1957 PRUNERIDGE AVENUE NOISE AND VIBRATION ASSESSMENT

Santa Clara, California

September 6, 2023

Prepared for:

Shannon George
Vice President & Principal Project Manager
David J. Powers & Associates, Inc.
1871 The Alameda, Suite 200
San José, CA 95126

Prepared by:

Micah Black
Michael S. Thill

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality
429 East Cotati Avenue
Cotati, CA 94931
(707) 794-0400

Project: 22-146

INTRODUCTION

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise and groundborne vibration, summarizes applicable regulatory background, and describes the existing noise environment in the project vicinity; 2) the Plan Consistency Analysis Section discusses the noise and land use compatibility of the project; and, 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents measures, where necessary, to mitigate the impacts of the project on sensitive receptors in the site vicinity.

The 2.47-acre site is currently developed with two buildings; a church and a one- to two-story office and school building. The proposed project would demolish the exiting uses, parking lot, and landscaping to construct 22 two-story residential units, an outdoor paseo area with walkways, and a new driveway that passes through the center of the site with entrances/exits to Pruneridge Avenue on the west and east sides of the site. Garage parking would be provided on the first floor of each residential unit.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA)*. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the

variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (L_{dn} or *DNL*) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

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 L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} 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 12-17 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 57-62 dBA L_{dn} with open windows and 65-70 dBA L_{dn} if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 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. The L_{dn} 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 L_{dn}. At a L_{dn} of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the percentage of the population highly annoyed increases to about 25-30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a L_{dn} of 60-70 dBA. Between a L_{dn} of 70-80 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 L_{dn} is 60 dBA, approximately 30-35 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 Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous or frequent intermittent vibration levels produce. The guidelines in Table 3 represent syntheses of vibration criteria for human response and potential damage to buildings resulting from construction vibration.

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.

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 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 3 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.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
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, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum 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 p.m. and 7:00 a.m.
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 p.m.to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m.
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 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.

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Threshold at which there is a risk of damage to fragile buildings with no risk of damage to most buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential structures
0.5	Severe – Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

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

Regulatory Background

The California Environmental Quality Act (CEQA) Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

Federal

Federal Transit Administration's Transit Noise and Vibration Impact Assessment Manual. The Federal Transit Administration's (FTA) Transit Noise and Vibration Impact Assessment Manual includes general assessment criteria for construction noise. During daytime hours, the hourly average noise level limit is 80 dBA L_{eq} at residential land uses and 90 dBA L_{eq} at commercial and industrial land uses.

State of California

State CEQA Guidelines. CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) 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) Generation of excessive groundborne vibration or groundborne noise levels; or

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

California Department of Transportation. To avoid damage to buildings, Caltrans recommends that construction vibration levels are limited to 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, to 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and to 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened (see Table 3).

Local

Santa Clara County Airport Land Use Commission Comprehensive Land Use Plan. The Comprehensive Land Use Plan (CLUP) adopted by the Santa Clara County Airport Land Use Commission contains policies and standards for projects within the vicinity of San José International Airport that apply to this project;

4.3.2.1 Noise Compatibility Policies

N-1 The Community Noise Equivalent Level (CNEL) method of representing noise levels shall be used to determine if a specific land use is consistent with the CLUP.

N-2 In addition to the other policies herein, the Noise Compatibility Policies presented in Table 4-1 shall be used to determine if a specific land use is consistent with this CLUP.

N-3 Noise impacts shall be evaluated according to the Aircraft Noise Contours presented on Figure 5 (not shown in this report).

Table 4 - 1

NOISE COMPATIBILITY POLICIES

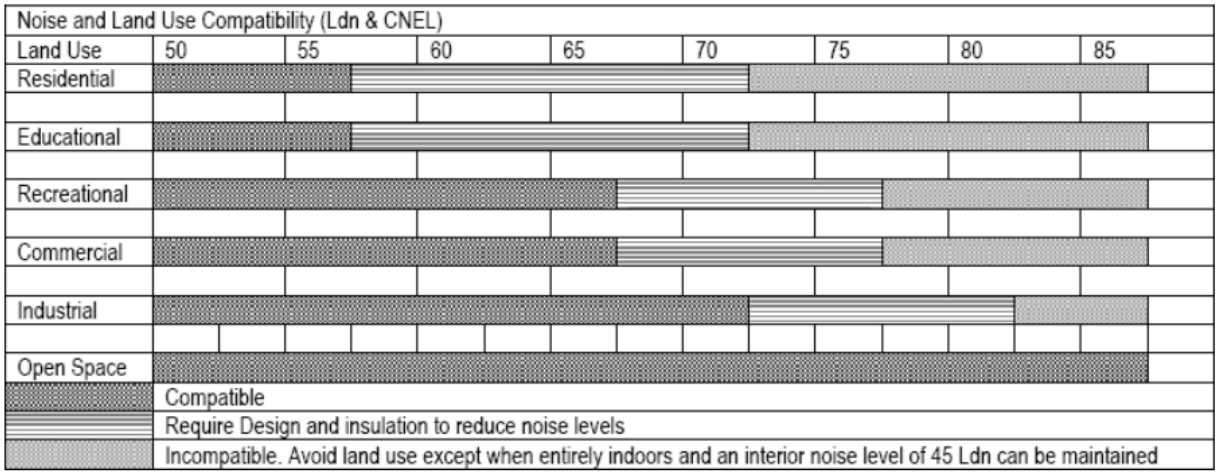
LAND USE CATEGORY	CNEL					
	55-60	60-65	65-70	70-75	75-80	80-85
Residential – low density Single-family, duplex, mobile homes	*	**	***	****	****	****
Residential – multi-family, condominiums, townhouses	*	**	***	****	****	****
Transient lodging - motels, hotels	*	*	**	****	****	****
Schools, libraries, indoor religious assemblies, hospitals, nursing homes	*	***	****	****	****	****
Auditoriums, concert halls, amphitheaters	*	***	***	****	****	****
Sports arena, outdoor spectator sports, parking	*	*	*	**	***	****
Playgrounds, neighborhood parks	*	*	***	****	****	****
Golf courses, riding stables, water recreation, cemeteries	*	*	*	**	***	****
Office buildings, business commercial and professional, retail	*	*	**	***	****	****
Industrial, manufacturing, utilities, agriculture	*	*	*	***	***	****
* Generally Acceptable	Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements. Mobile homes may not be acceptable in these areas. Some outdoor activities might be adversely affected.					
** Conditionally Acceptable	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. Outdoor activities may be adversely affected. Residential: Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.					
*** Generally Unacceptable	New construction or development should 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 activities are likely to be adversely affected.					
**** Unacceptable	New construction or development shall not be undertaken.					

Source: Based on General Plan Guidelines, Appendix C (2003), Figure 2 and Santa Clara County ALUC 1992 Land Use Plan, Table 1

Source: Comprehensive Land Use Plan Santa Clara County, Norman Y Mineta San José International Airport, May 25, 2011, Amended May 23, 2019.

City of Santa Clara General Plan. The City of Santa Clara's General Plan identifies noise and land use compatibility standards for various land uses and establishes policies to control noise within the community. Table 8.14-1 from the General Plan Appendix 8-14 shows acceptable noise levels for various land uses. Residential land uses are considered compatible in noise environments of 55 dBA Ldn/CNEL or less. The guidelines state that where the exterior noise levels are greater than 55 dBA Ldn/CNEL and less than 70 dBA Ldn/CNEL at residential uses, the design of the project should include measures to reduce interior noise to acceptable levels. Commercial land uses are considered compatible in noise environments of 65 dBA Ldn/CNEL or less. The guidelines state that where the exterior noise levels are greater than 65 dBA Ldn/CNEL and less than 75 dBA Ldn/CNEL at commercial uses, the design of the project should include measures to reduce interior noise to acceptable levels. Applicable policies presented in the General Plan are listed below. Note that Table 5.10-1 included in the General Plan and referenced in the policies, titled "Noise and Land Use Compatibility", instead shows typical noise sources and levels. Table 8.14-1 shown below, and titled "General Plan Noise Standards" from General Plan Appendix 8-14 has been used in previous noise assessments. Because this table was brought forward from the previous Noise Element it is assumed that the CNEL levels apply at the center of each box (as shown in the original version) and line up with the corresponding level of compatibility.

