APPENDIX Q

Noise Technical Report

Noise Technical Report

Sapphire Solar Project Riverside County

APRIL 2024

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Acronyms and Abbreviations

Acronym/Abbreviation	Meaning
ADT	Average Daily Trips
BESS	Battery Energy Storage System
BLM	Bureau of Land Management
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CNEL	Community Noise Equivalent Level
CUP	Conditional Use Permit
DA	Development Agreement
dB	Decibel
dBA	A-Weighted Decibel
d_{ref}	The Reference Distance that Helps Define Leq (Activity)
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HUD	U.S. Department of Housing and Urban Development
HVAC	Heating, Ventilation and Air Conditioning
Hz	Hertz
Gen-tie	Generation Tie
ISO	International Organization of Standardization
kV	Kilovolt
L_{dn}	Day-Night Sound Level
L_{eq}	Equivalent Sound Level
L_{max}	Maximum Sound Level
L_{min}	Minimum Sound Level
L_{v}	Vibration Level
L_{xx}	Percentile-Exceeded Sound Levels
MW	Megawatt
NEMA	National Electric Manufacturers Association
NEPA	National Environmental Policy Act
NPS	National Park Service
PPV	Peak Particle Velocity
PUP	Public Use Permit
PV	Photovoltaic
RCNM	Roadway Construction Noise Model
SCADA	Supervisory Control and Data Acquisition
USEPA	United States Environmental Protection Agency
U.S.C.	U.S. Code
VdB	Vibration Decibel

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1 Introduction

1.1 Executive Summary

This Noise Technical Report was prepared in support of an application submitted by EDF Renewables Development, Inc (EDFR) on behalf of Sapphire Solar, LLC (applicant) for the proposed development of the Sapphire Solar Project (Project), a solar energy facility on unincorporated lands in Riverside County (County). The Project is primarily located on private lands with linear features for access and transmission (Linear Facility Routes) located on Bureau of Land Management (BLM) administered lands.

The purpose of this Noise Technical Report is to assess the potential noise impacts associated with implementation of the proposed Project. This assessment uses the significance thresholds in Appendix G of the California Environmental Quality Act (CEQA) Guidelines (14 CCR 15000 et seq.), as well as standards established in the Riverside County general plan and noise ordinances, in determining the significance of Project impacts related to noise.

This Noise Technical Report evaluated the potential for Project-generated construction, operational, and decommissioning noise emissions that could result in adverse impacts to sensitive receptors (i.e., structures and humans). This Noise Technical Report also includes an assessment of ground-borne vibration impacts to sensitive receptors (i.e., structures and humans) based on vibration significance guidelines for Project construction and operation. As described below, this Noise Technical Report concludes that construction, operational, and decommissioning noise and vibration levels would not exceed CEQA thresholds. The Project as proposed would also be compliant with exterior noise exposure standards for residences under regulations of several federal agencies (Federal Aviation and Administration (FAA) and United States Department of Housing and Urban Development (HUD)), the most common standards applied for noise assessment under the National Environmental Policy Act (NEPA).

This Noise Technical Report was prepared by Jonathan Leech, AICP, INCE. Mr. Leech's resume is provided in Appendix A.

1.2 Project and Approach Overview

EDF Renewables Development Inc. on behalf of Sapphire Solar, LLC (Applicant) proposes to entitle, construct, operate, and maintain the Project, located in Riverside County, California. The Project would consist of approximately 1,192 acres with approximately 1,082 acres of private lands and approximately 110 acres of BLM administered lands. The Project would include up to 117-megawatts (MW) of photovoltaic (PV) solar generation and up to 117 MW of battery storage (Figure 1, Project Location).

The Applicant is pursuing a Conditional Use Permit (CUP), Public Use Permit (PUP), and a Development Agreement (DA) from Riverside County for the private lands associated with the Project and a Right-of-Way Grant from the BLM for the BLM-administered lands associated with the Project. As such, Riverside County will serve as the CEQA lead agency and the BLM as the NEPA lead agency.

1.3 Project Description

The Project would primarily consist of PV panels, a single-axis tracker system, inverters, converters, transformers, electrical collection and communication lines, a 12 kilovolt (kV) distribution line for backup power, an on-site electrical substation, a battery energy storage system (BESS), security fence, an operations and maintenance facility including a stand-alone spare parts storage building, up to three on-site groundwater wells, a meteorological station and albedometer weather station, a microwave/communication tower, and a supervisory control and data acquisition (SCADA) system that are located on private lands (Figure 2, Site Plan).

The Project includes three Linear Facility Routes, including two 230-kV generation tie (gen-tie) line alignment options (only one of which would be constructed), three options for access roads, and one collector line route, all of which are located on lands administered by the BLM and designed to support the Project, located on adjacent private lands. The Project would interconnect with the Southern California Edison (SCE) Red Bluff Substation via the existing Desert Harvest gen-tie line located on BLM-administered lands.

Construction of the Project is anticipated to occur in seven principal phases encompassing a total duration of between 12 and 18 months. The construction workforce would average 150 employees, with a maximum daily workforce of 250 employees. The Commercial Operation Date is anticipated to occur in December 2025. The operational life of the Project is anticipated to be 39 years or greater.

1.3.1 Project Location and Access

The proposed Project site is located in Riverside County, California, approximately 3 miles north of Desert Center, approximately 40 miles west of the City of Blythe, and 3.5 miles north of Interstate 10. The Project is bounded on the north, east, and west sides by BLM lands and to the south by Belsby Avenue. Two County roads intersect the interior of the Project site from east to west, Investor Avenue and Osborne Avenue. Melon Street runs along the west side of the Project boundary, and Jojoba Street runs on the east side. The east side of the Project site is adjacent to California State Route 177/Rice Road. Primary construction access would be from the main access road via Kaiser Road. A secondary access road for emergency services would be constructed within the Linear Facility Routes from either Kaiser Road (Linear Facility Route #1 or #2) or California State Route 177/Rice Road (exit 192) (Linear Facility Route #3). Figure 1 illustrates the location of the proposed Project relative to major highways, access roads, and cities.

While the Linear Facility Routes are within the land use jurisdiction of the BLM Palm Springs South Coast Field Office, the Sapphire Solar Project is within the land use jurisdiction of Riverside County. The entirety of the 110-acre area associated with the three Linear Facility Routes on BLM-administered lands is located within a Development Focus Area for solar, wind, and geothermal projects as designated by the Desert Renewable Energy Conservation Plan (DRECP). The DRECP Final Environmental Impact Statement was approved by a Record of Decision signed on September 14, 2016.

1.4 Noise Background and Terminology

1.4.1 Fundamentals of Environmental Noise

Vibrations, traveling as waves through air from a source, exert a force perceived by the human ear as sound. Sound pressure level (referred to as sound level) is measured on a logarithmic scale in decibel (dB) that represents the fluctuation of air pressure above and below atmospheric pressure. Frequency, or pitch, is a physical characteristic of sound and is expressed in units of cycles per second or hertz. The normal frequency range of hearing for most people extends from about 20 to 20,000 hertz. The human ear is more sensitive to middle and high frequencies, especially when the noise levels are quieter. As noise levels get louder, the human ear starts to hear the frequency spectrum more evenly. To accommodate for this phenomenon, a weighting system to evaluate how loud a noise level is to a human was developed. The frequency weighting, called "A" weighting, is typically used for quieter noise levels, which de-emphasizes the low-frequency components of the sound in a manner similar to the response of a human ear. This A-weighted sound level is called the "noise level" and is referenced in units of A-weighted decibel (dBA). Table 1 presents typical noise levels for common outdoor and indoor activities. Since sound is measured on a logarithmic scale, a doubling of sound energy results in a 3-dBA increase in the noise level. Changes in a community noise level of less than 3 dBA are not typically noticed by the human ear (Caltrans 2020a). Changes from 3 to 5 dBA may be noticed by some individuals who are extremely sensitive to changes in noise. A 5-dBA increase is readily noticeable (EPA 1974). The human ear perceives a 10-dBA increase in sound level as a doubling of the sound level (i.e., 65 dBA sounds twice as loud as 55 dBA to a human ear).

Table 1. Typical Noise Levels Associated with Common Activities

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110	Rock Band
Jet Flyover at 1,000 feet	105	
	100	
Gas Lawn Mower at three feet	95	
	90	
Diesel Truck at 50 feet, 50 miles per hour	85	Food Blender at 3 feet
	80	Garbage Disposal at 3 feet
Noisy Urban Area, Daytime	75	
	70	Vacuum Cleaner at 10 feet
Commercial Area	65	Normal speech at 3 feet
Heavy Traffic at 300 feet	60	
	55	Large Business Office
Quiet Urban Daytime	50	Dishwasher (in next room)
	45	
Quiet Urban Nighttime	40	Theater, Conference Room (background)
Quiet Suburban Nighttime	35	
	30	Library
Quiet Rural Nighttime	25	Bedroom at Night, Concert Hall (background)
	20	
	15	Broadcast/Recording Studio
	10	
	5	
Lowest Threshold of Human Hearing (Healthy)	0	Lowest Threshold of Human Hearing (Healthy)

Source: Caltrans 2020a. **Notes:** dBA = A-weighted decibel.

An individual's noise exposure occurs over time; however, noise level is a measure of noise at a given instant in time. Community noise sources vary continuously, being the product of many noise sources at various distances, all of which constitute a relatively stable background or ambient noise environment. The background, or ambient, noise level gradually changes throughout a typical day, corresponding to distant noise sources such as traffic volume and changes in atmospheric conditions. The time-varying character of environmental noise is often described with use of statistical or percentile noise descriptors including L_{10}, L_{50}, and L_{90}. These are the noise levels equaled or exceeded during 10, 50, and 90 percent of the measured time interval. Sound levels associated with L_{10} typically describe transient or short-term events, such as the noise from distinct passing cars and trucks. L_{50} represents the median sound level during the measurement. Levels will be above and below this value exactly one-half of the accumulated measurement time. L_{90} is the sound level exceeded 90 percent of the time, and often is used to describe background noise conditions or sources that are continuous or "steady-state" in character.

Noise levels are generally higher during the daytime and early evening when traffic (including airplanes), commercial, and industrial activity is the greatest. However, noise sources experienced during nighttime hours when background levels are generally lower can be potentially more conspicuous and irritating to the receptor. To evaluate noise in a way that considers periodic fluctuations experienced throughout the day and night, a concept termed "community noise equivalent level" (CNEL) was developed, wherein noise measurements are weighted, added, and averaged over a 24-hour period to reflect magnitude, duration, frequency, and time of occurrence.

Different types of measurements are used to characterize the time-varying nature of sound. These measurements include the equivalent sound level (L_{eq}), the minimum and maximum sound levels (L_{min} and L_{max}, respectively), percentile-exceeded sound level (L_{xx}), the day-night sound level (L_{dn}), and the CNEL. The following list provides brief definitions of noise terminology used in this report.

- **Decibel** (dB) is a unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micropascals.
- **A-weighted decibel** (dBA) is an overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
- **Equivalent sound level** (L_{eq}) is the constant level that, over a given time period, transmits the same amount of acoustic energy as the actual time-varying sound. Equivalent sound levels are the basis for both the L_{dn} and CNEL scales.
- **Maximum sound level** (L_{max}) is the maximum sound level measured during the measurement period.
- **Minimum sound level** (L_{min}) is the minimum sound level measured during the measurement period.
- **Percentile-exceeded sound level** (L_{xx}) is the sound level exceeded X% of a specific time period. L_{10} is the sound level exceeded 10% of the time.
- **Day-Night Average Sound Level** (L_{dn}) is a 24-hour average A-weighted sound level with a 10 dB penalty added each of the hourly average noise levels occurring in the nighttime hours from 10:00 p.m. to 7:00 a.m. The 10 dB penalty is applied to account for increased noise sensitivity during the nighttime hours.
- **Community Noise Equivalent Level** (CNEL) is the average equivalent A-weighted sound level during a 24 hour day. CNEL accounts for the increased noise sensitivity during the evening hours (7:00 p.m. to 10:00 p.m.) and nighttime hours (10:00 p.m. to 7:00 a.m.) by adding 5 dB to the recorded hourly average sound levels in the evening and 10 dB to the hourly average sound levels at night.

1.4.1.1 Exterior Noise Distance Attenuation

Noise sources are classified in two forms: (1) point sources, such as stationary equipment or a group of construction vehicles and equipment working within a spatially limited area at a given time; and (2) line sources, such as a roadway with a large number of pass-by sources (motor vehicles). Sound generated by a point source typically diminishes (attenuates) at a rate of 6.0 dBA for each doubling of distance from the source to the receptor at acoustically “hard” sites and at a rate of 7.5 dBA for each doubling of distance from source to receptor at acoustically “soft” sites (Caltrans 2020a). Sound generated by a line source (i.e., a roadway) typically attenuates at a rate of 3 dBA and 4.5 dBA per doubling distance, for hard and soft sites, respectively (Caltrans 2020a). Sound levels can also be attenuated by human-made or natural barriers. For the purpose of a sound attenuation discussion, a hard or reflective site does not provide any excess ground-effect attenuation and is characteristic of asphalt or concrete ground surfaces, as well as very hard-packed soils. An acoustically soft or absorptive site is characteristic of unpaved loose soil or vegetated ground.

With respect to examples of this distance-attenuation relationship for exterior noise, a 60-dBA noise level measured at 50 feet from a tractor installing fenceposts within a packed earth feedlot site would diminish to 54 dBA at 100 feet from the source, and to 48 dBA at 200 feet from the source. This scenario is addressed by the point source attenuation for a hard site (6 dBA with each doubling of the distance). For the scenario where soft-site conditions exist between the point source and receptor, represented by natural vegetation, planted row crop, or plowed furrows adjacent to the work area, an attenuation rate of 7.5 dBA per doubling of distance would apply; the tractor noise measured as 60 dBA at 50 feet would diminish to 52.5 dBA at 100 feet from the source and to 45 dBA at 200 feet from the source, where soft ground exists between the sound source and the receptor location.

1.4.1.2 Structural Noise Attenuation

Sound levels can also be attenuated by human-made or natural barriers. Solid walls, berms, or elevation differences typically reduce noise levels in the range of approximately 5 to 15 dBA (Caltrans 2020a). Structures can also provide noise reduction by insulating interior spaces from outdoor noise. The outside-to-inside noise attenuation provided by typical structures in California ranges between 17 to 30 dBA with open and closed windows, respectively, as shown in Table 2.

Table 2. Outside-to-Inside Noise Attenuation (dBA)

Building Type	Open Windows	Closed Windows
Residences	17	25
Schools	17	25
Churches	20	30
Hospitals/offices/hotels	17	25
Theaters	17	25

Source: Transportation Research Board, National Research Council 1971.
Notes: dBA = A-weighted decibel.
As shown, structures with closed windows can attenuate exterior noise by a minimum of 25 to 30 dBA

1.4.2 Fundamentals of Vibration

Vibration is an oscillatory motion that can be described in terms of displacement, velocity, or acceleration. Heavy equipment operation, including stationary equipment that produces substantial oscillation or construction equipment that causes percussive action against the ground surface, may be experienced by building occupants as perceptible vibration. It is also common for groundborne vibration to cause windows, pictures on walls, or items on shelves to rattle; this transfer of vibration energy in the ground to structures resulting in audible sound is termed groundborne noise. The metric for groundborne noise is the vibration decibel, written VdB. Although the perceived vibration from such equipment operation can be intrusive to building occupants, the vibration is seldom of sufficient magnitude to cause even minor cosmetic damage to buildings.

Peak particle velocity (PPV) that describes particle movement over time (in terms of physical displacement of mass, expressed as inches/second or in/sec) is generally employed for the discussion of vibration impacts on structures. Groundborne vibration generated by construction projects is usually highest during pile driving, rock blasting, soil compacting, jack hammering, and demolition-related activities. Next to pile driving and soil compacting, grading activity has the greatest potential for vibration impacts when earthwork involves large bulldozers, large trucks, or other heavy equipment.

1.4.3 Health Effects of Noise

Excessively noisy conditions can affect an individual's quality of life, health, and well-being. The effects of noise can be organized into six broad categories: sleep disturbance, permanent hearing loss, human performance and behavior, social interaction or communication, extra-auditory health effects, and general annoyance. An individual's reaction to noise and its level of disturbance depends on many factors such as the source of the noise, its loudness relative to the background noise level, time of day, whether the noise is temporary or permanent, and subjective sensitivity.

The United States Environmental Protection Agency (USEPA) in 1974 published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (EPA 550/9-74-004). This publication is considered an authoritative study on protective noise levels based on its large sampling of human reaction to community noise. The USEPA community noise level guidance does not provide a quantification of noise impact, but rather presents a reasonable estimate of potential noise interference with common activities, human health and welfare effects from noise, and annoyance with noise. These guidance community noise levels were derived without concern for their feasibility and contain a margin of safety to ensure their protective value; consequently, the guidance should not be considered to represent standards, criteria, or regulations. Rather, they represent levels below which there is no reason to suspect that the general population will be at risk from any of the identified effects of noise. The EPA guideline limits are summarized in Table 3.

Table 3. USEPA Cause and Effect Noise Levels Summary

Location	Level	Effect
All publicly accessible areas with prolonged exposure	70 dBA $L_{eq(24)}$	Safety
Outdoor at residential structure and other noise sensitive receptors where a large amount of time is spent	55 dBA L_{dn}	Protection against annoyance and activity interference
Outdoor areas where limited amounts of time are spent, e.g., park areas, school yards, golf courses, etc.	55 dBA $L_{eq(24)}$	
Indoor residential	45 dBA L_{dn}	
Indoor non-residential	55 dBA $L_{eq(24)}$	

Source: EPA 550/9-74-004.
Notes: dBA = A-weighted decibel; L_{dn} = Day Night Average; $L_{eq(24)}$ =sound equivalent level across a 24-hour period.

1.5 Noise Regulation and Management

1.5.1 Federal

1.5.1.1 Noise Control Act

The Noise Control Act of 1972 and its subsequent amendments in the Quiet Communities Act of 1978 (42 United States Code [U.S.C.] 4901 et seq.) delegate authority to the states to regulate environmental noise and directs government agencies to ensure compliance with local community noise statutes and regulations.

1.5.1.2 Federal Aviation Administration Standards

Enforced by the Federal Aviation Administration, Code of Federal Regulations Title 14, Part 150, prescribes the procedures, standards, and methodology governing the development, submission, and review of airport noise exposure maps and airport noise compatibility programs, including the process for evaluating and approving or disapproving those programs. Title 14 also identifies those land uses that are normally compatible with various levels of exposure to noise by individuals. The Federal Aviation Administration has determined that interior sound levels up to 45 dBA L_{dn} (or CNEL) are acceptable within residential buildings. The Federal Aviation Administration also considers residential land uses to be compatible with exterior noise levels at or less than 65 dBA L_{dn} (or CNEL).

1.5.1.3 Federal Transit Administration (FTA)

In its Transit Noise and Vibration Impact Assessment guidance manual, the FTA recommends a daytime construction noise level threshold of 80 dBA L_{eq} over an eight-hour period when detailed construction noise assessments are performed to evaluate potential impacts to community residences surrounding a project (FTA 2018). The FTA also recommends using a construction noise threshold of 75 dBA L_{dn} averaged over 30 days for residences exposed to construction noise lasting 30 days or longer. Although this FTA guidance is not a regulation, it can serve as a quantified standard in the absence of such limits at the state and local jurisdictional levels.

1.5.1.4 National Park Service (NPS)

NPS Director's Order #47: Soundscape Preservation and Management is the primary internal noise management policy guidance for NPS managers. Building on the NPS Management Policies, this order directs park managers to (1) measure baseline acoustic conditions, (2) determine which existing or proposed human-made sounds are consistent with park purposes, (3) set acoustic management goals and objectives based on these purposes, and (4) determine which noise sources are impacting the park and need to be addressed by management. The NPS will take action to prevent or minimize all noise that, through frequency, magnitude, or duration, adversely affects the natural soundscape or other park resources or values, or that exceeds levels that have been identified as being acceptable to, or appropriate for, visitor uses at the sites being monitored. At this time, no specific sound level limits have been identified for Joshua Tree National Park (https://www.nps.gov/jotr/learn/nature/soundscapes.htm). The closest boundaries of Joshua Tree National Park to the Project site are at distances of approximately 3 miles northeast and approximately 4.5 miles west.

1.5.1.5 US Department of Housing and Urban Development (HUD)

The HUD noise program is established in the noise regulation, 24 CFR 51B. The maximum normally acceptable exterior noise exposure level is 65 dBA CNEL for residences that are funded by HUD or which participate in any HUD subsidy programs. Interior noise levels in residences are not to exceed 45 dBA CNEL.

