Appendix 3.13-1

Noise Technical Report for the Las Camas Solar Project

NOISE TECHNICAL REPORT
LAS CAMAS SOLAR PROJECT

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Contents

Chapter 1 **Introduction** **1-1**

1.1 Project Description 1-1

1.2 Project Location and Site Description 1-4

1.3 Project Components Not Evaluated 1-4

Chapter 2 **Noise Fundamentals** **2-1**

2.1 Frequency, Amplitude, and Decibels 2-1

2.2 Noise Descriptors 2-3

2.3 Sound Propagation 2-4

2.4 Human Response to Noise 2-6

2.5 Noise-Sensitive Land Uses 2-7

Chapter 3 **Ground-borne Vibration Fundamentals** **3-1**

3.1 Displacement, Velocity, and Acceleration 3-1

3.2 Frequency and Amplitude 3-2

3.3 Vibration Descriptors 3-2

3.4 Vibration Propagation 3-3

3.5 Effects of Ground-borne Vibration 3-3

3.6 Vibration-Sensitive Land Uses 3-5

Chapter 4 **Existing Noise Environment** **4-1**

Chapter 5 **Regulatory Framework** **5-1**

5.1 Federal 5-1

5.2 State 5-1

5.3 Local 5-2

Chapter 6 **Effects and Recommended Mitigation Measures** **6-1**

6.1 Methodology 6-1

6.2 Thresholds of Significance 6-5

Chapter 7 **References** **7-1**

Appendix A Field Noise Measurements

Appendix B Construction Noise Modeling

Appendix C Traffic Noise Modeling

Appendix D Operational Noise Modeling

Tables

Table		Page
2-1	Rules for Combining Sound Levels by Decibel Addition	2-2
2-2	Typical A-Weighted Sound Levels	2-3
4-1	Measured Existing Noise Levels in the Project Vicinity	4-3
5-1	Caltrans Guideline Vibration Damage Criteria	5-2
5-2	Caltrans Guideline Vibration Annoyance Criteria	5-2
5-3	Merced County Noise Standards for New Uses Affected by Traffic, Railroad, and Airport Noise	5-4
5-4	Non-Transportation Noise Standards Median (L_{50}) /Maximum (L_{max})	5-5
6-1	Analyzed Receiver Locations and Corresponding Baseline Noise Measurements	6-1
6-2	Construction Equipment Vibration Levels	6-4
6-3	Solar Power Equipment Noise Levels	6-5
6-4	Construction Activities and Equipment Noise Levels	6-9
6-5	Composite Noise Levels for Each Construction Phase at 50 Feet	6-10
6-6	Weekday Daytime Noise Levels and Increases at Nearest Receptors for Each Construction Phase	6-11
6 7	Noise Levels and Increases for Evening Construction Activities	6-14
6-8	Modeled Construction Traffic Noise Levels in the Project Vicinity	6-16
6-9	Calculated Combined Noise Levels from On-site Construction and Construction Traffic	6-17
6-10	Calculated Operational Noise Levels for DC Option Equipment	6-20
6-11	Noise Level Exceedances Over Ambient due to DC Option Equipment	6-21
6-12	Calculated Operational Noise Levels for AC Option Equipment	6-23
6-13	Noise Level Exceedances Over Ambient due to AC Option Equipment	6-24
6-14	Calculated Operational Noise Levels for All Sources Combined	2-28
6-15	Noise Level Exceedances Over Ambient due to All Operational Sources Combined	2-29
6-16	Vibration Source Levels for Project Construction Equipment	2-30

Figures

Figure		Page
1	Project Location Map	1-2
2	Conceptual Site Plan	1-3
3a	Sensitive Receptor and Noise Measurement Location Map	4-2
3b	Sensitive Receptor and Noise Measurement Location Map	4-3
3c	Sensitive Receptor and Noise Measurement Location Map	4-4
3d	Sensitive Receptor and Noise Measurement Location Map	4-5

Acronyms and Abbreviations

AC	alternating current
BESS	battery energy storage system
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
dB	decibel
dBA	A-weighted decibel
DC	direct current
EDP	EDP Renewables
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
gen-tie line	generation tie line
HVAC	heating, ventilation, air-conditioning
Hz	Hertz
I-5	Interstate 5
in/sec	inch per second
kHz	kilohertz
kV	kilovolt
L_{dn}	day-night sound level
L_{eq}	equivalent sound level
L_{max}	maximum sound level
L_{min}	minimum sound level
LT	long term
L_V	vibration velocity level
L_{xx}	percentile-exceeded sound level
MCC	Merced County Code
MW	megawatts
PG&E	Pacific Gas and Electric Company
PG&E substation improvements	proposed improvements to PG&E Los Banos Substation
PPV	peak particle velocity
project site	area comprising solar project site, gen-tie line, and PG&E substation
proposed project	Las Camas Solar Project (includes solar project and PG&E substation improvements)
PV	photovoltaic
RCNM	Roadway Construction Noise Model
rms	root mean square
RV	recreational vehicle
SLM	sound level meter
solar project	proposed Las Camas solar facility
solar project site	1,741-acre site of proposed Las Camas solar facility
SPL	sound pressure level
SR	State Route
ST	short term
VdB	vibration decibels
µPa	micropascals

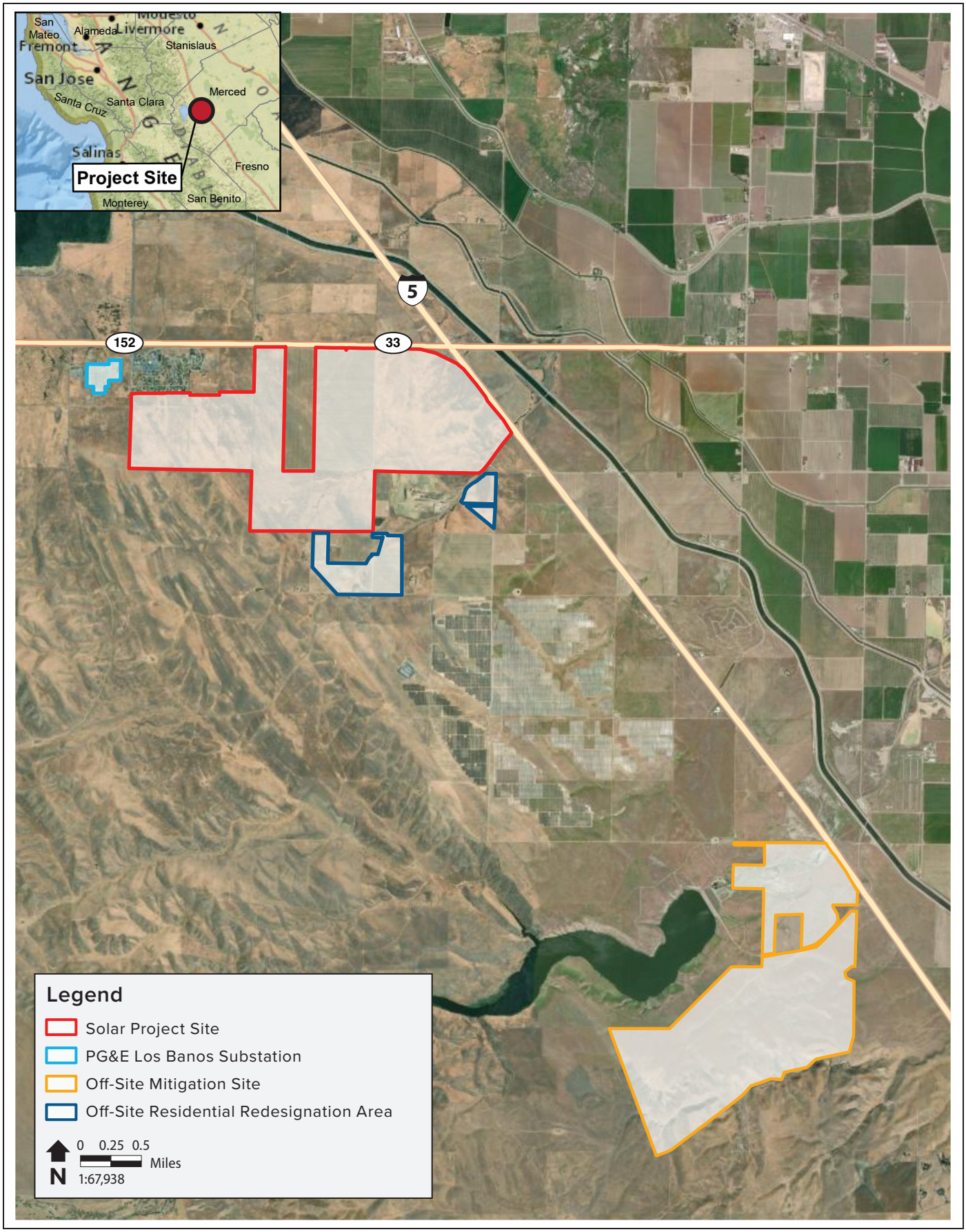
Chapter 1
Introduction

The purpose of this noise technical report is to identify noise or vibration effects associated with the proposed Las Camas Solar Project (proposed project) to be developed by EDP Renewables (EDP) in Merced County, California (refer to Figure 1 for the project location). The analysis provided in this report evaluates the potential for short- and long-term noise and vibration effects associated with construction and operation of the proposed project. The analysis includes a description of the environmental setting for the proposed project, including existing noise conditions, as well as a discussion of applicable laws and regulations. It also documents the assumptions, methodologies, and findings used to evaluate the effects.

1.1 Project Description

The proposed project includes construction, long-term operation, and eventual decommissioning of the Las Camas Solar Project, which would be located west of Los Banos in Merced County. The project would create a solar photovoltaic (PV) facility that would generate electricity from ground-mounted, single-axis tracking arrays (solar project). It would also intermittently store electricity by charging and discharging lithium-ion batteries. The solar PV facility would have the capacity to generate approximately 200 megawatts (MW) of alternating current (AC), with a battery storage capacity of approximately 100 MW. Two battery storage options are under consideration, a direct-current (DC) coupled system or an AC coupled system. Both options would use lithium-ion batteries for electrical storage; the batteries would be housed in battery energy storage system (BESS) enclosures. Under the DC coupled system, BESS enclosures would be distributed among the solar arrays and co-located with the solar PV inverters throughout the project site. Under the AC coupled system, all BESS enclosures would be co-located near the western central portion of the project site. Both the DC and AC options are evaluated at an equal level of detail in this analysis. Construction and most operational project components would generally be the same, regardless of the option selected; therefore, the construction noise analysis and most of the operational noise analysis, besides the assessment of operational electrical equipment, apply to both options. Operational equipment noise may differ between the scenarios; therefore, the operational noise analysis includes a separate assessment of equipment associated with the DC and AC options.

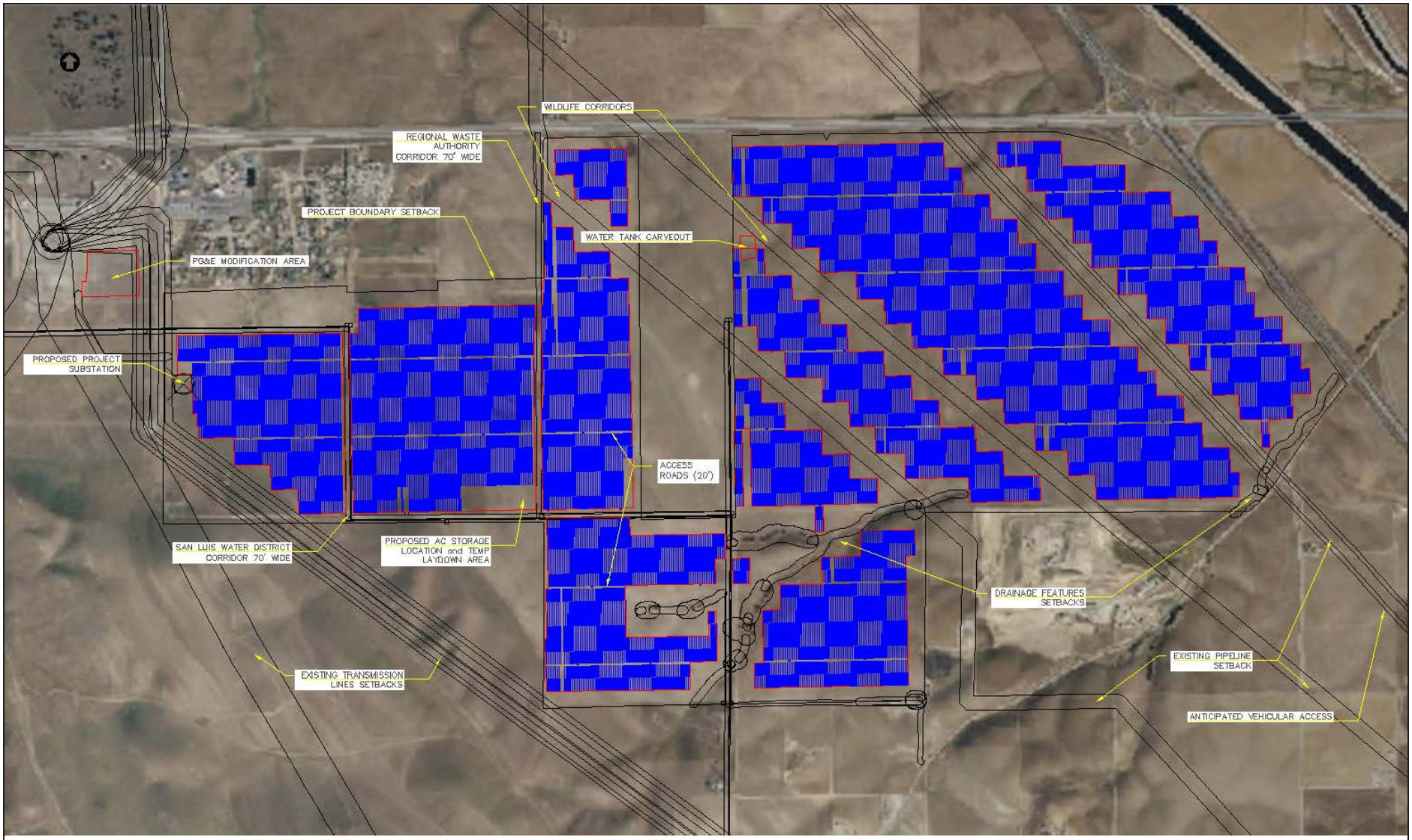
A new solar substation would be constructed along the western boundary of the solar project site, as shown in Figure 2. The solar substation would step the energy generated by the solar project up to a higher voltage and connect it to the project generation tie line (gen-tie line) for transmission to the wider electrical grid. The 230-kilovolt (kV) gen-tie line would convey all electricity from the solar project substation to the Pacific Gas and Electric Company (PG&E) Los Banos substation, which is located west of the solar project site. The proposed project also includes transmission system improvements around the existing Los Banos Substation (PG&E substation improvements). The PG&E substation improvements include connecting the PG&E substation to the solar project's gen-tie line and installing new structures and equipment within PG&E-owned substation property. The existing substation fence would be moved outward to the south and east, on existing substation property, to accommodate the additional equipment required.



Graphics ... 104366 (02-21-2024) JC

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Figure 1
Project Location



Note: Project has a sunset date of 2060

Source: EDP Renewables, 2024.

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Figure 2
Conceptual Site Plan
(AC Option)

Internal access roads would be developed throughout the solar project site to facilitate operational and maintenance trips and allow solar project employees to access the solar project site once the solar project is operational. These aggregate-surfaced access roads would be built around and between the solar arrays.

The project is anticipated to be operational in 2025. It is expected to operate for 35 years.

1.2 Project Location and Site Description

The solar project would be located on roughly 1,741 acres of undeveloped, privately owned land (solar project site) located approximately 3 miles southeast of the community of Santa Nella, California; 6 miles west of the city of Los Banos; and approximately 30 miles southwest of the city of Merced. The solar project site is at the southwest corner of the intersection of State Route (SR) 33/SR-152 and Interstate 5 (I-5); it can be accessed via Billy Wright Road from SR-33/SR-152.

The solar project site is undeveloped, consisting predominantly of nonnative annual grassland. Elevations on the solar project site range from approximately 220 feet above sea level at the lowest point to 558 feet at the highest point. The topography is mostly flat or gently rolling; steeper slopes are clustered near the southwest corner of the site and along a riverine feature in the southern portion of the solar project site. Three 230 kV transmission lines and one 69 kV transmission line run north–south through the solar project site and intersect at the western corner of the site.

PG&E's Los Banos substation is located approximately 0.2 mile west of the solar project site. The substation equipment is located within a footprint of approximately 37 acres within the substation fence.[1] The areas comprising the solar project site, gen-tie line, and PG&E substation are collectively referred to as the "project site" in this report.

The surrounding area is rural in character, with only pockets of development located nearby. Specifically, a residential subdivision, a recreational vehicle (RV) park, a commercial area, and the PG&E substation are located at the junction of SR-33 and SR-152, which is north of the western portion of the solar project site. Individual residences are located around other portions of the solar project site but at greater distances than the aforementioned residential pocket north of the western extent of the solar project site. The lands immediately east of I-5 support orchards, grazing, and dry farming. Farther east, irrigated agriculture is the primary land use. The community of Santa Nella, to the north, and city of Los Banos, to the east, are several miles from the solar project site.

1.3 Project Components Not Evaluated

It should be noted that the project includes two off-site components that will be evaluated in the environmental impact report (EIR) but are outside the scope of this report.

- **Off-Site Mitigation Site.** The project would establish a roughly 1,498-acre off-site mitigation site for San Joaquin kit fox. The mitigation site, which would be near the eastern and southern edges of Los Banos Reservoir, would be placed into a conservation easement in perpetuity. The land would be managed to provide habitat for San Joaquin kit fox and other covered species, as

[1] As measured on Google Earth.

necessary. The conservation easement on the mitigation site would require the continuation of current land management practices, including livestock grazing. Establishment and management of the mitigation site (see Figure 1) would not affect use of the solar project site or noise conditions, or change existing noise conditions at the mitigation site. Noise impacts at the off-site mitigation site will be evaluated in the proposed project's California Environmental Quality Act (CEQA) document and are not addressed further in this noise and vibration analysis.

- **Off-Site Residential Redesignation Area.** The project includes an amendment to the *2030 Merced County General Plan* to redesignate roughly 202.8 acres immediately south of the solar project site from single-family residential to high-density/medium-density residential. The proposed redesignation would preserve the supply of medium-density and/or high-density units in the county during the life of the solar project. The project does not propose any development within the off-site residential redesignation area. Noise impacts at the proposed residential redesignation area will be evaluated in the proposed project's CEQA document at a program level, and future development in this area would be subject to independent project-level review under CEQA. Impacts resulting from the proposed redesignation are not addressed further in this noise and vibration report.

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Chapter 2
Noise Fundamentals

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is often defined as sound that is objectionable because it is unwanted, disturbing, or annoying.

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receptor, and the propagation path between the two. The loudness of the noise source and the obstructions or atmospheric factors, which affect the propagation path to the receptor, determine the sound level and the characteristics of the noise perceived by the receptor. In the context of environmental noise and vibration assessment, the terms *receptor* and *receiver* are often used interchangeably. However, in this report, they are used to mean slightly different things. The term *receptor* is used to present a general discussions of acoustic concepts and describe noise-sensitive uses in the study area. The term *receiver* describes a specific geographical point used in the analysis to calculate noise levels. Each *receiver may be representative of one or more nearby receptors.*

The following sections provide an explanation of key concepts and acoustical terms used in the analysis of environmental and community noise.

2.1 Frequency, Amplitude, and Decibels

Continuous sound can be described by its *frequency* (pitch) and *amplitude* (loudness). A low-frequency sound is perceived as low in pitch; a high-frequency sound is perceived as high-pitched. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

The amplitude of pressure waves generated by a sound source correlate with the loudness of that source. The amplitude of a sound is typically described in terms of *sound pressure level* (SPL), also referred to simply as the sound level. The SPL refers to the root-mean-square (rms)[2] pressure of a sound wave and is measured in units called micropascals (µPa). One µPa is approximately one hundred-billionth (0.00000000001) of normal atmospheric pressure. Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to more than 100,000,000 µPa. Because of this large range of values, sound is rarely expressed in terms of µPa. Instead, a logarithmic scale is used to describe the SPL in terms of decibels, abbreviated dB. The decibel is a logarithmic unit that describes the ratio of the actual sound pressure to a reference pressure (20 µPa is the standard reference pressure level for acoustical measurements in air). Specifically, an SPL, in dB, is calculated as follows:

[2] Root mean square (rms) is defined as the square root of the mean (average) value of the squared amplitude of the noise signal.

$$SPL = 20 \times \log_{10}\left(\frac{X}{20\mu Pa}\right)$$

where *X* is the actual sound pressure and 20 µPa is the reference pressure. The threshold of hearing for young people is about 0 dB, which corresponds to 20 µPa.

2.1.1 Decibel Calculations

Because decibels represent noise levels on a logarithmic scale, SPLs cannot be added, subtracted, or averaged through ordinary arithmetic. On the dB scale, a doubling of sound energy corresponds to a 3 dB increase. In other words, when two identical sources are each producing sound of the same loudness, their combined sound level at a given distance would be 3 dB higher than one source under the same conditions. For example, if one bulldozer produces an SPL of 80 dB, two bulldozers would not produce a combined sound level of 160 dB. Rather, they would combine to produce 83 dB. The cumulative sound level of any number of sources, such as excavators, can be determined using decibel addition. The same decibel addition is used for A-weighted decibels, described below.

Similarly, the arithmetic mean (average) of a series of noise levels does not accurately represent the overall average noise level. Instead, the values must be averaged using a linear scale before converting the result back into a logarithmic (dB) noise level. This method is typically referred to as calculating the "energy average" of the noise levels. Table 2-1 demonstrates the general results of adding noise from multiple sources. (Note that the examples summarized in this table are rounded to the nearest whole number.)

Table 2-1. Rules for Combining Sound Levels by Decibel Addition

When two decibel values differ by…	…add the following amount to the higher decibel value	Example
0 to 1 dB	3 dB	60 dB + 61 dB = 64 dB
2 to 3 dB	2 dB	60 dB + 63 dB = 65 dB
4 to 9 dB	1 dB	60 dB + 69 dB = 70 dB
10 dB or more	0 dB	60 dB + 75 dB = 75 dB

Source: California Department of Transportation. 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol.* September. Available: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tens-sep2013-a11y.pdf. Accessed: August 2, 2021.

2.1.2 A-Weighting

The dB scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (i.e., energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by characteristics of the human ear.

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range of 1,000 to 5,000 Hz and perceive sounds within that range better than sounds of the same amplitude at higher or lower

frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted (i.e., adjusted), depending on human sensitivity to those frequencies. The resulting SPL is expressed in A-weighted decibels, or dBA.

The A-weighting scale approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments regarding the relative loudness or annoyance of a sound, their judgments correlate well with the A-weighted sound levels of those sounds. Table 2-2 describes typical A-weighted sound levels for various noise sources.

Table 2-2. Typical A-Weighted Sound Levels

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

Source: California Department of Transportation. 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol.* September. Available: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tens-sep2013-a11y.pdf. Accessed: August 2, 2021.

2.2 Noise Descriptors

Because sound levels can vary markedly over a short period of time, various descriptors or noise "metrics" have been developed to quantify environmental and community noise. These metrics generally describe either the average character of the noise or the statistical behavior of the variations in the noise level. Some of the most common metrics used to describe environmental noise, including those metrics used in this report, are described below.

- **Equivalent Sound Level (L_{eq})** is the most common metric used to describe short-term average noise levels. Many noise sources produce levels that fluctuate over time; examples include mechanical equipment that cycles on and off or construction work, which can vary sporadically. The L_{eq} describes the average acoustical energy content of noise for an identified period of time, commonly 1 hour. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustical energy over the duration of the exposure. For many noise sources, the L_{eq} will vary, depending on the time of day. A prime example is traffic noise, which rises and falls, depending on the amount of traffic on a given street or freeway.
- **Maximum Sound Level (L_{max})** and **Minimum Sound Level (L_{min})** refer to the maximum and minimum sound levels, respectively, that occur during the noise measurement period. More specifically, they describe the rms sound levels that correspond to the loudest and quietest 1-second intervals that occur during the measurement.
- **Percentile-Exceeded Sound Level (L_{xx})** describes the sound level exceeded for a given percentage of a specified period. For example, the L_{50} is the sound level exceeded 50 percent of the time (such as 30 minutes per hour), and L_{25} is the sound level exceeded 25 percent of the time (such as 15 minutes per hour).
- **Community Noise Equivalent Level (CNEL)** is a measure of the 24-hour average A-weighted noise level, which is also time weighted to "penalize" noise that occurs during the evening and nighttime hours when noise is generally recognized to be more disturbing (because people are trying to rest, relax, and sleep during these times). Specifically, 5 dBA is added to the L_{eq} during the evening hours of 7 p.m. to 10 p.m., and 10 dBA is added to the L_{eq} during the nighttime hours of 10 p.m. to 7 a.m. The energy average is then taken for the whole 24-hour day.
- **Day-Night Sound Level (L_{dn})** is very similar to the CNEL described above. L_{dn} is also a time-weighted average of the 24-hour A-weighted noise level. The only difference is that no "penalty" is applied to the evening hours of 7 p.m. to 10 p.m. However, 10 dBA is added to the L_{eq} during the nighttime hours of 10 p.m. to 7 a.m. The energy average is then taken for the whole 24-hour day.

It is noted that various federal, state, and local agencies have adopted CNEL or L_{dn} as the measure of community noise. Although not identical, CNEL and L_{dn} are normally within 1 dBA of each other when measured in typical community environments, and many noise standards/regulations use the two interchangeably.

2.3 Sound Propagation

When sound propagates over a distance, it changes in both level and frequency content. The manner in which noise is reduced with distance depends on the following important factors (described below). In general, noise attenuates (decreases) with distance. Roadway noise sources tend to be arranged linearly. Therefore, noise from roadway vehicular traffic attenuates at a rate of approximately 3.0 to 4.5 dB per doubling of distance from the source, depending on the intervening surface (paved or vegetated, respectively).[3] Point sources of noise, such as stationary equipment or construction equipment, typically attenuate at a rate of approximately 6.0 to 7.5 dB per doubling of

[3] Ibid.

distance from the source.[4] For example, a sound level of 80 dBA at 50 feet from the noise source will be reduced to 74 dBA at 100 feet, 68 dBA at 200 feet, and so on. Noise levels can also be attenuated by shielding the noise source or providing a barrier between the source and the receptor.

- **Geometric Spreading.** Sound from a single source (i.e., a "point" source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates (or drops off) at a general rate of 6 dBA for each doubling of distance. Highway noise is not a single stationary point source of sound. The movement of vehicles on a highway makes the source of the sound appear to emanate from a line (i.e., a "line" source) rather than from a point. This results in cylindrical spreading rather than the spherical spreading that results from a point source. The change in sound level (i.e., attenuation or decrease) from a line source is generally 3 dBA per doubling of distance.

- **Ground Absorption.** The noise path between the source and the observer is usually close to the ground. The excess noise attenuation from ground absorption occurs because of acoustic energy losses on sound wave reflection. For acoustically "hard" sites (i.e., sites with a reflective surface, such as a parking lot or a smooth body of water, between the source and the receptor), no excess ground attenuation is assumed because the sound wave is reflected without energy losses. For acoustically absorptive or "soft" sites (i.e., sites with an absorptive ground surface, such as soft dirt, grass, or scattered bushes and trees), an excess ground attenuation value of 1.5 dBA per doubling of distance is normally assumed. When added to the geometric spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dBA per doubling of distance for a line source and 7.5 dBA per doubling of distance for a point source.

- **Atmospheric Effects.** Research by the California Department of Transportation (Caltrans) and others has shown that atmospheric conditions can have a major effect on noise levels. Such factors include wind; air temperature, including vertical temperature gradients; humidity; and turbulence. Receptors downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas receptors upwind can have lower noise levels. Increased sound levels can also occur over relatively large distances because of temperature inversion conditions (i.e., increasing temperatures with elevation).

- **Shielding by Natural or Human-Made Features.** A large object or barrier in the path between a noise source and a receptor can substantially attenuate noise levels at the receptor. The amount of attenuation provided by this shielding depends on the size of the object, proximity to the noise source and receptor, surface weight, solidity, and the frequency content of the noise source. Natural terrain features (such as hills and dense woods) and human-made features (such as buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receptor with the specific purpose of reducing noise. In addition to the noise that diffracts over the top of a barrier, noise will also diffract around the ends of the barrier, resulting in "flanking" noise that can reduce the overall efficacy of the barrier. Assuming it is long enough to minimize the effects of flanking noise, a barrier that breaks the line of sight between a source and a receptor will typically result in at least 5 dB of noise reduction. A higher barrier may provide as much as 20 dB of noise reduction.

[4] The 1.5 dB variation in attenuation rate (6 dB versus 7.5 dB) can result from ground-absorption effects, which occur as sound travels over soft surfaces such as earth or vegetation (7.5 dB attenuation rate) versus hard surfaces such as pavement or hard-packed earth (6 dB rate).

2.4 Human Response to Noise

Noise can have a range of effects on people, including hearing damage, sleep interference, speech interference, performance interference, physiological responses, and annoyance. Each of these is briefly described below.

- **Hearing Damage.** A person who is exposed to high noise levels can suffer either gradual or traumatic hearing damage. Gradual hearing loss occurs with repeated exposure to excessive noise levels. It is most commonly associated with occupational noise exposures involving heavy industry or other very noisy work environments. Traumatic hearing loss is caused by a sudden exposure to an extremely high noise level, such as a gunshot or explosion at very close range. The potential for noise-induced hearing loss is not generally a concern in typical community noise environments. Noise levels in neighborhoods, even in very noisy airport environs, are not loud enough to cause hearing loss.

- **Sleep Interference.** Exposure to excessive noise levels at night has been shown to cause sleep disturbance. *Sleep disturbance* refers not only to awakening from sleep but also effects on the quality of sleep, such as alterations to the patterns and stages of sleep. World Health Organization guidelines recommend noise limits of 30 dBA L_{eq} (8-hour average) for continuous noise and 45 dBA L_{max} for single sound events inside bedrooms at night to minimize sleep disturbance (World Health Organization 1999).

- **Speech Interference.** Speech interference can be a problem in any situation where clear communication is desired. It is often of particular concern in learning environments (such as schools) or situations where poor communication could jeopardize safety. Normal conversational speech inside homes is typically in the range of 50 to 65 dBA (U.S. Environmental Protection Agency [EPA] 1977). Any noise in that range or louder may interfere with speech. As background noise levels rise, the intelligibility of speech decreases and the listener fails to recognize an increasing percentage of the words spoken. A speaker may raise his or her voice in an attempt to compensate for higher background noise levels, but this, in turn, can lead to vocal fatigue for the speaker.

- **Performance Interference.** Excessive noise has been found to have various detrimental effects on human performance, including information processing, concentration, accuracy, reaction times, and academic performance. Intrusive noise from individual events can also cause distraction. These effects are of obvious concern for learning and work environments.

- **Physiological Responses.** Acute noise has been shown to cause measurable physiological responses in humans, including changes in stress hormone levels, pulse rate, and blood pressure. The extent to which these responses cause harm, or are signs of harm, is not clearly defined, but it has been postulated that they could contribute to stress-related diseases, such as hypertension, anxiety, and heart disease. However, research indicates links between environmental noise and permanent health effects are generally weak and inconsistent. Statistically significant health risks have been found for extended exposure to very high noise levels, such as the risks for workers who are exposed to high levels of industrial noise for 5 to 30 years (World Health Organization 1999).

- **Annoyance.** The subjective effects of annoyance, nuisance, and dissatisfaction are possibly the most difficult to quantify, and no accurate method exists to measure the effects. This difficulty arises primarily from differences in individual sensitivity and habituation to sound, which can vary widely from person to person. What one person considers tolerable can be unbearable to

another of equal hearing acuity. An important tool in estimating the likelihood of annoyance due to a new sound is a comparison to the existing baseline or "ambient" environment to which a person has adapted. In general, the more the levels or tonal (frequency) variations of a sound exceed the previously existing ambient sound level or tonal quality, the less acceptable the new sound will be.

In most cases, effects from sounds typically found in the natural environment would be limited to annoyance or interference. Physiological effects and hearing loss would be more commonly associated with human-made noise, such as that in an industrial or occupational setting.

Studies have shown that, under controlled conditions in an acoustics laboratory, a healthy human ear is able to discern changes in sound levels of 1 dBA. In the normal environment, the healthy human ear can detect changes of about 2 dBA; however, it is widely accepted that a doubling of sound energy, which results in a change of 3 dBA in the normal environment, is considered just noticeable to most people. A change of 5 dBA is readily perceptible, and a change of 10 dBA is perceived as being twice as loud. Accordingly, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) resulting in a 3 dBA increase in sound would generally be barely detectable.

2.5 Noise-Sensitive Land Uses

Noise-sensitive land uses are locations that are likely to be adversely affected by excessive noise levels as well as locations where quiet is an essential element of their intended purpose. As defined in the *2030 Merced County General Plan* Noise Element, examples of sensitive interior spaces include, but are not limited to, all habitable rooms of residential and transient lodging facilities, hospital rooms, classrooms, library interiors, offices, worship spaces, and theaters. Sensitive outdoor areas include the primary outdoor activity areas associated with any given land use at which noise sensitivity exists (County of Merced 2013).

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Chapter 3
Ground-borne Vibration Fundamentals

This section describes basic concepts related to ground-borne vibration. Ground-borne vibration is a small, rapidly fluctuating motion transmitted through the ground. The effects of ground-borne vibration are typically limited to nuisance or annoyance for people, but at extreme vibration levels, damage to buildings may also occur.

In contrast to airborne sound, ground-borne vibration is not a phenomenon that most people experience every day. The ambient ground-borne vibration level in residential areas is usually much lower than the threshold of human perception. Most perceptible indoor vibration is caused by sources within buildings, such as mechanical equipment while in operation, people moving, or doors slamming. Typical outdoor sources of perceptible ground-borne vibration are heavy construction activities, such as blasting, pile driving, or earthmoving; trains with steel wheels; and traffic on rough roads. If a roadway is smooth, the ground-borne vibration from traffic is rarely perceptible, even in locations close to major roads. The strength of ground-borne vibration from typical environmental sources diminishes (or attenuates) fairly rapidly over distance.

