14

NOISE AND VIBRATION

INTRODUCTION

This chapter of the EIR presents the results of the environmental noise assessment conducted for the Project by Illingworth and Rodkin, included in Appendix H.

Included in this section is a brief description of the fundamentals of environmental noise, a summary of the applicable regulatory criteria, and the results of the noise monitoring surveys. Future noise levels at the site and surrounding areas are calculated and summarized. The report then evaluates impacts resulting from the Project in terms of noise, vibration, and land use compatibility, temporary noise level increases resulting from the Project construction, and permanent noise level increases resulting from the operation of the Project.

FUNDAMENTALS OF ENVIRONMENTAL NOISE

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB) with 0 dB corresponding roughly to the threshold of hearing. Decibels and other technical terms are defined in **Table 14.1**.

Most of the sounds which we hear in the environment do not consist of a single frequency, but rather a broad band of frequencies, with each frequency differing in sound level. The intensities of each frequency add together to generate a sound. The method commonly used to quantify environmental sounds consists of evaluating all of the frequencies of a sound in accordance with a weighting that reflects the fact that human hearing is less sensitive at low frequencies and extreme high frequencies. This is called "A" weighting, and the decibel level so measured is called the A-weighted sound level (dBA). In practice, the level of a sound source is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting curve. Typical A-weighted levels measured in the environment and in industry are shown in **Table 14.2** for different types of noise.

Although the A-weighted noise 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 distant sources which create a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of environmental noise, the statistical noise descriptors, L_{01}, L_{10}, L_{50}, and L_{90}, are commonly used. They are the A-weighted noise levels equaled or exceeded during 1 percent, 10 percent, 50 percent, and 90 percent of a stated time period. A single number descriptor called the L_{eq} is also widely used. The L_{eq} is the average A-weighted noise level during a stated period of time.

In determining the daily level of environmental noise, it is important to account for the difference in response of people to daytime and nighttime noises. During the nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noise becomes more noticeable. Further, most people sleep at night and are very sensitive to noise intrusion. To account for human sensitivity to nighttime noise levels, a descriptor, L_{dn}

Table 14.1: Definitions of Acoustical Terms

Term	Definitions
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, Leq	The average A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

Table 14.2: Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

(day/night average sound level), was developed. The L_{dn} divides the 24-hour day into the daytime of 7:00 AM to 10:00 PM and the nighttime of 10:00 PM to 7:00 AM. The nighttime noise level is weighted 10 dB higher than the daytime noise level. The Community Noise Equivalent Level (CNEL) is another 24-hour average which includes both an evening and nighttime weighting.

EFFECTS OF NOISE

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA Ldn. Typically, the highest steady traffic noise level during the daytime is about equal to the Ldn and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12 to 17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57 to 62 dBA Ldn with open windows and 65 to 70 dBA Ldn if the windows are closed. Levels of 55 to 60 dBA are common along collector streets and secondary arterials, while 65 to 70 dBA is a typical value for a primary/major arterial. Levels of 75 to 80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed; those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest.[1] The Ldn as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA Ldn. At a Ldn of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the Ldn increases to 70 dBA, the percentage of the population highly annoyed increases to about 25 to 30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a Ldn of 60 to 70 dBA. Between a Ldn of 70 to 80 dBA, each decibel increase increases by about 3 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the Ldn is 60 dBA, approximately 30 to 35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

FUNDAMENTALS OF GROUNDBORNE VIBRATION

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak

[1] Kryter, K. D. (1985). *The Effects of Noise on Man*. Academic Press.

Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave in units of inches per second (in/sec).

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to cause damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level. The California Department of Transportation's *Transportation and Construction Vibration Guidance Manual* provides a summary of vibration human responses and structural damage criteria that have been reported by researchers, organizations, and governmental agencies. These thresholds are utilized as standards in environmental analysis of vibration impacts and are summarized in **Table 14.3** and **Table 14.4**.

Table 14.3: Vibration Threshold Criteria for Building Damage

Structural Integrity	Maximum PPV (in/sec)	
	Transient	Continuous
Historic and some older buildings	0.50	0.12 to 0.2
Older residential structures	0.50	0.30
New residential structures	1.00	0.50
Modern industrial and commercial structures	2.00	0.50

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, 2020.

Table 14.4: Vibration Threshold Criteria for Human Response

Human Response	Maximum PPV (in/sec)	
	Transient	Continuous
Slightly perceptible	0.035	0.012
Distinctly perceptible	0.24	0.035
Strongly perceptible	0.90	0.10
Severe/Disturbing	2.0	0.7 (at 2 Hz) to 0.17 (at 20 Hz)
Very disturbing	--	3.6 (at 2 Hz) to 0.4 (at 20 Hz)

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, 2020.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 14.3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage.

Most buildings are included within the categories ranging from "Historic and some old buildings" to "Modern industrial/commercial buildings". Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The annoyance levels shown in Table 14.4 should be interpreted with care since vibration may be found to be annoying at lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

REGULATORY SETTING

The State of California and the Town of Portola Valley have established regulatory criteria that are applicable in this assessment. The State CEQA Guidelines, Appendix G, the California Building Code, and the Town of Portola Valley General Plan are used to assess the potential significance of impacts related to the construction and operation of the Project. A summary of the applicable regulatory criteria is provided below.

