Noise Impact Assessment
for the
Devil's Punch Bowl Nature Center Project

Los Angeles County, California

Prepared For:

Lacey Withers, ASLA
Principal, Landscape Architect
WITHERS & SANDGREN Landscape Architecture + Planning
20948 Tulsa St.
Chatsworth, CA 91311

Prepared By:

ECORP Consulting, Inc.
ENVIRONMENTAL CONSULTANTS
55 Hanover Lane, Suite A
Chico, California 95973

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LIST OF ACRONYMS AND ABBREVIATIONS

Term	Definition
ANSI	American National Standards Institute
BAT	Best Available Technologies
CalEEMod	California Emissions Estimator Model
Caltrans	California Department of Transportation
CNEL	Community Noise Equivalent Level
County	Los Angeles County

Term	Definition
dB	Decibel
dBA	Decibel is A-weighted
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
Hz	Hertz
ITE	Institute of Transportation Engineers
L_{dn}	Day-night average sound level
L_{eq}	Measure of ambient noise
L_{max}	The maximum A-weighted noise level during the measurement period.
L_{min}	The minimum A-weighted noise level during the measurement period.
NIOSH	National Institute for Occupational Safety and Health
OPR	Office of Planning and Research
OSHA	Federal Occupational Safety and Health Administration
PPV	Peak particle velocity
Project	Devil's Punch Bowl Nature Center Project
RCNM	Roadway Construction Noise Model
RMS	Root mean square
STC	Sound Transmission Class
VdB	Vibration Velocity Level

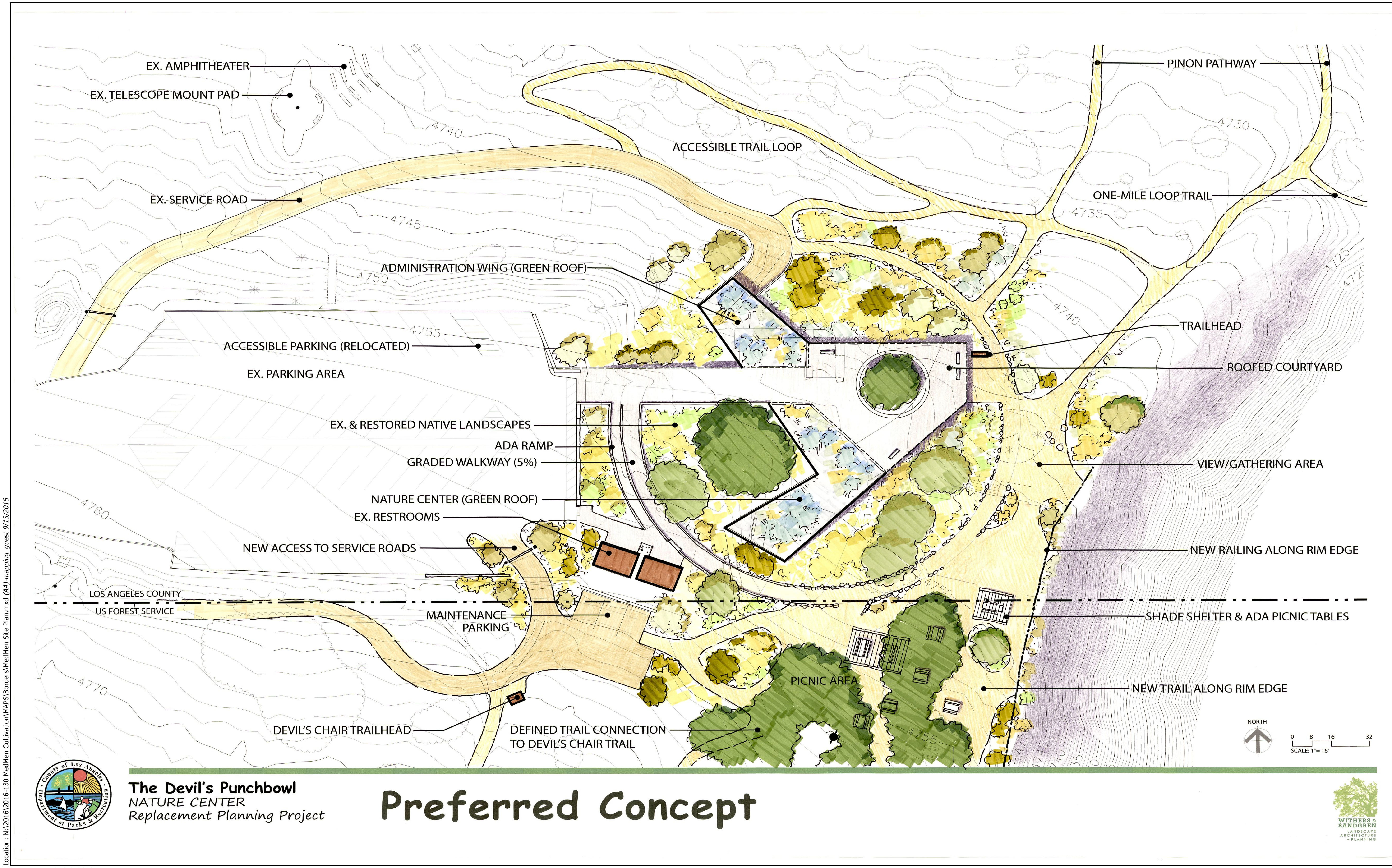
1.0 INTRODUCTION

This report documents the results of a Noise Impact Assessment completed for the Devil's Punch Bowl Nature Center Project (Project), which proposes the redevelopment of a Nature Center and associated features in the County of Los Angeles (County), California. This assessment was prepared as a comparison of predicted Project noise levels to noise standards promulgated by the County of Los Angeles General Plan Noise Element and the Los Angeles County Municipal Code. The purpose of this report is to estimate Project-generated noise and to determine the level of impact the Project would have on the environment.

1.1 Project Location and Description

The Project, located in unincorporated Los Angeles County, proposes the construction and operation of a Nature Center and associated features at the Devil's Punchbowl Natural Area. The Devil's Punchbowl is 1,310-acre County Park within the San Gabriel Mountains. Visitors can enjoy walking, hiking, and horseback riding through the canyon. The Project Site previously accommodated a Nature Center at the Devil's Punchbowl Natural Area, but it was burned down in the Bobcat Fire in September of 2020. The Nature Center has historically offered a place to learn about the native wildlife of the park and its history. The Project aims to reconstruct and renovate the Devil's Punch Bowl Nature Area, which includes a 3,245 square foot building that includes a Nature Center, administrative offices, and a gift shop (see Figure 1-1). The Proposed Project would also feature landscaped paths around the Nature Center, new trail heads, picnic areas, and shade structures.