For the prediction of ground-borne vibration, the fundamental model consists of a vibration source, a receptor, and the propagation path between the two. The power of the vibration source and the characteristics and geology of the intervening ground, which affect the propagation path to the receptor, determine the ground-borne vibration level and the characteristics of the vibration perceived by the receptor.

The following sections provide an explanation of key concepts and terms used in the analysis of environmental ground-borne vibration.

3.1 Displacement, Velocity, and Acceleration

When a vibration source (e.g., blasting, dynamic construction equipment, a train) impacts the ground, it imparts energy to the ground, creating vibration waves that propagate away from the source along the surface and downward into the earth. As vibration waves travel outward from a source, they excite the particles of rock and soil through which they pass and cause them to oscillate. The distance that these particles move is referred to as the *displacement* and is typically very small, usually only a few ten-thousandths to a few thousandths of an inch. *Velocity* describes the instantaneous speed of the motion, and *acceleration* is the instantaneous rate of change in the speed. Each of these measures can be further described in terms of *frequency* and *amplitude*, as discussed below.

Although displacement is generally easier to understand than velocity or acceleration, it is rarely used to describe ground-borne vibration because most transducers used to measure vibration measure velocity or acceleration directly, not displacement.

3.2 Frequency and Amplitude

The frequency of a vibrating object describes how rapidly it is oscillating. The unit of measurement for the frequency of vibration is Hz (the same as used in the measurement of noise), which describes the number of cycles per second.

The amplitude of displacement describes the distance that a particle moves from its resting (or equilibrium) position as it oscillates and can be measured in inches. The amplitude of vibration velocity (the speed of the movement) can be measured in inches per second (in/sec). The amplitude of vibration acceleration (the rate of change in the speed) can be measured in in/sec per second.

3.3 Vibration Descriptors

As noted above, there are various ways to quantify ground-borne vibration, based on its fundamental characteristics. Because vibration can vary markedly over a short period of time, various descriptors have been developed to quantify vibration. The two most common descriptors used in the analysis of ground-borne vibration are the peak particle velocity (PPV) and vibration velocity level (Lv), each of which is described below.

- **PPV** is defined as the maximum instantaneous positive or negative peak amplitude of the vibration velocity. The unit of measurement for PPV is in/sec. Unlike many quantities used in the study of environmental acoustics, PPV is typically presented using linear values and does not employ a dB scale. Because it is related to the stresses that are experienced by buildings, PPV is generally accepted as the most appropriate descriptor for evaluating the potential for building damage. Both Federal Transit Administration and Caltrans guidelines recommend using PPV for that purpose. It is also used in many instances to evaluate the human response to ground-borne vibration. Caltrans guidelines recommend using PPV for that purpose.
- **L_V** describes the rms vibration velocity. Because of the typically small amplitudes of ground-borne vibration, vibration velocity is often expressed in decibels, calculated as follows:

$$L_V = 20 \times \log_{10}\left(\frac{V}{V_{ref}}\right)$$

where V is the actual rms velocity amplitude and V_{ref} is the reference velocity amplitude. It is important to note that there is no universally accepted value for V_{ref}, but the accepted reference quantity for vibration velocity in the U.S. is 1 micro-inch per second (1×10^{-6} in/sec). The abbreviation VdB is commonly used for vibration decibels to distinguish from noise level decibels. L_V is often used to evaluate human response to vibration levels. Federal Transit Administration guidelines recommend using L_V for this purpose.

3.4 Vibration Propagation

Vibration energy spreads out as it travels through the ground, causing the vibration level to diminish with distance from the source. High-frequency vibrations reduce much more rapidly than low frequencies so that low frequencies tend to dominate the spectrum at large distances from the source. The propagation of ground-borne vibration is not as simple to model as airborne noise. This is because noise in the air travels through a relatively uniform medium while ground-borne vibrations travel through the earth, which may contain significant geological differences. Geological factors that influence the propagation of ground-borne vibration include the following:

- **Soil Conditions.** The type of soil is known to have a strong influence on the levels of ground-borne vibration. Among the most important factors are the stiffness and internal damping of the soil. Hard, dense, and compacted soil; stiff clay soil; and hard rock transmit vibration more efficiently than loose, soft soils; sand; or gravel.
- **Depth to Bedrock.** Shallow depth to bedrock has been linked to efficient propagation of ground-borne vibration. One possibility is that shallow bedrock acts to concentrate the vibration energy near the surface, reflecting vibration waves back toward the surface that would otherwise continue to propagate farther down into the earth.
- **Soil Strata.** Discontinuities in the soil strata (i.e., soil layering) can also cause diffractions or channeling effects that affect the propagation of vibration over long distances.
- **Frost Conditions.** Vibration waves typically propagate more efficiently in frozen soils than in unfrozen soils. Propagation also varies, depending on the depth of the frost.
- **Water Conditions.** The amount of water in the soil can affect vibration propagation. The depth of the water table in the path of the propagation also appears to have substantial effects on ground-borne vibration levels.

Specific conditions at the source and receptor locations can also affect vibration levels. For instance, how the source is connected to the ground (e.g., direct contact, through rails, by a structure) will affect the amount of energy transmitted into the ground. There are also notable differences when the source is underground, such as in a tunnel, versus on the surface. At the receptor, vibration levels can be affected by variables such as the foundation type, building construction, and acoustical absorption inside the rooms where people are located. When vibration encounters a building, a ground-to-foundation coupling loss will usually reduce the overall vibration level. However, under certain circumstances, the ground-to-foundation coupling may also amplify the vibration level because of structural resonances from the floors and walls.

3.5 Effects of Ground-borne Vibration

Vibration can result in effects that range from annoyance to structural damage. Annoyance or disturbance for people may occur at vibration levels that are substantially below those that would pose a risk of damage to buildings. Each of these effects is discussed below.

3.5.1 Potential Building Damage

When ground-borne vibration encounters a building, vibrational energy is transmitted to the structure, causing it to vibrate. If the vibration levels are high enough, damage to the building may occur. Depending on the type of building and the vibration levels, this damage could range from cosmetic architectural damage (e.g., cracked plaster, stucco, tile) to more severe structural damage (e.g., cracking of floor slabs, foundations, columns, beams, wells). Buildings can typically withstand higher levels of vibration from transient sources than from continuous or frequent intermittent sources. Transient sources are those that create a single isolated vibration event, such as blasting or the use of drop balls. Continuous/frequent intermittent sources include pile drivers (impact or vibratory), crack-and-seat equipment, and vibratory compaction equipment. Older fragile buildings, which may include important historic buildings, are of particular concern. Modern commercial and industrial buildings can generally withstand much higher vibration levels before potential damage occurs.

3.5.2 Human Disturbance or Annoyance

Ground-borne vibration can be annoying for people and cause serious concern for nearby neighbors, even when vibration is well below the level that could cause physical damage to structures. Ground-borne vibration is almost exclusively a concern inside buildings. It is rarely perceived as a problem outdoors where the motion may be discernible but the reaction is less adverse without the effects associated with a shaking building. The normal frequency range at which most ground-borne vibration starts to be felt is generally from less than 1 Hz to about 200 Hz.

When ground-borne vibration waves encounter a building, vibrational energy is transmitted to the building foundation. It then propagates throughout the remainder of the structure, causing surfaces (e.g., walls, floors, ceilings) to vibrate. This movement may be felt directly by building occupants. It may also generate a low-frequency rumbling noise as sound waves are radiated by the vibrating surfaces. At higher frequencies, building vibration can cause other audible effects, such as the rattling of windows, building fixtures, or items on shelves or hanging on walls. These audible effects due to ground-borne vibration are referred to as *ground-borne noise*. Ground-borne vibration levels that result in ground-borne noise are often experienced as a combination of perceptible vibration and low-frequency noise. However, sources that have the potential to generate ground-borne noise are likely to produce airborne noise impacts that mask the radiated ground-borne noise. Any perceptible effect (i.e., vibration or ground-borne noise) can lead to annoyance. The degree to which a person is annoyed depends on the activity in which they are participating at the time of the disturbance. For example, someone sleeping or reading will be more sensitive than someone who is engaged in some type of physical activity. Reoccurring vibration effects often lead people to believe that vibration is damaging their homes, even though the vibration levels are well below the minimum thresholds for damage potential (Caltrans 2020).

Numerous studies have been conducted to characterize the human response to vibration. Over the years, numerous vibration criteria and standards have been suggested by researchers, organizations, and governmental agencies. These studies suggest that the thresholds for perception and annoyance vary, according to duration, frequency, and amplitude of vibration. For a continuous or frequent intermittent vibration source, such as construction activity, including the use of pile drivers or vibratory compaction equipment, the human response to vibration varies from barely perceptible at a PPV of 0.01 in/sec to distinctly perceptible at a PPV of 0.04 in/sec, strongly perceptible at a PPV of 0.1 in/sec, and severe at a PPV of 0.4 in/sec (Caltrans 2020).

3.6 Vibration-Sensitive Land Uses

As noted above, the potential effects of ground-borne vibration can be divided into two categories: building damage and potential human annoyance. Because building damage would be considered a permanent negative effect at any building, regardless of land use, any type of building would typically be considered sensitive to this type of impact. Fragile structures, which often include historic buildings, are most susceptible to damage and of particular concern.

Human annoyance effects from ground-borne vibration are typically considered only inside occupied buildings and not at outside areas such as residential yards, parks, or open spaces. Buildings that would be considered sensitive to human annoyance caused by vibration are generally the same as those that would be sensitive to noise. These typically include residences, schools, hospitals, assisted-living facilities, mental care facilities, places of worship, libraries, performing arts facilities, and hotels and motels.

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Chapter 4
Existing Noise Environment

The project site is in an incorporated portion of southwest Merced County. Overall population density in the area is low, although there is an established neighborhood of single-family homes, as well as the Oasis West RV Park, adjacent to the northwest corner of the solar project site. Just west of the residential neighborhood is the existing PG&E Los Banos substation where the PG&E substation improvements are proposed. Other land uses surrounding the project site currently include large tracts of vacant and agricultural land in all directions, SR-33 (also designated SR-152) and the Apricot Hill Fruit Stand the north, I-5 to the east, sparsely distributed residential dwellings and the Merced County Disposal Site to the south and southeast, the Billy Wright Landfill (operated by the Merced County Regional Waste Authority) to the southeast, and existing electrical transmission lines to the west. There is also an existing solar project (Wright Solar project) approximately 0.9 mile to the southwest. The closest noise- and vibration-sensitive land uses to the project site are the existing residences to the north, which are shown in Figures 3a through 3d. Residential property lines to the northwest are as close as 90 feet from the solar project site boundary (with residential structures approximately 130 feet from the site boundary) and 420 feet from the PG&E substation. The portions of the solar project site where operational equipment would be installed are at least 400 feet from residential property lines or 510 feet from the nearest residential structures. Individual rural residences south and southeast of the solar project site are 800 to more than 2,000 feet from the solar project site perimeter.

The analysis of noise and vibration effects provided in this technical report focuses on the noise-sensitive land uses in the project vicinity, primarily on the residences closest to the project site (i.e., near the northwest portion of the solar site and east of the PG&E substation). Analyzing effects at uses closest to the project site provides a reasonable worst-case assessment; identified noise and vibration effects can be extrapolated out to farther distances, as needed.

The existing noise environment in the project vicinity is generally quiet. The dominant source of ambient noise is vehicular traffic on SR-33 and I-5 as well as local streets. Additional noise sources currently affecting the project area are the electrical infrastructure associated with the PG&E substation, agricultural sources (e.g., irrigation systems, farming equipment, livestock), operations at the Billy Wright Landfill, general residential sources (e.g., air conditioners, barking dogs, landscaping equipment), natural background sources (e.g., wind, birds), and distant aircraft.

Ten noise measurements were conducted between Wednesday, March 30, 2022, and Thursday, March 31, 2022, to document existing noise levels in the project area with the use of integrating sound level meters (SLMs). These included both short-term (ST) measurements conducted over a period of 20 minutes and long-term (LT) noise measurements, which logged hourly data over a period of at least 24 hours. The instrument used to obtain the ST noise measurements was a Type 1 Larson Davis SLM (Model 831). The instruments used to obtain the LT noise measurements were two Type 2 Piccolo I SLMs and four Type 2 Piccolo II SLMs. All SLMs were field calibrated by a Larson Davis CAL200 acoustical calibrator prior to each measurement to ensure accuracy. The instruments are maintained to manufacturer specifications, in accordance with American National Standards Institute standard S1.4.

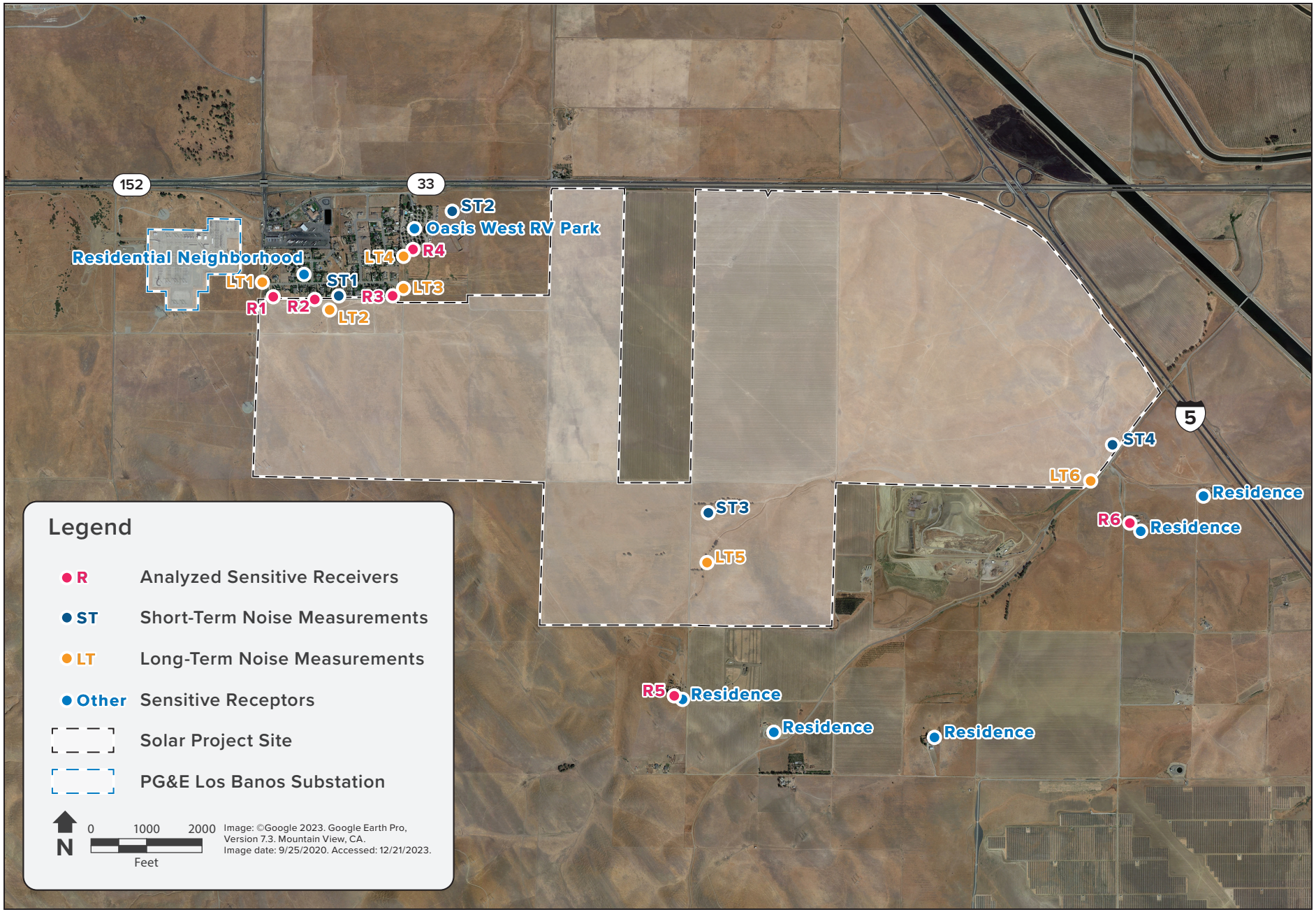
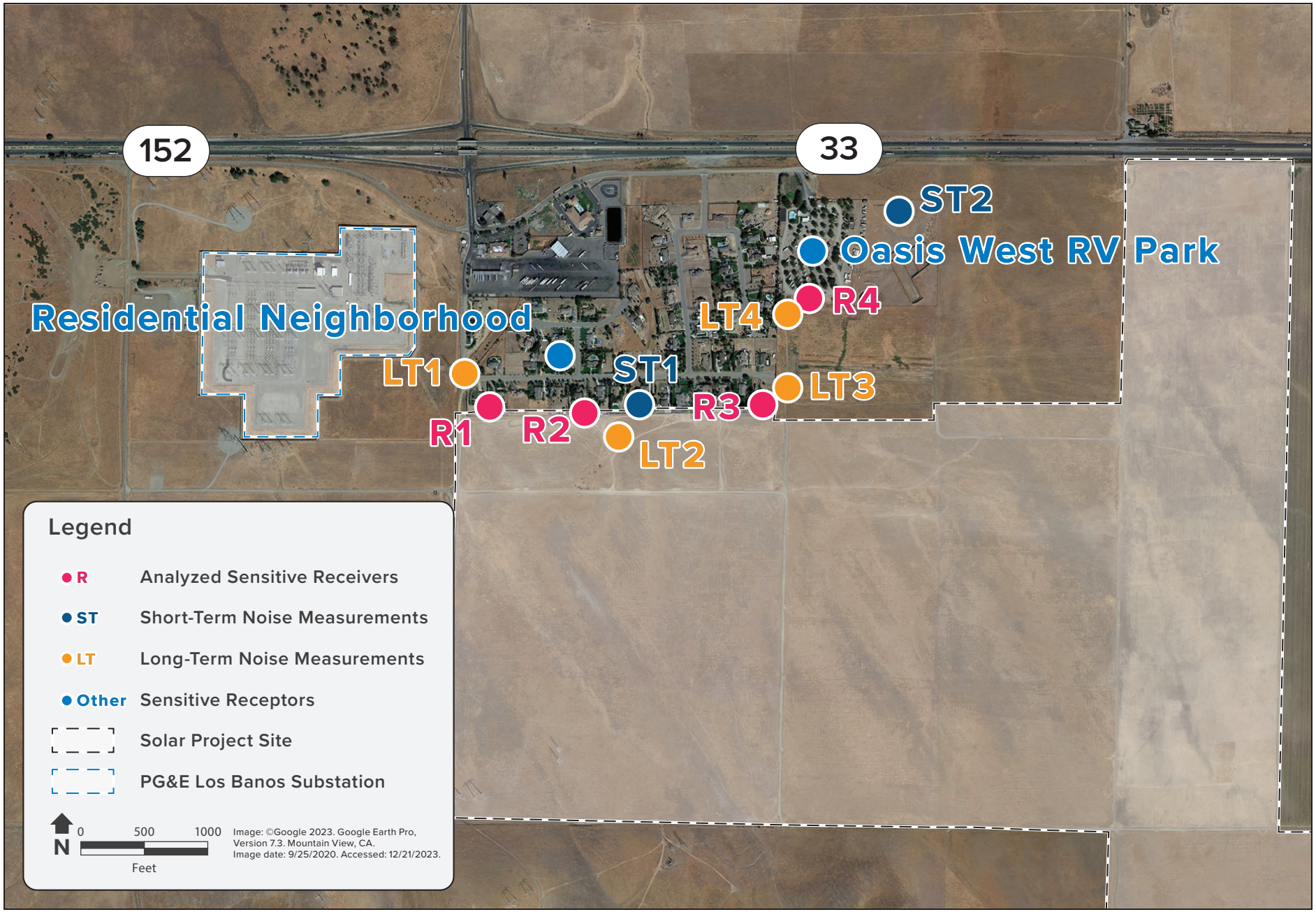


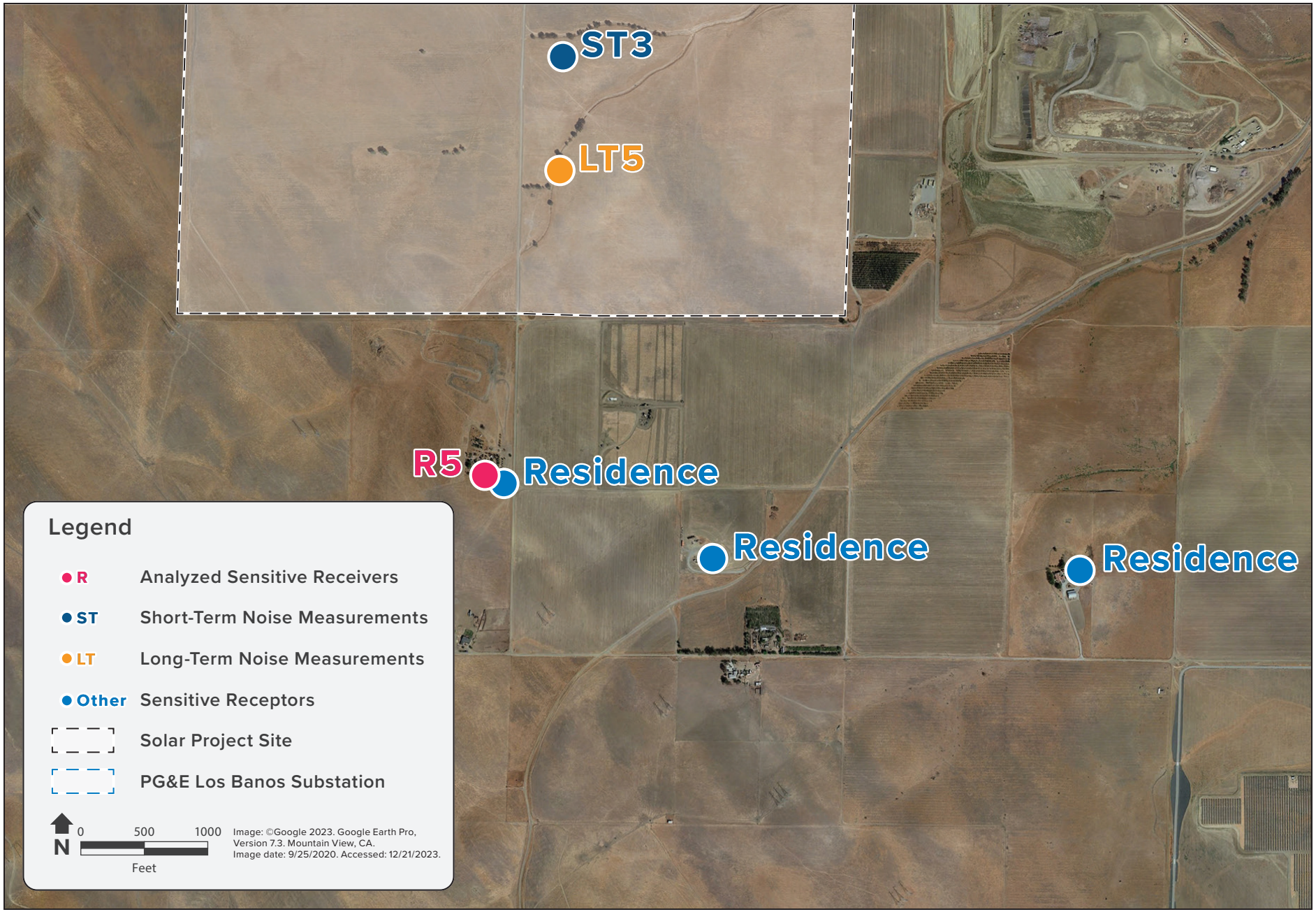
Figure 3a
Sensitive Receptor and Noise Measurement Location Map



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Figure 3b
Sensitive Receptor and Noise Measurement Location Map



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Figure 3c
Sensitive Receptor and Noise Measurement Location Map



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Figure 3d
Sensitive Receptor and Noise Measurement Location Map

The measurement locations were distributed throughout the project area, with an emphasis on locations that are representative of one or more noise-sensitive receptors (i.e., residential dwellings) near the project site. All measurement locations are indicated in Figures 3a through 3d.

The noise measurement results are summarized in Table 4-1. Field noise survey sheets are included in Appendix A of this report. Noise measurements indicate that the hourly ambient noise levels in the project vicinity were generally between 43 and 71 dBA L_{eq} during the daytime, between 42 and 62 dBA L_{eq} during the evening, and between 43 and 61 dBA L_{eq} during the nighttime. The LT noise measurements indicate that the average daily noise level ranged from 55 to 67 dBA CNEL in the project area.

Table 4-1. Measured Existing Noise Levels in the Project Vicinity

Location Number: Description	Date	Time	Noise Levels, dBA		
			L_{eq} Range (Average)	L_{max} Range	L_{dn}
LT1: Northwest of solar project site, adjacent to 28950 W. Vista Grande Drive	3/30/2022 to 3/31/2022	Daytime	53.3–70.5 (66.5)	71.8–86.8	67.0
		Evening	54.5–61.5 (58.5)	74.0–76.2	
		Nighttime	53.0–61.1 (58.3)	68.5–81.2	
LT2: On solar project site, approximately 100 feet south of 28751 W. Vista Grande Drive	3/30/2022 to 3/31/2022	Daytime	52.7–59.6 (56.1)	63.9–77.7	57.6
		Evening	49.5–51.5 (50.5)	61.6–71.4	
		Nighttime	48.5–51.4 (49.8)	57.7–62.1	
LT3: On vacant land, approximately 100 feet east of 28541 W. Vista Grande Court	3/30/2022 to 3/31/2022	Daytime	47.1–56.2 (53.0)	69.9–76.3	56.6
		Evening	48.5–50.4 (49.3)	57.0–73.3	
		Nighttime	47.1–52.3 (49.7)	60.5–67.6	
LT4: Near southwest corner of Oasis West RV Park at 28485 Gonzaga Road	3/30/2022 to 3/31/2022	Daytime	48.3–54.0 (52.1)	57.9–74.0	57.9
		Evening	51.3–52.9 (52.2)	59.4–72.5	
		Nighttime	48.8–54.1 (51.4)	59.6–66.5	
LT5: On south portion of solar project site (37.038335°N, -120.988913°E)	3/30/2022 to 3/31/2022	Daytime	42.6–56.8 (53.2)	52.8–78.0	54.6
		Evening	41.9–47.9 (45.2)	51.3–61.8	
		Nighttime	42.7–49.7 (47.1)	52.7–63.7	
LT6: On east portion of solar project site (37.042291°N, -120.965131°E)	3/30/2022 to 3/31/2022	Daytime	56.3–68.0 (64.0)	75.1–90.3	63.6
		Evening	47.4–57.6 (54.3)	66.7–73.5	
		Nighttime	47.6–57.2 (53.9)	63.0–75.6	
ST1:	3/31/2022	11:15 a.m.	44.1	58.4	NM
ST2:	3/31/2022	10:42 a.m.	57.1	64.6	NM
ST3:	3/31/2022	9:23 a.m.	39.8	52.8	NM
ST4:	3/31/2022	10:06 a.m.	44.6	59.1	NM

Daytime = 7:00 a.m. to 7:00 p.m. Evening = 7:00 p.m. to 10:00 p.m. Nighttime = 10:00 p.m. to 7:00 a.m.

Chapter 5
Regulatory Framework

5.1 Federal

No *federal* laws, regulations, or policies for construction-related noise and vibration apply to the proposed project.

5.2 State

California Public Utilities Commission General Order 131-D

The PG&E substation is under the jurisdiction of the California Public Utilities Commission (CPUC). CPUC General Order 131-D clarifies that "local jurisdictions acting pursuant to local authority are preempted from regulating electric power line projects, distribution lines, substations, or electric facilities constructed by public utilities subject to the [CPUC]'s jurisdiction. However, in locating such projects, the public utilities shall consult with local agencies regarding land use matters…" As a result, the PG&E substation improvements (but not the proposed solar project) would be exempt from local land use and zoning regulations, including noise ordinances and standards.

California Governor's Office of Planning and Research

The *State of California General Plan Guidelines,* published and updated by the Governor's Office of Planning and Research, provides guidelines for evaluating the compatibility of various land uses as a function of community noise exposure. These are guidelines for general land use planning that describe noise acceptability categories for different types of land uses. California also requires each local government entity to perform noise studies and implement a noise element as part of its general plan. The purpose of the noise element is to limit the exposure of the community to excessive noise levels; the noise element must be used to guide decisions concerning land use. A discussion of relevant noise-related policies in the *2030 Merced County General Plan* (County of Merced 2013) is provided below. (Note that the solar project site is within the jurisdiction of Merced County, whereas the PG&E substation is within the jurisdiction of the CPUC.)

California Department of Transportation

There are no state vibration standards that apply directly to the proposed project. As noted below, there are also no quantitative local standards that can be used to assess project-related vibration. However, the California Department of Transportation (Caltrans) has published guidance that provides ground-borne vibration criteria that are useful in establishing thresholds for the evaluation of vibration effects. Specifically, Caltrans' widely referenced *Transportation and Construction Vibration Guidance Manual* (Caltrans 2020) provides guidance for two types of potential effects: (1) damage to structures and (2) annoyance to people. Guideline criteria for each are provided in Tables 5-1 and 5-2. Although the proposed project would not be subject to Caltrans oversight, these criteria are used for purposes of this analysis, in the absence of other applicable regulatory requirements.

Table 5-1. Caltrans Guideline Vibration Damage Criteria

Structure and Condition	Maximum Peak Particle Velocity (PPV) (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: Caltrans. 2020.
Notes:
Transient sources create a single, isolated vibration event, such as blasting or the use of drop balls.
Continuous/frequent intermittent sources include pile drivers (impact and vibratory), crack-and-seat equipment, and vibratory compaction equipment.

Table 5-2. Caltrans Guideline Vibration Annoyance Criteria

Human Response	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

Source: Caltrans. 2020.
Notes:
Transient sources create a single, isolated vibration event, such as blasting or the use of drop balls.
Continuous/frequent intermittent sources include pile drivers (impact and vibratory), crack-and-seat equipment, and vibratory compaction equipment.

5.3 Local

The proposed solar project would be subject to local noise regulations provided by the Merced County Noise Ordinance and the Merced County General Plan. As noted above, the PG&E substation improvements are under the sole jurisdiction of the CPUC and would be exempt from local regulations. Nevertheless, because the CPUC does not provide any specific noise regulations, the local noise regulations are used to develop thresholds for the purposes of identifying project-related noise and vibration effects for both the solar project and the PG&E substation improvements.

Merced County Noise Ordinance

Chapter 10.60, Noise Control, of the Merced County Code (MCC) establishes sound level limits for any property within the unincorporated area of the county. Specifically, Section 10.60.030, Sound Level Limitations, of the MCC outlines the sound level limits in the county. The relevant portions of this section of the MCC are cited below.

A. No person shall cause, suffer, allow, or permit the operation of any sound source on private property in such a manner as to create a sound level that results in any of the following, when measured at or within the real property line of the receiving property:

   1. Exceeds the background sound level by at least ten (10) dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and by at least five (5) dBA during nighttime hours (10:00 p.m. to 7:00 a.m.). The background sound level for purposes of this section shall be determined as set forth in Section 10.60.060 (sound measurement procedures); or

   2. Sixty-five (65) dBA L_{dn} on residential real property or seventy (70) dBA L_{dn} on nonresidential real property; or

   3. Seventy-five (75) dBA L_{max} on residential real property or eighty (80) dBA L_{max} on nonresidential real property.

Because the MCC defines "ambient sound level" as the total sound pressure in the area of interest, including the noise source of interest, it is assumed that noise increases over background ambient levels should be quantified, based on the average noise level (L_{eq}) over the period of interest. Note that noise from construction activity is exempt from these limitations under MCC Section 10.60.030(B), provided that it is limited to the daytime hours between 7:00 a.m. and 6:00 p.m. and all construction equipment is properly muffled and maintained. Nighttime construction is prohibited between 6:00 p.m. and 7:00 a.m., except for emergency work or when the sound level does not exceed any applicable relative or absolute limits specified above.

It is noted that much of the information described above is reiterated as part of Merced County's Zoning Code in Chapter 18.40, *Performance Standards*, of the MCC.

Merced County General Plan

The *Merced County General Plan* Health and Safety Element (County of Merced 2013) contains policies and guidelines that pertain to noise in the county. In addition, noise level standards are included in the general plan to quantify noise effects in the county. Table 5-3 shows the noise level standards for noise-sensitive areas affected by traffic, railroad, and airport noise in the county.

Table 5-4 shows the interior and exterior noise level standards for noise-sensitive areas affected by existing non-transportation noise sources in the County. In addition to these standards, the policies in this section address ways to reduce or eliminate existing and future conflicts between land uses and noise.

Table 5-3. Merced County Noise Standards for New Uses Affected by Traffic, Railroad, and Airport Noise

New Land Use	Sensitive[1] Outdoor Area – L_{dn}	Sensitive Interior[2] Area – L_{dn}	Applicable Notes
All residential	65	45	3
Transient lodging	65	45	3,4
Hospitals and nursing homes	65	45	3, 4, 5
Theaters and auditoriums	—	35	4
Churches, meeting halls,	65	40	4
schools, libraries, etc.	65	40	4
Office buildings	65	45	4
Commercial buildings	—	50	4
Playgrounds, parks, etc.	70	—	—
Industry	65	50	4

Source: Merced County 2013

Notes:

1. "Sensitive Outdoor Area" includes primary outdoor activity areas associated with any given land use at which noise sensitivity exists as well as locations where a county's exterior noise level standards are applied.
2. "Sensitive Interior Area" includes any interior area associated with any given land use at which noise sensitivity exists as well as locations where a county's interior noise level standards are applied. Examples of sensitive interior spaces include, but are not limited to, all habitable rooms of residential and transient lodging facilities, hospital rooms, classrooms, library interiors, offices, worship spaces, and theaters. Interior noise level standards are applied within the noise-sensitive areas of the various land uses with windows and doors in the closed position.
3. Railroad warning horn usage shall not be included in the computation of L_{dn}.
4. Only the interior noise level standard shall apply if there are no sensitive exterior spaces proposed for these uses.
5. Because hospitals are often noise-generating uses, the exterior noise level standards are applicable only to clearly identified areas designated for outdoor relaxation by either hospital personnel or patients.

