

Joshua Tree Estates – TTM 20668

Noise Impact Study

San Bernardino County, CA

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1.0 Introduction

1.1 Purpose of Analysis and Study Objectives

This noise assessment was prepared to evaluate the potential noise impacts for the project study area and to recommend noise mitigation measures, if necessary, to minimize the potential noise impacts. The assessment was conducted and compared to the noise standards set forth by the Federal, State and Local agencies. Consistent with the County's Noise Guidelines, the project must demonstrate compliance to the applicable noise criterion as outlined within the County's Noise Element and Code.

The following is provided in this report:

- A description of the study area and the proposed project
- Information regarding the fundamentals of noise
- A description of the local noise guidelines and standards
- An analysis of traffic noise impacts to and from the project site
- An analysis of construction noise impacts

1.2 Site Location and Study Area

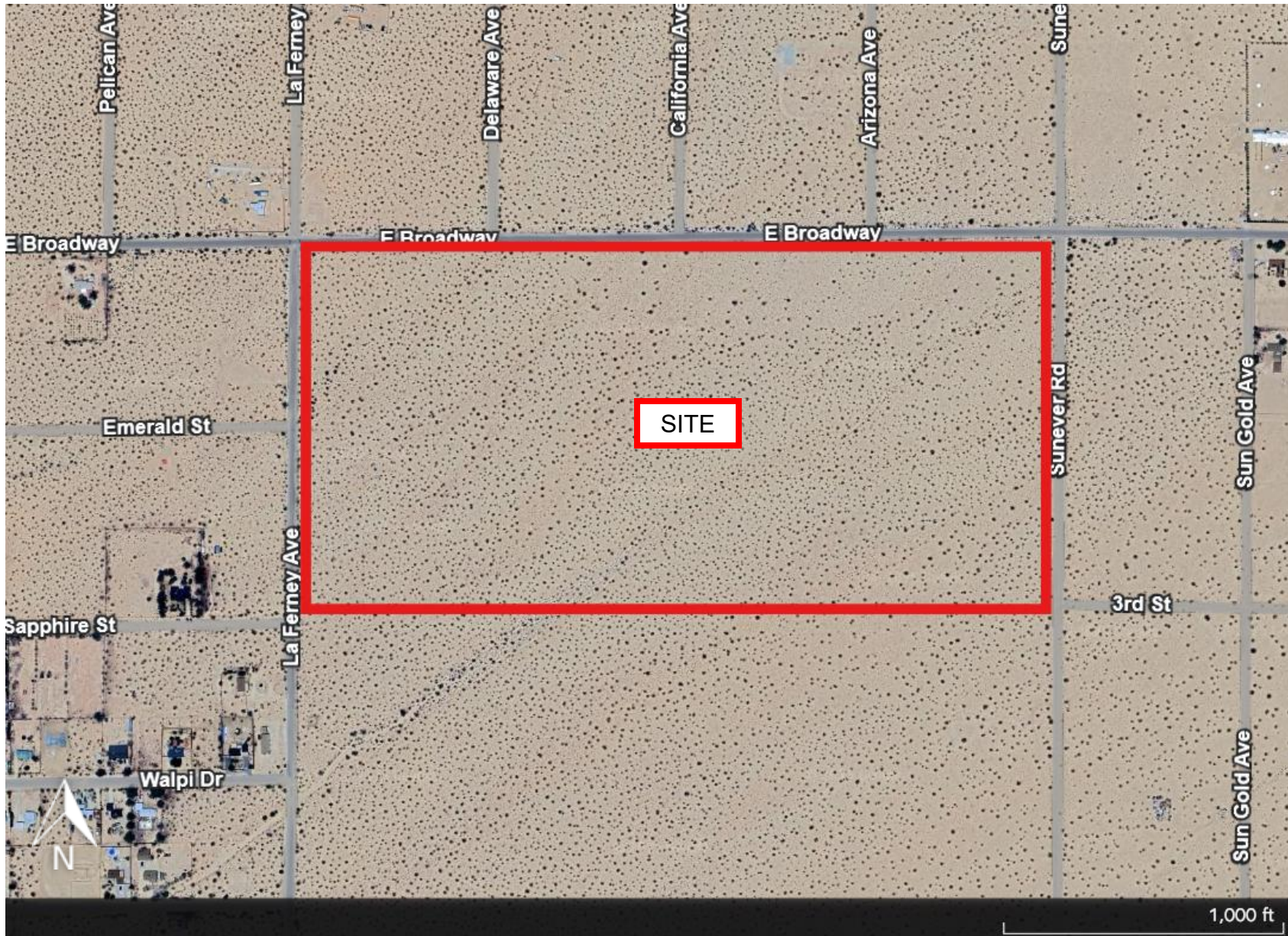
The project site is located at the southeast corner of E Broadway and La Ferney Avenue (APN: 0605-051-01) in Joshua Tree, an unincorporated territory within San Bernardino County, CA, as shown in Exhibit A. The site is currently zoned as Joshua Tree Rural Living (JT/RL) and is surrounded by JT/RL uses in all cardinal directions. E Broadway is to the north, Sunever Road is to the east, and La Ferney Avenue is to the west.

1.3 Proposed Project Description

The project proposes the development of 32 residential lots on approximately 81.2 acres. As a worst-case scenario, this assessment assumes the project is built out in one (1) complete phase. Construction activities within the project area will consist of on-site preparation, grading, building, paving, and architectural coating.

This study assesses both the traffic and short-term stationary noise to and from the project site and compares the results to the applicable County noise limits. The primary source of traffic noise propagates from E Broadway. The site plan used for this report is illustrated in Exhibit B.

Exhibit A Location Map



2.0 Fundamentals of Noise

This section of the report provides basic information about noise and presents some of the terms used within the report.

2.1 Sound, Noise, and Acoustics

Sound is a disturbance created by a moving or vibrating source and is capable of being detected by the hearing organs. Sound may be thought of as the mechanical energy of a moving object transmitted by pressure waves through a medium to a human ear. For traffic or stationary noise, the medium of concern is air. *Noise* is defined as sound that is loud, unpleasant, unexpected, or unwanted.