TABLE 8.14-1: GENERAL PLAN NOISE STANDARDS



Applicable goals and policies presented in the General Plan are as follows:

5.10.6-G1 Noise sources restricted to minimize impacts in the community.

5.10.6-G2 Sensitive uses protected from noise intrusion.

5.10.6-G3 Land use, development and design approvals that take noise levels into consideration.

5.10.6-P1 Review all land use and development proposals for consistency with the General Plan compatibility standards and acceptable noise exposure levels defined on Table 5.10-1.

5.10.6-P2 Incorporate noise attenuation measures for all projects that have noise exposure levels greater than General Plan "normally acceptable" levels, as defined on Table 5.10-1.

5.10.6-P3 New development should include noise control techniques to reduce noise to acceptable levels, including site layout (setbacks, separation and shielding), building treatments (mechanical ventilation system, sound-rated windows, solid core doors and baffling) and structural measures (earthen berms and sound walls).

5.10.6-P4 Encourage the control of noise at the source through site design, building design, landscaping, hours of operation and other techniques.

5.10.6-P5 Require noise-generating uses near residential neighborhoods to include solid walls and heavy landscaping along common property lines, and to place compressors and mechanical equipment in sound-proof enclosures.

5.10.6-P6 Discourage noise sensitive uses, such as residences, hospitals, schools, libraries and rest homes, from areas with high noise levels, and discourage high noise generating uses from areas adjacent to sensitive uses.

5.10.6-P7 Implement measures to reduce interior noise levels and restrict outdoor activities in areas subject to aircraft noise in order to make Office/Research and Development uses compatible with the Norman Y. Mineta International Airport land use restrictions.

City of Santa Clara Municipal Code. The City's Municipal Code establishes noise level performance standards for fixed sources of noise. Section 9.10.40 of the Municipal Code limits noise levels at residences to 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and 50 dBA at night (10:00 p.m. to 7:00 a.m.). The noise limits are not applicable to emergency work, licensed outdoor events, City-owned electric, water, and sewer utility system facilities, construction activities occurring within allowable hours, permitted fireworks displays, or permitted heliports. Construction activities are not permitted within 300 feet of residentially zoned property except within the hours of 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

The City Code does not define the acoustical time descriptor such as L_{eq} (the average noise level) or L_{max} (the maximum instantaneous noise level) that is associated with the above limits. A reasonable interpretation of the City Code would identify the ambient base noise level criteria as an average or median noise level (L_{eq}/L_{50}).

Existing Noise Environment

The project site is located on the north side of Pruneridge Avenue, between Winchester Boulevard and Crestview Drive, in the City of Santa Clara. All buildings and development currently on site will be demolished to make way for the new development. The site is bounded by Pruneridge Avenue to the south, an office building and residential land uses to the west, single-family

residential land uses to the north, and commercial land uses to the east. The Pacific Autism Center for Education and single-family residential land uses are located directly across Pruneridge Avenue from the site.

A noise monitoring survey, which included two long-term (LT-1 and LT-2) and two short-term (ST-1 and ST-2) noise measurements, was performed at the site beginning on Wednesday November 2, 2022 and concluding on Friday November 4, 2022 to quantify existing noise levels and characterize noise sources. Based on the results of the noise survey, the noise environment at the site and in the surrounding areas was found to result primarily from vehicular traffic along Pruneridge Avenue. Aircraft associated with the Norman Y. Mineta San José International Airport also contribute to the noise environment. Noise measurement locations are shown in Figure 1.

Long-term noise measurement LT-1 was made approximately 250 feet north of the centerline of Pruneridge Avenue, and was partially shielded from traffic noise by the existing church building. This location was chosen to represent ambient noise levels at the residential properties to the north. Hourly average noise levels at LT-1 typically ranged from 49 to 56 dBA L_{eq} during the day and from 40 to 55 dBA L_{eq} at night. Abnormal noise levels of 65 dBA L_{eq} were recorded during the 4:00 p.m. hour of Thursday, November 3, 2022, and were not used in this noise analysis. The CNEL on Thursday, November 3, 2022 was 55 dBA.

Long-term noise measurement LT-2 was made approximately 60 feet north of the centerline of Pruneridge Avenue. This location was chosen to represent ambient noise levels at the proposed building facades closest to Pruneridge Avenue, as well as at other existing land uses along Pruneridge Avenue. Hourly average noise levels at LT-2 typically ranged from 61 to 67 dBA L_{eq} during the day and from 49 to 63 dBA L_{eq} at night. The CNEL on Thursday, November 3, 2022 was 67 dBA CNEL. The daily trends in noise levels at LT-1 and LT-2 are shown in Appendix A of this report.

Short-term noise measurements ST-1 and ST-2 were made on Friday, November 4, 2022 in 10-minute intervals between 9:30 a.m. and 10:10 a.m., as summarized in Table 4. ST-1 was made on the east side of the site, approximately 155 feet from the centerline of Pruneridge Avenue between 9:30 a.m. and 9:40 a.m. During this measurement, 99 passenger vehicles and 2 trucks passed by along Pruneridge Avenue, generating noise levels ranging from 49 to 63 dBA. One aircraft produced noise levels up to 51 dBA. The 10-minute average noise level at ST-1 was 54 dBA L_{eq}. During the same measurement period, the 10-minute average noise levels at LT-1 and LT-2 were 50 and 63 dBA L_{eq} respectively.

ST-2 was made on the west side of the site, approximately 155 feet from the centerline of Pruneridge Avenue between 10:00 a.m. and 10:10 a.m. During this measurement, 94 passenger vehicles and 2 trucks passed by along Pruneridge Avenue, generating noise levels ranging from 54 to 67 dBA. One aircraft produced noise levels up to 48 dBA. The 10-minute average noise level at ST-2 was 56 dBA L_{eq}. During the same measurement period, the 10-minute average noise levels at LT-1 and LT-2 were 50 and 64 dBA L_{eq} respectively.

TABLE 4 Summary of Short-Term Noise Measurement Data (dBA)

Noise Measurement Location (Date, Time)	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}
ST-1: East side of site (11/4/2022, 9:30-9:40 a.m.)	65	62	58	52	45	54
ST-2: West side of site (11/4/2022, 10:00-10:10 a.m.)	67	64	60	52	45	56

FIGURE 1 Noise Measurement Locations

Source: Google Earth, 2022.

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

According to the City's General Plan, noise levels in outdoor use areas of residential land uses that are affected by transportation noise are required to be maintained at or below 57-60 dBA CNEL to be considered normally acceptable with the noise environment. Additionally, residential interior noise levels are required to meet the performance standard of 45 dBA CNEL.

Future Exterior Noise Environment

The future noise environment at the site would continue to result primarily from vehicular traffic along Pruneridge Avenue. Traffic noise levels are anticipated to increase by up to 2 dBA CNEL along Pruneridge Avenue by 2035.[1] This analysis conservatively assumes that the noise levels measured in 2022 would increase by 2 dBA CNEL, reaching 69 dBA CNEL at about 60 feet from the center of Pruneridge Avenue and 57 dBA CNEL at about 250 feet from the center of Pruneridge Avenue.

The site plan shows a centrally located landscaped paseo allowing walking access for residents to Pruneridge Avenue. Small outdoor decks are planned along Pruneridge Avenue. Partially enclosed private outdoor patio areas are shielded from Pruneridge Avenue traffic noise by the buildings and would be below the City's 55 dBA CNEL "compatible" threshold. Future exterior noise levels at the paseo would range from approximately 69 dBA CNEL closest to Pruneridge Avenue and 62 dBA CNEL at Drive Aisle A. This public area would exceed the City's 55 dBA CNEL "compatible" threshold without additional noise control. If this area is to be considered an outdoor use area, a noise barrier would be needed to reduce noise levels. Fences would need to be solid and about 9-feet high to reduce future noise levels in the paseo to 55 dBA CNEL and 6-feet high to reduce noise levels to 60 dBA CNEL. The City's exterior noise standard would apply to common outdoor use areas, but would not be applied at small private decks or balconies proposed by the project.