Table 5-4. Non-Transportation Noise Standards Median (L_{50}) /Maximum (L_{max})[1]

Outdoor Area[2]			Interior[3]	
Receiving Land Use	**Daytime**	**Nighttime**	**Day or Night**	**Applicable Notes**
All residential	55/75	50/70	35/55	—7
Transient lodging	55/75	—	35/55	4, 7
Hospitals and nursing homes	55/75	—	35/55	5, 6, 7
Theaters and auditoriums	—	—	30/50	6, 7
Churches, meeting halls, schools, libraries, etc.	55/75	—	35/60	6, 7
Office buildings	60/75	—	45/65	6, 7
Commercial buildings	55/75	—	45/65	6, 7
Playgrounds, parks, etc.	65/75	—	—	6, 7
Industry	60/80	—	50 /70	6, 7

Source: Merced County 2013

Notes:

1. These standards shall be reduced by 5 dB for sounds consisting primarily of speech or music as well as recurring impulsive sounds. If the existing ambient noise level exceeds the standards in this table, then the noise level standards shall be increased at 5 dB increments to encompass the ambient.
2. "Sensitive Outdoor Area" includes primary outdoor activity areas associated with any given land use at which noise sensitivity exists as well as locations where a county's exterior noise level standards are applied.
3. "Sensitive Interior Area" includes any interior area associated with any given land use at which noise sensitivity exists as well as locations where a county's interior noise level standards are applied. Examples of sensitive interior spaces include, but are not limited to, all habitable rooms of residential and transient lodging facilities, hospital rooms, classrooms, library interiors, offices, worship spaces, and theaters. Interior noise level standards are applied within noise-sensitive areas of the various land uses with windows and doors in the closed positions.
4. Outdoor activity areas of transient lodging facilities are not commonly used during nighttime hours.
5. Because hospitals are often noise-generating uses, the exterior noise level standards are applicable only to clearly identified areas designated for outdoor relaxation by either hospital personnel or patients.
6. The outdoor activity areas (if any) of these uses are not typically used during nighttime hours.
7. Where median (L_{50}) noise level data are not available for a particular noise source, average (L_{eq}) values may be substituted for the standards of this table, provided the noise source operates for at least 30 minutes. If the source operates less than 30 minutes, the maximum noise level standards shown shall apply.

The following policies from the *Merced County General Plan* pertain to the solar project:

- **Policy HS-7.1: Noise Standards for New Land Uses:** Require new development projects to meet the standards shown in Tables HS-1 and HS2 [Tables 5-3 and 5-4 in this document], at the property line of the proposed use, through either project design or other noise mitigation techniques.
- **Policy HS-7.4: New Noise or Ground-borne Vibration Generating Uses:** Require new commercial and industrial uses to minimize encroachment on incompatible noise or ground-borne vibration sensitive land uses. Also consider the potential for encroachment by residential and other noise or ground-borne vibration sensitive land uses on adjacent lands that could significantly impact the viability of the commercial or industrial areas.
- **Policy HS-7.5: Noise-Generating Activities:** Limit noise generating activities, such as construction, to hours of normal business operation
- **Policy HS-7.7: Noise- or Vibration-Impacted Residential Area Monitoring:** Consider any existing residential area "noise or vibration impacted" if the exposure to exterior noise exceeds the standards shown in Table HS-2 [Table 5-4 in this document] or if ground-borne

vibration levels exceed 70 VdB. Identify and evaluate potential noise- or ground-borne-vibration-impacted areas and identify possible means to correct the identified noise/land use incompatibilities.

- **Policy HS-7.12: New Project Noise Mitigation Requirements:** Require new projects to include appropriate noise mitigation measures to reduce noise levels in compliance with the Table HS-2 [Table 5-4 in this document] standards within sensitive areas. If a project includes the creation of new non-transportation noise sources, require the noise generation of those sources to be mitigated so they do not exceed the interior and exterior noise level standards of Table HS-2 at existing noise-sensitive areas in the project vicinity. However, if a noise-generating use is proposed adjacent to lands zoned for residential uses, then the noise generating use shall be responsible for mitigating its noise generation to a state of compliance with the standards shown in Table HS-2 at the property line of the generating use in anticipation of the future residential development.

The Villages of Laguna San Luis Community Plan

The solar project site includes approximately 1,180 acres of land designated as Urban Community under the Villages of Laguna San Luis Community Plan (County of Merced 2008). The Community Plan contains various objectives, policies, and implementation measures related to noise. These are primarily concerned with land use planning to ensure new noise-sensitive land uses are adequately protected from current or projected noise levels. The following policies from the Villages of Laguna San Luis Community Plan may be relevant to noise from the proposed project:

- **Land Use Plan, Policy 4.A.1:** Reduce visual and noise impacts of commercial and industrial uses on adjacent residential properties and neighborhoods by incorporating grading, landscaping, and other design treatments to screen parking, refuse storage, utility and other activity areas.
- **Land Use Plan, Policy 4.A.6:** Avoid incompatibility conflicts between the major PG&E substation and adjacent land uses.
- **Land Use Plan, Policy 4.E.1:** Residential and other noise sensitive land uses shall not be located in areas exposed to current or projected noise levels that exceed 65 dBA L_{dn}, or other community noise standards established in the General Plan Noise Chapter.
- **Land Use Plan, Policy 4.E.2:** Measures to buffer or screen noise sources are designed in an efficient and visually responsible manner.
- **Community Design Plan, Policy 1.D.3:** To the extent feasible, utilize vegetation and earth forms rather than sound walls along collector and arterial roadways to buffer residential land uses from the effects of traffic and for noise attenuation.
- **Community Design Plan, Policy 1.H.1:** Measures to promote the use of landscaping in developments which reduces heat, glare, and noise, aids in the percolation of stormwater; improves air quality; and buffers potentially incompatible land uses from one another.
- **Community Design Plan, Policy 4.A.1:** Landscaped earthen berms, or combinations of berms, vegetation, and walls rather than walls alone shall be used to mitigate roadway noise impacts such that residential development is not exposed to exterior noise levels that exceed 65 dBA L_{dn}. And interior noise levels that exceed 45 dBA L_{dn}. Noise walls, especially in residential areas, should not exceed 7 feet in height, but wall/berm combinations will be permitted within the Villages Specific Urban Development Plan that exceed 7 feet height (maximum 7 feet for the wall).
- **Community Design Plan, Policy 4.A.2:** Where feasible locate non-residential land uses in noise impacted areas to reduce the need for sound walls and other noise reduction measures.

Chapter 6
Effects and Recommended Mitigation Measures

6.1 Methodology

6.1.1 Analyzed Receiver Locations

As noted previously, sensitive receptors in the project area consist of residential dwellings in various directions from the project site. Given the size of the project site and the large range of distances to the surrounding receptors, project noise and vibration levels were not calculated for every individual dwelling. Rather, noise was analyzed using a subset of six receivers that represent the closest receptors in each direction from the project site, as illustrated in Figures 3a through 3d. Aside from being chosen for the purpose of depicting the potential worst-case noise and vibration levels that would be experienced, these analyzed receivers account for the range of ambient noise levels measured in the project vicinity, which is critical to determining noise effects relative to existing noise levels. Receiver R1 represents the closest home to the proposed PG&E substation improvements and is used specifically to assess effects from that element of the project. All other receivers (i.e., R2 through R6) are evaluated to assess effects from the solar project. The receivers and the corresponding noise measurements used to establish baseline noise measurements are summarized in Table 6-1.

Table 6-1. Analyzed Receiver Locations and Corresponding Baseline Noise Measurements

Receiver Number	Location	Corresponding Baseline Noise Measurement Location
R1	28971 W. Vista Grande Drive, east of substation expansion	LT2
R2	28807 W. Vista Grande Drive, northwest of project site	LT2
R3	28541 W. Vista Grande Court, northwest of project site	LT3
R4	Oasis West RV Park, northwest of solar project site	LT4
R5	Home at 17535 Billy Wright Road, south of solar project site	LT5
R6	17001 Billy Wright Road, southwest of solar project site	LT6

6.1.2 Construction Noise and Vibration

A combination of existing literature and industry-accepted or standard noise and vibration prediction and propagation algorithms was used to predict short-term construction and long-term operational noise levels and evaluate ground-borne vibration effects. The evaluation of potential noise and vibration effects associated with project construction was based on the construction schedule, phasing, and equipment assumptions provided by the project applicant.

Using the construction assumptions derived for the proposed project, noise and vibration levels were estimated using the methods described below.

Construction Noise

Construction-related noise was analyzed using data and modeling methodologies from the Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM) (FHWA 2008), which predicts average noise levels at nearby receptors by analyzing the type of equipment, the distance from source to receptor, usage factor (i.e., the fraction of time the equipment is operating in its noisiest mode), and the presence or absence of intervening shielding between source and receptor. This methodology calculates the composite average noise levels for the multiple pieces of equipment scheduled for use during each construction phase of the proposed project. Construction noise levels were predicted by assuming an average noise attenuation rate of 6 dB per doubling of distance from the source. The average hourly construction noise level (i.e., hourly L_{eq}) generated during each phase of construction was calculated at a reference distance of 50 feet. The reference noise levels were then adjusted for the analyzed receivers, based on the distance between the receivers and each construction activity. Details of the construction equipment and phasing considered for the proposed project, including the solar project site and the PG&E substation improvements, are provided in Section 6.3 of this report.

The source-to-receiver distances used to estimate the project's construction noise levels at each analyzed receiver considered either the closest distance to the residential dwelling or, to reflect the assumed distribution of equipment across the active construction area, the acoustical average distance between the construction area and the dwelling.[5] Most construction would take place during daytime hours, as defined in the MCC. However, some limited work may take place between 6:00 p.m. and 8:00 p.m. In order to provide a conservative estimate, the closest distance between activities and receivers was used for the analysis of evening construction noise effects, as opposed to the acoustical average distance.

To provide a quantitative estimate of construction noise levels at analyzed receivers, it was necessary to assign construction activities to a defined work area and estimate acoustical average distances between construction activities and receivers. The smaller the assumed work area, the more conservative the analysis because it implies construction equipment will be more tightly concentrated, leading to higher noise levels at the nearest receptors. Based on the total project site area (1,741 acres) and the anticipated duration of construction (14 months), the average amount of daily construction acreage would be approximately 5.7 acres.[6] To provide a slightly more conservative assumption, daytime construction activities were assumed to occur at the solar project site on a given day for a given activity within an approximately 4-acre area near each receiver. It should be noted that the use of a 4-acre daily construction area is meant to serve as a reasonable estimate, thereby allowing for a quantitative assessment. It is not intended to place any restrictions on the actual daily acreage where construction activities may occur at the solar project site.

Given the nature of construction activities, the size of the active construction area would fluctuate on a daily basis, depending on the types of activities and equipment involved. The actual construction area may be more than 4 acres or less. However, although multiple construction phases at different locations within the solar project site may occur concurrently on a given construction

[5] The acoustical average distance is used to represent noise sources that are mobile or distributed over an area (such as the analyzed construction area); it is calculated by multiplying the shortest distance between the receiver and the noise source area by the farthest distance and then taking the square root of the product.

[6] 14 months ≈ 426 days total, or 304 workdays (assume 5 days per week). 1,741 acres/304 days = 5.7 acres/day.

day, the localized nature of noise is such that noise levels generated over a construction area near a given receiver would dominate the noise environment compared with noise levels generated at a more distant location. Therefore, estimated noise levels from the nearest 4-acre construction area at a given receiver, especially during the loudest construction phases of the proposed project, would be representative of the noise exposure at that receiver during project construction.

The distance from the nearest receiver to the closest edge of the 4-acre daily construction area was measured, as was the distance from the nearest receiver to the farthest edge of the approximately 4-acre daily construction area. The acoustical average distance was then calculated from these two values.

For construction of the PG&E substation improvements, construction equipment was assumed to be distributed across the substation property within the adjusted fence line. The calculation of the acoustical average distance was based on the nearest and farthest boundaries of the substation improvement area.

During project construction, noise levels would also be generated by construction-related traffic associated with workers' trips and haul trucks on local roadways. The analysis of roadway noise levels from project construction traffic was conducted with use of a proprietary traffic noise model; calculations were based on data from the FHWA Traffic Noise Model (FHWA 2004). This model allows for the calculation of noise levels at specific distances from the center of a roadway, based on traffic volumes, average speeds, and site environmental conditions. Using this model, roadway noise levels resulting from project construction were estimated and compared to the existing (i.e., without project construction) modeled traffic noise levels as well as measured ambient noise levels. Construction-related traffic data were obtained from project's traffic impact analysis (KD Anderson & Associates, Inc. 2022).

Construction Vibration

Construction-related vibration resulting from the proposed project was analyzed using data and modeling methodologies provided by Caltrans' *Transportation and Construction Vibration Guidance Manual* (Caltrans 2020). This guidance manual provides typical vibration source levels for various types of construction equipment as well as methods for estimating the propagation of ground-borne vibration over distance. Table 6-2 provides PPV levels for a representative subset of the construction equipment expected to be used for the proposed project; the levels are provided at a reference distance of 25 feet. All of the analyzed equipment is classified as continuous/frequent intermittent vibration sources. The solar panels are assumed to be installed with the use of a post driver (essentially, a small pile driver). The PPV level for this equipment was calculated using methods provided in Caltrans' guidance manual (Caltrans 2020), as presented in Table 6-2.

The following equation from the guidance manual was used to estimate the change in PPV levels over distance:

$$PPV_{rec} = PPV_{ref} \times (25/D)^{n}$$

where PPV_{rec} is the PPV at a receptor; PPV_{ref} is the reference PPV at 25 feet from the equipment; D is the distance from the equipment to the receptor, in feet; and n is a value related to the vibration attenuation rate through ground (the default recommended value for n is 1.1). This equation was used to estimate the PPV at each of the closest vibration-sensitive receptors, based on the worst-case (closest) distance between each source and receptor.

Table 6-2. Construction Equipment Vibration Levels

Equipment Item	Reference PPV at 25 feet, in/sec[1]
Vibratory roller	0.210
Post driver[2]	0.161
Auger drill	0.089
Large bulldozer[3]	0.089
Loaded trucks (on rough terrain)	0.076
Small bulldozer[4]	0.003

Source: Caltrans 2020, except as noted

1. Obtained from Caltrans 2020.
2. Ambient Air Quality & Noise Consulting 2015. Calculation based on a reference PPV level of 0.65 in/sec for a 36,000-foot-pound pile driver and a maximum energy level of 2,200 foot-pounds for post drivers.
3. Considered representative of other heavy earthmoving equipment such as excavators, graders, backhoes, etc.
4. Considered representative of smaller equipment such as small skid steers and mini excavators.

6.1.3 Operational Noise

The primary operational noise sources associated with the solar project would be the BESS, electrical inverters and/or converters, and solar project substation. The solar project substation would have the same general configuration and location regardless of whether the AC Option or DC Option is selected. However, equipment specifications and the locations for the BESS, inverters, and converters would be different under each option. Under either option, the solar project would use single-axis tracker technology to tilt the PV panels and follow the course of the sun, thereby optimizing the incident angle of sunlight on the surface of the panels. Intermittent noise from operation of the electrical motors used to power the trackers would be negligible. The noise levels would be very low, occurring only periodically for brief durations throughout the day. Nonetheless, noise from tracker motors is included in the analysis.

To evaluate the noise levels that would be generated by the aforementioned noise sources, acoustical data (i.e., source noise levels) were derived from various sources, including manufacturers' specification sheets, previous noise assessments prepared for similar projects, and equipment information provided by the solar project applicant. Table 6-3 summarizes the solar project equipment considered in the operational noise analysis as well as the associated reference noise level at a reference distance of 50 feet. Detailed plans and specifications for the PG&E substation improvements have not yet been developed. Because the solar substation would include a dedicated substation with a large step-up transformer and an air-conditioned control house, it was assumed that operational noise from the PG&E substation improvements would be no greater than the operational noise from the solar project substation. To provide a conservative analysis, the PG&E substation improvements were evaluated assuming they would produce the same noise level as the solar project substation. (i.e., the combined noise level from the main step-up transformer and the substation control house HVAC.)

To analyze noise from on-site operations, modeling was conducted to estimate noise from individual pieces of equipment and combined equipment, as appropriate, based on the estimated locations for the equipment provided by the project applicant. Given the nature of the project, with both direct PV electrical generation and battery storage, which, presumably, could be accessed at any time, this analysis assumes that all equipment could be operational and generating noise up to 24 hours a day.

Table 6-3. Solar Project Equipment Noise Levels

Equipment	Proposed for AC or DC Option?	dBA L_{eq} Noise Level at 50 feet
AC option BESS enclosure (Tesla Megapack with integrated inverter)	AC	63.3
DC option BESS enclosure, with four HVAC units per BESS enclosure (Model: Envicool MC90HDNC1A)	DC	61.3
Solar PV inverter (Model: Power Electronics PE FS4200MU CE)	AC and DC	61.8
Substation main step-up transformer, daytime (data provided by project applicant)	AC and DC	80.4
Substation main step-up transformer, nighttime (data provided by project applicant)	AC and DC	69.4
Substation control house HVAC, with two HVAC units (Model: Bard W30AB-A10XPXXXJ)	AC and DC	56.9
DC-DC converters (Model: FreeMaq DC/DC Bi-Directional Converter. Model: FD0525)	DC	58.9
Single-axis tracker motor	AC and DC	46.0

HVAC = heating, ventilating, and air-conditioning; PV = photovoltaic; AC = alternating current; DC = direct current
Refer to Appendix D for source noise levels and calculation output files.

In addition to the aforementioned equipment, corona discharge noise emanating from the gen-tie lines may be audible at close range. This noise source is analyzed with use of data from prior noise studies for similar solar projects. Occasional noise would also be generated by periodic maintenance activities, such as panel washing. An analysis of these sources is also included in the operational noise assessment for the project.

The solar project could include one 25- to 50-kW diesel emergency generator. While generator noise during an emergency is exempt from county noise regulations, noise from generator testing is not. Accordingly, estimated noise levels from an example generator similar in size to the solar project generator are compared to allowable noise levels in the county to assess noise effects from emergency generator testing.

The analysis of traffic noise in the project area was conducted with the use of data from the project's traffic impact analysis (KD Anderson & Associates, Inc. 2022) and a proprietary traffic noise model; calculations were based on data from the FHWA Traffic Noise Model (FHWA 2004). This model allows for the calculation of noise levels at specific distances from the center of a roadway, based on traffic volumes, average speeds, and site environmental conditions. Using this model, roadway noise levels resulting from project operation were estimated and compared to the modeled existing traffic noise levels as well as measured ambient noise levels.

6.2 Thresholds of Significance

Appendix G of the CEQA Guidelines is used to inform the thresholds of significance and the effect evaluation contained in this report. The proposed project is evaluated to determine if it would result in any of the conditions listed below.

a) Generate 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) Generate excessive ground-borne vibration or ground-borne 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 2 miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels.

With respect to threshold (c), the project site is not within 2 miles of a public airport or public use airport. The nearest public use airport to the project site is Los Banos Municipal Airport, approximately 5 miles east of the project site. In addition, there are no private airstrips in the project vicinity. As such, the proposed project would not expose people working in the project area to excessive noise levels from either a public airport or public use airport. This criterion does not apply, and no further discussion of this topic is included in this report.

6.2.1 Short-Term Construction Noise Criteria

Merced County regulates construction noise levels per the requirements of Chapter 10.60, Noise Control, of the MCC. The noise ordinance contained in the MCC establishes acceptable hours for construction and limitations on construction-related noise at adjacent sensitive uses outside the set daytime exempt hours. In addition to regulating allowable noise increases, the MCC provides quantitative criteria in terms of both L_{dn} and L_{max}. L_{dn} is a measure of the 24-hour noise level, while L_{max} is a measure of the short-term maximum noise level. Because construction would not occur 24 hours a day, the L_{max} criterion is most appropriate for assessing potential construction noise impacts. Noise from construction activity is exempt from the MCC's quantitative noise limitation during weekday hours between 7:00 a.m. and 6:00 p.m., provided all construction equipment is properly maintained. Construction noise is evaluated to estimate combined noise levels at the nearest noise-sensitive land uses during daytime hours, noting the temporary construction noise exemption described above for daytime weekday hours. Construction activities that take place between 6:00 p.m. to 8:00 p.m. (noting no construction is proposed for after 8:00 p.m.) are evaluated, because they are outside of the daytime exempt hours, to determine if compliance with the overall noise standards contained in the MCC would occur Increases beyond these standards could result in a substantial temporary increase in ambient noise levels.

The MCC does not regulate construction traffic on public streets and freeways specifically. However, the Merced County General Plan Health and Safety Element provides traffic noise standards, which are assessed in terms of L_{dn} to account for the 24-hour nature of traffic. The general plan's criterion for residential uses is 65 dB L_{dn}; however, the general plan does not quantify a permissible noise increase. Guidance regarding acceptable noise increases is provided by the MCC (refer to Merced County Noise Ordinance in Section 5.3 of this report), which indicates noise increases should be limited to less than 10 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and 5 dBA during nighttime hours (10:00 p.m. to 7:00 a.m.) Because construction traffic would occur during daytime hours, a 10 dB increase in traffic noise is used as a threshold for consistency with the MCC.

Because of the aforementioned factors, a significant effect would occur if:

- Construction noise exceeds the average background sound level by at least 10 dBA at any noise-sensitive receptor (i.e., residence) during the non-exempt hours of 6:00 p.m. to 8:00 p.m.; or
- Construction noise exceeds 75 dBA L_{max} at any residential real property during the non-exempt weekday daytime hours of 6:00 p.m. to 8:00 p.m.
- Construction traffic generates noise in excess of 65 dB L_{dn} at any noise-sensitive receptor (i.e., residence); or
- Construction traffic exceeds existing traffic noise levels by at least 10 dB L_{dn} at any noise-sensitive receptor (i.e., residence).

The average daytime and nighttime ambient noise levels described in Chapter 4, *Existing Noise Environment*, were used to quantify potential construction noise exceedances over background sound levels. Construction noise was compared to the average noise level for the relevant corresponding time period. Construction traffic noise levels were compared to calculated existing traffic noise levels.

6.2.2 Long-Term Operational Noise Criteria

As discussed previously, stationary-source noise standards in Merced County are defined in MCC Chapter 10.60. Specifically, noise shall not exceed:

- 65 dBA L_{dn} on residential real property or 70 dBA L_{dn} on nonresidential real property; or
- 75 dBA L_{max} on residential real property or 80 dBA L_{max} on nonresidential real property; or
- The background sound level by 10 dBA or more during daytime hours (7:00 a.m. to 10:00 p.m.) and 5 dBA or more during nighttime hours (10:00 p.m. to 7:00 a.m.).

To determine if stationary sources of noise associated with the project would result in significant effects, modeled noise levels for project equipment were compared to the 65 dBA L_{dn}, 75 dBA L_{max}, and 10 dBA standards from the County Code, as defined above. The lowest hourly ambient noise levels described in Chapter 4, *Existing Noise Environment*, were used to quantify potential operational noise exceedances over background levels. Operational noise was compared to the average noise level for the relevant corresponding time period.

6.2.3 Ground-borne Vibration Criteria

Although there are currently no comprehensive local regulatory standards for ground-borne vibration that are applicable to the proposed project, the previously cited Caltrans vibration criteria included in the *Transportation and Construction Vibration Guidance Manual* are routinely used to evaluate a variety of projects (not merely transit projects) proposed by local jurisdictions. That guidance is used in this analysis.

Noise-1: Would the project generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in a local general plan or noise ordinance or applicable standards of other agencies?

Construction Noise

Weekday Daytime Construction Noise

Construction of the project is anticipated to begin in mid-2024 and take approximately 14 months. Portions of the project site would be graded to provide a level foundation for roads and project components. In addition, vegetation would be cleared from the area beneath the arrays, as necessary. Access roads would be constructed around and between the arrays. These may include crushed aggregate to prevent damage to the soil. The arrays would sit on piles that would raise them above the surface to avoid the need for additional landscaping work. Solar project construction would disturb a total of approximately 1,283 acres.

Following site grading and preparation, steel piles would be driven into the ground, and the solar PV tables, trackers, and panels would be installed on top of them. Trenches would be dug on-site to bury the underground collection cables that would conduct the energy output from the panels to the solar inverters, storage inverters or converters, the BESS, and ultimately the solar project substation. Remaining construction activities would include installing the solar inverters and storage inverters or converters on-site, installing the BESS, constructing the solar project substation, constructing the high-voltage gen-tie line between the solar project's substation and the project's point of interconnection, and constructing the PG&E substation improvements. After construction, the project is expected to operate for 35 years.

During the construction period for the project, temporary increases in noise levels in the vicinity would occur from the operation of various pieces of construction equipment. Given the size of the solar project site (approximately 1,741 acres), construction activities would not occur across the entire site at once but instead would occur on small portions of the site on any given day. Construction activities would occur for a relatively short period of time at a given location (e.g., a few days or weeks), then move to a new location. Therefore, noise levels experienced over the project construction period would fluctuate at individual receptors, depending on the type of construction activity and the proximity of that activity to the receptor in question. The noise levels generated by individual pieces of construction equipment planned for use with project construction activities are shown in Table 6-4.

In order to estimate combined construction noise levels for individual construction phases or activities, the composite hourly average noise levels for the multiple pieces of equipment proposed for concurrent use were first calculated at a reference distance of 50 feet. The details of these calculations, including a detailed list of equipment proposed for each project construction phase, are provided in Appendix B. The estimated composite hourly average noise levels for each construction phase at 50 feet are summarized in Table 6-5; as shown in the table, the average hourly noise levels for the proposed project's construction activities would range from approximately 76 to 92 dBA L_{eq} at a reference distance of 50 feet.

Table 6-4. Construction Activities and Equipment Noise Levels

	Individual Equipment Noise Levels (dBA) at 50 Feet	
Equipment	**L_{eq}[1]**	**L_{max}**
Air compressor	73.7	77.7
Boom truck	70.3	74.3
Backhoe	73.6	77.6
Drill seeder	72.1	79.1
Excavator	76.7	80.7
Generator	77.6	80.6
Grader	81.0	85.0
Light plants	69.8	72.8
Loader	75.1	79.1
Mower	80.0	84.0
Pickup truck	71.0	75.0
Roller	73.0	80.0
Rough terrain forklift	75.1	79.1
Scraper	79.6	83.6
Skid-steer loader	75.1	79.1
Crane	72.6	80.6
Post driver[2]	81.0	88.0
Tractor	80.0	84.0
Trencher	77.4	80.4
Vendor trucks	70.3	74.3
Water truck	72.5	76.5

Source: Federal Highway Administration. 2006. *FHWA Roadway Construction Noise Model User's Guide*. FHWA-HEP-05-054. January. Available: https://www.fhwa.dot.gov/ENVIRonment/noise/construction_noise/rcnm/rcnm.pdf. Accessed: May 18, 2021, except as noted.

1. Based on standard estimated utilization rates from FHWA.
2. Ambient Air Quality & Noise Consulting 2015.

Table 6-5. Composite Noise Levels for Each Construction Phase at 50 Feet

Construction Phase	Average Composite Hourly Noise Level (L_{eq}) at 50 feet, dBA
Site Preparation	88.3
Underground Work	89.9
PV System Installation	92.4
Battery Storage System Installation	81.1
Substation and Gen-Tie Line Installation	85.3
Testing and Commissioning	75.8
Solar Project Site Restoration	86.1
PG&E Substation Improvements, Site Preparation	88.3
PG&E Substation Improvements, Underground Work	89.9
PG&E Substation Improvements, Substation and Gen-Tie Line Installation	85.3
PG&E Substation Improvements, Testing and Commissioning	75.8
PG&E Substation Site Restoration	86.1

PV = photovoltaic
Source: Construction assumptions were provided by EDPR. See Appendix B for modeling data.
Modeling conducted using data from the Federal Highway Administration. 2006. *FHWA Roadway Construction Noise Model User's Guide*. FHWA-HEP-05-054. January. Available: https://www.fhwa.dot.gov/ENVIRonment/noise/construction_noise/rcnm/rcnm.pdf. Accessed: May 18, 2021.

To identify worst-case noise levels, potential construction-related noise was assessed at the nearest off-site receivers, which included residences to the northwest, north, southeast, and south. Although not all sensitive receptors in the project vicinity were analyzed for their individual construction noise exposure, the noise levels at the receptors not specifically analyzed would be no worse than those predicted at the analyzed receiver locations because they are further away from project construction activities. Noise from project site construction is assessed at receivers R2 through R6 for all phases of construction.

Construction of the PG&E substation improvements would overlap with the solar project's Underground Work, PV System Installation, Battery Storage System Installation, Substation and Gen-Tie Line Installation, Testing and Commissioning, and Project Site Restoration phases, and would take approximately eight months to complete. Because a detailed construction schedule for the PG&E substation improvements has not yet been developed, reasonable assumptions were applied for the purpose of this analysis. Many of the same general construction tasks would be necessary at the PG&E substation site as at the solar site, including Site Preparation, Underground Work, Substation Equipment Installation, and Testing and Commissioning, and Site Restoration at the end of construction. Other construction activities proposed at the solar project site, such as the installation of PV and battery storage systems, would not occur at the PG&E substation improvements site. Because the PG&E substation site is much smaller than the solar project site, it is anticipated that construction noise from the PG&E substation improvements would be no greater than the noise levels for similar activities at the solar site. As a result, the following construction phases for the solar project were used as proxies to estimate the noise levels associated with the PG&E substation improvements: Site Preparation, Underground Work, Substation and Gen-Tie Line

Installation, Testing and Commissioning, and Project Site Restoration. That is, the general activities within these same phases were assumed to occur at the PG&E substation. Noise levels from the construction of the PG&E substation improvements were assessed only at receiver R1, which is the closest receiver to those improvements, because noise levels at the other receivers would be lower as a result of their increased distance from the PG&E substation improvement area.

The closest construction activities to the residential neighborhood northwest of the project site would be limited to relatively brief and low-intensity activities, such as equipment mobilization and installation of the vegetative screening. It is expected that the perimeter fence would be installed approximately 25 feet north of the solar panels, which would be approximately 375 feet from the nearest residential property line. In addition, most site preparation activities (e.g., grading activities) would occur only within the footprint of the proposed solar arrays, or no closer than 400 feet from residential property lines. However, to ensure a conservative analysis, it is assumed that limited site preparation activities could occur anywhere on the site, or as close as 90 feet from the nearest residential property lines and 130 feet from the nearest residences. After site preparation is complete, construction activities would generally occur no closer than 400 feet from residential property lines or 510 feet from the nearest residences. Detailed calculations for each of the project's proposed construction phases are provided in Appendix B, and the estimated construction noise levels at the nearest sensitive receivers during each construction phase are summarized in Table 6-6.

Table 6-6. Weekday Daytime Noise Levels and Increases at Nearest Receivers for Each Construction Phase

Receiver	Construction Phase	Average Construction Noise Level (L_{eq}), dBA	Average Daytime Ambient Noise Level (L_{eq}), dBA	Increase Over Daytime Ambient (L_{eq}), dBA
R1	PG&E Substation Improvements (Site Preparation)	58.3	56.1	2.2
	PG&E Substation Improvements (Underground Work)	59.9		3.8
	PG&E Substation Improvements (Substation and Gen-Tie Line Installation)	55.3		0.0
	PG&E Substation Improvements (Testing and Commissioning)	45.8		0.0
	PG&E Substation Improvements (Project Site Restoration)	56.2		0.1
R2	Site Preparation	70.1	56.1	14.0
	Underground Work	60.1		4.0
	PV System Installation	61.1		5.0
	Battery Storage System Installation	49.9		0.0
	Substation and Gen-Tie Line Installation	49.1		0.0
	Testing and Commissioning	44.5		0.0
	Project Site Restoration	67.9		11.8

Receiver	Construction Phase	Average Construction Noise Level (L_{eq}), dBA	Average Daytime Ambient Noise Level (L_{eq}), dBA	Increase Over Daytime Ambient (L_{eq}), dBA
R3	Site Preparation	68.7	53.0	15.7
	Underground Work	61.6		8.6
	PV System Installation	64.1		11.1
	Battery Storage System Installation	52.8		0.0
	Substation and Gen-Tie Line Installation	42.7		0.0
	Testing and Commissioning	47.5		0.0
	Project Site Restoration	66.5		13.5
R4	Site Preparation	52.6	52.1	0.5
	Underground Work	52.9		0.8
	PV System Installation	55.3		3.2
	Battery Storage System Installation	44.1		0.0
	Substation and Gen-Tie Line Installation	39.9		0.0
	Testing and Commissioning	38.8		0.0
	Project Site Restoration	50.4		0.0
R5	Site Preparation	53.9	53.2	0.7
	Underground Work	54.0		0.8
	PV System Installation	56.5		3.3
	Battery Storage System Installation	45.2		0.0
	Substation and Gen-Tie Line Installation	22.9		0.0
	Testing and Commissioning	39.9		0.0
	Project Site Restoration	51.7		0.0
R6	Site Preparation	52.7	64.0	0.0
	Underground Work	52.6		0.0
	PV System Installation	55.1		0.0
	Battery Storage System Installation	43.8		0.0
	Substation and Gen-Tie Line Installation	28.7		0.0
	Testing and Commissioning	38.5		0.0
	Project Site Restoration	50.5		0.0

Source: Appendix B

As shown in Table 6-6, estimated worst-case noise levels at the nearest receiver due to construction at the PG&E substation improvements site could range from 46 to 60 dBA L_{eq} and exceed existing average daytime noise levels by 0 to 4 dBA. However, construction noise during weekday daytime hours is exempt from the limits of the MCC. Therefore, noise due to construction of the PG&E substation improvements completed during daytime exempt hours would comply with the MCC. Evening construction would not occur at the PG&E substation.

Estimated worst-case daytime noise levels at nearby receivers due to construction at the solar project site could range from 23 to 70 dBA L_{eq} and exceed existing average daytime noise levels by 0 to 16 dBA. These estimated worst-case noise levels would occur for only a relatively short period (i.e., when a given activity takes place in the areas nearest the affected receiver). For a large portion of the 14-month project construction schedule, construction activities would occur much farther from the residences, and noise levels from construction would be lower. However, construction noise during weekday daytime hours is exempt from the limits of the MCC. Therefore, although temporary construction noise increases would occur during daytime hours, construction noise would still comply with the MCC as a result of the daytime construction noise exemption.