1.5.2 State

1.5.2.1 California Department of Transportation Vibration Standards

The California Department of Transportation (Caltrans) conducted extensive research on human annoyance and damage to structures caused by vibration from short term construction activities and from long term highway operations and has published criteria for vibration management (Transportation and Construction Vibration Guidance Manual 2020). These criteria established by Caltrans are commonly used to assess vibration impacts from all types of projects and activities. Caltrans uses a threshold of 0.2 in/sec PPV for annoyance to persons, where a continuous vibration source is involved; for transient sources (represented by construction activities), Caltrans uses a threshold of 0.24 in/sec PPV (which equates to a distinctly perceptible level). For groundborne noise, Caltrans uses a daytime threshold of 78 VdB for residential occupants. For commercial buildings constructed of concrete and steel, Caltrans identifies a damage threshold of 0.5 in/sec PPV. For residential structures employing concrete foundation and wood frame construction, Caltrans identifies a conservative damage threshold vibration level standard of 0.3 in/sec PPV (Caltrans 2020b).

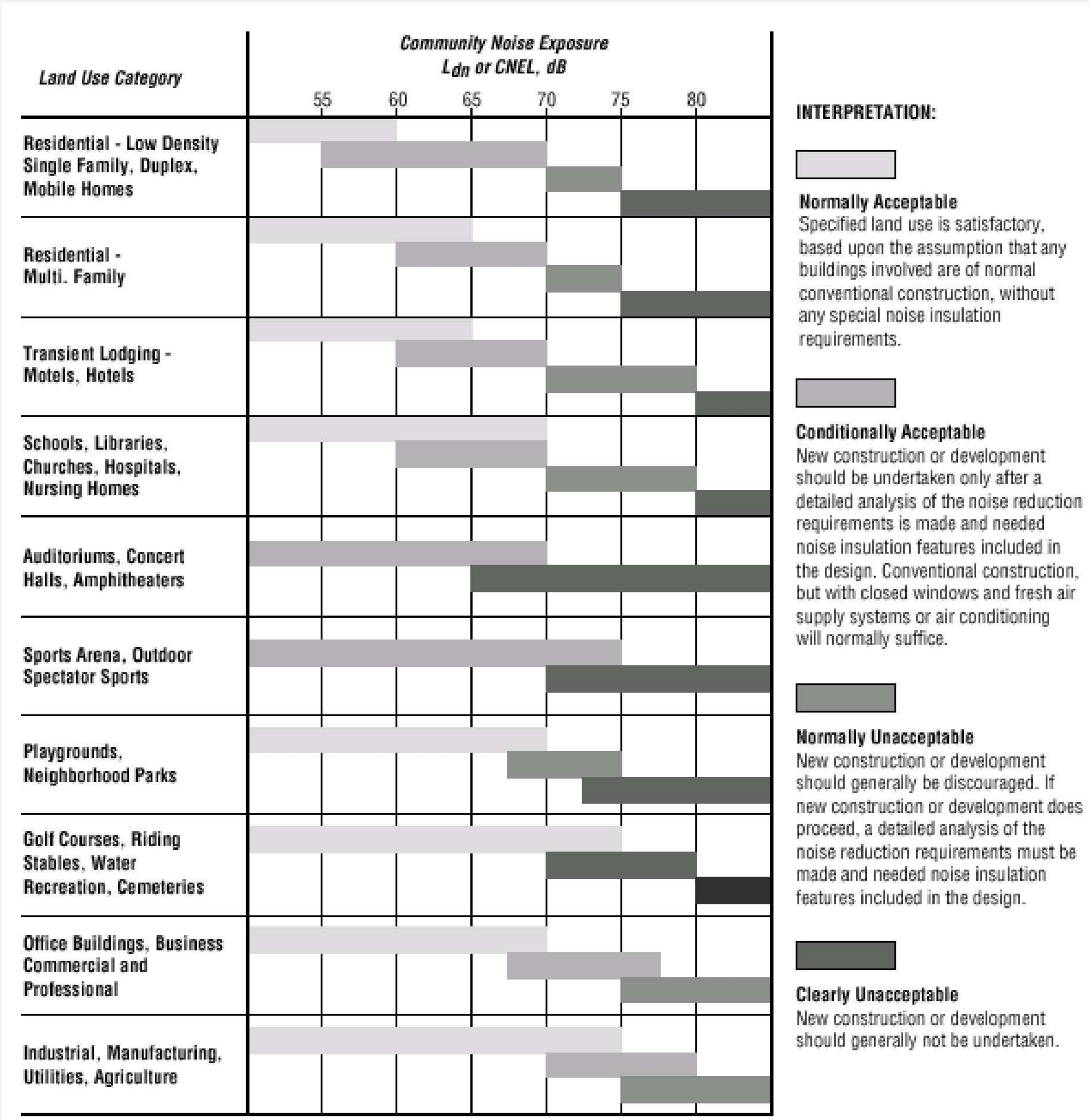
1.5.2.2 California Noise Control Act of 1973

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

1.5.2.3 California Department of Health Services

DHS has developed guidelines of community noise acceptability for use by local agencies, which have been published by the Governor’s Office of Planning and Research (2003) as the Land Use Compatibility for Community Noise Environments Matrix, provided herein.

Land Use Compatibility for Community Noise Environments Matrix



Source: Governor’s Office of Planning and Research (2003)

1.5.3 Local

1.5.3.1 Riverside County

Noise Limits for Stationary Sources

General Plan Noise Element

The County of Riverside has set exterior noise limits to control community noise impacts from non-transportation noise sources (such as mechanical equipment, including trash compactors, air-conditioning units, etc.). Policy N 4.1 of the Noise Element sets an exterior noise limit not to be exceeded for a cumulative period of more than ten minutes in any hour of 65 dBA Leq for daytime hours of 7:00 a.m. to 10:00 p.m., and 45 dBA Leq during the noise-sensitive nighttime hours of 10:00 p.m. to 7:00 a.m. These stationary-source noise level standards are consistent with the County of Riverside Office of Industrial Hygiene guidelines for noise studies within the County.

Riverside County Noise Ordinance No. 847

The County Noise Ordinance allows for different levels of acceptable noise depending upon land use. The Noise Ordinance or Ordinance No. 847 (Regulating Noise) is incorporated in the County Code as Chapter 9.52 (Noise Regulation). The standards in Chapter 9.52.040 (and also Section 4 of Ordinance No. 847) limit noise sources on any property from causing excessive exterior noise on any other nearby occupied property. The maximum decibel level standards depend on the receiving land use, such that sound levels in a low-density "Rural Community" shall not exceed 55 dBA Leq during the daytime hours (7:00 a.m. to 10:00 p.m.) or 45 dBA Leq during the nighttime hours (10:00 p.m. to 7:00 a.m.). These County standards protect the noise-sensitive receptors within the very low-density rural area surrounding the Project site.

Construction Noise Standards

Section 9.52.020(I) of the County's Noise Regulation Ordinance indicates that noise associated with any private construction activity located within one-quarter of a mile from an inhabited dwelling is considered exempt between the hours of 6:00 a.m. and 6:00 p.m., during the months of June through September, and 7:00 a.m. and 6:00 p.m., during the months of October through May. Neither the County's General Plan nor County Code establish numeric maximum acceptable construction source noise levels at potentially affected receptors, which would allow for a quantified determination of what constitutes a substantial temporary or periodic noise increase for purposes of CEQA analysis.

While the County of Riverside has not adopted construction noise level limits for construction activities conducted during daytime hours, the FTA has adopted a guideline for daytime construction noise exposure at residential land uses. The FTA guideline is a maximum of 80 dBA L_{eq} which is averaged over a typical 8-hour construction day. While Riverside County has not adopted this standard, it is a useful guideline when evaluating potential impacts from daytime construction noise.

1.5.3.2 Local Vibration Standards

According to the County of Riverside General Plan Noise Element, vibration levels with a PPV of 0.08 inches per second (in/sec) are considered readily perceptible and PPV above 0.2 in/sec are considered annoying to people in buildings. Further, County of Riverside General Plan Policy 16.3 identifies a motion velocity perception threshold for vibration due to passing trains of 0.01 in/sec over the range of one to 100 Hertz. For the purposes of this analysis, the vibration annoyance threshold of 0.2 in/sec shall be used to assess the potential impacts due to Project construction at nearby sensitive receptor locations.

1.6 Significance Criteria

Section XIII of Appendix G of the State CEQA Guidelines addresses typical adverse effects due to noise and includes the following threshold questions to evaluate a project's impacts due to noise. Would the project:

1. Result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?
2. Result in generation of excessive groundborne vibration or groundborne noise levels?
3. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels?

The following significance thresholds are set forth in Riverside County's Environmental Assessment Checklist, are derived from Section XIII of Appendix G of the State CEQA Guidelines (listed above), and are used to evaluate the significance of impacts due to noise in this analysis:

1. Would the project be located within an airport land use plan or, where such a plan has not been adopted, within two (2) miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?
2. Would the project be located within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?
3. Would the project result in the generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan, noise ordinance, or applicable standards of other agencies?
4. Would the project result in the generation of excessive ground-borne vibration or ground-borne noise levels?

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2 Environmental Setting

2.1 Sensitive Receptors

Noise- and vibration-sensitive land uses are locations where people reside or where the presence of unwanted sound or vibration could adversely affect the use of the land. Residences, hospitals, nursing care or assisted living facilities, guest lodging, and churches would be considered noise- and vibration-sensitive. In addition, vibration-sensitive land uses also include institutional uses such as laboratories where the activities within the building are particularly sensitive to vibration.

Noise and vibration-sensitive receptors in the Project vicinity are represented by residential units, including single-family homes and mobile homes, The closest sensitive receptors to the Project site include a cluster of three residences, the closest of which is located 0.4 miles (2,115 feet) east of the Project site along the west side of State Route 177 (SR 177), that is represented as location ST4/LT2 on Figure 3. The next closest noise-sensitive receptors are represented by mobile homes (Green Acres Mobile Park), located approximately 1 mile to the south of the Project site, on the east side of SR 177 (ST3 on Figure 3). Another set of sensitive receptors, Lake Tamarisk Desert Resort, includes mobile home spaces, a golf course, a community building, and single-family residences. It is located approximately 1.28 miles to the southwest of the Project site (ST1/LT1 on Figure 3). Single family residences in a small neighborhood (Shasta Drive) are located approximately 1.5 miles to the southwest of the Project site (ST2 on Figure 3). Refer to Figure 3, for the relative location of these receptors to the Project site.

2.2 Ambient Noise Survey

In order to establish existing baseline community noise levels (also known as outdoor ambient noise levels) Dudek performed a series of sound level measurements. Sound-pressure level measurements of short duration (i.e., less than an hour apiece) and long duration (at least 24 hours in length) were conducted in the vicinity of the Project site to quantify and characterize the existing outdoor ambient noise levels. The short-term measurements were conducted primarily to gather data necessary to calibrate the traffic noise model, while the long-term measurements provide sound level data throughout the day and night to describe representative ambient noise levels for receptors in the vicinity of the long-term measurement location.

The sound-pressure level measurements were performed by a Dudek field investigator using a SoftdB Piccolo model sound level meter equipped with a 0.5-inch, pre-polarized condenser microphone with pre-amplifier. The sound level meter meets the current American National Standards Institute standard for a Type 2 (general purpose) sound level meter. The accuracy of the sound level meter was verified using a field calibrator before and after the measurements, and the measurements were conducted with the microphone positioned approximately five feet above the ground. Table 4, Measured Short-Term Baseline Outdoor Noise Levels, and Table 5, Measured Long-Term Baseline Outdoor Noise Levels, provides the location and time at which these baseline noise level measurements were taken.

As detailed in Table 4, four short-term noise level measurement locations were selected (ST1-ST4) that represent either existing sensitive receptors and/or roadway facilities to which the Project would principally contribute trips. As detailed in Table 5, the long term measurement locations (LT1 and LT2) were placed adjacent to residences closest to the Project site. These noise measurement locations are depicted on Figure 3, Ambient Noise Monitoring Locations.

The L_{eq} and L_{max} noise levels measured at the short-term measurement locations are provided in Table 4. The primary noise sources at the sites identified in Table 4 consisted of traffic along roadways in the vicinity. As shown in Table 4, the measured existing ambient sound levels at ST1–ST4 ranged from approximately 37 dBA L_{eq} at ST1 to 72 dBA L_{eq} at ST3. ST-1 and ST-2 were located adjacent to local roads serving the Tamarisk Desert Resort and Shasta Drive residential neighborhood, with very light vehicle traffic over the duration of the measurement. The recorded ambient sound levels of 37 and 42 L_{eq} along these local streets is representative of quiet residential neighborhood conditions The higher noise levels recorded at ST3 and ST4 are also expected, due to their locations adjacent to the heavily traveled SR 177. Noise measurement data summarized in Table 4 is also included in Appendix B, along with field data sheets that provide additional information about field conditions and noise contributors to each measured sound level.

Table 4. Measured Short-Term Ambient Outdoor Noise Levels

Receptor	Location/Address	Time	L_{eq} (dBA)	L_{max} (dBA)
ST1	Lake Tamarisk Desert Resort southwest of Project site, west side of SR 177	4:55 PM to 5:25 PM	37	54
ST2	Small residential neighborhood southwest of Project site, west side of SR 177	12:10 PM to 12:25 PM	42	59
ST3	Mobile home park, due south of Project site (second-closest sensitive receptor), east side of SR 177	12:35 PM to 12:50 PM	72	88
ST4	Closest residence to Project site, due east of Project, west side of SR 177	3:05 PM to 3:35 PM	70	92

Source: Appendix B
Notes: L_{eq} = equivalent continuous sound level (time-averaged sound level); L_{max} = maximum sound level during the measurement interval; dBA = A-weighted decibels; ST = short-term noise measurement locations.

For the long-term measurements, each Piccolo sound level meter was configured to record data for one-hour intervals. Sound level metrics including L_{eq}. L_{max}, L_{min}, were recorded for each one-hour period. Data logs for each of the two measurement locations are included in Appendix B. Table 5 presents a summary of the results of the long-term measurements.

Table 5. Measured Long-Term Ambient Outdoor Noise Levels

Receptor	Location/Address	Daytime L_{eq} (dBA)	Evening L_{eq} (dBA)	Nighttime L_{eq} (dBA)	CNEL (dBA)
LT1	Lake Tamarisk Desert Resort southwest of Project site, west side of SR 177	51	46	41	51
LT2	Closest residence to Project site, due east of Project, west side of SR 177	65	60	60	67

Source: Appendix B
Notes: L_{eq} = equivalent continuous sound level (time-averaged sound level); dBA = A-weighted decibels; CNEL = community noise equivalent level; LT = long-term noise measurement locations.

Based upon Table 5, existing ambient noise levels at the residences represented by LT2 are strongly influenced by traffic along SR 177. In contrast, existing ambient noise levels at receptors represented by LT1 are much lower, indicating this vicinity is less exposed to SR 177 traffic noise. Because the 24-hour measurement data provides more detailed information regarding ambient noise levels, the existing ambient noise levels for this report are based on the 24-hour measurement results presented in Table 5.

2.3 Existing Traffic Noise Levels

Dudek's transportation team identified the existing average daily trips (ADT) on roadways in the Project vicinity including State Route 177 (Rice Road) north and south of Ragsdale Road and Kaiser Road west of State Route 177(Traffic Generation Assessment for the Sapphire Solar Project, Dudek, June 2023). The ADT determination for the roadways is based upon detailed counts of vehicle movements through intersections as conducted by transportation professionals and forms the basis of transportation-related roadway performance analysis. The ADT identified by transportation professionals is used as an input to the traffic noise model.

Kaiser Road is proposed as the primary Project access as well as the route for construction traffic to access the Project site, while State Route 177 would be utilized as an emergency services route for the Project. Residences in the general vicinity of the Lake Tamarisk Desert Resort are located adjacent to Kaiser Road for the segment west/south of the Project, and also along State Route 177 which is located east and southeast of the Project. Based upon the identified existing ADTs for these roadway segments, Dudek calculated the traffic noise level along the roadways using equations adapted from the Federal Highway Administration (FHWA) Traffic Noise Model (TNM 2.5). The traffic noise levels in Table 6 are based upon reported existing ADTs, and not on the manual traffic counts conducted during the short-term ambient noise measurements (short term manual counts are used in calibrating the model to ensure accuracy for local conditions).

Table 6. Modeled Existing Traffic Noise Levels (dBA)

Road	Associated Short-term Noise Measure Location	Daytime Hourly L_{eq}	Nighttime Hourly L_{eq}	CNEL
SR 177 North of Ragsdale Road	ST3 & ST4	67	58	68
Kaiser Road west/north of SR 177	ST1 & ST2	55	47	56

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3 Impacts and Mitigations

3.1 Methodology

3.1.1 Construction Noise / Decommissioning Noise

One of the most extensive and widely used databases for sound levels from motorized or powered equipment is the FHWA Roadway Construction Noise Model (RCNM). While the focus of data compilation was for equipment that would typically be employed for the construction of transportation facilities, the list is comprehensive enough to be useful in assessing sound levels for nearly every activity for which powered equipment is used. Table 7 provides an excerpt from RCNM of the sound levels generated by various powered equipment that could be associated with construction and eventual decommissioning of the Project. Note that the equipment noise levels presented in Table 7 are maximum noise levels. Usually, construction equipment operates in alternating cycles of full power and low power, producing average noise levels over time that are less than the maximum noise level. The average sound level of construction or decommissioning activity also depends on the amount of time that the equipment operates and the intensity of construction or decommissioning activities during that time.

Table 7. Selected Powered Equipment Noise Emission Levels from RCNM

Equipment	Maximum Sound Level (dBA L_{max}) – 50 feet from Source
Air Compressor	81
Backhoe	80
Compactor	82
Concrete Mixer	85
Crane, Mobile	83
Dozer	85
Generator	81
Grader	85
Loader	85
Paver	89
Pneumatic Tool	85
Pump	76
Roller	74
Saw	76
Scraper	89
Truck	88

Source: FHWA 2006a, 2006b.
Notes: dBA = decibel (A-weighted).

Noise emissions from the construction phase of the Project were estimated based upon construction scenario information provided by the Project applicant, including phasing, equipment mix, and vehicle trips, and CalEEMod default values when Project specifics were not known. The construction equipment mixes, and vehicle trips used for estimating the Project-generated construction noise emissions are included in Appendix C.

A Microsoft Excel–based noise prediction model emulating and using reference data from the FHWA RCNM was used to estimate construction noise levels at the nearest noise-sensitive land use (i.e., residence), based upon the distance between the closest Project construction activities and this residence. Aggregate noise emission from Project construction activities, broken down by sequential phase of construction activity, was predicted for the worst-case construction activity occurring along the closest construction boundary to the off-site closest residence. Dudek compared predicted construction noise levels to the recommended FTA construction noise exposure standard and to measured ambient noise levels. Decommissioning of the Project would involve the removal of all the installed equipment and site improvements, essentially the reverse of the construction process. As such, decommissioning would be anticipated to include the same construction equipment and the same activities (but reversed) as the construction process, and therefore decommissioning activities would result in the same noise levels as construction activities at the closest residences to the Project site.

3.1.2 Traffic Noise

Dudek's transportation team identified the existing average daily trips (ADT) on roadways in the Project vicinity including Kaiser Road west/north of State Route 177 (Rice Road) and State Route 177 north and south of Ragsdale Road. (Traffic Generation Assessment for the Sapphire Solar Project, Dudek, June 2023). Residences are located adjacent to the segment of Kaiser Road south of the Project site and adjacent to State Route 177 east and southeast of the Project Site. Project-related traffic noise levels were examined along these same roadways using the results of the traffic analysis. Acoustical calculations using standard noise modeling equations adapted from the FHWA noise prediction model were performed for the following scenarios: Existing, Existing Plus Project Construction Traffic, and Existing Plus Project Operational Traffic.

The modeling calculations take into account the posted vehicle speed, average daily traffic volumes for each scenario, and the estimated vehicle mix (i.e., automobiles, medium and heavy trucks). The model assumed soft-site propagation conditions, as the roadways are surrounded by undeveloped agriculture lands. Noise levels were modeled at 25 feet from the centerline of each road. Noise levels at greater distances from the roadway centerline would be lower due to attenuation provided by increased distance from the noise source. Generally, noise from heavily traveled roadways would experience a decrease of approximately 3 dBA for every doubling of distance from the roadway. The noise model does not take into account the sound-attenuating effect of intervening structures, barriers, vegetation, or topography. Therefore, the noise levels predicted by the model are conservative with respect to traffic noise exposure levels along these roadways.

3.1.3 Operational Noise Level Quantification

Stationary Source Reference Sound Levels

Long-term operational Project noise was assessed based upon the site layout plans indicating locations for each of the major noise-generating components, identified sound level for each piece of equipment, and the location of the closest noise-sensitive receptors (i.e., residences) to the Project site. Noise-producing equipment associated with the proposed Project includes PV trackers, string inverters for PV panel arrays, integrated BESS consisting of batteries, controllers, and inverters, mid-level transformers, emergency electrical power generators, substations/switching stations with step-up transformers, and heating, ventilation and air conditioning (HVAC) equipment for the BESS, as well as the operations and maintenance building.. A description of major Project equipment and the employed sound level reference for each are provided below. Refer to Figure 3 for the site layout indicating the location of the Project components described below. For the operational noise modeling, Dudek used the “Southern Alternative Location” for the BESS, Proposed Substation and Operations and Maintenance Building because this represents the worst-case (shortest distance separation) with respect to the largest concentration of noise sensitive receptors (mobile home park and residential neighborhood to the southwest of the Project site).

