APPELLATION HOTEL NOISE AND VIBRATION ASSESSMENT

Petaluma, California

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INTRODUCTION

The proposed Appellation Hotel at 2 Petaluma Boulevard South, in Petaluma, California, is planned to be a six-story-tall, 72,300 square-foot building, utilizing the maximum amount of space available on the 0.33-acre lot. The site is located on the south corner of Petaluma Boulevard South and B Street, and is currently undeveloped. Floors two through six will contain hotel rooms, while the first floor will have a lobby, and the basement level will include parking. An outdoor terrace is planned for the southwest side of the second floor of the building and will be mostly shielded from local traffic noise by the building itself. A sixth-floor exterior roof top patio is also planned. A ground floor restaurant is proposed to have outdoor seating along Petaluma Boulevard South and B Street.

This report evaluates the project's potential to result in significant environmental noise 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 vibration, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing conditions; 2) the General Plan Consistency section discusses land use compatibility utilizing noise policies in the City's General Plan; 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 to a less-than-significant level.

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 the 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 which are 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* (*DNL* or L_{dn}) 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 additional decibel increases the percentage of the population highly annoyed by about 3 percent. 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.

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 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 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.

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 of 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 of 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 in 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.

Railroad and light-rail operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of railroad track. People's response to ground vibration from rail vehicles has been correlated best with the average, root mean square

(RMS) velocity of the ground. The velocity of the ground is expressed on the decibel scale. The reference velocity is 1 x 10-6 in/sec RMS, which equals 0 VdB, and 1 in/sec equals 120 VdB. Although not a universally accepted notation, the abbreviation "VdB" is used in this document for vibration decibels to reduce the potential for confusion with sound decibels.

Typical background vibration levels in residential areas are usually 50 VdB or lower, well below the threshold of perception for most humans. Perceptible vibration levels inside residences are attributed to the operation of heating and air conditioning systems, door slams and foot traffic. Construction activities, train operations, and street traffic are some of the most common external sources of vibration that can be perceptible inside residences. Table 4 illustrates some common sources of vibration and the association to human perception or the potential for structural damage.

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.

TABLE 4 Typical Levels of Groundborne Vibration

Human/Structural Response	Velocity Level, VdB	Typical Events (50-foot setback)
Threshold, minor cosmetic damage	100	Blasting, pile driving, vibratory compaction equipment
		Heavy tracked vehicles (Bulldozers, cranes, drill rigs)
Difficulty with tasks such as reading a video or computer screen	90	
		Commuter rail, upper range
Residential annoyance, infrequent events	80	Rapid transit, upper range
Residential annoyance, occasional events		Commuter rail, typical Bus or truck over bump or on rough roads
Residential annoyance, frequent events	70	Rapid transit, typical
Approximate human threshold of perception to vibration		Buses, trucks and heavy street traffic
	60	
		Background vibration in residential settings in the absence of activity
Lower limit for equipment ultra-sensitive to vibration	50	

Source: Transit Noise and Vibration Impact Assessment, US Department of Transportation Federal Transit Administration, September 2018.

Regulatory Background

The project would be subject to noise-related regulations, plans and policies established by the State of California and the City of Petaluma. Applicable planning documents include Appendix G of the CEQA Guidelines, and the California Building Code, the Health and Safety Element of the Petaluma 2025 General Plan, and the City of Petaluma Noise Ordinance. Regulations, plans, and policies presented within these documents form the basis of the significance criteria used to assess project impacts.

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;

(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.

2022 California Building Code, Title 24, Part 2. The current version of the California Building Code (CBC) requires interior noise levels attributable to exterior environmental noise sources to be limited to a level not exceeding 45 dBA L_{dn}/CNEL in any habitable room.

City of Petaluma General Plan 2025. Section 10.2 of the City of Petaluma's Health and Safety Element includes objectives and policies applicable to the proposed hotel project. The City's objective is to, "Protect public health and welfare by eliminating or minimizing the effects of existing noise problems, and by minimizing the increase of noise levels in the future." Hotels are considered "normally acceptable" in noise environments up to 65 dBA L_{dn} or CNEL, "conditionally acceptable" up to 70 dBA L_{dn} or CNEL, "normally unacceptable" between 70 and 80 dBA L_{dn} or CNEL, and "clearly unacceptable" above 80 dBA L_{dn} or CNEL. These thresholds are normally applied in common outdoor activity areas in hotel developments.

The following General Plan policies are applicable to the proposed hotel project:

Policy A: Continue efforts to incorporate noise considerations into land use planning decisions and guide the locations and design of transportation facilities to minimize the effects of noise on adjacent land uses.

Policy B: Discourage location of new noise-sensitive uses, primarily homes, in areas with projected noise levels greater than 65 dBA CNEL. Where such uses are permitted, require incorporation of mitigation measures to ensure that interior noise levels do not exceed 45 dB CNEL.

Policy C: Ensure that the City's Noise Ordinance and other regulations:

- Require that applicants for new noise-sensitive development in areas subject to noise levels greater than 65 dB CNEL obtain the services of a professional acoustical engineer to provide a technical analysis and design of mitigation measures.
- Require placement of fixed equipment, such as air conditioning units and condensers, inside or in the walls of new buildings or on roof-tops of central units in order to reduce noise impacts on any nearby sensitive receptors.

Policy D: Continue to require control of noise or mitigation measures for any noise-emitting construction equipment or activity. The City's Noise Ordinance establishes controls on construction-related noise.

Policy E: As part of development review, use Figure 10-2: Land Use Compatibility Standards to determine acceptable uses and installation requirements in noise-impacted areas.

Policy F: Discourage the use of sound walls anywhere except along Highway 101 and/or along the NWPRA corridor without findings that such walls will not be detrimental to community character. When sound walls are deemed necessary, integrate them into the streetscape.

Policy G: In making a determination of impact under the California Environmental Quality Act (CEQA) consider an increase of four or more dBA to be "significant" if the resulting noise level would exceed that described as normally acceptable for the affected use in Figure 10-3: Land Use Compatibility for Community Noise Environments.

City of Petaluma Implementing Zoning Ordinance. Section 21.040 A of the City of Petaluma Implementing Zoning Ordinance contains the following regulations which are generally applicable to operational (non-traffic) related noise in the City:

3. **Noise Regulations Generally.**

a. The following specific acts, subject to the exemptions provided in Section 21.040(A)(5), are declared to be public nuisances and are prohibited:

1) The operation or use of any of the following before 7:00 a.m. or after 10:00 p.m. daily (except Saturday, Sunday and State, Federal or Local Holidays, when the prohibited time shall be before 9:00 a.m. and after 10:00 p.m.):

2) A hammer or any other device or implement used to repeatedly pound or strike an object.

3) An impact wrench, or other tool or equipment powered by compressed air.

4) Any tool or piece of equipment powered by an internal-combustion engine such as, but not limited to, chain saw, backpack blower, and lawn mower. Except as specifically included in this Ordinance, motor vehicles, powered by an internal combustion engine and subject to the State of California vehicle code, are excluded from this prohibition.

5) Any electrically or battery powered tool or piece of equipment used for cutting, drilling, or shaping wood, plastic, metal, or other materials or objects, such as but not limited to a saw, drill, lathe or router.

6) Any of the following: the operation and/or loading or unloading of heavy equipment (such as but not limited to bulldozer, road grader, back hoe), ground drilling and boring equipment, hydraulic crane and boom equipment, portable power generator or pump, pavement equipment (such as but not limited to pneumatic hammer, pavement breaker, tamper, compacting equipment), pile-driving equipment, vibrating roller, sand blaster, gunite machine, trencher, concrete truck, and hot kettle pump and the like.

7) Construction, demolition, excavation, erection, alteration or repair activity.

8) Operating or permitting the operation of powered model vehicles including but not limited to cars, aircraft and boats.

9) Using or operating for any purpose any loudspeaker, loudspeaker system or similar device in such a manner as to create a noise disturbance. Any permit issued pursuant to PMC Section 13.28.050 (amplified sound permit within a public park) is exempt from this section.

10) The use of truck/tractor trailer "Jake Brakes" on any public street under the jurisdiction of the City of Petaluma Police Department.

b. In the case of urgent necessity and in the interest of public health and safety, the Noise Control Officer may issue a permit for exemption from the requirements with subsection 21.040(A)(3). Such period shall not exceed ten (10) working days in length but may be renewed for successive periods of thirty (30) days or less, not to exceed a total of 90 days while the emergency continues. Requests for exemptions beyond 90 days shall require public hearing approval. The Noise Control Officer may limit such permit as to time of use and/or permitted action, depending upon the nature of the emergency and the type of action requested.

c. The operation of any licensed motor vehicle in violation of the State Vehicle Code or the operation of stereo, public address or other such amplified equipment on or within a motor vehicle in violation of the State Vehicle Code.

d. Continued or repeated operation of a Public Address System between the hours of 10:00 a.m. and 7:00 p.m. daily shall not exceed a decibel level of 5 dBA above the measured ambient of the area in which this activity is occurring. Unless specifically approved by the City of Petaluma (i.e. Use Permit, Parks Director, Exception or Exemption from this Code Sec.) no Public Address System shall be permitted during the hours of 7:00 p.m. to 10:00 a.m.