Evening Construction Noise

Although construction activities for the proposed project would occur mostly during the weekday daytime hours of 7:00 a.m. to 6:00 p.m., during which time construction noise is considered exempt from the quantitative noise thresholds contained in the MCC, some evening construction may occur. Although evening work is not specifically proposed, if work falls behind schedule, construction activities that generate low noise levels may extend past the typical daily end time of 6:00 p.m. but no later than 8:00 p.m. on a worst-case day when evening work is required. Evening construction would not occur at the PG&E substation.

Construction-related activities that may occur during evening hours include delivery offloads, panel laying, and cable laying and termination. Up to 20 individual nights/evenings (from 6:00 p.m. to 8:00 p.m.) are estimated for each activity as a reasonable worst-case scenario, resulting in a total of up to 60 individual evenings of construction activity. Note that evening activities would not take place in proximity to the nearest off-site residences. However, to ensure a conservative assessment, this analysis assumes that evening work could occur anywhere on the solar project site.

If evening construction were to occur in the northwest portion of the solar project site, equipment could be operating as close as 400 feet from the nearest residential property line or 510 feet from the nearest residence. To estimate reasonable worst-case noise levels from short-term localized evening construction, this analysis assumes that the three loudest pieces of equipment proposed for each evening phase would be operating concurrently and close to one another in the construction area closest to each of the analyzed receivers.

The construction equipment list provided by the project applicant was used in the modeling conducted to estimate reasonable worst-case noise levels from delivery offloads, panel laying, and cable laying and termination. Refer to Table 6-7 for the noise modeling results.

As shown in Table 6-7, noise levels from evening construction activities would not exceed the 75 dBA L_{max} threshold at nearby residential properties. In addition, evening construction would not exceed existing average evening noise levels by 10 dBA or more. Therefore, noise from solar project construction activities occurring during evening hours would comply with the standards contained in the MCC. No evening construction activities would occur at the PG&E substation improvements site.

Table 6-7. Noise Levels and Increases for Evening Construction Activities

Receiver	Construction Phase	Construction Noise Levels (L_{eq}), dBA		Average Evening Ambient Noise Level (L_{eq}), dBA	Increase Over Evening Ambient (L_{eq}), dBA
		L_{max}	L_{eq}		
R2	Delivery Offloads	54.0	50.1	50.5	0.0
	Panel Laying	55.7	50.5		0.0
	Cable Laying and Termination	54.2	50.2		0.0
R3	Delivery Offloads	57.8	53.8	49.3	4.5
	Panel Laying	59.4	54.2		4.9
	Cable Laying and Termination	57.9	53.9		4.6
R4	Delivery Offloads	47.2	43.3	52.2	0.0
	Panel Laying	48.9	43.7		0.0
	Cable Laying and Termination	47.3	43.4		0.0
R5	Delivery Offloads	48.5	44.6	45.2	0.0
	Panel Laying	50.2	45.0		0.0
	Cable Laying and Termination	48.7	44.7		0.0
R6	Delivery Offloads	46.9	42.9	54.3	0.0
	Panel Laying	48.6	43.3		0.0
	Cable Laying and Termination	47.0	43.0		0.0

Source: Appendix B

Decommissioning Noise

Decommissioning and site reclamation would begin immediately after the 35-year lifespan of the solar project, expected in 2058, and would primarily occur during the daytime hours specified in the MCC (e.g., 7:00 a.m. to 6:00 p.m. weekdays). As with the solar project, although evening work is not specifically proposed, if work falls behind schedule, activities that generate low noise levels may extend past the typical daily end time of 6:00 p.m. but would occur no later than 8:00 p.m. on a worst-case day when evening work is required. Decommissioning activities that take place during the daytime weekday hours of 7:00 a.m. to 6:00 p.m. would be exempt from the quantitative noise standards contained in the MCC. Construction noise from activities that may take place outside of these daytime exempt hours is evaluated to determine if a 10 dB increase in noise or an exceedance of the 75 dBA L_{max} standard is anticipated to occur.

Decommissioning activities would not take place at the PG&E substation improvements site because decommissioning would not occur at that location.

Noise levels generated by decommissioning activities would be similar to those associated with project construction because they would use similar types of heavy construction equipment operating over the same project area. As shown in Table 6-7 for the solar project, noise levels from

evening construction and/or decommissioning activities would not exceed the 75 dBA L_{max} threshold at nearby residential properties. In addition, evening construction would not exceed existing average evening noise levels by 10 dBA or more. As a result, noise from solar project decommissioning activities occurring during evening hours would not be expected to exceed the applicable thresholds.

In summary, similar to construction noise, decommissioning noise during the daytime weekday hours of 7:00 a.m. to 6:00 p.m. would be exempt from the quantitative MCC standards, and decommissioning activities occurring between 6:00 p.m. and 8:00 p.m. would not result in noise levels in excess of applicable thresholds.

Construction Traffic Noise

The data used in the analysis of construction traffic noise comes from the project traffic impact analysis (KD Anderson & Associates, Inc. 2022). Construction traffic would include trips made by workers' vehicles and heavy trucks (e.g., haul trucks, water trucks, vendor trucks) associated with work at both the solar project site and the PG&E substation site. Two different routes would be used to access the solar project site, depending on the type of vehicle. All construction workers commuting to the solar project site would use Billy Wright Road. All heavy trucks (e.g., haul trucks, water trucks, vendor trucks) would travel to the site via San Luis Drive, except for oversized trucks, which would need to use Billy Wright Road. Workers and trucks accessing the PG&E substation would use Jasper Sears Road.

On a peak day during construction, the project could have up to 408 persons working on-site, generating 734 vehicle trips (367 round trips) in automobiles and light-duty trucks (i.e., personal pickup trucks). 720 of these trips would access the solar site via Billy Wright Road and the remaining 14 would access the PG&E substation via Jasper Sears Road. A peak day could also include 638 heavy truck trips (319 round trips), with 274 water truck trips and 364 truck trips for other construction (haul trucks, vendor trucks, etc.). 628 of these heavy truck trips would access the solar site via San Luis Drive and the remaining 10 would access the PG&E substation via Jasper Sears Road. Trips involving oversized trucks would be rare, estimated at 65 round trips over 14 months of construction, for an average of less than five per month. For the purposes of this analysis, it was assumed that two oversized trucks would use Billy Wright Road to access the site during the peak day.

To estimate traffic noise increases from workers' vehicles and heavy trucks during the project construction period, "existing" and "existing plus construction traffic" scenarios were modeled, using a spreadsheet based on the FHWA Traffic Noise Model. For traffic on highways (SR-33, SR-152, I-5), it was conservatively assumed that all the construction traffic (734 automobiles and light-duty trucks and 638 heavy trucks) could use each highway segment in a single day. For Billy Wright Road, San Luis Drive, and Jasper Sears Road the specific construction traffic distribution discussed above was applied (i.e., solar project workers' vehicles and oversized trucks on Billy Wright Road, all solar project heavy trucks on San Luis Drive, and all PG&E substation-related traffic on Jasper Sears Road). Refer to Table 6-8 for the results of construction traffic noise modeling.

Table 6-8. Modeled Construction Traffic Noise Levels in the Project Vicinity

Roadway	Segment	Distance from Roadway Centerline	Traffic Noise, dBA L_{dn}			
			Existing	Const.	Existing plus Const.	Increase Due to Const.
SR-152	SR-33 to I-5	150	75.8	60.9	76.0	0.2
SR-152	I-5 to Volta Rd	150	74.9	60.9	75.1	0.2
I-5	South of SR-152	150	78.6	60.9	78.7	0.1
SR-33	North of SR-152	150	73.3	60.9	73.5	0.2
SR-33	South of SR-152	150	73.7	60.9	73.9	0.2
Billy Wright Rd	South of SR-152	900	45.3	36.0	45.8	0.5
San Luis Dr	South of SR-152	50	49.0	60.0	60.3	11.3
Jasper Sears Dr	South of Gonzaga	50	46.3	45.9	49.1	2.8

Source: Appendix C.
Notes: Distances are the approximate distances from the roadway centerline to the nearest home and vary by location and roadway width.

As shown in Table 6-8, construction-related traffic would not generate noise in excess of 65 dB L_{dn} at any noise-sensitive receptor. Construction-related traffic would result in traffic noise increases well below the 10 dB threshold (2.8 dB or less) along all the roadways in the project area, except for San Luis Drive where the traffic noise increase due to project construction is estimated to be 11.3 dB. However, the overall measured ambient noise level in the vicinity of San Luis Drive was 57.6 dB L_{dn}, based on measurement LT2; therefore, the overall noise increase would actually be 2.7 dB.[7] In addition, the resulting traffic noise level would be below the allowable 65 dBA L_{dn} noise compatibility guideline for outdoor residential areas in the county. In conclusion, noise from construction traffic for both the solar project site and the PG&E substation improvements site would not exceed the applicable increase threshold.

Combined Construction Noise Levels

On-site construction noise levels and construction traffic noise levels are not typically analyzed together because they are regulated separately and assessed using different metrics (weighted 24-hour noise metrics for traffic versus shorter-term average noise levels for on-site construction). It is also common for construction activities to be fully or partially exempt from local noise standards, as is the case in Merced County. For these reasons the following analysis of combined construction noise levels is provided for informational purposes only. Calculations were conducted to analyze the combined noise levels from on-site construction activities and construction traffic. This analysis considered daytime activity because this is the period when the highest noise levels are predicted for both sources. For each of the six analyzed receivers, noise levels were added together from the worst-case on-site construction noise and the construction traffic on the nearest street that would be used for vehicular site access. Worst-case construction noise levels were taken directly from the

[7] Although LT1 is closer to San Luis Drive than LT2, LT1 was not selected to define ambient noise levels because it was on a light pole immediately adjacent to the roadway. Therefore, measured noise levels at LT1 were very likely higher than the actual ambient noise levels at outdoor areas of frequent human use (e.g., yards). LT2 is a more appropriate measurement for representing actual residential backyards or outdoor areas of frequent human use.

construction noise analysis summarized in Table 6-6 (*Weekday Daytime Noise Levels and Increases at Nearest Receivers for Each Construction Phase*). Estimates of traffic noise were based on the traffic noise analysis in Appendix C and the closest distance from each receiver to the nearest construction route (Billy Wright Road or San Luis Drive). To quantify the noise increases due to combined project operations, calculated noise levels were compared to measured ambient noise levels. The results are summarized in Table 6-9. Referring to Table 6-9, combined construction noise levels are dominated by on-site construction at all analyzed receivers except R1, where construction traffic noise levels are approximately 2 dB higher than PG&E Substation construction noise levels. Combined construction noise levels are 0 to 4 dB higher than the noise levels for on-site construction alone, but overall noise level increases over ambient range from approximately 0 to 16 dB, which is the same range of increases anticipated for on-site construction activities alone (i.e., without construction traffic).

Table 6-9. Calculated Combined Noise Levels from On-site Construction and Construction Traffic

Receiver	Noise Source	Daytime L_{eq}, dBA	Combined Daytime L_{eq}, dBA	Average Daytime Ambient L_{eq}, dBA	Exceedance Above Ambient L_{eq}, dBA
R1	PG&E Substation Construction	59.9	64.0	56.1	7.9
	Construction Traffic	61.9			
R2	Solar Site Construction	70.1	70.1	56.1	14.0
	Construction Traffic	41.5			
R3	Solar Site Construction	68.7	68.7	53.0	15.7
	Construction Traffic	36.6			
R4	Solar Site Construction	55.3	55.4	52.1	3.3
	Construction Traffic	35.9			
R5	Solar Site Construction	56.5	56.5	53.2	3.3
	Construction Traffic	34.1			
R6	Solar Site Construction	55.1	55.1	64.0	0.0
	Construction Traffic	36.8			

Summary of Construction Noise Conclusions

Solar Project

Construction activities at the solar project site would take place primarily during daytime weekday hours (7:00 a.m. to 6:00 p.m.), during which time construction noise is exempt from quantitative noise standards. During non-exempt hours, construction noise would comply with the County's 75 dBA L_{max} and 10 dB increase thresholds. Therefore, construction noise would comply with the applicable local noise standards. Demolition noise due to decommissioning activities at the solar project site would also be limited to the exempt daytime hours in the County, and would therefore comply with applicable local guidelines. In conclusion, noise due to construction and decommissioning activities would comply with the applicable local standards contained in the MCC.

PG&E Substation Improvements

Noise from construction activities at the PG&E substation site during daytime weekday hours would comply with local applicable noise guidelines for construction; no evening construction would take place at this site, so there would be no noise effects related to evening construction at the PG&E substation site. Noise related to construction traffic accessing the PG&E substation site would also not exceed applicable thresholds. Furthermore, PG&E construction traffic noise would not combine with on-site construction noise to result in greater overall noise at the nearest homes because that traffic would utilize Jasper Sears Road, which is west of the PG&E substation site and more than 2,500 feet west of the nearest residential property). In conclusion, overall construction noise from the PG&E substation site would comply with the applicable thresholds contained in the MCC.

Whole Project

The project consists of the solar project and the PG&E substation improvements. As described above, construction noise from the project, inclusive of each project component, would comply with the applicable local standards contained in the MCC.

Project Operation

Stationary Noise Sources

As discussed previously, two battery system options are being considered for the solar project, a DC coupled system (DC Option) and an AC coupled system (AC Option). These are evaluated at an equal level of detail in this report and the noise analysis for each option is presented below. Under the DC Option, 43 BESS equipment areas would be distributed among the solar arrays and co-located with the solar PV inverters throughout the solar project site. Under the AC Option, all lithium-ion batteries would be aggregated within a single centralized storage area near the western central portion of the solar project site (see Figure 2).

This analysis uses a combination of sound specification data provided by the project applicant and example equipment similar to that expected for use with the project. Table 6-3, in the Methodology section of this report, summarizes estimated noise levels from proposed operational equipment at a reference distance of 50 feet.

The noise contribution at each analyzed receiver was first calculated for various individual project elements, then overall operational noise levels were calculated by combining the contributions from all project elements.

Two techniques were used to calculate noise contributions from individual project elements depending on how the associated equipment would be distributed within the project site. The first technique was for project elements consisting of equipment located within a defined area of the project site. These elements would include the solar project substation, the PG&E substation improvements, and the centralized BESS under the AC Option. The noise contributions from these elements were calculated based on the total equipment within each defined area and the closest distances between each receiver and each area (based on the project layout shown in Figure 2).

The second technique was for project elements that would have equipment distributed throughout the entire solar project site. These elements would include the BESS and DC-DC converters under the DC Option, the PV inverters, and the tracker motors. The noise contributions from these elements were calculated based on the distance from each receiver to the closest solar array and the approximate number of noise sources that would dominate nearby noise levels for each equipment type. Using the closest distances for these distributed project elements generates a worst-case assessment and provides flexibility for potential adjustments to the solar project design within the solar arrays. Estimated noise levels from proposed operational equipment at a reference distance of 50 feet are included in Table 6-2 in the Methodology section of this report. Calculations of the contributions from noise sources at each analyzed receiver were based on the closest distance between the sources and the combined noise levels for all equipment specified within each area. An analysis of the noise levels associated with the equipment proposed for each option is presented below.

A vegetated screen is proposed for development along the northern perimeter of the solar project site near the adjacent residential land uses. While this would help obstruct the view of the solar project from the neighboring homes, it is uncommon for vegetation to result in a noticeable reduction in noise unless the vegetated area is very dense and wide (Caltrans 2013). Therefore, the analysis assumes no noise attenuation as a result of the vegetated screen.

On-site Electrical Equipment for the DC Option

A previous study for a solar installation indicated there would be 1,133 single-axis tracking system motors on a 485-acre site (VHB 2020). Assuming an equivalent number of motors per acre for the proposed solar project, approximately 4,067 single-axis tracking system motors would be distributed across the solar project site. These motors would all be within the solar array footprint.

Approximately 55 solar PV inverters would be distributed among the solar arrays throughout the 1,741-acre solar project site. Although the anticipated solar array footprint has been established, as shown in Figure 2, the exact locations for the inverters have not yet been determined.

Under the DC option, there would be 43 “DC BESS equipment areas,” which would be co-located with up to 43 solar PV inverters. One DC BESS equipment area would consist of one DC-DC converter and one DC BESS enclosure. DC BESS equipment areas would generally be co-located on a one-to-one basis with the solar PV inverters but may be co-located at up to a three-to-one ratio at some locations. This three-to-one scenario is considered a worst-case scenario for potential noise effects because it could group more equipment near a single noise-sensitive receiver. Each BESS enclosure would have a door-mounted cooling system with approximately four small heating, ventilation, and air-conditioning (HVAC) units. This cooling system would be the dominant source of noise from the BESS.

In addition to these distributed noise sources, other equipment in the solar project and the PG&E substation improvements would generate noise. The other primary noise sources associated with the solar project would be the main step-up transformer and two HVAC units, which would provide cooling for the substation control house. Because detailed plans and specifications for the PG&E substation improvements have not yet been developed, noise levels from the PG&E substation improvements were estimated based on the solar project substation, as described in Section 6.1.3 of this report.

As described above, noise from the solar project site and the PG&E substation was modeled at the locations defined in the Project Description. To provide an estimate of remaining noise contributions from equipment, the following equipment was assumed to operate at the closest solar array boundary: six DC BESS enclosures (i.e., 24 BESS HVAC units), two DC-DC converters, two PV inverters, and 140 tracker motors. Complete calculation details and results are provided in Appendix D. The results are summarized in Table 6-10. The three noise thresholds that apply to this equipment are: noise is limited to 65 dBA L_{dn} at the nearest residential property, noise is limited to 75 dBA L_{max} at the nearest residential property, and the background sound level shall not be exceeded by 10 dBA during daytime hours and/or 5 dBA during nighttime hours. The results in Table 6-10 illustrate that the DC option would comply with the first two criteria because all calculated L_{max} values are below 75 dBA and all calculated L_{dn} values are below 65 dBA. To quantify the noise increases due to operation of the DC option, calculated noise levels are compared to measured ambient noise levels, as shown in Table 6-11. The results in Table 6-11 illustrate that the DC option would also comply with the third criterion because calculated daytime or nighttime noise levels would not exceed the corresponding measured ambient noise level by 10 dBA or 5 dBA, respectively. In conclusion, estimated noise levels from operation of the DC option, including operation of the PG&E substation improvements, demonstrate that applicable noise thresholds would not be exceeded,

Table 6-10. Calculated Operational Noise Levels for DC Option Equipment

		Equipment Noise Levels		Combined Equipment Noise Levels, dBA		
		L_{eq}/		Daytime	Nighttime	
Receiver	Noise Source	L_{max}[1]	L_{dn}	L_{eq}/L_{max}[1]	L_{eq}/L_{max}[1]	L_{dn}
R1	BESS, DC-DC converters, and PV inverter	43.3	49.7	57.8	48.4	58.1
	Solar project substation, daytime	45.9	45.6			
	Solar project substation, nighttime	35.1				
	Tracker motors	38.8	36.8			
	PG&E substation, daytime	57.3	57.0			
	PG&E substation, nighttime	46.5				
R2	BESS, DC-DC converters, and PV inverter	43.3	49.7	50.2	44.5	52.3
	Solar project substation, daytime	45.9	45.6			
	Solar project substation, nighttime	35.1				
	Tracker motors	38.8	36.8			
	PG&E substation, daytime	45.6	45.4			
	PG&E substation, nighttime	34.9				
R3	BESS, DC-DC converters, and PV inverter	49.4	55.8	51.2	49.5	56.2
	Solar project substation, daytime	38.9	38.6			
	Solar project substation, nighttime	28.1				
	Tracker motors	44.9	42.8			
	PG&E substation, daytime	36.7	36.4			
	PG&E substation, nighttime	25.9				

Receiver	Noise Source	Equipment Noise Levels		Combined Equipment Noise Levels, dBA		
		L_{eq}/ L_{max}[1]	L_{dn}	Daytime L_{eq}/L_{max}[1]	Nighttime L_{eq}/L_{max}[1]	L_{dn}
R4	BESS, DC-DC converters, and PV inverter	36.6	43.0	41.5	37.2	44.6
	Solar project substation, daytime	35.6	35.3			
	Solar project substation, nighttime	24.8				
	Tracker motors	32.1	30.0			
	PG&E substation, daytime	36.3	36.1			
	PG&E substation, nighttime	25.6				
R5	BESS, DC-DC converters, and PV inverter	38.4	44.8	39.9	38.5	45.1
	Solar project substation, daytime	24.3	24.0			
	Solar project substation, nighttime	13.5				
	Tracker motors	33.9	31.9			
	PG&E substation, daytime	22.7	22.4			
	PG&E substation, nighttime	11.9				
R6	BESS, DC-DC converters, and PV inverter	38.4	44.8	39.8	38.4	45.1
	Solar project substation, daytime	18.2	17.9			
	Solar project substation, nighttime	7.4				
	Tracker motors	33.9	31.9			
	PG&E substation, daytime	17.5	17.2			
	PG&E substation, nighttime	6.7				

1. Assumes 100 percent utilization and constant noise levels; therefore $L_{eq} = L_{max}$.
Refer to Appendix D for source noise levels and calculation output files.
BESS = battery energy storage system; PV = photovoltaic; DC = direct current

Table 6-11. Noise Level Exceedances Over Ambient due to DC Option Equipment

Receiver	Combined Equipment Noise Levels, L_{eq} dBA		Lowest Hourly Ambient, L_{eq} dBA		Hourly Exceedance, L_{eq} dBA	
	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
R1	57.8	48.4	49.5	48.5	8.3	0.0
R2	50.2	44.5	49.5	48.5	0.7	0.0
R3	51.2	49.5	47.1	57.1	4.1	0.0
R4	41.5	37.2	58.3	53.8	0.0	0.0
R5	39.9	38.5	51.9	47.7	0.0	0.0
R6	39.8	38.4	57.4	52.6	0.0	0.0

Refer to Appendix D for source noise levels and calculation output files.

On-site Electrical Equipment for the AC Option

Using the same assumptions described under the DC Option, it is assumed that approximately 4,067 single-axis tracking system motors would be distributed across the solar project site under the AC Option. These motors would all be within the proposed solar array footprint.

Under the AC Option, approximately 55 solar PV inverters would be distributed among the solar arrays throughout the 1,741-acre solar project site. Although the anticipated solar array footprint has been established, as shown in Figure 2, the exact locations for the inverters have not yet been determined. In addition, 112 BESS units would be aggregated within a single centralized storage area near the western central portion of the solar project site. These would be Tesla Megapack units, each with its own integrated inverter.

In addition to these distributed noise sources, other equipment in the solar project site and the PG&E substation would generate noise. The other primary noise sources associated with the solar project site would be the main step-up transformer and two HVAC units, which would provide cooling for the substation control house. Because detailed plans and specifications for the PG&E substation improvements have not yet been developed, noise levels from the PG&E substation improvements were estimated based on the solar project substation, as described in Section 6.1.3 of this report.

As described above, all noise from the solar project site and the PG&E substation was modeled at the locations defined in the Project Description. To provide an estimate of remaining noise contributions from equipment, the following equipment was assumed to operate at the closest solar array boundary: two PV Inverters and 140 tracker motors.

Complete calculation details and results are provided in Appendix D. The results are summarized in Table 6-12. The three noise thresholds that apply to this equipment are: noise is limited to 65 dBA L_{dn} at the nearest residential property, noise is limited to 75 dBA L_{max} at the nearest residential property, and the background sound level shall not be exceeded by 10 dBA during daytime hours and/or 5 dBA during nighttime hours. The results in Table 6-12 illustrate that the AC Option would comply with the first two criteria because all calculated L_{max} values are below 75 dBA and all calculated L_{dn} values are below 65 dBA. To quantify the noise increases due to operation of the AC Option, calculated noise levels are compared to measured ambient noise levels, as shown in Table 6-13. The results in Table 6-13 illustrate that the AC Option would also comply with the third criterion because calculated daytime or nighttime noise levels would not exceed the corresponding measured ambient noise level by 10 dBA or 5 dBA, respectively. In conclusion, estimated noise levels from operation of the AC Option, including operation of the PG&E substation improvements, demonstrate that applicable noise thresholds would not be exceeded.

Table 6-12. Calculated Operational Noise Levels for AC Option Equipment

		Equipment Noise Levels		Combined Equipment Noise Levels, dBA		
Receiver	Noise Source	L_{eq}/L_{max}[1]	L_{dn}	Daytime L_{eq}/L_{max}[1]	Nighttime L_{eq}/L_{max}[1]	L_{dn}
R1	Solar project substation, daytime	45.9	45.6	57.7	47.4	57.6
	Solar project substation, nighttime	35.1				
	PV inverters	36.2	42.6			
	BESS	34.0	40.4			
	Tracker motors	38.8	36.8			
	PG&E substation, daytime	57.3	57.0			
	PG&E substation, nighttime	46.5				
R2	Solar project substation, daytime	45.9	45.6	49.6	41.6	50.5
	Solar project substation, nighttime	35.1				
	PV inverters	36.2	42.6			
	BESS	35.9	42.4			
	Tracker motors	38.8	36.8			
	PG&E substation, daytime	45.6	45.4			
	PG&E substation, nighttime	34.9				
R3	Solar project substation, daytime	38.9	38.6	48.3	44.0	51.3
	Solar project substation, nighttime	28.1				
	PV inverters	42.2	48.6			
	BESS	38.6	45.0			
	Tracker motors	44.9	42.8			
	PG&E substation, daytime	36.7	36.4			
	PG&E substation, nighttime	25.9				
R4	Solar project substation, daytime	35.6	35.3	41.7	37.8	45.0
	Solar project substation, nighttime	24.8				
	PV inverters	29.4	35.8			
	BESS	36.5	42.9			
	Tracker motors	32.1	30.0			
	PG&E substation, daytime	36.3	36.1			
	PG&E substation, nighttime	25.6				
R5	Solar project substation, daytime	24.3	24.0	39.0	37.1	43.8
	Solar project substation, nighttime	13.5				
	PV inverters	31.2	37.7			
	BESS	35.7	42.1			
	Tracker motors	33.9	31.9			
	PG&E substation, daytime	22.7	22.4			
	PG&E substation, nighttime	11.9				

Receiver	Noise Source	Equipment Noise Levels		Combined Equipment Noise Levels, dBA		
		L_{eq}/L_{max}[1]	L_{dn}	Daytime L_{eq}/L_{max}[1]	Nighttime L_{eq}/L_{max}[1]	L_{dn}
R6	Solar project substation, daytime	18.2	17.9	36.3	32.4	39.6
	Solar project substation, nighttime	7.4				
	PV inverters	31.2	37.7			
	BESS	25.7	32.1			
	Tracker motors	33.9	31.9			
	PG&E substation, daytime	17.5	17.2			
	PG&E substation, nighttime	6.7				

1. Assumes 100 percent utilization and constant noise levels; therefore $L_{eq} = L_{max}$.
Refer to Appendix D for source noise levels and calculation output files.
BESS = battery energy storage system; PV = photovoltaic; DC = direct current

Table 6-13. Noise Level Exceedances Over Ambient due to AC Option Equipment

Receiver	Combined Equipment Noise Levels, L_{eq} dBA		Lowest Hourly Ambient, L_{eq} dBA		Hourly Exceedance, L_{eq} dBA	
	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
R1	57.7	47.4	49.5	48.5	8.2	0.0
R2	49.6	41.6	49.5	48.5	0.1	0.0
R3	48.3	44.0	47.1	57.1	1.2	0.0
R4	41.7	37.8	58.3	53.8	0.0	0.0
R5	39.0	37.1	51.9	47.7	0.0	0.0
R6	36.3	32.4	57.4	52.6	0.0	0.0

Refer to Appendix D for source noise levels and calculation output files.

Gen-Tie Line

Overhead electrical lines, such as the proposed gen-tie line, would emit noise associated with corona discharge, an electrical discharge that ionizes the surrounding air. The noise associated with corona discharge is typically described as a crackling or humming sound. Based on data from a previous noise study for a solar project (Ambient Air Quality & Noise Consulting 2015), the noise level from corona discharge along a 230 kV transmission line is approximately 25 dBA at a distance of 25 feet. The gen-tie line would be more than 25 feet from the nearest residences at the closest point. The noise level would be well below all applicable Merced County noise standards (e.g., 65 dBA L_{dn}, 75 dBA L_{max}, increases over ambient noise levels). Therefore, noise from the lines would generally not be audible above background levels at nearby homes, and noise levels would exceed any applicable thresholds.

On-site Maintenance Activities

The primary maintenance activity that would generate noticeable noise levels at the solar project site would be the washing of solar panels, which is anticipated to occur once a year. Panel washing would occur Monday through Friday for up to 20 business days over the course of a 30-day period, taking place only during daylight hours (not during the nighttime hours of 10 p.m. to 7 a.m.). Based on manufacturer's published data, pressure washers have been determined to generate noise levels of up to 82 dBA at 10 feet. Comparing this noise level to the applicable noise thresholds, pressure washer noise would be reduced to 75 dBA L_{max} at a distance of approximately 20 feet, 65 dB L_{dn} at a distance of approximately 90 feet, and to within 10 dB of daytime ambient noise levels at distances of approximately 150 to 250 feet, depending on the receptor. Because there are no sensitive receptors (homes) within these distances from the proposed solar panel arrays, there would be no exceedances of the thresholds. Furthermore, washing activity at any one area within the project site would be relatively brief; once completed in one area, washing operations would move to another area of the roughly 1,741-acre site. As a result, noise resulting from on-site operations and maintenance would not exceed applicable noise thresholds.

There would be no panel washing at the PG&E substation (because no solar panels would be installed there) and no new maintenance activities that would be expected to generate substantial noise levels. General maintenance of new PG&E equipment would be generally the same as the period maintenance activities that already occur at the substation, such as visual inspections and cleaning, equipment measurements and testing, correcting torque settings, and checking oil and other fluid levels. As a result, no substantial noise increases would occur due to PG&E substation maintenance.

Emergency Generator

An emergency generator may be required as part of the proposed project. Emergency generator noise is evaluated in this report to address the potential for an emergency generator to be added to the solar project site plan at a later time. Note that generator noise is typically considered exempt from local ordinances during an emergency. However, during intermittent testing of the generator, generally monthly for a period of 30 to 60 minutes, noise levels must comply with the local allowable noise limits.

Should it be determined that a generator is required for the proposed project, the applicant has indicated that the size range of the generator would be between 25 and 50 kW. As an example, a 50 kW Cummins C50D6C generator can generate a noise level of 85 dBA at a distance of 50 feet without accounting for any attenuation features. A specific location for the potential generator has not been selected. Depending on the final location selected, it is possible that noise from the generator would be below the allowable noise levels in the county (e.g., 75 dBA L_{max}, 65 dBA L_{dn}, 10 dB or 5 dB above the ambient noise level during daytime and nighttime hours, respectively) at the nearby residential land uses, based on distance attenuation. However, because specific details regarding the size of the emergency generator, the location, and the testing schedule are currently unknown, it is conservatively assumed that the proposed emergency generator could result in noise levels in excess of allowable limits at nearby sensitive uses in the county during testing. This is especially true if generator testing were to occur during evening or nighttime hours when people are generally considered more sensitive to noise.

To reduce the potential operational noise levels associated with the testing of the emergency generator, Recommended Mitigation Measure NOI-1 is recommended. With the implementation of Recommended Mitigation Measure NOI-1, the emergency generator would not result in noise levels in excess of thresholds in the county.

Recommended Mitigation Measure NOI-1: **Design the emergency generator installation to comply with the requirements of the MCC during periodic testing**.

Should an emergency generator be determined necessary for solar project implementation, a focused acoustical study shall be completed by the project applicant and submitted to the director of the Community & Economic Development Department prior to installation of the generator to ensure that the applicable Merced County noise standards are not exceeded at any nearby noise-sensitive receptors. Specifically, the study shall determine the design features (including any necessary noise control features) necessary to ensure that the generator will be in compliance with the following requirements of the County noise ordinance (Section 10.60.030 of the MCC) during periodic testing:

- The generator shall not exceed the background sound level by ten (10) dBA or more during daytime hours (7:00 a.m. to 10:00 p.m.) or by five (5) dBA or more during nighttime hours (10:00 p.m. to 7:00 a.m.). The background sound level for purposes of this assessment shall be determined as set forth in MCC Section 10.60.060. Suitable measured background sound levels are provided in Table 4-1 of this technical report. The minimum measured daytime or nighttime L_{eq} shall be selected from the measurement location(s) that best represent the sensitive receptor(s) to be analyzed.
- Noise from the generator shall not exceed sixty-five (65) dBA L_{dn} on residential real property.
- Noise from the generator shall not exceed seventy-five (75) dBA L_{max} on residential real property.

Generator noise control measures may include, but are not limited to:

- Locating the emergency generator away from noise-sensitive receptors;
- Selecting a quieter generator model;
- Equipping the generator with an appropriate muffler (exhaust silencer) to reduce exhaust noise;
- Equipping the generator with an appropriate sound enclosure to reduce radiated noise; and
- Placing a noise barrier(s) around one or more sides of the generator.

The calculations shall be based on the most recent solar project plans and emergency generator specifications and may include additional details regarding the solar project design, which could help to reduce noise levels (e.g., the effects of site-specific terrain and ground cover or the shielding of noise sources by intervening equipment or structures, including solar arrays). The Study shall be approved by the director of the Community & Economic Development Department prior to installation of the generator.

Recommended Mitigation Measure NOI-1 would be effective because multiple proven noise-reduction techniques could be used independently or together to reduce generator noise. Generator sound enclosures combined with exhaust silencers routinely reduce generator noise by 10 dB or more; screen walls that block the line of sight between a noise source (e.g., a generator) and a receptor can reduce noise levels by 5 dB or more. As a result, multiple effective design approaches are available for controlling generator noise. Furthermore, given the size of the solar project site, it would be possible to ensure noise levels do not exceed the applicable thresholds by simply placing the generator far enough away from the closest receptors.

The PG&E substation improvements do not include an emergency generator.

Operational Traffic

The traffic data from the project traffic impact analysis (KD Anderson & Associates, Inc. 2022) indicate that, on a peak day, up to eight employee vehicles and 21 water trucks would travel to and from the project site during operation. This would equate to a total of 16 trips by automobiles and light-duty trucks and 42 trips by heavy trucks. These vehicles would access the project site via Billy Wright Road. The traffic noise modeling, provided in Appendix C, indicates that daily project noise levels would be approximately 36 dBA L_{dn} at the closest residence to Billy Wright Road. This is substantially lower than the estimated existing traffic noise level of 45 dBA L_{dn}. As a result, the predicted noise would not cause a substantial increase in existing noise levels or cause a traffic noise level in excess of the County standard of 65 dBA L_{dn} for residential property. It is also noted that operational traffic on Billy Wright Road would be inaudible at the residential uses northwest of the solar project site because they are approximately two miles away. In conclusion, noise from operational traffic would not exceed applicable noise thresholds.