Future Interior Noise Environment

Standard residential construction provides approximately 15 dBA of exterior-to-interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA CNEL, the inclusion of adequate forced-air mechanical ventilation is often the method selected to reduce interior noise levels to acceptable levels by closing the windows to control noise. Where noise levels exceed 65 dBA CNEL, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound-rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant's discretion.

[1] 2010-2035 General Plan ADEIR Noise Section, Illingworth & Rodkin, Inc., April 30, 2010.

Exterior noise levels are calculated to reach 69 dBA CNEL at about 60 feet from the center of Pruneridge Avenue and 58 dBA CNEL at about 250 feet from the center of Pruneridge Avenue. The worst-case exterior noise exposure would occur at the units nearest to Pruneridge Avenue where the traffic noise levels would reach 69 dBA CNEL. Assuming windows are partially open for ventilation, future interior noise levels in these units would reach 54 dBA CNEL.

Noise Insulation Features to Reduce Future Interior Noise Levels

The following noise insulation features shall be incorporated into the proposed project to reduce interior noise levels to 45 dBA CNEL or less at residential interiors:

- Provide a suitable form of forced-air mechanical ventilation, as determined by the local building official, so that windows can be kept closed at the occupant's discretion to control interior noise and achieve the interior noise standards. Preliminary calculations indicate that worst-case units along Pruneridge Avenue would require windows and doors having a minimum rating of 26 STC in order to achieve the interior noise threshold of 45 dBA CNEL.

Conditions of Approval

A qualified acoustical specialist shall prepare a detailed analysis of interior residential noise levels resulting from all exterior sources during the design phase pursuant to requirements set forth in the Santa Clara General Plan. The study will review the final site plan, building elevations, and floor plans prior to construction and recommend building treatments to reduce residential interior noise levels to 45 dBA CNEL or lower. Treatments would include, but are not limited to, sound-rated windows and doors, sound-rated wall and window constructions, acoustical caulking, protected ventilation openings, etc. The specific determination of what noise insulation treatments are necessary shall be conducted on a unit-by-unit basis during final design of the project. Results of the analysis, including the description of the necessary noise control treatments, shall be submitted to the City, along with the building plans and approved design, prior to issuance of a building permit.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- A significant noise impact would be identified if the project would generate a substantial temporary or permanent noise level increase over ambient noise levels at existing noise-sensitive receptors surrounding the project site and that would exceed applicable noise standards presented in the General Plan or Municipal Code at existing noise-sensitive receptors surrounding the project site.

- A substantial temporary noise increase would be identified if noise levels would exceed 80 dBA L_{eq} at residential land uses or 90 dBA L_{eq} at commercial land uses in the project vicinity.

- A significant permanent noise level increase would occur if project-generated traffic generated by the project or project improvements/operations would substantially increase noise levels at sensitive receivers in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA CNEL or greater, with a future noise level of less than the "normally acceptable" standard, or b) the noise level increase is 3 dBA CNEL or greater, with a future noise level equal to or greater than the "normally acceptable" standard.

- 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.

- 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.

- A significant noise impact would be identified if the project would expose people residing or working in the project area to excessive aircraft noise levels.

Impact 1a: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. The incorporation of construction best management practices would also assist in reducing noise levels. This is a **less-than-significant** temporary noise impact.

The project would demolish the exiting uses to construct 22 two-story residential units. The construction schedule assumed that the earliest possible start date would be January 2023 and the project would be built out over a period of approximately 7 months. Construction phases would include demolition, site preparation, grading, trenching, building construction (exterior, interior, and architectural coating) and paving. During each phase of construction, there would be a different mix of equipment operating, and noise levels would vary by phase and vary within phases, based on the amount of equipment in operation and the location at which the equipment is operating.

Noise impacts resulting from construction 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.

The City's Municipal Code limits construction activities (including the loading and unloading of materials and truck movements) within 300 feet of residentially zoned property to the hours of 7:00 a.m. to 6:00 p.m. on weekdays and between the hours of 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

However, the City of Santa Clara does not establish noise level thresholds for construction activities. As an alternative, this analysis uses the noise limits established by the Federal Transit Administration (FTA) to identify the potential for impacts due to substantial temporary construction noise. The FTA identifies construction noise limits in the *Transit Noise and Vibration Impact Assessment Manual*.[2] During daytime hours, an exterior threshold of 80 dBA L_{eq} shall be enforced at residential land uses and 90 dBA L_{eq} shall be enforced at commercial and industrial land uses.

The typical range of maximum instantaneous noise levels for the proposed project would be 70 to 90 dBA L_{max} at a distance of 50 feet (see Table 5) from the equipment. Table 6 shows the hourly average noise level ranges, by construction phase, typical for various types of projects. Hourly average noise levels generated by construction are about 65 to 88 dBA L_{eq} for residential buildings, measured at a distance of 50 feet from the center of a busy construction site. 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.

Equipment expected to be used in each construction phase are summarized in Table 7, along with the quantity of each type of equipment, the unshielded reference noise level at 50 feet assuming the operation of the two loudest pieces of construction equipment, and the estimated noise levels at the nearest property lines projected from the center of the construction activity by phase. The estimated noise levels to the north account for noise reduction from the existing 6-foot-tall fence along the north property line. Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM) was used to calculate the hourly average noise levels for each phase of construction, assuming the two loudest pieces of equipment would operate simultaneously, as recommend by the FTA for construction noise evaluations. This construction noise model includes representative sound levels for the most common types of construction equipment and the approximate usage factors of such equipment that were developed based on an extensive database of information gathered during the construction of the Central Artery/Tunnel Project in Boston, Massachusetts (CA/T Project or "Big Dig"). The usage factors represent the percentage of time that the equipment would be operating at full power.

[2] Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, FTA Report No. 0123, September 2018.

TABLE 5 Construction Equipment 50-Foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes:

[1] Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.

[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

[3] Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

TABLE 6 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	**II**	**I**	**II**	**I**	**II**	**I**	**II**
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

TABLE 7 Construction Noise Levels

Phase (Work Days)	Construction Equipment (Quantity)	Calculated Hourly Average L_{eq} (dBA) at Nearest Property Lines From Operation of Two Loudest Pieces of Construction Equipment at Acoustic Center of the Site				
		Noise Level at 50 feet (Unshielded)	North Residential (110 feet)	South Residential/ School (185 feet)	East Commercial (260 feet)	West Residential/ Commercial (260 feet)
Demolition (10 days)	Concrete/Industrial Saw (1)* Excavator (2)* Tractor/Loader/Backhoe (2)	84	71	72	69	69
Site Preparation (5 days)	Rubber-Tired Dozer (1)* Tractor/Loader/Backhoe (2)*	79	66	70	68	68
Grading (17 days)	Grader (1)* Tractor/Loader/Backhoe (2) Scraper (1)*	83	71	72	69	69
Trenching (30 days)	Tractor/Loader/Backhoe (2)* Excavator (2)*	78	66	67	64	64
Building Exterior (90 days)	Forklift (2)* Tractor/Loader/Backhoe (2)*	75	62	63	60	60
Building Interior / Architectural Coating, and Paving (45 days)	Aerial Lift (1)*	68	55	56	53	53
Paving (1 day)	Paving Equipment (1)* Roller (1)* Tractor/Loader/Backhoe (1)	77	64	65	62	62

*Denotes two loudest pieces of construction equipment per phase with the exception of the building interior phase when only one Aerial Lift is proposed. The two loudest pieces of construction equipment were selected to conservatively represent the entire period.

