Noise Technical Report for the Diamond Tail Solar Project, Sandoval County, New Mexico

NOVEMBER 2024

PREPARED FOR

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NOISE TECHNICAL REPORT FOR THE DIAMOND TAIL SOLAR PROJECT, SANDOVAL COUNTY, NEW MEXICO

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CONTENTS

Appendices

Figures

Tables

1 INTRODUCTION

SWCA Environmental Consultants (SWCA) has prepared this noise technical report for the proposed Diamond Tail Solar Project (the Project) in Sandoval County, New Mexico (Figure 1). PCR Investments SP4 LLC (PCR) plans to construct, operate, and maintain a utility-scale photovoltaic (PV) solar facility and battery energy storage system (BESS) on approximately 1,833 acres of private land located about 2.66-miles northwest of Golden, NM and approximately 1.75-miles west of State Route (SR) 14 also known as the Turquoise Trail National Scenic Byway. The Project area is surrounded primarily by undeveloped desert lands.

1.1 Purpose

The purpose of this report is to outline the methodologies used to assess the impact of the Project on the existing soundscape. This report provides an analysis and estimates of noise impacts during both construction and operational phases, with a primary focus on sound levels at the Project's site boundary and nearest noise sensitive areas (NSAs). It aims to determine whether the proposed activities will result in a significant, permanent increase in ambient noise levels near the Project area and if noise at the site boundary will remain within maximum allowable limits.

2 PROJECT DESCRIPTION

The Project involves the construction and operation of a proposed PV solar and lithium-ion BESS facility within an 1,833-acre undeveloped area in Sandoval County, New Mexico. The area surrounding the project area is largely undeveloped native desert land. The project area is located near Golden, New Mexico, with the closest NSAs being residences situated about 1.0 mile to the north of the site boundary.

Among the project components, the BESS and inverters are the primary sources with potential to impact ambient noise levels. The project will also install a 345-kV overhead line from the PV facility to the existing Diamond Tail substation. This line will generate some noise but is unlikely to affect the surrounding noise environment. Figure 2 illustrates a preliminary layout of these components. The noise impact evaluation provided here includes computer noise modeling conducted using SoundPLAN Version 9.1 (SoundPLAN) and an assessment of results measured at the Project's site boundary and nearest NSAs to ensure compliance with applicable sound standards.

In addition to assessing operational noise, this report includes an evaluation of construction-related noise impacts using the Roadway Construction Noise Model (RCNM), a tool developed by the Federal Highway Administration (FHWA 2011). RCNM was used to estimate noise levels from typical construction equipment and activities anticipated during the Project's construction phase. This analysis aims to determine potential short-term noise impacts on the surrounding area, particularly in relation to the nearest residences.

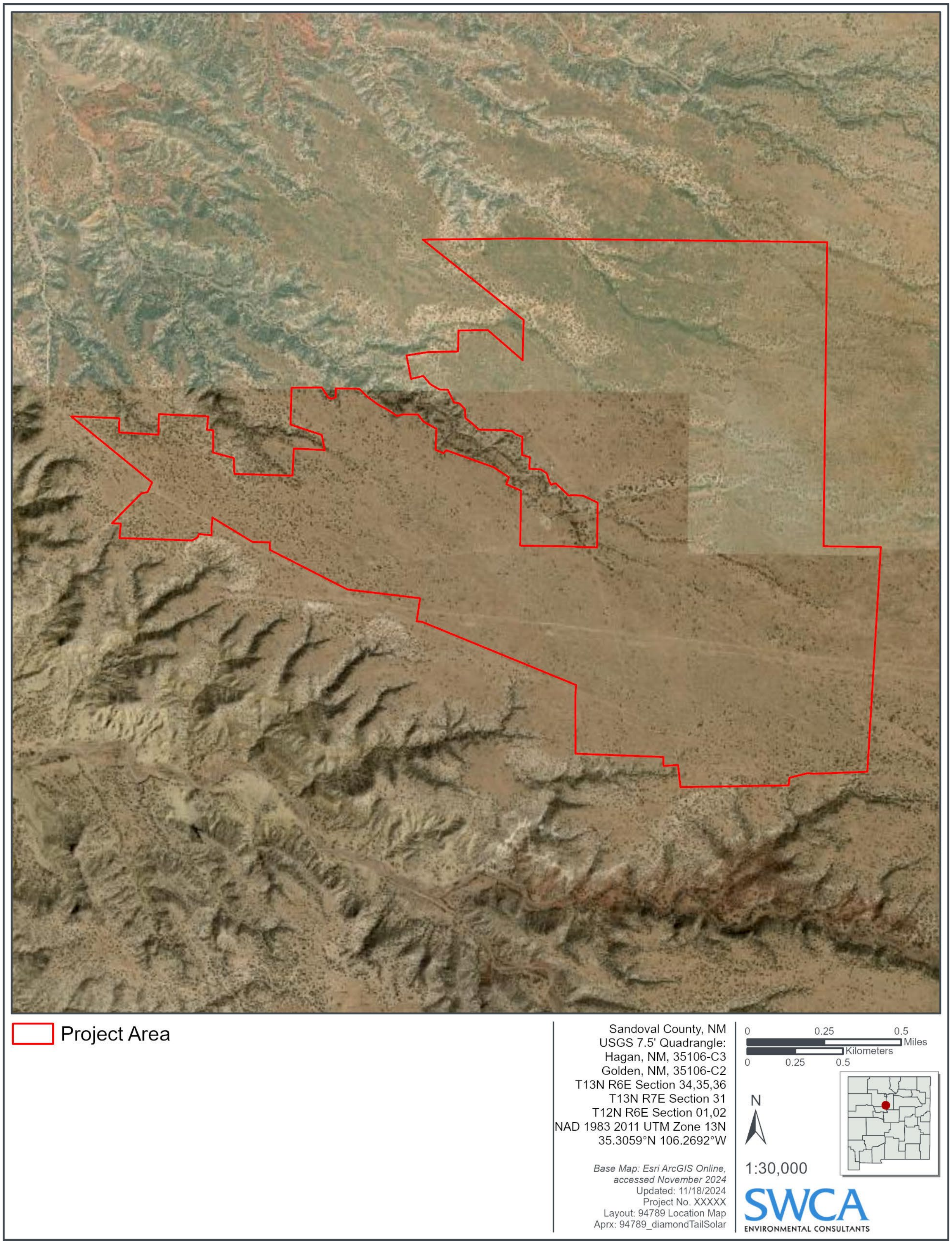

Figure 1. Project location map.