The PG&E substation improvements would not result in additional operational trips to the PG&E substation site beyond what already occurs.

Combined Operational Noise Levels

Additional calculations were conducted to analyze whether the combined noise from all operational noise sources would exceed any of the established thresholds. The three noise thresholds that apply to the operational noise levels are: noise is limited to 65 dBA L_{dn} at the nearest residential property, noise is limited to 75 dBA L_{max} at the nearest residential property, and the background sound level shall not be exceeded by 10 dBA during daytime hours and/or 5 dBA during nighttime hours. L_{max} noise levels are short-term (1 second or less) levels that are typically dominated by a single loudest/closest noise source. Therefore, the potential exceedances of L_{max} thresholds are already covered by the individual noise source analyses provided above. The following combined noise analysis focuses on the L_{dn} and noise increase (L_{eq}) thresholds which consider longer time periods (1-hour or 24-hours) over which average noise levels from multiple sources would combine.

For each of the six analyzed receivers, noise levels were added together for the worst-case on-site electrical equipment noise option (DC or AC), gen-tie noise, maintenance noise, and traffic noise. The noise levels for on-site electrical noise were taken from Table 6-13, which already accounts for the distances from each receiver to the various noise sources. Gen-tie noise levels were estimated based on the source level described previously (25 dBA at 25 feet) and the closest distance from each receiver to the proposed gen-tie line; it was assumed gen-tie noise would occur 24 hours per day. Maintenance noise levels were estimated based on the panel

washing level described previously (82 dBA at 10 feet) and the closest distance from each receiver to the proposed solar arrays; to provide a conservative analysis, it was assumed that panel washing would occur at the closest location to each receiver for up to eight hours during the daytime but would not occur at night. Traffic noise levels were estimated based on the traffic noise analysis in Appendix C and the closest distance from each receiver to the portion of Billy Wright Road that would be used for vehicular site access. The emergency generator would not be part of typical operations, so was not included in this analysis.

Complete calculation details and results are provided in Appendix D. The results are summarized in Table 6-14. The results in Table 6-14 illustrate that all calculated L_{dn} values are below 65 dBA. To quantify the noise increases due to combined project operations, calculated noise levels are compared to measured ambient noise levels, as shown in Table 6-15. The results in Table 6-15 illustrate that the combined project operations would also comply with the noise increase criterion because calculated daytime or nighttime noise levels would not exceed the corresponding measured ambient noise level by 10 dBA or 5 dBA, respectively. In conclusion, noise from combined project operations, including the operation of the PG&E substation improvements, would not result in exceedances of any applicable noise thresholds.

Table 6-14. Calculated Operational Noise Levels for All Sources Combined

		Noise Levels, dBA[1]			Combined Noise Levels, dBA		
Receiver	Noise Source	Daytime L_{eq}	Nighttime L_{eq}	L_{dn}	Daytime L_{eq}	Nighttime L_{eq}	L_{dn}
R1	On-site Electrical Equipment[2]	57.8	48.4	58.1	57.9	48.4	58.1
	Gen-tie	0	0	0			
	Maintenance	40.0	-	35.2			
	Traffic	< 25	-	< 25			
R2	On-site Electrical Equipment[2]	50.2	44.5	52.3	50.6	44.5	52.3
	Gen-tie	0	0	0			
	Maintenance	40.0	-	35.2			
	Traffic	< 25	-	< 25			
R3	On-site Electrical Equipment[2]	51.2	49.5	56.2	52.2	49.5	56.2
	Gen-tie	0	0	0			
	Maintenance	45.4	-	40.7			
	Traffic	< 25	-	< 25			
R4	On-site Electrical Equipment[2]	41.7	37.8	45.0	42.3	37.8	45.0
	Gen-tie	0	0	0			
	Maintenance	32.6	-	27.9			
	Traffic	< 25	-	< 25			
R5	On-site Electrical Equipment[2]	39.9	38.5	45.1	41.4	38.5	45.1
	Gen-tie	0	0	0			
	Maintenance	35.5	-	30.7			
	Traffic	< 25	-	< 25			

Receiver	Noise Source	Noise Levels, dBA[1] Daytime L_{eq}	Nighttime L_{eq}	L_{dn}	Combined Noise Levels, dBA Daytime L_{eq}	Nighttime L_{eq}	L_{dn}
R6	On-site Electrical Equipment[2]	36.3	32.4	39.6	41.2	32.4	39.6
	Gen-tie	0	0	0			
	Maintenance	35.5	-	30.7			
	Traffic	37.3	-	35.9			

1. A noise level of 0 dB is very low (approximately the threshold of human hearing) and the lowest noise level calculated in the analysis; actual noise levels could be lower (i.e., negative dB values). Where values are indicated as "-," the noise source would not be operating and would not contribute to the overall noise level during nighttime hours. A level of < 25 indicates noise levels would be 25 dBA or lower; a level of 25 dBA has been assumed for the purposes of calculating combined noise levels.
2. Includes solar project equipment and PG&E equipment. The stated value is for each receiver is for whichever option (DC or AC) generates the highest noise levels.

Refer to Appendix D for source noise levels and calculation output files.

Table 6-15. Noise Level Exceedances Over Ambient due to All Operational Sources Combined

Receiver	Combined Noise Levels, L_{eq} dBA Daytime	Nighttime	Lowest Hourly Ambient, L_{eq} dBA Daytime	Nighttime	Hourly Exceedance, L_{eq} dBA Daytime	Nighttime
R1	57.9	48.4	49.5	48.5	8.4	0.0
R2	50.6	44.5	49.5	48.5	1.1	0.0
R3	52.2	49.5	47.1	57.1	5.1	0.0
R4	42.3	37.8	58.3	53.8	0.0	0.0
R5	41.4	38.5	51.9	47.7	0.0	0.0
R6	41.2	32.4	57.4	52.6	0.0	0.0

Refer to Appendix D for source noise levels and calculation output files.

Summary of Operational Noise Conclusions

Solar Project

Stationary equipment noise sources (besides the generator, which is discussed below) at the solar project site under both the AC and the DC options would result in operational noise that would comply with all three applicable criteria in Merced County. In addition, noise from project gen-tie lines, on-site operations and maintenance activities, and solar project traffic would also not exceed applicable thresholds.

Noise from the potential emergency generator are not currently known, so it is not possible to guarantee that noise levels would comply with applicable thresholds. To reduce noise from the emergency generator such that compliance with applicable threshold would be achieved, Recommended Mitigation Measure NOI-1 would be required. With the implementation of Recommended Mitigation Measure NOI-1, the emergency generator would not result in noise levels

in excess of applicable thresholds in the County. As a result, and with implementation of this recommended measure, all operational noise sources would comply with applicable local noise standards.

PG&E Substation Improvements

Stationary equipment noise sources from the PG&E substation site would comply with all three applicable criteria in Merced County.

Whole Project

The project consists of the solar project and the PG&E substation improvements. The only potential operational noise exceedance identified for the whole project relates to the potential generator. With implementation of Recommended Mitigation Measure NOI-1, the operational noise effects of the whole project would be reduced and compliance with all applicable thresholds would be achieved.

Noise-2: Would the project expose persons to or generate excessive ground-borne vibration or ground-borne noise levels?

Damage to Structures

Construction of the proposed project would involve the use of construction equipment that could generate ground-borne vibration. Typical vibration levels associated with heavy-duty construction equipment at a reference distance of 25 feet, as well as other distances, are shown in Table 6-16. The most vibration-intensive types of construction equipment expected to be used for the project are a post driver (to install the panel racks) and a vibratory roller. Use of the post driver would be limited to the solar project site. It is assumed that the remaining equipment items would be used at both the solar project site and the PG&E substation site,

Table 6-16. Vibration Source Levels for Project Construction Equipment

Equipment	Reference PPV at 25 Feet	PPV at 130 Feet	PPV at 500 Feet
Vibratory roller	0.210	**0.034**	0.008
Post driver[1]	0.161	0.026	**0.006**
Auger drill	0.089	0.015	0.003
Large bulldozer[2]	0.089	0.015	0.003
Loaded trucks	0.076	0.012	0.003
Small bulldozer[3]	0.003	0.000	0.000

Note: **Bold** text indicates values that are used in the analysis below.
Source: Caltrans 2020, except as noted.
1. Calculation based on a reference PPV level of 0.65 in/sec for a 36,000-foot-pound pile driver and a maximum energy level of 2,200 foot-pounds for post drivers.
2. Considered representative of other heavy earthmoving equipment such as excavators, graders, backhoes, etc.
3. Considered representative of smaller equipment such as small skid steers and mini excavators.

Construction activities such as equipment mobilization and installation of the vegetative screening could occur as close as 130 feet from the nearest residential structure (i.e., the nearest occupied sensitive buildings). However, the more vibration-intensive construction activities, such as grading and post driving for the solar PV arrays, would be approximately 500 feet from the nearest residential structure. The PG&E substation improvements would be at least 500 feet from the nearest residential structure.

Referring to Table 6-14, the most vibration-intensive piece of equipment proposed for project construction would be a vibratory roller, which is assumed to operate anywhere on the solar project site and the PG&E substation site. Therefore, an analysis of a vibratory roller at a distance of 130 feet provides a reasonable worst-case assessment for construction-related vibration effects from the solar project site and an analysis of a vibratory roller at a distance of 500 feet provides a reasonable worst-case assessment for construction-related vibration effects from the PG&E substation site.

At a distance of 130 feet, the PPV vibration level from a vibratory roller would be approximately 0.026 in/sec. For the purposes of this analysis, structures in the neighborhood north of the solar project site are conservatively assumed to fall under the "older residential structures" category, a Caltrans vibration category for damage impacts, as shown in Table 5-1. The damage criterion for structures in this category is a PPV of 0.3 in/sec for continuous/frequent intermittent sources of vibration, such as construction activity. Therefore, the estimated vibration level from a vibratory roller at the nearest residential structures to the solar site would be well below the damage criterion (i.e., PPV of 0.3 in/sec) for "older residential structures."

Although a post driver would also be used at the solar project site, it would generate less vibration than a vibratory roller and would be used farther from homes. Specifically, a post driver would be used to install the supports for the solar arrays; therefore, it would operate at least 500 feet from the nearest residential structure. At a distance of 500 feet, the post driver would result in a PPV vibration level of 0.006 in/sec. This vibration level is also well below the PPV damage criterion for "older residential structures" of 0.3 in/sec.

At a distance of 500 feet, the PPV vibration level from a vibratory roller would be approximately 0.008 in/sec. As noted above, structures in the neighborhood east of the PG&E substation site are conservatively assumed to fall under Caltrans' "older residential structures" category, with a damage criterion of 0.3 in/sec PPV for continuous/frequent intermittent sources of vibration, such as construction activity. Therefore, the estimated vibration level from a vibratory roller at the nearest residential structures to the PG&E substation site would be well below the damage criterion (i.e., PPV of 0.3 in/sec) for "older residential structures."

Based on the estimated vibration levels presented above, the equipment proposed for project construction near off-site residential uses would result in vibration levels that would be below the applicable criterion. Note that project construction equipment would typically be operating even farther from off-site structures than the aforementioned distances, resulting in even lower vibration levels. Therefore, vibration levels from the most vibration-intensive project construction activities, as well as the nearest project construction activities to off-site uses, would not be expected to exceed the applicable damage criterion for structures near either the solar project site or the PG&E substation site.

Vibration-Related Annoyance

Vibration-related annoyance is typically considered to be substantial if it is expected to result in sleep disturbance at nearby residences. The Caltrans vibration-related "strongly perceptible" annoyance criterion (i.e., PPV of 0.1 in/sec) is often used to assess the potential for sleep

disturbance during nighttime hours. Construction activities for the proposed project would occur mostly during the daytime hours of 7:00 a.m. to 6:00 p.m. However, some evening construction may occur at the solar project site, with construction ending by 8:00 p.m. on a worst-case day when evening work is required. Evening construction would not occur at the PG&E substation. Although no construction would occur at night when people are most likely to be sleeping, estimated vibration levels from proposed construction equipment are evaluated to determine if a strongly perceptible vibration level would be generated during daytime or evening hours (i.e., not only during nighttime hours). This approach provides a conservative analysis of annoyance-related vibration effects.

As described under *Damage to Structures*, above, worst-case PPV vibration levels at the homes closest to the solar project site are expected to be between 0.006 in/sec (for a post driver at 500 feet) and 0.026 in/sec (for a vibratory roller at 130 feet). Worst-case vibration levels at the homes closest to the PG&E substation site are expected be 0.008 in/sec PPV (for a vibratory at 500 feet). These vibration levels are all below the Caltrans "strongly perceptible" criterion for vibration-related annoyance (i.e., PPV of 0.1 in/sec). Therefore, annoyance-related vibration effects from the construction of either the solar project or the PG&E substation improvements would not be substantial.

Chapter 7
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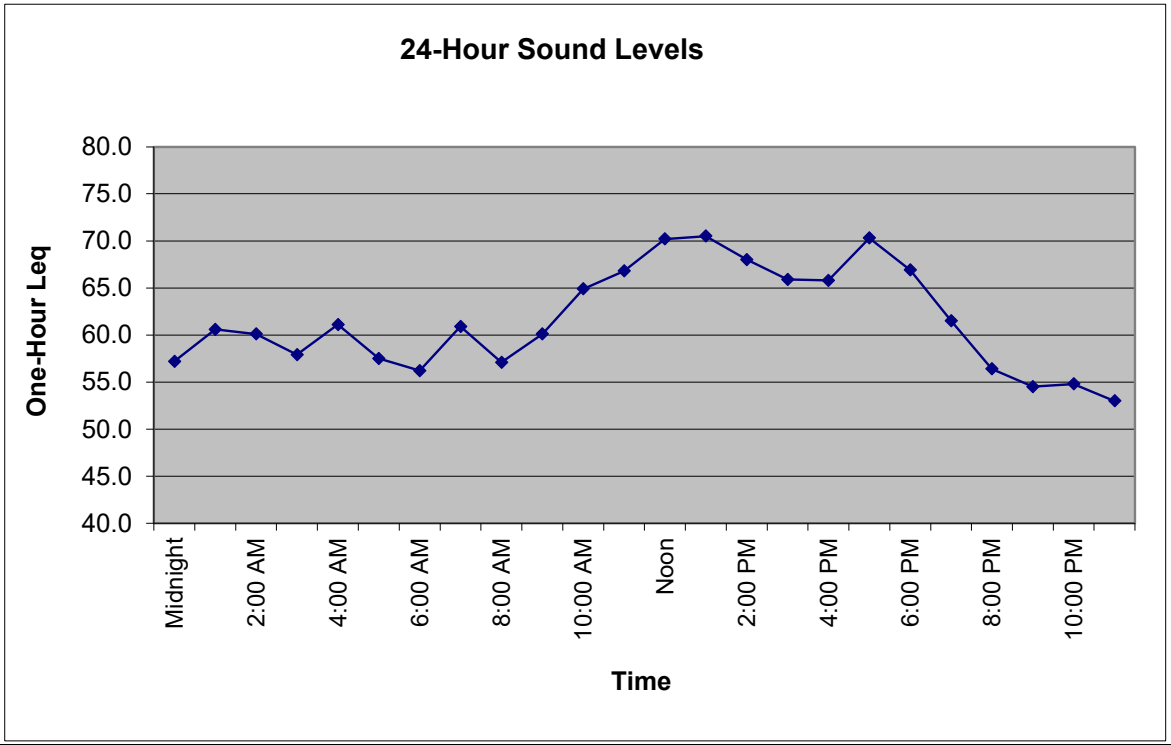
Appendix A

Field Noise Measurements

Long Term Measurement Data

Ldn/CNEL Calculation Spreadsheet

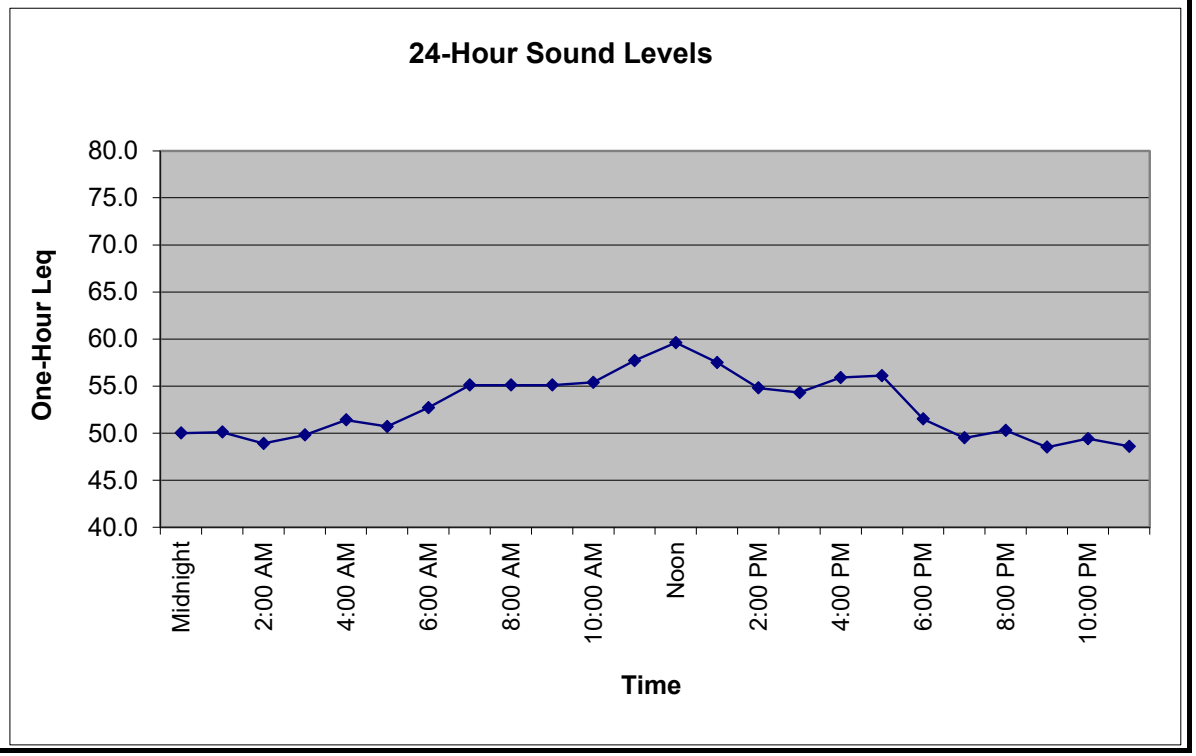
Project:	Las Camas Solar		Date:	3/30/2022	Analyst:	Schumaker, N		
Location:	LT-1							
Time	Wednesday 3/30/2022	Leq(24)	Ldn	CNEL	Worst Hour Leq	Ldn minus Worst Hour Leq	CNEL minus Ldn	Day
Midnight	57.2	64.7	67.2	67.3	70.5	-3.3	0.2	Evening
1:00 AM	60.6		6.3	6.4				Night
2:00 AM	60.1							
3:00 AM	57.9							
4:00 AM	61.1							
5:00 AM	57.5							
6:00 AM	56.2							
7:00 AM	60.9							
8:00 AM	57.1							
9:00 AM	60.1							
10:00 AM	64.9							
11:00 AM	66.8							
Noon	70.2							
1:00 PM	70.5							
2:00 PM	68.0							
3:00 PM	65.9							
4:00 PM	65.8							
5:00 PM	70.3							
6:00 PM	66.9							
7:00 PM	61.5							
8:00 PM	56.4							
9:00 PM	54.5							
10:00 PM	54.8							
11:00 PM	53.0							



Ldn	67.2
Worst Hour Leq	70.5
Lowest Hour LEQ	53.0
12-hour Leq	67.1

Ldn/CNEL Calculation Spreadsheet

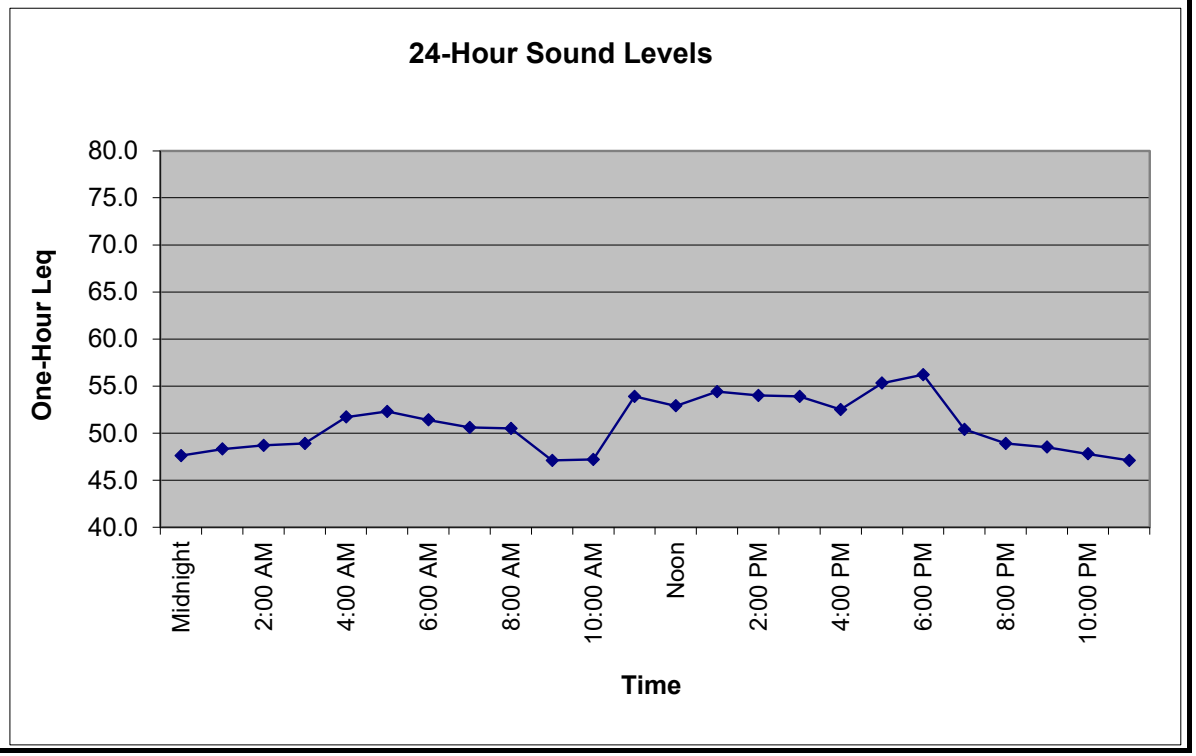
Project:	Las Camas Solar		Date:	3/30/2022	Analyst:	Schumaker, N		
Location:	LT-2							
Time	Wednesday 3/30/2022	Leq(24)	Ldn	CNEL	Worst Hour Leq	Ldn minus Worst Hour Leq	CNEL minus Ldn	Day
Midnight	50.0	54.1	57.9	58.1	59.6	-1.7	0.2	Evening
1:00 AM	50.1		2.8	3.0				Night
2:00 AM	48.9							
3:00 AM	49.8							
4:00 AM	51.4							
5:00 AM	50.7							
6:00 AM	52.7							
7:00 AM	55.1							
8:00 AM	55.1							
9:00 AM	55.1							
10:00 AM	55.4							
11:00 AM	57.7							
Noon	59.6							
1:00 PM	57.5							
2:00 PM	54.8							
3:00 PM	54.3							
4:00 PM	55.9							
5:00 PM	56.1							
6:00 PM	51.5							
7:00 PM	49.5							
8:00 PM	50.3							
9:00 PM	48.5							
10:00 PM	49.4							
11:00 PM	48.6							



Ldn	57.9
Worst Hour Leq	59.6
Lowest Hour LEQ	48.5
12-hour Leq	56.1

Ldn/CNEL Calculation Spreadsheet

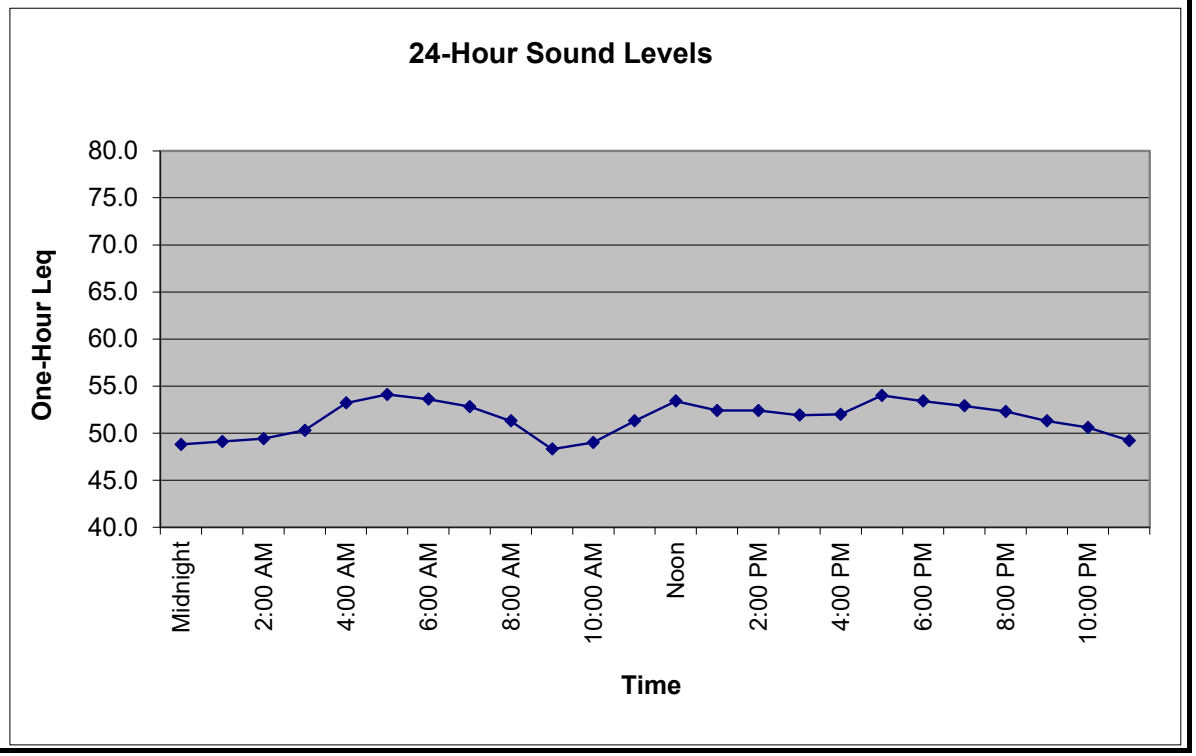
Project:	Las Camas Solar		Date:	3/30/2022	Analyst:	Schumaker, N		
Location:	LT-3							
Time	Wednesday 3/30/2022	Leq(24)	Ldn	CNEL	Worst Hour Leq	Ldn minus Worst Hour Leq	CNEL minus Ldn	Day
Midnight	47.6	51.7	56.7	56.9	56.2	0.5	0.2	Evening
1:00 AM	48.3		6.1	6.3				Night
2:00 AM	48.7							
3:00 AM	48.9							
4:00 AM	51.7							
5:00 AM	52.3							
6:00 AM	51.4							
7:00 AM	50.6							
8:00 AM	50.5							
9:00 AM	47.1							
10:00 AM	47.2							
11:00 AM	53.9							
Noon	52.9							
1:00 PM	54.4							
2:00 PM	54.0							
3:00 PM	53.9							
4:00 PM	52.5							
5:00 PM	55.3							
6:00 PM	56.2							
7:00 PM	50.4							
8:00 PM	48.9							
9:00 PM	48.5							
10:00 PM	47.8							
11:00 PM	47.1							



Ldn	56.7
Worst Hour Leq	56.2
Lowest Hour LEQ	47.1
12-hour Leq	53.1

Ldn/CNEL Calculation Spreadsheet

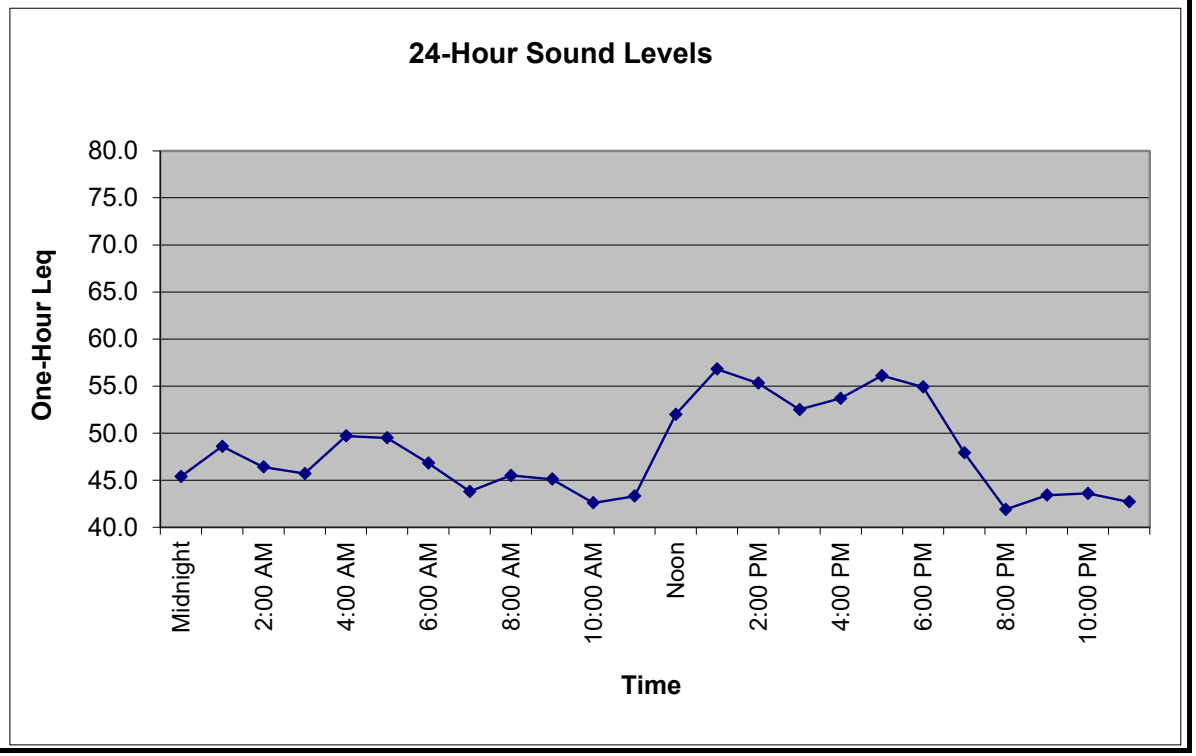
Project:	Las Camas Solar		Date:	3/30/2022	Analyst:	Schumaker, N		
Location:	LT-4							
Time	Wednesday 3/30/2022	Leq(24)	Ldn	CNEL	Worst Hour Leq	Ldn minus Worst Hour Leq	CNEL minus Ldn	Day
Midnight	48.8	51.9	57.9	58.2	54.1	3.8	0.3	Evening
1:00 AM	49.1		5.1	5.4				Night
2:00 AM	49.4							
3:00 AM	50.3							
4:00 AM	53.2							
5:00 AM	54.1							
6:00 AM	53.6							
7:00 AM	52.8							
8:00 AM	51.3							
9:00 AM	48.3							
10:00 AM	49.0							
11:00 AM	51.3							
Noon	53.4							
1:00 PM	52.4							
2:00 PM	52.4							
3:00 PM	51.9							
4:00 PM	52.0							
5:00 PM	54.0							
6:00 PM	53.4							
7:00 PM	52.9							
8:00 PM	52.3							
9:00 PM	51.3							
10:00 PM	50.6							
11:00 PM	49.2							



Ldn	57.9
Worst Hour Leq	54.1
Lowest Hour LEQ	48.3
12-hour Leq	52.1

Ldn/CNEL Calculation Spreadsheet

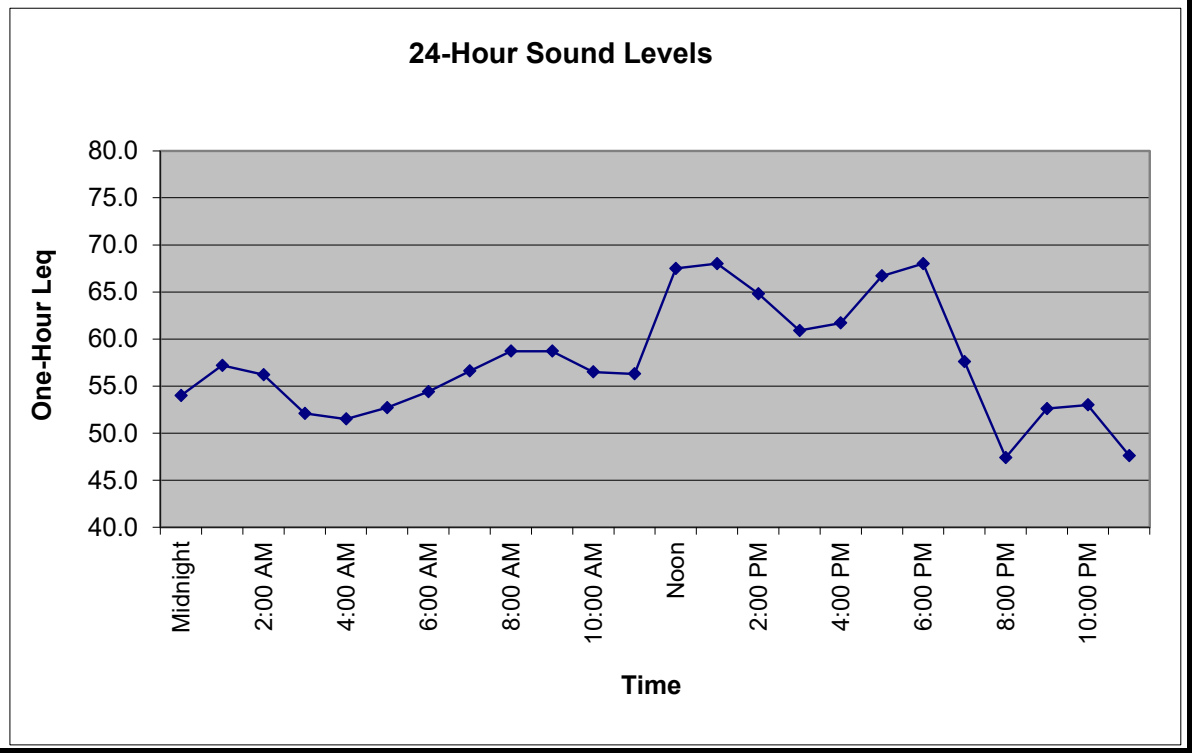
Project:	Las Camas Solar		Date:	3/30/2022	Analyst:	Schumaker, N		
Location:	LT-5							
Time	Wednesday 3/30/2022	Leq(24)	Ldn	CNEL	Worst Hour Leq	Ldn minus Worst Hour Leq	CNEL minus Ldn	Day
Midnight	45.4	50.7	54.6	54.7	56.8	-2.2	0.1	Evening
1:00 AM	48.6		10.8	10.9				Night
2:00 AM	46.4							
3:00 AM	45.7							
4:00 AM	49.7							
5:00 AM	49.5							
6:00 AM	46.8							
7:00 AM	43.8							
8:00 AM	45.5							
9:00 AM	45.1							
10:00 AM	42.6							
11:00 AM	43.3							
Noon	52.0							
1:00 PM	56.8							
2:00 PM	55.3							
3:00 PM	52.5							
4:00 PM	53.7							
5:00 PM	56.1							
6:00 PM	54.9							
7:00 PM	47.9							
8:00 PM	41.9							
9:00 PM	43.4							
10:00 PM	43.6							
11:00 PM	42.7							