As shown in Table 7, unshielded construction noise levels would intermittently range from 68 to 84 dBA L_{eq} when activities occur approximately 50 feet from nearby receptors. When accounting for the existing 6-foot-tall fence along the north property line, construction noise levels would intermittently range from 62 to 78 dBA L_{eq} when activities occur approximately 50 feet from nearby receptors to the north. Construction noise levels would typically range from 53 to 72 dBA L_{eq} at nearby receptors when focused near the center of the project site. Construction noise levels would not exceed the exterior threshold of 80 dBA L_{eq} at nearby residential land uses and would not exceed 90 dBA L_{eq} at commercial land uses in the project vicinity. The project construction is expected to last for a period of approximately 7 months. Since project construction would last less than one year and produce noise levels below 80 dBA L_{eq} at nearby residences and below 90 dBA L_{eq} at nearby commercial land uses, this temporary construction impact would be considered less-than significant.

Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction material, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life. The construction crew shall adhere to the following construction best management practices to reduce construction noise levels emanating from the site and minimize disruption and annoyance at existing noise-sensitive receptors in the project vicinity. The incorporation of construction best management practices as project conditions of approval would assist in assuring that construction noise would result in a less-than-significant temporary noise impact.

Construction Best Management Practices

Develop a construction noise control plan, including, but not limited to, the following available controls:

- Ensure that excavating, grading and filling activities, and other construction activities (including the loading and unloading of materials and truck movements) within 300 feet of residentially zoned property, including hotel properties, are limited to the hours of 7:00 a.m. to 6:00 p.m. on weekdays and between the hours of 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

- Construct temporary noise barriers, where feasible, to screen stationary noise-generating equipment. Temporary noise barrier fences would provide a 5 dBA noise reduction if the noise barrier interrupts the line-of-sight between the noise source and receptor and if the barrier is constructed in a manner that eliminates any cracks or gaps.

- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Unnecessary idling of internal combustion engines should be strictly prohibited.

- Locate stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from sensitive receptors as feasible. If they must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) shall

be used to reduce noise levels at the adjacent sensitive receptors. Any enclosure openings or venting shall face away from sensitive receptors.

- Utilize "quiet" air compressors and other stationary noise sources where technology exists.

- Construction staging areas shall be established at locations that will create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

- Locate material stockpiles, as well as maintenance/equipment staging and parking areas, as far as feasible from residential receptors.

- Route construction-related traffic along major roadways and as far as feasible from sensitive receptors.

- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.

- The contractor shall prepare a detailed construction schedule for major noise-generating construction activities. The construction plan shall identify a procedure for coordination with adjacent residential land uses so that construction activities can be scheduled to minimize noise disturbance.

- Designate a "disturbance coordinator" who would be responsible for responding to any complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., bad muffler, etc.) and will require that reasonable measures be implemented to correct the problem. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include in it the notice sent to neighbors regarding the construction schedule.

Implementation of the above measures would reduce construction noise levels emanating from the site, limit construction hours, and minimize disruption and annoyance. With the implementation of these measures as project conditions of approval and recognizing that noise generated by construction activities would occur over a temporary period, the temporary increase in ambient noise levels would result in a less-than-significant impact.

Mitigation Measure 1a: No further mitigation necessary.

Impact 1b: Permanent Noise Level Increase/Exceed Applicable Standards. The proposed project would not cause a substantial permanent noise level increase at the existing noise-sensitive land uses in the project vicinity or generate noise levels in excess of standards established in the City's General Plan of Municipal Code with the incorporation of standard conditions of project approval. **This is a less-than-significant impact.**

A significant impact would occur if the permanent noise level increase due to project-generated traffic is 3 dBA CNEL or greater for future ambient noise levels exceeding 60 dBA CNEL or is 5

dBA CNEL or greater for future ambient noise levels at or below 60 dBA CNEL. Existing ambient levels, based on the measurements made in the project vicinity, range from 54 to 67 dBA CNEL. Therefore, a significant impact would occur if the proposed project would permanently increase ambient levels by 3 dBA CNEL within 130 feet of the centerline of Pruneridge Avenue, or by 5 dBA CNEL 130 feet or more from the centerline of Pruneridge Avenue.

The City's Municipal Code establishes noise level performance standards for fixed sources of noise. Section 9.10.40 of the Municipal Code limits noise levels at residences to 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and 50 dBA at night (10:00 p.m. to 7:00 a.m.).

Vehicle Traffic and Parking

The project's traffic study was reviewed to determine the change in traffic noise levels along roadways serving the site due to the proposed project. The net increase in traffic volumes is estimated to be 207 trips per day, with 15 new trips in the AM peak hour and 21 new trips in the PM peak hour.[3] This small increase in daily trips would not measurably increase traffic noise levels along the surrounding roadways. Noise from vehicles utilizing the two driveway entrances would be similar to existing noise levels produced by surface parking. The overall change in the noise environment due to vehicles associated with the project would be 0 dBA CNEL.

Mechanical Equipment

Noise levels received at nearby sensitive land uses would depend on system design level specifications, including the equipment location, type, size, capacity, and enclosure design. These details are typically not available until later phases of the project design and development review process. Mechanical equipment that will service the buildings have not been selected as the project design is not far enough along at this point to provide such details. Generally, one HVAC unit will be provided per unit, and this analysis assumes that mechanical equipment will be located at the ground level and shielded by property line noise barriers, which will contain the noise on the property where it is generated.

Noise levels produced by a typical residential air conditioning condenser are approximately 66 dBA at 3 feet during operation. Based on the above generic assumptions, air conditioning condensers would need to be 10 feet or more from the residential property line to the north to meet the 50 dBA nighttime limit established in the City's Municipal Code. This calculation accounts for the existing 6-foot-tall fence along the property line, which reduces noise levels. If no sound barrier were present, the air conditioning condensers would need to be 20 feet or more from the residential property line. Mechanical equipment noise levels are calculated to be 50 dBA or less at off-site residential land uses shielded by property line noise barriers, meeting the 50 dBA limit established in the City's Municipal Code. No equipment is anticipated for a project of this scale that would make meeting the applicable noise limits with standard noise control measures difficult. However, during final design of the mechanical systems, the noise levels from the proposed equipment should be calculated to ensure compliance with the City's Municipal Code. This is a less-than-significant impact.

[3] Hexagon Transportation Consultants, Inc., *Transportation Analysis for the Proposed Residential Project at 1957 Pruneridge Avenue,* October 13 2022.

Mitigation Measure 1b: **None required.**

Impact 2: **Exposure to Excessive Groundborne Vibration.** Construction-related vibration levels is not calculated to exceed applicable vibration thresholds at nearby sensitive land uses. **This is a less-than-significant impact.**

The construction of the project may generate perceptible vibration when heavy equipment or impact tools are used. Construction phases utilizing such equipment or tools would include demolition, site preparation, grading, trenching, building construction, and paving. Foundation construction techniques involving impact or vibratory pile driving equipment, which can cause excessive vibration, are not expected with the proposed project.

For structural damage, 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, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. No known ancient buildings or buildings that are documented to be structurally weakened adjoin the project area. Therefore, conservatively, groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in a significant vibration impact.

Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 8 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may, if uncontrolled, generate substantial vibration in the immediate vicinity. Vibratory rollers typically generate vibration levels of 0.202 in/sec PPV at 25 feet while drilling and the use of jackhammers typically generates vibration levels ranging from 0.035 to 0.089 in/sec PPV at a distance of 25 feet.

Vibration levels are highest close to the source, and then attenuate with increasing distance at the rate $(D_{ref}/D)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet. Table 8 summarizes the vibration levels expected at nearby structures (including one inground swimming pool). All sensitive structures in the project vicinity would be located at least 20 feet or more from the primary work area, and groundborne vibration levels attributable to project construction would not exceed the 0.3 in/sec PPV threshold .

The US Bureau of Mines has analyzed the effects of blast-induced vibration on buildings in USBM RI 8507,[4] and these findings have been applied to vibrations emanating from construction equipment on buildings.[5] Figure 2 presents the damage probability, as reported in USBM RI 8507 and reproduced by Dowding, assuming a maximum vibration level of 0.268 in/sec PPV at 20 feet.