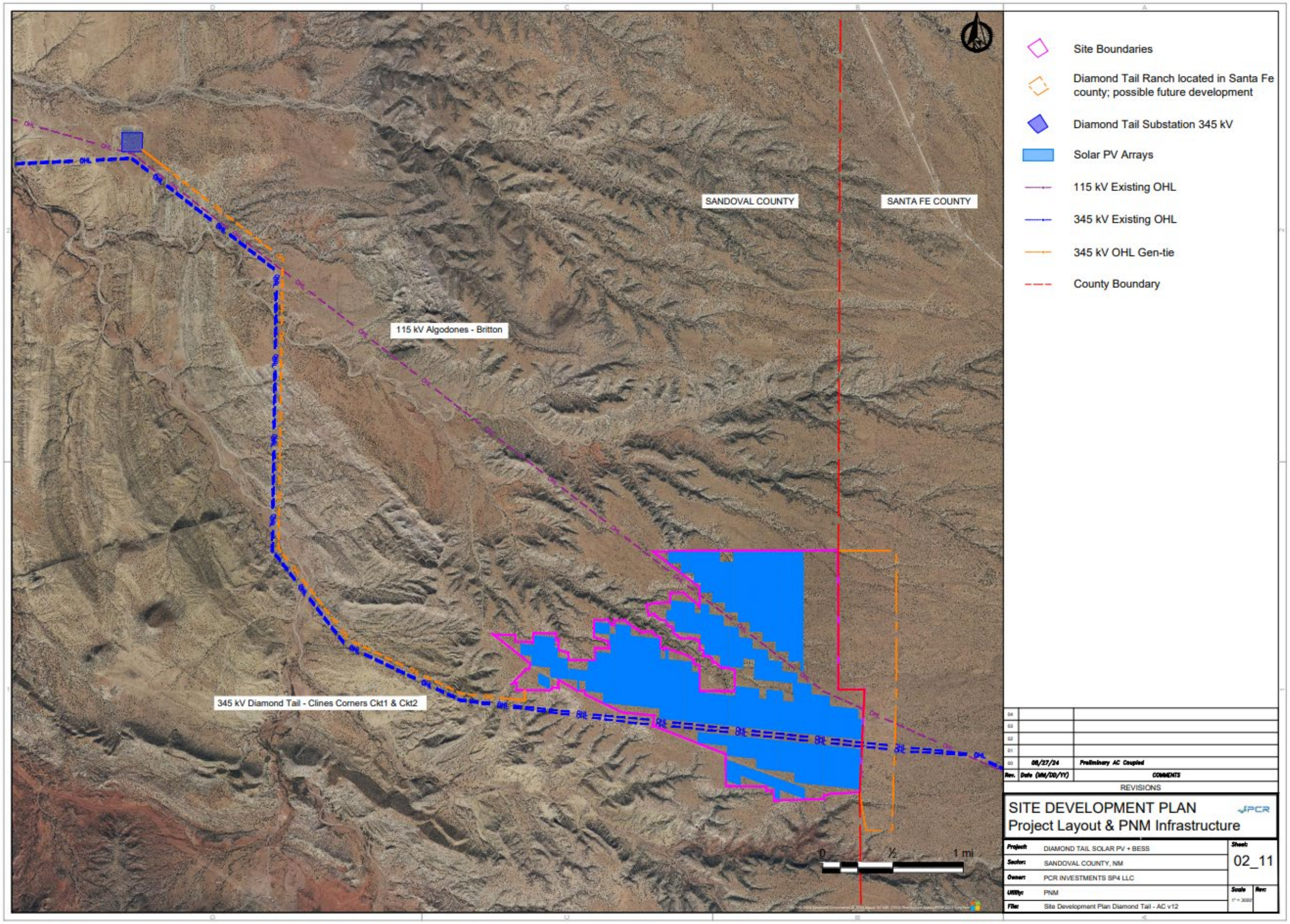

Figure 2. Project Layout.

3 SOUND FUNDAMENTALS – BACKGROUND

Sound is defined as a form of energy that is transmitted by pressure variations, which the animal or human ear can detect. Noise can be defined as any unpleasant or unwanted sound that is unintentionally added to a desired sound or environment. The effects of noise on humans include interference with communication, learning, rest, sleep, and physiological health effects. There are two main properties of sound: the amplitude and the frequency. Amplitude refers to the energy level that reaches the ear (how loud we perceive the sound), while frequency is the number of cycles or oscillations per unit of time completed by the source. Frequency is normally expressed in hertz (Hz).

Sound power is defined as the measurement of the ability of a source to produce sound. It is independent of the acoustic environment in which it is located. The sound power level (L_{pw}) of a source is the amount of energy it produces relative to a reference value and is normally expressed in decibels (dB). The decibel is a logarithmic scale to describe the sound pressure ratio.

Humans perceive a frequency range of about 20 Hz to about 20,000 Hz. An internationally standardized frequency weighting, the A-weighting scale, was designed to approximate the audible range of frequencies of a healthy human ear. The A-weighting scale corresponds to the fact that the human ear is not as sensitive to sound at the lower frequencies as it is at the higher frequencies.

3.1 Definition of Acoustical Terms

Several different descriptors of time-averaged sound levels are used to account for fluctuations of sound intensity over time. The sound descriptors calculated by the sound meters and used in this report to describe environmental sound are defined below:

- Ambient sound level is defined as the composite of noise from all sources near and far, the normal or existing level of environmental noise at a given location.
- Decibel (dB) is the physical unit commonly used to measure sound levels. Technically, a dB is a unit of measurement that describes the amplitude of sound equal to 20 times the base 10 logarithm of the ratio of the reference pressure to the sound of pressure, which is 20 micropascals (μPa).
- Equivalent Continuous Noise Level (L_{eq}) is the average sound level over a specified period, representing a constant sound level containing the same acoustic energy as the varying levels during that period. It is often used to describe environmental noise exposure.
- The Maximum Sound Level (L_{max}) is the highest sound level recorded during a specific period, crucial for assessing short-term noise events that could cause disturbance or harm.
- Day-Night Average Sound Level (L_{dn}) is the A-weighted equivalent sound level for a 24-hour period with an additional 10 dB weighting imposed on the equivalent sound levels occurring during night-time hours (10 p.m. [22:00] to 7 a.m. [07:00]).
- Daytime Sound Level (L_d) is defined as the equivalent sound level for a 15-hour period between 7 a.m. (07:00) and 10 p.m. (22:00).
- Nighttime Sound Level (L_n) is defined as the equivalent sound level for a 9-hour period between 10 p.m. (22:00) and 7 a.m. (07:00).
- Residual Sound Level (L_{90}) is the level that is exceeded 90% of the time over a specified period. The residual sound level excludes intruding sound from sporadic anthropogenic noises, wildlife, and wind gusts that raise the average and maximum levels over a measurement period.