PV Inverters & Mid-Level Transformers

For string inverters distributed within the solar panel array, Dudek used the sound reference level for a SMA model Sunny Central SC 2500-EV, for which the manufacturer reports a sound pressure level of 64 dBA at 10 meters (32.8 feet). Based on the given capacity of 117 MW of photovoltaic generation for Sapphire solar, it is anticipated that a total of 33 string inverters would be included. Each inverter would be paired with a mid-level transformer. According to National Electric Manufacturers Association (NEMA) Standards Publication No. TR 20- 2014 – Dry Type Transformers for General Applications (NEMA 2014), noise level limits are specified for equivalent winding kilovolt-amps ranges and cooling systems. 67 dBA is the highest acceptable noise level at 1 foot from transformers for the capacity expected to be necessary for the field transformers; at 32.8 feet the sound level for the field transformers would be 37 dBA apiece. Because the transformers would generate sound levels 31 dBA lower than the inverters, the combined sound level of each inverter/transformer pair would be no greater than the inverter by itself (when two sound levels differ by more than 10 dBA, the sum of the two is equal to the higher sound level). A sound pressure level reference of 64 dBA at 32.8 feet was thus used to model each string inverter/transformer pair.

Substation and Switching Station Transformers

Switching stations typically include step-up transformers. Dudek reviewed noise level data associated with various capacity transformers previously analyzed for other projects. Based upon this review, Dudek identified that noise levels associated with switching station transformers that are expected to be employed at the Project typically range from approximately 75 to 89 dB at a distance of 3 feet from the source. A reference sound level of 89 dBA at 1 meter (3.28 feet) from the source is used in this analysis to represent the substation transformer.

Battery Energy Storage System

BESS units could be consolidated in one area of the site and employ individual BESS containers or units or could be housed in a centralized structure. Worst-case noise levels would be associated with a configuration that places individual BESS units in a dedicated portion of the Project site, as this would represent a concentration of multiple noise sources (as opposed to a single BESS structure).

Dudek modeled the BESS component in a dedicated area of the site (as indicated in the site layout), employing individual BESS units (not within a single centralized structure). The modeled battery storage unit is the Powin Stack 750 Centipede; according to the manufacturer, the Stack 750 has a sound level rating of 72 dBA at 10 meters (32.8 feet). It is estimated that based on the size of the proposed BESS facility approximately 396 Stack 750 units would be needed to achieve the desired energy storage capacity. Dudek rounded this estimate to 400 units for the modeling.

The battery storage units would be supported by combined inverter / transformer units. The modeled battery inverter product is the SMA Sunny Central 3950 UP-XT-US; according to the manufacturer, the sound level rating for this equipment is 65 dBA at 10 meters (32.8 feet). One UP-XT-US would be required for each 10 Stack 750 units, therefore Dudek modeled a total of 40 of these units for the BESS component.

Operations & Maintenance Building

Up to three emergency electrical generators may be included with the O&M building, substation and/or BESS component, to ensure that cooling equipment for the BESS systems would continue to function in the event of an electrical service interruption and that control and monitoring systems would also remain energized. Dudek used the sound reference level for a Generac SG250 generator (250 kW capacity) with a factory supplied level 1 acoustic enclosure. The reported sound level is 77.8 dBA at 23 feet. The O&M building is anticipated to include an office space that is temperature controlled. For the HVAC unit, Dudek used a Carrier Infinity 19VS air conditioner with 6-ton capacity. The air conditioner element of the HVAC system is the only exterior component that would generate sound levels outdoors. The Carrier Infinity 19VS 6-ton version has a sound power rating of 72 L_W which equals a sound pressure level of 64 dBA at 1 meter (3.28 feet) from the unit.

Trackers

The Project's photovoltaic (PV) panels would utilize axis trackers to periodically adjust the angle of the PV panels in relation to the sun. This would occur intermittently throughout the daytime hours. Noise levels associated with trackers are very low in nature, approximately 37 dB at a distance of 10 feet from the source (AECOM 2012). Such noise levels are essentially negligible and inaudible beyond a few feet from the source. Noise contributions from the trackers were therefore not combined with the noise contributions from the major equipment in the noise analysis.

Electrical Transmission Lines (Gen-Tie Lines)

The Project would include overhead electrical transmission lines, generally referred to as gen-tie lines. The exact gen-tie line routes are not known at this time, and two options are being considered. Gen-tie lines are used to facilitate the transmission of generated electricity to off-site stations. Noise associated with gen-tie lines are considered negligible and are generally limited to noise associated with corona discharge. The noise is often described as a crackling or humming sound, and associated noise levels could be expected to be approximately 25 dBA at a distance of 25 feet from the source (AECOM 2012). Such noise levels are negligible and inaudible beyond a few feet from the source, and this noise contribution was therefore not combined with other sources in the analysis.

Stationary Source Operational Sound Level Modeling

Prediction of operation noise attributed to the Project involved creation of a sound propagation model using a Dudek proprietary Excel-based software tool. Dudek NoisePro is used for calculation, presentation, assessment, and prediction of environmental noise. Estimated sound emission from the battery storage units (POWIN Stack 750 units with top-mounted cooling units), battery inverter/transformer units (SMA Sunny Central 3950 UP-XT-US), PV string inverters (SMA Sunny Central SC 2500-EV), medium-voltage transformers, step-up transformers, emergency electrical generators and O&M Building HVAC were entered into the Dudek NoisePro model. The outdoor noise propagation formulas in NoisePro follow the International Organization of Standardization (ISO) Standard 9613-2, "Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation" (ISO 1996).

Calculation parameters that establish how the NoisePro model predicts combined noise level from the above-listed Project sources include as follows:

- Sound propagation per International Organization of Standardization (ISO) 9613-2 (ISO 1996);
- Default ground acoustical absorption coefficient = 0.5 (on a scale of 0 = reflective, 1 = absorptive); and;
- Zero order of reflection.

3.1.4 Methodology – Vibration Assessment

California Department of Transportation (Caltrans) has been assembling data for vibration levels generated by heavy construction equipment operation during the building of transportation projects for many years. The vibration levels from use of such equipment are representative for other types of construction efforts, not just transportation projects, and are therefore widely employed to assess vibration levels from heavy equipment use for any effort. According to Caltrans (2020b) the most important equipment relative to generation of vibration, and the vibration levels produced by such equipment, is illustrated in Table 8.

Table 8. Vibration Velocities for Typical Construction Equipment

Equipment	PPV at 25 Feet (Inches Per Second)	Approximate VdB at 25 feet
Vibratory Roller	0.210	94
Large Bulldozer	0.089	87
Loaded Trucks	0.076	86
Drill Rig / Auger	0.089	97
Jackhammer	0.035	79
Small Bulldozer	0.003	58
Vibratory Pile Driver	0.650	104

Source: Caltrans 2020b.

According to the County of Riverside General Plan Noise Element, vibration levels with a PPV of 0.8 inches per second (in/sec) are considered readily perceptible and PPV above 0.2 in/sec are considered annoying to people in buildings. Further, County of Riverside General Plan Policy 16.3 identifies a motion velocity perception threshold for vibration due to passing trains of 0.01 in/sec over the range of one to 100 Hertz. For the purposes of this analysis, the vibration annoyance threshold of 0.2 in/sec shall be used to assess the potential impacts due to Project construction at nearby sensitive receptor locations.

Using the vibration level value for each of the equipment listed in Table 8, the distance to the target vibration level of 0.2 in/sec PPV was determined, using the following formula:

Peak particle velocity at distance (d) = peak particle velocity(d_{ref}) * (d_{ref}/d)$^{1.5}$

In the above equation, "d" is the distance between the receptor and a vibration source, "d_{ref}" is the reference distance that applies for the indicated vibration magnitude. The calculated distance to a vibration level of 0.2 in/sec PPV represents the radius from each equipment type within which potentially significant vibration impacts from Project construction could occur. Table 9 presents the results of applying the above equation to the equipment in Table 8.

As illustrated in Table 9, ground borne vibration levels for most construction equipment would attenuate to less than 0.2 in/sec PPV within approximately 15 feet from the equipment. For a vibratory roller, the distance at which ground borne vibration levels would attenuate to 0.2 in/sec PPV would be approximately 30 feet; for a vibratory pile driver the distance would be 60 feet.

Table 9. Distance Radius From Construction Equipment to Vibration Level of 0.2 in/sec PPV

Equipment	Distance From Equipment Where Vibration Level is Reduced to 0.2 in/sec PPV (Feet)
Vibratory Roller	30
Large Bulldozer	15
Loaded Trucks	15
Drill Rig / Auger	15
Jackhammer	10
Small Bulldozer	2
Vibratory Pile Driver	60

Source: Caltrans 2020b

With respect to groundborne noise, the VdB at any distance is calculated using the following formula:

VdB(D) = VdB(25 ft) – 30log(D/25)

Where:

VdB(D) = Vibration level at distance D

D = distance from equipment to the receiver in feet

VdB(25 ft) = reference vibration level at 25 feet from source

The calculated distance to a groundborne noise level of 78 VdB (the Caltrans daytime threshold for residential occupants) represents the radius from each equipment type within which potentially significant groundborne noise impacts from Project construction could occur. Table 10 presents the results of applying the above equation to the equipment in Table 8.

Table 10. Distance Radius From Construction Equipment to Groundborne Noise Level of 78 VdB

Equipment	Distance From Equipment Where Vibration Level is Reduced to 0.2 in/sec PPV (Feet)
Vibratory Roller	90
Large Bulldozer	50
Loaded Trucks	50
Drill Rig / Auger	120
Jackhammer	30
Small Bulldozer	10
Vibratory Pile Driver	200

Source: Caltrans 2020b

As illustrated in Table 10, groundborne noise levels for most construction equipment would attenuate to less than 78 VdB within approximately 50 feet from the equipment. For a vibratory roller, the distance at which ground borne noise levels would attenuate to 78 VdB would be approximately 90 feet; for an auger drill rig the distance would be 120 feet; for a vibratory pile driver the distance would be 200 feet.

3.2 Impacts Analysis

3.2.1 Project Impacts – Increases in Ambient Noise Levels

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

3.2.1.1 Project Construction & Decommissioning

As described under Section 3.1.1 (Construction Noise Methodology), construction noise modeling was performed to predict construction noise levels at Project vicinity noise-sensitive uses, including a group of residences approximately 0.4 miles (2,115) feet east of the Project site (Figure 3, LT2) and receptors at the Lake Tamarisk Desert Resort (LT1) no closer than approximately 1.25 miles (6,600 feet) from Project construction activity. Table 11 provides a summary of the construction noise modeling; detailed information is provided in Appendix C. Because decommissioning of the Project would represent the reverse of the construction process, involving the same equipment and activities as Project construction, decommissioning of the Project would be anticipated to result in the same temporary noise levels at vicinity noise sensitive receptors as the construction noise levels presented in Table 11.

Table 11. Construction Noise Levels at Nearby Noise-Sensitive Receptor by Phase

Phase	Construction Noise Level (dBA) at LT1		Construction Noise Level (dBA) at LT2	
	L_{max}	$L_{eq\ 8\text{-}hr\ /\ 1\ hr}$	L_{max}	$L_{eq\ 8\text{-}hr\ /\ 1\ hr}$
(1) Move On	55	51	65	61
(2) Site Prep & Grading	55	52	65	62
(3) New Access Road Construction	54	50	64	60
(4) Generation Tie Line Construction	51	47	61	57
(5) Internal Roads Construction	51	47	61	57
(6) Electrical Sub-Station (Switchyard) and Microwave Tower	51	47	61	57
(7) Solar Arrays, Underground, Battery Storage, O&M Building	57	53	66	63
Highest Noise Level Across All Phases	**57**	**53**	**66**	**63**

Section 9.52.020(I) of the County's Noise Regulation Ordinance indicates that noise associated with any private construction activity located within one-quarter of a mile from an inhabited dwelling is considered exempt between the hours of 6:00 a.m. and 6:00 p.m., during the months of June through September, and 7:00 a.m. and 6:00 p.m., during the months of October through May. Construction is scheduled to occur between 6:00 a.m. and 6:00 p.m., but limited nighttime work may be necessary during certain phases of construction/times of year/weather conditions to protect workers from high heat and/or other safety or risk avoidance factors. In the event that nighttime construction work is required and authorized, such would pe performed in accordance with the provisions described below, Neither the County's General Plan nor County Code establish numeric maximum acceptable construction source noise levels at potentially affected receptors. The closest residential receptors are not within

one quarter mile of the Project site. However, based upon the intent of Section 9.52.020(I), nighttime construction noise (generally between 6:00 p.m. and 6:00 a.m.) should be managed such that it is not audible at residences in the general vicinity of the Project construction site, which would imply that construction noise should not be greater than 3 dBA over ambient for any night-time construction activities. Based upon results of the 24-hour noise measurement conducted near the closest residences (LT2 on Figure 3), the nighttime ambient average noise level is 60 dBA L_{eq} while the highest noise levels for construction activity occurring at the nearest portion of the Project site could range up to 63 dBA L_{eq} (no greater than 3 dBA L_{eq} higher). As such, night-time construction activities audible at residences represented by LT2 would not be anticipated to result in noise levels that would exceed the apparent intent of the nighttime noise restrictions under the noise ordinance. However, to avoid disturbances to the public, general construction activities should be limited from 6:00 p.m. to 6:00 a.m. when conducted within 2,500 feet of the residences to the east of the Project. The same nighttime restrictions should be observed during decommissioning activities at the end of Project life. Pre-operations testing of installed solar facility components would not involve heavy construction equipment, and therefore testing activities would not be subject to nighttime "construction" restrictions.

Based upon results of the 24-hour noise measurement conducted near the Lake Tamarisk Desert Resort (LT1), the nighttime ambient average noise level is 41 dBA while the highest noise levels for construction activity occurring at the nearest portion of the Project site (1.25 miles or 6,600 feet from the resort) could range up to 54 dBA L_{eq} (up to 13 dBA L_{eq} higher than nighttime ambient). From the furthest point of the Project construction zone to Lake Tamarisk Desert Resort (approximately 2.65 miles or 14,000 feet), construction noise levels at Lake Tamarisk Desert Resort could reach up to 47 dBA L_{eq} (up to 6 dBA L_{eq} higher than nighttime ambient). As such, general noise generating night-time construction activities should be limited from 6:00 p.m. to 6:00 a.m. The same nighttime restrictions should be observed during decommissioning activities at the end of Project life. Again, pre-operations testing of installed solar facility components would not involve heavy construction equipment, and therefore testing activities would not be subject to these nighttime "construction" restrictions.

Because neither the Riverside County General Plan nor Code provide quantitative limits for daytime construction noise, this analysis applies a significance threshold of (i) a 20 dBA over baseline sound levels standard for short-term, daily noise; and (ii) a construction-phase average sound level standard (e.g., the average sound level for a given phase of construction) of 10 dBA over baseline sound levels. As explained below, these thresholds were identified after conducting a review of regulatory agency documents and published scientific reports.

Baseline measurements identified exterior CNELs ranging from 51 to 67 dBA at Project area residences. The FTA recommends that for areas already exposed to high ambient noise levels (e.g., 65 dBA CNEL or greater) ambient sound levels should not be increased by more than 10 dBA averaged over a 30-day period. Given the transitory nature of construction noise, and quasi-mobile characteristics of most construction equipment (e.g., dozers, graders, etc.) two ambient threshold increase limits have been identified to determine significant temporary increases in ambient noise levels: a short- term (daily) 20 dBA threshold and a long term (overall construction phase) 10 dBA threshold. In addition, the USEPA publication "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety" identifies a sustained level of 70 dBA $L_{eq(24)}$, as the limit beyond which sustained noise can contribute to hearing loss (which translates to a CNEL of 77 dBA). This threshold was used as the 24-hour limit for construction noise from the Project. As a consequence, the 20 dBA daily and 10 dBA construction phase ambient increase thresholds are capped at 77 dBA CNEL.

These thresholds have been identified as a conservatively appropriate for assessing the significance of temporary ambient noise increases as a result of construction of this Project because:

1. The noise ceiling of 77 dBA CNEL for both daily and construction phase noise levels represents a level that, if exceeded on a sustained basis, could contribute to hearing loss and is less than the criterion employed by FTA on similar major infrastructure projects.
2. A daily relative construction noise level limit of 20 dBA over baseline would be perceived as a quadrupling of sound level at the exterior of a noise sensitive receptor and represents a level that would be significant on a daily basis for when construction is closest to a given receptor.
3. An average construction phase noise level increase of 10 dBA over baseline would be perceived as a doubling in noise level and, because it would last for a longer period of time, its exceedance would be considered significant.
4. The noise environment in the vicinity of the Project frequently includes periodic noise from heavy truck traffic along SR 177, which are similar to heavy machinery used in construction.
5. The temporary, up to 18-month construction period for the Project will occur in shorter-term phases across the entire Project site, such that sensitive receptors will be exposed to higher noise levels for only a portion of the Project's construction period.

With regard to daytime construction noise levels, comparing the predicted highest average (L_{eq}) construction noise level from Table 11 at the closest residence (63 dBA L_{eq}) to the recorded daytime ambient noise level (65 dBA L_{eq}), we see the construction noise level would remain at least 2 dBA L_{eq} lower than the recorded daytime ambient noise level, and therefore would not cause an increase in ambient noise levels at the closest residence. For the receptors in the Lake Tamarisk Desert Resort area, the highest construction levels (up to 54 dBA L_{eq}) could exceed daytime ambient levels by 3 dBA L_{eq} which would remain well below the identified significance threshold of a 20 dBA L_{eq} increase and is anticipated to be barely noticeable to residents. During construction, activity will overlap between phases, increasing the amount of equipment used and the resulting composite noise levels. The most intense sequentially adjacent phases (Phase I and Phase 2) have an individual L_{eq} of 61 and 62 at L2, respectively; even if these phases occurred simultaneously, the composite construction noise level at L2 would increase to only 65 dBA L_{eq} which would equal the recorded daytime ambient noise level at LT2. The overlapping of other sequential phases would in each case produce composite sound levels less than 65 dBA L_{eq}. At LT1, sequential phases would sum to no more than 60 dBA, even if conducted simultaneously; this would represent only a 9 dBA L_{eq} increase over the recorded daytime ambient noise level, and thus would fall below the daily threshold of a 20 dBA L_{eq} increase or 10 dBA L_{eq} increase for the duration of any construction phase. These exterior noise levels would be attenuated by a minimum of 20 dBA inside the affected residences, with the result that daytime construction noise levels inside would not be expected to exceed 45 dBA L_{eq} and would therefore not interfere with conversations or other household noise-sensitive activities.

While the County of Riverside has not adopted quantified construction noise level limits for construction activities conducted during daytime hours. the FTA has adopted a guideline for daytime construction noise exposure at residential land uses. The FTA guideline is a maximum of 80 dBA L_{eq} which is averaged over a typical 8-hour construction day. Assuming construction activity intensity is similar across the 8-hour construction day, the L_{eq} value for the FTA 8-hour averaging period would be equal to the $L_{eq\ 1hr}$ value for any given hour within the 8-hour construction window (hence the labeling of $L_{eq\ 8\text{-hr}\ /\ 1\ hr}$) in the right-hand column of Table 10. Construction noise levels are predicted to be no greater than an 8-hour average of 63 dBA L_{eq} at the closest residence to the Project and would therefore not exceed the FTA guidelines. With the potential for overlap of adjacent construction phase timing, the noise level from combined phases would not be anticipated to exceed an 8-hour average of 65 dBA L_{eq} at the closest residence to the Project. Consequently, construction noise impacts of the Project would be less than significant. Similarly, decommissioning activities at the end of Project life would be anticipated to result in temporary noise levels no greater than those quantified for construction, and therefore Project decommissioning activities would result in less than significant temporary noise impacts.

3.2.1.2 Project Traffic Noise

The Dudek transportation team quantified average daily trips on Kaiser Road north of SR 177 (Rice Road) and on SR 177 north and south of Ragsdale Road to which the Project could principally contribute trips, including scenarios for existing, existing plus construction traffic, and existing plus Project operation traffic (Traffic Generation Assessment for the Sapphire Solar Project, Dudek, June 2023). Kaiser Road north of SR 177 currently carries approximately 360 average daily traffic (ADT), SR 177 on the segment north of Ragsdale Road currently carries approximately 1,480 ADT. Dudek used these ADT values to model existing traffic noise levels. The traffic counts were collected on October 4, 2022, during a time that the Oberon Renewable Energy project may have been under construction, however, it is uncertain the number of trips that would've been generated by the Oberon project on the exact day of the traffic counts. The Oberon Renewable Energy Project is located southeast of the Project and uses SR 177 as the primary access route, therefore it is feasible that the traffic counts may have included construction trips associated with the Oberon Renewable Energy Project.

The peak day of construction for the Project would generate approximately 1,052 daily trips. The permanent operations and maintenance phase, of the Project is expected to generate 10 daily trips. As a worst-case traffic noise exposure scenario for existing residences in the Project vicinity, Dudek assumed all construction and operation trips would travel along Kaiser Road to access the site. In an abundance of caution and to model the worst case noise scenarios, Dudek also evaluated a scenario with all Project traffic routed on SR 177 due to the proximity residences.