Ldn	54.6
Worst Hour Leq	56.8
Lowest Hour LEQ	41.9
12-hour Leq	52.7

Ldn/CNEL Calculation Spreadsheet

Project:	Las Camas Solar		Date:	3/30/2022	Analyst:	Schumaker, N		
Location:	LT-6							
Time	Wednesday 3/30/2022	Leq(24)	Ldn	CNEL	Worst Hour Leq	Ldn minus Worst Hour Leq	CNEL minus Ldn	Day
Midnight	54.0	61.6	63.6	63.7	68.0	-4.4	0.1	Evening
1:00 AM	57.2		7.0	7.1				Night
2:00 AM	56.2							
3:00 AM	52.1							
4:00 AM	51.5							
5:00 AM	52.7							
6:00 AM	54.4							
7:00 AM	56.6							
8:00 AM	58.7							
9:00 AM	58.7							
10:00 AM	56.5							
11:00 AM	56.3							
Noon	67.5							
1:00 PM	68.0							
2:00 PM	64.8							
3:00 PM	60.9							
4:00 PM	61.7							
5:00 PM	66.7							
6:00 PM	68.0							
7:00 PM	57.6							
8:00 PM	47.4							
9:00 PM	52.6							
10:00 PM	53.0							
11:00 PM	47.6							



Ldn	63.6
Worst Hour Leq	68.0
Lowest Hour LEQ	47.4
12-hour Leq	64.2

LT-1 Time History

Number	Start Date	Start Time	End Time	Duration	Meas Mode	Input Range	Input Type	Sensitivity	LAeq
1	3/30/2022	8:39:00 AM	9:00:00 AM	0:21:00	Auto	High	Mic	16.82mV/Pa	68.9
2	3/30/2022	9:00:02 AM	10:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	60.1
3	3/30/2022	10:00:02 AM	11:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	64.9
4	3/30/2022	11:00:02 AM	12:00:00 PM	0:59:58	Auto	High	Mic	16.82mV/Pa	66.8
5	3/30/2022	12:00:02 PM	1:00:00 PM	0:59:58	Auto	High	Mic	16.82mV/Pa	70.2
6	3/30/2022	1:00:02 PM	2:00:00 PM	0:59:58	Auto	High	Mic	16.82mV/Pa	70.5
7	3/30/2022	2:00:02 PM	3:00:00 PM	0:59:58	Auto	High	Mic	16.82mV/Pa	68
8	3/30/2022	3:00:02 PM	4:00:00 PM	0:59:58	Auto	High	Mic	16.82mV/Pa	65.9
9	3/30/2022	4:00:02 PM	5:00:00 PM	0:59:58	Auto	High	Mic	16.82mV/Pa	65.8
10	3/30/2022	5:00:02 PM	6:00:00 PM	0:59:58	Auto	High	Mic	16.82mV/Pa	70.3
11	3/30/2022	6:00:02 PM	7:00:00 PM	0:59:58	Auto	High	Mic	16.82mV/Pa	66.9
12	3/30/2022	7:00:02 PM	8:00:00 PM	0:59:58	Auto	High	Mic	16.82mV/Pa	61.5
13	3/30/2022	8:00:02 PM	9:00:00 PM	0:59:58	Auto	High	Mic	16.82mV/Pa	56.4
14	3/30/2022	9:00:02 PM	10:00:00 PM	0:59:58	Auto	High	Mic	16.82mV/Pa	54.5
15	3/30/2022	10:00:02 PM	11:00:00 PM	0:59:58	Auto	High	Mic	16.82mV/Pa	54.8
16	3/30/2022	11:00:02 PM	12:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	53
17	3/31/2022	12:00:02 AM	1:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	57.2
18	3/31/2022	1:00:02 AM	2:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	60.6
19	3/31/2022	2:00:02 AM	3:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	60.1
20	3/31/2022	3:00:02 AM	4:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	57.9
21	3/31/2022	4:00:02 AM	5:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	61.1
22	3/31/2022	5:00:02 AM	6:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	57.5
23	3/31/2022	6:00:02 AM	7:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	56.2
24	3/31/2022	7:00:02 AM	8:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	60.9
25	3/31/2022	8:00:02 AM	9:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	57.1
26	3/31/2022	9:00:02 AM	10:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	55.2
27	3/31/2022	10:00:02 AM	11:00:00 AM	0:59:58	Auto	High	Mic	16.82mV/Pa	53.3
28	3/31/2022	11:00:01 AM	11:43:48 AM	0:43:47	Auto	High	Mic	16.82mV/Pa	62
29	3/31/2022	11:43:50 AM	11:43:53 AM	0:00:03	Single	High	Mic	16.82mV/Pa	68.5

LT-2 Time History

		Rec 1 to 26	Slow Response	A-Weighted
Number	Date	Time (hh:mm:ss)	LeqPeriod	Leq
1	3/30/2022	9:33:23 AM	1.0 hour	62.6
2	3/30/2022	10:33:23 AM	1.0 hour	55.4
3	3/30/2022	11:33:23 AM	1.0 hour	57.7
4	3/30/2022	12:33:23 PM	1.0 hour	59.6
5	3/30/2022	1:33:23 PM	1.0 hour	57.5
6	3/30/2022	2:33:23 PM	1.0 hour	54.8
7	3/30/2022	3:33:23 PM	1.0 hour	54.3
8	3/30/2022	4:33:23 PM	1.0 hour	55.9
9	3/30/2022	5:33:23 PM	1.0 hour	56.1
10	3/30/2022	6:33:23 PM	1.0 hour	51.5
11	3/30/2022	7:33:23 PM	1.0 hour	49.5
12	3/30/2022	8:33:23 PM	1.0 hour	50.3
13	3/30/2022	9:33:23 PM	1.0 hour	48.5
14	3/30/2022	10:33:23 PM	1.0 hour	49.4
15	3/30/2022	11:33:23 PM	1.0 hour	48.6
16	3/31/2022	12:33:23 AM	1.0 hour	50
17	3/31/2022	1:33:23 AM	1.0 hour	50.1
18	3/31/2022	2:33:23 AM	1.0 hour	48.9
19	3/31/2022	3:33:23 AM	1.0 hour	49.8
20	3/31/2022	4:33:23 AM	1.0 hour	51.4
21	3/31/2022	5:33:23 AM	1.0 hour	50.7
22	3/31/2022	6:33:23 AM	1.0 hour	52.7
23	3/31/2022	7:33:23 AM	1.0 hour	55.1
24	3/31/2022	8:33:23 AM	1.0 hour	55.1
25	3/31/2022	9:33:23 AM	1.0 hour	55.1
26	3/31/2022	10:33:23 AM	1.0 hour	54.8

LT-3 Time History

		Rec 1 to 27	Slow Response	A-Weighted
Number	Date	Time (hh:mm:ss)	LeqPeriod	Leq
1	3/30/2022	9:52:48 AM	1.0 hour	60.9
2	3/30/2022	10:52:48 AM	1.0 hour	53.9
3	3/30/2022	11:52:48 AM	1.0 hour	52.9
4	3/30/2022	12:52:48 PM	1.0 hour	54.4
5	3/30/2022	1:52:48 PM	1.0 hour	54
6	3/30/2022	2:52:48 PM	1.0 hour	53.9
7	3/30/2022	3:52:48 PM	1.0 hour	52.5
8	3/30/2022	4:52:48 PM	1.0 hour	55.3
9	3/30/2022	5:52:48 PM	1.0 hour	56.2
10	3/30/2022	6:52:48 PM	1.0 hour	50.4
11	3/30/2022	7:52:48 PM	1.0 hour	48.9
12	3/30/2022	8:52:48 PM	1.0 hour	48.5
13	3/30/2022	9:52:48 PM	1.0 hour	47.8
14	3/30/2022	10:52:48 PM	1.0 hour	47.1
15	3/30/2022	11:52:48 PM	1.0 hour	47.6
16	3/31/2022	12:52:48 AM	1.0 hour	48.3
17	3/31/2022	1:52:48 AM	1.0 hour	48.7
18	3/31/2022	2:52:48 AM	1.0 hour	48.9
19	3/31/2022	3:52:48 AM	1.0 hour	51.7
20	3/31/2022	4:52:48 AM	1.0 hour	52.3
21	3/31/2022	5:52:48 AM	1.0 hour	51.4
22	3/31/2022	6:52:48 AM	1.0 hour	50.6
23	3/31/2022	7:52:48 AM	1.0 hour	50.5
24	3/31/2022	8:52:48 AM	1.0 hour	47.1
25	3/31/2022	9:52:48 AM	1.0 hour	47.2
26	3/31/2022	10:52:48 AM	1.0 hour	51.1
27	3/31/2022	11:52:48 AM	21.6 min	66.8

LT-4 Time History

Number	Start Date	Start Time	End Time	Duration	Meas Mode	Input Range	Input Type	Sensitivity	LAeq
1	3/30/2022	9:05:51 AM	10:00:00 AM	0:54:09	Auto	Low	Mic	13.67mV/Pa	67
2	3/30/2022	10:00:02 AM	11:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	52.2
3	3/30/2022	11:00:02 AM	12:00:00 PM	0:59:58	Auto	Low	Mic	13.67mV/Pa	51.3
4	3/30/2022	12:00:02 PM	1:00:00 PM	0:59:58	Auto	Low	Mic	13.67mV/Pa	53.4
5	3/30/2022	1:00:02 PM	2:00:00 PM	0:59:58	Auto	Low	Mic	13.67mV/Pa	52.4
6	3/30/2022	2:00:02 PM	3:00:00 PM	0:59:58	Auto	Low	Mic	13.67mV/Pa	52.4
7	3/30/2022	3:00:02 PM	4:00:00 PM	0:59:58	Auto	Low	Mic	13.67mV/Pa	51.9
8	3/30/2022	4:00:02 PM	5:00:00 PM	0:59:58	Auto	Low	Mic	13.67mV/Pa	52
9	3/30/2022	5:00:02 PM	6:00:00 PM	0:59:58	Auto	Low	Mic	13.67mV/Pa	54
10	3/30/2022	6:00:02 PM	7:00:00 PM	0:59:58	Auto	Low	Mic	13.67mV/Pa	53.4
11	3/30/2022	7:00:02 PM	8:00:00 PM	0:59:58	Auto	Low	Mic	13.67mV/Pa	52.9
12	3/30/2022	8:00:02 PM	9:00:00 PM	0:59:58	Auto	Low	Mic	13.67mV/Pa	52.3
13	3/30/2022	9:00:02 PM	10:00:00 PM	0:59:58	Auto	Low	Mic	13.67mV/Pa	51.3
14	3/30/2022	10:00:02 PM	11:00:00 PM	0:59:58	Auto	Low	Mic	13.67mV/Pa	50.6
15	3/30/2022	11:00:02 PM	12:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	49.2
16	3/31/2022	12:00:02 AM	1:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	48.8
17	3/31/2022	1:00:02 AM	2:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	49.1
18	3/31/2022	2:00:02 AM	3:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	49.4
19	3/31/2022	3:00:02 AM	4:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	50.3
20	3/31/2022	4:00:02 AM	5:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	53.2
21	3/31/2022	5:00:02 AM	6:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	54.1
22	3/31/2022	6:00:02 AM	7:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	53.6
23	3/31/2022	7:00:02 AM	8:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	52.8
24	3/31/2022	8:00:02 AM	9:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	51.3
25	3/31/2022	9:00:02 AM	10:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	48.3
26	3/31/2022	10:00:02 AM	11:00:00 AM	0:59:58	Auto	Low	Mic	13.67mV/Pa	49
27	3/31/2022	11:00:02 AM	11:55:00 AM	0:54:58	Auto	Low	Mic	13.67mV/Pa	63.8

LT-5 Time History

Number	Start Date	Start Time	End Time	Duration	Meas Mode	Input Range	Input Type	Sensitivity	LAeq
1	3/30/2022	10:54:11 AM	11:00:00 AM	0:05:49	Auto	High	Mic	17.82mV/Pa	66.9
2	3/30/2022	11:00:02 AM	12:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	57.2
3	3/30/2022	12:00:02 PM	1:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	56.6
4	3/30/2022	1:00:02 PM	2:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	56.8
5	3/30/2022	2:00:02 PM	3:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	55.3
6	3/30/2022	3:00:02 PM	4:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	52.5
7	3/30/2022	4:00:02 PM	5:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	53.7
8	3/30/2022	5:00:02 PM	6:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	56.1
9	3/30/2022	6:00:02 PM	7:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	54.9
10	3/30/2022	7:00:02 PM	8:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	47.9
11	3/30/2022	8:00:02 PM	9:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	41.9
12	3/30/2022	9:00:02 PM	10:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	43.4
13	3/30/2022	10:00:02 PM	11:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	43.6
14	3/30/2022	11:00:02 PM	12:00:00 AM	0:59:58	Auto	High	Mic	17.82mV/Pa	42.7
15	3/31/2022	12:00:02 AM	1:00:00 AM	0:59:58	Auto	High	Mic	17.82mV/Pa	45.4
16	3/31/2022	1:00:02 AM	2:00:00 AM	0:59:58	Auto	High	Mic	17.82mV/Pa	48.6
17	3/31/2022	2:00:02 AM	3:00:00 AM	0:59:58	Auto	High	Mic	17.82mV/Pa	46.4
18	3/31/2022	3:00:02 AM	4:00:00 AM	0:59:58	Auto	High	Mic	17.82mV/Pa	45.7
19	3/31/2022	4:00:02 AM	5:00:00 AM	0:59:58	Auto	High	Mic	17.82mV/Pa	49.7
20	3/31/2022	5:00:02 AM	6:00:00 AM	0:59:58	Auto	High	Mic	17.82mV/Pa	49.5
21	3/31/2022	6:00:02 AM	7:00:00 AM	0:59:58	Auto	High	Mic	17.82mV/Pa	46.8
22	3/31/2022	7:00:02 AM	8:00:00 AM	0:59:58	Auto	High	Mic	17.82mV/Pa	43.8
23	3/31/2022	8:00:02 AM	9:00:00 AM	0:59:58	Auto	High	Mic	17.82mV/Pa	45.5
24	3/31/2022	9:00:02 AM	10:00:00 AM	0:59:58	Auto	High	Mic	17.82mV/Pa	45.1
25	3/31/2022	10:00:02 AM	11:00:00 AM	0:59:58	Auto	High	Mic	17.82mV/Pa	42.6
26	3/31/2022	11:00:02 AM	12:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	43.3
27	3/31/2022	12:00:02 PM	1:00:00 PM	0:59:58	Auto	High	Mic	17.82mV/Pa	52
28	3/31/2022	1:00:00 PM	1:01:35 PM	0:01:35	Auto	High	Mic	17.82mV/Pa	70.5
29	3/31/2022	1:01:38 PM	1:01:42 PM	0:00:04	Auto	High	Mic	17.82mV/Pa	66.2

LT-6 Time History

Number	Start Date	Start Time	End Time	Duration	Meas Mode	Input Range	Input Type	Sensitivity	LAeq
1	3/30/2022	10:30:40 AM	11:00:00 AM	0:29:20	Auto	High	Mic	17.21mV/Pa	66.2
2	3/30/2022	11:00:02 AM	12:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	61.9
3	3/30/2022	12:00:02 PM	1:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	67.5
4	3/30/2022	1:00:02 PM	2:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	68
5	3/30/2022	2:00:02 PM	3:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	64.8
6	3/30/2022	3:00:02 PM	4:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	60.9
7	3/30/2022	4:00:02 PM	5:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	61.7
8	3/30/2022	5:00:02 PM	6:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	66.7
9	3/30/2022	6:00:02 PM	7:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	68
10	3/30/2022	7:00:02 PM	8:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	57.6
11	3/30/2022	8:00:02 PM	9:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	47.4
12	3/30/2022	9:00:02 PM	10:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	52.6
13	3/30/2022	10:00:02 PM	11:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	53
14	3/30/2022	11:00:02 PM	12:00:00 AM	0:59:58	Auto	High	Mic	17.21mV/Pa	47.6
15	3/31/2022	12:00:02 AM	1:00:00 AM	0:59:58	Auto	High	Mic	17.21mV/Pa	54
16	3/31/2022	1:00:02 AM	2:00:00 AM	0:59:58	Auto	High	Mic	17.21mV/Pa	57.2
17	3/31/2022	2:00:02 AM	3:00:00 AM	0:59:58	Auto	High	Mic	17.21mV/Pa	56.2
18	3/31/2022	3:00:02 AM	4:00:00 AM	0:59:58	Auto	High	Mic	17.21mV/Pa	52.1
19	3/31/2022	4:00:02 AM	5:00:00 AM	0:59:58	Auto	High	Mic	17.21mV/Pa	51.5
20	3/31/2022	5:00:02 AM	6:00:00 AM	0:59:58	Auto	High	Mic	17.21mV/Pa	52.7
21	3/31/2022	6:00:02 AM	7:00:00 AM	0:59:58	Auto	High	Mic	17.21mV/Pa	54.4
22	3/31/2022	7:00:02 AM	8:00:00 AM	0:59:58	Auto	High	Mic	17.21mV/Pa	56.6
23	3/31/2022	8:00:02 AM	9:00:00 AM	0:59:58	Auto	High	Mic	17.21mV/Pa	58.7
24	3/31/2022	9:00:02 AM	10:00:00 AM	0:59:58	Auto	High	Mic	17.21mV/Pa	58.7
25	3/31/2022	10:00:02 AM	11:00:00 AM	0:59:58	Auto	High	Mic	17.21mV/Pa	56.5
26	3/31/2022	11:00:02 AM	12:00:00 PM	0:59:58	Auto	High	Mic	17.21mV/Pa	56.3
27	3/31/2022	12:00:01 PM	12:44:51 PM	0:44:50	Auto	High	Mic	17.21mV/Pa	63.7

Short Term Measurement Data

ST-1 Summary

File Name on Meter	831_Data.036.s
File Name on PC	831_0003785-20220331 111500-831_Data.036.ldbin
Serial Number	0003785
Model	Model 831
Firmware Version	2.403
User	
Location	
Job Description	
Note	

Measurement

Description	
Start	2022-03-31 11:15:00
Stop	2022-03-31 11:35:00
Duration	00:20:00.0
Run Time	00:20:00.0
Pause	00:00:00.0
Pre-Calibration	2022-03-31 11:11:59
Post-Calibration	None
Calibration Deviation	---

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRM831
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	A Weighting
OBA Max Spectrum	Bin Max
Gain	20.0 dB
Overload	125.0 dB

	A	C	Z
Under Range Peak	**57.6**	54.6	59.6 dB
Under Range Limit	**24.8**	25.6	33.6 dB
Noise Floor	15.7	16.5	21.8 dB

Results

L_{Aeq}	44.1	
LAE	74.9	
EA	3.464	µPa²h
$L_{Apeak\ (max)}$	2022-03-31 11:20:33	78.3 dB
L_{ASmax}	2022-03-31 11:33:01	58.4 dB
L_{ASmin}	2022-03-31 11:16:01	35.8 dB
SEA	-99.9	dB
LAS > 65.0 dB (Exceedance Counts / Duration)	0	0.0 s
LAS > 85.0 dB (Exceedance Counts / Duration)	0	0.0 s
L_{Apeak} > 135.0 dB (Exceedance Counts / Duration)	0	0.0 s
L_{Apeak} > 137.0 dB (Exceedance Counts / Duration)	0	0.0 s
L_{Apeak} > 140.0 dB (Exceedance Counts / Duration)	0	0.0 s

Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**	**LDay 07:00-19:00**	**LEvening 19:00-22:00**
	44.1	44.1	-99.9	44.1	44.1	-99.9

L_{Ceq}	57.2	dB
L_{Aeq}	44.1	dB
L_{Ceq} - L_{Aeq}	13.0	dB
L_{AIeq}	47.1	dB
L_{Aeq}	44.1	dB
L_{AIeq} - L_{Aeq}	2.9	dB

	A		C		Z	
	dB	**Time Stamp**	**dB**	**Time Stamp**	**dB**	**Time Stamp**
L_{eq}	44.1		57.2		66.0	
$L_{S(max)}$	58.4	2022/03/31 11:33:01	68.6	2022/03/31 11:33:19	85.3	2022/03/31 11:28:01
$L_{F(max)}$	62.1	2022/03/31 11:33:01	70.5	2022/03/31 11:28:00	87.8	2022/03/31 11:27:59
$L_{I(max)}$	62.9	2022/03/31 11:33:01	73.4	2022/03/31 11:28:00	90.9	2022/03/31 11:28:00
$L_{S(min)}$	35.8	2022/03/31 11:16:01	52.0	2022/03/31 11:19:30	57.0	2022/03/31 11:16:49
$L_{F(min)}$	32.8	2022/03/31 11:16:01	50.1	2022/03/31 11:23:57	54.6	2022/03/31 11:16:48
$L_{I(min)}$	36.8	2022/03/31 11:19:39	52.9	2022/03/31 11:20:57	58.7	2022/03/31 11:16:46
$L_{Peak(max)}$	78.3	2022/03/31 11:20:33	79.2	2022/03/31 11:33:19	93.8	2022/03/31 11:28:00

Overload Count	0	
Overload Duration	0.0	s
OBA Overload Count	0	
OBA Overload Duration	0.0	s

Statistics

LA1.00	53.1	dB
LA10.00	46.0	dB
LA33.00	43.6	dB
LA50.00	42.6	dB
LA90.00	39.4	dB
LA99.00	37.5	dB

ST-2 Summary

File Name on Meter	831_Data.035.s
File Name on PC	831_0003785-20220331 104200-831_Data.035.ldbin
Serial Number	0003785
Model	Model 831
Firmware Version	2.403
User	
Location	
Job Description	
Note	

Measurement

Description	
Start	2022-03-31 10:42:00
Stop	2022-03-31 11:02:00
Duration	00:20:00.0
Run Time	00:20:00.0
Pause	00:00:00.0
Pre-Calibration	2022-03-31 10:39:51
Post-Calibration	None
Calibration Deviation	---

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRM831
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	A Weighting
OBA Max Spectrum	Bin Max
Gain	20.0 dB
Overload	125.0 dB

	A	C	Z
Under Range Peak	**57.6**	54.6	59.6 dB
Under Range Limit	**24.8**	25.6	33.6 dB
Noise Floor	15.7	16.5	21.8 dB

Results

L_{Aeq}	57.1	
LAE	87.9	
EA	68.371 µPa²h	
$L_{Apeak\ (max)}$	2022-03-31 10:58:08	84.7 dB
L_{ASmax}	2022-03-31 10:58:08	69.6 dB
L_{ASmin}	2022-03-31 10:46:16	41.8 dB
SEA	-99.9 dB	
LAS > 65.0 dB (Exceedance Counts / Duration)	14	41.5 s
LAS > 85.0 dB (Exceedance Counts / Duration)	0	0.0 s
L_{Apeak} > 135.0 dB (Exceedance Counts / Duration)	0	0.0 s
L_{Apeak} > 137.0 dB (Exceedance Counts / Duration)	0	0.0 s
L_{Apeak} > 140.0 dB (Exceedance Counts / Duration)	0	0.0 s

Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**	**LDay 07:00-19:00**	**LEvening 19:00-22:00**
	57.1	57.1	-99.9	57.1	57.1	-99.9

L_{Ceq}	68.3 dB	
L_{Aeq}	57.1 dB	
L_{Ceq} - L_{Aeq}	11.2 dB	
L_{AIeq}	58.9 dB	
L_{Aeq}	57.1 dB	
L_{AIeq} - L_{Aeq}	1.8 dB	

	A		C		Z	
	dB	**Time Stamp**	**dB**	**Time Stamp**	**dB**	**Time Stamp**
L_{eq}	57.1		68.3		71.0	
$L_{S(max)}$	69.6	2022/03/31 10:58:08	79.6	2022/03/31 10:58:40	82.9	2022/03/31 10:44:29
$L_{F(max)}$	73.1	2022/03/31 10:58:08	82.0	2022/03/31 10:44:29	85.3	2022/03/31 10:44:29
$L_{I(max)}$	74.5	2022/03/31 10:53:27	84.1	2022/03/31 10:44:29	86.8	2022/03/31 10:44:29
$L_{S(min)}$	41.8	2022/03/31 10:46:16	55.8	2022/03/31 10:51:17	61.4	2022/03/31 10:51:25
$L_{F(min)}$	40.7	2022/03/31 10:51:23	54.0	2022/03/31 10:51:17	59.2	2022/03/31 10:51:23
$L_{I(min)}$	41.2	2022/03/31 10:51:24	56.6	2022/03/31 10:51:17	62.9	2022/03/31 10:47:40
$L_{Peak(max)}$	84.7	2022/03/31 10:58:08	93.1	2022/03/31 10:58:08	93.2	2022/03/31 10:44:27

Overload Count	0
Overload Duration	0.0 s
OBA Overload Count	0
OBA Overload Duration	0.0 s

Statistics

LA1.00	65.8 dB
LA10.00	60.4 dB
LA33.00	56.6 dB
LA50.00	54.5 dB
LA90.00	48.3 dB
LA99.00	43.0 dB

ST-3 Summary

File Name on Meter	831_Data.033.s
File Name on PC	831_0003785-20220331 092300-831_Data.033.ldbin
Serial Number	0003785
Model	Model 831
Firmware Version	2.403
User	
Location	
Job Description	
Note	

Measurement

Description	
Start	2022-03-31 09:23:00
Stop	2022-03-31 09:43:00
Duration	00:20:00.0
Run Time	00:20:00.0
Pause	00:00:00.0
Pre-Calibration	2022-03-31 09:19:15
Post-Calibration	None
Calibration Deviation	---

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRM831
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	A Weighting
OBA Max Spectrum	Bin Max
Gain	20.0 dB
Overload	125.0 dB

	A	C	Z
Under Range Peak	**57.6**	54.6	59.6 dB
Under Range Limit	**24.8**	25.6	33.6 dB
Noise Floor	15.7	16.5	21.8 dB

Results

L_{Aeq}	39.8	
LAE	70.6	
EA	1.282	µPa²h
$L_{Apeak\ (max)}$	2022-03-31 09:23:02	86.8 dB
L_{ASmax}	2022-03-31 09:23:02	52.8 dB
L_{ASmin}	2022-03-31 09:35:15	33.5 dB
SEA	-99.9	dB
LAS > 65.0 dB (Exceedance Counts / Duration)	0	0.0 s
LAS > 85.0 dB (Exceedance Counts / Duration)	0	0.0 s
L_{Apeak} > 135.0 dB (Exceedance Counts / Duration)	0	0.0 s
L_{Apeak} > 137.0 dB (Exceedance Counts / Duration)	0	0.0 s
L_{Apeak} > 140.0 dB (Exceedance Counts / Duration)	0	0.0 s

Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**	**LDay 07:00-19:00**	**LEvening 19:00-22:00**
	39.8	39.8	-99.9	39.8	39.8	-99.9

L_{Ceq}	53.8	dB
L_{Aeq}	39.8	dB
L_{Ceq} - L_{Aeq}	14.0	dB
L_{ALeq}	45.1	dB
L_{Aeq}	39.8	dB
L_{ALeq} - L_{Aeq}	5.3	dB

	A		C		Z	
	dB	**Time Stamp**	**dB**	**Time Stamp**	**dB**	**Time Stamp**
L_{eq}	39.8		53.8		71.7	
$L_{S(max)}$	52.8	2022/03/31 9:23:02	64.4	2022/03/31 9:26:42	83.2	2022/03/31 9:29:04
$L_{F(max)}$	61.0	2022/03/31 9:23:02	68.5	2022/03/31 9:31:29	88.8	2022/03/31 9:29:03
$L_{I(max)}$	66.4	2022/03/31 9:23:02	71.4	2022/03/31 9:31:29	91.1	2022/03/31 9:29:03
$L_{S(min)}$	33.5	2022/03/31 9:35:15	46.1	2022/03/31 9:30:19	54.5	2022/03/31 9:42:47
$L_{F(min)}$	31.7	2022/03/31 9:30:14	44.1	2022/03/31 9:30:18	50.9	2022/03/31 9:36:32
$L_{I(min)}$	33.7	2022/03/31 9:25:01	46.9	2022/03/31 9:34:57	56.3	2022/03/31 9:42:56
$L_{Peak(max)}$	86.8	2022/03/31 9:23:02	87.1	2022/03/31 9:23:02	92.3	2022/03/31 9:29:03

Overload Count	0	
Overload Duration	0.0	s
OBA Overload Count	0	
OBA Overload Duration	0.0	s

Statistics

LA1.00	48.2	dB
LA10.00	42.6	dB
LA33.00	38.9	dB
LA50.00	37.8	dB
LA90.00	35.5	dB
LA99.00	34.3	dB

ST-4 Summary

File Name on Meter	831_Data.034.s
File Name on PC	831_0003785-20220331 100600-831_Data.034.ldbin
Serial Number	0003785
Model	Model 831
Firmware Version	2.403
User	
Location	
Job Description	
Note	

Measurement

Description	
Start	2022-03-31 10:06:00
Stop	2022-03-31 10:26:00
Duration	00:20:00.0
Run Time	00:20:00.0
Pause	00:00:00.0
Pre-Calibration	2022-03-31 10:01:52
Post-Calibration	None
Calibration Deviation	---

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRM831
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	A Weighting
OBA Max Spectrum	Bin Max
Gain	20.0 dB
Overload	125.1 dB

	A	C	Z
Under Range Peak	**57.6**	54.6	59.6 dB
Under Range Limit	**24.8**	25.6	33.6 dB
Noise Floor	15.7	16.5	21.9 dB

Results

L_{Aeq}	44.6
LAE	75.4
EA	3.881 µPa²h
$LA_{peak\ (max)}$	2022-03-31 10:09:59 87.1 dB
LAS_{max}	2022-03-31 10:25:02 59.4 dB
LAS_{min}	2022-03-31 10:18:25 35.8 dB
SEA	-99.9 dB
LAS > 65.0 dB (Exceedance Counts / Duration)	0 0.0 s
LAS > 85.0 dB (Exceedance Counts / Duration)	0 0.0 s
LA_{peak} > 135.0 dB (Exceedance Counts / Duration)	0 0.0 s
LA_{peak} > 137.0 dB (Exceedance Counts / Duration)	0 0.0 s
LA_{peak} > 140.0 dB (Exceedance Counts / Duration)	0 0.0 s

Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**	**LDay 07:00-19:00**	**LEvening 19:00-22:00**
	44.6	44.6	-99.9	44.6	44.6	-99.9

L_{Ceq}	61.0 dB
L_{Aeq}	44.6 dB
L_{Ceq} - L_{Aeq}	16.3 dB
L_{Aleq}	47.2 dB
L_{Aeq}	44.6 dB
L_{Aleq} - L_{Aeq}	2.6 dB

	A		C		Z	
	dB	**Time Stamp**	**dB**	**Time Stamp**	**dB**	**Time Stamp**
L_{eq}	44.6		61.0		70.0	
$L_{S(max)}$	59.4	2022/03/31 10:25:02	76.3	2022/03/31 10:16:30	82.5	2022/03/31 10:16:30
$L_{F(max)}$	63.7	2022/03/31 10:09:59	80.4	2022/03/31 10:16:30	87.6	2022/03/31 10:21:00
$L_{I(max)}$	68.9	2022/03/31 10:09:59	82.5	2022/03/31 10:16:29	89.8	2022/03/31 10:16:29
$L_{S(min)}$	35.8	2022/03/31 10:18:25	52.3	2022/03/31 10:20:20	58.6	2022/03/31 10:19:11
$L_{F(min)}$	35.0	2022/03/31 10:18:23	50.6	2022/03/31 10:20:18	55.0	2022/03/31 10:19:04
$L_{I(min)}$	35.4	2022/03/31 10:18:23	53.4	2022/03/31 10:20:20	59.6	2022/03/31 10:19:58
$L_{Peak(max)}$	87.1	2022/03/31 10:09:59	89.4	2022/03/31 10:16:29	95.0	2022/03/31 10:16:29

Overload Count	0
Overload Duration	0.0 s
OBA Overload Count	0
OBA Overload Duration	0.0 s

Statistics

LA1.00	55.0 dB
LA10.00	47.4 dB
LA33.00	42.6 dB
LA50.00	41.2 dB
LA90.00	38.3 dB
LA99.00	36.5 dB

Field Sheets

Day 2

NOISE MEASUREMENT SITE INFORMATION SHEET

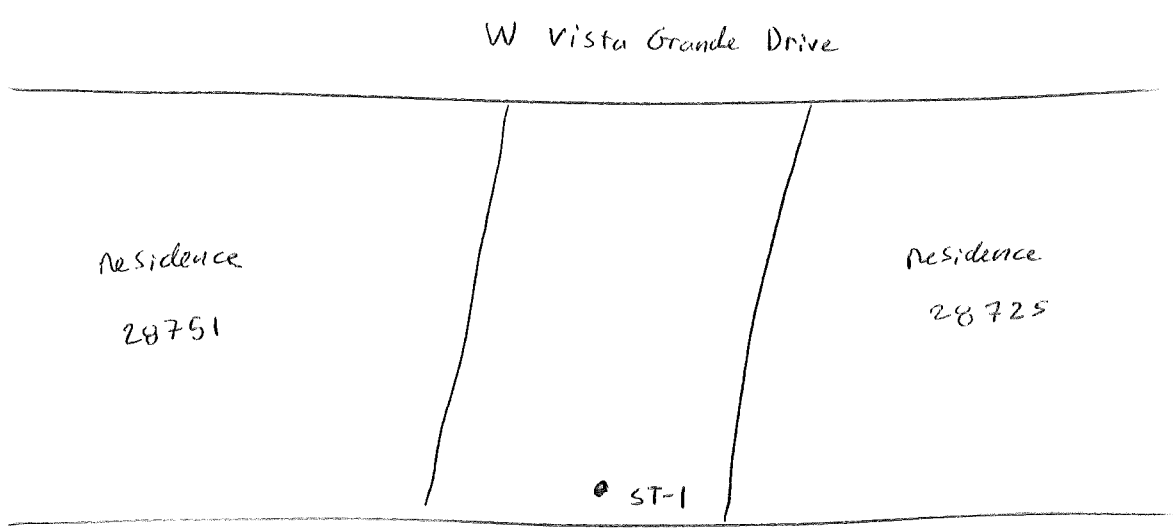
PROJECT NAME: Las Camas Solar Field Project PROJECT #:

SITE NUMBER: ST 1 DATE/TIME: 03/31/2022 10:42am

LOCATION/ADDRESS: 28725 Vista Grande Dr. ENGINEERS: Noah Schumaker, Zachary Cornejo

SITE SKETCH: Show microphone location, nearby residences/buildings, potential reflective surfaces, project roadways, local roadways, driveways, ground type, trees. Indicate reference distances between objects, arrows showing wind direction, North, and camera locations/directions. Describe the line-of-sight and topography/elevation changes relative to noise sources.