California Building Standards Code

The California Building Standards Code is contained in Title 24 of the California Code of Regulations and consists of 11 different parts that set various construction and building requirements. Part 2, California Building Code, Section 1207, Sound Transmission, establishes sound transmission standards for interior walls, partitions, and floor/ceiling assemblies. Specifically, Section 1207.4 establishes that interior noise levels attributable to exterior noise sources shall not exceed 45 dBA Ldn or CNEL (as set by the local General Plan) in any habitable room.

The California Green Building Standards Code is Part 11 to the California Building Standards Code. Chapter 5, Nonresidential Mandatory Standards, Section, establishes additional standards for interior noise levels:

- Section 5.507.4.1.1 sets forth that buildings exposed to a noise level of 65 dB Leq (1-hour) during any hour of operation shall have exterior wall and roof-ceiling assemblies exposed to the noise source meeting a composting sound transmission class (STC) rating of at least 45 (or an outdoor indoor transmission class (OITC) of 35, with exterior windows of a minimum STC of 40.
- Section 5.507.4.2 sets forth that wall and roof assemblies for buildings exposed to a 65 dBA Leq pursuant to Section 5.507.4.1.1, shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed 50 dBA Leq in occupied areas during any hour of operation. This requirement shall be documented by preparing an acoustical analysis documenting interior sound levels prepared by personnel approved by the architect or engineer of record.

California Environmental Quality Act

CEQA requires an evaluation of the significance of potential Project noise impacts. CEQA does not define what noise level increase would be considered substantial. Typically, an increase of 3 dBA CNEL or more caused by the Project would be considered a significant impact when projected noise levels would exceed those considered acceptable for the affected land use. A noise increase of 5 dBA

CNEL or more caused by the Project would be considered a significant impact when projected noise levels would remain at or below the noise levels considered acceptable for the affected land use.

Town of Portola Valley General Plan

Part 4 of the 2010 General Plan (Environmental Quality) discusses noise. The following goals and policies apply to the proposed Project:

4316 Goal 1: Develop Land Uses Compatible with the Noise Environment

Transportation Generated Noise (Policies 1–3)

1. The town will utilize the noise contours in Figure 1 and noise/land use compatibility standards on Figure 2.

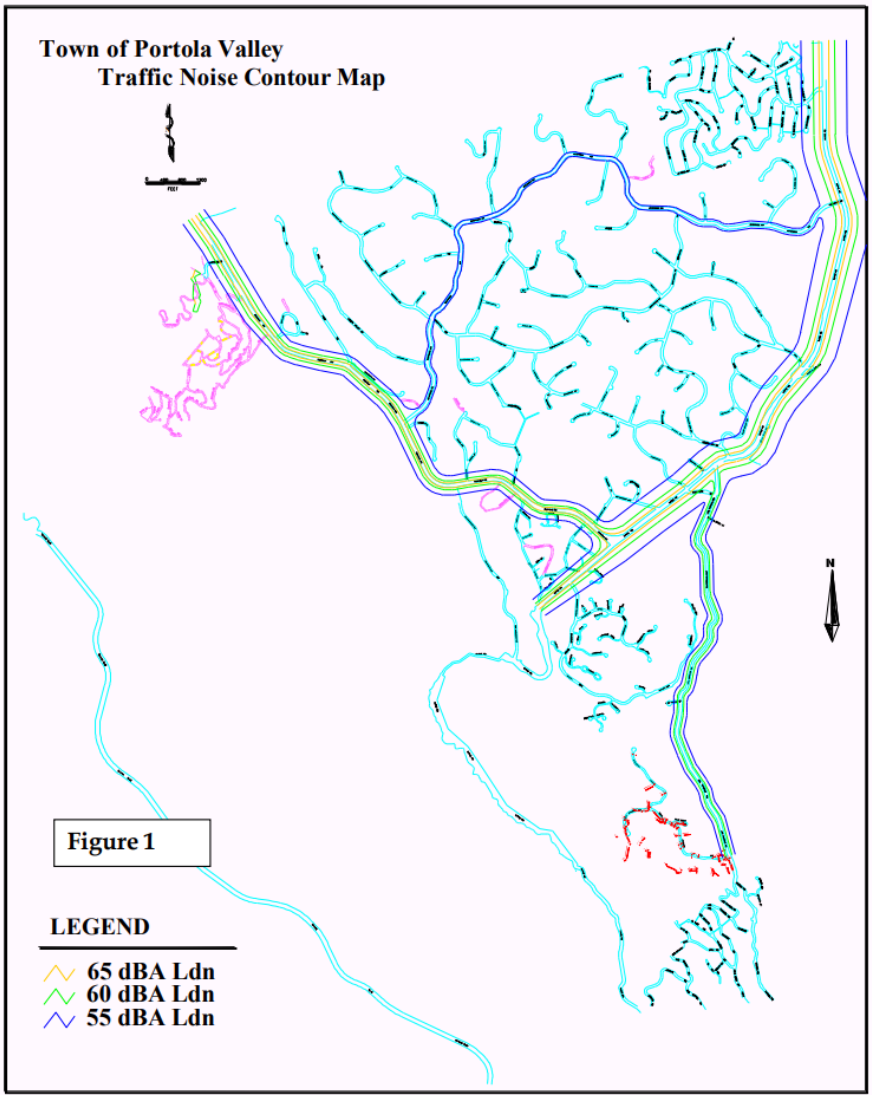
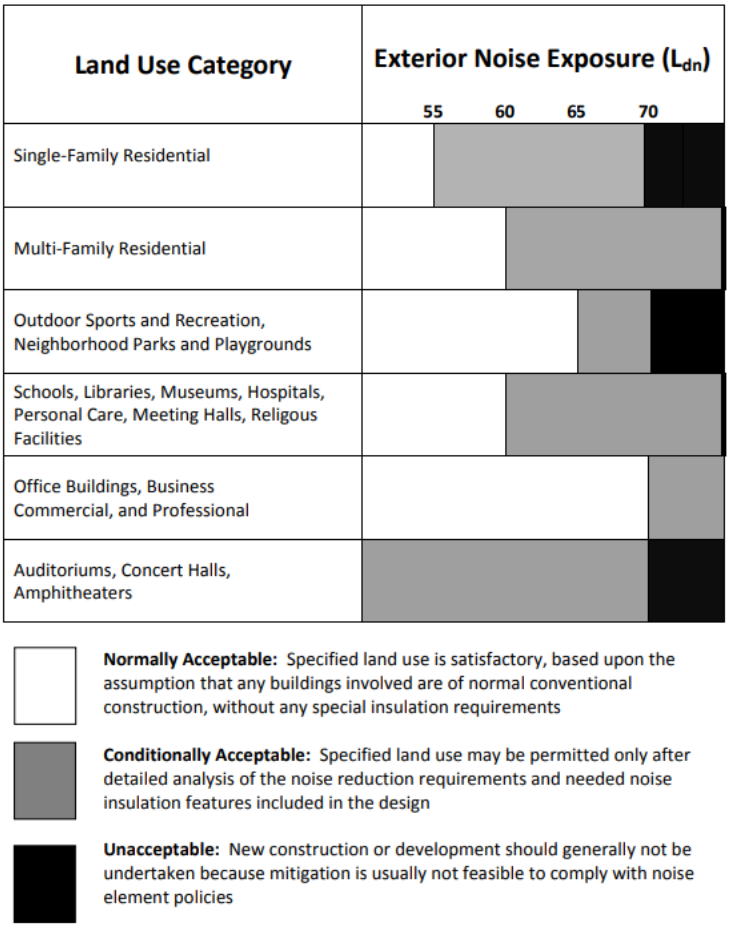