As described in Section 3.12 (Traffic Noise Methodology), acoustical calculations using standard noise modeling equations adapted from the FHWA noise prediction model were performed using the above ADT values for Existing Plus Project Construction Traffic and Existing Plus Project Operational Traffic. Tables 12 and 13 present the results of the traffic noise modeling, detailed information is provided in Appendix D.

Table 12. Project Construction Traffic Noise Levels Compared to Existing

Roadway	Existing dBA CNEL	Existing + Construction dBA CNEL	Increase From Construction Traffic	Significant Increase?	Sensitive Receptors Along roadway
Kaiser Road	55.8	61.7	5.9	No	Yes
SR 177	67.6	70.0	2.4	No	Yes

Source: Appendix D

As indicated in Table 12, assuming that all construction traffic accessed the site via Kaiser Road, construction traffic noise level increases on Kaiser Road attributable to the Project (5.9 dBA CNEL) would remain well below the construction noise significance level of a 10 dBA L_{eq} increase over ambient (the threshold to be applied across an entire phase of construction, which would be appropriate since construction traffic would occur along this roadway segment across each phase of construction). As also indicated in Table 12, assuming that all construction traffic accessed the Project site via SR 177, construction traffic noise level increases on SR 177 attributable to the Project

(2.4 dBA CNEL) would also remain well below the construction noise significance level of a 10 dBA Leq increase over ambient. Consequently, Project construction traffic noise impacts would be less than significant.

Table 13. Project Operational Traffic Noise Levels Compared to Existing

Roadway	Existing dBA CNEL	Existing + Operations dBA CNEL	Increase From Operations Traffic	Noticeable Increase?	Sensitive Receptors Along roadway
Kaiser Road	55.8	55.9	0.1	No	Yes
SR 177	67.6	67.7	0.1	No	Yes

Source: Appendix D

As indicated in Table 13, long-term operation of the Project would involve trip generation that would result in traffic noise level increases on Kaiser Road of 0.1 dBA CNEL (assuming all operational traffic accesses the Project via Kaiser Road), which would not be a change by the human ear. As indicated in Table 13, assuming all Project trips used SR 177 to access the site, there would also be an increase of only 0.1 dBA CNEL along SR 177. Consequently, operational traffic noise impacts would be less than significant.

3.2.1.3 Project Operational Noise

As described under Section 3.1.3 (Operational Noise Methodology), operational noise was modeled in the NoisePro model space, with a receptor at the closest existing residence to the proposed facility (ST4), as well as receptors at each of the other three locations where ambient noise measurements were performed (ST1-ST3), for comparison of Project operational noise levels against ambient noise levels.

Table 14 and 15 present the results of the operational noise modeling at ST1- ST4 and compare these modeled operational noise levels to recorded ambient noise levels and to limits contained in the Riverside County Zoning Ordinance. Detailed information for the operational noise modeling is provided in Appendix E.

Table 14. Project Operational Noise Levels Compared to Ambient

Receptor ID	Lowest Measured Existing Ambient (dBA L_{eq}) [1]	Predicted Operational Noise Level (dBA L_{eq})	Existing + Project (dBA L_{eq})	Increase (dBA L_{eq})
ST1/LT1	37	19	37	0
ST2	42	17	42	0
ST3	72	20	72	0
ST4/LT2	60	19	60	0

Source: Appendix E.
Notes: Represents lowest value at location for short-term or long-term measurement data.

As indicated in Table 14, the Project would not result in an increase in the ambient noise level at any of the locations where ambient noise monitoring was performed.

Table 15. Project Operational Noise Levels Compared to Zoning Ordinance Limits

Receptor ID	Predicted Operational Noise Level (dBA L_{eq})	Predicted Operational Noise Level (dBA CNEL)	Noise Ordinance Limit (dBA CNEL)	Limit Exceeded?
ST1/LT1	19	26	65	No
ST2	17	24		No
ST3	20	27		No
ST4/LT2	19	26		No

Source: Appendix E.

As indicated in Table 15, even if all of the facility equipment operated continuously over a 24-hour period, the predicted operational sound level at each of the ambient noise monitoring locations would fall well below the zoning ordinance limit of 65 dBA CNEL. Consequently, operational noise impacts of the Project would be less than significant.

NoisePro calculates the noise level across the entire grid that encompasses the Project site and adjacent areas. Figure 4 graphically represents the noise model results, providing noise contours extending outward from the proposed Project to illustrate the hourly noise level from operation of the Project. As illustrated on Figure 4, the 40-45 dBA L_{eq} contour is essentially contained within the Project site.

3.2.1.4 Mitigation

The proposed Project would not result in a significant temporary or permanent increase in ambient noise levels; therefore, no mitigation is required. Although there are no exceedances of the temporary increase over ambient threshold, as a precaution the following noise mitigation measures are recommended to minimize Project construction noise:

MM N-1 Construction Noise Equipment Controls

- The use of noise-producing signals, including horns, whistles, alarms, and bells, will be for safety warning purposes only.
- Construction equipment will be muffled per manufacturer's specifications. Electrically powered equipment will be used instead of pneumatic or internal combustion powered equipment, where feasible.
- All stationary construction equipment will be placed in a manner so that emitted noise is directed away or blocked from sensitive receptors nearest the Project site where possible.

MM N-2 Public Notification Process

At least 15 days prior to the start of ground disturbance, the Project owner shall notify all residents within one mile of the Project site and the linear facilities, by mail or by other effective means, of the commencement of Project construction. At the same time, the Project owner shall establish a telephone number for use by the public to report any undesirable noise conditions associated with the construction and operation of the Project. If the telephone is not staffed 24 hours a day, the Project owner shall include an automatic answering feature, with date and time stamp recording, to answer calls when the phone is unattended. This telephone number shall be posted at the

Project site during construction where it is visible to passersby. This telephone number shall be maintained until the Project has been operational for at least one year.

MM N-3 Noise Complaint Process.

Throughout the construction and operation of the Project, the Project owner shall document, investigate, evaluate, and attempt to resolve all Project-related noise complaints.

By further minimizing construction noise, notifying neighbors when construction will commence, and resolving noise complaints during construction, these measures will ensure that construction noise from the Project remains less than significant.

Significance After Mitigation

Mitigation is not required, because impacts would be less than significant without mitigation. The above recommended mitigation would further ensure that Project construction noise impacts would remain below significant levels.

3.2.2 Project Impacts – Vibration and Groundborne Noise Generation

Significance Criteria 2: Would the project result in generation of excessive groundborne vibration or groundborne noise levels?

3.2.2.1 Construction Vibration and Groundborne Noise

As discussed in Section 3.1.3 (Vibration Methodology) groundborne vibration generated from construction equipment would be attenuated to 0.2 in/sec PPV (the threshold for human annoyance) at a distance of no greater than 60 feet from construction activity. Consequently, for construction activities that are no closer than 60 feet from vibration sensitive uses, including residences, construction-related vibration levels would remain below the significance threshold. As also discussed in Section 3.13, groundborne noise generated from construction equipment would be attenuated to 78 VdB (the daytime threshold for residential structure occupants) at a distance of no greater than 200 feet from construction activity. Consequently, for construction activities that are no closer than 200 feet from groundborne noise sensitive uses, including residences, construction-related groundborne noise levels would remain below the significance threshold. The closest existing vibration-sensitive use (a residence) is located approximately 2,115 feet from the Project construction boundary. The vibration level from a vibratory pile driver at a distance of 2,115 feet would be 0.0008 in/sec PPV; the groundborne noise level would be at 49 VdB. Therefore, Project construction-related vibration levels and groundborne noise levels would be less than significant.

3.2.2.2 Operation Phase Vibration and Groundborne Noise

Vibration impacts associated with industrial and commercial facility operations are limited to large scale equipment with rotational components or involving repeated impact or “striking” movements (e.g., pile driving, industrial grade compressors, stamping machines, printing presses), or with the maneuvering of heavy trucks or similar large-scale materials-transport equipment. The ongoing operation of the proposed solar facility would not involve rotational equipment, or impact equipment. One water truck delivery per week is anticipated for long term operation of the Project; as discussed under construction vibration, potentially significant vibration impacts from a loaded truck operation would be limited to a distance of 18 feet, which would not extend beyond the road right-of-way for roads used by the water truck to access the site. Consequently, long-term operation of the Project would not be anticipated to generated perceptible vibration levels nor result in perceptible groundborne noise levels in vicinity structures; operational vibration and groundborne noise levels are therefore considered less than significant.

3.2.2.3 Mitigation Measures

The proposed Project would not result in a significant vibration impact; therefore, no mitigation is required.

Significance After Mitigation

Mitigation is not required, because impacts would be less than significant without mitigation.

3.2.3 Project Impacts – Airport Noise Exposure

Significance Criteria 3: For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

The closest public use airport to the Project site is the Jacqueline Cochran Regional Airport located approximately 45 miles to the west. Airport operations and aircraft activity associated with this public airport would not contribute to ambient noise levels in the Project vicinity, nor result in the exposure of vicinity residents or Project-related construction workers to excessive noise levels. Because the Project is not located within an airport land use plan or within two miles of a public airport or public use airport, there would be no impact.

Significance Criteria 4: For a project located within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

Desert Center Airport is located approximately 1.25 miles to east of the Project site. This airstrip was once a portion of General Patton's Desert Training Center. In 2006, the Riverside County Economic Development Agency sold the airport property to a private entity (Chuckwalla Valley Associates, LLC). The airport includes one paved runway with a length of 4,200 feet, which can accommodate moderate sized propeller driven aircraft. However, Desert Center Airport does not have a control tower, and neither aviation fuel nor other flight services are available at the facility. Consequently, aircraft activity at Desert Center Airport tends to be fairly limited. The Project would have no affect upon the volume of aircraft activity at Desert Center Airport, and the Project would also not include development of new residential structures. With the very limited aircraft operations at this nearby private airstrip, it is not anticipated that construction workers for the Project would be exposed to elevated noise levels associated with Desert Center Airport. Therefore, any impacts would be less than significant.

4 References Cited

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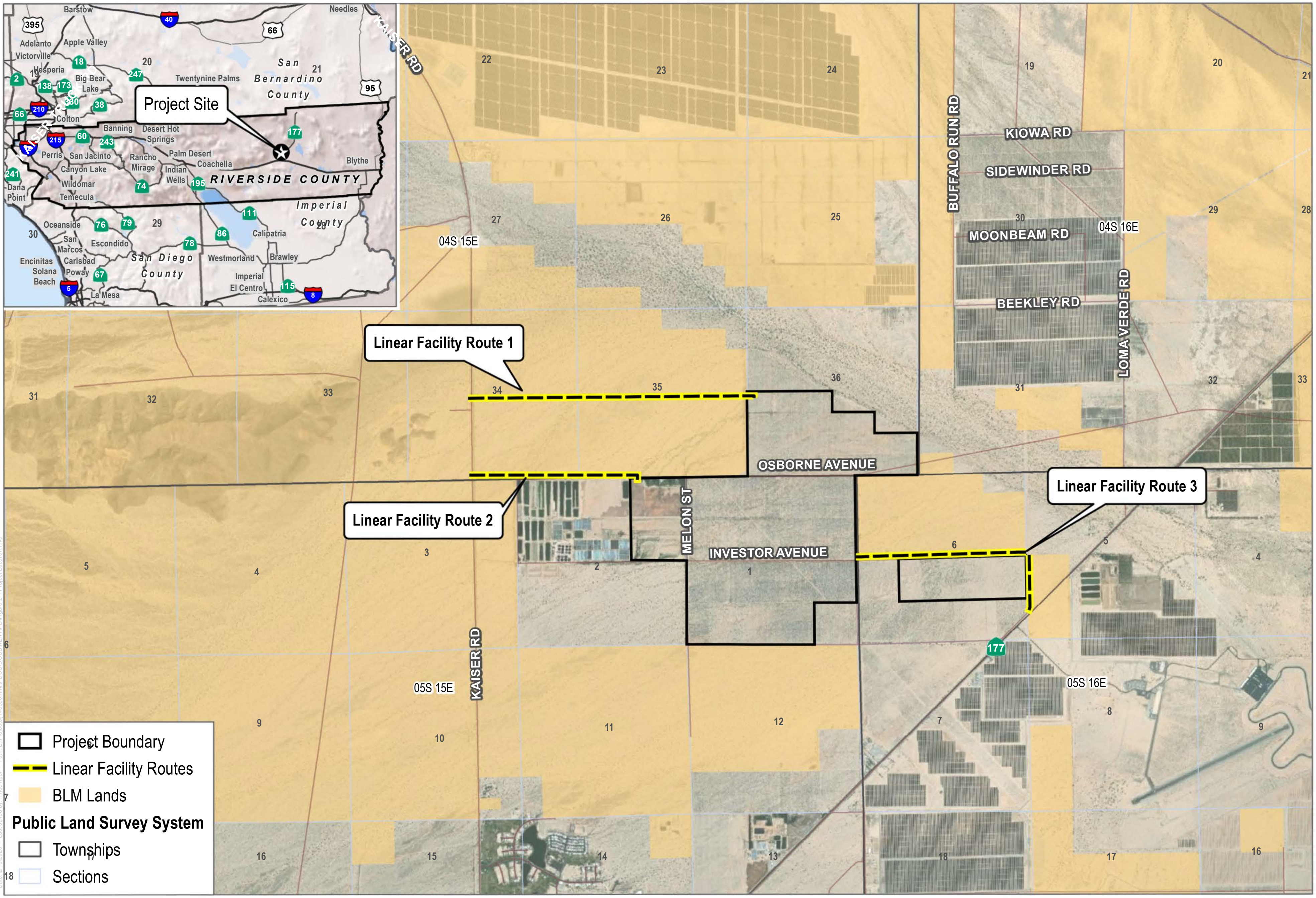

SOURCE: Esri World Imagery Basemap (accessed 2022); County of Riverside 2022; BLM 2022

DUDEK

FIGURE 1

Project Location

Sapphire Solar Project

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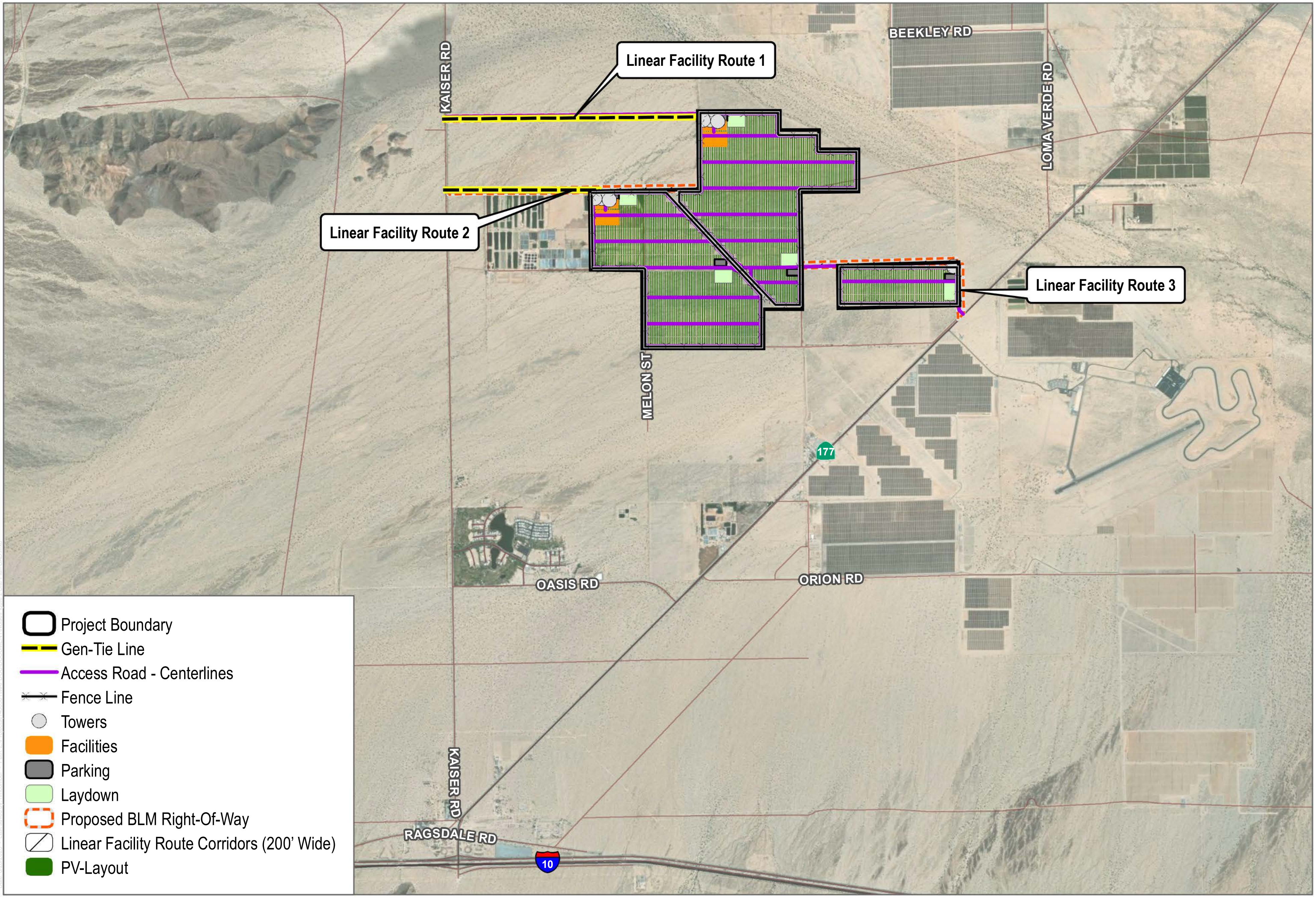

SOURCE: Esri World Imagery Basemap (accessed 2022); County of Riverside 2022; BLM 2022

DUDEK

0 2,200 4,400 Feet

FIGURE 2

Site Plan

Sapphire Solar Project

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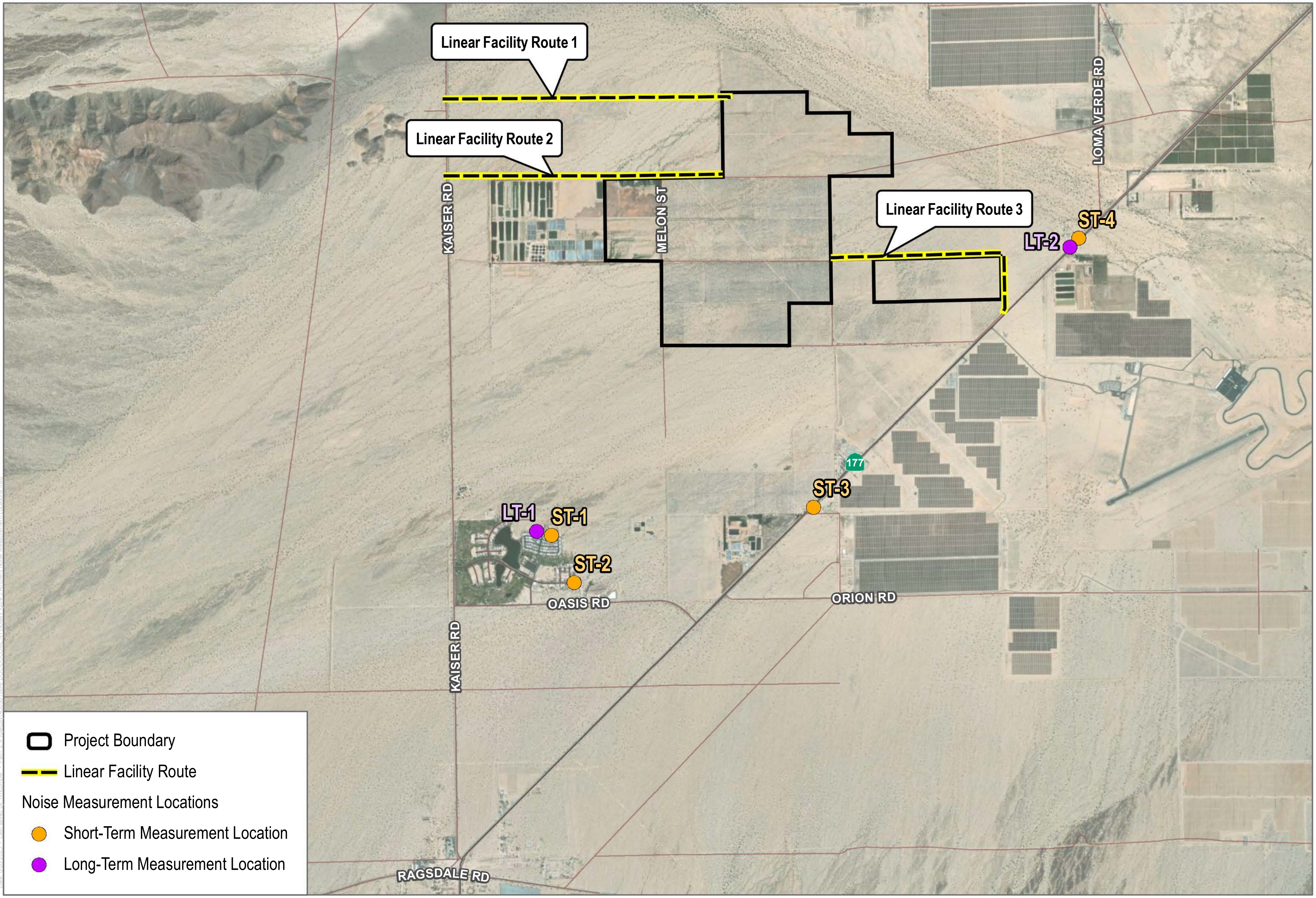