The Project Site is located at the Devil's Punch Bowl Natural Area located at the terminus of Devil's Punchbowl Road, with the surrounding area consisting of rural open space and several single-family homes accessed from Big Sky Drive. The Project Site is located about two miles south of the community of Valermo.



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Map Date: *5/10/2023*
Photo (or Base) Source: *Withers and Sandgreen 2023*

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Figure 1-1. Conceptual Site Plan

2022-124.001 Devil's Punch Bowl

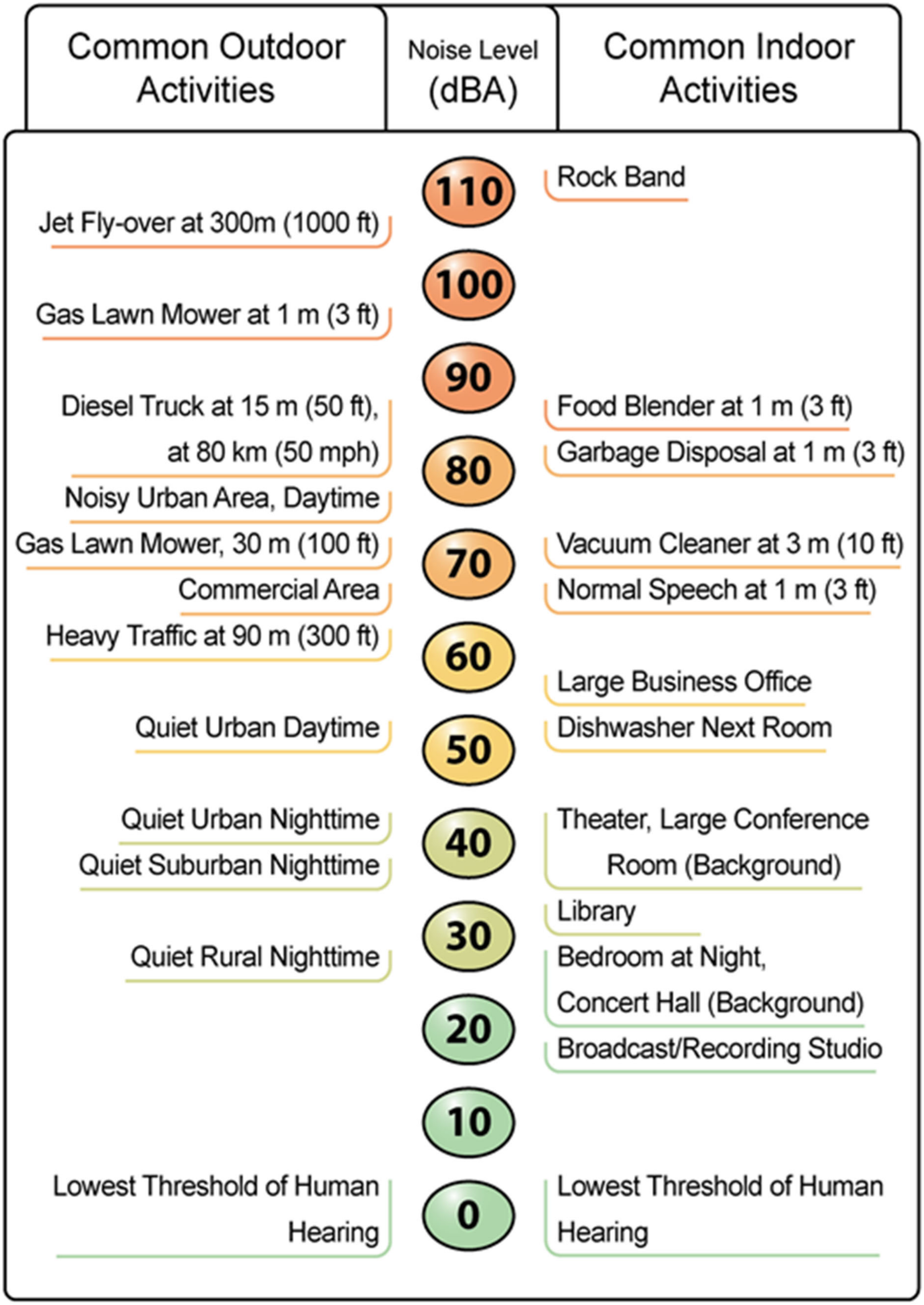
2.0 ENVIRONMENTAL NOISE AND GROUNDBORNE VIBRATION ANALYSIS

2.1 Fundamentals of Noise and Environmental Sound

2.1.1 Addition of Decibels

The decibel (dB) scale is logarithmic, not linear, and therefore sound levels cannot be added or subtracted through ordinary arithmetic. Two sound levels 10 dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted (dBA), an increase of 10 dBA is generally perceived as a doubling in loudness. For example, a 70-dBA sound is half as loud as an 80-dBA sound and twice as loud as a 60-dBA sound. When two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be three dB higher than one source under the same conditions (Federal Transit Administration [FTA] 2017). For example, a 65-dB source of sound, such as a truck, when joined by another 65 dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by three dB). Under the decibel scale, three sources of equal loudness together would produce an increase of five dB.

Typical noise levels associated with common noise sources are depicted in Figure 2-1.



Source: California Department of Transportation (Caltrans) 2020a

Figure 2-1. Common Noise Levels

2.1.2 Sound Propagation and Attenuation

Noise can be generated by a number of sources, including mobile sources such as automobiles, trucks and airplanes, and stationary sources such as construction sites, machinery, and industrial operations. Sound spreads (propagates) uniformly outward in a spherical pattern, and the sound level decreases (attenuates) at a rate of approximately 6 dB (dBA) for each doubling of distance from a stationary or point source (Federal Highway Administration [FHWA] 2017). Sound from a line source, such as a highway, propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of approximately 3 dBA for each doubling of distance from a line source, such as a roadway, depending on ground surface characteristics (FHWA 2017). No excess attenuation is assumed for hard surfaces like a parking lot or a body of water. Soft surfaces, such as soft dirt or grass, can absorb sound, so an excess ground-attenuation value of 1.5 dBA per doubling of distance is normally assumed. For line sources, an overall attenuation rate of three dB per doubling of distance is assumed (FHWA 2011).