4. **Noise Measurement**: Utilizing the "A" weighting scale of a sound level meter and the "slow" meter response (use "fast" response for impulsive type sounds), the ambient noise level shall first be measured at a position or positions at any point on the receptor's property which can include private and public property. In general, the microphone shall be located four to five feet above the ground; ten feet or more from the nearest reflective surface where possible. If possible, the ambient noise shall be measured with the alleged offending noise source inoperative. If for any reason the alleged offending noise source cannot be shut down, the ambient noise must be estimated by performing a measurement in the same general area of the source but at a sufficient distance such that the noise from the source is at least 10dB below the ambient in order that only the ambient level will be measured.

a. If the measured ambient level is greater than 60dB, the Maximum Noise Exposure standard shall be adjusted in 5dB increments for each time period as appropriate to encompass or reflect the measured ambient noise level. In no case shall the maximum allowed threshold exceed 75dB after adjustments are made.

b. In the event the measured ambient noise level is 70dB or greater, the maximum allowable noise level shall be increased to reflect the maximum ambient noise level. In this case, adjustments for loudness and time as contained in Table 21.1 shall not be permitted.

c. No person shall cause or allow to cause, any source of sound at any location within the incorporated City or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which when measured on the property where the noise disturbance is being experienced within public or private open/outdoor spaces, exceeds the noise level of Table 21.1.

TABLE 21.1: Maximum Exterior Noise Exposure (dBA)			
Category Description	**Noise Metric**[1]	**Nighttime Hours** (10:00 pm to 7:00 am M-F, 10:00 pm to 8:00 am S, S and Holidays)	**Daytime Hours** (7:00 am to 10:00 pm M-F, 8:00 am to 10:00 pm S, S and Holidays)
General Plan Ambient	L_{eq}	60 dBA	60 dBA
Cumulative period of 15 min. or more in one hour	L_{25}	65 dBA	70 dBA
Cumulative period of 5 min. or more in one hour	L_{08}	70 dBA	75 dBA
Cumulative period of 1 min. or more in one hour	L_{02}	75 dBA	80 dBA
Note 1: The noise metric column was added by Illingworth& Rodkin, Inc. to provide a measurable hourly noise level to compare with the Table 21.1 noise categories. These levels equate to the sound level exceeded n% of the time in any hour. For example, the L_{25} is the value exceeded 25% of the time or 15 minutes in any hour. These levels, which are used to evaluate noise events which occur during a given daytime or nighttime hour, differ from the CNEL metric used for the General Plan Noise and Land Use Compatibility standards, which is used to evaluate noise events over a 24 hour period.			

Existing Noise Environment

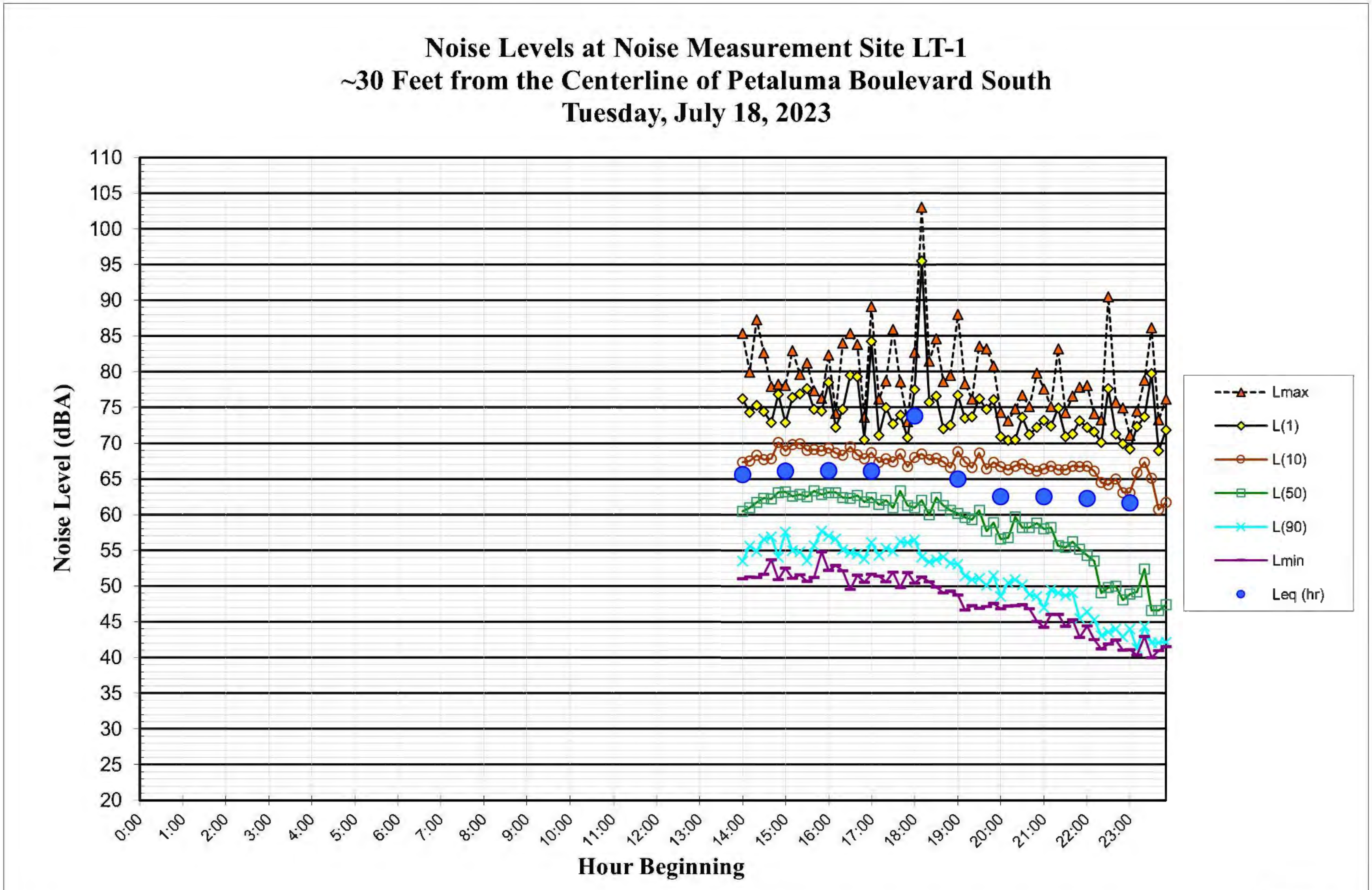
A noise monitoring survey was conducted between Tuesday, July 18, 2023, and Friday July 21, 2023, to quantify the existing noise environment at the project site and at nearby sensitive receptors. The noise monitoring survey included two long-term noise measurements at locations indicated as LT-1 and LT-2, and four short-term noise measurements indicated as ST-1 through ST-4 in Figure 1. The noise measurements were conducted with Larson Davis Laboratories (LDL) Model LxT1 Type I Sound Level Meters fitted with ½-inch pre-polarized condenser microphones and windscreens. The meters were calibrated with a Larson Davis precision acoustic calibrator prior to and following the measurement survey. Weather conditions were good for conducting noise measurements during the survey. Figure 1 also shows the project site, nearby land uses, and nearby sources of noise.

Long-term noise measurement LT-1 was located approximately 30 feet from the centerline of Petaluma Boulevard South. The purpose of this measurement was to quantify noise levels produced by vehicular traffic at a location representative of the planned building façade along Petaluma Boulevard South. Figures 2-5 contain graphical summaries of the noise data collected at Site LT-1. A review of these data indicates that daytime and evening hourly equivalent noise levels (L_{eq}) typically ranged from 62 to 69 dBA L_{eq} and nighttime noise levels typically ranged from 50 dBA to 67 dBA L_{eq}. The calculated community noise equivalent level at this location was 70 dBA CNEL on both Wednesday, July 19, 2023, and Thursday, July 20, 2023.

Long-term noise measurement LT-2 was located approximately 22 feet from the centerline of B Street. Noise levels were measured at this position to represent the noise exposure at the planned building façade along B Street. Figures 6-9 contain graphical summaries of the noise data collected at Site LT-2. A review of these data indicates that daytime and evening hourly equivalent noise levels (L_{eq}) typically ranged from 57 to 68 dBA L_{eq} and nighttime noise levels typically ranged from 45 to 62 dBA L_{eq}. The calculated community noise equivalent level at this location was 66 dBA CNEL on Wednesday, July 19, 2023, and 65 dBA CNEL on Thursday, July 20, 2023.