SOURCE: Esri World Imagery Basemap (accessed 2022); County of Riverside 2022; CALFIRE 2022

DUDEK

0 2,000 4,000 Feet

FIGURE 3

Ambient Noise Measurement Locations

Sapphire Solar Project

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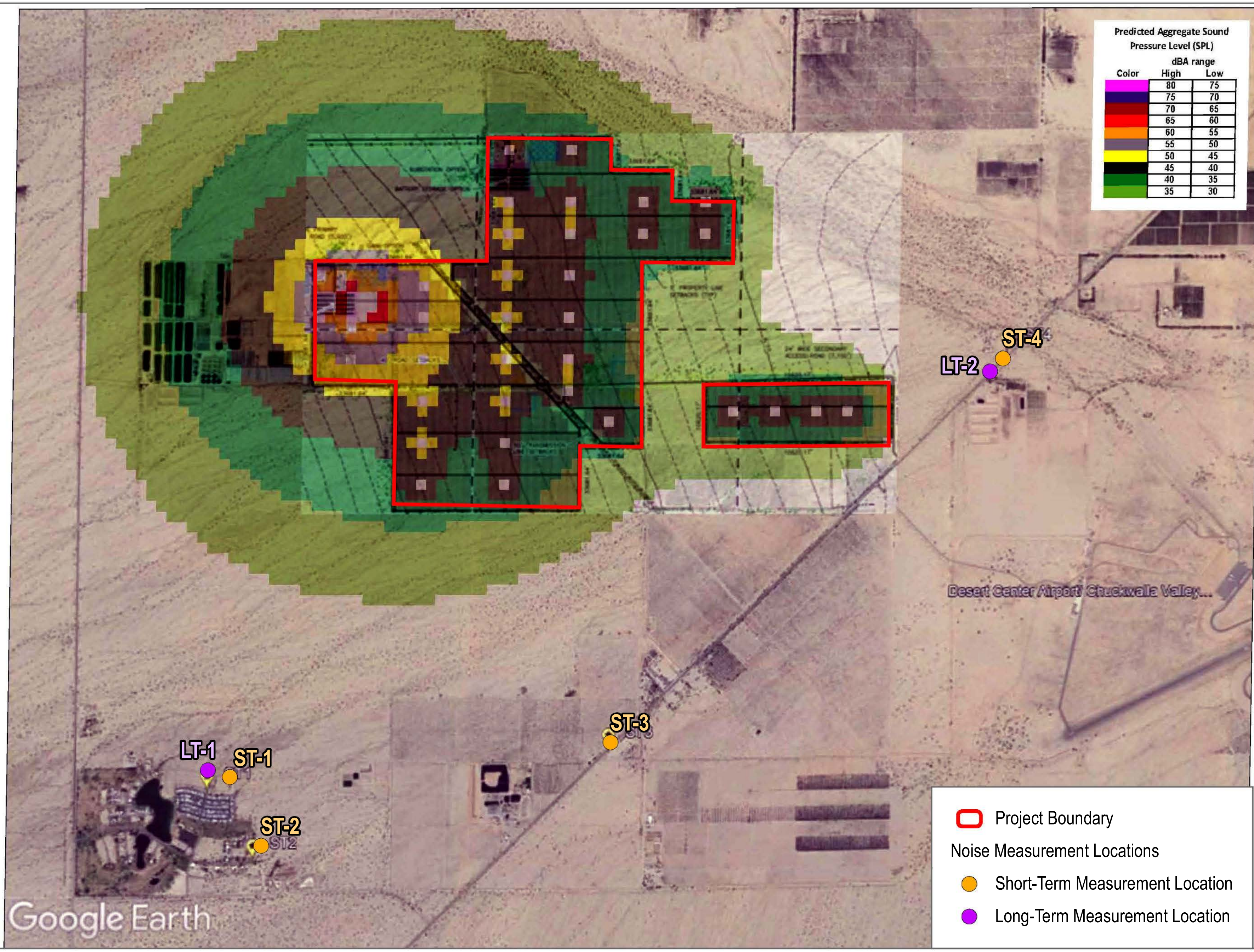

SOURCE: Esri World Imagery Basemap (accessed 2022); County of Riverside 2022; CALFIRE 2022

DUDEK

0 1,450 2,900 Feet

FIGURE 4

Ambient Noise Measurement Locations

Sapphire Solar Project

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Appendix A
Jonathan Leech Resume

DUDEK

Jonathan Leech, AICP, INCE, PG

SENIOR PROJECT MANAGER, ENVIRONMENTAL SPECIALIST

Jonathan Leech is a senior project manager and environmental specialist with 35 years' environmental planning experience, including environmental research, hazardous materials and environmental impact assessment, condition compliance and mitigation monitoring, and land use analysis. Mr. Leech has contributed to more than 200 CEQA and NEPA environmental documents including: environmental assessments (EAs); environmental impact reports (EIRs); mitigated negative declarations (MNDs); specific plans; and policy documents for numerous local agencies within the State of California..

Mr. Leech also has more than 19 years of focused experience in noise assessments, including evaluation of noise generation from commercial, municipal, and industrial facilities, as well as large-scale evaluations of proposed subdivisions and specific plan projects, for inclusion in environmental impact reports (EIRs) or negative declarations (NDs). He has performed noise evaluation of construction and operational impacts including traffic-related noise, as well as provided noise monitoring during construction for compliance with project conditions and noise ordinance restrictions.

Education

University of California, Santa Barbara
BA, Environmental Studies/ Geology, 1984

Pennsylvania State University
Coursework in Graduate Acoustics Program, 2012

Certifications

American Institute of Certified Planners (AICP)

Professional Geologist (PG), CA

Professional Affiliations

American Planning Association

Association of Environmental Professionals

Institute of Noise Control Engineers (INCE)

Project Experience

Grapevine Specific Plan, Kern County, California. Prepared the noise technical report and noise and vibration EIR section for the Grapevine Specific Plan which includes approximately 8,010 acres, of which approximately 3,232 acres (or about 40%) would be designated for ongoing open space uses (with grazing and open space as the predominant land uses), while approximately 4,778 acres (60%) would be developed as a residential community and employment center. The overall development for the entire Specific Plan is restricted to a maximum of 12,000 residential units and 5.1 million square feet of commercial and industrial floor area. The land use plan is designed as a series of conveniently located village centers, each composed of a mix of housing, neighborhood-serving retail and office uses, schools, parks, and community services.

The Creek at Dominguez Hills, Carson, California. Prepared noise technical report and completed the noise and vibration section of the EIR . The proposed project includes a new sports, recreation, fitness, and wellness destination on a portion of the approximately 171-acre Victoria Golf Course, located at 340 Martin Luther King Jr. Street (formerly E. 192nd Street) in the City of Carson. The project site would be developed with approximately 532,500 square feet of buildings, including a multi-use indoor sports complex, youth learning experience facility, indoor skydiving facility, marketplace, clubhouse, recreation and dining center, restaurants (alternatively, a specialty grocery store may be developed in place of some of the restaurant uses), and a sports wellness center. The proposed project would also provide ziplining facilities, a community park, open space areas, a putting green, and a jogging path.

Yosemite Avenue-Gardner Avenue to Hatch Road Annexation, City of Merced, California. Performed noise and vibration assessment of this mixed-use development proposal and prepared the noise and vibration section of the EIR for the project. The approximately 70-acre annexation site was proposed to be developed with 20 multi-family structures containing a total of 540 units, a 13,700 square foot clubhouse, and a mixed use building with 66,00 square feet of ground floor retail and 30 residential units on the second floor.

Angleton Energy Storage Facility, Confidential Client, Angleton, Texas. Completed an ambient noise survey and prepared a noise technical study to quantify operational noise from transformer and inverter equipment at adjacent residential receivers. The technical memorandum compared the operational noise levels against allowable limits prescribed in the special use permit for the facility and demonstrated the facility would be in compliance with such standards.

Southern California Gas Company, Goleta Storage Field Expansion Proposal, Santa Barbara County, California. Under contract to the Energy & Minerals Division of Santa Barbara County, conducted independent verification sound level measurements, completed third party technical review of applicant submitted noise reports, and prepared the noise section for the Re-circulated Draft EIR addressing a proposal for development of new wells to access deeper natural gas storage basins.

Copper Energy Storage Facility, Confidential Client, Butte, Montana. Completed an ambient noise survey and prepared a noise technical study to quantify operational noise from transformer and inverter equipment at adjacent residential receivers. The technical memorandum compared the operational noise levels against standards prescribed in the Butte-Silver Bow County Zoning Ordinance and demonstrated the facility would be in compliance with such standards.

Central Valley Gas Storage Project, Colusa County, California. Prepared the noise assessment for the Central Valley Gas Storage Project proposed by Central Valley Gas Storage LLC (Central Valley), involving the development of a depleted underground reservoir at the Princeton Gas Field located in Colusa County, 60 miles northwest of Sacramento, California. The project involves constructing a 10-acre compressor station site, a 4-acre remote well pad site with nine injection/withdrawal wells, up to five observation wells, a 1-acre metering station site, and a 14.7-mile, 24-inch diameter pipeline to connect to PG&E's transmission system. The noise assessment was conducted pursuant to the provisions of CEQA and CPUC procedures.

North Street Energy Storage Facility, Confidential Client, Brookhaven, New York. Completed an ambient noise survey and prepared a noise technical study to quantify operational noise from transformer and inverter equipment at adjacent residential receivers. The technical memorandum compared the operational noise levels against standards prescribed in the Brookhaven municipal code and demonstrated the facility would be in compliance with such standards.

Rugged Solar Farm, Boulevard Community, San Diego County, California. Prepared a noise technical study for incorporation into an EIR addressing a proposed 80 MW solar generation facility on 765 acres. Analysis included assessment of facility equipment noise at adjacent residential property lines, calculation of construction noise levels at nearby sensitive receptors, and cumulative construction noise analysis.

Tierra Del Sol Solar Farm, Boulevard Community, San Diego County, California. Prepared a noise technical study for incorporation into an EIR addressing a proposed 60 MW solar generation facility on 420 acres. Analysis included assessment of facility equipment noise at adjacent residential property lines, calculation of construction noise levels at nearby sensitive receptors, and cumulative construction noise analysis.

Westside and Whitney Point Solar Farm, Westside Community, Fresno County, California. Project manager for permitting of two separate 20 MW solar generating facilities on two adjacent 160 acre project sites. As a condition of allowing a connection to electrical distribution infrastructure, Pacific Gas & Electric required 5 acres within the property to construct an electrical substation to serve the project and other solar electrical generating facilities.

Little Bear Solar Farm, Fresno County, California. Prepared a noise technical study for incorporation into an EIR addressing a proposed 180 MW solar generation facility on 1,288 acres. Analysis included assessment of facility equipment noise at adjacent residential property lines and calculation of construction noise levels at nearby sensitive receptors.

San Joaquin Valley Solar Farm, Confidential Client, Fresno County, California. Prepared a noise technical study for incorporation into an EIR addressing a proposed 200 MW solar generation facility on 1,700 acres. Analysis included assessment of facility equipment noise at adjacent residential property lines and calculation of construction noise levels at nearby sensitive receptors.

Sandrini Valley Solar Farm, County of Kern, Mettler, California. Under contract to Kern County, completed peer review of an applicant provided acoustic report and prepared the noise and vibration section of the EIR. The proposed facility consists of a 300 megawatt (MW) solar photovoltaic facility including a 100 MW battery energy storage system. Analysis included construction noise and assessment of facility equipment noise at adjacent residential property lines and nearby sensitive receptors.

Cascade Energy Storage Facility, Confidential Client, Stockton, California. Completed an ambient noise survey and prepared a noise technical study to quantify construction-related noise levels and operational noise from transformer and inverter equipment at adjacent residential receivers. The noise study compared the operational noise levels against standards prescribed in the San Joaquin County code of ordinances and demonstrated the facility would be in compliance with such standards.

Ceres Energy Storage Facility, Confidential Client, Stockton, California. Prepared a noise technical study to quantify operational noise from transformer and inverter equipment at adjacent residential receivers. The noise study compared the operational noise levels against standards prescribed in the City of Stockton noise ordinance and demonstrated the facility would be in compliance with such standards.

Solar Farm, Confidential Client, Champagne County, Illinois. Prepared a noise technical study for satisfaction of permit requirements and to demonstrate compliance with Illinois noise regulations addressing a proposed 150 MW solar generation facility on 1,275 acres. Analysis included measurements to characterize the ambient noise level from farming and transportation sources in the area, and assessment of facility equipment operational noise at nearby sensitive receptors (i.e., adjacent rural residences).

Avondale Energy Storage Facility, Confidential Client, Avondale, Arizona. Completed an ambient noise survey and prepared a noise technical study to quantify operational noise from transformer and inverter equipment at adjacent residential receivers. The noise study compared the operational noise levels against standards prescribed in the Avondale zoning ordinance and demonstrated the facility would be in compliance with such standards and would not generate noise levels at area residences substantially higher than ambient noise levels.

Solar Farm, Confidential Client, Culpeper County, Virginia. Prepared a noise technical study for satisfaction of permit requirements and to demonstrate compliance with Culpeper County noise regulations addressing a proposed 80 MW solar generation facility. Analysis included assessment of facility equipment noise at adjacent residential property lines and calculation of construction noise levels at nearby sensitive receptors.

Appendix B
Ambient Noise Measurement Data

MEASUREMENT LOCATION: ST1

Start Date	Start Time	End Time	LAeq	LAmax	LAmin	L10	L50	L90
10/6/2022	4:55:27 PM	4:56:00 PM	35.3	46.4	33.1	36.9	33.7	33.4
10/6/2022	4:56:00 PM	4:57:00 PM	38.2	47.2	33.3	43.1	34.3	33.7
10/6/2022	4:57:00 PM	4:58:00 PM	43.3	53.5	33.8	48.1	37	34.4
10/6/2022	4:58:00 PM	4:59:00 PM	38.1	50.5	33.9	39.6	36.2	34.3
10/6/2022	4:59:00 PM	5:00:00 PM	34.8	41.2	33.5	35.4	34.1	33.7
10/6/2022	5:00:00 PM	5:01:00 PM	40.9	51.7	33.9	43.4	36.9	34.1
10/6/2022	5:01:00 PM	5:02:00 PM	37.8	42.8	34	40.6	36.6	34.7
10/6/2022	5:02:00 PM	5:03:00 PM	34.5	36.3	33.7	35	34.3	33.9
10/6/2022	5:03:00 PM	5:04:00 PM	35.8	38.2	34.2	37	35.6	34.7
10/6/2022	5:04:00 PM	5:05:00 PM	34.1	35.8	33.4	34.8	34	33.5
10/6/2022	5:05:00 PM	5:06:00 PM	35	38	33.6	36.2	34.5	33.9
10/6/2022	5:06:00 PM	5:07:00 PM	34.6	38	33.2	35.7	34.3	33.5
10/6/2022	5:07:00 PM	5:08:00 PM	33.8	35.6	32.8	34.5	33.6	33.1
10/6/2022	5:08:00 PM	5:09:00 PM	34.5	37.2	33.3	35.6	34.3	33.6
10/6/2022	5:09:00 PM	5:10:00 PM	34.1	35.3	33.4	34.8	33.9	33.5
10/6/2022	5:10:00 PM	5:11:00 PM	36.7	40.1	33.9	38.2	36.5	34.4
10/6/2022	5:11:00 PM	5:12:00 PM	34.4	36.4	33.2	35.7	34.2	33.4
10/6/2022	5:12:00 PM	5:13:00 PM	33.6	35	33	34	33.5	33.2
10/6/2022	5:13:00 PM	5:14:00 PM	35.2	40	33	37.2	34.2	33.4
10/6/2022	5:14:00 PM	5:15:00 PM	35.4	38.2	33.5	37	34.8	33.8
10/6/2022	5:15:00 PM	5:16:00 PM	36.3	40.4	33.8	37.9	36.1	34.4
10/6/2022	5:16:00 PM	5:17:00 PM	33.8	36.1	32.9	34.6	33.7	33.2
10/6/2022	5:17:00 PM	5:18:00 PM	35.5	40.1	32.8	37.8	33.5	33
10/6/2022	5:18:00 PM	5:19:00 PM	34.9	39.9	33.5	36.8	34.5	33.7
10/6/2022	5:19:00 PM	5:20:00 PM	34.5	39.6	33.4	35.1	34.2	33.8
10/6/2022	5:20:00 PM	5:21:00 PM	35.8	40.5	33.9	36.7	35.5	34.7
10/6/2022	5:21:00 PM	5:22:00 PM	34.8	37.1	33.4	35.9	34.5	33.8
10/6/2022	5:22:00 PM	5:23:00 PM	33.8	34.4	33.4	34.1	33.8	33.6
10/6/2022	5:23:00 PM	5:24:00 PM	33.9	36.9	33.3	34.3	33.7	33.4
10/6/2022	5:24:00 PM	5:25:00 PM	34.6	39.3	33.3	35.6	34.2	33.5
10/6/2022	5:25:00 PM	5:25:36 PM	41.8	51	34.2	47.2	35.5	34.6

Leq	36.7
Lmax	53.5
Lmin	32.8

MEASUREMENT LOCATION: ST2

Start Date	Start Time	End Time	LAeq	LAmax	LAmin	L10	L50	L90
10/6/2022	4:18:58 PM	4:19:00 PM	38.7	40.7	37.4	40.3	38.5	37.6
10/6/2022	4:19:00 PM	4:20:00 PM	45.6	52.1	35.9	49.3	43.7	38.4
10/6/2022	4:20:00 PM	4:21:00 PM	39.7	47.9	36	42.5	38.5	36.9
10/6/2022	4:21:00 PM	4:22:00 PM	37.8	42.8	35.5	40.4	36.6	35.7
10/6/2022	4:22:00 PM	4:23:00 PM	40.3	44.6	35.7	42.9	39.8	36.5
10/6/2022	4:23:00 PM	4:24:00 PM	38.9	50.3	33.7	41.9	35.6	34.3
10/6/2022	4:24:00 PM	4:25:00 PM	40.8	49.1	33.9	45	37.9	34.2
10/6/2022	4:25:00 PM	4:26:00 PM	34.7	40.7	33.9	35.2	34.3	34.1
10/6/2022	4:26:00 PM	4:27:00 PM	39	47.4	34.3	42.5	36.5	34.5
10/6/2022	4:27:00 PM	4:28:00 PM	41.8	46.8	35.9	44.8	41.1	36.9
10/6/2022	4:28:00 PM	4:29:00 PM	34.8	37.3	34.2	35.8	34.6	34.3
10/6/2022	4:29:00 PM	4:30:00 PM	34.7	35.2	34.3	35	34.7	34.4
10/6/2022	4:30:00 PM	4:31:00 PM	34.9	35.4	34.4	35.1	34.9	34.6
10/6/2022	4:31:00 PM	4:32:00 PM	34.4	34.9	34	34.6	34.4	34.2
10/6/2022	4:32:00 PM	4:33:00 PM	34.8	36.4	33.9	35.3	34.7	34.4
10/6/2022	4:33:00 PM	4:34:00 PM	35.2	36.5	33.9	36	34.9	34.2
10/6/2022	4:34:00 PM	4:35:00 PM	38.5	43	35	41.1	37.5	35.4
10/6/2022	4:35:00 PM	4:36:00 PM	34.9	35.9	34.4	35.4	34.8	34.6
10/6/2022	4:36:00 PM	4:37:00 PM	36.2	40.6	34.5	38.9	35	34.6
10/6/2022	4:37:00 PM	4:38:00 PM	35.9	37.8	34.9	36.9	35.8	35.1
10/6/2022	4:38:00 PM	4:39:00 PM	35	37	34.5	35.3	34.9	34.7
10/6/2022	4:39:00 PM	4:40:00 PM	36.2	41.5	34.7	37.9	35.4	35
10/6/2022	4:40:00 PM	4:41:00 PM	36.3	39.3	35.1	37.3	36	35.4
10/6/2022	4:41:00 PM	4:42:00 PM	35.9	42.9	34.8	36	35.2	35
10/6/2022	4:42:00 PM	4:43:00 PM	35.1	35.8	34.9	35.3	35.1	35
10/6/2022	4:43:00 PM	4:44:00 PM	45.7	55.1	35	48.6	38.5	35.5
10/6/2022	4:44:00 PM	4:45:00 PM	46.7	50.1	42.2	48.5	46.2	44.3
10/6/2022	4:45:00 PM	4:46:00 PM	51.7	58.9	38.8	56.7	48.5	40.8
10/6/2022	4:46:00 PM	4:47:00 PM	49.1	56.9	36.3	55.2	44.1	36.9
10/6/2022	4:47:00 PM	4:48:00 PM	41	52.6	35.2	44.3	37.4	36.1
10/6/2022	4:48:00 PM	4:48:52 PM	39.2	47.4	33.3	42.4	35.9	34