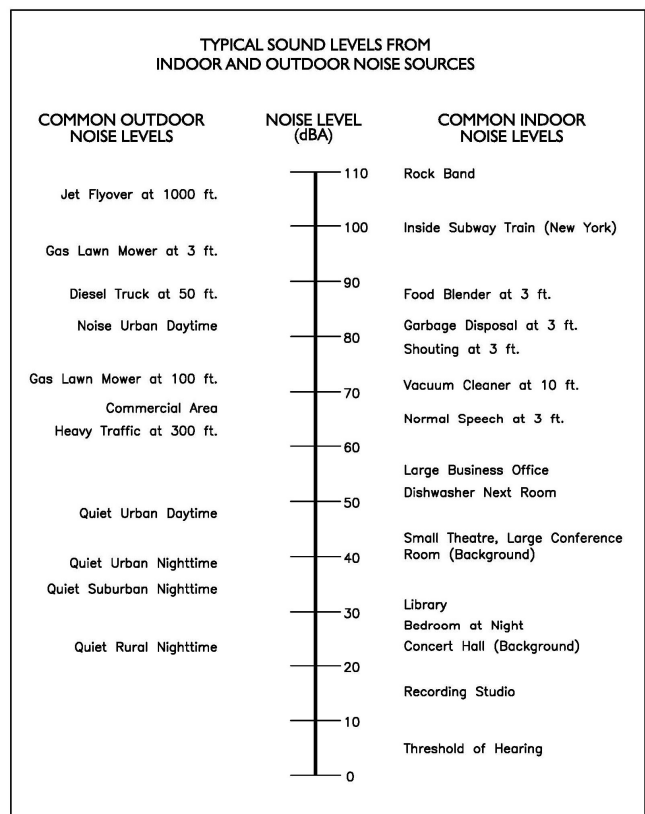
2.2 Frequency and Hertz

A continuous sound is described by its *frequency* (pitch) and its *amplitude* (loudness). Frequency relates to the number of pressure oscillations per second. Low-frequency sounds are low in pitch (bass sounding), and high-frequency sounds are high in pitch (squeak). These oscillations per second (cycles) are commonly referred to as Hertz (Hz). The human ear can hear from the bass pitch starting at 20 Hz all the way to the high pitch of 20,000 Hz.

2.3 Sound Pressure Levels and Decibels

The *amplitude* of a sound determines its loudness. The loudness of sound increases or decreases as the amplitude increases or decreases. Sound pressure amplitude is measured in units of micro-Newton per square inch meter (N/m²), also called micro-Pascal (μPa). One μPa is approximately one hundred billionths (0.0000000001) of normal atmospheric pressure. Sound pressure level (SPL or L_p) is used to describe in logarithmic units the ratio of actual sound pressures to a reference pressure squared. These units are called decibels, abbreviated dB. Exhibit C illustrates reference sound levels for different noise sources.

Exhibit C: Typical A-Weighted Noise Levels



2.4 Addition of Decibels

Because decibels are on a logarithmic scale, sound pressure levels cannot be added or subtracted by simple plus or minus addition. When two sounds or equal SPL are combined, they will produce an SPL 3 dB greater than the original single SPL. In other words, sound energy must be doubled to produce a 3 dB increase. If two sounds differ by approximately 10 dB, the higher sound level is the predominant sound.

2.5 Human Response to Changes in Noise Levels

In general, the healthy human ear is most sensitive to sounds between 1,000 Hz and 5,000 Hz (on the A-weighted scale), perceiving a sound within that range as being more intense than one with a higher or lower frequency of the same magnitude. For purposes of this report, as well as with most environmental documents, the A-scale weighting is typically reported in terms of A-weighted decibel (dBA). Typically, the human ear can barely perceive a change in noise level of 3 dB. A change in 5 dB is readily perceptible, and a change in 10 dB is perceived as being twice or half as loud. As previously discussed, a doubling of sound energy results in a 3 dB increase in sound, which means that a doubling of sound energy (e.g., doubling the volume of traffic on a highway) would result in a barely perceptible change in sound level.

Table 1: Change in Loudness

Changes in Intensity Level, dBA	Changes in Apparent Loudness
1	Not perceptible
3	Just perceptible
5	Clearly noticeable
10	Twice (or half) as loud

https://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/polguide/polguide02.cfm

2.6 Noise Descriptors

Noise in our daily environment fluctuates over time. Some noise levels occur in regular patterns, others are random. Some noise levels are constant while others are sporadic. Noise descriptors were created to describe the different time-varying noise levels.

A-Weighted Sound Level: The sound pressure level in decibels as measured on a sound level meter using the A-weighted 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 response of the human ear. A numerical method of rating human judgment of loudness.

Ambient Noise Level: The composite of noise from all sources, near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

Community Noise Equivalent Level (CNEL): The average equivalent A-weighted sound level during a 24-hour day, obtained after addition of five (5) decibels to sound levels in the evening from 7:00 to 10:00 PM and after addition of ten (10) decibels to sound levels in the night before 7:00 AM and after 10:00 PM.

Decibel (dB): A unit for measuring the amplitude of a 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, which is 20 micro-pascals.

dB(A): A-weighted sound level (see definition above).

Equivalent Sound Level (LEQ): The sound level corresponding to a steady noise level over a given sample period with the same amount of acoustic energy as the actual time-varying noise level. The energy average noise level during the sample period.

Habitable Room: Any room meeting the requirements of the Uniform Building Code or other applicable regulations which is intended to be used for sleeping, living, cooking or dining purposes, excluding such enclosed spaces as closets, pantries, bath or toilet rooms, service rooms, connecting corridors, laundries, unfinished attics, foyers, storage spaces, cellars, utility rooms and similar spaces.

L(n): The A-weighted sound level exceeded during a certain percentage of the sample time. For example, L10 in the sound level exceeded 10 percent of the sample time. Similarly L50, L90 and L99, etc.

Noise: Any unwanted sound or sound which is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying. The State Noise Control Act defines noise as "...excessive undesirable sound...".