See Previous sheet.



WEATHER DATA: (temperature, wind speed/direction, sky conditions, relative humidity)

68.0°F, 1.2 mph from NW, Partly cloudy, 64.6% humidity

EQUIPMENT DATA: (sound level meter, microphone, preamp, calibrator, factory cal. date)

File - Data. 036 LD 831

ESTIMATED CONSTRUCTION DATE OF RESIDENCES: (Pre-1978, or new construction) N/A

POSTED SPEED: N/A COMMENTS:

TRAFFIC COUNTS:

Roadway/Direction	Autos	Medium	Heavy		Speed	Start Time	Duration

NOISE MEASUREMENT LOG SHEET (20)

Day 2

PROJECT NAME: Las Cumes Solar
PROJECT #:
SITE NUMBER: ST-1
DATE/TIME: 2022 03 31 11:15am
LOCATION/ADDRESS: 28725 Vista Grande Drive
ENGINEERS: Schumacher / Cornejo

#	Minute Starting	Measured Leq (dBA)	O or X	Autos	Medium Trucks	Heavy Trucks	Other Noise Sources/Comments (include SLM equipment, Calibration Data)
1	11:15						Maximum wind speed: 4.0 mph
2	16						0.8 mph loons
3	17						1.5 mph Bird calling (crow?) Loon
4	18						0.8 mph small birds in are
5	19						1.9 mph
6	20						1.5 mph Plane overhead high in sky
7	21						0.9 mph more plane.
8	22						1.3 mph plane further away
9	23						1.1 mph
10	24						0.6 mph
11	25						1.4 mph uptick in traffic noise from highway.
12	26						1.9 mph
13	27						4.6 mph
14	28						2.8 mph
15	29						2.2 mph loons
16	30						2.4 mph loons
17	31						4.2 mph
18	32				distant plane moves overhead.		1.8 mph
19	33				plane overhead still plane further away.		2.9 mph
20	34				2nd distant plane		3.6 mph

Leq	44.1
Lmax	58.4
Lmin	35.8
L10	46.0
L33	43.6
L50	42.6
L90	39.4

Overall Leq (Include "O" minutes, Exclude "X" minutes) = dBA
Subset Leq (Exclude "O" and "X" minutes) = dBA

"O" = other characteristic sources that contributed to the Leq

"X" = exclude from Leq calculation; a non-typical source contaminated the measurement

* Noise sources active throughout measurement:
  - Roosters
  - loons
  - Tweetie Birds
  - Distant highway (SR33) noise.

Day 2

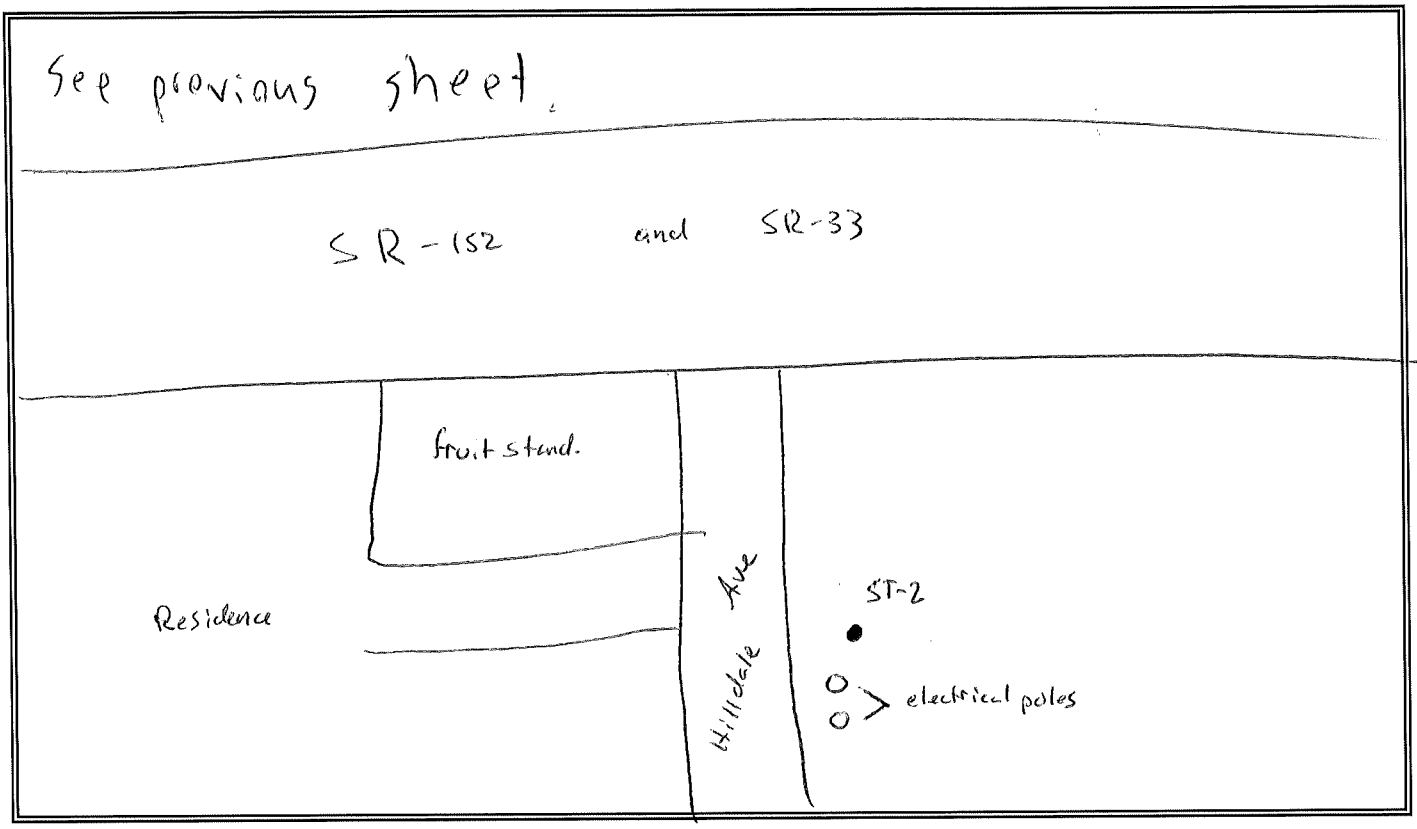
NOISE MEASUREMENT SITE INFORMATION SHEET

PROJECT NAME: Las Camas Solar Field Proj PROJECT #:

SITE NUMBER: ST 2 DATE/TIME: 03/31/2022

LOCATION/ADDRESS: Hilldale Rd and CA-152/SR33 ENGINEERS: Noah Schumaker, Zachary Cornejo

SITE SKETCH: Show microphone location, nearby residences/buildings, potential reflective surfaces, project roadways, local roadways, driveways, ground type, trees. Indicate reference distances between objects, arrows showing wind direction, North, and camera locations/directions. Describe the line-of-sight and topography/elevation changes relative to noise sources.



WEATHER DATA: (temperature, wind speed/direction, sky conditions, relative humidity)

68.7°F, 1.0 mph from NW, Partly cloudy, 73.4% humidity

EQUIPMENT DATA: (sound level meter, microphone, preamp, calibrator, factory cal. date)

File - Data.035 LD 831

ESTIMATED CONSTRUCTION DATE OF RESIDENCES: (Pre-1978, or new construction) NA

POSTED SPEED: 25 mph COMMENTS:

TRAFFIC COUNTS:

Roadway/Direction	Autos	Medium	Heavy		Speed	Start Time	Duration

Day 2

NOISE MEASUREMENT LOG SHEET (20)

PROJECT NAME: Las Camas Solar
PROJECT #:
SITE NUMBER: ST-2
DATE/TIME: 20220331 10:42 AM
LOCATION/ADDRESS: Hilldale Road and SR-152/SR-33
ENGINEERS: Schumacher / Cornejo

#	Minute Starting	Measured Leq (dBA)	O or X	Autos	Medium Trucks	Heavy Trucks	Other Noise Sources/Comments (include SLM equipment, Calibration Data)
1	10:42						Maximum Wind Speed: 0.9 mph
2	43						2.7 mph
3	44						1.8 mph
4	45						1.4 mph
5	46						2.6 mph
6	47						1.7 mph clanking of large semi on SR 33 Hawks fighting in air
7	48						1.5 mph
8	49						2.7 mph ~ 10:49:40 - 10:49:45 no traffic on highway.
9	50						2.0 mph
10	51						1.6 mph 2 large Trucks on SR33 (end of minute)
11	52						1.4 mph
12	53						1.6 mph
13	54						3.2 mph
14	55						1.2 mph
15	56				car on hilldale driving towards SR33		0.8 mph
16	57						2.1 mph
17	58			~ 10:58:14	loud pick up on SR33		1.7 mph
18	59						1.5 mph
19	11:00						2.6 mph
20	11:01						3.6 mph

Leq	57.1
Lmax	64.6
Lmin	41.8
L10	60.4
L33	56.6
L50	54.3
L90	48.3

Overall Leq (Include "O" minutes, Exclude "X" minutes) = dBA
Subset Leq (Exclude "O" and "X" minutes) = dBA

* noise sources Active Throughout Measurement:
- SR33 Traffic
- Tweetie Birds

"O" = other characteristic sources that contributed to the Leq

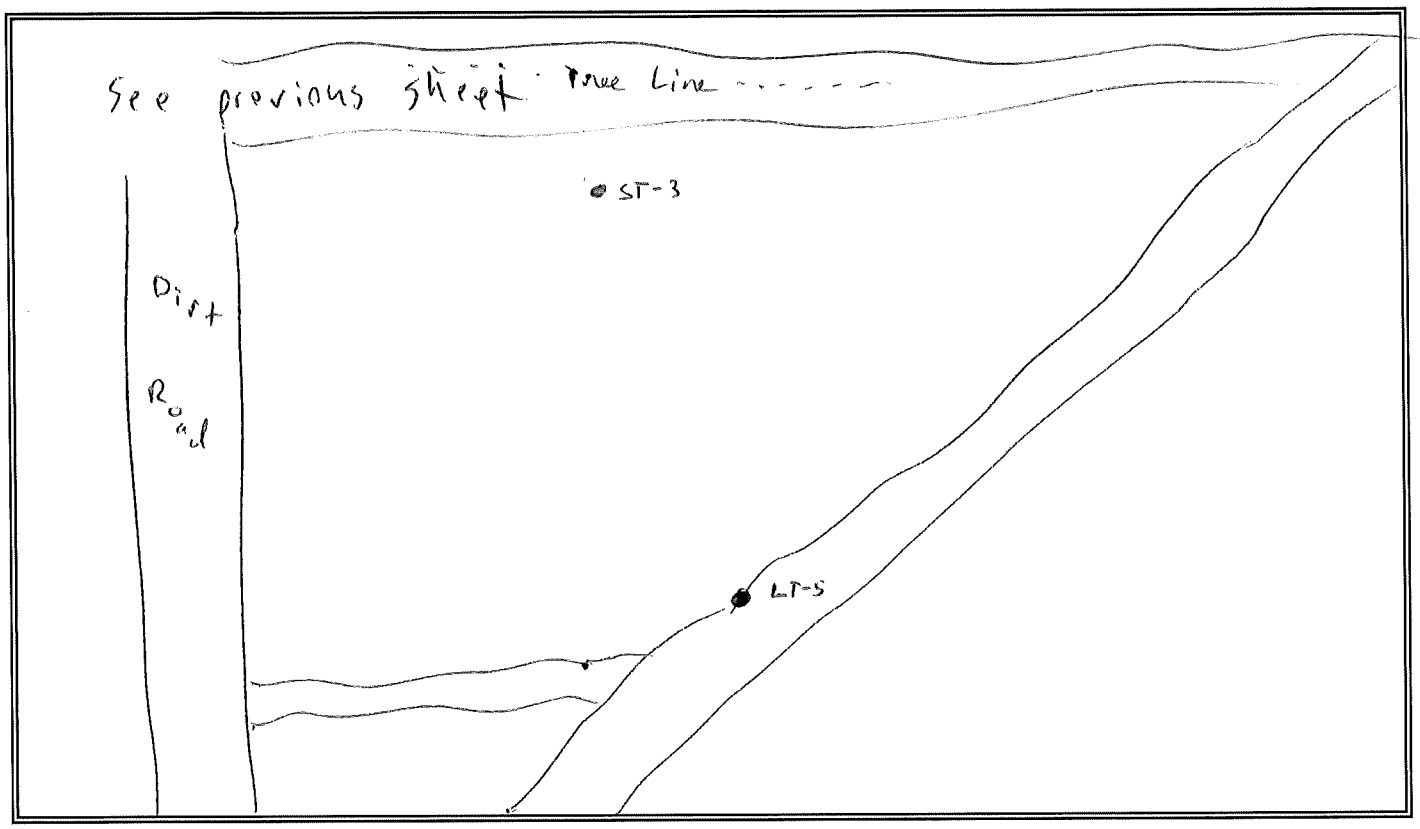
"X" = exclude from Leq calculation; a non-typical source contaminated the measurement

Day 2

NOISE MEASUREMENT SITE INFORMATION SHEET

PROJECT NAME: La Cumbre Solar Field Project
PROJECT #:
SITE NUMBER: ST3
DATE/TIME: 03/31/2022
LOCATION/ADDRESS: ~ 37.040821, -120.9884879
ENGINEERS: Noah Schumaker, Zachary Cornejo

SITE SKETCH: Show microphone location, nearby residences/buildings, potential reflective surfaces, project roadways, local roadways, driveways, ground type, trees. Indicate reference distances between objects, arrows showing wind direction, North, and camera locations/directions. Describe the line-of-sight and topography/elevation changes relative to noise sources.



WEATHER DATA: (temperature, wind speed/direction, sky conditions, relative humidity)

63.2°F, 3.1 mph from NW, Overcast/partly cloudy, 66.6% humidity

EQUIPMENT DATA: (sound level meter, microphone, preamp, calibrator, factory cal. date)

File - Data. 033 LD 831

ESTIMATED CONSTRUCTION DATE OF RESIDENCES: (Pre-1978, or new construction) N/A

POSTED SPEED: N/A COMMENTS:

TRAFFIC COUNTS:

Roadway/Direction	Autos	Medium	Heavy		Speed	Start Time	Duration

NOISE MEASUREMENT LOG SHEET (20)

Day 2

PROJECT NAME: Las Camas Solar
PROJECT #:
SITE NUMBER: ST-3
DATE/TIME: 2022 03 31 9:23 AM
LOCATION/ADDRESS: N 37.040 8217, -120.988 4878
ENGINEERS: Schumacher / Cornejo

#	Minute Starting	Measured Leq (dBA)	O or X	Autos	Medium Trucks	Heavy Trucks	Other Noise Sources/Comments (include SLM equipment, Calibration Data)
1	9:23						Maximum wind speed: 4.8 mph
2	24						5.1 mph loon hoots Distant Backup Beeps
3	25						5.9 mph Two birds call to each other while landing in tree
4	26						4.6 mph plane overhead
5	27						5.8 mph plane far away distant Backup Beeps
6	28						7.1 mph Back up Beeps distant Loon
7	29						3.4 mph Loon calls Loon calls more
8	30						6.1 mph loons Crow calls 8 times
9	31						6.3 mph loons
10	32						6.1 mph loon Bird Squawk
11	33						5.4 mph Bang/clank? distant Screech? Short duration.
12	34						3.9 mph Bang -> distant loons
13	35				faint highway noise		3.7 mph
14	36				Birds call to eachother while flying		2.1 mph
15	37				loons further away		5.1 mph
16	38						6.2 mph
17	39						5.9 mph
18	40				loons (end of minute)		3.4 mph
19	41				LOONS!		4.1 mph
20	42				more loons		3.3 mph

Leq	39.8
Lmax	52.8
Lmin	33.5
L10	42.6
L33	38.9
L50	37.8
L90	35.5

Overall Leq (Include "O" minutes, Exclude "X" minutes) = dBA
Subset Leq (Exclude "O" and "X" minutes) = dBA

* noise sources Active throughout Measurement:
- Crickets
- Tweetie Birds

"O" = other characteristic sources that contributed to the Leq

"X" = exclude from Leq calculation; a non-typical source contaminated the measurement

Day 2

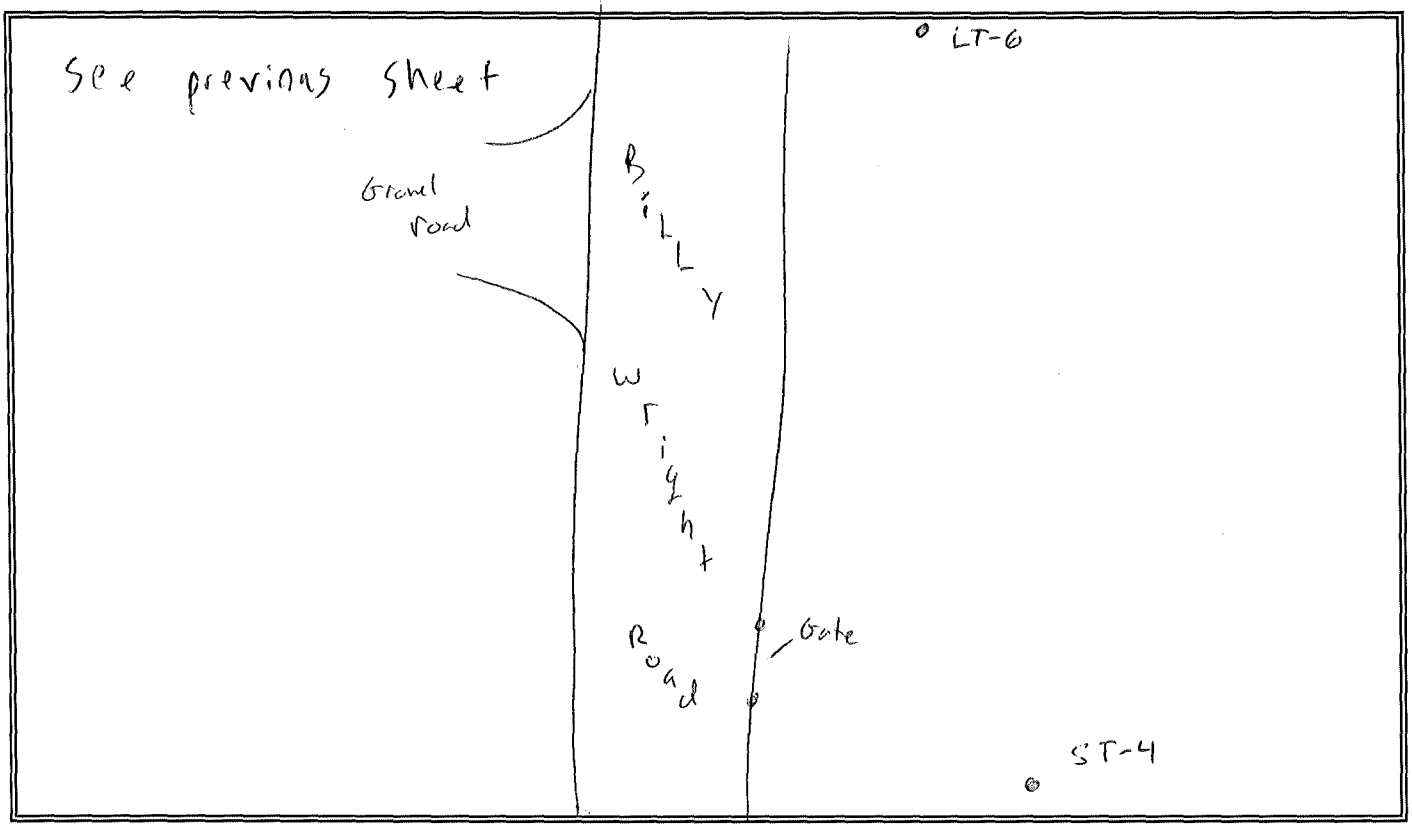
NOISE MEASUREMENT SITE INFORMATION SHEET

PROJECT NAME: Las Cumas Solar Field Project PROJECT #:

SITE NUMBER: ST4 DATE/TIME: 03/31/2022

LOCATION/ADDRESS: N 37.2437852, -120.9641119 ENGINEERS: Noah Schumaker, Zachary Cornejo

SITE SKETCH: Show microphone location, nearby residences/buildings, potential reflective surfaces, project roadways, local roadways, driveways, ground type, trees. Indicate reference distances between objects, arrows showing wind direction, North, and camera locations/directions. Describe the line-of-sight and topography/elevation changes relative to noise sources.



WEATHER DATA: (temperature, wind speed/direction, sky conditions, relative humidity)

64.7°F, 2.5 mph from NW, Overcast, 66.3% humidity

EQUIPMENT DATA: (sound level meter, microphone, preamp, calibrator, factory cal. date)

File - Data.034

ESTIMATED CONSTRUCTION DATE OF RESIDENCES: (Pre-1978, or new construction) N/A

POSTED SPEED: N/A COMMENTS:

TRAFFIC COUNTS:

Roadway/Direction	Autos	Medium	Heavy	Speed	Start Time	Duration

Day 2

NOISE MEASUREMENT LOG SHEET (20)

PROJECT NAME: Los Cerros Solar
PROJECT #:
SITE NUMBER: ST-4
DATE/TIME: 2022 03 31 10:06
LOCATION/ADDRESS: N 37.24378892, -120.96411119
ENGINEERS: Schumacher / Cornejo

#	Minute Starting	Measured Leq (dBA)	O or X	Autos	Medium Trucks	Heavy Trucks	Other Noise Sources/Comments (include SLM equipment, Calibration Data)
1	10:06						Maximum wind Speed: 2.3 mph plane overhead (distant)
2	07						5.4 mph
3	08						4.9 mph
4	09						3.3 mph Truck on Billy Wright
5	10						5.5 mph Truck on Billy Wright → rumbles over bumps
6	11						4.7 mph pickup on Billy Wright
7	12						2.2 mph faint Beckup Beeps (Land fill?)
8	13						6.8 mph plane overhead distant pickup/trailer on Billy Wright
9	14						4.3 mph pickup on BWR
10	15						2.3 mph pickup and Semi on BWR Semi rumbles over Bumps
11	16						4.0 mph
12	17						3.1 mph Distant Hawk calls.
13	18						1.7 mph
14	19				pickup on BWR		3.9 mph
15	20				mini van on BWR		3.5 mph
16	21				Hawks		6.1 mph
17	22				garbage truck on BWR Backup Beeps (distant)		4.2 mph
18	23						4.4 mph
19	24				garbage truck and Semi on BWR		2.4 mph
20	25				Semi continued pickup garbage truck		2.8 mph

Leq	44.6
Lmax	59.1
Lmin	35.8
L10	47.4
L33	42.6
L50	41.2
L90	38.3

Overall Leq (Include "O" minutes, Exclude "X" minutes) = _____ dBA
Subset Leq (Exclude "O" and "X" minutes) = _____ dBA

* noise Sources Active throughout Measurement:
- Steady highway noise
- crickets

"O" = other characteristic sources that contributed to the Leq

"X" = exclude from Leq calculation; a non-typical source contaminated the measurement

Field Photographs

Noise Monitoring Site LT-1
Location: 28950 West Vista Grande Drive



Looking west towards South San Luis Drive.



Standing on West Vista Grande Drive, looking north.



Standing at the corner of South San Luis Drive and West Vista Grande Drive, looking east.

Noise Monitoring Site LT-2
Location: 28751 West Vista Grande Drive



Looking west, SLM attached to a tree south of 28751 West Vista Grande Drive.



Facing northwest, 28751 West Vista Grande Drive ~100 north of SLM.



Facing southwest.

Noise Monitoring Site LT-3
Location: West Vista Grande Court



Looking west, standing on the Project Site.



Facing north, ~100 east of West Vista Grande Court.



Looking east, West Vista Grande Court behind camera.

Noise Monitoring Site LT-4
Location: Oasis West RV Park



Facing west, Oasis West RV Park off camera to the right.



Facing southwest.



Facing northeast, looking over the Project site.

Noise Monitoring Site LT-5
Location: Project site (37.038335°, -120.988913°)



Facing west, ~290 east of the a utility road.



Facing south, tree on the east side of a ditch.



Facing east.

Noise Monitoring Site LT-6
Location: Project site (37.042291°, - 120.965131°)



Facing west, Project site is beyond the SLM.



Facing southwest, Billy Wright Road is ~80 feet from the SLM.



Facing northeast, gravel driveway on opposite side of Billy Wright Road is ~420 feet northeast of SLM.

Noise Monitoring Site ST-1
Location: Empty lot east of 28751 West Vista Grande Drive



Facing northwest, SLM set up on the southern border of the vacant lot.



Facing north, ~280 feet from West Vista Grande Drive.



Facing east.



Facing south, looking over the Project site.

Noise Monitoring Site ST-2

Location: Hilldale Road and SR-33



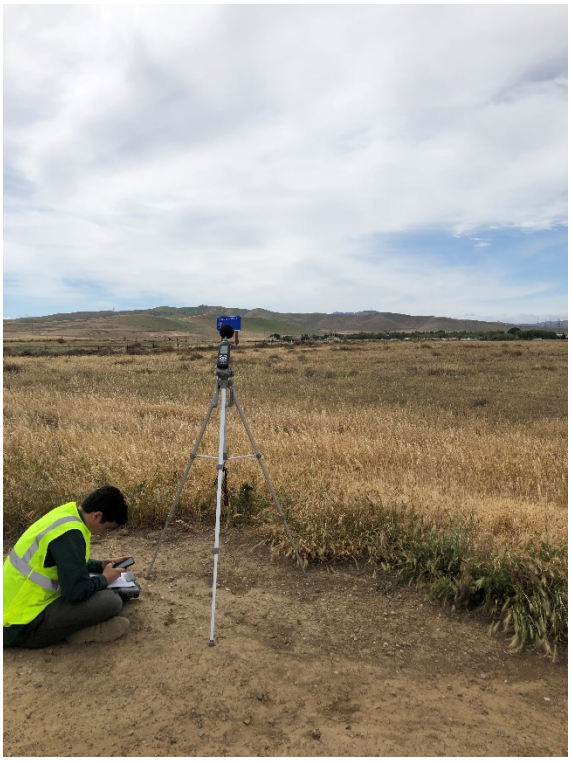
Looking north, SR-22 is behind the camera.



Facing east, Hilldale Road is behind the SLM.



Facing south, SR-33 is approximately 200 feet from the SLM.



Looking southwest, SLM is ~141 from Apricot Hill Fruit Stand.

Noise Monitoring Site ST-3

Location: Project site (37.040848°, -120.988763°)



Looking south, SLM facing west.



Looking east, a row of trees to the left of the SLM is ~80 feet away.



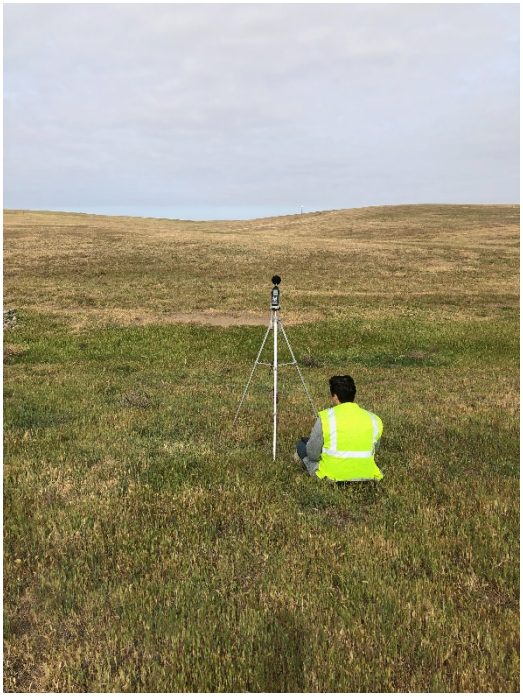
Facing north, the tree pictured has an approximate 80-foot open space to its left before reaching the next tree.



Looking west, utility road is ~320 feet west of the SLM.

Noise Monitoring Site ST-4

Location: Project site (37.044215°, -120.963819°)



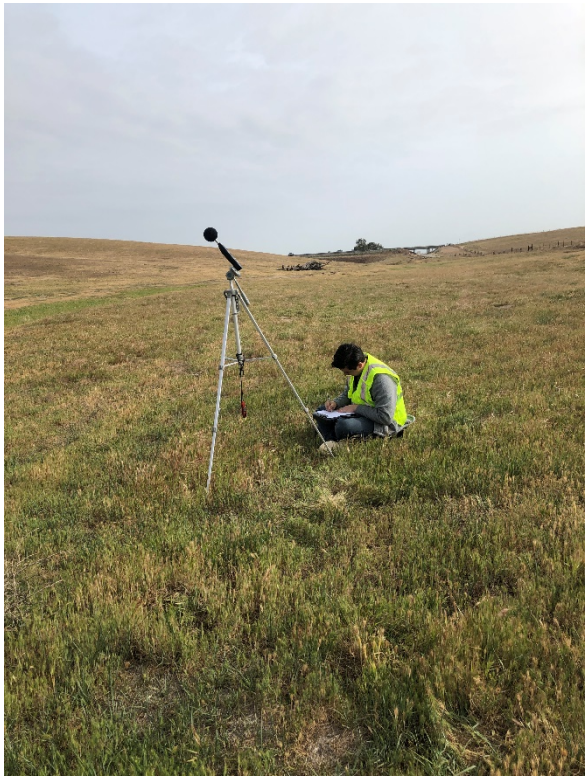
Facing west, overlooking the Project site.



Facing south, Billy Wright Road is ~200 feet from the SLM (left of frame).



Standing in a nearby ditch, looking east towards Billy Wright Road.



Facing north, I-5 bridge over Billy Wright Road can be seen in the distance (~1400 feet from SLM).