Leq	42.1
Lmax	58.9
Lmin	33.3

MEASUREMENT LOCATION: ST3

Start Date	Start Time	End Time	LAeq	LAmax	LAmin	L10	L50	L90
10/6/2022	3:41:14 PM	3:42:00 PM	54.5	73.2	34.6	61.3	38.4	35.4
10/6/2022	3:42:00 PM	3:43:00 PM	69.6	84.6	34.9	67.7	43.2	37.7
10/6/2022	3:43:00 PM	3:44:00 PM	78	88.3	39.3	83.5	61	43.6
10/6/2022	3:44:00 PM	3:45:00 PM	73.5	84.2	49.8	78.9	64.9	52.6
10/6/2022	3:45:00 PM	3:46:00 PM	69.2	80.8	42.9	73.1	52.8	45
10/6/2022	3:46:00 PM	3:47:00 PM	76.1	85	47.5	81.4	65.6	49.4
10/6/2022	3:47:00 PM	3:48:00 PM	74.3	85.8	42.1	80.1	60.4	43.8
10/6/2022	3:48:00 PM	3:49:00 PM	71.1	84	41.2	75.1	49.5	43.1
10/6/2022	3:49:00 PM	3:50:00 PM	67.1	82.2	35.1	65.1	39	36.1
10/6/2022	3:50:00 PM	3:51:00 PM	71.5	85	35.5	76.5	44.8	36.6
10/6/2022	3:51:00 PM	3:52:00 PM	68.9	84.3	38.5	67.4	43.7	40
10/6/2022	3:52:00 PM	3:53:00 PM	72.5	85.6	36.9	76.4	44.6	38.2
10/6/2022	3:53:00 PM	3:54:00 PM	69.4	84.5	34.6	68.4	43.6	36.2
10/6/2022	3:54:00 PM	3:55:00 PM	72.1	85.1	33.6	76.3	50.2	34.2
10/6/2022	3:55:00 PM	3:56:00 PM	72.3	84.4	46.9	76.5	54	48.3
10/6/2022	3:56:00 PM	3:57:00 PM	71.7	85.2	38.2	71.4	46.7	40.5
10/6/2022	3:57:00 PM	3:58:00 PM	71.4	83.4	43.4	76.9	54.8	44.8
10/6/2022	3:58:00 PM	3:59:00 PM	72.5	85.8	35.7	71.8	45.8	36.4
10/6/2022	3:59:00 PM	4:00:00 PM	69.1	82.5	36.1	71.3	45.1	36.9
10/6/2022	4:00:00 PM	4:01:00 PM	73.6	84.7	38.4	80.1	46.3	39.5
10/6/2022	4:01:00 PM	4:02:00 PM	73.4	85.8	36.5	78.8	54.7	37.8
10/6/2022	4:02:00 PM	4:03:00 PM	65.1	79.8	35.6	64.6	44.7	36.7
10/6/2022	4:03:00 PM	4:04:00 PM	73.5	85.8	35.2	78.5	46.9	35.5
10/6/2022	4:04:00 PM	4:05:00 PM	70.5	84.1	35.8	74.3	48.9	36.9
10/6/2022	4:05:00 PM	4:06:00 PM	71.8	86.6	38.1	70.6	43.6	38.8
10/6/2022	4:06:00 PM	4:07:00 PM	69.6	83.5	37.2	66.8	42.8	38.1
10/6/2022	4:07:00 PM	4:08:00 PM	72	87.2	42.9	72.9	56.2	46.5
10/6/2022	4:08:00 PM	4:09:00 PM	73.4	86.9	39	77	50.8	40.4
10/6/2022	4:09:00 PM	4:10:00 PM	71.7	85.4	45.2	75.6	56.8	46.9
10/6/2022	4:10:00 PM	4:11:00 PM	69.5	84.8	43.3	67.8	49.6	44
10/6/2022	4:11:00 PM	4:11:45 PM	49.2	63.3	36.1	54.8	46.7	36.9

Leq	72.0
Lmax	88.3
Lmin	33.6

MEASUREMENT LOCATION: ST4

Start Date	Start Time	End Time	LAeq	LAmax	LAmin	L10	L50	L90
10/6/2022	3:04:48 PM	3:05:00 PM	42.8	45.6	36.7	44.3	42.7	37
10/6/2022	3:05:00 PM	3:06:00 PM	69	83.3	34	67.9	42.1	34.7
10/6/2022	3:06:00 PM	3:07:00 PM	69.2	81.3	34.1	74.3	44.3	34.7
10/6/2022	3:07:00 PM	3:08:00 PM	69.8	82.9	34.2	73	41.6	35.1
10/6/2022	3:08:00 PM	3:09:00 PM	65.9	79.1	35.3	71.2	54	39.2
10/6/2022	3:09:00 PM	3:10:00 PM	64.3	80.8	33.2	47.9	36.1	33.9
10/6/2022	3:10:00 PM	3:11:00 PM	74.3	86.1	39.6	79.6	61.6	40.6
10/6/2022	3:11:00 PM	3:12:00 PM	72.9	86.1	44.4	77.7	58.4	49.2
10/6/2022	3:12:00 PM	3:13:00 PM	67.3	81.4	35.7	67.7	50.2	37.5
10/6/2022	3:13:00 PM	3:14:00 PM	78.5	91.8	55.8	81.3	68.4	57.9
10/6/2022	3:14:00 PM	3:15:00 PM	55.7	71.3	32.4	60.8	38.2	32.7
10/6/2022	3:15:00 PM	3:16:00 PM	65.8	80.2	33.3	65.3	45.6	33.7
10/6/2022	3:16:00 PM	3:17:00 PM	69.1	81.5	31.9	74.7	33.3	32
10/6/2022	3:17:00 PM	3:18:00 PM	70.7	82	38.7	75.8	54.9	40
10/6/2022	3:18:00 PM	3:19:00 PM	73.1	85.2	38.9	77.3	59.4	41.1
10/6/2022	3:19:00 PM	3:20:00 PM	43.4	56.4	32	48.7	34.4	32.7
10/6/2022	3:20:00 PM	3:21:00 PM	38.5	48.3	30.8	42.3	33.3	30.9
10/6/2022	3:21:00 PM	3:22:00 PM	71.8	81.8	41.8	77.8	58.1	43.3
10/6/2022	3:22:00 PM	3:23:00 PM	48.7	58.8	31.6	56.5	34.9	32.2
10/6/2022	3:23:00 PM	3:24:00 PM	70.2	79.9	31.8	76.2	58.5	33.2
10/6/2022	3:24:00 PM	3:25:00 PM	62.5	76.5	35.1	62.8	42.1	35.7
10/6/2022	3:25:00 PM	3:26:00 PM	64.4	78.4	31.6	64.7	42.2	32.9
10/6/2022	3:26:00 PM	3:27:00 PM	68.6	78.1	31.7	75.5	38.4	32.2
10/6/2022	3:27:00 PM	3:28:00 PM	68.7	83.4	32.3	53.5	35.5	32.8
10/6/2022	3:28:00 PM	3:29:00 PM	71.7	82.7	38	77.4	55.5	41.2
10/6/2022	3:29:00 PM	3:30:00 PM	72.6	82.5	39.1	77.6	60.6	43.2
10/6/2022	3:30:00 PM	3:31:00 PM	72	84.5	44.3	76.9	62	46.4
10/6/2022	3:31:00 PM	3:32:00 PM	71.8	83.9	36.5	76.3	46.1	38.2
10/6/2022	3:32:00 PM	3:33:00 PM	68.9	80.3	33.2	74.4	37.7	34.3
10/6/2022	3:33:00 PM	3:34:00 PM	68.6	83.2	34.8	70	44.6	39.6
10/6/2022	3:33:59 PM	3:34:50 PM	66.7	79.8	34.9	68.6	45.3	37.5

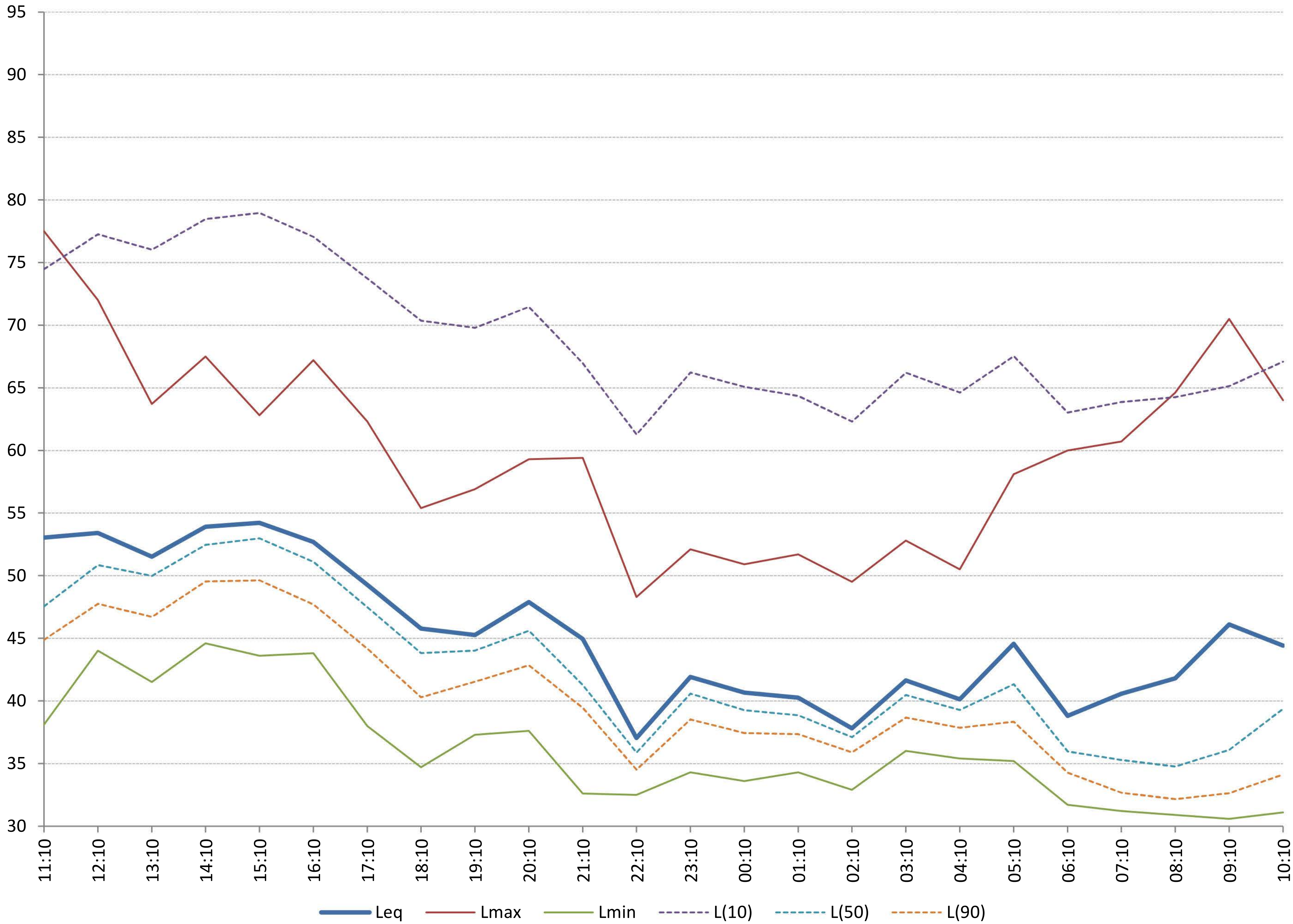
Leq	70.2
Lmax	91.8
Lmin	30.8

MEASUREMENT LOCATION: LT1

Start Date	Start Time	End Time	LAeq	LAmax	LAmin	L10	L50	L90
5/1/2023	11:10:00 AM	12:10:00 PM	53	78	38	74	48	45
5/1/2023	12:10:00 PM	1:10:00 PM	53	72	44	77	51	48
5/1/2023	1:10:00 PM	2:10:00 PM	52	64	42	76	50	47
5/1/2023	2:10:00 PM	3:10:00 PM	54	68	45	78	52	50
5/1/2023	3:10:00 PM	4:10:00 PM	54	63	44	79	53	50
5/1/2023	4:10:00 PM	5:10:00 PM	53	67	44	77	51	48
5/1/2023	5:10:00 PM	6:10:00 PM	49	62	38	74	47	44
5/1/2023	6:10:00 PM	7:10:00 PM	46	55	35	70	44	40
5/1/2023	7:10:00 PM	8:10:00 PM	45	57	37	70	44	42
5/1/2023	8:10:00 PM	9:10:00 PM	48	59	38	71	46	43
5/1/2023	9:10:00 PM	10:10:00 PM	45	59	33	67	41	39
5/1/2023	10:10:00 PM	11:10:00 PM	37	48	33	61	36	35
5/1/2023	11:10:00 PM	12:10:00 AM	42	52	34	66	41	39
5/1/2023	12:10:00 AM	1:10:00 AM	41	51	34	65	39	37
5/2/2023	1:10:00 AM	2:10:00 AM	40	52	34	64	39	37
5/2/2023	2:10:00 AM	3:10:00 AM	38	50	33	62	37	36
5/2/2023	3:10:00 AM	4:10:00 AM	42	53	36	66	40	39
5/2/2023	4:10:00 AM	5:10:00 AM	40	51	35	65	39	38
5/2/2023	5:10:00 AM	6:10:00 AM	45	58	35	68	41	38
5/2/2023	6:10:00 AM	7:10:00 AM	39	60	32	63	36	34
5/2/2023	7:10:00 AM	8:10:00 AM	41	61	31	64	35	33
5/2/2023	8:10:00 AM	9:10:00 AM	42	65	31	64	35	32
5/2/2023	9:10:00 AM	10:10:00 AM	46	71	31	65	36	33
5/2/2023	10:10:00 AM	11:10:00 AM	44	64	31	67	39	34

Leq day	D	51
Leq eve	E	46
Leq night	N	41
CNEL		51

Leq day	D	50
Leq night	N	41
LDN		51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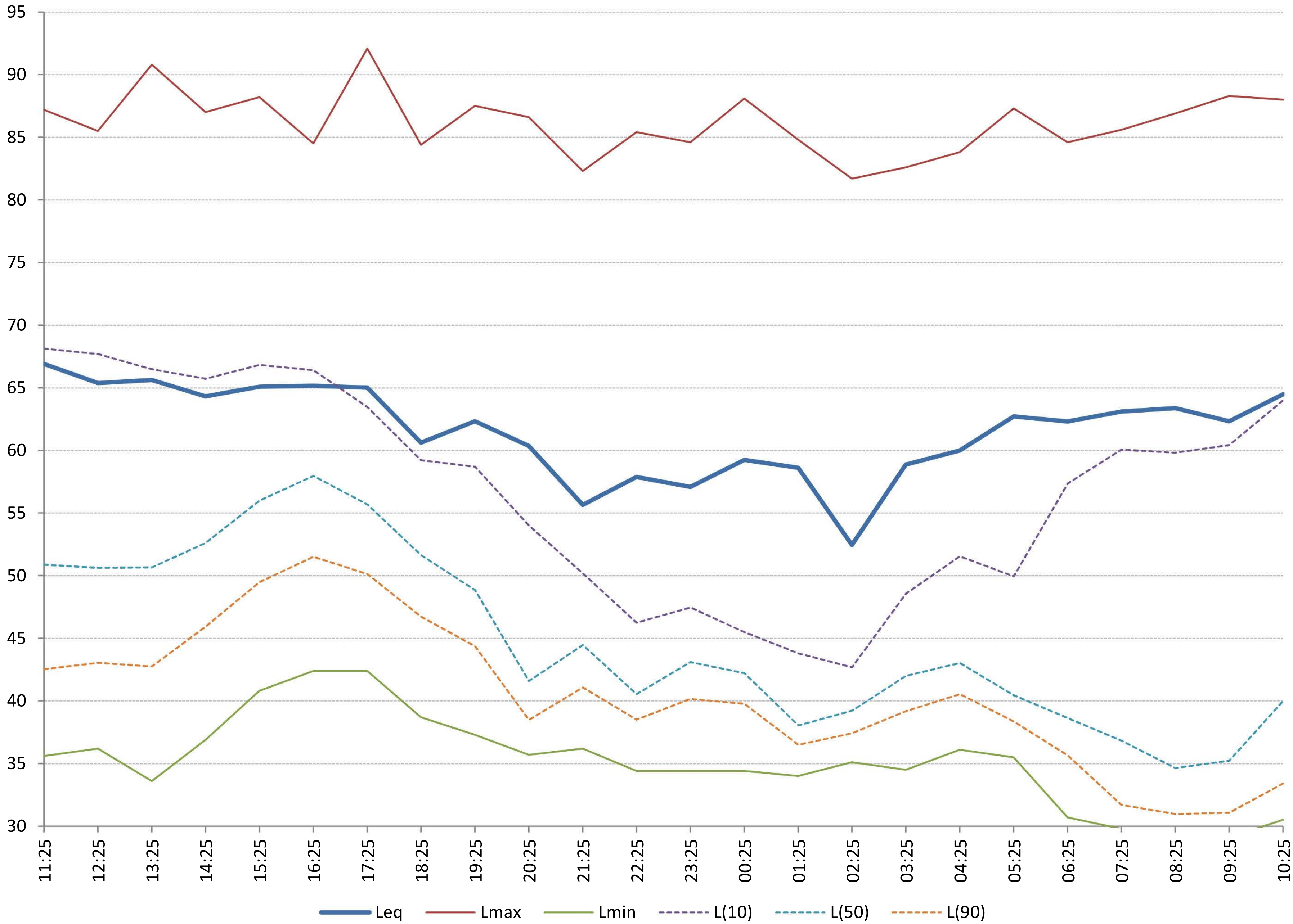
MEASUREMENT LOCATION: LT2

Start Date	Start Time	End Time	LAeq	LAmax	LAmin	L10	L50	L90
5/1/2023	11:25:00 AM	12:25:00 PM	67	87	36	68	51	43
5/1/2023	12:25:00 PM	1:25:00 PM	65	86	36	68	51	43
5/1/2023	1:25:00 PM	2:25:00 PM	66	91	34	66	51	43
5/1/2023	2:25:00 PM	3:25:00 PM	64	87	37	66	53	46
5/1/2023	3:25:00 PM	4:25:00 PM	65	88	41	67	56	49
5/1/2023	4:25:00 PM	5:25:00 PM	65	85	42	66	58	52
5/1/2023	5:25:00 PM	6:25:00 PM	65	92	42	63	56	50
5/1/2023	6:25:00 PM	7:25:00 PM	61	84	39	59	52	47
5/1/2023	7:25:00 PM	8:25:00 PM	62	88	37	59	49	44
5/1/2023	8:25:00 PM	9:25:00 PM	60	87	36	54	42	38
5/1/2023	9:25:00 PM	10:25:00 PM	56	82	36	50	44	41
5/1/2023	10:25:00 PM	11:25:00 PM	58	85	34	46	41	39
5/1/2023	11:25:00 PM	12:25:00 AM	57	85	34	47	43	40
5/1/2023	12:25:00 AM	1:25:00 AM	59	88	34	46	42	40
5/2/2023	1:25:00 AM	2:25:00 AM	59	85	34	44	38	37
5/2/2023	2:25:00 AM	3:25:00 AM	52	82	35	43	39	37
5/2/2023	3:25:00 AM	4:25:00 AM	59	83	35	49	42	39
5/2/2023	4:25:00 AM	5:25:00 AM	60	84	36	52	43	41
5/2/2023	5:25:00 AM	6:25:00 AM	63	87	36	50	40	38
5/2/2023	6:25:00 AM	7:25:00 AM	62	85	31	57	39	36
5/2/2023	7:25:00 AM	8:25:00 AM	63	86	30	60	37	32
5/2/2023	8:25:00 AM	9:25:00 AM	63	87	30	60	35	31
5/2/2023	9:25:00 AM	10:25:00 AM	62	88	29	60	35	31
5/2/2023	10:25:00 AM	11:25:00 AM	64	88	31	64	40	33

Leq day	D	65
Leq eve	E	60
Leq night	N	60
CNEL		67

Leq day	D	64
Leq night	N	60
LDN		67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09:25
10:25
Leq
Lmax
Lmin
L(10)
L(50)
L(90)

FORMS DUDEK FIELD DATA REPORT

Field Noise Measurement Data

Record: 1492	
Project Name	*Sapphire Solar*
Project #	*14389.01*
Observer(s)	
Date	*2022-10-06*

Meteorological Conditions	
Temp (F)	*103.5*
Humidity % (R.H.)	*26.1*
Wind	*Calm*
Wind Speed (MPH)	*1*
Wind Direction	*North*
Sky	*Partly Cloudy*