[4] Siskind, D.E., M.S. Stagg, J.W. Kopp, and C.H. Dowding, Structure Response and Damage Produced by Ground Vibration form Surface Mine Blasting, RI 8507, Bureau of Mines Report of Investigations, U.S. Department of the Interior Bureau of Mines, Washington, D.C., 1980.

[5] Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996.

Based on the data summarized in Figure 2, there would be an approximate 4% chance or less of "threshold damage" assuming a maximum vibration level of 0.268 in/sec PPV.

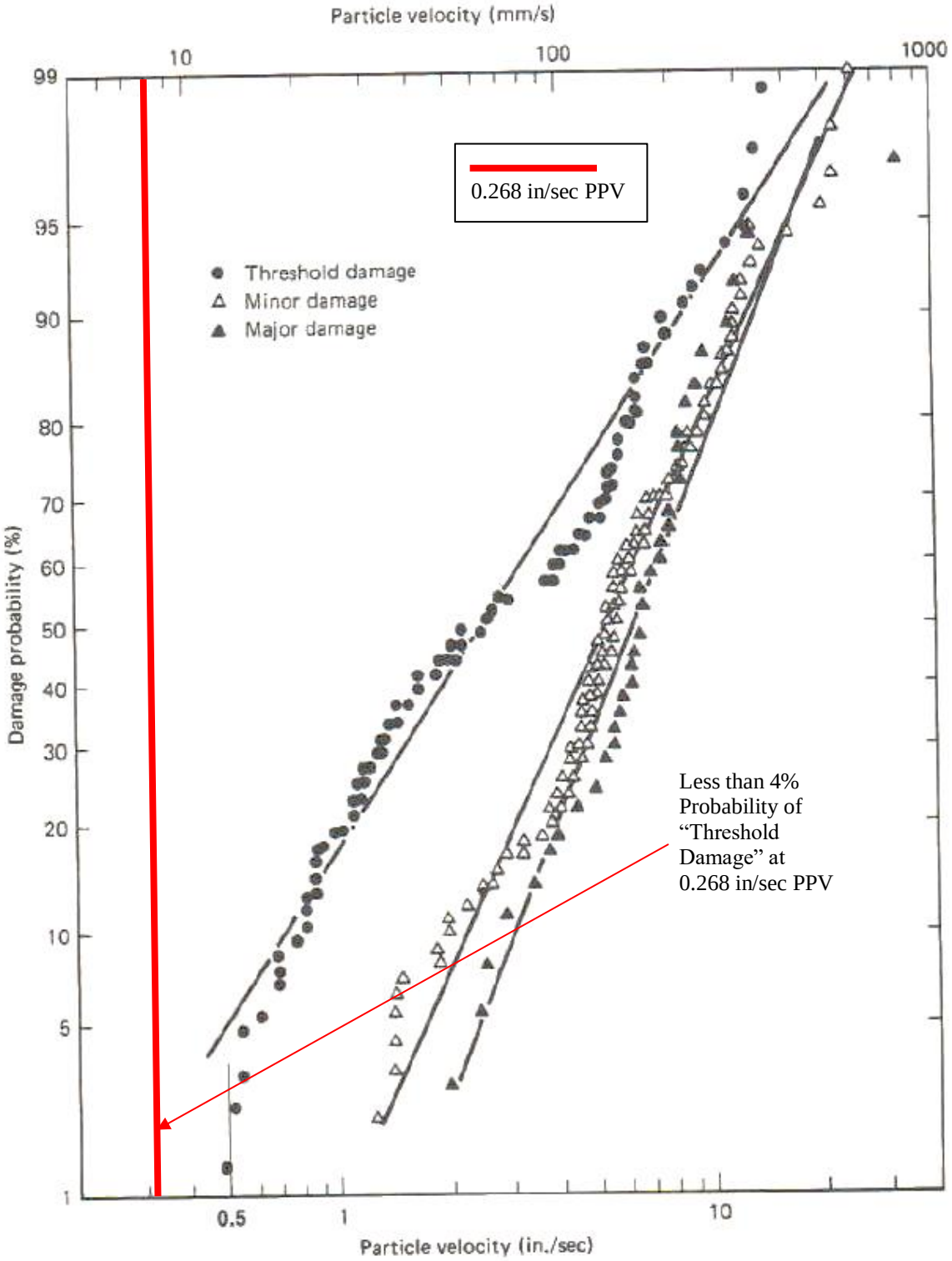
At these locations, and in other surrounding areas where vibration would not be expected to cause cosmetic damage, vibration levels may still be perceptible. However, as with any type of construction, this would be anticipated and would not be considered significant, given the intermittent and short duration of the phases that have the highest potential of producing vibration (use of jackhammers and other high-power tools). By use of administrative controls, such as notifying neighbors of scheduled construction activities and scheduling construction activities with the highest potential to produce perceptible vibration during hours with the least potential to affect nearby businesses, perceptible vibration can be kept to a minimum.

TABLE 8 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Estimated Vibration Levels at Structures Surrounding the Project Site, in/sec PPV			
			North Residential (20 feet)	East Commercial (30 feet)	West Commercial /Residential (35 feet)	South Residential/ School (100 feet)
Clam shovel drop		0.202	0.258	0.165	0.140	0.044
Hydromill (slurry wall)	in soil	0.008	0.010	0.007	0.006	0.002
	in rock	0.017	0.022	0.014	0.012	0.004
Vibratory Roller		0.210	0.268	0.172	0.145	0.046
Hoe Ram		0.089	0.114	0.073	0.061	0.019
Large bulldozer		0.089	0.114	0.073	0.061	0.019
Caisson drilling		0.089	0.114	0.073	0.061	0.019
Loaded trucks		0.076	0.097	0.062	0.052	0.017
Jackhammer		0.035	0.045	0.029	0.024	0.008
Small bulldozer		0.003	0.004	0.002	0.002	0.001

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018, as modified by Illingworth & Rodkin, Inc., November 2022.

FIGURE 2 Probability of Cracking and Fatigue from Repetitive Loading



Source: Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996, as modified by Illingworth & Rodkin, Inc., November 2022.

Mitigation Measure 2: **None required.**

Impact 3: **Excessive Aircraft Noise.** The proposed project would not expose people residing or working in the area to excessive aircraft noise levels as the project site is located more than two miles from the nearest public airport. **This is a less-than-significant impact.**

Norman Y. Mineta San José International Airport is a public-use airport located over two miles northeast of the project site. According to the City's new Airport Master Plan Environmental Impact Report,[6] the project site lies outside the 60 dBA CNEL contour line (see Figure 3). Aircraft noise levels less than 65 dBA CNEL would be considered compatible at exterior use areas and within buildings proposed by the project, and this is a less-than-significant impact.