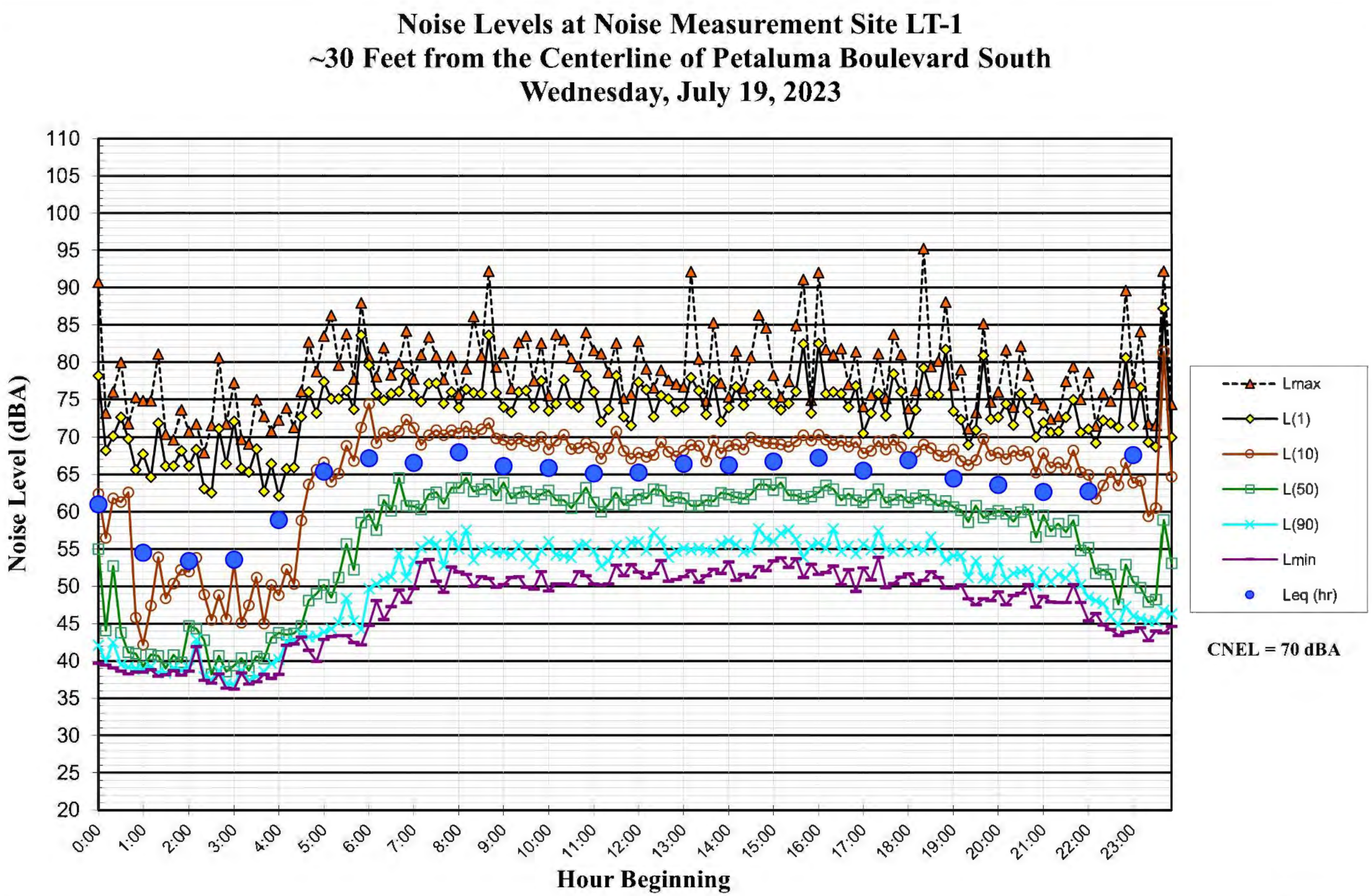
FIGURE 1 Aerial Image Showing Noise Measurement Locations

Source: Google Earth, 2023.



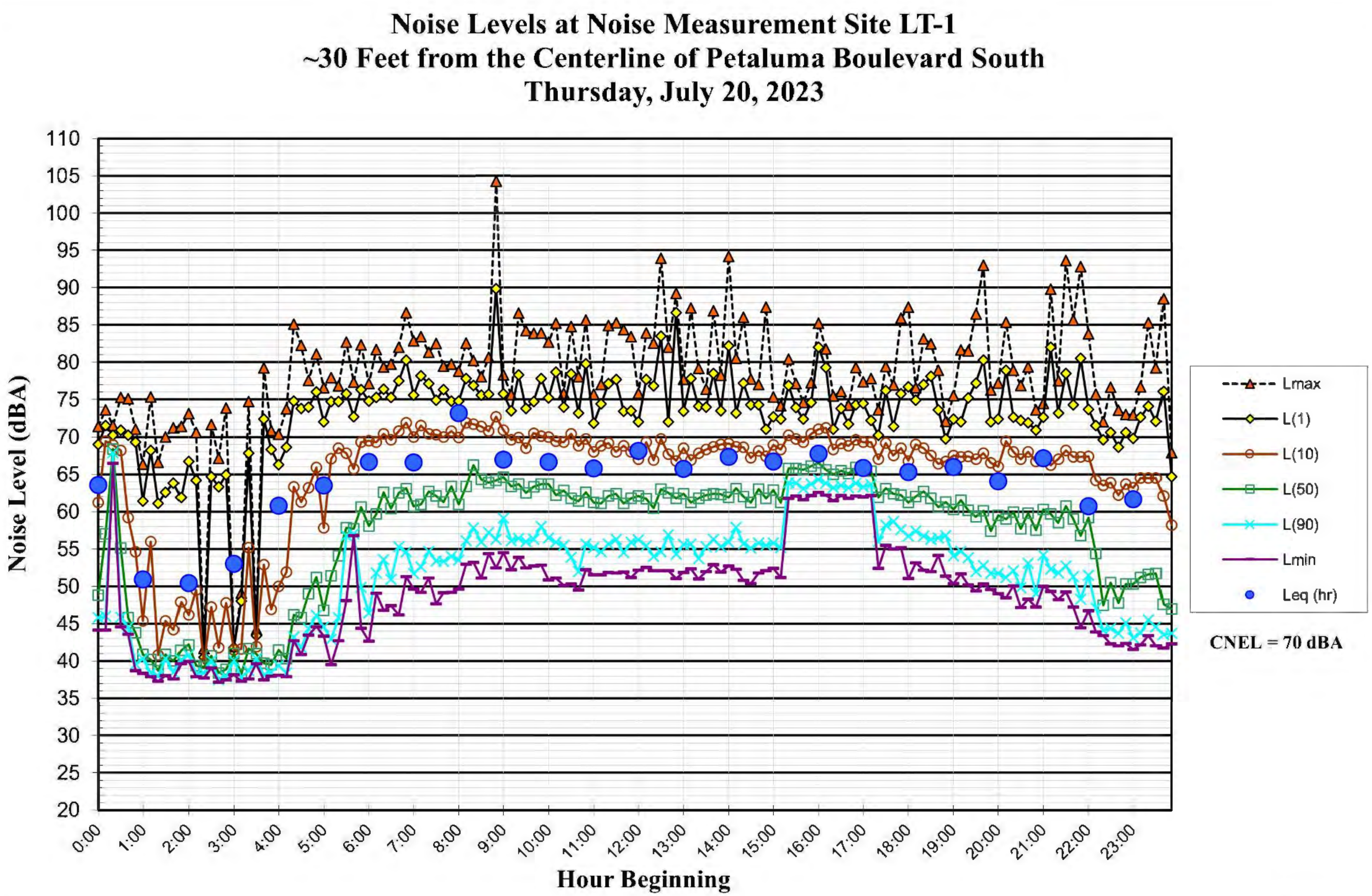
Noise Levels at Noise Measurement Site LT-1
~30 Feet from the Centerline of Petaluma Boulevard South
Tuesday, July 18, 2023
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 2



Noise Levels at Noise Measurement Site LT-1
~30 Feet from the Centerline of Petaluma Boulevard South
Wednesday, July 19, 2023
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
CNEL = 70 dBA

Figure 3



Noise Levels at Noise Measurement Site LT-1
~30 Feet from the Centerline of Petaluma Boulevard South
Thursday, July 20, 2023
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
CNEL = 70 dBA