Outdoor Living Area: Outdoor spaces that are associated with residential land uses typically used for passive recreational activities or other noise-sensitive uses. Such spaces include patio areas, barbecue areas, jacuzzi areas, etc. associated with residential uses; outdoor patient recovery or resting areas associated with hospitals, convalescent hospitals, or rest homes; outdoor areas associated with places of worship which have a significant role in services or other noise-sensitive activities; and outdoor school facilities routinely used for educational purposes which may be adversely impacted by noise. Outdoor areas usually not included in this definition are: front yard areas, driveways, greenbelts, maintenance areas and storage areas associated with residential land uses; exterior areas at hospitals that are not used for patient activities; outdoor areas associated with places of worship and principally used for short-term social gatherings; and, outdoor areas associated with school facilities that are not typically associated with educational uses prone to adverse noise impacts (for example, school play yard areas).

Percent Noise Levels: See L(n).

Sound Level (Noise Level): The weighted sound pressure level obtained by use of a sound level meter having a standard frequency filter for attenuating part of the sound spectrum.

Sound Level Meter: An instrument, including a microphone, an amplifier, an output meter, and frequency weighting networks for the measurement and determination of noise and sound levels.

Single Event Noise Exposure Level (SENEL): The dB(A) level which, if it lasted for one second, would produce the same A-weighted sound energy as the actual event.

2.7 Traffic Noise Prediction

Noise levels associated with traffic depend on a variety of factors: (1) volume of traffic, (2) speed of traffic, (3) auto, medium truck (2 axle), and heavy truck percentage (3 axle and greater), and sound propagation. The greater the volume of traffic, the higher the speeds, and the truck percentages

equate to a louder volume in noise. A doubling of the Average Daily Traffic (ADT) along a roadway will increase noise levels by approximately 3 dB; reasons for this are discussed in the sections above.

2.8 Sound Propagation

As sound propagates from a source, it spreads geometrically. Sound from a small, localized source (i.e., a point source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates at a rate of 6 dB per doubling of distance. The movement of vehicles down a roadway makes the source of the sound appear to propagate from a line (i.e., line source) rather than a point source. This line source results in the noise propagating from a roadway in a cylindrical spreading, versus a spherical spreading that results from a point source. The sound level attenuates for a line source at a rate of 3 dB per doubling of distance.

As noise propagates from the source, it is affected by the ground and atmosphere. Noise models use hard site (reflective surfaces) and soft site (absorptive surfaces) to help calculate predicted noise levels. Hard site conditions assume no excessive ground absorption between the noise source and the receiver. Soft site conditions such as grass, soft dirt, or landscaping attenuate noise at a rate of 1.5 dB per doubling of distance. When added to the geometric spreading, the excess ground attenuation results in an overall noise attenuation of 4.5 dB per doubling of distance for a line source and 7.5 dB per doubling of distance for a point source.

Research has demonstrated that atmospheric conditions can have a significant effect on noise levels when noise receivers are located at least 200 feet from a noise source. Wind, temperature, air humidity, and turbulence can further impact how far sound can travel.

3.0 Ground-Borne Vibration Fundamentals

3.1 Vibration Descriptors

Ground-borne vibrations consist of rapidly fluctuating motions within the ground that have an average motion of zero. The effects of ground-borne vibrations typically only cause a nuisance to people, but at extreme vibration levels, damage to buildings may occur. Although ground-borne vibration can be felt outdoors, it is typically only an annoyance to people indoors where the associated effects of the shaking of a building can be notable. Ground-borne noise is an effect of ground-borne vibration and only exists indoors, since it is produced from noise radiated from the motion of the walls and floors of a room, and may also consist of the rattling of windows or dishes on shelves.

Several different methods are used to quantify vibration amplitude.

PPV – Known as the peak particle velocity (PPV), which is the maximum instantaneous peak in vibration velocity, typically given in inches per second.

RMS – Known as root mean squared (RMS) can be used to denote vibration amplitude

VdB – A commonly used abbreviation to describe the vibration level (VdB) for a vibration source.

3.2 Vibration Perception

Typically, developed areas are continuously affected by vibration velocities of 50 VdB or lower. These continuous vibrations are not noticeable to humans whose threshold of perception is around 65 VdB. Outdoor sources that may produce perceptible vibrations are usually caused by construction equipment, steel-wheeled trains, and traffic on rough roads, while smooth roads rarely produce perceptible ground-borne noise or vibration. To counter the effects of ground-borne vibration, the Federal Transit Administration (FTA) has published guidance relative to vibration impacts. According to the FTA, fragile buildings can be exposed to ground-borne vibration levels of 0.3 inches per second without experiencing structural damage.

3.3 Vibration Perception

There are three main types of vibration propagation: surface, compression, and shear waves. Surface waves, or Rayleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wave front, similar to ripples produced by throwing a rock into a pool of water. P-waves, or compression waves, are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal (i.e., in a "push-pull" fashion). P-waves are analogous to airborne sound waves. S-waves, or shear waves, are also body waves that carry energy along an expanding spherical wave front. However, unlike P-waves, the particle motion is transverse, or side-to-side and perpendicular to the direction of propagation.

As vibration waves propagate from a source, the vibration energy decreases in a logarithmic manner, and the vibration levels typically decrease by 6 VdB per doubling of the distance from the vibration source. As stated above, this drop-off rate can vary greatly depending on the soil, but has been shown to be effective enough for screening purposes, in order to identify potential vibration impacts that may need to be studied through actual field tests.

4.0 Regulatory Setting

The proposed project is located in Joshua Tree which is an unincorporated territory within San Bernardino County, California and noise regulations are addressed through the efforts of various federal, state and local government agencies. The agencies responsible for regulating noise are discussed below.