Noise levels may also be reduced by intervening structures; generally, a single row of detached buildings between the receptor and the noise source reduces the noise level by about five dBA (FHWA 2006), while a solid wall or berm generally reduces noise levels by 10 to 20 dBA (FHWA 2011). However, noise barriers or enclosures specifically designed to reduce site-specific construction noise can provide a sound reduction of 35 dBA or greater (Western Electro-Acoustic Laboratory, Inc. 2000).

To achieve the most potent noise-reducing effect, a noise enclosure/barrier must physically fit in the available space, must completely break the *line of sight* between the noise source and the receptors, must be free of degrading holes or gaps, and must not be flanked by nearby reflective surfaces. Noise barriers must be sizable enough to cover the entire noise source and extend lengthwise and vertically as far as feasibly possible to be most effective.

The limiting factor for a noise barrier is not the component of noise transmitted through the material, but rather the amount of noise flanking around and over the barrier. In general, barriers contribute to decreasing noise levels only when the structure breaks the "line of sight" between the source and the receiver.

The manner in which older homes in California were constructed generally provides a reduction of exterior-to-interior noise levels of about 20 to 25 dBA with closed windows (California Department of Transportation [Caltrans] 2002). The exterior-to-interior reduction of newer residential units is generally 30 dBA or more (Harris Miller, Miller & Hanson Inc. 2006). Generally, in exterior noise environments ranging from 60 dBA Community Noise Equivalent Level (CNEL) to 65 dBA CNEL, interior noise levels can typically be maintained below 45 dBA, a typical residential interior noise standard, with the incorporation of an adequate forced air mechanical ventilation system in each residential building, and standard thermal-pane residential windows/doors with a minimum rating of Sound Transmission Class (STC) 28. (STC is an integer rating of how well a building partition attenuates airborne sound. In the U.S., it is widely used to rate interior partitions, ceilings, floors, doors, windows, and exterior wall configurations). In exterior noise environments of 65 dBA CNEL or greater, a combination of forced-air mechanical ventilation and sound-rated construction methods is often required to meet the interior noise level limit. Attaining the necessary noise reduction from exterior to interior spaces is readily achievable in noise environments less than 75 dBA CNEL with proper wall construction techniques following California Building Code methods, the selections of proper windows and doors, and the incorporation of forced-air mechanical ventilation systems.

2.1.3 Noise Descriptors

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Several rating scales have been developed to analyze the adverse effect of community noise on people. Because environmental noise fluctuates over time, these scales consider that the effect of noise on people is largely dependent on the total acoustical energy content of the noise, as well as the time of day when the noise occurs. The noise descriptors most often encountered when dealing with traffic, community, and environmental noise include the average hourly noise level (in L_{eq}) and the average daily noise levels/community noise equivalent level (in L_{dn}/CNEL). The L_{eq} is a measure of ambient noise, while the L_{dn} and CNEL are measures of community noise. Each is applicable to this analysis and defined as follows:

- Equivalent Noise Level (L_{eq}) is the average acoustic energy content of noise for a stated period of time. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.
- Day-Night Average (L_{dn}) is a 24-hour average L_{eq} with a 10-dBA "weighting" added to noise during the hours of 10:00 pm to 7:00 am to account for noise sensitivity in the nighttime. The logarithmic effect of these additions is that a 60 dBA 24-hour L_{eq} would result in a measurement of 66.4 dBA Ldn.
- Community Noise Equivalent Level (CNEL) is a 24-hour average L_{eq} with a 5-dBA weighting during the hours of 7:00 pm to 10:00 pm and a 10-dBA weighting added to noise during the hours of 10:00 pm to 7:00 am to account for noise sensitivity in the evening and nighttime, respectively.

Table 2-1 provides a list of other common acoustical descriptors.

Table 2-1. Common Acoustical Descriptors	
Descriptor	**Definition**
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micropascals (or 20 micronewtons per square meter), where 1 pascal is the pressure resulting from a force of 1 newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micropascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hertz (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sounds are below 20 Hz and ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels is measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high-frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average acoustic energy content of noise for a stated period of time. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.
Lmax, Lmin	The maximum and minimum A-weighted noise level during the measurement period.
L01, L10, L50, L90	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, Ldn	A 24-hour average L_{eq} with a 10 dBA "weighting" added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for noise sensitivity in the nighttime. The logarithmic effect of these additions is that a 60 dBA 24-hour L_{eq} would result in a measurement of 66.4 dBA Ldn.
Community Noise Equivalent Level, CNEL	A 24-hour average L_{eq} with a 5 dBA "weighting" during the hours of 7:00 p.m. to 10:00 p.m. and a 10 dBA "weighting" added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for noise sensitivity in the evening and nighttime, respectively. The logarithmic effect of these additions is that a 60 dBA 24-hour L_{eq} would result in a measurement of 66.7 dBA CNEL.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends on its amplitude, duration, frequency, and time of occurrence and tonal or informational content, as well as the prevailing ambient noise level.
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.

The A-weighted decibel sound level scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events.

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

2.1.4 Human Response to Noise

The human response to environmental noise is subjective and varies considerably from individual to individual. Noise in the community has often been cited as a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from interference with human activities, including sleep, speech, recreation, and tasks that demand concentration or coordination. Hearing loss can occur at the highest noise intensity levels.

Noise environments and consequences of human activities are usually well represented by median noise levels during the day or night or over a 24-hour period. Environmental noise levels are generally considered low when the CNEL or L_{dn} is below 60 dBA, moderate in the 60 to 70 dBA range, and high above 70 dBA. Examples of low daytime levels are isolated, natural settings with noise levels as low as 20 dBA and quiet, suburban, residential streets with noise levels around 40 dBA. Noise levels above 45 dBA at night can disrupt sleep. Examples of moderate-level noise environments are urban residential or semi-commercial areas (typically 55 to 60 dBA) and commercial locations (typically 60 dBA). People may consider louder environments adverse, but most will accept the higher levels associated with noisier urban residential or residential-commercial areas (60 to 75 dBA) or dense urban or industrial areas (65 to 80 dBA). Regarding increases in A-weighted noise levels (dBA), the following relationships should be noted in understanding this analysis:

- Except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived by humans.
- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference.
- A change in level of at least 5 dBA is required before any noticeable change in community response would be expected. An increase of 5 dBA is typically considered substantial.
- A 10-dBA change is subjectively heard as an approximate doubling in loudness and would almost certainly cause an adverse change in community response.