3.2 Sound Levels of Representative Sounds and Noises

The U.S. Environmental Protection Agency (EPA) has developed an index to assess noise impacts from a various sources using residential receptors. Residential development is not recommended if L_{dn} values exceed 65 dBA (EPA 1979). Noise levels in a quiet rural area at night are typically between 32 and 35 dBA. Quiet urban night-time noise levels range from 40 to 50 dBA. Levels above 70 dBA tend to be associated with task interference. Levels between 50 and 55 dBA are associated with raised voices in a normal conversation. Noise levels during the day in a noisy urban area are frequently as high as 70 to 80 dBA. Noise levels above 110 dBA become intolerable. Table 1 presents sound levels for some common noise sources and the human response to those decibel levels.

Table 1. Sound Levels of Representative Sounds and Noises

Source and Distance	Sound Level (dBA)	Human Response
Jet takeoff (nearby)	150	
Jet takeoff (15 m/50 feet)	140	
50-hp siren (30 m/100 feet)	130	
Loud rock concert (near stage)	120	Pain threshold
Construction noise (3 m/10 feet)	110	Intolerable
Jet takeoff (610 m/2,000 feet)	100	
Heavy truck (8 m/25 feet)	90	
Garbage disposal (0.6 m/2 feet)	80	Constant exposure endangers hearing
Busy traffic	70	
Normal conversation	60	
Light traffic (30 m/100 feet)	50	Quiet
Library	40	
Soft whisper (4.5 m/15 feet)	30	Very quiet
Rustling leaves	20	
Normal breathing	10	Barely audible
Threshold of hearing	0	

Source: Beranek (1988).

Table 2 provides criteria that have been used to estimate an individual's perception of increases in sound. Generally, an average person perceives an increase of 3 dBA or less as barely perceptible. An increase of 10 dBA is perceived as a doubling of the sound.

Table 2. Average Human Ability to Perceive Changes in Sound Levels

Increase in Sound Level (dBA)	Human Perception of Sound
2–3	Barely perceptible
5	Readily noticeable
10	Doubling of the sound
20	Dramatic change

Source: Bolt Beranek and Newman, Inc. (1973).

4 EXISTING CONDITIONS

4.1 Existing Sound Conditions

Ambient sound levels can be highly variable and are influenced by the sound sources in the immediate area. As described above, land uses in the Project area and area surrounding the project area are primarily undeveloped, with buildings sparsely scattered across the landscape. Existing noise levels around NSAs are typically affected by local road traffic, agricultural activities, and sounds from equipment such farm machinery, along with natural sounds from wildlife, insects, and wind.

Typical ambient day-night–averaged noise levels can be estimated based on the dominant land usage of an area. Table 3 provides typical ambient noise levels associated with different land uses, offering a reference for evaluating the project's impact within its rural setting.

Table 3. A-Weighted Day, Night, and Day-Night Average Sound Levels

Land Use Category	Typical L_{dn} (dBA)	Day Level, L_d (dBA)	Night Level, L_n (dBA)	People per square mile	People per square km
1. Very noisy urban residential	67	66	58	63,840	24,650
2. Noisy urban residential	62	61	54	20,000	7,722
3. Urban and noisy suburban residential	57	55	49	6,384	2,465
4. Quiet urban and normal suburban residential	52	50	44	2,000	772
5. Quiet suburban residential	47	45	39	638	247
6. Very quiet suburban and rural residential	42	40	34	200	77

Source: Schomer Dossin, Freytag, Luo, Machesky, Nookala and Pamdighantam (2010).

Note: L_d = daytime average level, L_{dn} = day-night level, L_n = nighttime average level.

No background noise level measurements were collected at the nearest NSAs or within the Project area. Instead, ambient noise levels are estimated based on the predominant land use within and surrounding the Project area.

The Project area is best described as a rural residential setting with minimal nearby sound sources. Accordingly, background sound levels are conservatively represented by *"Category 6 (very quiet suburban and rural residential)"* from the American National Standards Institute (ANSI)/Acoustical Society of America (ASA) S12.9-2013/Part 3 standard (ANSI 2013).

Category 6 applies to low-density areas with population levels around 200 people per square mile. While the population density of Sandoval County is approximately 40.1 people per square mile (US Census Bureau, 2020)—well below the threshold—Category 6 remains a reasonable representation of the area due to its rural and quiet nature, characterized by predominantly undeveloped land and minimal surrounding development.

The Project area itself is located in an especially remote portion of Sandoval County, where the surrounding population density is even lower than the county average. To account for this difference and more accurately reflect the existing sound environment, a 5 dBA reduction has been applied to the Category 6 values for average sound levels.

In lieu of direct measurements, daytime and nighttime equivalent continuous sound levels (L_d and L_n) are conservatively assumed to be 35 dBA and 29 dBA, respectively.

4.2 Noise-Sensitive Areas

NSAs are areas where quiet is essential to their intended use, such as residential zones, schools, hospitals, churches, and libraries. The nearest NSA to the Project is a residence approximately 1.0 mile north of the closest PV installation.

5 REGULATORY SETTING

Federal, state, and local agencies have set noise regulations and policies to protect the health and welfare of the public, as described below.

5.1 Federal

There are no federally enforceable noise standards applicable to this Project. However, the EPA has issued guidance recommending a noise level of 55 dBA L_{dn} as a threshold for protecting public health and welfare with an adequate margin of safety (EPA, 1974). This level represents an outdoor average over a 24-hour period, with an additional 10 dBA penalty applied to nighttime noise to account for increased sensitivity during sleeping hours.

For reference, a 55 dBA L_{dn} is equivalent to a constant 48.6 dBA L_{eq} over a 24-hour period. While this is not a regulatory requirement, it is commonly used in noise impact assessments as a benchmark for evaluating potential noise effects on residential and community areas.

5.2 State

There are no applicable state level noise standards.