Appendix B

Construction Noise Modeling

Construction Noise Analysis Table 1A. Site Preparation

Equipment		Typical Level @ 50', dBA[1]	Usage Factor[1,2]	Number of Units	Hours Per Day	Analysis Period (Hours)	Distance to Receiver, ft.	Hard or Soft Site?	Barrier Attenuation, dB	Leq(h), dBA	Lmax, dBA
Item No.	Description										
60	Tractor	84	0.4	1	8	8	50	hard	0	80.0	84.0
23	Grader	85	0.4	2	8	8	50	hard	0	84.0	88.0
61	Truck, Dump	76.5	0.4	4	8	8	50	hard	0	78.5	82.5
29	Loader (Front End Loader)	79.1	0.4	1	6	8	50	hard	0	73.9	79.1
29	Loader (Front End Loader)	79.1	0.4	1	8	8	50	hard	0	75.1	79.1
44	Roller	80	0.2	4	8	8	50	hard	0	79.0	86.0
51	Scraper	83.6	0.4	1	8	8	50	hard	0	79.6	83.6
2	Backhoe	77.6	0.4	1	8	8	50	hard	0	73.6	77.6
	Combined Equipment									***88.3***	***92.8***

Construction Noise Analysis Table 1B. Underground Work

Equipment		Typical Level @ 50', dBA[1]	Usage Factor[1,2]	Number of Units	Hours Per Day	Analysis Period (Hours)	Distance to Receiver, ft.	Hard or Soft Site?	Barrier Attenuation, dB	Leq(h), dBA	Lmax, dBA
Item No.	Description										
18	Excavator	80.7	0.4	2	8	8	50	hard	0	79.7	83.7
70	Post Driver	88	0.2	5	8	8	50	hard	0	88.0	95.0
55	Slurry Trenching Machine	80.4	0.5	2	8	8	50	hard	0	80.4	83.4
60	Tractor	84	0.4	1	8	8	50	hard	0	80.0	84.0
44	Roller	80	0.2	1	8	8	50	hard	0	73.0	80.0
29	Loader (Front End Loader)	79.1	0.4	1	6	8	50	hard	0	73.9	79.1
	Combined Equipment									***89.9***	***96.1***

Construction Noise Analysis Table 1C. PV System Installation

Equipment		Typical Level @ 50', dBA[1]	Usage Factor[1,2]	Number of Units	Hours Per Day	Analysis Period (Hours)	Distance to Receiver, ft.	Hard or Soft Site?	Barrier Attenuation, dB	Leq(h), dBA	Lmax, dBA
Item No.	Description										
70	Post Driver	88	0.2	5	8	8	50	hard	0	88.0	95.0
29	Loader (Front End Loader)	79.1	0.4	10	6	8	50	hard	0	83.9	89.1
12	Crane	80.6	0.16	1	4	8	50	hard	0	69.6	80.6
20	Generator	80.6	0.5	10	8	8	50	hard	0	87.6	90.6
10	Compressor, Air	77.7	0.4	5	8	8	50	hard	0	80.7	84.7
21	Generator (<25KVA, VMS sign	72.8	0.5	10	4	8	50	hard	0	76.8	82.8
63	Truck, Pickup	75	0.4	8	8	8	50	hard	0	80.1	84.0
	Combined Equipment									***92.4***	***97.8***

Construction Noise Analysis Table 1D. Battery Storage System Installation

Equipment		Typical Level @ 50', dBA[1]	Usage Factor[1,2]	Number of Units	Hours Per Day	Analysis Period (Hours)	Distance to Receiver, ft.	Hard or Soft Site?	Barrier Attenuation, dB	Leq(h), dBA	Lmax, dBA
Item No.	Description										
29	Loader (Front End Loader)	79.1	0.4	4	6	8	50	hard	0	79.9	85.1
2	Backhoe	77.6	0.4	1	8	8	50	hard	0	73.6	77.6
12	Crane	80.6	0.16	1	4	8	50	hard	0	69.6	80.6
	Combined Equipment									***81.1***	***87.0***

Construction Noise Analysis Table 1E. Substation and Gen-Tie line Installation

Equipment		Typical Level @ 50', dBA[1]	Usage Factor[1,2]	Number of Units	Hours Per Day	Analysis Period (Hours)	Distance to Receiver, ft.	Hard or Soft Site?	Barrier Attenuation, dB	Leq(h), dBA	Lmax, dBA
Item No.	Description										
29	Loader (Front End Loader)	79.1	0.4	3	8	8	50	hard	0	79.9	83.9
63	Truck, Pickup	75	0.4	4	8	8	50	hard	0	77.0	81.0
29	Loader (Front End Loader)	79.1	0.4	4	8	8	50	hard	0	81.1	85.1
12	Crane	80.6	0.16	1	8	8	50	hard	0	72.6	80.6
62	Truck, Flat Bed	74.3	0.4	2	8	8	50	hard	0	73.3	77.3
61	Truck, Dump	76.5	0.4	1	8	8	50	hard	0	72.5	76.5
	Combined Equipment									***85.3***	***89.6***

Construction Noise Analysis Table 1F. Testing and Commissioning

Equipment		Typical Level @ 50', dBA[1]	Usage Factor[1,2]	Number of Units	Hours Per Day	Analysis Period (Hours)	Distance to Receiver, ft.	Hard or Soft Site?	Barrier Attenuation, dB	Leq(h), dBA	Lmax, dBA
Item No.	Description										
63	Truck, Pickup	75	0.4	3	8	8	50	hard	0	75.8	79.8
	Combined Equipment									***75.8***	***79.8***

Construction Noise Analysis Table 1G. Project Site Restoration

Equipment		Typical Level @ 50', dBA[1]	Usage Factor[1,2]	Number of Units	Hours Per Day	Analysis Period (Hours)	Distance to Receiver, ft.	Hard or Soft Site?	Barrier Attenuation, dB	Leq(h), dBA	Lmax, dBA
Item No.	Description										
23	Grader	85	0.4	2	8	8	50	hard	0	84.0	88.0
63	Truck, Pickup	75	0.4	4	8	8	50	hard	0	77.0	81.0
17	Drill Rig, Truck	79.1	0.2	2	8	8	50	hard	0	75.1	82.1
61	Truck, Dump	76.5	0.4	1	8	8	50	hard	0	72.5	76.5
29	Loader (Front End Loader)	79.1	0.4	1	8	8	50	hard	0	75.1	79.1
2	Backhoe	77.6	0.4	1	8	8	50	hard	0	73.6	77.6
	Combined Equipment									***86.1***	***90.4***

Construction Noise Analysis Table 1H. Delivery Offloads (evening work)

Equipment		Typical Level @ 50', dBA[1]	Usage Factor[1,2]	Number of Units	Hours Per Day	Analysis Period (Hours)	Distance to Receiver, ft.	Hard or Soft Site?	Barrier Attenuation, dB	Leq(h), dBA	Lmax, dBA
Item No.	Description										
29	Loader (Front End Loader)	79.1	0.4	2	2	2	50	hard	0	78.1	82.1
62	Truck, Flat Bed	74.3	0.4	1	2	2	50	hard	0	70.3	74.3
	Combined Equipment									***78.8***	***82.8***

Construction Noise Analysis Table 1I. Panel Laying (evening work)

Equipment		Typical Level @ 50', dBA[1]	Usage Factor[1,2]	Number of Units	Hours Per Day	Analysis Period (Hours)	Distance to Receiver, ft.	Hard or Soft Site?	Barrier Attenuation, dB	Leq(h), dBA	Lmax, dBA
Item No.	Description										
29	Loader (Front End Loader)	79.1	0.4	2	2	2	50	hard	0	78.1	82.1
12	Crane	80.6	0.16	1	2	2	50	hard	0	72.6	80.6
	Combined Equipment									***79.2***	***84.4***

Construction Noise Analysis Table 1J. Cable Laying and Termination (evening work)

Equipment		Typical Level @ 50', dBA[1]	Usage Factor[1,2]	Number of Units	Hours Per Day	Analysis Period (Hours)	Distance to Receiver, ft.	Hard or Soft Site?	Barrier Attenuation, dB	Leq(h), dBA	Lmax, dBA
Item No.	Description										
29	Loader (Front End Loader)	79.1	0.4	2	2	2	50	hard	0	78.1	82.1
63	Truck, Pickup	75	0.4	1	2	2	50	hard	0	71.0	75.0
	Combined Equipment									***78.9***	***82.9***

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use.

Construction Noise Analysis Table 2. Receiver Summary

Receiver #	Location
R1	Homes on west end of W Vista Grande Dr, adjacent to northwest project site
R2	Homes on south side of W Vista Grande Dr, adjacent to northwest project site
R3	Homes on east end of W Vista Grande Cir, adjacent to northwest project site
R4	Oasis West RV Park northwest of project site
R5	Home at 17535 Billy Wright Rd, south of project site
R6	Home at 17001 Billy Wright Rd, southwest of project site

Construction Noise Analysis Table 3. Reference Noise Levels and Assumptions, Daytime Construction

Construction Phase	Phase Abbreviation	Leq, dBA at 50 feet	Lmax, dBA at 50 feet[1]	Assumed daily work area (acres)	Assumed daily work area (sf)	Work area side length (ft)[2]
Site Preparation	Site Prep	88.3	92.8	4	174,240	417
Underground Work	UG Work	89.9	96.1	4	174,240	417
PV System Installation	PV Install	92.4	97.8	4	174,240	417
Battery Storage System Installation	Batt Install	81.1	87.0	4	174,240	417
Substation and Gen-Tie line Installation	Sub & Gen-Tie	85.3	89.6	2	65,340	256
Testing and Commissioning	Test & Comm	75.8	79.8	4	174,240	417
Project Site Restoration	Restoration	86.1	90.4	4	174,240	417
PG&E Substation Improvements, Site Preparation	PG&E Site Prep	88.3	92.8	Within the adjusted PG&E substation fence line		
PG&E Substation Improvements, Underground Work	PG&E UG Work	89.9	96.1	Within the adjusted PG&E substation fence line		
PG&E Substation Improvements, Substation and Gen-Tie line Installation	PG&E Sub & Gen-Tie	85.3	89.6	Within the adjusted PG&E substation fence line		
PG&E Substation Improvements, Testing and Commissioning	PG&E Test & Comm	75.8	79.8	Within the adjusted PG&E substation fence line		
PG&E Substation Improvements, Site Restoration	PG&E Restoration	86.1	90.4	Within the adjusted PG&E substation fence line		

[1] Daytime construction is not subject to MCC's Lmax criteria. Lmax is shown for informational purposes only

[2] Assumes square-shaped daily work area

Construction Noise Analysis Table 4. Reference Noise Levels and Assumptions, Nighttime Construction

Construction Phase	Phase Abbreviation	Leq, dBA at 50 feet	Lmax, dBA at 50 feet[1]
Delivery Offloads	Deliveries	78.8	82.8
Panel Laying	Panel Laying	79.2	84.4
Cable Laying and Termination	Cable Lay & Term	78.9	82.9

Construction Noise Analysis Table 5. Daytime Construction Noise Levels at Receivers

Receiver	Construction Phase	Closest Approximate Distance (ft)	Furthest Approximate Distance (ft)	Acoustical Average Distance	Ref. Noise Level @ 50 feet, dBA		Construction Noise Level, dBA		Average Daytime Ambient Leq, dBA	Increase Over Daytime Ambient Leq, dBA
					Leq	Lmax[1]	Leq	Lmax[1]		
R1	PG&E Sub Site Prep	520	1,200	790	88.3	92.8	58.3	62.8	56.1	2.2
R1	PG&E Sub UG Work	520	1,200	790	89.9	96.1	59.9	66.1	56.1	3.8
R1	PG&E Sub & Gen-Tie	520	1,200	790	85.3	89.6	55.3	59.6	56.1	0.0
R1	PG&E Sub Test & Comm	520	1,200	790	75.8	79.8	45.8	49.8	56.1	0.0
R1	PG&E Sub Restoration	520	1,200	790	86.1	90.4	56.2	60.5	56.1	0.1
R2	Site Prep	130	547	267	88.3	92.8	70.1	74.6	56.1	14.0
R2	UG Work	600	1,017	781	89.9	96.1	60.1	66.2	56.1	4.0
R2	PV Install	705	1,122	889	92.4	97.8	61.1	66.5	56.1	5.0
R2	Batt Install	705	1,122	889	81.1	87.0	49.9	55.7	56.1	0.0
R2	Sub & Gen-Tie	1,270	1,526	1,392	85.3	89.6	49.1	53.5	56.1	0.0
R2	Test & Comm	705	1,122	889	75.8	79.8	44.5	48.5	56.1	0.0
R2	Restoration	130	547	267	86.1	90.4	67.9	72.3	56.1	11.8
R3	Site Prep	160	577	304	88.3	92.8	68.7	73.2	53.0	15.7
R3	UG Work	500	917	677	89.9	96.1	61.6	67.8	53.0	8.6
R3	PV Install	500	917	677	92.4	97.8	64.1	69.5	53.0	11.1
R3	Batt Install	500	917	677	81.1	87.0	52.8	58.7	53.0	0.0
R3	Sub & Gen-Tie	2,400	2,656	2,525	85.3	89.6	42.7	47.0	53.0	0.0
R3	Test & Comm	500	917	677	75.8	79.8	47.5	51.5	53.0	0.0
R3	Restoration	160	577	304	86.1	90.4	66.5	70.8	53.0	13.5
R4	Site Prep	1,150	1,567	1,342	88.3	92.8	52.6	57.1	52.1	0.5
R4	UG Work	1,320	1,737	1,514	89.9	96.1	52.9	59.0	52.1	0.8
R4	PV Install	1,320	1,737	1,514	92.4	97.8	55.3	60.7	52.1	3.2
R4	Batt Install	1,320	1,737	1,514	81.1	87.0	44.1	49.9	52.1	0.0
R4	Sub & Gen-Tie	3,150	3,406	3,275	85.3	89.6	39.9	44.2	52.1	0.0
R4	Test & Comm	1,320	1,737	1,514	75.8	79.8	38.8	42.7	52.1	0.0
R4	Restoration	1,150	1,567	1,342	86.1	90.4	50.4	54.7	52.1	0.0
R5	Site Prep	1,000	1,417	1,190	88.3	92.8	53.9	58.4	53.2	0.7
R5	UG Work	1,170	1,587	1,363	89.9	96.1	54.0	60.2	53.2	0.8
R5	PV Install	1,170	1,587	1,363	92.4	97.8	56.5	61.9	53.2	3.3
R5	Batt Install	1,170	1,587	1,363	81.1	87.0	45.2	51.1	53.2	0.0
R5	Sub & Gen-Tie	15,550	15,806	15,677	85.3	89.6	22.9	27.2	53.2	0.0
R5	Test & Comm	1,170	1,587	1,363	75.8	79.8	39.9	43.9	53.2	0.0
R5	Restoration	1,000	1,417	1,190	86.1	90.4	51.7	56.0	53.2	0.0
R6	Site Prep	1,140	1,557	1,332	88.3	92.8	52.7	57.2	64.0	0.0
R6	UG Work	1,360	1,777	1,555	89.9	96.1	52.6	58.7	64.0	0.0
R6	PV Install	1,360	1,777	1,555	92.4	97.8	55.1	60.4	64.0	0.0
R6	Batt Install	1,360	1,777	1,555	81.1	87.0	43.8	49.7	64.0	0.0
R6	Sub & Gen-Tie	9,000	9,256	9,127	85.3	89.6	28.7	33.1	64.0	0.0
R6	Test & Comm	1,360	1,777	1,555	75.8	79.8	38.5	42.5	64.0	0.0
R6	Restoration	1,140	1,557	1,332	86.1	90.4	50.5	54.8	64.0	0.0

[1] Daytime construction is not subject to MCC's Lmax criteria. Lmax is shown for informational purposes only

Construction Noise Analysis Table 6. Nighttime Construction Noise Levels at Receivers

Receiver	Construction Phase	Closest Approximate Distance (ft)	Ref. Noise Level @ 50 feet, dBA		Construction Noise Level, dBA		Average Evening Ambient Leq, dBA	Increase Over Evening Ambient Leq, dBA	Excess Over 10 dB
			Leq	Lmax	Leq	Lmax			
R2	Deliveries	705	78.8	82.8	50.1	54.0	50.5	0.0	0.0
R2	Panel Laying	705	79.2	84.4	50.5	55.7	50.5	0.0	0.0
R2	Cable Lay & Term	705	78.9	82.9	50.2	54.2	50.5	0.0	0.0
R3	Deliveries	500	78.8	82.8	53.8	57.8	49.3	4.5	0.0
R3	Panel Laying	500	79.2	84.4	54.2	59.4	49.3	4.9	0.0
R3	Cable Lay & Term	500	78.9	82.9	53.9	57.9	49.3	4.6	0.0
R4	Deliveries	1,320	78.8	82.8	43.3	47.2	52.2	0.0	0.0
R4	Panel Laying	1,320	79.2	84.4	43.7	48.9	52.2	0.0	0.0
R4	Cable Lay & Term	1,320	78.9	82.9	43.4	47.3	52.2	0.0	0.0
R5	Deliveries	1,170	78.8	82.8	44.6	48.5	45.2	0.0	0.0
R5	Panel Laying	1,170	79.2	84.4	45.0	50.2	45.2	0.0	0.0
R5	Cable Lay & Term	1,170	78.9	82.9	44.7	48.7	45.2	0.0	0.0
R6	Deliveries	1,360	78.8	82.8	42.9	46.9	54.3	0.0	0.0
R6	Panel Laying	1,360	79.2	84.4	43.3	48.6	54.3	0.0	0.0
R6	Cable Lay & Term	1,360	78.9	82.9	43.0	47.0	54.3	0.0	0.0

Construction Noise Analysis Table 7. Combined Onsite Construction and Construction Traffic Noise Levels at Receivers

Receiver	Source	Closest Approximate Distance (ft)	Daytime Noise Levels, Leq dBA	Combined Daytime Noise Levels, Leq dBA	Average Daytime Ambient Leq, dBA	Increase Over Daytime Ambient Leq, dBA
R1	PG&E Substation Construction	520	59.9	64.0	56.1	7.9
R1	Construction Traffic	50	61.9			
R2	Solar Site Constriuction	130	70.1	70.1	56.1	14.0
R2	Construction Traffic	830	41.5			
R3	Solar Site Constriuction	160	68.7	68.7	53.0	15.7
R3	Construction Traffic	2,280	36.6			
R4	Solar Site Constriuction	1,150	55.3	55.4	52.1	3.3
R4	Construction Traffic	2,700	35.9			
R5	Solar Site Constriuction	1,000	56.5	56.5	53.2	3.3
R5	Construction Traffic	1,600	34.1			
R6	Solar Site Constriuction	1,140	55.1	55.1	64.0	0.0
R6	Construction Traffic	900	36.8			

Appendix C

Traffic Noise Modeling

This spreadsheet calculates traffic noise levels based on TNM Version 2.5 Lookup Tables.

**** Type in yellow cells only.**

Traffic Data:

- ☑ Enter ADT Traffic
- ☐ Enter Loudest-hour Traffic

Units:

- ☐ Metric
- ☑ English

Calculate

Link	Roadway	Segment Location	Hard or Soft Ground (H or S)	BARRIER Present 1=yes	BARRIER Height min. 7 ft. max. 32 ft.	BARRIER Distance 35 ft. or 100 ft.	Total Daily Traffic Volumes (ADT)	Traffic Mix Number #	Traffic Mix Description	Vehicle Speed mph max. 80	Sound Levels at Receiver Locations Distance feet, min. 33 max. 1000	Sound Levels at Receiver Locations dB Ldn	Sound Levels at Receiver Locations dB CNEL	Sound Levels at Receiver Locations dBA Leq1h (loudest hour)
1	SR-152 (Existing)	From SR 33 to I-5	H				33,600	5	SR-152	65	150	75.8	76.3	73.3
2	SR-152 (Existing)	From I-5 to Volta Rd	H				27,000	5	SR-152	65	150	74.9	75.3	72.3
3	I-5 (Existing)	South of SR-152	H				41,500	6	I-5 S of SR-152	65	150	78.6	79.0	75.3
4	SR-33 (Existing)	North of SR-152	H				11,300	12	SR-33 N of SR-152	65	150	73.3	73.6	69.8
5	SR-33 (Existing)	South of SR-152	H				12,900	13	SR-33 S of SR-152	65	150	73.7	74.0	70.3
6	Billy Wright Rd (Existing)	South of SR-152	H				485	14	Billy Wright Rd	35	900	45.3	45.6	41.3
7	San Luis Dr (Existing)	Between Gonzaga and Vista Grande	H				280	15	San Luis / Jasper Sears	25	50	49.0	49.5	46.7
8	Jasper Sears Dr (Existing)	South of Gonzaga	H				100	15	San Luis / Jasper Sears	25	50	46.3	46.8	43.0
9	All Construction Traffic	Multiple Routes	H				1,373	16	All Construction Traffic	65	150	60.9	62.5	62.9
10	Construction Traffic Billy Wright Rd	South of SR-152	H				722	17	Billy Wright Construction Traffic	35	900	36.0	37.2	36.8
11	Construction Traffic San Luis Dr	Between Gonzaga and Vista Grande	H				628	18	San Luis Construction Traffic	25	50	60.0	61.5	61.9
12	Construction Traffic Jasper Sears Rd	South of Gonzaga	H				25	19	Jasper Sears Construction Traffic	25	50	45.9	46.8	45.0
13	Billy Wright Rd	Operational Traffic	H				58	20	Operational Traffic	35	900	36.3	37.6	37.3
14	Billy Wright Rd	Operational Traffic Max Distance (~980 ft)	H				58	20	Operational Traffic	35	980	35.9	37.1	36.8
15	Construction Traffic San Luis Dr	R1	H				628	18	San Luis Construction Traffic	25	50	60.0	61.5	61.9
16	Construction Traffic San Luis Dr	R2	S				628	18	San Luis Construction Traffic	25	830	39.6	41.1	41.5
17	Construction Traffic San Luis Dr	Max Distance (~980 ft)	S				628	18	San Luis Construction Traffic	25	980	38.3	39.8	40.3
18	Construction Traffic Billy Wright Rd	Max Distance (~980 ft)	H				722	17	Billy Wright Construction Traffic	35	980	35.4	36.7	36.2
19	Construction Traffic Billy Wright Rd	R6	H				722	17	Billy Wright Construction Traffic	35	900	36.0	37.2	36.8

Appendix D

Operational Noise Modeling

Operational Noise Analysis Table 1. Summary of Onsite Electrical Equipment Source Noise Levels

Source	Equipment Area/System	Equipment Item	Notes Regarding Noise Source Configuration	Additional Notes	Stated Noise Level per Unit	Stated/ Calculated Sound Power per Unit (SWL)	Noise Level per Unit at 50 feet, dBA Leq	Reasonable Worst-Case Number of Units Dominating at a Single Receiver	Reasonable Worst-Case Combined Noise Level at 50 feet, dBA Leq	Reasonable Worst-Case Combined Noise Level at 50 feet, dBA Ldn
DC System BESS										
1	BESS DC Coupled System	BESS Container HVAC Unit Envicool MC90HDNC1A	4 HVAC units per BESS container, 43 containers *throughout* site. Up to 3 BESS containers at a single location.	DC BESS Equipment area = 1 PV Converter and 1 DC Block. One DC block = 1 DC BESS enclosure. There are 55 PV inverter locations, up to 43 will have BESS equipment assuming 1:1 ratio (less if there are more BESS at individual locations).	73 - 78 dBA @ 1 meter 70 - 76 dBA @ 1.5 meter	86.9 dBA	55.3	24	69.1	75.5
		Power Electronics FreeMaq FD0525 DC/DC Bi Directional Converter	Total of 43 DC-DC converters (1 per DC BESS equipment area)		79 dBA @ 1 meter	90.5 dBA	58.9	6	66.7	73.1
	Solar PV Inverter	Power Electronics PE FS4200MU CE (white blocks)	BESS will be collocated with PV inverters, but not all PV converters have a BESS container associated with them		79 dBA @ 1 meter	93.4 dBA	61.8	2	64.8	71.2
	Combined DC BESS Noise (3 DC BESS collocated with 1 PV inverter x 2)								**72.0**	**78.4**
DC System Substation										
2	Substation	Main Step-Up Transformer	--	--	Nighttime SWL = 101 dBA	101 dBA	69.4	1	69.4	75.8
			--	--	Daytime SWL = 112 dBA	112 dBA	80.4	1	80.4	86.8
	HVAC for Substation	HVAC Unit Bard W30AB-A10XPXXXJ	2 HVAC units for the control house.	--	67.1 dBA @ 10 feet	85.5 dBA	53.9	2	56.9	63.3
	Combined Daytime Substation Noise								**80.4**	**80.1**
	Combined Nighttime Substation Noise								**69.6**	
AC System BESS (collocated/grouped together)										
1	BESS AC Coupled System	Tesla Megapack	112 Megapacks collocated together	--	61.2 - 68.5 dBA @ 10 meters	95.0 dBA	63.3	112	83.8	90.2
		Inverter	--	--	N/A - included in Megapack	--	--	--	--	--
	Combined Collocated AC BESS Noise								**83.8**	**90.2**
AC System Substation										
2	Substation	Main Step-Up Transformer	--	--	Nighttime SWL = 101 dBA	101 dBA	69.4	1	69.4	75.8
			--	--	Daytime SWL = 112 dBA	112 dBA	80.4	1	80.4	86.8
	HVAC for Substation	HVAC Unit Bard W30AB-A10XPXXXJ	2 HVAC units for the control house.	--	67.1 dBA @ 10 feet	85.5 dBA	53.9	2	56.9	63.3
	Combined Daytime Substation Noise								**80.4**	**80.1**
	Combined Nighttime Substation Noise								**69.6**	

Source	Equipment Area/System	Equipment Item	Notes Regarding Noise Source Configuration	Additional Notes	Stated Noise Level per Unit	Stated/ Calculated Sound Power per Unit (SWL)	Noise Level per Unit at 50 feet, dBA Leq	Reasonable Worst-Case Number of Units Dominating at a Single Receiver	Reasonable Worst-Case Combined Noise Level at 50 feet, dBA Leq	Reasonable Worst-Case Combined Noise Level at 50 feet, dBA Ldn
PV Inverters (distributed among arrays)										
3	Solar PV Inverter	Power Electronics PE FS4200MU CE	Distributed throught the solar arrays	--	79 dBA @ 1 Meter	93.4 dBA	61.8	2	64.8	71.2
	Combined PV Inverter Noise								**64.8**	**71.2**
Tracker Motors (distributed among arrays)										
4	Tracker Motors	NEXTracker's Horizon Single Axis Tracker motor	Distributed throught the solar arrays	--	69.6 dBA @ 3.3 feet	77.6 dBA	46.0	140	67.5	73.9
	Combined PV Tracker Motor Noise								**67.5**	**65.4**

Operational Noise Analysis Table 2. DC Option Operational Noise Levels at Receivers Due to Onsite Electrical Equipment

Receiver	Source	Closest Approximate Distance, feet	Ref. Noise Level @ 50 feet, dBA		Operational Noise Level, dBA		Combined Noise Levels, dBA			Lowest Daytime Ambient Leq, dBA	Lowest Nighttime Ambient Leq, dBA	Exceedance Above Ambient Noise, dBA Leq	
			Leq/Lmax[1]	Ldn	Leq/Lmax[1]	Ldn	DC Daytime Leq/Lmax	DC Nighttime Leq/Lmax	DC Ldn			DC Daytime	DC Nighttime
R1	DC BESS Area	700	72.0	78.4	43.3	49.7							
R1	Daytime Substation	1,200	80.4	80.1	45.9	45.6							
R1	Nighttime Substation	1,200	69.6		35.1		57.8	48.4	58.1	49.5	48.5	8.3	0.0
R1	Tracker Motors	700	67.5	65.4	38.8	36.8							
R1	Daytime PG&E Substation	420	80.4	80.1	57.3	57.0							
R1	Nighttime PG&E Substation	420	69.6		46.5								
R2	DC BESS Area	700	72.0	78.4	43.3	49.7							
R2	Daytime Substation	1,200	80.4	80.1	45.9	45.6							
R2	Nighttime Substation	1,200	69.6		35.1		50.2	44.5	52.3	49.5	48.5	0.7	0.0
R2	Tracker Motors	700	67.5	65.4	38.8	36.8							
R2	Daytime PG&E Substation	1,230	80.4	80.1	45.6	45.4							
R2	Nighttime PG&E Substation	1,230	69.6		34.9								
R3	DC BESS Area	400	72.0	78.4	49.4	55.8							
R3	Daytime Substation	2,300	80.4	80.1	38.9	38.6							
R3	Nighttime Substation	2,300	69.6		28.1		51.2	49.5	56.2	47.1	57.1	4.1	0.0
R3	Tracker Motors	400	67.5	65.4	44.9	42.8							
R3	Daytime PG&E Substation	2,800	80.4	80.1	36.7	36.4							
R3	Nighttime PG&E Substation	2,800	69.6		25.9								
R4	DC BESS Area	1,300	72.0	78.4	36.6	43.0							
R4	Daytime Substation	3,100	80.4	80.1	35.6	35.3							
R4	Nighttime Substation	3,100	69.6		24.8		41.5	37.2	44.6	58.3	53.8	0.0	0.0
R4	Tracker Motors	1,300	67.5	65.4	32.1	30.0							
R4	Daytime PG&E Substation	2,900	80.4	80.1	36.3	36.1							
R4	Nighttime PG&E Substation	2,900	69.6		25.6								
R5	DC BESS Area	1,100	72.0	78.4	38.4	44.8							
R5	Daytime Substation	8,800	80.4	80.1	24.3	24.0							
R5	Nighttime Substation	8,800	69.6		13.5		39.9	38.5	45.1	51.9	47.7	0.0	0.0
R5	Tracker Motors	1,100	67.5	65.4	33.9	31.9							
R5	Daytime PG&E Substation	10,200	80.4	80.1	22.7	22.4							
R5	Nighttime PG&E Substation	10,200	69.6		11.9								
R6	DC BESS Area	1,100	72.0	78.4	38.4	44.8							
R6	Daytime Substation	15,400	80.4	80.1	18.2	17.9							
R6	Nighttime Substation	15,400	69.6		7.4		39.8	38.4	45.1	57.4	52.6	0.0	0.0
R6	Tracker Motors	1,100	67.5	65.4	33.9	31.9							
R6	Daytime PG&E Substation	16,400	80.4	80.1	17.5	17.2							
R6	Nighttime PG&E Substation	16,400	69.6		6.7								

1. Assumes 100 percent utilization and constant noise levels; therefore Leq = Lmax.

Operational Noise Analysis Table 3. AC Option Operational Noise Levels at Receivers Due to Onsite Electrical Equipment

Receiver	Source	Closest Approximate Distance, feet	Ref. Noise Level @ 50 feet, dBA		Operational Noise Level, dBA		Combined Noise Levels, dBA			Lowest Daytime Ambient Leq, dBA	Lowest Nighttime Ambient Leq, dBA	Exceedance Above Ambient Noise, dBA Leq	
			Leq/Lmax[1]	Ldn	Leq/Lmax[1]	Ldn	AC Daytime Leq/Lmax	AC Nighttime Leq/Lmax	AC Ldn			AC Daytime	AC Nighttime
R1	Daytime Substation	1,200	80.4	80.1	45.9	45.6							
R1	Nighttime Substation	1,200	69.6		35.1								
R1	AC PV Location	700	64.8	71.2	36.2	42.6							
R1	AC BESS Location	4,900	83.8	90.2	34.0	40.4	57.7	47.4	57.6	49.5	48.5	8.2	0.0
R1	Tracker Motors	700	67.5	65.4	38.8	36.8							
R1	Daytime PG&E Substation	420	80.4	80.1	57.3	57.0							
R1	Nighttime PG&E Substation	420	69.6		46.5								
R2	Daytime Substation	1,200	80.4	80.1	45.9	45.6							
R2	Nighttime Substation	1,200	69.6		35.1								
R2	AC PV Location	700	64.8	71.2	36.2	42.6							
R2	AC BESS Location	4,100	83.8	90.2	35.9	42.4	49.6	41.6	50.5	49.5	48.5	0.1	0.0
R2	Tracker Motors	700	67.5	65.4	38.8	36.8							
R2	Daytime PG&E Substation	1,230	80.4	80.1	45.6	45.4							
R2	Nighttime PG&E Substation	1,230	69.6		34.9								
R3	Daytime Substation	2,300	80.4	80.1	38.9	38.6							
R3	Nighttime Substation	2,300	69.6		28.1								
R3	AC PV Location	400	64.8	71.2	42.2	48.6							
R3	AC BESS Location	3,200	83.8	90.2	38.6	45.0	48.3	44.0	51.3	47.1	57.1	1.2	0.0
R3	Tracker Motors	400	67.5	65.4	44.9	42.8							
R3	Daytime PG&E Substation	2,800	80.4	80.1	36.7	36.4							
R3	Nighttime PG&E Substation	2,800	69.6		25.9								
R4	Daytime Substation	3,100	80.4	80.1	35.6	35.3							
R4	Nighttime Substation	3,100	69.6		24.8								
R4	AC PV Location	1,300	64.8	71.2	29.4	35.8							
R4	AC BESS Location	3,900	83.8	90.2	36.5	42.9	41.7	37.8	45.0	58.3	53.8	0.0	0.0
R4	Tracker Motors	1,300	67.5	65.4	32.1	30.0							
R4	Daytime PG&E Substation	2,900	80.4	80.1	36.3	36.1							
R4	Nighttime PG&E Substation	2,900	69.6		25.6								
R5	Daytime Substation	8,800	80.4	80.1	24.3	24.0							
R5	Nighttime Substation	8,800	69.6		13.5								
R5	AC PV Location	1,100	64.8	71.2	31.2	37.7							
R5	AC BESS Location	4,200	83.8	90.2	35.7	42.1	39.0	37.1	43.8	51.9	47.7	0.0	0.0
R5	Tracker Motors	1,100	67.5	65.4	33.9	31.9							
R5	Daytime PG&E Substation	10,200	80.4	80.1	22.7	22.4							
R5	Nighttime PG&E Substation	10,200	69.6		11.9								
R6	Daytime Substation	15,400	80.4	80.1	18.2	17.9							
R6	Nighttime Substation	15,400	69.6		7.4								
R6	AC PV Location	1,100	64.8	71.2	31.2	37.7							
R6	AC BESS Location	10,500	83.8	90.2	25.7	32.1	36.3	32.4	39.6	57.4	52.6	0.0	0.0
R6	Tracker Motors	1,100	67.5	65.4	33.9	31.9							
R6	Daytime PG&E Substation	16,400	80.4	80.1	17.5	17.2							
R6	Nighttime PG&E Substation	16,400	69.6		6.7								

1. Assumes 100 percent utilization and constant noise levels; therefore Leq = Lmax.

Operational Noise Analysis Table 4. Combined Operational Noise Levels

Receiver	Source	Closest Approximate Distance, feet	Noise Levels, dBA			Combined Noise Levels, dBA			Lowest Daytime Ambient Leq, dBA	Lowest Nighttime Ambient Leq, dBA	Exceedance Above Ambient Noise, dBA Leq	
			Daytime Leq	Nighttime Leq	Ldn	Daytime Leq	Nighttime Leq	Ldn			Daytime	Nighttime
R1	Onsite Electrical Equipment	Varies	57.8	48.4	58.1	57.9	48.4	58.1	49.5	48.5	8.4	0.0
R1	Gentie	1,100	0	0	0							
R1	Maintenance	660	40.0	-	35.2							
R1	Traffic	>12,000	<25	-	<25							
R2	Onsite Electrical Equipment	Varies	50.2	44.5	52.3	50.6	44.5	52.3	49.5	48.5	1.1	0.0
R2	Gentie	1,400	0	0	0							
R2	Maintenance	660	40.0	-	35.2							
R2	Traffic	>12,000	<25	-	<25							
R3	Onsite Electrical Equipment	Varies	51.2	49.5	56.2	52.2	49.5	56.2	47.1	57.1	5.1	0.0
R3	Gentie	2,500	0	0	0							
R3	Maintenance	400	45.4	-	40.7							
R3	Traffic	>12,000	<25	-	<25							
R4	Onsite Electrical Equipment	Varies	41.7	37.8	45.0	42.3	37.8	45.0	58.3	53.8	0.0	0.0
R4	Gentie	3,300	0	0	0							
R4	Maintenance	1,300	32.6	-	27.9							
R4	Traffic	>12,000	<25	-	<25							
R5	Onsite Electrical Equipment	Varies	39.9	38.5	45.1	41.4	38.5	45.1	51.9	47.7	0.0	0.0
R5	Gentie	9,100	0	0	0							
R5	Maintenance	1,000	35.5	-	30.7							
R5	Traffic	8,000	<25	-	<25							
R6	Onsite Electrical Equipment	Varies	36.3	32.4	39.6	41.2	32.4	39.6	57.4	52.6	0.0	0.0
R6	Gentie	15,700	0	0	0							
R6	Maintenance	1,000	35.5	-	30.7							
R6	Traffic	900	37.3	-	35.9							