2.1.5 Effects of Noise on People

2.1.6 Hearing Loss

While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise.

The Occupational Safety and Health Administration (OSHA) has a noise exposure standard that is set at the noise threshold where hearing loss may occur from long-term exposures. The maximum allowable level is 90 dBA averaged over eight hours. If the noise is above 90 dBA, the allowable exposure time is correspondingly shorter.

2.1.7 Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that causes of annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation between noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources.

2.2 Fundamentals of Environmental Groundborne Vibration

2.2.1 Vibration Sources and Characteristics

Sources of earthborne vibrations include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) or manmade causes (explosions, machinery, traffic, trains, construction equipment, etc.). Vibration sources may be continuous (e.g., factory machinery) or transient (e.g., explosions).

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One is the peak particle velocity (PPV); another is the root mean square (RMS) velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration.

PPV is generally accepted as the most appropriate descriptor for evaluating the potential for building damage. For human response, however, an average vibration amplitude is more appropriate because it takes time for the human body to respond to the excitation (the human body responds to an average vibration amplitude, not a peak amplitude). Because the average particle velocity over time is zero, the RMS amplitude is typically used to assess human response. The RMS value is the average of the amplitude squared over time, typically a 1- sec. period (FTA 2018).

Table 2-2 displays the reactions of people and the effects on buildings produced by continuous vibration levels. The annoyance levels shown in the table should be interpreted with care since vibration may be found to be annoying at much lower levels than those listed, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high-noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Ground vibration can be a concern in instances where buildings shake, and substantial rumblings occur. However, it is unusual for vibration from typical urban sources such as buses and heavy trucks to be perceptible. For instance, heavy-duty trucks generally generate groundborne vibration velocity levels of 0.006 PPV at 50 feet under typical circumstances, which as identified in Table 2-2 is considered very unlikely to cause damage to buildings of any type. Common sources for groundborne vibration are planes, trains, and construction activities such as earth-moving which requires the use of heavy-duty earth moving equipment.

Table 2-2. Human Reaction and Damage to Buildings for Continuous or Frequent Intermittent Vibration Levels

Peak Particle Velocity (inches/ second)	Approximate Vibration Velocity Level	Human Reaction	Effect on Buildings
0.006–0.019	64–74	Range of threshold of perception	Vibrations unlikely to cause damage of any type
0.08	87	Vibrations readily perceptible	Threshold at which there is a risk of architectural damage to extremely fragile historic buildings, ruins, ancient monuments
0.1	92	Level at which continuous vibrations may begin to annoy people, particularly those involved in vibration sensitive activities	Threshold at which there is a risk of architectural damage to fragile buildings. Virtually no risk of architectural damage to normal buildings
0.25	94	Vibrations may begin to annoy people in buildings	Threshold at which there is a risk of architectural damage to historic and some old buildings
0.3	96	Vibrations may begin to feel severe to people in buildings	Threshold at which there is a risk of architectural damage to older residential structures
0.5	103	Vibrations considered unpleasant by people subjected to continuous vibrations	Threshold at which there is a risk of architectural damage to new residential structures and Modern industrial/commercial buildings

Source: Caltrans 2020b

3.0 EXISTING ENVIRONMENTAL NOISE SETTING

3.1 Noise Sensitive Land Uses

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Additional land uses such as hospitals, historic sites, cemeteries, and certain recreation areas are considered sensitive to increases in exterior noise levels. Schools, churches, hotels, libraries, and other places where low interior noise levels are essential are also considered noise-sensitive land uses.

The nearest sensitive receptor to the Project Site is a residence accessed from Big Sky Drive, approximately 1,236 feet to the northwest of the Project Site.

3.1.1 Existing Ambient Noise Environment

The Project Site is currently located within the Devil's Punch Bowl Natural Area in the San Gabriel Mountains and is surrounded by a mix of rural residential uses. The most common noise source associated with this land use is mobile noise generated by transportation-related sources such as vehicle traffic on major roadways such as County Road N6, also known as Devil's Punch Bowl Road. Other sources of noise are the residential land uses that generate stationary-source noise.

The American National Standards Institute (ANSI) Standard 12.9-2013/Part 3 "Quantities and Procedures for Description and Measurement of Environmental Sound – Part 3: Short-Term Measurements with an Observer Present" provides a table of approximate background sound levels in L_{dn}, daytime L_{eq}, and nighttime L_{eq}, based on land use and population density. The ANSI standard estimation divides land uses into six distinct categories. Descriptions of these land use categories, along with the typical daytime and nighttime levels, are provided in Table 3-1. At times, one could reasonably expect the occurrence of periods that are both louder and quieter than the levels listed in the table. ANSI notes, "*95% prediction interval [confidence interval] is on the order of +/- 10 dB*." The majority of the Project Area would be considered ambient noise Category 5 or 6.

Table 3-1. ANSI Standard 12.9-2013/Part 3 A-weighted Sound Levels Corresponding to Land Use and Population Density

Category	Land Use	Description	People per Square Mile	Typical L_{dn}	Daytime L_{eq}	Nighttime L_{eq}
1	Noisy Commercial & Industrial Areas and Very Noisy Residential Areas	Very heavy traffic conditions, such as in busy, downtown commercial areas; at intersections for mass transportation or other vehicles, including elevated trains, heavy motor trucks, and other heavy traffic; and at street corners where many motor buses and heavy trucks accelerate.	63,840	67 dBA	66 dBA	58 dBA
2	Moderate Commercial & Industrial Areas and Noisy Residential Areas	Heavy traffic areas with conditions similar to Category 1, but with somewhat less traffic; routes of relatively heavy or fast automobile traffic, but where heavy truck traffic is not extremely dense.	20,000	62 dBA	61 dBA	54 dBA
3	Quiet Commercial, Industrial Areas and Normal Urban & Noisy Suburban Residential Areas	Light traffic conditions where no mass-transportation vehicles and relatively few automobiles and trucks pass, and where these vehicles generally travel at moderate speeds; residential areas and commercial streets, and intersections, with little traffic, compose this category.	6,384	57 dBA	55 dBA	49 dBA
4	Quiet Urban & Normal Suburban Residential Areas	These areas are similar to Category 3, but for this group, the background is either distant traffic or is unidentifiable; typically, the population density is one-third the density of Category 3.	2,000	52 dBA	50 dBA	44 dBA
5	Quiet Residential Areas	These areas are isolated, far from significant sources of sound, and may be situated in shielded areas, such as a small wooded valley.	638	47 dBA	45 dBA	39 dBA
6	Very Quiet Sparse Suburban or rural Residential Areas	These areas are similar to Category 4 but are usually in sparse suburban or rural areas; and, for this group, there are few if any nearby sources of sound.	200	42 dBA	40 dBA	34 dBA