Figure 2 – Land Use Compatibility for Transportation Noise



2. New development of residential or other noise-sensitive land uses are discouraged in noise impacted areas unless effective mitigation measures are incorporated into the project design to reduce noise levels in outdoor activity areas to 55 dBA Ldn or less.

3. Interior noise levels shall not exceed 45 Ldn in all new residential units (single- and multi-family). Residential development sites exposed to exterior noise levels exceeding 55 Ldn shall be analyzed following protocols in the 2007 California Building Code (Chapter 12, Appendix Section 1207.11.2) or the most recent revision.

Non-Transportation Noise (Policy 4)

4. New development of noise-sensitive land uses are discouraged where the noise level due to non-transportation noise sources will exceed the standards of Table 3. Where noise sensitive land uses exist or are proposed in areas exposed to existing or proposed exterior non-transportation noise levels exceeding the performance levels of Table 3, an acoustical analysis shall be submitted by an applicant so that the noise mitigation may be included in the design of the new development.

TABLE 3 Non-Transportation Noise Standards

Land Use Receiving the Noise	Hourly Noise-Level Descriptor	Exterior Noise-Level Standard In Any Hour (dBA)		Interior Noise-Level Standard In Any Hour (dBA)	
		Daytime (7am-10pm)	Nighttime (10pm-7am)	Daytime (7am-10pm)	Nighttime (10pm-7am)
Residential	L_{eq}	50	40	40	30
	L_{max}	65	55	55	45
Medical, convalescent	L_{eq}	55	45	45	35
	L_{max}	70	60	55	45
Theater, auditorium	L_{eq}	--	--	35	35
	L_{max}	--	--	50	50
Religious Facility, meeting hall	L_{eq}	55	--	40	40
	L_{max}		--	55	55
Office building	L_{eq}	--	--	45	--
School, library, museum	L_{eq}	55	--	40	--
	L_{max}		--	55	--
Playground, park	L_{eq}	55	--	--	--

Notes:

a) The Residential standards apply to all residentially zoned properties.

b) Each of the noise levels specified above shall be lowered by 5 dBA for tonal noises characterized by a whine, screech, or hum, noises consisting primarily of speech or music, or recurring impulsive noises.

c) The exterior noise standards are measured at the property line of the receiving property.

d) The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors, the thresholds are about 15 dBA higher. Steady noise of sufficient intensity, above 35 dBA, and fluctuating noise levels above about 45 dBA have been shown to affect sleep.

4318 Goal 3: Mitigate Noise from New Projects

1. Noise created by new transportation noise sources (e.g., increased traffic or a new roadway) shall be mitigated so as to not cause the following criteria to be exceeded or to cause a significant adverse community response:

   - Cause the Ldn at noise-sensitive uses to increase by 3 dBA or more and exceed the "normally acceptable" level. See Figure 2 for the definition of "normally acceptable."
   - Cause the Ldn at noise-sensitive uses to increase by 5 dBA or more and remain "normally acceptable."

