively considerable contribution to the potentially significant cumulative impact. No additional mitigation measures are required.

Operational Noise

No mitigation measures are required.

4.11.5 References Cited

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