Source: The American National Standards Institute (ANSI) 2013

4.0 REGULATORY FRAMEWORK

4.1 Federal

4.1.1 Occupational Safety and Health Act of 1970

OSHA regulates onsite noise levels and protects workers from occupational noise exposure. To protect hearing, worker noise exposure is limited to 90 decibels with A-weighting (dBA) over an eight-hour work shift (29 Code of Regulations 1910.95). Employers are required to develop a hearing conservation program when employees are exposed to noise levels exceeding 85 dBA. These programs include provision of hearing protection devices and testing employees for hearing loss on a periodic basis.

4.2 State

4.2.1 State of California General Plan Guidelines

The State of California regulates vehicular and freeway noise affecting classrooms, sets standards for sound transmission and occupational noise control, and identifies noise insulation standards and airport noise/land-use compatibility criteria. The State of California General Plan Guidelines (Office of Planning and Research [OPR] 2003), published by the Governor's OPR, also provides guidance for the acceptability of projects within specific CNEL/L_{dn} contours. The guidelines also present adjustment factors that may be used in order to arrive at noise acceptability standards that reflect the noise control goals of the community, the particular community's sensitivity to noise, and the community's assessment of the relative importance of noise pollution.

4.2.2 State Office of Planning and Research Noise Element Guidelines

The State OPR *Noise Element Guidelines* include recommended exterior and interior noise level standards for local jurisdictions to identify and prevent the creation of incompatible land uses due to noise. The Noise Element Guidelines contain a Land Use Compatibility table that describes the compatibility of various land uses with a range of environmental noise levels in terms of the CNEL.

4.2.3 California Department of Transportation

In 2020, the California Department of Transportation (Caltrans) published the Transportation and Construction Vibration Manual (Caltrans 2020b). The manual provides general guidance on vibration issues associated with the construction and operation of projects concerning human perception and structural damage. Table 2-2 above presents recommendations for levels of vibration that could result in damage to structures exposed to continuous vibration.

4.3 Local

4.3.1 Los Angeles County General Plan Noises Element

The County of Los Angeles's regulations with respect to noise are included in the Noise Element of the County's General Plan. The following policies are relevant to the Proposed Project.

Policy N 1.2: Reduce exposure to noise impacts by promoting land use compatibility.

Policy N 1.3: Minimize impacts to noise-sensitive land uses by ensuring adequate site design, acoustical construction, and use of barriers, berms, or additional engineering controls through Best Available Technologies (BAT).

Policy N 1.4: Enhance and promote noise abatement programs in an effort to maintain acceptable levels of noise as defined by the Los Angeles County Exterior Noise Standards and other applicable noise standards.

Policy N 1.6: Ensure cumulative impacts related to noise do not exceed health-based safety margins.

Policy N 1.9: Require construction of suitable noise attenuation barriers on noise sensitive uses that would be exposed to exterior noise levels of 65 dBA CNEL and above, when unavoidable impacts are identified.

4.3.2 Los Angeles County Municipal Code

The Los Angeles County Municipal Code Section 12.08.390 states that the following exterior noise standards, shown below in Table 4-1, shall apply to all receptor properties within the land use designations.

Table 4-1. Exterior Noise Standards		
Land Use Category	**Time Period**	**Noise Level (dBA CNEL)**
Noise Sensitive	Anytime	45 dBA
Residential	10:00 p.m. to 7:00 a.m. (nighttime)	45 dBA
	7:00 a.m. to 10:00 p.m. (daytime)	50 dBA
Commercial	10:00 p.m. to 7:00 a.m. (nighttime)	55 dBA
	7:00 a.m. to 10:00 p.m. (daytime)	60 dBA
Industrial	Anytime	70 dBA

Source: Los Angeles Municipal Code 2023

Additionally, the Municipal Code Section 12.08.440 prohibits construction noise between the hours of 8:00 p.m. and 7:00 a.m. on weekdays and Saturdays or anytime on Sundays or holidays. There are exceptions for emergency work of public service utilities or by variance issued by the health officer. Furthermore, the construction noise restrictions at affected structures are shown below in Table 4-2. According to Table 4-2 below, the contractor shall conduct construction activities in such a manner that the maximum noise levels at the affected buildings will not exceed those listed in the following schedule:

Table 4-2. Construction Noise Standards			
Land Use Category	**Time Period**	**Noise Level from Mobile Equipment (dBA CNEL)**	**Noise Level from Stationary Equipment (dBA CNEL)**
Single Family Residential	7:00 a.m. to 8:00 p.m. (daytime)	75 dBA	60 dBA
	8:00 p.m. to 7:00 a.m. (nighttime)	60 dBA	50 dBA
Multifamily Residential	7:00 a.m. to 8:00 p.m. (daytime)	80 dBA	65 dBA
	8:00 p.m. to 7:00 a.m. (nighttime)	64 dBA	55 dBA
Semi residential/Commercial	7:00 a.m. to 8:00 p.m. (daytime)	85 dBA	70 dBA
	8:00 p.m. to 7:00 a.m. (nighttime)	70 dBA	60 dBA
Businesses	Anytime	85 dBA	85 dBA

Source: Los Angeles Municipal Code 2023

The County also regulates vibration in Section 12.08.560 of the County's Municipal Code. This section prohibits the operation of any device that creates a vibration that is above the vibration perception threshold of any individual at or beyond the property line of private property. The perception threshold shall be a motion velocity of 0.01 inches per second over the range of 1 to 100 Hertz.