5.3 County

Currently, there are no specific county-level noise standards applicable to this Project. However, for the purposes of this analysis, the Sandoval County Comprehensive Zoning Ordinance Section 10(1), Subsection F(i) – Sound and Vibration Mitigation Performance Standards for mining operations (Sandoval County 2020) – will be referenced as a guiding framework. The ordinance states:

> *"A sand and gravel mining operation shall not cause or allow the emission of any sound from any property-line-noise-source (impulse or continuous) which exceeds the allowable A-weighted sound levels specified in the following table when measured at any point.*"

Classification of Adjacent Land Use	***Allowable Sound Pressure Levels(dB) of Emitted Sound***
Residential, Single-Family, Mobile Homes	70 dBA
Residential, Multi-family	70 dBA
Schools, Churches, Hospitals, Nursing Homes	70 dBA
Offices, Business, Commercial and Professional Buildings	70 dBA
Industrial, Utilities, Agricultural	75 dBA
Undeveloped Public Lands	75 dBA

The maximum allowable sound level of 75 dBA for undeveloped and agricultural lands, as outlined in the Sandoval County Comprehensive Zoning Ordinance Section 10(1), Subsection F(i) (Sandoval County 2020) – will be used as the threshold for the Project.

While there are no specific county-level noise standards directly applicable to this Project, the referenced ordinance provides a robust framework for establishing allowable sound levels. The ordinance stipulates maximum A-weighted sound pressure levels for various land-use classifications, with a limit of 75 dBA for areas classified as industrial, utilities, agricultural, or undeveloped public lands.

Given that the land use surrounding the Project area consists predominantly of undeveloped public lands with some areas designated as agricultural, the 75 dBA threshold is both appropriate and applicable.

6 THRESHOLDS OF SIGNIFICANCE AND METHODOLOGY

6.1 Short-Term Construction Noise Criteria

The construction noise criteria outlined in the Federal Transit Administration's (FTA) Transit Noise and Vibration Impact Assessment Manual (FTA 2018) were used to evaluate potential construction noise impacts on noise-sensitive residential areas surrounding the Project. The FTA identifies a daytime exterior construction noise threshold of 80 dBA L_{eq} for residential areas, 85 dBA L_{eq} for commercial areas, and 90 dBA L_{eq} for industrial zones. As no other ordinances specify construction noise limits for this type of Project, the FTA standards will serve as benchmarks to assess potential noise impacts on nearby properties during construction.

6.2 Long-Term Operational Noise Criteria

In accordance with the Sandoval County Comprehensive Zoning Ordinance Section 10(1), Subsection F(i), the maximum allowable sound level for undeveloped public lands and agricultural areas is 75 dBA. This threshold is specifically outlined in the ordinance's Sound and Vibration Mitigation Performance Standards for mining operations and will be applied as the primary criterion for this analysis.

The 75-dBA threshold provides a limit to evaluate whether the Project's operational noise levels remain within the parameters set by the County. This standard ensures that potential noise impacts are assessed in alignment with local regulations, maintaining the integrity of the surrounding environment and land uses.

6.3 Methodology

Both construction and operation of the Project will generate noise. To estimate these noise impacts, established literature and widely accepted noise prediction and propagation methodologies were applied. Using Project-specific assumptions for construction and operational activities, potential noise levels were calculated based on the methods outlined below.

6.3.1 *Noise Assessment Components*

A noise assessment is based on the following components: a sound-generating source, a medium through which the source transmits, the pathways taken by these sounds, and an evaluation of the proximity to NSAs. Soundscapes are affected by the following factors:

- Source. The sources of sound are any generators of small back-and-forth motions (i.e., motions that transfer their motional energy to the transmission path where it is propagated). The acoustic characteristics of the sources are very important. Sources must generate sound of sufficient strength, approximate pitch, and duration so that the sound may be perceived and can cause adverse effects, compared with the natural ambient sounds.
- Transmission path or medium. The transmission path or medium for sound or noise is most often the atmosphere (i.e., air). For the noise to be transmitted, the transmission path must support the free propagation of the small vibratory motions that make up the sound. Atmospheric conditions (e.g., wind speed and direction, temperature, humidity, precipitation) influence the attenuation of sound. Barriers and/or discontinuities (e.g., existing structures, topography, foliage, ground cover, etc.) that attenuate the flow of sound may compromise the path.
- Proximity to NSAs. An NSA is defined as a location where excessive noise interferes with the normal use of the location. Typical NSAs include residential areas, parks, and wilderness areas, but also include passive parks and monuments, schools, hospitals, churches, and libraries.

6.3.2 *On-Site Construction Noise*

The evaluation of potential noise impacts associated with Project construction was based on the construction schedule, phasing, and equipment assumptions provided for the Project.

Construction-related noise was analyzed using data and modeling methodologies from FHWA's RCNM (FHWA 2011). The RCNM is FHWA's national model for the prediction of construction noise. This software is based on actual sound level measurements from various equipment types taken during the Central Artery/Tunnel Project conducted in Boston, Massachusetts, during the early 1990s (FWHA 2011).

Estimates of noise from the construction of the Project are based on a roster of the maximum amount of construction equipment used on a given day. Table 4 presents standard construction equipment and the associated noise level at 50 feet. The RCNM has noise levels for various types of equipment preprogrammed into the software; that is, the noise level associated with the equipment is typical for the equipment type and not based on any specific make or model. Table 4 contains equipment that may be used in construction of the Project.

Table 4. Noise Levels for Common Construction Equipment

Equipment Description	Typical Maximum Noise Levels at 50 Feet (dBA)
Drill rig truck	84.0
Flatbed truck	84.0
Front-end loader	80.0
Impact pile driver	96.8
Pickup truck	55.0

Source: FHWA (2011), SWCA 2022.

In addition to the RCNM estimates, this analysis incorporates measured sound pressure levels for pile driving. These measurements are based on data collected and reported in the Pile-Driving Sound Measurements associated with the Fleming Solar Project in Fleming County, Kentucky (January 2022), prepared by SWCA Environmental Consultants for AEUG Fleming Solar, LLC as shown in Table 4.

The approximate noise generated by Project construction equipment has been conservatively calculated based on the equipment anticipated to be used at the construction site and does not consider further attenuation due to atmospheric interference or intervening structures. The predicted noise from construction activity is presented as a worst-case (highest noise level) scenario, where it is assumed that all equipment is present and operating simultaneously on-site for each stage of construction.

To evaluate the potential noise impacts of the Project, the average 1-hour L_{eq} noise level generated during the loudest construction phase was estimated at the site boundary based on the distance to the closest PV installation. The noisiest phase is anticipated to be pile driving, with an estimated construction duration of 150 to 180 days. This data point was provided by PCR as part of their construction planning analysis.