Figure 4

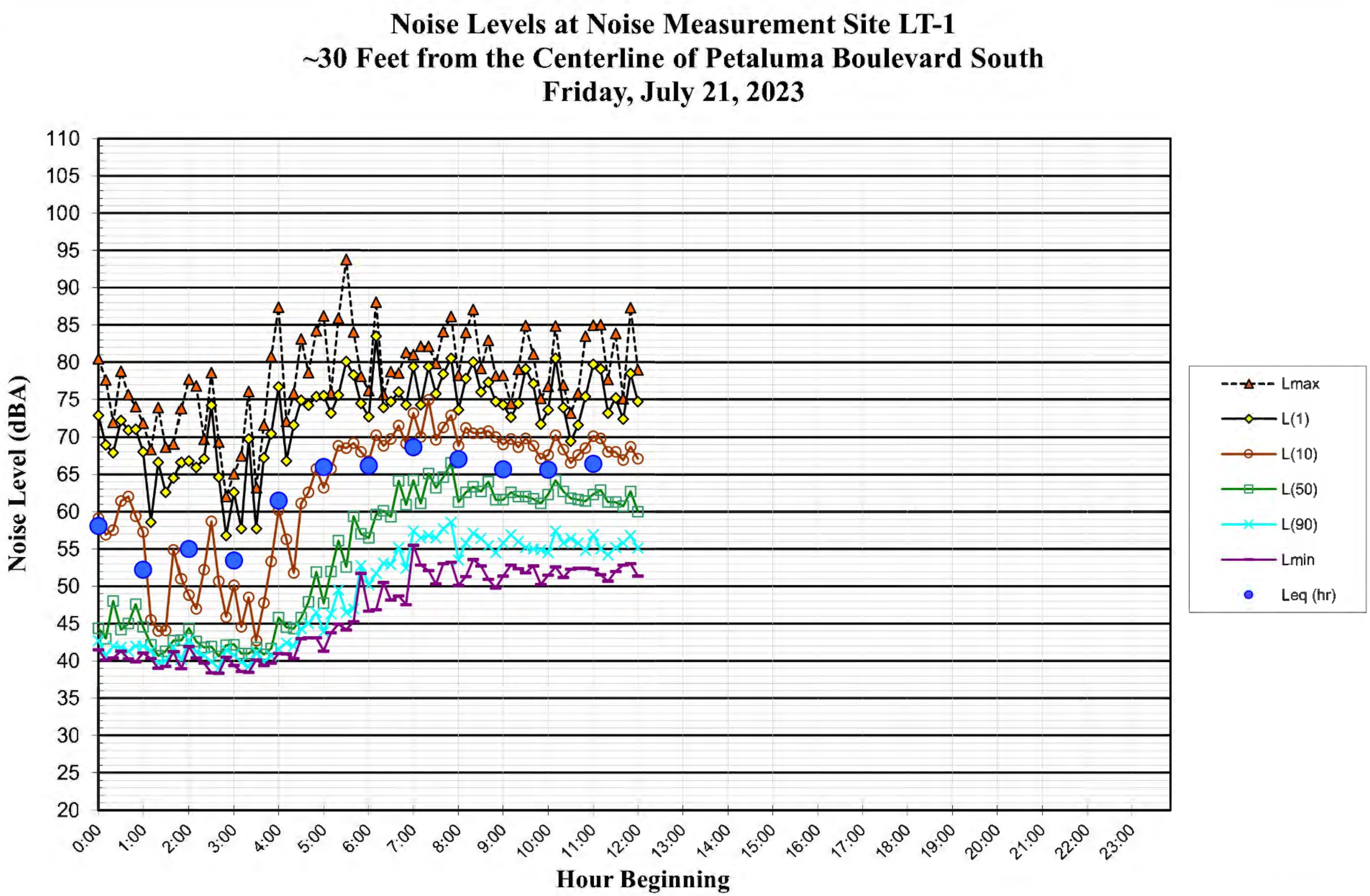
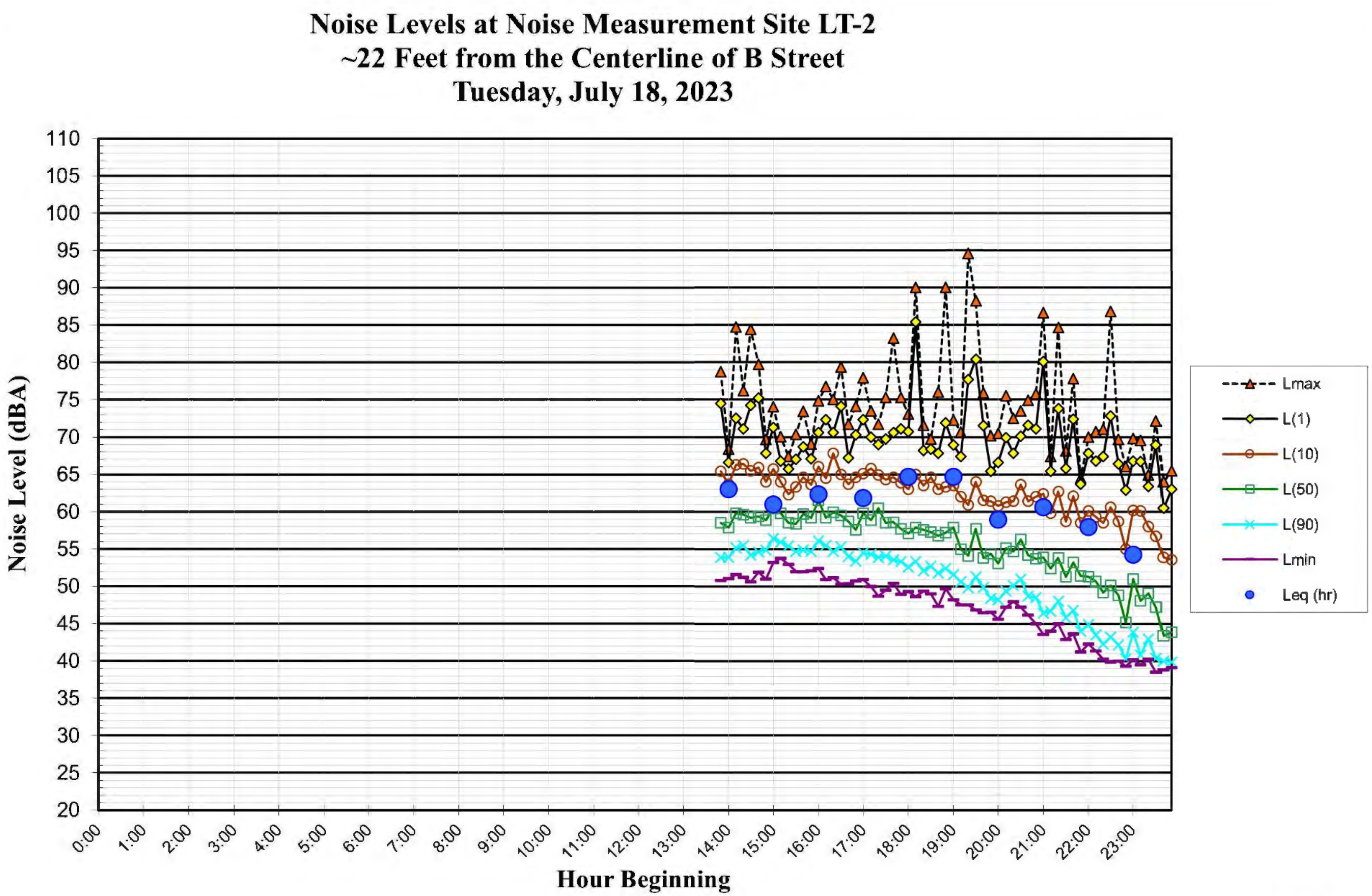
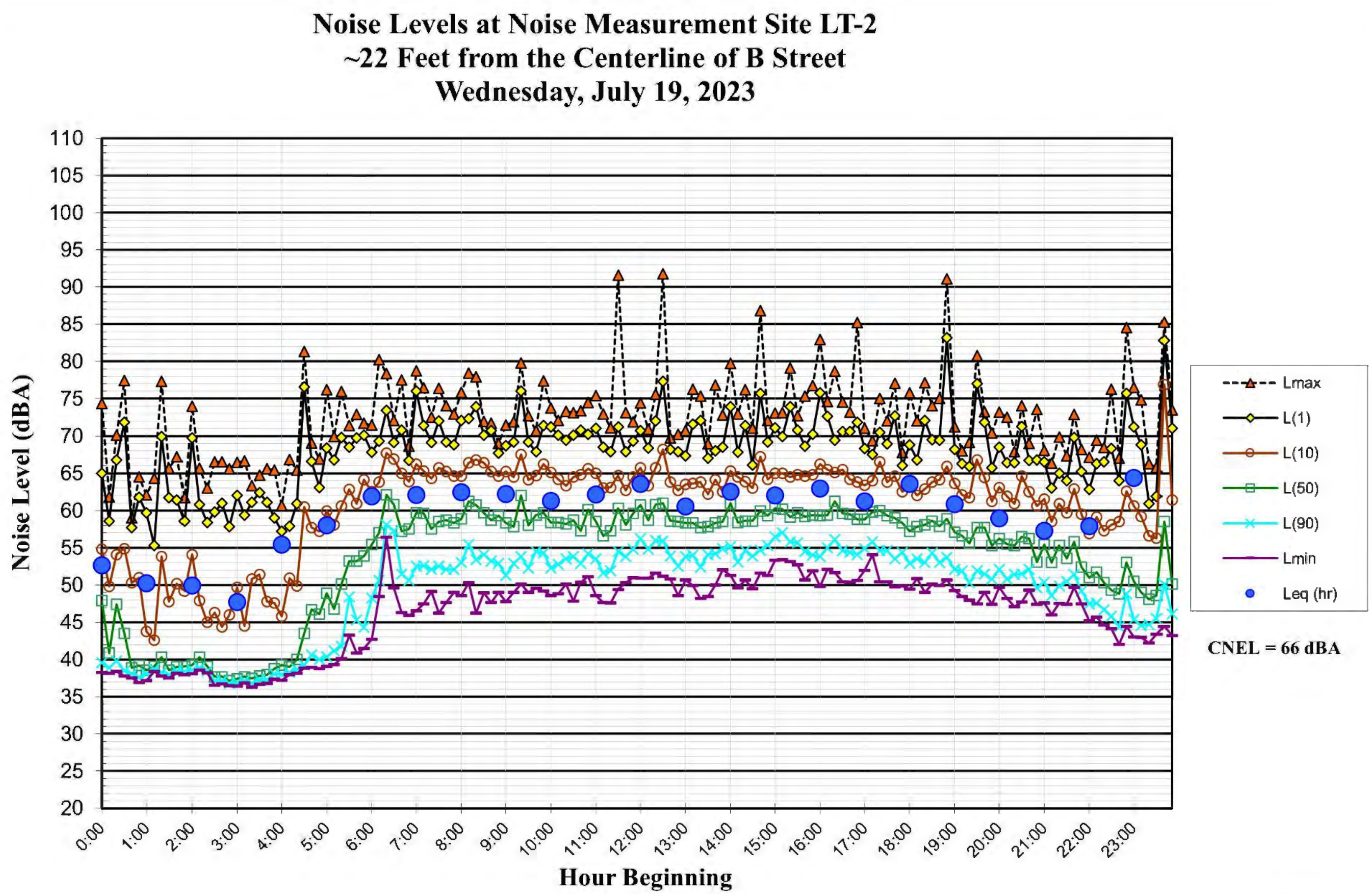