4.1 Federal Regulations

The adverse impact of noise was officially recognized by the federal government in the Noise Control Act of 1972, which serves three purposes:

- Publicize noise emission standards for interstate commerce
- Assist state and local abatement efforts
- Promote noise education and research

The Federal Office of Noise Abatement and Control (ONAC) originally was tasked with implementing the Noise Control Act. However, it was eventually eliminated, leaving other federal agencies and committees to develop noise policies and programs. Some examples of these agencies are as follows: The Department of Transportation (DOT) assumed a significant role in noise control through its various agencies. The Federal Aviation Agency (FAA) is responsible for regulating noise from aircraft and airports. The Federal Highway Administration (FHWA) is responsible for regulating noise from the interstate highway system. The Occupational Safety and Health Administration (OSHA) is responsible for the prohibition of excessive noise exposure to workers.

The federal government advocates that local jurisdictions use their land use regulatory authority to arrange new development in such a way that “noise sensitive” uses are either prohibited from being constructed adjacent to a highway or alternatively that the developments are planned and constructed in such a manner that potential noise impacts are minimized.

Since the federal government has preempted the setting of standards for noise levels that can be emitted by the transportation source, the city is restricted to regulating the noise generated by the transportation system through nuisance abatement ordinances and land use planning.

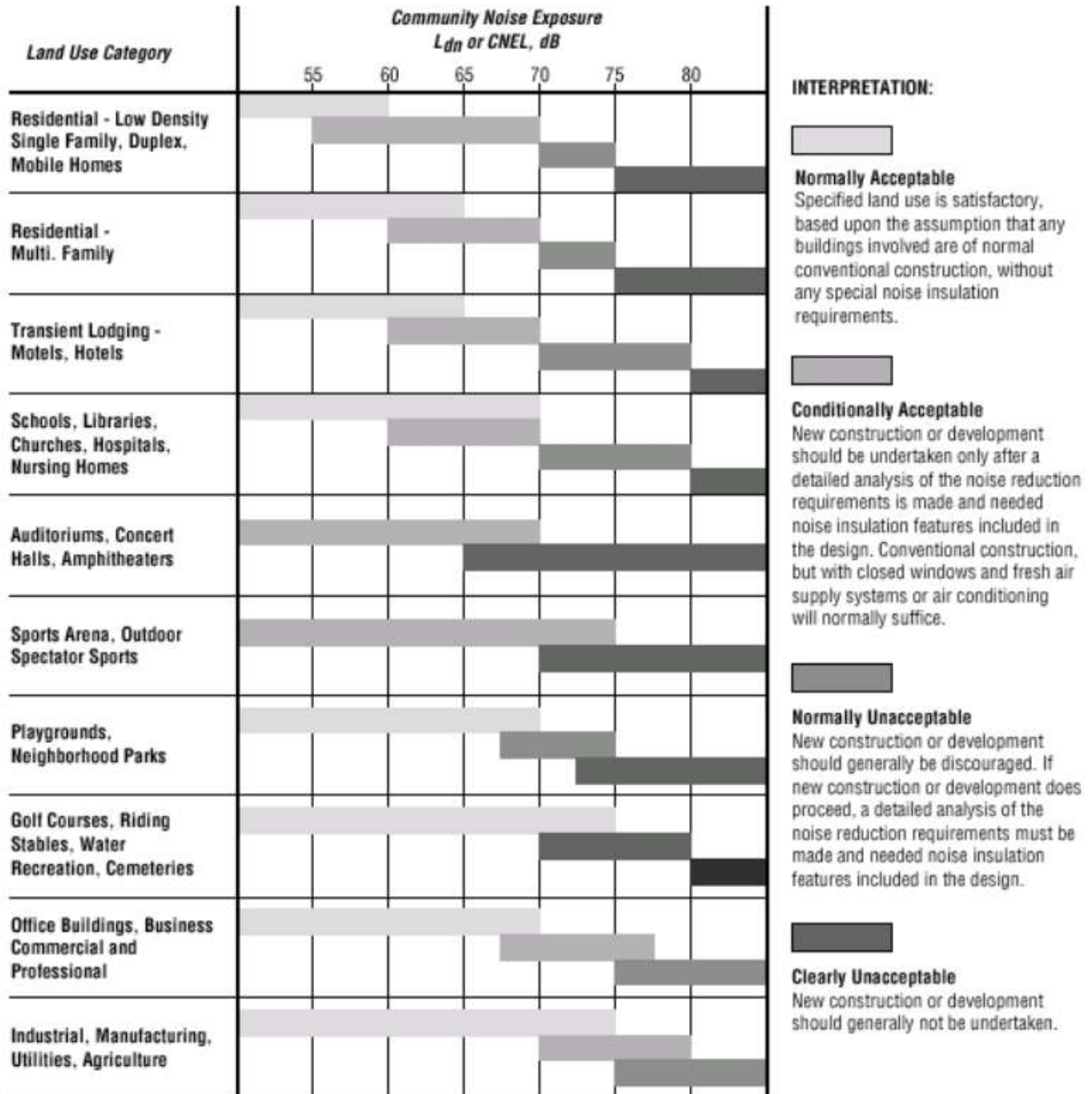
4.2 State Regulations

Established in 1973, the California Department of Health Services Office of Noise Control (ONC) was instrumental in developing regulatory tools to control and abate noise for use by local agencies. One significant model is the “Land Use Compatibility for Community Noise Environments Matrix.” The matrix allows the local jurisdiction to clearly delineate the compatibility of sensitive uses with various incremental levels of noise.

The State of California has established noise insulation standards as outlined in Title 24 and the California Building Code (CBC), which, in some cases, requires acoustical analyses to outline exterior noise levels and to ensure interior noise levels do not exceed the interior threshold. The State

mandates that the legislative body of each county and city adopt a noise element as part of its comprehensive general plan. The local noise element must recognize the land use compatibility guidelines published by the State Department of Health Services. The guidelines rank noise land use compatibility in terms of normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable, as illustrated in Exhibit D. The County has not adopted a version of these guidelines.

Exhibit D: Land Use Compatibility Guidelines



4.3 San Bernardino County Noise Regulations

The San Bernardino County outlines their noise regulations and standards within the Policy Plan, Safety and Security Section, Hazards Element from the General Plan and the Noise Ordinance from the Development Code.