6.3.3 *On-Site Operational Noise*

On-site noise levels from operation sources will primarily result from stationary sources, such as mechanical equipment. Using noise level data from published sources, noise impacts from these stationary sources were evaluated by estimating the sound levels they generate at the site boundary. These estimates account for the distance between each noise source and receptor. As described in Section 2, the noise impact analysis was conducted using SoundPLAN, a computer noise modeling tool. SoundPLAN generates noise contours for the overall Project in compliance with multiple standards, primarily the International Standards Organization (ISO) 9613-2, which provides acoustic standards for noise propagation calculations.

Sound propagation losses, including geometric spreading, air absorption, ground absorption, and barrier shielding, are calculated according to these standards. The model applies industry-accepted propagation algorithms and uses sound power levels (L_w in dB) provided by manufacturers and other verified sources.

The ISO 9613-2 standard estimates sound pressure levels at specified distances by subtracting various attenuation factors from the source's L_w for each octave frequency band. These attenuation factors include the following:

- *Geometrical divergence* occurs as the source L_{pw} is spread out over an increasing surface area (i.e., as the distance from the source increases). The estimated loss rate is the same for all frequencies. This is considered the most significant loss associated with propagation. Attenuation due to geometrical divergence is highly dependent on the distance between the source and the receiver. Direction also affects the noise level: for example, a noise level for a 0 degree (°) direct line of sight will be higher than one for a 90° indirect line of sight to an emission point. Therefore, the differences in ground elevation, receiver height, and hub height (source height) are important parameters.
- *Ground effect* is described according to the parameter Ground Factor (G), which varies between 0 for surfaces with low porosity ("hard" ground) and 1 for surfaces such as loose dirt, grass, crops and other vegetation ("soft" ground). This factor describes the effect of sound waves reflected off the ground. Parameters influencing the ground effect are the source height, receiver height, and propagation distance between the source and receiver and the ground conditions.
- *Barrier attenuation* describes the effect of sound waves refracted around an imperforate element or barrier. A barrier could include human-made objects such as structures, buildings, and fences, as well as topographical features. Therefore, the differences in ground elevation, source height, receiver height, dimension, location absorption and reflection coefficients of human-made structures, and topographic features are important parameters when estimating barrier attenuation in SoundPLAN.

The following assumptions were made when running SoundPLAN:

- Noise impacts depicted in the isopleths were estimated assuming a receiver height of 1.5 meters above ground level.
- Elevations of the sources and the receptors examined in the modeling were determined from U.S. Geological Survey digital elevation maps (DEM) and are based on the North American Datum of 1927.
- The Project was assumed to operate 24 hours per day. The noise attenuation model was set up to represent "worst-case" noise conditions.

To ensure the model accounts for realistic and scientifically defensible conditions, key factors influencing noise propagation, including meteorological conditions and ground surface properties, were carefully selected. These parameters are detailed in the following sections.

6.3.4 *Meteorological Conditions for Noise Propagation*

The evaluation he ISO 9613-2 standard assumes meteorological conditions that favor sound propagation, representing scenarios where atmospheric effects maximize the transmission of sound from source to receiver. These conditions are typically associated with downwind propagation or the presence of a temperature inversion, both of which reduce sound attenuation and enhance sound levels at greater distances. To align with these assumptions and model realistic worst-case propagation, specific values for temperature and humidity have been selected based on their impact on atmospheric absorption.

A temperature of 10°C has been chosen as it reflects typical conditions during nighttime or early morning hours when temperature inversions are most likely to occur. Under these conditions, cooler air near the ground is trapped beneath warmer air aloft, creating a stable atmospheric layer that refracts sound waves downward. This reduces vertical dissipation and increases sound levels at receptors located far from the source. Lower temperatures also reduce molecular absorption of sound, particularly in the lower and mid-frequency ranges, which are significant for environmental noise assessments.

The relative humidity has been set to 70% to represent conditions where atmospheric sound absorption is minimized. Humidity affects the attenuation of sound waves by influencing the absorption characteristics of the atmosphere. At higher humidity levels, such as 70%, the molecular absorption of sound decreases, especially in the mid to high-frequency ranges. This choice reflects realistic environmental conditions during calm, cool weather, which are often conducive to enhanced noise propagation.

The selected values of 10°C and 70% relative humidity are consistent with the assumptions of ISO 9613-2, which models favorable propagation conditions such as mild downwind or inversion-like scenarios. These meteorological parameters result in minimal atmospheric attenuation, thereby representing a scientifically defensible worst-case scenario.

6.3.5 *Ground Factor Selection*

The ground factor (G) represents the acoustic properties of the ground surface between the noise source and the receiver, with values ranging from 0 for hard, reflective surfaces to 1 for porous, absorptive surfaces. For this assessment, a ground factor of G=0.6 has been selected to represent the specific land cover conditions in the project area.

The terrain in the project area is primarily composed of shrublands and grasslands. While these ground types are generally absorptive, the presence of variable conditions such as compacted soil, bare patches, and sparsely vegetated areas introduces reflective elements into the acoustic environment. Shrublands typically feature a mix of low-lying shrubs and open soil, and grasslands, while absorptive overall, can include areas of denser, compacted ground that partially reflects sound. These factors make G=0.6 an appropriate and defensible choice, capturing the intermediate characteristics of the ground.

By adopting G=0.6, this assessment takes a conservative approach to estimating ground attenuation. This value is consistent with ISO 9613-2 recommendations for environments with mixed ground types that include both absorptive and reflective components. The selection of this G value also ensures that potential noise impacts are not underestimated, particularly in areas where ground conditions may vary.

The use of G=0.6 is further supported by its applicability to landscapes with a combination of natural vegetation and compacted or exposed soil. This conservative approach aligns with best practices for noise assessments, ensuring that modeled sound levels reflect realistic propagation conditions and provide a reliable basis for evaluating potential impacts in the project area.

7 IMPACTS

7.1 Construction Noise

The noise generated by construction equipment can vary significantly, influenced by factors such as equipment type, make, size, condition, operating schedule, and the surrounding environment. For this Project, construction is anticipated to last approximately 24 months, involving various activities across multiple phases.

To evaluate potential noise impacts, this report focuses on the phase expected to generate the highest noise levels: the pile installation phase. Table 5 provides a detailed estimate of the maximum number of equipment pieces anticipated to be active during this phase.

Noise levels for construction activities were estimated using standardized data from the RCNM. During pile-driving operations, sound pressure levels at a distance of 50 feet are expected to peak at 96.8 dBA.