Noise Levels at Noise Measurement Site LT-1
~30 Feet from the Centerline of Petaluma Boulevard South
Friday, July 21, 2023
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 5



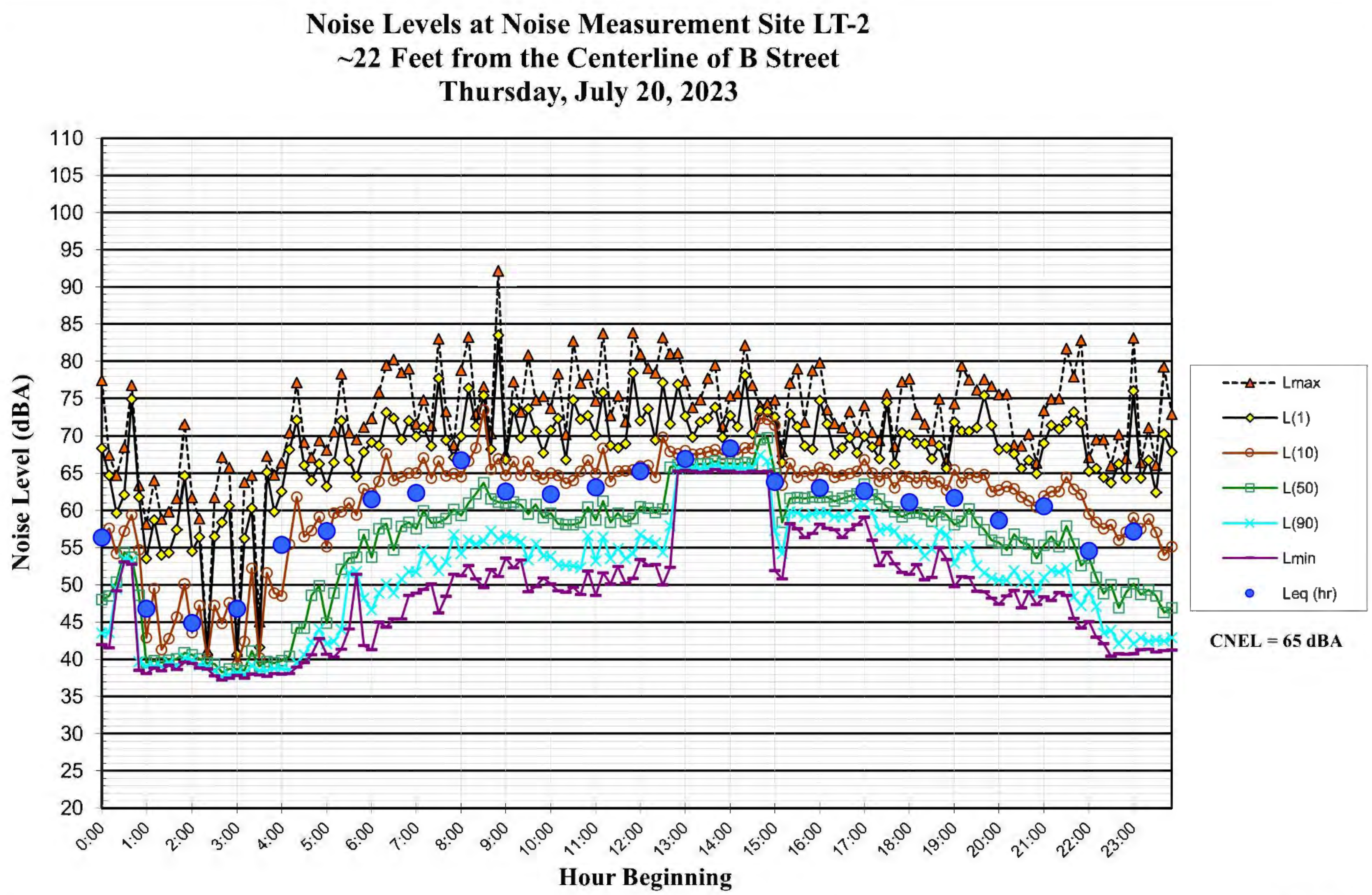
Noise Levels at Noise Measurement Site LT-2
~22 Feet from the Centerline of B Street
Tuesday, July 18, 2023
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 6



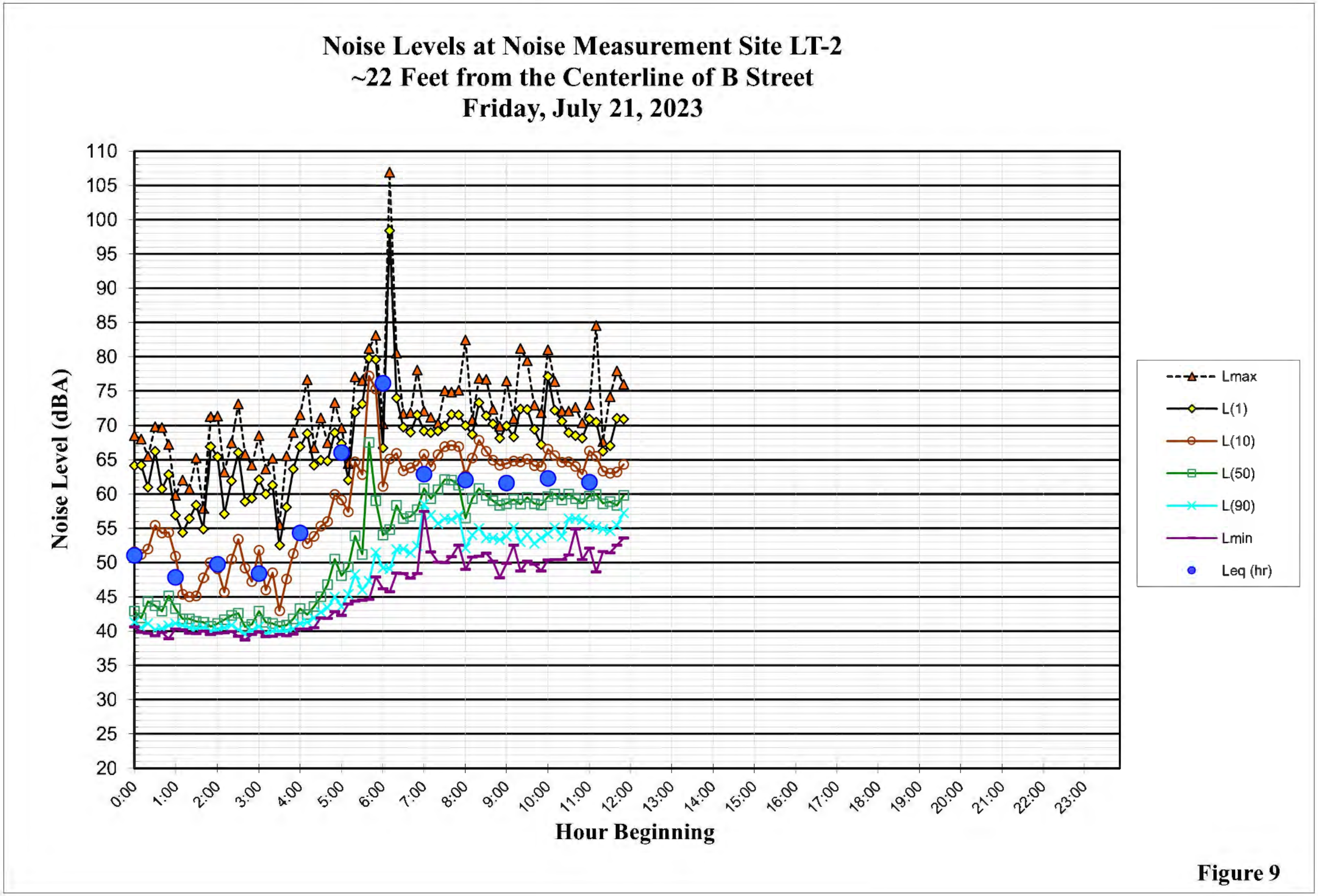
Noise Levels at Noise Measurement Site LT-2
~22 Feet from the Centerline of B Street
Wednesday, July 19, 2023
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
CNEL = 66 dBA