San Bernardino County Countywide General Plan

Applicable policies and standards governing environmental noise in the County are set forth in the General Plan Policy Plan. Section Safety and Security, in its goal HZ-2 Human-generated Hazards, outlines the noise policies within the county.

The County has outlined goals, policies, and implementation measures to reduce potential noise impacts and are presented below:

Goals, Policies, and Implementation Measures

Policies, goals and implementation program measures from the Policy Plan that would mitigate potential impacts on noise include the following.

Goal HZ-2 Human-generated Hazards: People and the natural environment protected from exposure to hazardous materials, excessive noise, and other human-generated hazards.

- Policy HZ-2.6: Coordination with transportation authorities. We collaborate with airport owners, FAA, Caltrans, SBCTA, SCAG, neighboring jurisdictions, and other transportation providers in the preparation and maintenance of, updates to transportation related plans and projects to minimize noise impacts and provide appropriate mitigation measures
- Policy HZ-2.7: Truck delivery areas. We encourage truck delivery areas to be located away from residential properties and require associated noise impacts to be mitigated.
- Policy HZ-2.8: Proximity to noise generating uses. We limit or restrict new noise sensitive land uses in proximity to existing conforming noise generating uses and planned industrial areas.
- Policy HZ-2.9: Control sound at the source. We prioritize noise mitigation measures that control sound at the source before buffers, soundwalls, and other perimeter measures.
- Policy HZ-2.10: Agricultural operations. We require new development adjacent to existing conforming agricultural operations to provide adequate buffers to reduce the exposure of new development to operational noise, odor, and the storage or application of pesticides or other hazardous materials.

San Bernardino County– Noise Ordinance/Development Code

Chapter 83.01 General Performance Standards of the County’s Development Code outlines the County’s noise ordinance.

Section 83.01.080 –Noise

This Section establishes standards concerning acceptable noise levels for both noise-sensitive land uses and for noise-generating land uses.

(a) *Noise Measurement.* Noise shall be measured:

- (1) At the property line of the nearest site that is occupied by, and/or zoned or designated to allow the development of noise-sensitive land uses;
- (2) With a sound level meter that meets the standards of the American National Standards Institute (ANSI § S14 1979, Type 1 or Type 2);
- (3) Using the “A” weighted sound pressure level scale in decibels (ref. pressure = 20 micronewtons per meter squared). The unit of measure shall be designated as dB(A).

(b) *Noise Impacted Areas.* Areas within the County shall be designated as “noise-impacted” if exposed to existing or projected future exterior noise levels from mobile or stationary sources exceeding the standards listed in Subdivision (d) (Noise Standards for Stationary Noise Sources) and Subdivision (e) (Noise Standards for Adjacent Mobile Noise Sources), below. New development of residential or other noise-sensitive land uses shall not be allowed in noise-impacted areas unless effective mitigation measures are incorporated into the project design to reduce noise levels to these standards. Noise-sensitive land uses shall include residential uses, schools, hospitals, nursing homes, religious institutions, libraries, and similar uses.

(c) *Noise Standards for Stationary Noise Sources.*

- (1) *Noise Standards.* Table 83-2 (Noise Standards for Stationary Noise Sources) describes the noise standard for emanations from a stationary noise source, as it affects adjacent properties:

Table 83-2 Noise Standards for Stationary Noise Sources		
<i>Affected Land Uses (Receiving Noise)</i>	<i>7:00 a.m. – 10 p.m. Leq</i>	<i>10:00 p.m. – 7 a.m. Leq</i>
Residential	55 dB(A)	45 dB(A)
Professional Services	55 dB(A)	55 dB(A)
Other Commercial	60 dB(A)	60 dB(A)
Industrial	70 dB(A)	70 dB(A)
Notes:		
(1) Leq = (Equivalent Energy Level). The sound level corresponding to a steady-state sound level containing the same total energy as a time-varying signal over a given sample period, typically one, eight or 24 hours. (2) dB(A) = (A-weighted Sound Pressure Level). The sound pressure level, in decibels, as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound, placing greater emphasis on those frequencies within the sensitivity range of the human ear.		

(2) Noise Limit Categories. No person shall operate or cause to be operated a source of sound at a location or allow the creation of noise on property owned, leased, occupied, or otherwise controlled by the person, which causes the noise level, when measured on another property, either incorporated or unincorporated, to exceed any one of the following:

- (a) The noise standard for the receiving land use as specified in Subdivision (b) (Noise-Impacted Areas), above, for a cumulative period of more than 30 minutes in any hour.
- (b) The noise standard plus five dB(A) for a cumulative period of more than 15 minutes in any hour.
- (c) The noise standard plus ten dB(A) for a cumulative period of more than five minutes in any hour.
- (d) The noise standard plus 15 dB(A) for a cumulative period of more than one minute in any hour.
- (e) The noise standard plus 20 dB(A) for any period of time.

(d) Noise Standards for Adjacent Mobile Noise Sources. Noise from mobile sources may affect adjacent properties adversely. When it does, the noise shall be mitigated for any new development to a level that shall not exceed the standards described in the following Table 83-3 (Noise Standards for Adjacent Mobile Noise Sources).

Table 83-3 Noise Standards for Adjacent Mobile Noise Sources			
<i>Land Use</i>		<i>Ldn (or CNEL) dB(A)</i>	
<i>Categories</i>	<i>Uses</i>	<i>Interior⁽¹⁾</i>	<i>Exterior⁽²⁾</i>
Residential	Single and multi-family, duplex, mobile homes	45	60 ⁽³⁾
Commercial	Hotel, motel, transient housing	45	60 ⁽³⁾
	Commercial retail, bank, restaurant	50	N/A
	Office building, research and development, professional offices	45	65
	Amphitheater, concert hall, auditorium, movie theater	45	N/A
Institutional/Public	Hospital, nursing home, school classroom, religious institution, library	45	65
Open Space	Park	N/A	65

Notes:

- (1) The indoor environment shall exclude bathrooms, kitchens, toilets, closets and corridors.
- (2) The outdoor environment shall be limited to:
- Hospital/office building patios
 - Hotel and motel recreation areas
 - Mobile home parks
 - Multi-family private patios or balconies
 - Park picnic areas
 - Private yard of single-family dwellings
 - School playgrounds
- (3) An exterior noise level of up to 65 dB(A) (or CNEL) shall be allowed provided exterior noise levels have been substantially mitigated through a reasonable application of the best available noise reduction technology, and interior noise exposure does not exceed 45 dB(A) (or CNEL) with windows and doors closed. Requiring that windows and doors remain closed to achieve an acceptable interior noise level shall necessitate the use of air conditioning or mechanical ventilation.
- CNEL = (Community Noise Equivalent Level). The average equivalent A-weighted sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night from 10:00 p.m. to 7:00 a.m.