Table 5. Anticipated Construction Equipment

Phase (Duration)	Equipment Used		
	Type	Number	Hours/Day
Pile Driving	Forklift	1	8
	Impact Pile driver	1	8
	Pickup truck	3	8
	Front-end loader	1	8
	Skid Steer	1	8

The approximate noise generated by the construction equipment used at the facility has been conservatively calculated based on an estimated project construction equipment roster projected to be used at the construction site and not considering further attenuation due to atmospheric interference or intervening structures. Results of the RCNM construction noise calculations are presented in Table 6.

Table 6. Predicted Construction Noise Levels

Phase	Equipment	Distance (feet)	Construction 1-hr L_{eq} (dBA)	Construction L_{Max} (dBA)
Pile driving	Forklift (1), pile driver (1), pickup truck (3), front-end loader (1), and skid steer (1)	100	84.4	90.8
		250	76.4	82.8
		348*	73.5	79.9
		500	70.4	76.8
		1,000	64.4	70.8
		2,000	58.3	64.8
		2,640	55.9	62.3
		5,280†	49.9	56.3

* Distance at which the L_{max} from construction falls below the 80 dBA FTA threshold.
† Distance to closest NSA.

The estimated noise levels at varying distances from the Project boundary, as presented in Table 6, show that at a distance of 100 feet from the buildable area, the predicted 1-hour L_{eq} is 84.4 dBA, with an L_{max} of 90.8 dBA. This L_{max} level does not comply with the FTA threshold of 80 dBA for residential areas, indicating that construction noise impacts would surpass recommended limits at this location without mitigation.

Noise levels decline as distance from the construction site increases. At 348 feet, where the L_{max} reaches 79.9 dBA, the FTA threshold is met. The closest NSA is located at approximately 5,280 feet, where the L_{max} further decreases to 56.3 dBA, remaining well within acceptable limits. As no residential areas are located within the 348 feet buffer where the FTA threshold would be surpassed, no residential areas will be impacted by construction.

This analysis applies conservative assumptions, such as simultaneous operation of equipment near the closest photovoltaic (PV) system to an NSA. In practice, equipment usage is staggered and spread across the site, leading to lower actual noise exposure levels at any one point.

7.2 Operational Noise

To determine the potential noise impact from these sources, detailed noise modeling was conducted. The noise levels at the site boundary and nearest NSAs from the operation of the project have been predicted and compared with the relevant noise criteria.

7.2.1 *Operational Activities*

The Diamond Tail Solar site will consist of a solar facility with BESS, each outfitted with inverters, which are critical for converting the direct current (DC) electricity generated by solar panels and stored in batteries into alternating current (AC) electricity suitable for grid distribution. The solar field facility will feature 70 inverters. The inverters produce noise primarily from internal cooling fans and the electronic switching mechanisms essential to their operation, with noise levels generally low but constant during active periods.

The BESS area will feature 114 inverters and BESS enclosures, as well as 29 Generator Step-Up Transformers (GSU). Additionally, a transformer will be stationed at the substation site to facilitate voltage adjustments for efficient power transmission to the grid. The noise generated by the BESS system will primarily stem from the operation of cooling systems within the battery containers and the transformers.

In addition to the BESS and substation components, the analysis also accounted for 5,578 PV trackers, which are part of the solar array system and contribute to the overall noise profile of the Project. These motors track the sun's arc by moving the panels no more than five degrees every 15 minutes and operate for no more than one minute out of each 15-minute cycle. These elements collectively inform the assessment of noise impacts during operation.

7.2.2 *Noise Profile*

Table 7 lists the acoustic emissions for each equipment noise source associated with the Project. All sound levels are based on data provided by equipment manufacturers, or where manufacturer data was unavailable, from supplemental sources or calculated estimates. These values represent noise levels for equipment operating at full capacity (100% load), providing a conservative basis for noise impact assessment.

Table 7. Equipment Sound Power Levels

Description	Quantity	Overall Acoustic Emissions (dBA)
PV Inverters - Sungrow SG3600UD-MV-US 3600kVA	70	95.6
PV Trackers - Array Omnitrack	5,578	78.0 *
Substation Transformers	1	68.0
BESS Enclosures - Tesla Megapack 969 kW/3878 kWh	114	101.8 †
BESS Transformers - 4400 kVA	29	68.0

Note: Equipment selection is preliminary and subject to change; final equipment used may vary based on availability and project requirements.
* Noise levels for trackers are based on an operational assumption of one minute of activity per 15-minute cycle, equivalent to four minutes of operation per hour.
† Sound levels for Tesla Megapacks assume operation at a 100% fan duty cycle. A modeling correction factor of K_0=1 has been applied.

7.2.3 *Operational Noise Impacts*

The analysis modeled noise emissions from key operational components—including inverters, transformers, trackers, and the BESS—and assessed the cumulative sound levels projected at the site boundary and nearest NSA. Noise levels were estimated based on equipment specifications and acoustic emissions data, simulating an operational environment at full load. The modeled noise levels, listed in Table 8 present the maximum modeled sound levels expected at any point along the site boundary during the operational phase of the Project, providing a comprehensive representation of potential noise impacts.

Table 8. Maximum Modeled Sound Levels at the Project Site Boundary

Description	Modeled Project Level L_{eq}, dBA	Existing Daytime Level L_d, dBA	Existing Nighttime Level L_n, dBA	Cumulative Daytime Level, dBA	Cumulative Nighttime Level, dBA
Site boundary	72.5	35.0	29.0	72.5	72.5

The noise impact analysis, as summarized in Table 8, confirms that the modeled operational noise levels for the Project comply with Sandoval County's noise threshold of 75 dBA for undeveloped public lands and agricultural areas, as specified in the ordinance. The maximum modeled 1-hour L_{eq} at any point along the Project's property boundary was 72.5 dBA, which remains below the County's allowable limit.

When combined with the assumed existing ambient noise levels—35 dBA for daytime and 29 dBA for nighttime—the resulting cumulative noise levels remain at 72.5 dBA for both daytime and nighttime conditions. This outcome confirms that the Project's operational noise will not exceed the County's noise standard.

In addition to assessing noise impacts at the site boundary, the analysis evaluated noise levels at multiple nearby NSAs surrounding the Project. Among these, the NSA expected to experience the highest noise levels from the Project was identified, and its results are presented in Table 9.

Table 9. Maximum Modeled Sound Levels at the NSA with Highest Projected Noise Impact

Distance (Feet) and Direction of NSA from Project	Modeled Project Level L_{eq}, dBA	Existing Daytime Level L_d, dBA	Existing Nighttime Level L_n, dBA	Cumulative Daytime Level, dBA	Cumulative Nighttime Level, dBA
6,755 S	36.1	35.0	29.0	38.6	36.9

The results for the evaluated NSA with the highest projected noise impact, as summarized in Table 9, indicate that the NSA is located 6,755 feet south of the Project. The modeled operational noise level at this NSA is 36.1 dBA, which is well below the 70 dBA noise threshold established by the Sandoval County ordinance for residential land uses.