   Where a proposed transportation noise source is likely to produce noise levels that would exceed the above standards, an acoustical analysis shall be required as a part of project review or as part of the environmental review process so that noise mitigation may be included in the project design.

2. Noise created by new non-transportation noise sources shall be mitigated so as to not cause the land use receiving the noise to exceed interior and exterior noise level standards of Table 3. Where proposed non-transportation noise sources are likely to produce noise levels that would exceed the standards of Table 3, an acoustical analysis shall be required as a part of project review or as part of the environmental review process so that noise mitigation may be included in the project design.

3. All acoustical analyses shall:

   - Be the responsibility of the applicant for the project.

- Be prepared by a qualified person experienced in the fields of environmental noise assessment and architectural acoustics.
- Include representative noise level assessments with sufficient sampling periods and locations to adequately describe local conditions.
- Estimate existing and projected (20 years) noise levels in terms of Ldn and/or the standards of Table 3, and compare those levels to the policies of this Element.
- Recommend mitigation to achieve compliance with the adopted policies and standards of this Element. Where the noise source in question consists of intermittent single events, the report must address the effects of maximum noise levels in sleeping rooms in terms of possible sleep disturbance.
- Describe a post-project assessment program that could be used to evaluate the effectiveness of the proposed mitigation measures.

4319 Goal 4: Control Noise from Construction and Yard Maintenance Activities

1. Implement appropriate standard controls for all construction projects carried out by contractors or homeowners.
2. Implement appropriate standard controls for yard maintenance activities carried out by commercial companies and homeowners.
3. Require ASCC review for all construction projects scheduled for or lasting more than 24 months and submittal of construction staging, timing and noise management plans.
4. Develop a guidance manual to provide information to the public regarding noise control.

Town of Portola Valley Municipal Code

9.10.030 - Noise Standards

It is unlawful for any person in any location in the town from the effective date of this chapter to create or cause to be created any noise that exposes properties in the vicinity to noise levels that exceed the levels indicated in Table 9.10-1, provided that, if the noise is generated by a structure or integral part of a structure, such compliance is required within twelve months after the effective date of the ordinance, August 21, 2009. Noises permitted by Sections 9.10.040 and 9.10.070 are not subject to Table 9.10-1.

Table 9.10-1 Non-Transportation Generated Noise Standards [excerpt]

Land Use Receiving the Noise	Hourly Noise-Level Descriptor	Exterior Noise-Level Standard in Any Hour (dBA)		Interior Noise-Level Standard in Any Hour (dBA)	
		Daytime (7:00 a.m.—10:00 p.m.)	Nightime (10:00 p.m.—7:00 a.m.)	Daytime (7:00 a.m.—10:00 p.m.)	Nightime (10:00 p.m.—7:00 a.m.)
Residential	L_{eq} L_{max}	50 65	40 55	40 55	30 45

In addition, the Municipal Code prohibits specific noise provoking activities throughout town, including persistent animals and fowl; sounding horns and signal devices; racing engine; musical instruments, sound amplifiers and human voice amplification; outdoor amplified sound on town-owned property; explosives, firearms, and similar devices; motor

vehicle maintenance and leaf blowers. Leaf blowers shall not produce a sound that exceeds sixty-five dBA when measured from a distance of fifty feet utilizing American National Standard Institute methodology. No person shall operate any leaf blower which does not bear an affixed manufacturer's label indicating the model number of the leaf blower and designating a noise level not in excess of sixty-five dBA. Any leaf blower that bears such a manufacturer's label shall be presumed to comply with any noise level limit of this chapter provided that it is operated with all mufflers and full extension tubes supplied by the manufacturer for that leaf blower. No person shall operate any leaf blower without attachment of all mufflers and full extension tubes supplied by the manufacturer for that leaf blower.

9.10.040 - Permitted Sources of Noise

The Portola Valley Municipal Code authorizes certain noise-generating activities associated with residential use. All vehicles, equipment and machines associated with the permitted activities shall incorporate design features in good operating order that meet current industry standards for noise muffling and noise reduction. Further permitted noise sources delineated in the Municipal Code shall be subject to applicable conditional use permit conditions, construction program agreements, town noise reduction guidelines, and other forms of regulation.

A. Construction Activities. Commercial construction activities may take place between eight a.m. and five-thirty p.m., Monday through Friday. Any resident may personally (including with the help of immediate family members) undertake construction activities during the following hours: Monday through Friday between eight a.m. and five-thirty p.m. and Saturday and Sunday between ten a.m. and five p.m. Commercial and resident construction activities are prohibited on holidays. Exceptions to these hours may be permitted in unusual circumstances pursuant to written authorization from the director of public works. No radios or other amplified sound devices shall be audible beyond the property line of the construction site.