- (e) *Increases in Allowable Noise Levels.* If the measured ambient level exceeds any of the first four noise limit categories in Subdivision (d)(2), above, the allowable noise exposure standard shall be increased to reflect the ambient noise level. If the ambient noise level exceeds the fifth noise limit category in Subdivision (d)(2), above, the maximum allowable noise level under this category shall be increased to reflect the maximum ambient noise level.
- (f) *Reduction in Allowable Noise Levels.* If the alleged offense consists entirely of impact noise or simple tone noise, each of the noise levels in Table 83-2 (Noise Standards for Stationary Noise Sources) shall be reduced by five dB(A).
- (g) *Exempt Noise.* The following sources of noise shall be exempt from the regulations of this Section:
- (1) Motor vehicles not under the control of the commercial or industrial use.
 - (2) Emergency equipment, vehicles, and devices.
 - (3) Temporary construction, maintenance, repair, or demolition activities between 7:00 a.m. and 7:00 p.m., except Sundays and Federal holidays.
- (h) *Noise Standards for Other Structures.* All other structures shall be sound attenuated against the combined input of all present and projected exterior noise to not exceed the criteria.

Table 83-4 Noise Standards for Other Structures	
Typical Uses	12-Hour Equivalent Sound Level (Interior) in dBA Ldn
Educational, institutions, libraries, meeting facilities, etc.	45
General office, reception, etc.	50
Retail stores, restaurants, etc.	55
Other areas for manufacturing, assembly, testing, warehousing, etc.	65

Summary of Development Code Standards

Per Table 83-2 of the Development Code, as outlined above, the County’s stationary noise limit for residential uses is 55 dBA during the hours of 7:00 AM to 10:00 PM and 45 dBA during the hours of 10:00 PM to 7:00 AM.

In addition, the County has exterior transportation noise limits for residential uses of 60 dBA Ldn or CNEL and interior limits of 45 dBA Ldn and CNEL as outlined in Table 83-3 of the Development Code.

5.0 Study Method and Procedure

The following section describes the noise modeling procedures and assumptions used for this assessment.

5.1 Noise Measurement Procedure and Criteria

Noise measurements are taken to determine the existing noise levels. A noise receiver or receptor is any location in the noise analysis in which noise might produce an impact. The following criteria are used to select measurement locations and receptors:

- Locations expected to receive the highest noise impacts, such as the first row of houses
- Locations that are acoustically representative and equivalent of the area of concern
- Human land usage
- Sites clear of major obstruction and contamination

MD conducted the sound level measurements in accordance with the County's and Caltrans (TeNS) technical noise specifications. All measurement equipment meets American National Standards Institute (ANSI) specifications for sound level meters (S1.4-1983 identified in Chapter 19.68.020.AA). The following gives a brief description of the Caltrans Technical Noise Supplement procedures for sound level measurements:

- Microphones for sound level meters were placed 5 feet above the ground for all measurements
- Sound level meters were calibrated (Larson Davis CAL 200) before and after each measurement
- Following the calibration of the equipment, a windscreen was placed over the microphone
- Frequency weighting was set on "A" and slow response
- Results of the short-term noise measurements were recorded on field data sheets
- During any short-term noise measurements, any noise contaminations such as barking dogs, local traffic, lawnmowers, or aircraft fly-overs were noted
- Temperature and sky conditions were observed and documented

5.2 Noise Measurement Locations

Noise monitoring locations were selected based on the nearest noise sources and sensitive uses relative to the proposed project site. Three (3) short-term 15-minute noise measurements were conducted at the project site and are illustrated in Exhibit E. Appendix A includes photos, a field sheet, and measured noise data.

5.3 Traffic Noise Impact

Per the project's Vehicle Miles Traveled (VMT) Screening, as prepared by TJW Engineering, Inc., the project is located within a low VMT-generating area and is consistent with the existing land use of the area. Therefore, the project is presumed to have a less-than-significant impact and qualifies for an exemption from a VMT analysis based on the County's guidelines. Thus, the traffic noise level projections were not analyzed for this project.

5.4 FHWA Roadway Construction Noise Model

The construction noise analysis utilizes the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RNCM), together with several key construction parameters. Key inputs include distance to the sensitive receiver, equipment usage, % usage factor, and baseline parameters for the project site.

The project was analyzed based on typical construction phases using CalEEMod methodology. Construction noise is expected to be loudest during the grading phase of construction. The construction noise calculation output worksheet is located in Appendix B.