When combined with the existing ambient sound levels of 35.0 dBA during the daytime and 29.0 dBA at night, the cumulative noise levels are 38.6 dBA for daytime and 36.9 dBA for nighttime. These cumulative levels also comply with the EPA's recommended noise limit of 55 dBA L_{dn} for protecting public health and welfare. The daytime cumulative level of 38.6 dBA is significantly lower than the equivalent constant 48.6 dBA L_{eq} associated with the 55 dBA L_{dn} standard. Similarly, the nighttime cumulative level of 36.9 dBA is well below thresholds for typical quiet environments and far below any limits established for residential or community protection.

While the cumulative daytime level represents an increase of 3.6 dBA over the existing ambient, this is a change that is just perceptible to the human ear. The nighttime cumulative level reflects an increase of 7.9 dBA, which is more noticeable but still represents relatively low sound levels when compared to everyday quiet environments. For context, cumulative noise levels of 38.6 dBA (daytime) and 36.9 dBA (nighttime) are consistent with sound levels typically found in a quiet rural area or a library, both of which are generally considered calm and unobtrusive acoustic environments.

The isopleth maps generated for this noise impact assessment are presented in Appendix A. These maps illustrate compliance with Sandoval County's 75 dBA threshold, as specified in Section 10(1), Subsection F(i), of the County's zoning regulations. These visual representations effectively show the extent of noise propagation and validate adherence to County noise standards.

7.2.4 *Corona Noise Effect*

During project operation, the transmission lines will produce noise, primarily from the corona effect, which occurs when the electrical field strength around the conductors ionizes the surrounding air, causing a faint hissing or crackling sound. Corona noise is influenced by factors such as line voltage, weather conditions, and ambient noise levels. The elevation of the proposed transmission line, ranging from approximately 5,660 to 6,630 feet, may also influence corona noise generation, as higher altitudes are associated with lower air density, which can slightly increase the likelihood of corona discharge under certain conditions.

Corona noise data from 345-kV transmission projects in similar high-elevation (5,000–6,000 feet), semi-arid environments provide useful benchmarks for assessing potential impacts. For example, the maximum modeled audible noise within the right-of-way for the Rush Creek Wind 345-kV project in eastern Colorado was 29.5 dBA during fair weather and 51 dBA during wet weather (Pearson n.d.). Based on these findings and comparable data from similar projects, corona noise generated by the Gen-Tie Project's 345-kV line is anticipated to range from approximately 29.5 dBA to 51 dBA, depending on weather conditions.

Under fair-weather conditions, corona noise is typically faint, reaching levels comparable to a whisper or rustling leaves (29.5 dBA), and it diminishes rapidly with distance. Even in the worst-case scenario (51 dBA in wet weather), the noise is expected to drop below the rural ambient sound level of 29 dBA within approximately 158.5 feet from the transmission line. Beyond this distance, the noise blends into the ambient environment or becomes inaudible.

Additionally, during foul weather, corona noise is often masked by the natural sounds of rain, wind, or storm activity, which are generally louder and more widespread. As a result, corona noise in these conditions is typically imperceptible to human listeners, even at distances closer to the line.

The nearest noise-sensitive receptor, a residential structure located approximately 1,485 feet north of the proposed transmission line, would experience a corona noise level of approximately 19.3 dBA during wet weather. At this distance, the noise would be effectively inaudible, blending into or falling below the natural ambient soundscape.

This analysis demonstrates that corona noise from the Gen-Tie Project's 345-kV line is unlikely to cause adverse noise impacts at sensitive receptors or in the surrounding environment, even under the most challenging conditions.

8 CONCLUSION

The noise impact assessment demonstrates that the Project will comply with applicable noise regulations during construction and operation phases, with minimal impacts on nearby NSAs.

During construction, noise levels decline rapidly with distance from the buildable area. At 348 feet, the L_{max} meets the 80 dBA FTA threshold for residential areas (79.9 dBA) and decreases further to 56.3 dBA at the nearest NSA, located 5,280 feet away. Since no residential areas are within the buffer where noise exceeds the threshold, no significant construction noise impacts are expected.

Operational noise modeling confirms compliance with Sandoval County's 75 dBA threshold for undeveloped public and agricultural lands. At the site boundary, the maximum modeled noise level is 72.5 dBA, remaining below the limit. At the residential NSA with the highest predicted noise impact, located 6,755 feet south, the modeled noise level is 36.1 dBA, well within the threshold. Combined with ambient levels, cumulative noise remains low, with daytime and nighttime levels of 38.6 dBA and 36.9 dBA, respectively.

Transmission line noise from corona discharge is expected to range between 29.5 dBA (fair weather) and 51 dBA (wet weather) within the right-of-way. At the nearest NSA, located 1,485 feet away, corona noise is modeled at 19.3 dBA during wet weather, making it effectively inaudible and blending with the natural ambient soundscape.

In all phases, the Project complies with regulatory thresholds and demonstrates minimal noise impacts to nearby receptors, ensuring it remains compatible with the rural and undeveloped character of the area.