B. Domestic Garden Tools. Domestic garden tools, including electric-powered leaf blowers, may be used by commercial companies only Monday through Friday between eight a.m. and five-thirty p.m. and Saturday between ten a.m. and five p.m.; provided that chippers and chain saws may not be used on Saturday. Any resident may personally (including with the help of immediate family members) use domestic garden tools during the following hours: Monday through Friday between eight a.m. and five-thirty p.m. and Saturday and Sunday between ten a.m. and five p.m. Domestic garden tools may be used by property owners only for the purpose of removing seasonal grasses and plant materials that pose a fire hazard on all days, except holidays, between eight a.m. and eight p.m. from April 15 to June 15; however, this provision does not allow the use of chain saws and chippers on Sundays. The commercial and resident use of domestic garden tools is prohibited on holidays.

C. Large Vehicle Delivery and Loading. For other than construction activities, the loading, unloading or delivery of goods, merchandise, vehicles or supplies by large trucks, tractor-trailers, or other similar vehicles is restricted to the hours between eight a.m. and five-thirty p.m., Monday through Friday, unless otherwise authorized by a conditional use permit.

D. Garbage Collection. Collection of garbage and other refuse is restricted to the hours between eight a.m. and five p.m., Monday through Friday, unless authorized otherwise by a franchise agreement with the town.

ENVIRONMENTAL SETTING

SENSITIVE RECEPTORS

Portola Valley Municipal Code Section 9.10.020 defines "Noise sensitive land use" as locations where there are greater sensitivities to excess noise, including, but not limited to, residences, hospitals, nursing homes, theaters, auditoriums, religious facilities, meeting halls, schools, libraries, museums, and parks.

The closest sensitive receptors to the site are residents in the single-family homes adjacent to the Project site. Residential properties are located to the north along Westridge Drive adjacent to the Residential Development Area. The Fire Access Road is 200 feet at the closest point to residential properties to the south of the Project site along Golden Oaks Drive/Minoca Road. Ladera Community Church UCC is located just over one half mile to the north of the Residential Development Area. Other than additional residential units, there are no other noise-sensitive receptors located less than a mile from the Project site. Once constructed, the Project would introduce new noise-sensitive receptors (i.e., residents) to the area.

EXISTING NOISE ENVIRONMENT

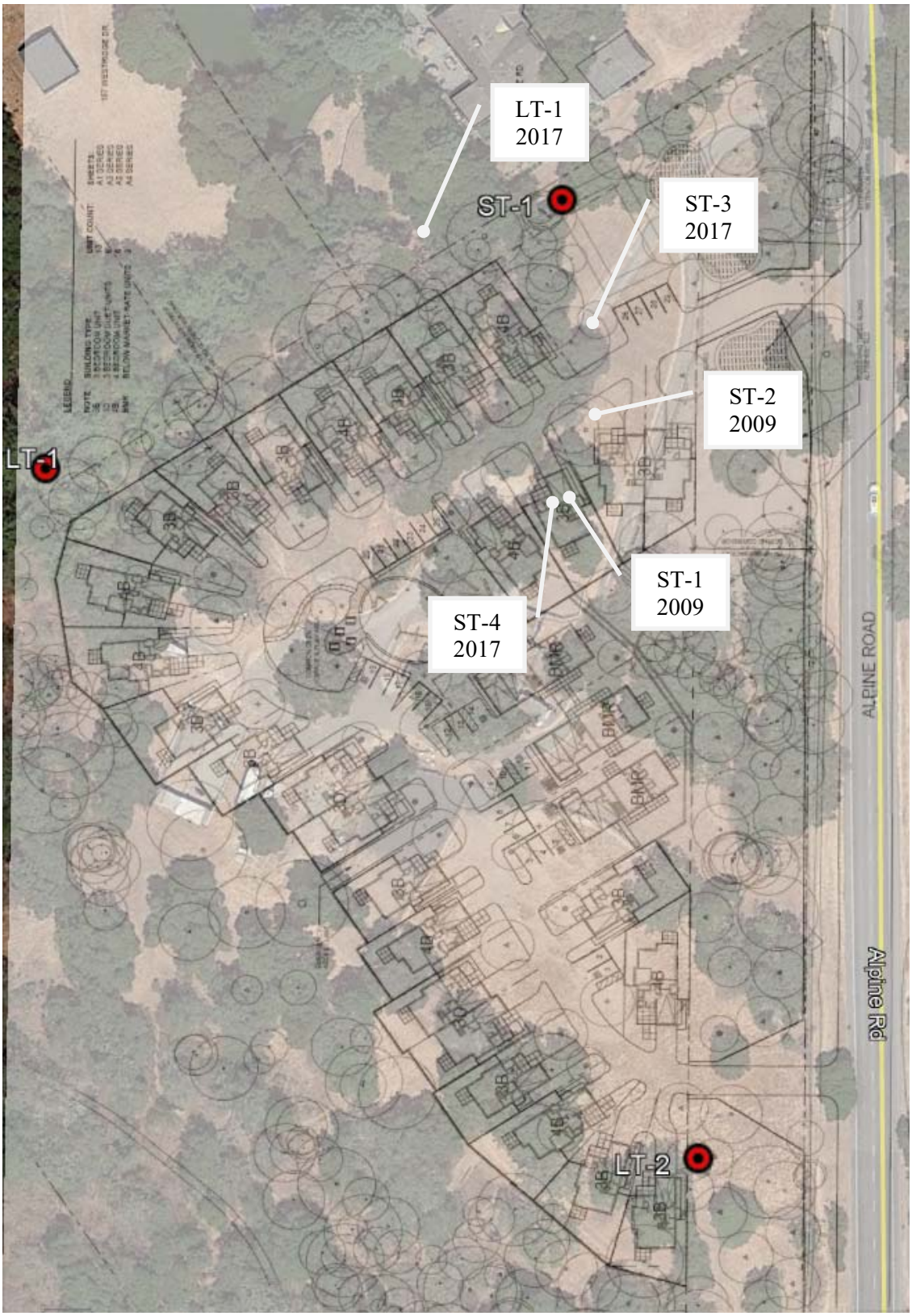
The Project site is located near the eastern boundary of Portola Valley, roughly three quarters of a mile west of Interstate 280, and near the intersection of Alpine Road and Westridge Drive. Residential properties exist just to the north of the site along Westridge Drive. Alpine Road runs along the eastern border of the site, while woodlands exist to the south and west.