Figure 7



Noise Levels at Noise Measurement Site LT-2
~22 Feet from the Centerline of B Street
Thursday, July 20, 2023
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
CNEL = 65 dBA

Figure 8



Noise Levels at Noise Measurement Site LT-2
~22 Feet from the Centerline of B Street
Friday, July 21, 2023
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 9

Short term (10-minute duration) noise measurements were made between 2:10 p.m. and 3:00 p.m. on Tuesday, July 18, 2023, at four positions to document noise levels at the site and at noise sensitive receptor locations in the project vicinity. ST-1 was made at the proposed corner of the building closest to the intersection of Petaluma Boulevard South and B Street, where noise levels were primarily the result of local traffic. ST-2 was made at the proposed corner of the building furthest from the intersection of Petaluma Boulevard South and B Street, where noise levels were also primarily the result of local traffic. ST-3 was made approximately 25 feet from the centerline of C Street, between 4th Street and 5th Street, to document local traffic noise at nearby residences along C Street. ST-4 was made approximately 30 feet from the centerline of B Street, near 5th Street, to document local traffic noise at nearby residences along B Street. The measurements were conducted simultaneously with measurements at LT-1 and LT-2. The results of the short-term measurements are shown in Table 5.

TABLE 5 Summary of Short-Term Noise Measurement Data, dBA

Noise Measurement Location	Time	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}
ST-1: North corner of site.	2:10-2:20 pm (7/18/2023)	95	77	67	61	56	71
ST-2: South corner of site.	2:10-2:20 pm (7/18/2023)	73	65	57	52	49	56
ST-3: Along C Street.	2:40-2:50 pm (7/18/2023)	67	65	58	50	47	54
ST-4: Along B Street.	2:50-3:00 pm (7/18/2023)	76	73	64	55	50	61

PLAN CONSISTENCY ANALYSIS

Compatibility Thresholds

The applicable compatibility thresholds were presented in detail in the Regulatory Background section and are summarized below for the proposed project:

- The City of Petaluma's "normally acceptable" noise limit for hotels is 65 dBA L_{dn} or CNEL.

- The City of Petaluma's interior noise level limit is 45 dBA L_{dn} or CNEL for new noise-sensitive uses and is consistent with the requirements of the California Building Code.

Exterior Noise Environment

Exterior noise levels in the project area are anticipated to increase by less than 1 dBA due to future traffic volume increases expected along Petaluma Boulevard South and B Street. An outdoor terrace is planned for the southwest side of the second floor of the building. This outdoor area would be shielded from the traffic noise by the building itself and the neighboring building to the southwest. The calculated shielding, which includes the setback from the centerline of the roadway, would be approximately 22 dBA at the center of the outdoor area. A wall is also planned that will further reduce noise levels. A sixth-floor exterior roof top patio is also planned for the project, which will be 56 feet above the roadways, and shielded from traffic noise by the building itself. When considering the elevation above the transportation noise sources and the shielding provided by the building, the attenuation would be approximately 25 dBA, and traffic noise levels at the rooftop patio will be below 65 dBA CNEL. Future exterior noise levels at these two outdoor areas would be consistent with the City of Petaluma General Plan, and no additional controls would be required. However, a ground floor outdoor seating area associated with the planned restaurant would be exposed to future noise levels ranging from 65 to 71 dBA CNEL. The seating area along B Street would be within the City's normally acceptable noise exposure range, while the seating area along Petaluma Boulevard South would exceed the City's normally acceptable noise exposure range by 1 dBA. If this entire seating area is to be within the City's normally acceptable range, a basic noise barrier would need to be installed along the Petaluma Boulevard South portion of the area that would need to obstruct the direct line of site between seated customers and the vehicular traffic along Petaluma Boulevard South. It should be mentioned that there are similar outdoor seating areas at other businesses along Petaluma Boulevard South, and in this regard, this aspect of the project would be compatible with the downtown Petaluma layout.

Interior Noise Environment

The State of California Building Code and the City of Petaluma require that interior noise levels within new hotels not exceed 45 dBA CNEL. Interior noise levels would vary depending upon the design of the buildings (relative window area to wall area) and the selected construction materials and methods. For exterior noise environments ranging from 65 to 70 dBA CNEL, interior noise levels can typically be maintained below 45 dBA CNEL with the incorporation of an adequate forced-air mechanical ventilation system in each hotel room, allowing the windows to be closed. In noise environments of 70 dBA CNEL or greater, a combination of forced-air mechanical ventilation and sound-rated construction methods are often necessary to meet the interior noise level limit. The northeastern façade of the proposed building would have hotel rooms on the second through sixth floors, with setbacks from the centerline of Petaluma Boulevard South of approximately 70 feet. At this setback, hotel rooms facing Petaluma Boulevard South would be exposed to future exterior noise levels up to 71 dBA CNEL.

The following available controls shall be implemented during final design to reduce noise levels within the hotel to 45 dBA CNEL or less, consistent with the State of California Building Code and the City of Petaluma General Plan:

- Provide a suitable form of forced-air mechanical ventilation, as determined by the local building official, for all hotel rooms, so that windows can be kept closed to control noise.

- Provide sound-rated construction assemblies to reduce interior noise levels to 45 dBA L_{dn}/CNEL or less. Preliminary calculations indicate that exterior rooms facing Petaluma Boulevard South along the northeastern building façade would require windows with a minimum STC[1] rating of 28 to meet the interior noise threshold established by the City.

[1] **Sound Transmission Class (STC)** A single figure rating designed to give an estimate of the sound insulation properties of a partition. Numerically, STC represents the number of decibels of speech sound reduction from one

- A qualified acoustical consultant shall review the final site plan, building elevations, and floor plans prior to construction and recommend building treatments to reduce interior noise levels to 45 dBA L_{dn}/CNEL or less. 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 room-by-room 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

This section describes the significance criteria used to evaluate project impacts under CEQA, provides a discussion of each project impact, and presents mitigation measures, where necessary, to provide a compatible project in relation to adjacent receptors.

Significance Criteria

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

- **Temporary or Permanent Noise Increases in Excess of Established Standards.** A significant impact would be identified if project construction or operations would result in a substantial temporary or permanent increase in ambient noise levels at sensitive receptors in excess of the standards contained in the local general plan or noise ordinance, or applicable standards of other agencies.

- **Generation of Excessive Groundborne Vibration.** A significant impact would be identified if the construction of the project would generate excessive groundborne vibration levels (i.e., 0.3 in/sec PPV or greater).

- **Exposure of Residents or Workers to Excessive Noise Levels in the Vicinity of a Public Airport or Private Airstrip.** A significant impact would be identified if the project would expose people residing or working in the project area to aircraft noise levels exceeding 65 dBA CNEL.

Impact 1 **Temporary or Permanent Noise Increases in Excess of Established Standards.** The proposed project would not generate noise levels in excess of standards contained in the local general plan or noise ordinance, or applicable standards of other agencies at the nearby sensitive receptors. **This is a less-than-significant impact.**

Construction Noise

side of the partition to the other. The STC is intended for use when speech and office noise constitute the principal noise problem.

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), if the construction occurs in areas immediately adjoining noise-sensitive receptors, or when construction lasts over extended periods of time.

The City of Petaluma does not quantitatively evaluate or regulate noise levels produced by construction activities. However, the Federal Transit Administration has developed general assessment criteria for analyzing construction noise, which are considered applicable in this assessment. The detailed assessment criteria set construction noise limits, which are summarized in Table 6 below.