Instrument and Calibrator Information	
Instrument Name List	*Piccolo #1893*
Instrument Name	*Piccolo #1893*
Instrument Name Lookup Key	*Piccolo #1893*
Manufacturer	*Soft dB inc.*
Model	*Piccolo*
Serial Number	*P0222050202*
Calibration Date	*05/02/2022*
Calibrator Name	*(SB) LD CAL200*
Calibrator Name	*(SB) LD CAL200*
Calibrator Name Lookup Key	*(SB) LD CAL200*
Calibrator Manufacturer	*Larson Davis*
Calibrator Model	*LD CAL200*
Calibrator Serial #	*19952*
GPS Assistance Used	*No*
Pre-Test (dBA SPL)	*93.7*
Post-Test (dBA SPL)	*94*
Windscreen	*Yes*
Weighting?	*A-WTD*
Slow/Fast?	*Slow*
ANSI?	*Yes*

Monitoring	
Record #	*1*
Site ID	*ST4*
Site Location Lat/Long	*33.767234, -115.336169*
Begin (Time)	*15:07:00*
End (Time)	*15:37:00*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*Traffic*
Other Noise Sources (Background)	*Birds, Distant Industrial, Distant Traffic*
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

FORMS FIELD DATA REPORT

Source Info and Traffic Counts

Number of Lanes	*2*
Lane Width (feet)	*10*
Roadway Width (feet)	*20*
Roadway Width (m)	*6.1*
Distance to Roadway (feet)	*20*
Distance to Roadway (m)	*6.1*
Distance Measured to Centerline or Edge of Pavement?	*Edge of Pavement*
Roadway Type	*Road*
Estimated Vehicle Speed (MPH)	*65*
Speeds Estimated by:	*Driving the Pace*
Posted Speed Limit Sign (MPH)	*65*

Traffic Counts

Vehicle Count Summary	*A 50, MT 0, HT 0, B 0, MC 0*
Select Method for Recording Count Duration	*Enter Manually*
Counting Both Directions?	*Yes*
Count Duration (minutes)	*30*
Vehicle Count Tally	
Select Method for Vehicle Counts	*Use Counter (+/-)*
Number of Vehicles - Autos	*50*
Number of Vehicles - Medium Trucks	*0*
Number of Vehicles - Heavy Trucks	*0*
Number of Vehicles - Buses	*0*
Number of Vehicles - Motorcyles	*0*

Description / Photos

Terrain	*Mixed*

Site Photos

Photo

Comments / Description	*ST4 North*

DUDEK FORMS FIELD DATA REPORT

Site Photos

Photo	
Comments / Description	*ST4 West*

Site Photos

Photo	
Comments / Description	*ST4 South*

FORMS FIELD DATA REPORT

Site Photos

Photo	
Comments / Description	*ST4 East*

Monitoring

Record #	*2*
Site ID	*ST3*
Site Location Lat/Long	*33.743952, -115.364225*
Begin (Time)	*15:44:00*
End (Time)	*15:14:00*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*Traffic*
Other Noise Sources (Background)	*Distant Industrial, Distant Traffic*
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

Source Info and Traffic Counts

Number of Lanes	*2*
Lane Width (feet)	*10*
Roadway Width (feet)	*20*
Roadway Width (m)	*6.1*
Distance to Roadway (feet)	*13*
Distance to Roadway (m)	*4*
Distance Measured to Centerline or Edge of Pavement?	*Edge of Pavement*
Roadway Type	*Road*
Estimated Vehicle Speed (MPH)	*65*
Speeds Estimated by:	*Driving the Pace*
Posted Speed Limit Sign (MPH)	*65*

FORMS DUDEK FIELD DATA REPORT

Traffic Counts

Vehicle Count Summary	*A 65, MT 1, HT 0, B 1, MC 0*
Select Method for Recording Count Duration	*Enter Manually*
Counting Both Directions?	*Yes*
Count Duration (minutes)	*30*
Vehicle Count Tally	
Select Method for Vehicle Counts	*Use Counter (+/-)*
Number of Vehicles - Autos	*65*
Number of Vehicles - Medium Trucks	*1*
Number of Vehicles - Heavy Trucks	*0*
Number of Vehicles - Buses	*1*
Number of Vehicles - Motorcyles	*0*

Description / Photos

Terrain	*Mixed*

Site Photos

Photo

Comments / Description	*ST3 North*

Site Photos

Photo	
Comments / Description	*ST3 West*

Site Photos

Photo	
Comments / Description	*ST3 East*

FORMS FIELD DATA REPORT

Site Photos

Photo	
Comments / Description	*ST3 South*

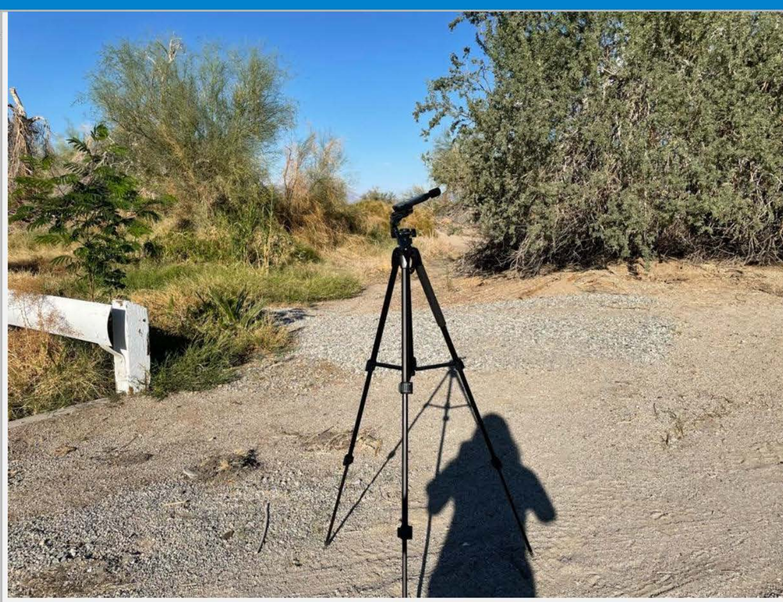
Monitoring

Record #	*3*
Site ID	*ST2*
Site Location Lat/Long	*33.737945, -115.388278*
Begin (Time)	*16:21:00*
End (Time)	*16:51:00*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*Traffic*
Other Noise Sources (Background)	*Birds, Distant Aircraft, Distant Dog Barking, Distant Traffic, Rustling Leaves*
Other Noise Sources Additional Description	*Crickets*
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

Description / Photos

Terrain	*Mixed*

Site Photos	
Photo	
Comments / Description	*ST2 North*

Site Photos	
Photo	
Comments / Description	*ST2 West*

Site Photos	
Photo	
Comments / Description	*ST2 East*

Site Photos	
Photo	
Comments / Description	*ST2 South*

FORMS FIELD DATA REPORT

Monitoring

Record #	*4*
Site ID	*ST1*
Site Location Lat/Long	*33.743373, -115.394563*
Begin (Time)	*16:58:00*
End (Time)	*17:28:00*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*Birds Chirping*
Other Noise Sources (Background)	*Birds, Distant Aircraft, Distant Conversations / Yelling, Distant Dog Barking, Distant Kids Playing, Distant Traffic, Rustling Leaves*
Other Noise Sources Additional Description	*Bugs buzzing, Housing electricity*
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

Description / Photos

Terrain	*Mixed*

Site Photos

Photo	
Comments / Description	*ST1 North*

FIELD DATA REPORT

Site Photos

Photo	
Comments / Description	*ST1 South*

Site Photos

Photo	
Comments / Description	*ST1 West*

FORMS FIELD DATA REPORT

Site Photos

Photo	
Comments / Description	*ST1 East*

Appendix C
Construction Noise Modeling Data

PHASE I CONSTRUCTION

Noise level limit for construction phase at residential land use, per FTA guidance = 80
Averaging Period (in hours): 1

Construction Sub-Phase	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Lmax @ 50 ft. for quantity of equipment	Source to NSR Distance (ft.)	Distance-Adjusted Lmax	Predicted 1-hour Leq
1. Move On	Flat Bed Truck	1	40	74	74	2115	41.5	37
	Gradall	4	40	83	89	2115	56.5	53
	Generator	4	50	72	78	2115	45.5	42
	Grader	4	40	85	91	2115	58.5	55
	All Other Equipment > 5 HP	6	50	85	93	2115	60.3	57
	Roller	2	20	80	83	2115	50.5	43
	Dozer	2	40	82	85	2115	52.5	49
	Scraper	2	40	84	87	2115	54.5	51
	Backhoe	4	40	78	84	2115	51.5	48
	Slurry Trenching Machine	2	50	80	83	2115	50.5	47
					Total for 1. Move On Phase:		**64.9**	**61.2**
2. Site Preparation and Grading	Flat Bed Truck	1	40	74	74	2115	41.5	37
	Grader	4	40	85	91	2115	58.5	55
	All Other Equipment > 5 HP	9	50	85	95	2115	62.0	59
	Roller	4	20	80	86	2115	53.5	47
	Dozer	4	40	82	88	2115	55.5	52
	Scraper	3	40	84	89	2115	56.2	52
	Front End Loader	4	40	79	85	2115	52.5	49
					Total for 2. Site Preparation and Grading Phase:		**65.4**	**61.8**
3. New Access Road Construction	Flat Bed Truck	1	40	74	74	2115	41.5	37
	Grader	4	40	85	91	2115	58.5	55
	All Other Equipment > 5 HP	4	50	85	91	2115	58.5	55
	Roller	4	20	80	86	2115	53.5	47
	Dozer	3	40	82	87	2115	54.2	50
	Scraper	3	40	84	89	2115	56.2	52
					Total for 3. New Access Road Construction Phase:		**63.7**	**59.8**

PGE SUBSTATION CONSTRUCTION

Noise level limit for construction phase at residential land use, per FTA guidance = 80

Averaging Period (in hours): 1

Construction Sub-Phase	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Lmax @ 50 ft. for quantity of equipment	Source to NSR Distance (ft.)	Distance-Adjusted Lmax	Predicted 1-hour Leq
4. Generation Tie Line Construction	Flat Bed Truck	1	40	74	74	2115	41.5	37
	Man Lift	3	20	75	80	2115	47.2	40
	Crane	3	16	81	86	2115	53.2	45
	Tractor	2	40	84	87	2115	54.5	51
	Gradall	2	40	83	86	2115	53.5	50
	Generator	2	50	72	75	2115	42.5	39
	All Other Equipment > 5 HP	2	50	85	88	2115	55.5	52
	Backhoe	3	40	78	83	2115	50.2	46
					Total for 4. Generation Tie Line Construction Phase:		**61.0**	**56.8**
5. Internal Roads Construction	Flat Bed Truck	1	40	74	74	2115	41.5	37
	Grader	3	40	85	90	2115	57.2	53
	All Other Equipment > 5 HP	2	50	85	88	2115	55.5	52
	Roller	3	20	80	85	2115	52.2	45
	Backhoe	3	40	78	83	2115	50.2	46
					Total for 5. Internal Roads Construction Phase:		**60.7**	**56.7**
6. Electrical Sub-Station & Microwave Tower	Flat Bed Truck	1	40	74	74	2115	41.5	37
	Man Lift	3	20	75	80	2115	47.2	40
	Crane	2	16	81	84	2115	51.5	44
	Gradall	2	40	83	86	2115	53.5	50
	All Other Equipment > 5 HP	2	50	85	88	2115	55.5	52
	Backhoe	5	40	78	85	2115	52.5	48
	Slurry Trenching Machine	5	50	80	87	2115	54.5	51
					Total for 6. Electrical Sub-Station & Microwave Tower Phase:		**60.9**	**57.1**
7. Solar Array, Underground, Battery Install, O & M	Flat Bed Truck	1	40	74	74	2115	41.5	37
	Gradall	6	40	83	91	2115	58.3	54
	Generator	11	50	72	82	2115	49.9	47
	All Other Equipment > 5 HP	9	50	85	95	2115	62.0	59
	Pumps	11	50	77	87	2115	54.9	52
	Roller	2	20	80	83	2115	50.5	43
	Tractor	9	40	84	94	2115	61.0	57
	Front End Loader	2	40	79	82	2115	49.5	46
	Slurry Trenching Machine	5	50	80	87	2115	54.5	51
					Total for 7. Solar Array, Underground, Battery Install, O & M Phase:		**66.5**	**63.0**

PHASE I CONSTRUCTION

Noise level limit for construction phase at residential land use, per FTA guidance = 80

Averaging Period (in hours): 1

Construction Sub-Phase	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Lmax @ 50 ft. for quantity of equipment	Source to NSR Distance (ft.)	Distance-Adjusted Lmax	Predicted 1-hour Leq
1. Move On	Flat Bed Truck	1	40	74	74	6600	31.6	28
	Gradall	4	40	83	89	6600	46.6	43
	Generator	4	50	72	78	6600	35.6	33
	Grader	4	40	85	91	6600	48.6	45
	All Other Equipment > 5 HP	6	50	85	93	6600	50.4	47
	Roller	2	20	80	83	6600	40.6	34
	Dozer	2	40	82	85	6600	42.6	39
	Scraper	2	40	84	87	6600	44.6	41
	Backhoe	4	40	78	84	6600	41.6	38
	Slurry Trenching Machine	2	50	80	83	6600	40.6	38
						Total for 1. Move On Phase:	**55.0**	**51.4**
2. Site Preparation and Grading	Flat Bed Truck	1	40	74	74	6600	31.6	28
	Grader	4	40	85	91	6600	48.6	45
	All Other Equipment > 5 HP	9	50	85	95	6600	52.1	49
	Roller	4	20	80	86	6600	43.6	37
	Dozer	4	40	82	88	6600	45.6	42
	Scraper	3	40	84	89	6600	46.4	42
	Front End Loader	4	40	79	85	6600	42.6	39
						Total for 2. Site Preparation and Grading Phase:	**55.5**	**51.9**
3. New Access Road Construction	Flat Bed Truck	1	40	74	74	6600	31.6	28
	Grader	4	40	85	91	6600	48.6	45
	All Other Equipment > 5 HP	4	50	85	91	6600	48.6	46
	Roller	4	20	80	86	6600	43.6	37
	Dozer	3	40	82	87	6600	44.4	40
	Scraper	3	40	84	89	6600	46.4	42
						Total for 3. New Access Road Construction Phase:	**53.8**	**49.9**

PGE SUBSTATION CONSTRUCTION

Noise level limit for construction phase at residential land use, per FTA guidance = 80
Averaging Period (in hours): 1

Construction Sub-Phase	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Lmax @ 50 ft. for quantity of equipment	Source to NSR Distance (ft.)	Distance-Adjusted Lmax	Predicted 1-hour Leq
4. Generation Tie Line Construction	Flat Bed Truck	1	40	74	74	6600	31.6	28
	Man Lift	3	20	75	80	6600	37.4	30
	Crane	3	16	81	86	6600	43.4	35
	Tractor	2	40	84	87	6600	44.6	41
	Gradall	2	40	83	86	6600	43.6	40
	Generator	2	50	72	75	6600	32.6	30
	All Other Equipment > 5 HP	2	50	85	88	6600	45.6	43
	Backhoe	3	40	78	83	6600	40.4	36
					Total for 4. Generation Tie Line Construction Phase:		**51.1**	**46.9**
5. Internal Roads Construction	Flat Bed Truck	1	40	74	74	6600	31.6	28
	Grader	3	40	85	90	6600	47.4	43
	All Other Equipment > 5 HP	2	50	85	88	6600	45.6	43
	Roller	3	20	80	85	6600	42.4	35
	Backhoe	3	40	78	83	6600	40.4	36
					Total for 5. Internal Roads Construction Phase:		**50.8**	**46.8**
6. Electrical Sub-Station & Microwave Tower	Flat Bed Truck	1	40	74	74	6600	31.6	28
	Man Lift	3	20	75	80	6600	37.4	30
	Crane	2	16	81	84	6600	41.6	34
	Gradall	2	40	83	86	6600	43.6	40
	All Other Equipment > 5 HP	2	50	85	88	6600	45.6	43
	Backhoe	5	40	78	85	6600	42.6	39
	Slurry Trenching Machine	5	50	80	87	6600	44.6	42
					Total for 6. Electrical Sub-Station & Microwave Tower Phase:		**51.0**	**47.2**
7. Solar Array, Underground, Battery Install, O & M	Flat Bed Truck	1	40	74	74	6600	31.6	28
	Gradall	6	40	83	91	6600	48.4	44
	Generator	11	50	72	82	6600	40.0	37
	All Other Equipment > 5 HP	9	50	85	95	6600	52.1	49
	Pumps	11	50	77	87	6600	45.0	42
	Roller	2	20	80	83	6600	40.6	34
	Tractor	9	40	84	94	6600	51.1	47
	Front End Loader	2	40	79	82	6600	39.6	36
	Slurry Trenching Machine	5	50	80	87	6600	44.6	42
					Total for 7. Solar Array, Underground, Battery Install, O & M Phase:		**56.6**	**53.1**

Equipment Description	Impact Device?	Acoustical Use Factor (%)	Lesser of or available Lmax	Spec. 721 Lmax	Measured L_{max} @50ft (dBA, slow)
All Other Equipment > 5 HP	No	50	85	85	-- N/A --
Auger Drill Rig	No	20	84	85	84
Backhoe	No	40	78	80	78
Bar Bender	No	20	80	80	-- N/A --
Blasting	Yes	-- N/A --	94	94	-- N/A --
Boring Jack Power Unit	No	50	80	80	83
Chain Saw	No	20	84	85	84
Clam Shovel (dropping)	Yes	20	87	93	87
Compactor (ground)	No	20	80	80	83
Compressor (air)	No	40	78	80	78
Concrete Batch Plant	No	15	83	83	-- N/A --
Concrete Mixer Truck	No	40	79	85	79
Concrete Pump Truck	No	20	81	82	81
Concrete Saw	No	20	90	90	90
Crane	No	16	81	85	81
Dozer	No	40	82	85	82
Drill Rig Truck	No	20	79	84	79
Drum Mixer	No	50	80	80	80
Dump Truck	No	40	76	84	76
Excavator	No	40	81	85	81
Flat Bed Truck	No	40	74	84	74
Front End Loader	No	40	79	80	79
Generator	No	50	72	72	81
Generator (<25KVA, VMS signs)	No	50	70	70	73
Gradall	No	40	83	85	83
Grader	No	40	85	85	-- N/A --
Grapple (on backhoe)	No	40	85	85	87
Horizontal Boring Hydr. Jack	No	25	80	80	82
Hydra Break Ram	Yes	10	90	90	-- N/A --
Impact Pile Driver	Yes	20	95	95	101
Jackhammer	Yes	20	85	85	89
Man Lift	No	20	75	85	75
Mounted Impact Hammer (hoe ram)	Yes	20	90	90	90
Pavement Scarafier	No	20	85	85	90
Paver	No	50	77	85	77
Pickup Truck	No	40	55	55	75
Pneumatic Tools	No	50	85	85	85
Pumps	No	50	77	77	81
Refrigerator Unit	No	100	73	82	73
Rivit Buster/chipping gun	Yes	20	79	85	79

Equipment Description	Impact Device?	Acoustical Use Factor (%)	Lesser of or available Lmax	Spec. 721 Lmax	Measured L_{max} @50ft (dBA, slow)
Rock Drill	No	20	81	85	81
Roller	No	20	80	85	80
Sand Blasting (Single Nozzle)	No	20	85	85	96
Scraper	No	40	84	85	84
Shears (on backhoe)	No	40	85	85	96
Slurry Plant	No	100	78	78	78
Slurry Trenching Machine	No	50	80	82	80
Soil Mix Drill Rig	No	50	80	80	-- N/A --
Tractor	No	40	84	84	-- N/A --
Vacuum Excavator (Vac-truck)	No	40	85	85	85
Vacuum Street Sweeper	No	10	80	80	82
Ventilation Fan	No	100	79	85	79
Vibrating Hopper	No	50	85	85	87
Vibratory Concrete Mixer	No	20	80	80	80
Vibratory Pile Driver	No	20	95	95	101
Warning Horn	No	5	83	85	83
Welder / Torch	No	40	73	73	74

Appendix D
Traffic Noise Modeling Data

FHWA - HIGHWAY TRAFFIC NOISE PREDICTION MODEL
(modified for CNEL)

DUDEK

PROJECT:	Sapphire Solar	JN:	13459
ROADWAY:	SR 177 North of Ragsdale Road	DATE:	3/1/2023
Scenario:	**Existing**	BY:	J. Leech

ADT	1,480		PK HR VOL	148
SPEED	65			
PK HR %	10			
DIST CTL	25			
DIST N/F	36	(M=76,P=52,S=36,C=12)	AUTO SLE DISTANCE	18.1
DIST WALL	0		MED TRUCK SLE DIST	17.6
DIST W/OB	25		HVY TRUCK SLE DIST	17.6
HTH WALL	0.0	********		
HTH OBS	5.0			
AMBIENT	40.0			
ROADWAY VIEW:				
LF ANGLE	-60			
RT ANGLE	60			
DF ANGLE	120			

SITE CONDITIONS: (15=HARD SITE, 10=SOFT SITE)

AUTOM	10.0
MED TR	10.0
HVY TR	10.0
BARRIER	0 (0=WALL,1=BERM)

ELEVATIONS:

PAD	0.0		AUTOMOBILES =	0.00
ROAD	0.0		MEDIUM TRUCKS=	2.30
			HEAVY TRUCKS =	8.01
GRADE:	0.0	%	GRADE ADJUSTM=	0.0 (TO HEAVY TRUCKS)

VEHICLE DISTRIBUTION:

	DAY	EVE	NIGHT	DAILY
AUTOMOBILES	0.770	0.134	0.096	0.9400
MEDIUM TRUCKS	0.872	0.053	0.075	0.0250
HEAVY TRUCKS	0.889	0.030	0.081	0.0350

NOISE IMPACTS WITHOUT TOPO OR BARRIER SHIELDING:

	LEQ PK HR	LEQ DAY	LEQ EVE	LEQ NIGHT	CNEL
AUTOMOBILES	65.1	63.2	61.6	55.4	64.7
MEDIUM TRUCKS	59.8	58.4	52.3	49.0	58.6
HEAVY TRUCKS	64.6	63.3	54.6	54.1	63.3
VEHICULAR NOISE	68.5	66.9	62.8	58.4	**67.6**

FHWA - HIGHWAY TRAFFIC NOISE PREDICTION MODEL

(modified for CNEL)

DUDEK

PROJECT:	Sapphire Solar	JN:	13459
ROADWAY:	SR 177 North of Ragsdale Road	DATE:	3/1/2023
Scenario:	**Existing + Construction**	BY:	J. Leech

ADT	2,530		PK HR VOL	253
SPEED	65			
PK HR %	10			
DIST CTL	25			
DIST N/F	36	(M=76,P=52,S=36,C=12)	AUTO SLE DISTANCE	18.1
DIST WALL	0		MED TRUCK SLE DIST	17.6
DIST W/OB	25		HVY TRUCK SLE DIST	17.6
HTH WALL	0.0	********		
HTH OBS	5.0			
AMBIENT	40.0			
ROADWAY VIEW:				
LF ANGLE	-60			
RT ANGLE	60			
DF ANGLE	120			

SITE CONDITIONS: (15=HARD SITE, 10=SOFT SITE)

AUTOM	10.0	
MED TR	10.0	
HVY TR	10.0	
BARRIER	0	(0=WALL,1=BERM)

ELEVATIONS:

PAD	0.0	AUTOMOBILES =	0.00	
ROAD	0.0	MEDIUM TRUCKS=	2.30	
		HEAVY TRUCKS =	8.01	
GRADE:	0.0 %	GRADE ADJUSTM=	0.0	(TO HEAVY TRUCKS)

VEHICLE DISTRIBUTION:

	DAY	EVE	NIGHT	DAILY
AUTOMOBILES	0.770	0.134	0.096	0.9400
MEDIUM TRUCKS	0.872	0.053	0.075	0.0250
HEAVY TRUCKS	0.889	0.030	0.081	0.0350

NOISE IMPACTS WITHOUT TOPO OR BARRIER SHIELDING:

	LEQ PK HR	LEQ DAY	LEQ EVE	LEQ NIGHT	CNEL
AUTOMOBILES	67.5	65.5	64.0	57.7	67.0
MEDIUM TRUCKS	62.2	60.8	54.6	51.4	60.9
HEAVY TRUCKS	66.9	65.6	56.9	56.4	65.6
VEHICULAR NOISE	70.8	69.3	65.2	60.7	**70.0**

FHWA - HIGHWAY TRAFFIC NOISE PREDICTION MODEL

(modified for CNEL)

DUDEK

PROJECT:	Sapphire Solar	JN:	13459
ROADWAY:	SR 177 North of Ragsdale Road	DATE:	3/1/2023
Scenario:	**Existing + Project Operations**	BY:	J. Leech

ADT	1,490		PK HR VOL	149
SPEED	65			
PK HR %	10			
DIST CTL	25			
DIST N/F	36	(M=76,P=52,S=36,C=12)	AUTO SLE DISTANCE	18.1
DIST WALL	0		MED TRUCK SLE DIST	17.6
DIST W/OB	25		HVY TRUCK SLE DIST	17.6
HTH WALL	0.0	********		
HTH OBS	5.0			
AMBIENT	40.0			
ROADWAY VIEW:				
LF ANGLE	-60			
RT ANGLE	60			
DF ANGLE	120			

SITE CONDITIONS:		(15=HARD SITE, 10=SOFT SITE)
AUTOM	10.0	
MED TR	10.0	
HVY TR	10.0	
BARRIER	0	(0=WALL,1=BERM)

ELEVATIONS:				
PAD	0.0	AUTOMOBILES =	0.00	
ROAD	0.0	MEDIUM TRUCKS=	2.30	
		HEAVY TRUCKS =	8.01	
GRADE:	0.0 %	GRADE ADJUSTM=	0.0	(TO HEAVY TRUCKS)

VEHICLE DISTRIBUTION:

	DAY	EVE	NIGHT	DAILY
AUTOMOBILES	0.770	0.134	0.096	0.9400
MEDIUM TRUCKS	0.872	0.053	0.075	0.0250
HEAVY TRUCKS	0.889	0.030	0.081	0.0350

NOISE IMPACTS WITHOUT TOPO OR BARRIER SHIELDING:

	LEQ PK HR	LEQ DAY	LEQ EVE	LEQ NIGHT	CNEL
AUTOMOBILES	65.2	63.2	61.7	55.4	64.7
MEDIUM TRUCKS	59.9	58.5	52.3	49.1	58.6
HEAVY TRUCKS	64.6	63.3	54.6	54.1	63.3
VEHICULAR NOISE	68.5	67.0	62.9	58.4	**67.7**

FHWA - HIGHWAY TRAFFIC NOISE PREDICTION MODEL
(modified for CNEL)

DUDEK

PROJECT:	Sapphire Solar	JN:	13459
ROADWAY:	Kaiser Road West/North of SR 177	DATE:	3/1/2023
Scenario:	**Existing**	BY:	J. Leech

ADT	360		PK HR VOL	36
SPEED	35			
PK HR %	10			
DIST CTL	25			
DIST N/F	36	(M=76,P=52,S=36,C=12)	AUTO SLE DISTANCE	18.1
DIST WALL	0		MED TRUCK SLE DIST	17.6
DIST W/OB	25		HVY TRUCK SLE DIST	17.6
HTH WALL	0.0	********		
HTH OBS	5.0			
AMBIENT	40.0			
ROADWAY VIEW:				
LF ANGLE	-60			
RT ANGLE	60			
DF ANGLE	120			

SITE CONDITIONS:		(15=HARD SITE, 10=SOFT SITE)
AUTOM	10.0	
MED TR	10.0	
HVY TR	10.0	
BARRIER	0	(0=WALL,1=BERM)

ELEVATIONS:				
PAD	0.0		AUTOMOBILES =	0.00
ROAD	0.0		MEDIUM TRUCKS=	2.30
			HEAVY TRUCKS =	8.01
GRADE:	0.0	%	GRADE ADJUSTM=	0.0 (TO HEAVY TRUCKS)

VEHICLE DISTRIBUTION:

	DAY	EVE	NIGHT	DAILY
AUTOMOBILES	0.770	0.134	0.096	0.9400
MEDIUM TRUCKS	0.872	0.053	0.075	0.0250
HEAVY TRUCKS	0.889	0.030	0.081	0.0350

NOISE IMPACTS WITHOUT TOPO OR BARRIER SHIELDING:

	LEQ PK HR	LEQ DAY	LEQ EVE	LEQ NIGHT	CNEL
AUTOMOBILES	51.4	49.5	47.9	41.7	51.0
MEDIUM TRUCKS	47.3	45.9	39.7	36.5	46.0
HEAVY TRUCKS	54.5	53.2	44.5	44.0	53.3
VEHICULAR NOISE	56.8	55.3	50.0	46.5	**55.8**

FHWA - HIGHWAY TRAFFIC NOISE PREDICTION MODEL

(modified for CNEL)

DUDEK

PROJECT:	Sapphire Solar	JN:	13459
ROADWAY:	'Kaiser Road West/North of SR 177	DATE:	3/1/2023
Scenario:	**Existing + Construction**	BY:	J. Leech

ADT	1,410		PK HR VOL	141
SPEED	35			
PK HR %	10			
DIST CTL	25			
DIST N/F	36	(M=76,P=52,S=36,C=12)	AUTO SLE DISTANCE	18.1
DIST WALL	0		MED TRUCK SLE DIST	17.6
DIST W/OB	25		HVY TRUCK SLE DIST	17.6
HTH WALL	0.0	********		
HTH OBS	5.0			
AMBIENT	40.0			
ROADWAY VIEW:				
LF ANGLE	-60			
RT ANGLE	60			
DF ANGLE	120			

SITE CONDITIONS: (15=HARD SITE, 10=SOFT SITE)

AUTOM	10.0	
MED TR	10.0	
HVY TR	10.0	
BARRIER	0	(0=WALL,1=BERM)

ELEVATIONS:

PAD	0.0	AUTOMOBILES =	0.00
ROAD	0.0	MEDIUM TRUCKS=	2.30
		HEAVY TRUCKS =	8.01
GRADE:	0.0 %	GRADE ADJUSTM=	0.0 (TO HEAVY TRUCKS)

VEHICLE DISTRIBUTION:

	DAY	EVE	NIGHT	DAILY
AUTOMOBILES	0.770	0.134	0.096	0.9400
MEDIUM TRUCKS	0.872	0.053	0.075	0.0250
HEAVY TRUCKS	0.889	0.030	0.081	0.0350

NOISE IMPACTS WITHOUT TOPO OR BARRIER SHIELDING:

	LEQ PK HR	LEQ DAY	LEQ EVE	LEQ NIGHT	CNEL
AUTOMOBILES	57.4	55.4	53.9	47.7	56.9
MEDIUM TRUCKS	53.2	51.8	45.7	42.4	51.9
HEAVY TRUCKS	60.5	59.2	50.5	50.0	59.2
VEHICULAR NOISE	62.7	61.2	55.9	52.4	**61.7**

FHWA - HIGHWAY TRAFFIC NOISE PREDICTION MODEL

(modified for CNEL)

DUDEK

PROJECT:	Sapphire Solar	JN:	13459
ROADWAY:	'Kaiser Road West/North of SR 177	DATE:	3/1/2023
Scenario:	**Existing + Project Operations**	BY:	J. Leech

ADT	370		PK HR VOL	37
SPEED	35			
PK HR %	10			
DIST CTL	25			
DIST N/F	36	(M=76,P=52,S=36,C=12)	AUTO SLE DISTANCE	18.1
DIST WALL	0		MED TRUCK SLE DIST	17.6
DIST W/OB	25		HVY TRUCK SLE DIST	17.6
HTH WALL	0.0	********		
HTH OBS	5.0			
AMBIENT	40.0			
ROADWAY VIEW:				
LF ANGLE	-60			
RT ANGLE	60			
DF ANGLE	120			

SITE CONDITIONS:		(15=HARD SITE, 10=SOFT SITE)
AUTOM	10.0	
MED TR	10.0	
HVY TR	10.0	
BARRIER	0	(0=WALL,1=BERM)

ELEVATIONS:				
PAD	0.0	AUTOMOBILES =	0.00	
ROAD	0.0	MEDIUM TRUCKS=	2.30	
		HEAVY TRUCKS =	8.01	
GRADE:	0.0 %	GRADE ADJUSTM=	0.0	(TO HEAVY TRUCKS)

VEHICLE DISTRIBUTION:

	DAY	EVE	NIGHT	DAILY
AUTOMOBILES	0.770	0.134	0.096	0.9400
MEDIUM TRUCKS	0.872	0.053	0.075	0.0250
HEAVY TRUCKS	0.889	0.030	0.081	0.0350

NOISE IMPACTS WITHOUT TOPO OR BARRIER SHIELDING:

	LEQ PK HR	LEQ DAY	LEQ EVE	LEQ NIGHT	CNEL
AUTOMOBILES	51.6	49.6	48.1	41.8	51.1
MEDIUM TRUCKS	47.4	46.0	39.9	36.6	46.1
HEAVY TRUCKS	54.6	53.3	44.6	44.2	53.4
VEHICULAR NOISE	56.9	55.4	50.1	46.6	**55.9**

Appendix E

Noisepro Modeling Data

Technical Basis of Dudek's "NoisePro" Excel-based Outdoor Sound Propagation Prediction Model

In summary, the Microsoft Excel-based **NoisePro** outdoor sound propagation model developed by Dudek calculates the aggregate sound pressure level (SPL) received by each and every cell within a two-dimensional (2D) array (a product of X columns of cells by Y rows of cells). The quantity of this received SPL, in A-weighted decibels (dBA), is the logarithmic sum of acoustical contribution from each of "n" user-input sound emitting point sources located on the same 2D array, which may be written as follows:

$$SPL_{X,Y} = 10 * \log \sum_{i=1}^{n} 10^{0.1[L_i - A_i]}$$

where each individual source sound level (L_i) is attenuated by an algebraic sum of three attenuation factors ($A_i = A_{div} + A_{atm} + A_{gr}$) that are each dependent on the distance between the sound source position on the X by Y array and the receiving $SPL_{X,Y}$ position on a different position in the same 2D array of worksheet cells, where each cell is defined by the user as representing the center of a square area having equal sides of user-defined length in feet. The above expression is based on Equation 5 from the International Organization for Standardization (ISO) 9613-2 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation", and the individual attenuation factors used by **NoisePro** emulate those in Equation 4 and may be summarized as follows:

- $\boldsymbol{A_{div}}$ = attenuation due to *geometrical divergence* (i.e., pure distance), equating to 20*LOG(d/d_{ref}); and where $\boldsymbol{d}$ is the horizontal distance between a source and a receiver position, while $\boldsymbol{d_{ref}}$ is the reference distance at which the sound source L_i is defined.
- $\boldsymbol{A_{atm}}$ = attenuation due to *atmospheric absorption*, which for 1,000 Hz (1 kHz) = 4.16*$\boldsymbol{d}$/3280 and is derived from Equation 5.7 in Noise & Vibration Control Engineering (Beranek and Ver, 1992).
- $\boldsymbol{A_{gr}}$ = attenuation due to *ground effects*, appearing as Equation 10 in ISO 9613-2 and can be expressed with the following Excel formula:

  $\boldsymbol{A_{gr}}$ = MAX(0,4.8-[$\boldsymbol{h_s}$+$\boldsymbol{h_r}$]/$\boldsymbol{d}$*[17+984/$\boldsymbol{d}$])

  where $\boldsymbol{h_s}$ and $\boldsymbol{h_r}$ are the heights (in feet) of the sound source and receiver positions above grade, respectively. This means that for small distances, attenuation from ground effects will be small or essentially zero; and, even at great distances, the attenuation from ground effects is effectively capped at 4.8 dB.

The Excel workbook comprising **NoisePro** calculates $SPL_{X,Y}$ by using a coding loop to evaluate the acoustic contribution from each attenuated sound source ($\boldsymbol{L_i}$ - $\boldsymbol{A_i}$) in sequence, and logarithmically adding the new evaluation to the previous total in a cumulative manner. When all sources have been evaluated, the loop terminates and yields an aggregate or log-summed total $SPL_{X,Y}$ value that is thus unique to a position in the 2D array of cells represented by X and Y, and can thus be "mapped". If the user has defined a particular cell in the X by Y array as a uniquely tagged Receiver, then the corresponding $SPL_{X,Y}$ value can be indexed and displayed accordingly.

The resulting output array of cells, each having an individually calculated $SPL_{X,Y}$ numerical value, is then filled with a color (from a user-defined palette) by application of a Conditional Formatting rules set (an Excel formatting feature) that compares the dB quantity with user-defined "high" and "low" dB ranges for each available color. Each colored cell can thus be likened to a "pixel" within a 2D array that forms a composite image representing—visually—the sound propagation from all modeled sound sources.

GRID CALCULATION WORKSHEET

Example Portion of Concluded Calculations Loop

	grid size (ft)	
x	220	
y	220	
	rcvr plane height (ft)	
z	5	

Source	44
Source Tag	INV33
Source X-coordinate	17820
Source Y-coordinate	8580
Source Z-coordinate	8
Source Reference SPL	64
Source Ref. Distance (ft.)	32.8

Grid Upper Left (C,R)

1	1

Grid Lower Right (C,R)

120	90

		Receiver Location			
Column	Row	X-coord	Y-coord	Z-coord	Cumulative SPL
1	1	220	220	5	21.7
1	2	220	440	5	22.0
1	3	220	660	5	22.3
1	4	220	880	5	22.6
1	5	220	1100	5	22.8
1	6	220	1320	5	23.1
1	7	220	1540	5	23.4
1	8	220	1760	5	23.7
1	9	220	1980	5	23.9
1	10	220	2200	5	24.2
1	11	220	2420	5	24.4
1	12	220	2640	5	24.7
1	13	220	2860	5	24.9
1	14	220	3080	5	25.1
1	15	220	3300	5	25.3
1	16	220	3520	5	25.5
1	17	220	3740	5	25.7
1	18	220	3960	5	25.9
1	19	220	4180	5	26.0
1	20	220	4400	5	26.2
1	21	220	4620	5	26.3
1	22	220	4840	5	26.4
1	23	220	5060	5	26.5
1	24	220	5280	5	26.6
1	25	220	5500	5	26.7
1	26	220	5720	5	26.7
1	27	220	5940	5	26.8
1	28	220	6160	5	26.8
1	29	220	6380	5	26.8

grid scale	ft
x	220
y	220

Noise Source Description	Type	SPL (dBA)	Ref. Distance (ft)
Stack 750 Battery Storage Unit	STK	88	3.28
Inverter	INV	64	32.8
Sub-station Step-up Transformer	SUB	89	3.28
Battery Inverter	BI	76.1	32.8
Emergency Generator	GEN	77.8	23
O & M Blg. HVAC	HVAC	64	3.28

Source Inventory with Model Grid Coordinate Locations and Sound Pressure Reference Levels

Source	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Source Tag	**STK01**	**STK02**	**STK03**	**STK04**	**STK05**	**STK06**	**STK07**	**STK08**	**STK09**	**STK10**	**GSU01**	**INV01**	**INV02**	**INV03**	**INV04**	**INV05**	**INV06**	**INV07**	**INV08**	**INV09**
Source X-coordinate (feet)	6600	6600	6600	6820	6820	7480	7480	7480	7700	7700	6600	7260	7260	8800	8800	8800	8800	8800	8800	10560
Source Y-coordinate (feet)	6160	6380	6600	6160	6380	6160	6380	6600	6160	6380	5720	6820	7480	5940	6600	7480	8360	9240	10120	7480
Source Type	STK	STK	STK	STK	STK	STK	STK	STK	STK	STK	SUB	INV	INV	INV	INV	INV	INV	INV	INV	INV
Source Refernce SPL	88	88	88	88	88	88	88	88	88	88	89	64	64	64	64	64	64	64	64	64
Source Reference Dist. (ft.)	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	23	3.28	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8
Source Height Above Grade (ft.)	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8

Source	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Source Tag	**INV10**	**INV11**	**INV12**	**INV13**	**INV14**	**INV15**	**INV16**	**INV17**	**INV18**	**INV19**	**INV20**	**INV21**	**INV22**	**INV23**	**INV24**	**INV25**	**INV26**	**INV27**	**INV28**	**INV29**
Source X-coordinate (feet)	10560	10560	10560	10560	10560	10560	10560	11880	11880	10560	11880	11880	11880	11880	11880	12760	13420	13420	14740	14740
Source Y-coordinate (feet)	8360	9240	10120	3080	4180	5720	6600	3080	4180	4840	4840	5720	6600	7480	8140	8800	4180	4840	4180	4840
Source Type	INV	INV	INV	INV	INV	INV	INV	INV	INV	INV	INV	INV	INV	INV	INV	INV	INV	INV	INV	INV
Source Refernce SPL	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64
Source Reference Dist. (ft.)	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8
Source Height Above Grade (ft.)	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8

Source	41	42	43	44	45	46	47	48	49	50
Source Tag	**INV30**	**INV31**	**INV32**	**INV33**	**HVAC01**	**GEN01**	**GEN01**	**BI01**	**BI02**	**BI03**
Source X-coordinate (feet)	15400	16280	17160	17820	7040	7040	7700	7260	7260	7260
Source Y-coordinate (feet)	8580	8580	8580	8580	5720	5940	5940	6160	6380	6600
Source Type	INV	INV	INV	INV	HVAC	GEN	GEN	BI	BI	BI
Source Refernce SPL	64	64	64	64	64	78	78	88	88	88
Source Reference Dist. (ft.)	32.8	32.8	32.8	32.8	3.28	23	23	32.8	32.8	32.8
Source Height Above Grade (ft.)	8	8	8	8	8	8	8	8	8	8

Receiver Inventory with Model Grid Coordinate Locations and Predicted Operational Sound Level Exposure

Receiver Tag	ST1	ST2	ST3	ST4
Receiver X-coordinate (feet)	4400	5280	12980	21120
Receiver Y-coordinate (feet)	16500	18040	15620	7040
Receiver Ht Above Ground (ft)	5	5	5	5
SPL Predicted at Receiver	**19.5**	**17.0**	**20.3**	**19.5**