A noise monitoring survey was performed to document existing noise levels in the Project vicinity beginning on Wednesday, January 22, 2020 and concluding on Friday, January 24, 2020. The monitoring survey included two long-term (LT-1 and LT-2) noise measurements and one short-term (ST-1) noise measurement. All measurement locations are shown in **Figure 14.1**. The existing noise environment in the Project vicinity results primarily from local vehicular traffic along Alpine Road. Occasional aircraft also contribute to the noise environment. Daily trend in noise levels at all measurement locations are summarized below and graphical representation is also included as Figures 2 through 7 in Appendix H.

Long-term noise measurement LT-1 was made at the north end of the Project site, approximately 530 feet west of the centerline of Alpine Road, and at the fence line of one of the nearest residential properties bordering the site. Hourly average noise levels typically ranged from 43 to 53 dBA Leq during the day and from 41 to 47 dBA Leq at night. The day-night average noise level on Thursday, January 23, 2020 was 52 dBA Ldn.

LT-2 was made at the south end of the Project site, approximately 110 feet west of the centerline of Alpine Road, which was representative of the setback of the proposed buildings adjacent to the roadway. Hourly average noise levels typically ranged from 50 to 57 dBA Leq during the day and from 34 to 53 dBA Leq at night. The day-night average noise level on Thursday, January 23, 2020 was 55 dBA Ldn.

Figure 14.1: Noise Measurement Locations



Source: Google Earth 2020

A short-term noise measurement was made over a 10-minute period, concurrent with the long-term noise data, on Wednesday, January 22, 2020 in order to complete the noise survey. ST-1 was made along the northern property line of the site between 11:30 am and 11:40 am. In addition to the roadway traffic, three jets passed overhead, producing maximum instantaneous noise levels of 53 to 60 dBA. During the 101 light passenger vehicle pass-bys, noise levels of 52 to 59 dBA were measured. Four trucks passed the site in this 10-minute period, generating noise levels of 61 to 65 dBA. The 10-minute average noise level measured at ST-1 was 55 dBA Leq(10-min). The short-term measurement results are summarized in **Table 14.5**.

Table 14.5: Summary of Short-Term Noise Measurements (dBA)

Noise Measurement Location (Date, Time)	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	$L_{eq(10\text{-}min)}$
ST-1: ~200' West of the Alpine Road Centerline (1/22/2020, 11:30-11:40 am)	65	64	58	54	47	55

IMPACTS AND MITIGATION MEASURES

THRESHOLDS OF SIGNIFICANCE

The following thresholds for measuring a Project's environmental impacts are based upon Appendix G of the CEQA Guidelines thresholds:

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?

2. Would the project result in generation of excessive groundborne vibration or groundborne noise levels?

3. 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, would the project expose people residing or working in the project area to excessive noise levels?

NOISE EXPOSURE

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?*

   The following standards are used to determine an impact under this threshold of significance:

   - A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. The Town of Portola Valley considers a Project that will cause the Ldn at noise-sensitive uses to increase by 3 dBA or more and exceed the "normally acceptable" level to be a significant noise impact.
   - A significant permanent noise level increase would occur if Project-generated traffic would result in the Ldn at noise-sensitive uses to increase by 5 dBA or more and remain "normally acceptable."

- A significant noise impact would be identified if the Project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan or Municipal Code.

Construction Period

Impact Noise-1: **Temporary Construction Noise**. Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to Project construction activities, but these would be constrained to weekday daytime hours and require appropriate noise control measures according to existing Town regulations and requirements. This is a ***less-than-significant*** temporary noise impact.

The potential for temporary noise impacts due to Project construction activities would depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time. Policy 4319 of the Town's General Plan requires that all construction operations within the Town implement appropriate standard controls for all construction projects carried out by contractors or homeowners, implement appropriate standard controls for yard maintenance activities carried out by commercial companies and homeowners, require ASCC review for all construction projects scheduled for or lasting more than 24 months and submittal of construction staging, timing and noise management plans, and develop a guidance manual to provide information to the public regarding noise control. The Municipal Code permits commercial construction activities between 8:00 am and 5:30 pm Monday through Friday.

Construction activities can generate considerable amounts of noise, especially during earth-moving activities (such as for grading of the Residential Development Area and Fire Access Road and undergrounding of utilities) and during the construction of the building's foundation when heavy equipment is used. The highest noise levels would be generated during grading, excavation, and foundation construction. The hauling of excavated materials and construction materials would generate truck trips on local roadways, as well.