TABLE 6 FTA Detailed Assessment Criteria for Construction Noise

	Eight-Hour Leq (dBA)	
Land Use	**Day**	**Night**
Residential	80	70
Commercial	85	85
Industrial	90	90

Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual, FTA Report No. 0123, Table 7-3, September 2018, Office of Planning and Environment, *https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf*, accessed August 14, 2023.

Construction activities would include site preparation, grading and excavation, trenching and foundation work, building construction, architectural coating, and paving. 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. The hauling of excavated materials and construction materials would generate truck trips on local roadways as well.

The center of the project's construction area would be approximately 300 feet from nearest residences to the east, along Petaluma Boulevard South, approximately 450 feet from the residences to the south, along C Street, and approximately 50 feet from the nearest commercial use, sharing the southwest property line with the project site.

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. Based on the applicant supplied construction equipment lists, the site preparation phase of the project is calculated to produce noise levels up to 81 dBA L_{eq} at 50 feet. The grading and excavation phase is calculated to produce noise levels up to 79 dBA L_{eq} at 50 feet. The trenching and foundation phase is calculated to produce noise levels up to 77 dBA L_{eq}. The building construction phase is calculated to produce noise levels up to 79 dBA L_{eq}. The architectural coating phase of the project is calculated to produce noise levels up to 74 dBA L_{eq}, and the paving phase of the project is calculated to produce noise levels up to 77 dBA L_{eq} at 50 feet. These project specific levels generally agree with the range of noise levels presented in

Table 7 for hotel building projects, assuming that only the two loudest pieces of equipment per phase are present at the site due to the relatively small size of the project site.

Hourly average construction noise levels at the nearest residential land use approximately 300 feet to the east of the center of the site are calculated to range from 58 to 65 dBA L_{eq} during construction. At the nearest commercial receptors, hourly average construction noise levels are calculated to range from 74 to 81 dBA L_{eq}.

TABLE 7 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: USE.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

TABLE 8 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.

Per the requirements of the Implementing Zoning Ordinance, construction of the project would only occur during the daytime. The construction schedule assumes that the earliest possible start date would be November 2024 and the project would be built out over an approximate 18.5-month period from November 2024 to May 2026. Average noise levels produced by the hotel construction activities would not exceed the FTA's 85 dBA L_{eq} commercial threshold or 80 dBA L_{eq} residential threshold, assuming that only the two loudest pieces of equipment per phase are present at the site. This is a less-than-significant impact; however, best management practices are recommended to reduce noise levels as low as feasible.

Best Management Practices

Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction materials, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life. Construction equipment shall be well-maintained and used judiciously to be as quiet as possible. The following best management practices will be implemented to reduce noise from construction activities near sensitive receptors:

- Pursuant to the Implementing Zoning Ordinance, restrict noise-generating activities at the construction site or in areas adjacent to the construction site to the hours between 7:00 a.m. and 10:00 p.m., Monday through Friday and 9:00 a.m. to 10:00 p.m. on Saturday, Sunday and State, Federal or Local Holidays;

- Utilize 'quiet' models of air compressors and other stationary noise sources where technology exists;

- Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment;

- Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from adjacent receptors;

- Acoustically shield stationary equipment located near adjacent receptors with temporary noise barriers;

- Locate staging areas and construction material areas as far away as possible from adjacent receptors;

- Prohibit all unnecessary idling of internal combustion engines;

- Route all construction traffic to and from the project site via designated truck routes and prohibit construction related heavy truck traffic in residential areas where feasible;

- Notify all adjacent receptors of the construction schedule in writing;

- Designate a "disturbance coordinator" who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures warranted to correct the problem be implemented; and

- Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction.

Rooftop Patio Noise

The type and size of events that will take place at the rooftop indoor event space or rooftop patio area has not been specified. The indoor event space is planned to be 1,412 square feet and the patio area is planned to be 6,200 square feet, allowing for an unspecified number of guests. To estimate the noise levels associated with events at the proposed outdoor patio area, the nature of the noise produced must be considered. Table 9, below, lists typical noise levels generated by small to moderate sized special events at a distance of 50 feet from the source.

TABLE 9 Typical Noise Source Levels for Special Events (A-Weighted L_{50} Levels)

Event or Activity	Typical Noise Level @ 50 ft
Amplified wedding (or similar type event) Music	72 dBA
Amplified Speech	71 dBA
Non-amplified (acoustic) Music	67 dBA
Films – Voices/Music	64 dBA
Raised Conversation	64 dBA

For the purpose of establishing a credible worst-case analysis, events with amplified music would be considered the loudest type of event that could occur, with typical noise levels of 72 dBA at 50 feet. Because the patio area is to be elevated approximately 56-feet above grade and surrounded by a parapet, some noise attenuation will result from the building and parapet functioning as a noise barrier. The nearest noise-sensitive receptor that could be affected by rooftop event noise is located on the third-floor-level of a mixed-use building, approximately 300-feet from the acoustical center of the rooftop patio area. When considering the distance between the center of the patio area and the nearest receptor, as well as the attenuation provided by the hotel building itself, event noise would be 56 dBA or less at the nearest noise-sensitive receptor. Therefore, noise levels generated by an event with amplified music would not create noise levels at the nearest noise-sensitive receptor that would exceed the noise limits set by the City. This is a less-than-significant impact.

On-Site Operational Noise

On-site operational noise sources would primarily consist of mechanical equipment necessary for heating, ventilation, and cooling purposes, exhaust fans, and other similar equipment. This equipment would be located on the rooftop of the hotel building. At the time of this study, the specific models of equipment are unknown, but the quantities are known. Given the distance separating the proposed location of mechanical equipment from nearby sensitive receptors, as well as shielding provided by the building itself and parapet, it is expected that mechanical equipment for the proposed project could feasibly be designed to meet the City's applicable noise limit of 60 dBA L_{eq} day or night.

Available project plans identify approximately 40 pieces of rooftop mechanical equipment that would potentially contribute to the noise environment. These include condensing units, heat pumps, fans, exhaust, and DOAS units. A review of I&R files indicates that this equipment would range from about 46 to 75 dBA at three feet, and would range from 56 to 58 dBA on average. For the purpose of establishing a credible worst-case analysis, all project rooftop equipment was assumed to be 75 dBA at three feet. When combining these noise generating sources, the noise level is calculated to be approximately 65 dBA at 50 feet, unshielded.

Comparable to the rooftop events component of the project, mechanical equipment that will service the building will be at a similar distance from the nearest noise sensitive receptor as event noise would be. Event noise was calculated to be 72 dBA at 50 feet and would not cause noise levels above 60 dBA L_{eq} at the nearest receptor. Combined noise levels for rooftop mechanical equipment would be less than event noise at the same distance. Therefore, like event noise, rooftop mechanical noise would not cause noise levels above 60 dBA L_{eq} at the nearest receptor. Based on the above generic assumptions, mechanical equipment noise levels are calculated to be less than 60 dBA L_{eq} at all off-site residential receptors more than 300 feet away. No mechanical equipment is anticipated for a project of this scale that would make meeting the applicable noise limits with standard noise control measures difficult. This is a less-than-significant impact.

Traffic Noise

A significant noise impact would occur if traffic generated by the project would increase noise levels at sensitive receptors by 4 dBA CNEL or more beyond acceptable standards for noise-sensitive receptors. For reference, existing traffic volumes would have to double for traffic noise levels to increase by 3 dBA CNEL, and triple for traffic noise levels to increase by 5 dBA CNEL, where traffic is the primary source of environmental noise levels.

Traffic data provided by *W-Trans* were reviewed to identify roadway segments that would experience a substantial increase in traffic volumes with the project. Primary vehicular access to the hotel site will be provided via a garage entrance along B Street. Peak hour turning movement data were provided for the intersection of Petaluma Boulevard South and B Street. Existing plus project traffic volumes were compared to existing volumes to conservatively estimate the project's contribution to the permanent noise level increase. Upon comparison of these traffic conditions, a traffic noise increase of less than 1 dBA CNEL was calculated along both Petaluma Boulevard South and B Street. Therefore, the impact is less-than-significant as the project would not increase overall noise levels by 4 dBA CNEL or more.

Mitigation Measures: **None Required.**

Impact 2: Exposure to Excessive Groundborne Vibration due to Construction. Construction-related vibration levels could exceed 0.3 in/sec PPV at the nearest buildings of conventional construction. **This is a significant impact.**

Construction of the project may temporarily generate perceptible vibration when heavy equipment or impact tools are used near the boundary of the site. Proposed construction phases include site preparation, grading, trenching/foundation, paving, and new building framing and finishing.

The City of Petaluma does not specify a construction vibration limit. 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 0.25 in/sec PPV for historic and some old buildings (see Table 3). The 0.3 in/sec PPV vibration limit would be applicable to properties in the vicinity of the project site.