5.0 IMPACT ASSESSMENT

5.1 Thresholds of Significance

The impact analysis provided below is based on the following California Environmental Quality Act Guidelines Appendix G thresholds of significance. The Project would result in a significant noise-related impact if it would result in the:

1) 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) 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 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.

For the purposes of this analysis, the County noise standards were used for evaluation of Project-related noise impacts for construction and onsite operational noise. As previously stated, Section 12.08.440 of the County's Municipal Code prohibits construction noise between the hours of 8:00 p.m. and 7:00 a.m. on weekdays and Saturdays or anytime on Sundays or holidays. The Project would be required to adhere to this standard. In order to evaluate the potential health-related effects (physical damage to the ear and mental damage from lack of sleep or focus) from construction noise, construction equipment noise levels are calculated and compared against the construction-related noise level thresholds established by the County in Table 4-2. Consistent with County noise standards, both Project traffic noise and Project on-site noise are evaluated against the County noise standards contained in Tables 4-1.

5.2 Methodology

This analysis of the existing and future noise environments is based on empirical observations and noise prediction modeling. Predicted construction noise levels were calculated utilizing the FHWA's Roadway Construction Noise Model (2006). Groundborne vibration levels associated with construction-related activities for the Project have been evaluated utilizing typical groundborne vibration levels associated with construction equipment. Potential groundborne vibration impacts related to structural damage and human annoyance were evaluated, taking into account the distance from construction activities to nearby structures and typically applied criteria for structural damage and human annoyance.

Transportation-source noise levels in the Project vicinity were calculated using the FHWA Highway Noise Prediction Model (FHWA-RD-77-108) with trips generation rates provided by KOA Traffic Engineers (2023).

5.3 Impact Analysis

5.3.1 Would the Project Result in Short-Term Construction-Generated Noise in Excess of County's Standards?

5.3.1.1 Onsite Construction Noise

Construction noise associated with the Proposed Project would be temporary and would vary depending on the specific nature of the activities being performed. Noise generated would primarily be associated with the operation of off-road equipment for onsite construction activities as well as construction vehicle traffic on area roadways. Construction noise typically occurs intermittently and varies depending on the nature or phase of construction (e.g., site preparation, excavation, paving). Noise generated by construction equipment, including earth movers, pile drivers, and portable generators, can reach high levels. Typical operating cycles for these types of construction equipment may involve one or two minutes of full power operation followed by three to four minutes at lower power settings. Other primary sources of acoustical disturbance would be random incidents, which would last less than one minute (such as dropping large pieces of equipment or the hydraulic movement of machinery lifts). During construction, exterior noise levels could negatively affect sensitive land uses in the vicinity of the construction site.

As previously stated, the Section 12.08.440 of the County's Municipal Code prohibits construction noise between the hours of 8:00 p.m. and 7:00 a.m. on weekdays and Saturdays or anytime on Sundays or holidays and promulgates thresholds for construction noise shown in Table 4-2. Nevertheless, construction noise is temporary, short term, intermittent in nature, and would cease on completion of the Project. Additionally, construction would occur throughout the Project Site and would not be concentrated at one point.

To estimate the worst-case onsite construction noise levels that may occur at the nearest noise-sensitive receptors and in order to evaluate the potential health-related effects (physical damage to the ear) from construction noise, the construction equipment noise levels were calculated using the FHWA's Roadway Noise Construction Model and compared against the single-family mobile construction equipment construction-related noise level threshold established by the County's standards shown in Table 4-2.

The nearest sensitive receptor to the Project Site is a single-family residence access from Big Sky Drive, approximately 1,236 feet to the northwest of the Project Site. The anticipated short-term construction noise levels generated for the necessary equipment are presented in Table 5-1.

Table 5-1. Construction Average (dBA) Noise Levels at Nearest Receptors			
Construction Phase	**Estimated Exterior Construction Noise Level @ Closest Noise Sensitive Receptor (dBA L_{eq})**	**Construction Noise Standard (dBA L_{eq})**	**Exceeds Standards?**
Demolition	59.5	*75*	**No**
Site Preparation	57.2	*75*	**No**
Grading	58.0	*75*	**No**
Building Construction, Paving, and Painting	61.0	*75*	**No**

Source: Construction noise levels were calculated by ECORP Consulting using the FHWA Roadway Noise Construction Model (FHWA 2006). Refer to Attachment A for Model Data Outputs.

Notes: Construction equipment used during construction derived from the California Emissions Estimator Model v. 2022.1. The California Emissions Estimator Model is designed to calculate air pollutant emissions from construction activity and contains default construction equipment and usage parameters for typical construction projects based on several construction surveys conducted in order to identify such parameters.

L_{eq} = The equivalent energy noise level, is the average acoustic energy content of noise for a stated period of time. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.

As shown in Table 5-1, construction activities would not exceed the County's single-family residential standard of 75 dBA. It is noted that construction noise was modeled on a worst-case basis and for mobile construction equipment. It is very unlikely that all pieces of construction equipment would be operating at the same time for the various phases of Project construction as well as at the point closest to the nearest noise-sensitive receptor.

5.3.1.2 Offsite Construction Worker Trips

Project construction would result in additional traffic on adjacent roadways over the period that construction occurs. According to the California Emissions Estimator Model (CalEEMod), which is used to predict the number of construction-related automotive trips, the maximum number of Project construction trips traveling to and from the Project Site during a single construction phase would not be expected to exceed 15 daily trips in total. According to Caltrans Technical Noise Supplement to the Traffic Noise Analysis Protocol (2013), a doubling of traffic on a roadway is required to result in an increase of 3 dB (outside of the laboratory, a 3-dBA change is considered a just-perceivable difference). The Project Site is accessible from Devil's Punchbowl Road, also known as County Road N6. The surrounding areas that are accessible from Devil's Punchbowl Road mainly consist of the Devil's Punchbowl Nature Center and approximately 14 single-family homes. According to the Institute of Transportation Engineer's (ITE) 10th Edition Trip Generation Manual (2017), single family homes generate an average of 9.44 trips daily, and therefore these 14 existing residences could be expected to contribute up to 132 traffic trips daily on Devil's Punchbowl Road (9.44 x 14 = 132). Thus, Project construction would not result in a doubling of traffic, and therefore its contribution to existing traffic noise would not be perceptible. Additionally, it is noted that construction is temporary, and these trips would cease upon completion of the Project.