The construction schedule provided was approximately 22 months, or 462 construction workdays. Construction activities for individual projects are typically carried out in stages. During each stage of construction, there would be a different mix of equipment operating, and noise levels would vary by stage and vary within stages, based on the amount of equipment in operation and the location at which the equipment is operating. Maximum noise levels produced by various construction equipment, typical construction noise levels at a distance of 50 feet, and maximum instantaneous noise levels for various types of construction equipment are detailed in Appendix H (Tables 5 through 7). Most demolition and construction noise falls with the range of 80 to 90 dBA Lmax at a distance of 50 feet from the source. Average noise levels produced by the construction of domestic housing projects and related roadways generally fall within the range of 65 to 88 dBA Leq at a receptor approximately 50 feet from the construction work area. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain often result in lower construction noise levels at distant receptors.

As discussed in the Environmental Setting above, the closest noise-sensitive receptors are the adjacent residential land uses to the north. Based on noise monitoring, ambient daytime noise levels typically ranging from 43 to 57 dBA Leq due to traffic along Alpine Road. Based on the proposed

Project details and surroundings, during busy construction periods, noise levels would generally fall within the range of 62 to 72 dBA Leq at these nearest receptors. Noise levels from construction of the Fire Access Road would be similar and farther away from receptors and as with the utility undergrounding along the Project's Alpine Road frontage, would move along a linear path at varying distances from receptors over time. As discussed above, noise levels are reduced at farther distances from the source. Therefore, this analysis focuses on the closest noise-sensitive receptors, and all other construction noise levels at vicinity noise-sensitive receptors would be the same or less than reported here. Noise levels due to construction activities would substantially exceed ambient conditions for the construction period at nearby receptors.

However, the potential short-term noise impacts associated with Project construction activities would be mitigated by the implementation of General Plan Policy 4319, requiring noise control measures during construction activities, which are incorporated into the construction plan and implemented during all phases of construction activity, and by consistency with Municipal Code requirements for construction hours. With required implementation of these existing Town measures, noise from Project construction activities would be consistent with applicable standards and requirements and the Project impact with respect to construction noise would be ***less-than-significant***.

Operation

Impact Noise-2: **Operational Noise**. The proposed Project would generate operational noise related to residential use of the site including home mechanical equipment, increased traffic noise, and ongoing vegetation management. However, operational noise from the Project and increased noise levels at existing sensitive receptors would comply with applicable standards. This is a ***less-than-significant*** operational noise impact.

Noise Levels Attributable to On-Site Operations

Residential mechanical equipment is generally assumed to run continuously during the daytime and nighttime hours. Per Municipal Code requirements, noise levels at nearby existing residential properties would be limited to 50 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and to 40 dBA at night (10:00 p.m. to 7:00 a.m.). No equipment is anticipated for a project of this type and scale that would make meeting the applicable noise limits with standard noise control measures difficult as demonstrated through the assessment below.

The Project would include mechanical equipment, such as heating, ventilation, and air conditioning systems. Based on a review of the Project plans, the condensing units of residential heat pump systems would be located at ground level on the side yards of each single-family unit. Noise levels produced by a typical residential heat pump are approximately 56 dBA at 3 feet away during operation and would be reduced the farther the receptor is located from the source. Mechanical equipment associated with the proposed Project is anticipated to produce noise levels less than 35 dBA at the nearest existing residential property lines to the north. Operational noise levels would not exceed the most conservative 40 dBA Leq nighttime residential threshold at surrounding land uses and would generally be below ambient noise levels in the area. This is a ***less-than-significant*** impact.

Noise Levels Attributable to Vegetation Management

As noted in Chapter 3: Project Description, a Vegetation Management Plan would be implemented to reduce and manage wildfire risk at the Project site. Initial Vegetation Management activities would involve hand-cutting trees for removal and a chipper or masticator to reduce size of remaining materials where there is not currently good access for material removal. Following construction of the

Fire Access Road, materials would be cut by hand and removed from the site via the Fire Access Road.

As noted above, the Fire Access Road is located at least 200 feet from the closest residential properties and while Vegetation Management activities would occur throughout the Project site, noise levels related to intermittent Vegetation Management on this site would not be expected to exceed noise levels from intermittent property management activities at surrounding residences. Ongoing Vegetation Management activities to manage wildfire risk at the site would be required to comply with section 9.10.040 of the Portola Valley Municipal Code, including the types of activities and allowable hours. This is a ***less-than-significant*** impact.

Noise Levels Attributable to Traffic

According to Policy 4318 of the Town's General Plan, a significant permanent noise increase would occur if the Project would increase noise levels at noise-sensitive receptors by 3 dBA Ldn or more where ambient noise levels exceed the "normally acceptable" noise level standard. Where ambient noise levels are at or below the "normally acceptable" noise level standard, noise level increases of 5 dBA Ldn or more would be considered significant. The Town's General Plan defines the "normally acceptable" outdoor noise level standard for the residential land uses to be 55 dBA Ldn. Existing ambient levels were 55 dBA Ldn at the proposed residential units nearest to Alpine Road. Therefore, a significant impact would occur if traffic due to the proposed Project would permanently increase ambient levels by 3 dBA Ldn. For reference, a 3 dBA Ldn noise increase would be expected if the Project would double existing traffic volumes along a roadway.