Table 10 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet and summarizes the expected vibration levels at buildings between 5 and 30 feet of the site. 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 generate substantial vibration in the immediate vicinity. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 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. At a distance of approximately 5 feet, vibration levels due to most heavy equipment are conservatively calculated to reach up to approximately 1.233 in/sec PPV and would exceed the 0.3 in/sec PPV threshold for conventional buildings. Vibratory rollers or the dropping of heavy equipment would have the potential to produce vibration levels of 0.3 in/sec PPV or more at buildings of normal conventional construction located within approximately 20 feet of the project site.

The US Bureau of Mines has analyzed the effects of blast-induced vibration on buildings in USBM RI 8507[2], and these findings have been applied to vibrations emanating from construction equipment on buildings[3]. As shown on Figure 10, these studies indicate a 5% probability of "threshold damage" (referred to as cosmetic damage elsewhere in this report) at vibration levels of 0.4 in/sec PPV or less and no observations of "minor damage" or "major damage" at vibration levels of 1.1 in/sec PPV or less. Figure 10 presents the damage probability as reported in USBM RI 8507 and reproduced by Dowding assuming a maximum vibration level of 1.233 in/sec PPV at 5-feet. Based on these data, cosmetic or threshold damage would be manifested in the form of hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of

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[2] 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.

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

loose objects. Minor damage (e.g., hairline cracking in masonry or the loosening of plaster) would possibly occur. Major structural damage (e.g., wide cracking or shifting of foundation or bearing walls) would not occur at the adjacent buildings within 5 feet of the site assuming a maximum vibration level of 1.233 in/sec PPV. Other buildings of normal conventional construction located beyond 20 feet from the project site would not be exposed to vibration levels exceeding the 0.3 in/sec PPV threshold for normal buildings. The nearest historic building located near the site is located at 20 4th Street, and is approximately 220-feet from the site. At this distance, the 0.25 in/sec PPV limit for historic and old buildings would not be exceeded.

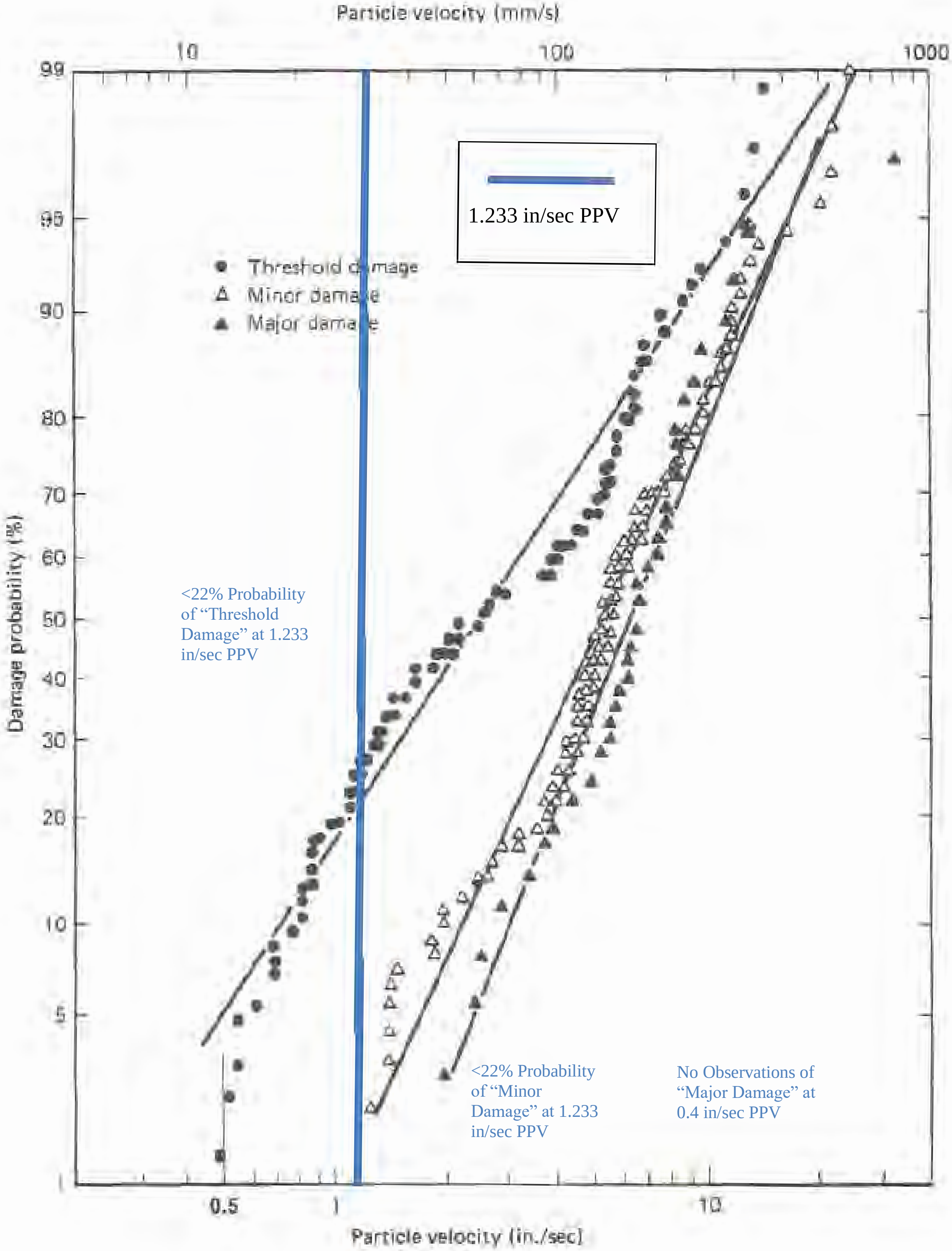
Project-generated vibration levels would be capable of cosmetically damaging the adjacent buildings and creating minor damage along the southwest boundary of the site if vibratory rollers are used, or heavy equipment is dropped, within 20 feet of the buildings. At these locations, and in other surrounding areas where vibration would not be expected to cause structural 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. 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 residences and businesses, perceptible vibration can be kept to a minimum.

TABLE 10 Construction Vibration Levels at Nearby Buildings

Equipment		PPV (in/sec)				
		Source Level at 25 ft	Vibration Level at 5 ft	Vibration Level at 10 ft	Vibration Level at 20 ft	Vibration Level at 30 ft
Clam shovel drop		0.202	1.186	0.553	0.258	0.165
Hydromill (slurry wall)	in soil	0.008	0.047	0.022	0.010	0.007
	in rock	0.017	0.100	0.047	0.022	0.014
Vibratory Roller		0.210	1.233	0.575	0.268	0.172
Hoe Ram		0.089	0.523	0.244	0.114	0.073
Large bulldozer		0.089	0.523	0.244	0.114	0.073
Caisson drilling		0.089	0.523	0.244	0.114	0.073
Loaded trucks		0.076	0.446	0.208	0.097	0.062
Jackhammer		0.035	0.206	0.096	0.045	0.029
Small bulldozer		0.003	0.018	0.008	0.004	0.002

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, FTA Report No. 0123, September 2018, as modified by Illingworth & Rodkin, Inc., August 2023.

FIGURE 10 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., August 2023.

Mitigation Measures:

The following measures shall be implemented where vibration levels due to construction activities would exceed 0.3 in/sec PPV at nearby buildings:

- Prohibit the use of heavy vibration-generating construction equipment within 20 feet of adjacent buildings.
- Use a smaller vibratory roller, such as the Caterpillar model CP433E vibratory compactor, when compacting materials within 20 feet of adjacent buildings. Only use the static compaction mode when within 10 feet of the adjacent buildings.
- Avoid dropping heavy equipment and use alternative methods for breaking up existing pavement, such as a pavement grinder, instead of dropping heavy objects, within 20 feet of adjacent buildings.
- Designate a person responsible for registering and investigating claims of excessive vibration. The contact information of such person shall be clearly posted on the construction site.

The implementation of these mitigation measures would reduce a potential impact to a less-than-significant level.

Impact 3 **Exposure of Residents or Workers to Excessive Noise Levels in the Vicinity of a Public Airport or Private Airstrip.** The project site would not be exposed to aircraft noise levels of 65 dBA CNEL or greater. **This is a less-than-significant impact.**

Petaluma Municipal Airport is located approximately 2.3 miles northeast of the project site and is the only significant source of aircraft noise in the project vicinity. Noise levels expected from aircraft associated with the airport are best represented by the Petaluma General Plan 2025 Airport Noise Contours. Figure 11 depicts the 65 dB CNEL noise contour that defines the noise impact boundary for new hotel development. Most aircraft activity is concentrated in the Airport's immediate environs, and the noise exposure map shows the 55 dBA CNEL noise contour located east of S. Ely Boulevard. The project site lies outside the 2025 65 dBA CNEL noise contour and noise levels resulting from aircraft would be compatible with the proposed land use.

Mitigation Measures: **None Required.**

FIGURE 11 Noise Exposure Map Showing Site in Relation to Airport Noise Contours