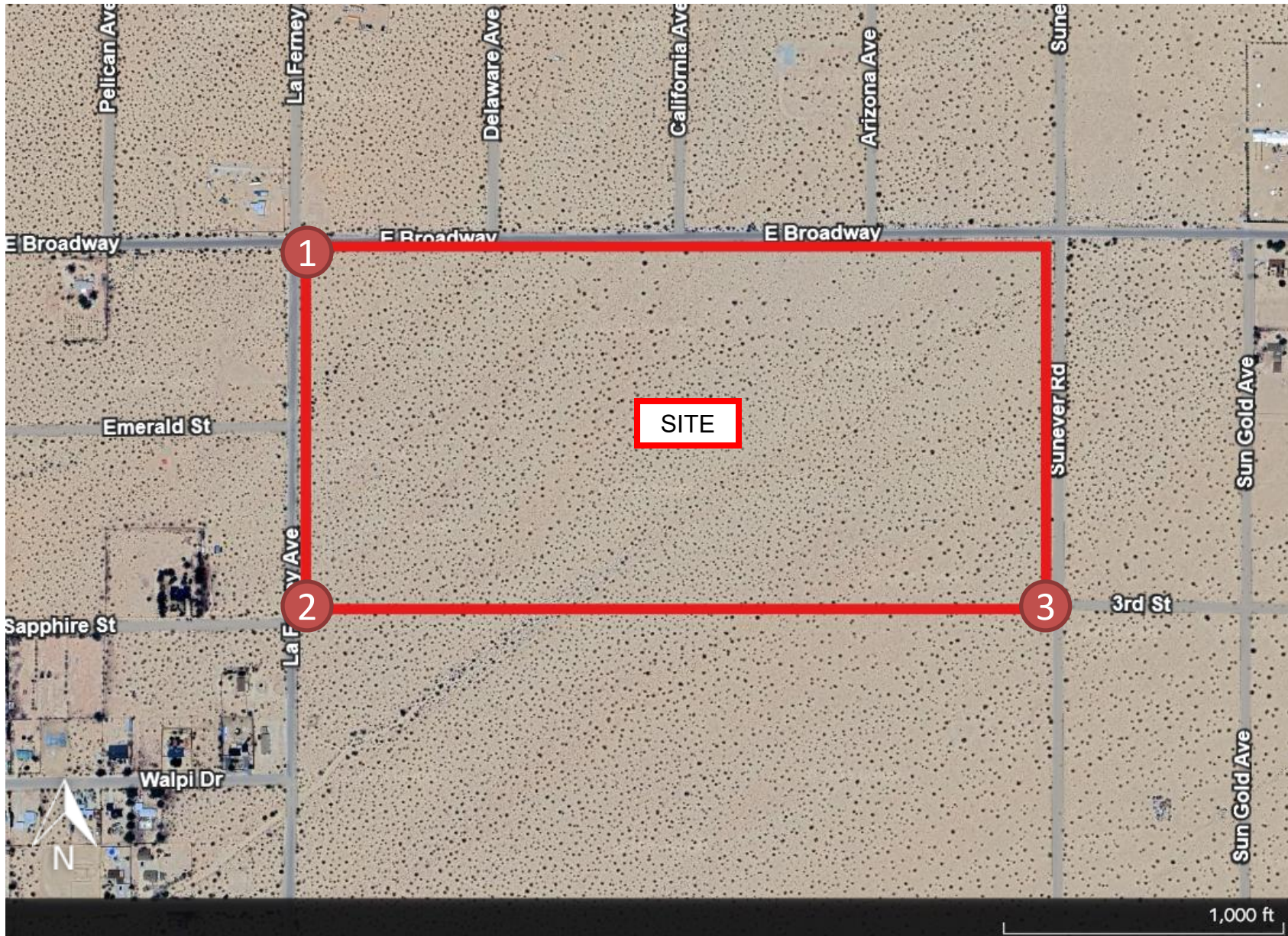
5.5 Stationary Noise Modeling

The future worst-case noise level projections were modeled using referenced sound level data for typical HVAC units by tonnage and transformers by kilovolt-ampere (kVA) capacity. The worst-case scenario considers one 10-ton HVAC unit working continuously on each single-family parcel and one 50 kVA transformer for every two single-family parcels. The reference sound level data is provided in Appendix C.

Exhibit E

Measurement Locations

= Short-Term
Monitoring Location



6.0 Existing Noise Environment

Three (3) 15-minute ambient noise measurements were conducted at the project site. The noise measurements were taken to determine the existing ambient noise levels. Noise data indicate that traffic is the primary source of noise impacting the site and the adjacent uses.

6.1 Short-Term Noise Measurement Results

The results of the short-term noise measurements are presented in Table 2.

Table 2: Short-Term Noise Measurement Data (dBA)¹

Location	Start Time	Stop Time	LEQ	L _{MAX}	L _{MIN}	L ₂	L ₈	L ₂₅	L ₅₀	L ₉₀
NM1	7:45 AM	8:00 AM	43.4	60.7	28.4	55.4	44.2	38.7	34.6	30.3
NM2	8:11 AM	8:26 AM	44.2	66.6	28.5	51.2	43.8	35.6	33.7	31
NM3	8:47 AM	9:02 AM	35.7	49.4	31.4	41	38.5	35.9	34.4	32.7

Notes:
¹ Short-term noise monitoring locations are illustrated in Exhibit E.

Noise data indicate the ambient noise level ranges from 36 to 44 dBA Leq at the project site. Additional field notes and photographs are provided in Appendix A

7.0 Future Noise Environment Impacts and Mitigation

This assessment analyzes future noise impacts to and from the project and compares the results to the County's Noise Standards. The analysis details the estimated exterior noise levels associated with traffic from adjacent roadways.

7.1 Future Exterior Noise

The exterior noise level off-site of the project will not be impacted by transportation-related sources but will be impacted by stationary sources from the site. The following outlines the exterior noise levels due to stationary sources associated with the proposed project.

7.1.1 Noise Impacts to Off-Site Receptors Due to Stationary Sources

On-site operational noise includes transformers and HVAC. All HVAC equipment is likely to be located on the ground next to the residences, with one 10-ton unit per household. Equipment will be at least 185 feet away from the nearest residential property line to the northwest (across the intersection of E Broadway and La Ferney Ave). The maximum sound power level from a single unit is 80 dBA. At 185 feet away, the sound pressure level is estimated to be 37 dBA. Thus, the noise due to HVAC operations will be below 45 dBA at the residential uses and meets the County's nighttime noise level limit for residential properties. Note that the project cannot impact itself. See Appendix C.

A typical residential 50 kVA transformer will be 40 dBA at a distance of 8 feet (per IEEE C57.12.20). The closest transformer will be located more than 100 feet away from the nearest residential use to the northwest. Thus, the noise due to transformer operations will be 18 dBA at the residential uses and meets the County's nighttime noise level limit for residential properties.

Combined, the stationary noise sources will be up to 37 dBA, which meets the County nighttime noise limit for adjacent residential properties.