See Chapter 14 and Appendix I for details of the traffic analysis performed for the Project. The Project would result in trip generation of 26 net additional trips during the peak AM hour and 34 net additional trips during the peak PM hour. While traffic volumes in the vicinity are generally low, the nearby Alpine Road and Westridge Drive intersection carries just over 1,000 vehicles during the peak hours. The Project would make an even smaller contribution to traffic volumes along higher-volume corridors and with increased traffic from cumulative development. Project traffic does not have the potential to result in doubling of traffic volumes and would not result in a permanent noise increase of 3 dBA Ldn or more and the impact is therefore ***less-than-significant***.

GROUNDBORNE VIBRATION

2. *Would the project result in generation of excessive groundborne vibration or groundborne noise levels?*

   The following standard is used to determine an impact under this threshold of significance:

   - A significant impact would be identified if the construction of the Project would generate excessive vibration levels surrounding receptors. Groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

Impact Noise-3: **Vibration**. Residential uses are not a source of substantial operational vibration and while construction activities can result in vibration, Project construction would not result in vibration levels exceeding applicable standards (0.3 in/sec PPV) at the surrounding sensitive land uses levels. This is a ***less-than-significant*** impact.

Construction Period

The construction of the Project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include site demolition,

preparation work, foundation work, installation of project infrastructure (including roadways and utilities), utility undergrounding along Alpine Road, and new building framing and finishing. Pile driving, which can cause excessive vibration, is not expected to be required for Project construction.

The California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards in order to reduce the potential for cosmetic damage to structures. Cosmetic damage is defined as hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. A vibration limit of 0.3 in/sec PPV has been used for buildings that are found to be structurally sound but where structural damage is a major concern.

Calculations were made to estimate vibration levels at the nearest residential and commercial structures surrounding the site. Vibration levels are highest close to the source, and then attenuate with increasing distance. Project-generated vibration levels would fall below the 0.3 in/sec PPV threshold at 20 feet from the Project site during construction activities producing the highest vibration levels (e.g., vibratory roller). Since all off-site structures are more than 20 feet from the Project site boundaries, neither cosmetic, minor, or major damage would occur at these conventional buildings. While vibration would not be expected to cause significant impacts, vibration levels may still be perceptible. However, as with any type of construction, this would be anticipated and would not be considered significant, given the intermittent and short duration of the phases that have the highest potential of producing vibration (use of a vibratory roller, jackhammers, and other high-power tools). Therefore, the impact related to construction-period vibration would be a ***less-than-significant*** impact.

The potential for nuisances associated with vibration would be further reduced by the implementation of General Plan Policy 4319, which requires noise control measures during construction activities, and by consistency with Municipal Code requirements for construction hours, both of which would also affect construction-period vibration generation.

Operation

There are no known sources of substantial groundborne vibration at or near the Project site and the proposed residential use is not a use that would produce substantial groundborne vibration. Vegetation Management activities would not produce substantial groundborne vibration at nearby properties. This is a ***less than significant*** impact**.**

AIRPORTS

3. 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, would the project expose people residing or working in the project area to excessive noise levels?

Impact Noise-4: **Excessive Aircraft Noise**. The Project site is located over 6 miles from a public airport or public use airport and would not expose people residing or working in the Project area to excessive aircraft noise. This is a ***less-than-significant*** impact.

Palo Alto Airport and Moffett Federal Airfield are public and civil-military airports located approximately 6.3 and 7.8 miles from the Project site, respectively. The Project site lies well outside both Palo Alto Airport and Moffett Federal Airfield noise contours, which means that aircraft noise would be less than 65 CNEL. Therefore, the Project would not be within two miles of an airport or

within areas subjected to excessive airport-related noise levels and would have a ***less-than-significant*** impact with respect to exposing people to excessive airport-related noise levels.

While not rising to the level of a significant impact under CEQA, residents can be aware of aircraft noise at lower noise levels than those considered excessive under airport planning. Additional discussion of airport-related noise levels is provided here for informational purposes. Ongoing noise monitoring reports for Portola Valley from the San Francisco International Airport Aircraft Noise Abatement Office have consistently demonstrated that aircraft noise within Portola Valley is generally the same or less than existing community levels at 50 CNEL or below.[2] CNEL is a more restrictive calculation of community nose levels than the Ldn calculation used in the Town's General Plan, so would show a higher noise level. Therefore, we can compare the reported CNEL of less than 50 for aircraft noise to the Town's General Plan land use compatibility table (Figure 2 in the General Plan, as excerpted in the Regulatory Setting above) indicating that noise levels of 55 Ldn or less are normally acceptable for all residential uses. This means that future exterior noise levels due to aircraft noise are compatible with the proposed land use.

[2] San Francisco International Airport Aircraft Noise Abatement Office, *Portola Valley Noise Monitoring Report*, issued quarterly and available from 2015 to quarter 3 of 2021, accessed 1/28/2022, available at: https://www.flysfo.com/community/noise/reports-and-resources/aircraft-noise-monitoring-reports#.

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