5.3.2 Would the Project Result in a Substantial Permanent Increase in Ambient Noise Levels in Excess of County's Standards During Operations?

As previously described, noise-sensitive land uses are locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Residences, schools, hospitals, guest lodging, libraries, and some passive recreation areas would each be considered noise-sensitive and may warrant unique measures for protection from intruding noise. The nearest sensitive receptor to the Project Site is a single-family residence accessed from Big Sky Drive, approximately 1,236 feet to the northwest of the Project Site.

5.3.2.1 Operational Traffic Noise

Future traffic noise levels within the Project vicinity for the Proposed Project were modeled based on the traffic volumes identified by KOA Traffic Engineers (2023) to determine the noise levels along Project vicinity roadways. The Project proposes to develop a Nature Center and the associated structures. The Proposed Project will result in approximately 40 weekday trips, 100 Saturday trips, and 105 Sunday trips. The calculated noise levels as a result of Project traffic at affected sensitive land uses are compared against the County's Exterior Noise standards.

The calculated noise levels at affected land uses as a result of the Project are compared to the roadway noise standards promulgated by the County and presented in Tables 4-1. The contribution of Project traffic noise, calculated using the FHWA roadway noise prediction model in conjunction with the Sunday daily trip generation rate identified by KOA Traffic Engineers (2023), would equate to 43.2 dBA CNEL (see Attachment B). This noise level is below the standards established by the County for the protection of residential land uses, the predominate sensitive land use surrounding the Project Area. Thus, the Proposed Project would not result in a transportation noise exposure in excess of County's standards.

Additionally, it is noted from the Caltrans Technical Noise Supplement to the Traffic Noise Analysis Protocol (2013) that a doubling of traffic on a roadway is required to result in an increase of 3 dB (outside of the laboratory, a 3-dBA change is considered a just-perceivable difference). The Project Site is accessible from Devil's Punchbowl Road, or County Road N6. As previously described, the surrounding areas that are accessible from Devil's Punchbowl Road mainly consist of the Devil's Punchbowl Nature Center and approximately 14 single-family homes. According to the ITE 10th Edition Trip Generation Manual (2017), single family homes generate an average of 9.44 trips daily, and therefore these 14 existing residences could be expected to contribute up to 132 traffic trips daily on Devil's Punchbowl Road (9.44 x 14 = 132). Thus, the Project's contribution of 105 peak daily traffic trips would not result in a doubling of traffic, and therefore its contribution to existing traffic noise would not be perceptible.

5.3.2.2 *Operational Onsite Noise*

As previously described, the Project proposes to develop a Nature Center and the associated structures. Therefore, the main onsite stationary noise sources related to long-term operation on the Project Site would be from the visitors. It is noted that the Proposed Project would replace the Devil's Punchbowl Nature Center that was destroyed due to the Bobcat fire in 2020. As such, no new land uses or activities are expected to occur on the site as a result of the Project. Furthermore, uses associated with a Nature Center are not typically associated with excessive, ongoing operations-related noise that would lead to substantial permanent increases in ambient noise levels. For instance, the Proposed Project would only experience visitors during the daytime hours. Much of the operational stationary noise generated by the Project would be voices and maneuvering vehicles in and out of the parking lot. According to previous field noise measurements conducted by ECORP, a non-busy parking lot generates noise levels less than 51.0 dBA at 10 feet. These measurements were taken with a Larson Davis SoundExpert LxT precision sound level meter, which satisfies the American National Standards Institute for general environmental noise measurement instrumentation. Prior to the measurements, the SoundExpert LxT sound level meter was calibrated according to manufacturer specifications with a Larson Davis CAL200 Class I Calibrator. The closest residence is located approximately 1,236 feet to the northwest of the Project Site. Given that the noise attenuates a rate of approximately six dB for each doubling of distance from a stationary or point source (FHWA 2011), the residence would experience noise levels below the County's daytime exterior standard of 50 dBA.

The Project proposes to re-establish the Nature Center adjacent to existing residential uses. The most basic planning strategy to minimize adverse impacts on new land uses due to noise is to avoid designating certain land uses at locations within the community that would negatively affect noise sensitive land uses. The Project is consistent with the types, intensity, and patterns of land use envisioned for the Project Area, and as previously described, the Project is considered compatible with the existing noise environment. The operation of the Project would not result in a significant noise-related impact associated with onsite sources.

5.3.3 Would the Project Expose Structures to Substantial Groundborne Vibration During Construction?

Excessive groundborne vibration impacts result from continuously occurring vibration levels. Increases in groundborne vibration levels attributable to the Project would be primarily associated with short-term construction-related activities. Construction on the Project Site would have the potential to result in varying degrees of temporary groundborne vibration, depending on the specific construction equipment used and the operations involved. Ground vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increases in distance.

Construction-related ground vibration is normally associated with impact equipment such as pile drivers, jackhammers, and the operation of some heavy-duty construction equipment, such as dozers and trucks. It is not anticipated that pile drivers would be necessary during Project construction. Vibration decreases rapidly with distance, and it is acknowledged that construction activities would occur throughout the Project Site and would not be concentrated at the point closest to sensitive receptors. Groundborne vibration levels associated with construction equipment are summarized in Table 5-2.

Table 5-2. Representative Vibration Source Levels for Construction Equipment	
Equipment Type	**Peak Particle Velocity at 25 Feet (inches per second)**
Large Bulldozer	0.089
Caisson Drilling	0.170
Loaded Trucks	0.076
Rock Breaker	0.089
Jackhammer	0.035
Small Bulldozer/Tractor	0.003
Vibratory Roller	0.210

Source: FTA 2018; Caltrans 2020b

As previously stated, the County's regulation pertaining to vibration is included in Section 12.08.560 of the County Code and limits vibration to a perception threshold of 0.01 inches per sec.

It is acknowledged that construction activities would occur throughout the Project Site and would not be concentrated at the point closest to the nearest structure. The nearest structure of concern to the construction site, with regard to groundborne vibrations, are residences, approximately 1,236 feet northwest from the Project Site.

Based on the representative vibration levels presented for various construction equipment types in Table 5-2 and the construction vibration assessment methodology published by the FTA (2018), it is possible to estimate the potential Project construction vibration levels. The FTA provides the following equation:

$$[PPVequip = PPVref \times (25/D)^{1.5}]$$

Table 5-3 presents the expected Project related vibration levels at a distance of 1,236 feet.