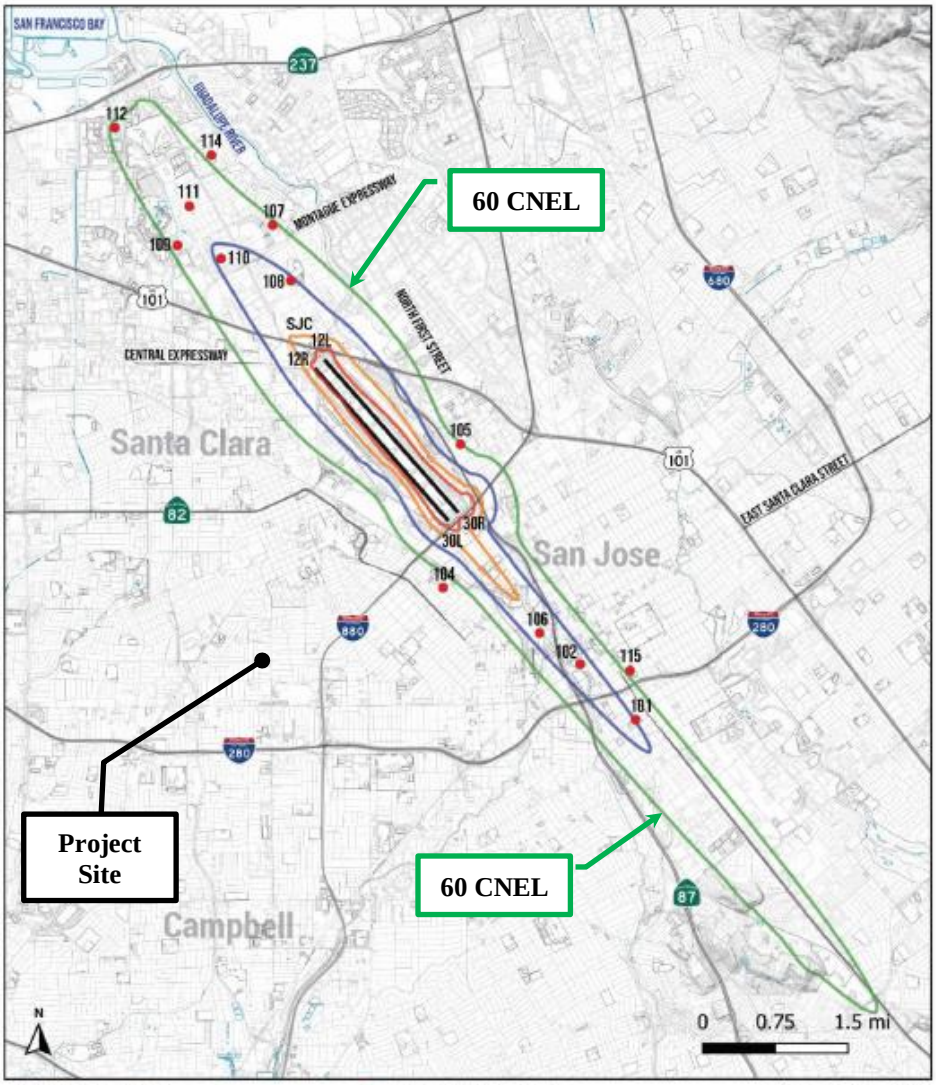
Mitigation Measure 3: **None required.**

[6] David J. Powers & Associates, Inc., Integrated Final Environmental Impact Report, Amendment to Norman Y. Mineta San Jose International Airport Master Plan, April 2020.

FIGURE 3 2037 CNEL Noise Contours for SJIA Relative to Project Site

Figure 5
Scenario 2: With Project 2037 Noise Contour Map

SAN JOSE INTERNATIONAL AIRPORT | Environmental Impact Report FINAL | October 2019



NORMAN Y. MINETA SAN JOSE INTERNATIONAL AIRPORT

- Noise Monitoring Station
- 101 Site ID
- Runway
- 75 dBA and Greater CNEL Contour
- 70 dBA and Greater CNEL Contour
- 65 dBA and Greater CNEL Contour
- 60 dBA and Greater CNEL Contour

Figure 5 Scenario 2: With Project 2037 Noise Contour Map

Source: BridgeNet International 2019

Cumulative Impacts

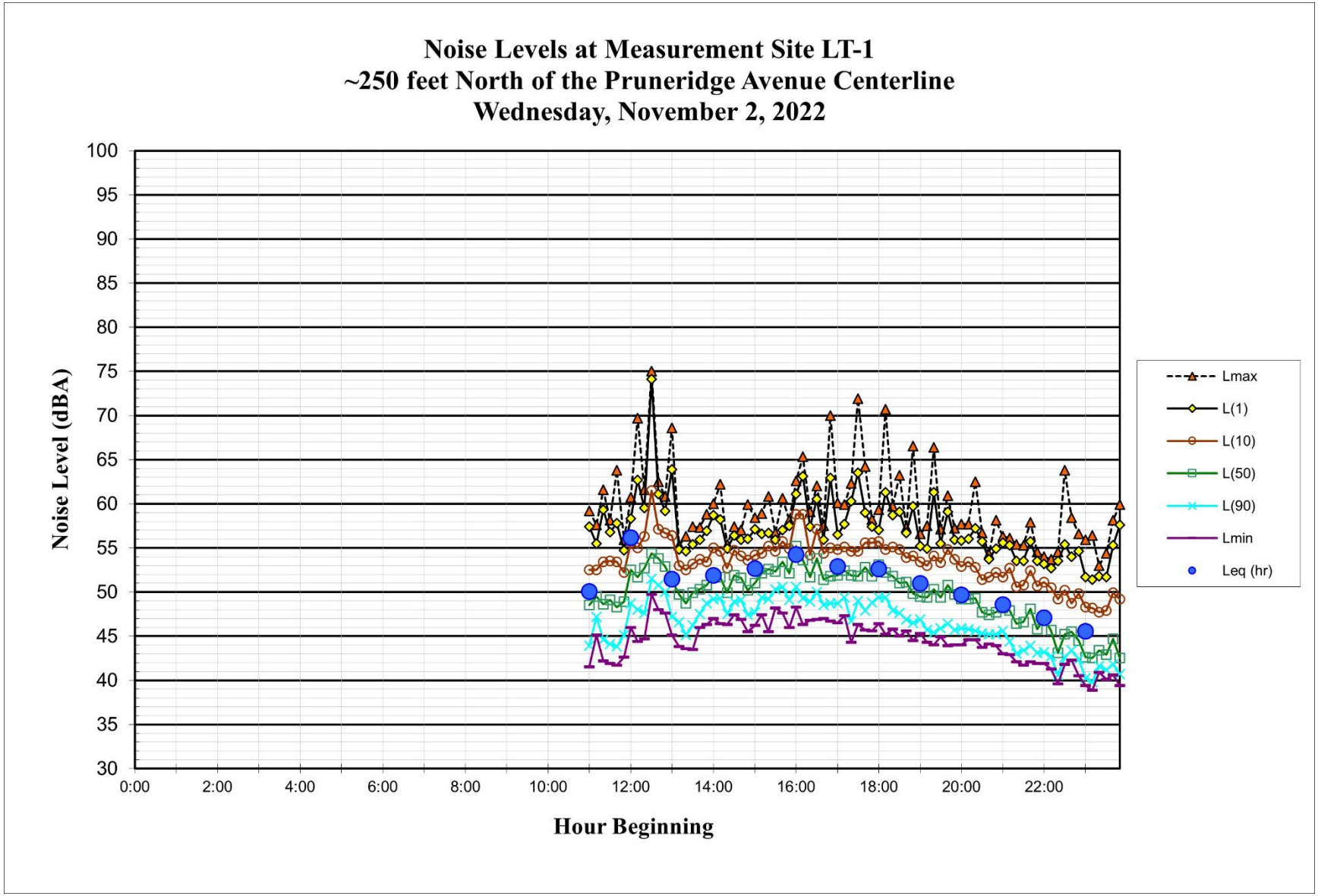
Cumulative noise impacts could result from cumulative traffic noise increases under future conditions or temporary construction noise from cumulative construction projects.