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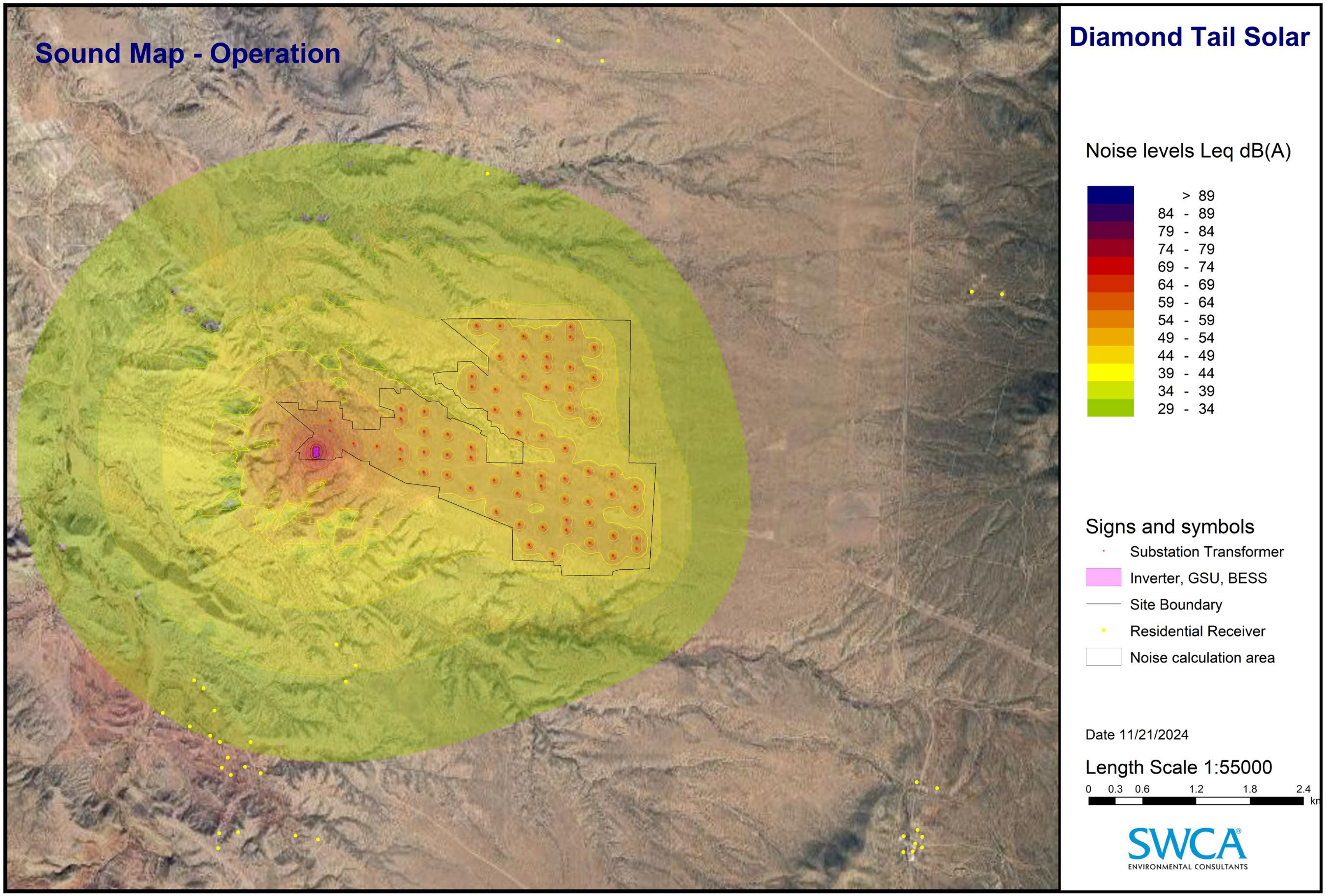
APPENDIX A

Project Operation Isopleths



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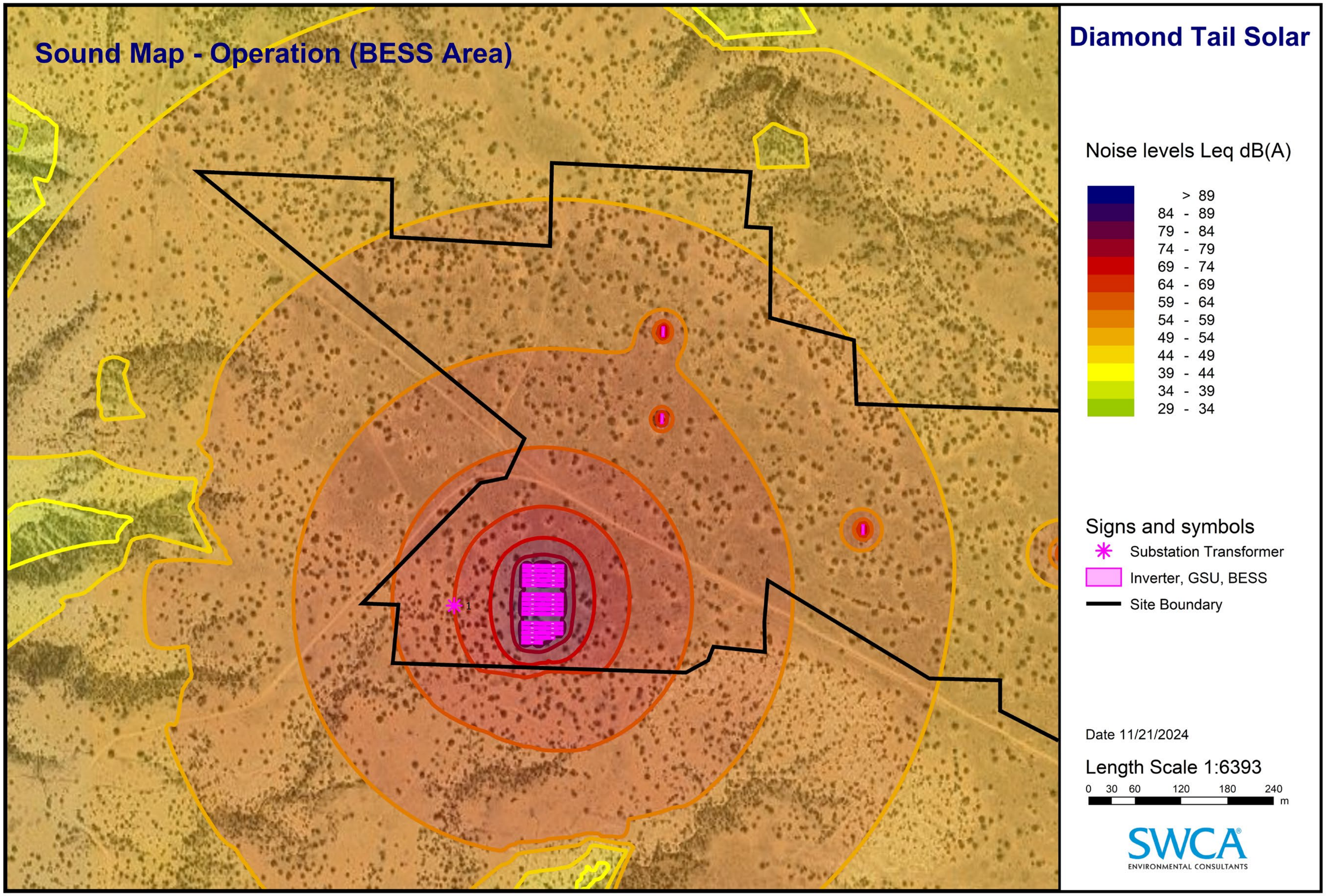

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