Table 5-3. Construction Vibration Levels at 1,236 Feet							
Receiver PPV Levels[1]					Peak Vibration	Threshold	Exceed Threshold?
Large Bulldozer, Caisson Drilling, & Hoe Ram	Loaded Trucks	Jackhammer	Small Dozer	Vibratory Roller			
0.0003	0.0003	0.0001	0.000	0.0006	**0.0006**	*0.01*	**No**

Notes: [1]Based on the Vibration Source Levels of Construction Equipment included in Table 5-4 (FTA 2018). Distance to the nearest structure of concern is approximately 1,236 feet measured from Project Site.

As shown in Table 5-3, vibration as a result of onsite construction activities on the Project Site would not exceed the County's threshold of 0.01 PPV at the nearest structure. Thus, onsite Project construction would not exceed the recommended threshold.

5.3.4 Would the Project Expose Structures to Substantial Groundborne Vibration During Operations?

Project operations would not include the use of any stationary equipment that would result in excessive vibration levels. The Project would not accommodate any heavy-duty trucks or equipment. Therefore, the Project would result in negligible groundborne vibration impacts during operations.

5.3.5 Would the Project Expose People Residing or Working in the Project Area to Excessive Airport Noise?

The Project Site is located approximately 5.22 miles southwest of Crystal Airport in Llano. This is a private airport and mainly accommodates glider aircraft. Implementation of the Proposed Project would not affect airport operations, nor result in increased exposure of those on the Project Site to aircraft noise.

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LIST OF APPENDICES

ATTACHMENT A

Federal Highway Administration Roadway Construction Noise Outputs

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/10/2023
Case Description: Demolition

Description	Land Use
Demolition	Residential

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)
Tractor	No	40	84		1236
Tractor	No	40	84		1236
Tractor	No	40	84		1236
Dozer	No	40		81.7	1236
Concrete Saw	No	20		89.6	1236

Calculated (dBA)

Equipment		*Lmax	Leq
Tractor		56.1	52.2
Tractor		56.1	52.2
Tractor		56.1	52.2
Dozer		53.8	49.8
Concrete Saw		61.7	54.7
	Total	**61.7**	**59.5**

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/10/2023
Case Description: Site Preparation

Description	**Land Use**
Site Preparation	Residential

Description	**Impact Device**	**Usage(%)**	**Equipment Spec Lmax (dBA)**	**Actual Lmax (dBA)**	**Receptor Distance (feet)**
Grader	No	40	85		1236
Scraper	No	40		83.6	1236
Tractor	No	40	84		1236

Calculated (dBA)

Equipment		***Lmax**	**Leq**
Grader		57.1	53.2
Scraper		55.7	51.7
Tractor		56.1	52.2
	Total	**57.1**	**57.2**

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/10/2023
Case Description: Grading

Description	**Land Use**
Grading	Residential

Description	**Impact Device**	**Usage(%)**	**Equipment Spec Lmax (dBA)**	**Actual Lmax (dBA)**	**Receptor Distance (feet)**
Grader	No	40	85		1236
Dozer	No	40		81.7	1236
Tractor	No	40	84		1236
Tractor	No	40	84		1236

Calculated (dBA)

Equipment		***Lmax**	**Leq**
Grader		57.1	53.2
Dozer		53.8	49.8
Tractor		56.1	52.2
Tractor		56.1	52.2
	Total	**57.1**	**58**

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/10/2023
Case Description: Building Construction, Paving, Painting

Description	**Land Use**
Building Construction, Paving, Painting	Residential

Description	**Impact Device**	**Usage(%)**	**Equipment Spec Lmax (dBA)**	**Actual Lmax (dBA)**	**Receptor Distance (feet)**
Crane	No	16		80.6	1236
Gradall	No	40		83.4	1236
Gradall	No	40		83.4	1236
Generator	No	50		80.6	1236
Tractor	No	40	84		1236
Welder / Torch	No	40		74	1236
Welder / Torch	No	40		74	1236
Tractor	No	40	84		1236
Paver	No	50		77.2	1236
Pavement Scarafier	No	20		89.5	1236
Roller	No	20		80	1236
Roller	No	20		80	1236
Concrete Mixer Truck	No	40		78.8	1236
Compressor (air)	No	40		77.7	1236

Calculated (dBA)

Equipment	***Lmax**	**Leq**
Crane	52.7	44.7
Gradall	55.5	51.6
Gradall	55.5	51.6
Generator	52.8	49.8
Tractor	56.1	52.2
Welder / Torch	46.1	42.2
Welder / Torch	46.1	42.2
Tractor	56.1	52.2
Paver	49.4	46.3
Pavement Scarafier	61.6	54.6
Roller	52.1	45.1
Roller	52.1	45.1
Concrete Mixer Truck	50.9	47
Compressor (air)	49.8	45.8
Total	**61.6**	**61**

*Calculated Lmax is the Loudest value.

ATTACHMENT B

Federal Highway Administration Traffic Noise Model Outputs

TRAFFIC NOISE LEVELS

Project Number: 2022-124.01
Project Name: Devil's PunchBowl Nature Center

Background Information

Model Description: FHWA Highway Noise Prediction Model (FHWA-RD-77-108) with California Vehicle Noise (CALVENO) Emission Levels.
Analysis Scenario(s): **Project Traffic**
Source of Traffic Volumes: KOA (2023)
Community Noise Descriptor: L_{dn}: ____ CNEL: x

Assumed 24-Hour Traffic Distribution:	Day	Evening	Night
Total ADT Volumes	77.70%	12.70%	9.60%
Medium-Duty Trucks	87.43%	5.05%	7.52%
Heavy-Duty Trucks	89.10%	2.84%	8.06%

Traffic Noise Levels

Analysis Condition Roadway Segment	Land Use	Lanes	Median Width	Peak Hour Volume	ADT Volume	Design Speed (mph)	Dist. from Center to Receptor[1]	Alpha Factor	Barrier Attn. dB(A)	Vehicle Mix Medium Trucks	Vehicle Mix Heavy Trucks	Peak Hour dB(A) L_{eq}	24-Hour dB(A) CNEL
Devil's Punchbowl Road													
Devil's Punchbowl Road near Project Site	Residential	2	0		105	45	100	0.5	0	1.8%	0.7%	0.0	43.2