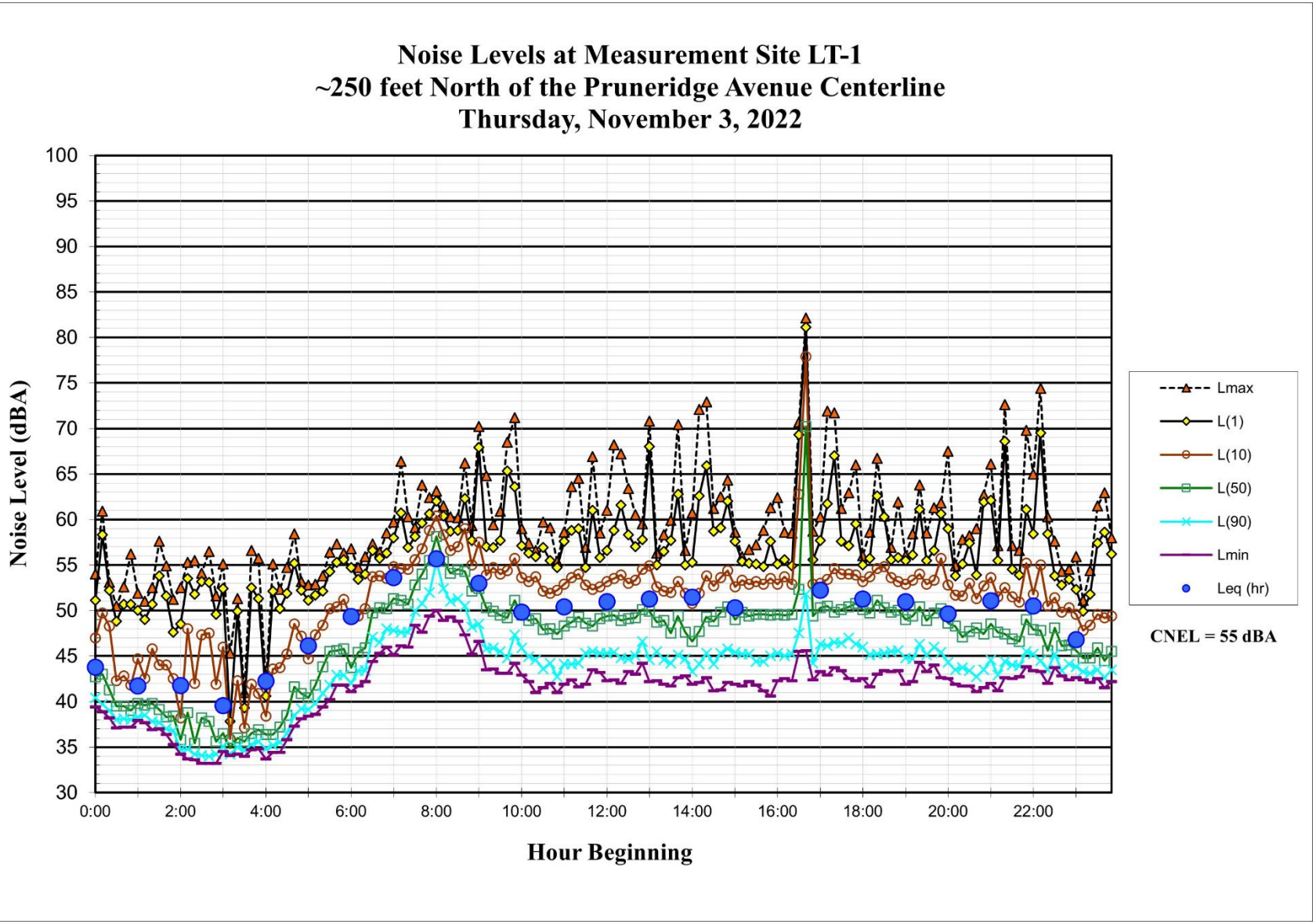
A significant cumulative traffic noise increase would occur if two criteria are met: 1) if the cumulative traffic noise level increase is 3 dBA CNEL or greater for future levels exceeding 60 dBA CNEL or is 5 dBA CNEL or greater for future levels at or below 60 dBA CNEL; and 2) if the project would make a "cumulatively considerable" contribution to the overall traffic noise increase. A "cumulatively considerable" contribution would be defined as an increase of 1 dBA CNEL or more attributable solely to the proposed project.

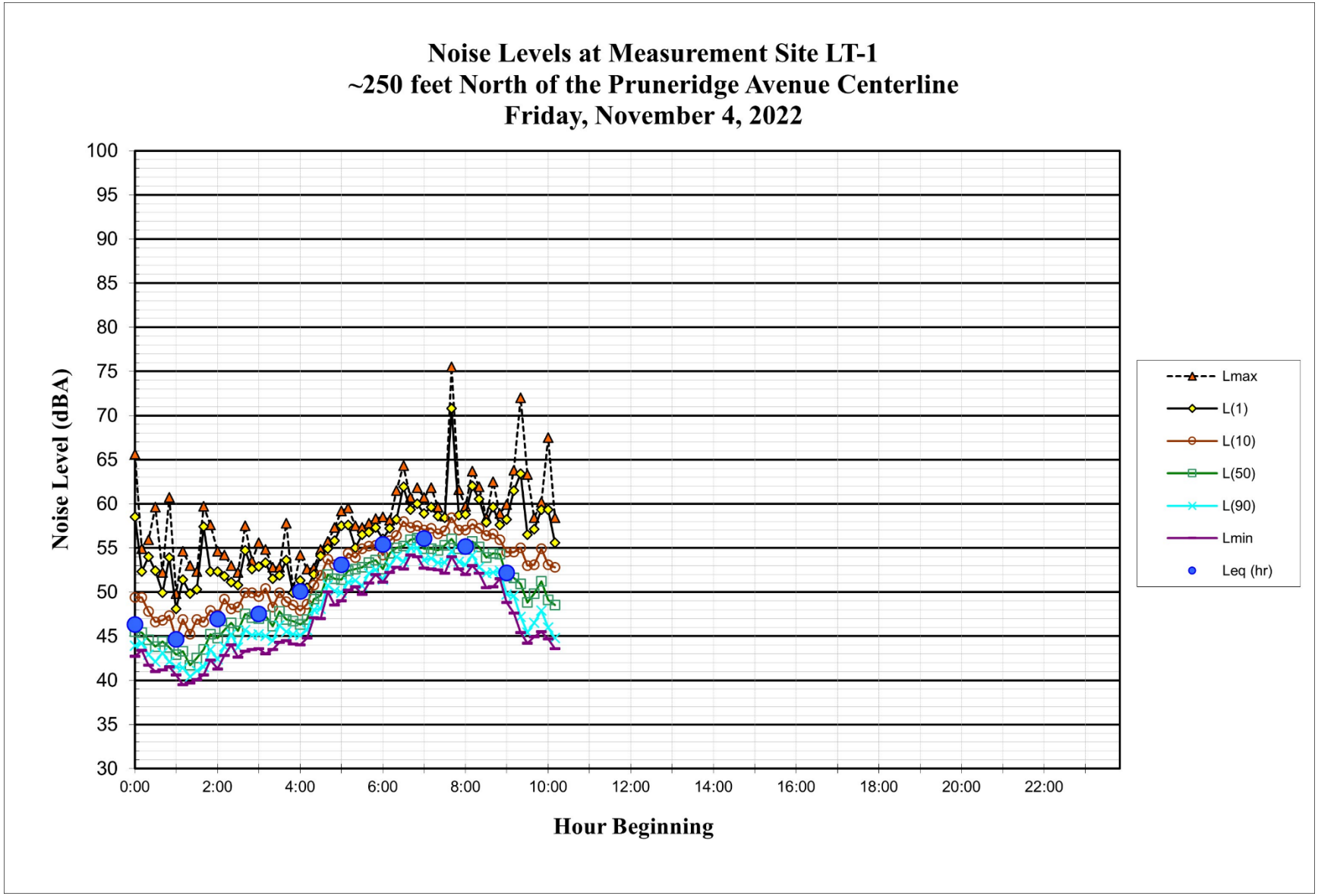
The project would not make a cumulatively considerable contribution along any roadway segments with noise-sensitive receptors. Therefore, the project would not result in a cumulative noise increase due to traffic.

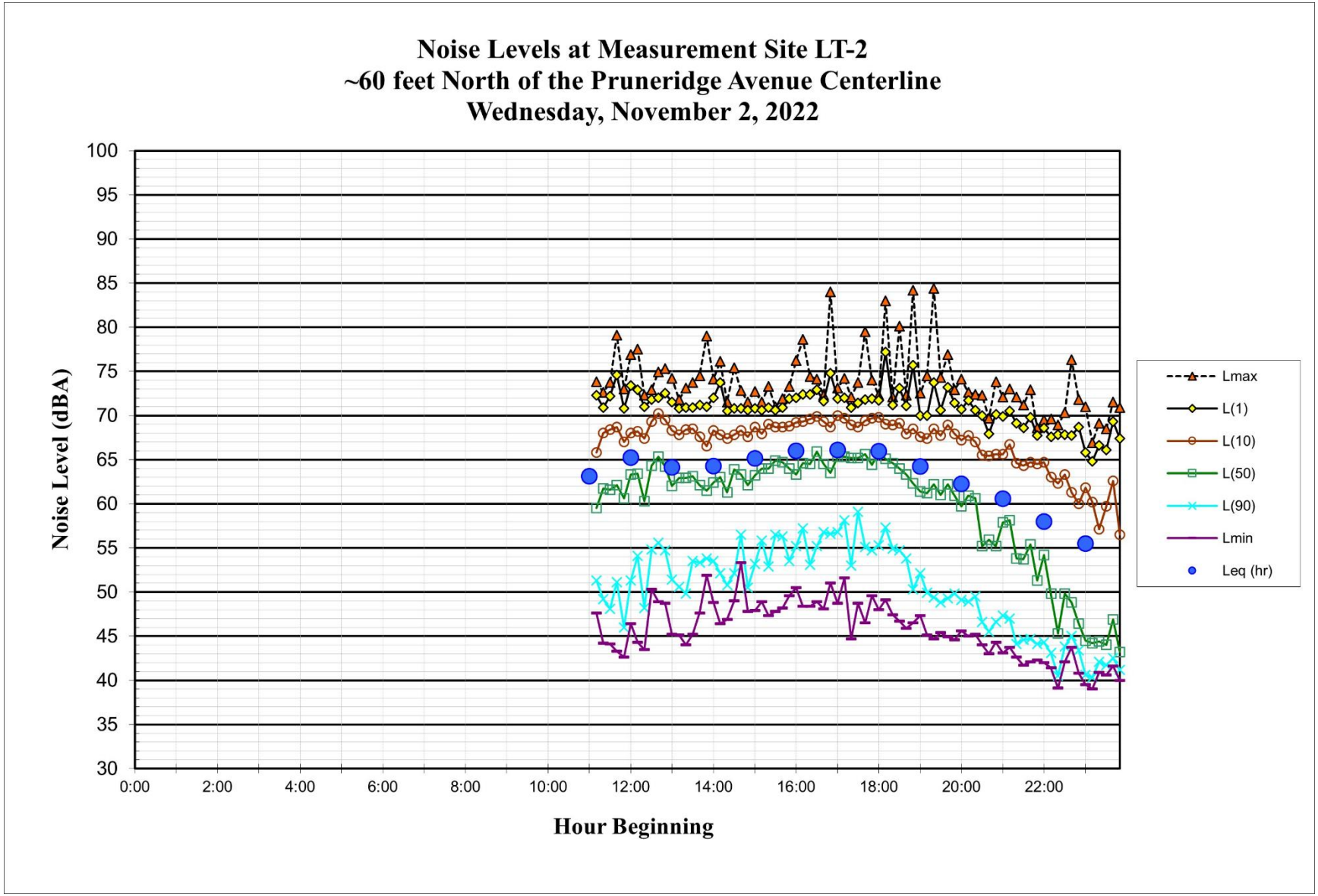
There are no known approved projects surrounding the project site that would be constructed during the same timeframe as the proposed project. Therefore, the noise-sensitive receptors surrounding the project site would not be subject to cumulative construction impacts.

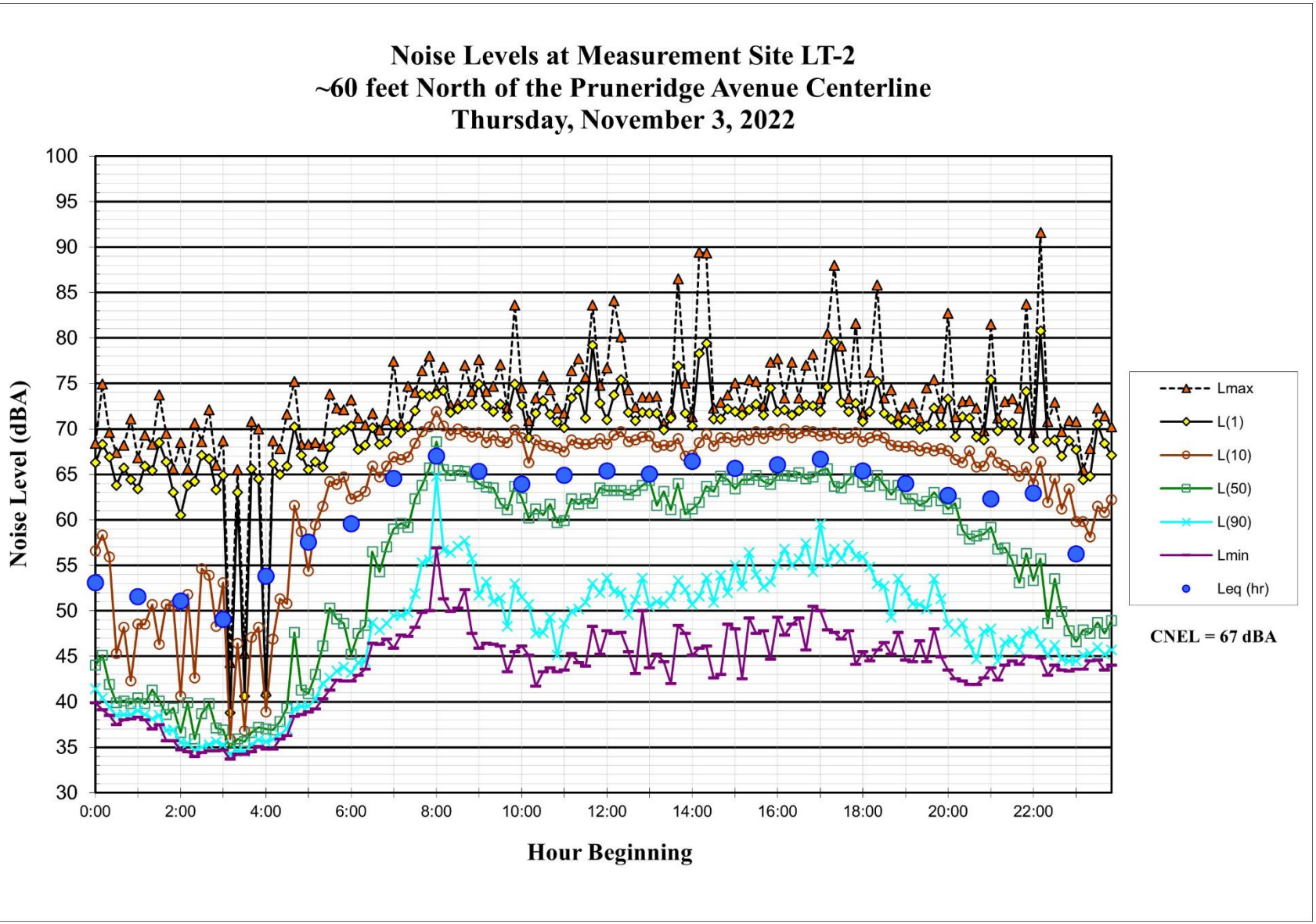
APPENDIX A – LONG-TERM NOISE DATA


Noise Levels at Measurement Site LT-1
~250 feet North of the Pruneridge Avenue Centerline
Wednesday, November 2, 2022
Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Measurement Site LT-1
~250 feet North of the Pruneridge Avenue Centerline
Thursday, November 3, 2022
Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
CNEL = 55 dBA


Noise Levels at Measurement Site LT-1
~250 feet North of the Pruneridge Avenue Centerline
Friday, November 4, 2022
Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Measurement Site LT-2
~60 feet North of the Pruneridge Avenue Centerline
Wednesday, November 2, 2022
Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Measurement Site LT-2
~60 feet North of the Pruneridge Avenue Centerline
Thursday, November 3, 2022
Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
CNEL = 67 dBA

Noise Levels at Measurement Site LT-2
~60 feet North of the Pruneridge Avenue Centerline
Friday, November 4, 2022