8.0 Construction Noise Impact

The degree of construction noise may vary for different areas of the project site and also vary depending on the construction activities. Noise levels associated with the construction will vary with the different phases of construction.

8.1 Construction Noise

The Environmental Protection Agency (EPA) has compiled data regarding the noise-generated characteristics of typical construction activities. The data is presented in Table 3.

Table 3: Typical Construction Noise Levels¹

Equipment Powered by Internal Combustion Engines	
Type	Noise Levels (dBA) at 50 Feet
Earth Moving	
Compactors (Rollers)	73 - 76
Front Loaders	73 - 84
Backhoes	73 - 92
Tractors	75 - 95
Scrapers, Graders	78 - 92
Pavers	85 - 87
Trucks	81 - 94
Materials Handling	
Concrete Mixers	72 - 87
Concrete Pumps	81 - 83
Cranes (Movable)	72 - 86
Cranes (Derrick)	85 - 87
Stationary	
Pumps	68 - 71
Generators	71 - 83
Compressors	75 - 86
Impact Equipment	
Type	Noise Levels (dBA) at 50 Feet
Saws	71 - 82
Vibrators	68 - 82
Notes:	
¹ Referenced Noise Levels from the Environmental Protection Agency (EPA)	

Construction noise is considered a short-term impact and would be considered significant if construction activities are taken outside the allowable times as described in the County’s Code (Section 83.01.080(g)(3)). Construction is anticipated to occur during the permissible hours (7 AM to 7 PM) according to the County’s Code. Construction noise will have a temporary or periodic increase in the ambient noise level above the existing level within the project vicinity. Furthermore, noise reduction measures are provided to further reduce construction noise. The impact is considered less than significant; however, construction noise level projections are provided.

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. Noise levels will be loudest during the grading phase. A likely worst-case construction noise scenario during grading assumes the use of a grader, a dozer, two (2) excavators, two (2) tractors, and two (2) scrapers operating at an average of 1500 feet from the nearest sensitive receptor (center of the site to the residence to the northwest across E Broadway). The noise level is projected from the center of the site per the FTA Noise and Vibration manual. Table 4 outlines the estimated noise levels during construction at the nearest sensitive receptor (residence to the northwest).

Table 4: Construction Noise Levels

Phase	dBA Lmax	dBA Leq
Site Preparation	84.0	48.4
Grading	85.0	49.1
Paving	84.0	46.9
Building Construction	83.0	43.0
Arch Coating	78.0	34.7

Although construction activity will happen within the allowable hours as outlined by the County, construction noise reduction policies are included in Section 8.3. With adherence to the County’s Code and implementation of the noise reduction policies, the impact from construction will be less than significant.

8.2 Construction Vibration

Construction activities can produce vibration that may be felt by adjacent land uses. The construction of the proposed project would not require the use of equipment such as pile drivers, which are known to generate substantial construction vibration levels. The primary vibration source during construction may be from a vibratory roller. A vibratory roller has a vibration impact of 0.210 inches per second peak particle velocity (PPV) at 25 feet, which is perceptible but below any risk to architectural damage.

The fundamental equation used to calculate vibration propagation through average soil conditions and distance is as follows:

$$PPV_{equipment} = PPV_{ref} (25/D_{rec})^n$$

Where: PPV_{ref} = reference PPV at 25 ft.

D_{rec} = distance from equipment to receiver in ft.

$n = 1.1$ (the value related to the attenuation rate through ground)

The thresholds from the Caltrans Transportation and Construction Induced Vibration Guidance Manual in Table 5 provide general thresholds and guidelines as to the vibration damage potential from vibratory impacts.

Table 5: Guideline Vibration Damage Potential Threshold Criteria

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

Source: Table 19, Transportation and Construction Vibration Guidance Manual, Caltrans, Sept. 2013.
 Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Table 6 gives approximate vibration levels for particular construction activities. This data provides a reasonable estimate for a wide range of soil conditions.

Table 6: Vibration Source Levels for Construction Equipment¹

Equipment	Peak Particle Velocity (inches/second) at 25 feet	Approximate Vibration Level LV (dVB) at 25 feet
Pile driver (impact)	1.518 (upper range)	112
	0.644 (typical)	104
Pile driver (sonic)	0.734 upper range	105
	0.170 typical	93
Clam shovel drop (slurry wall)	0.202	94
Hydromill	0.008 in soil	66
(slurry wall)	0.017 in rock	75
Vibratory Roller	0.21	94
Hoe Ram	0.089	87
Large bulldozer	0.089	87
Caisson drill	0.089	87
Loaded trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

¹ Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006.

At a distance of 175 feet from the nearest residential building façade to the northwest, a vibratory roller would yield a worst-case 0.025 PPV (in/sec), which is perceptible but below the threshold of architectural damage for newer residential structures. Therefore, the impact is less than significant, and no mitigation is required.

8.3 Construction Noise Reduction Policies

Construction operations must follow the County's Noise Ordinance, which states that construction, repair or excavation work performed must occur within the permissible hours of 7 AM to 7 PM. To further ensure that construction activities do not disrupt the adjacent land uses, the following best practices should be taken:

1. Construction shall occur during the permissible hours as defined in Section 83.01.080(6)(3).
2. During construction, the contractor shall ensure all construction equipment is equipped with appropriate noise attenuating devices.
3. The contractor shall locate equipment staging areas that will create the greatest distance between construction-related noise/vibration sources and sensitive receptors nearest the project site during all project construction.
4. Idling equipment shall be turned off when not in use.
5. Equipment shall be maintained so that vehicles and their loads are secured from rattling and banging.

9.0 References

State of California General Plan Guidelines: 2017. Governor’s Office of Planning and Research.

San Bernardino County: General Policy Plan Hazards Element. October 2020.

San Bernardino County: Chapter 83.01, Section 83.01.080 Noise.

San Bernardino County: Countywide Plan Transportation Existing Conditions Report.

Federal Highway Administration. Noise Barrier Design Handbook. June 2017.

Federal Transit Administration. Transit Noise and Vibration Impact Assessment Manual. September 2018.

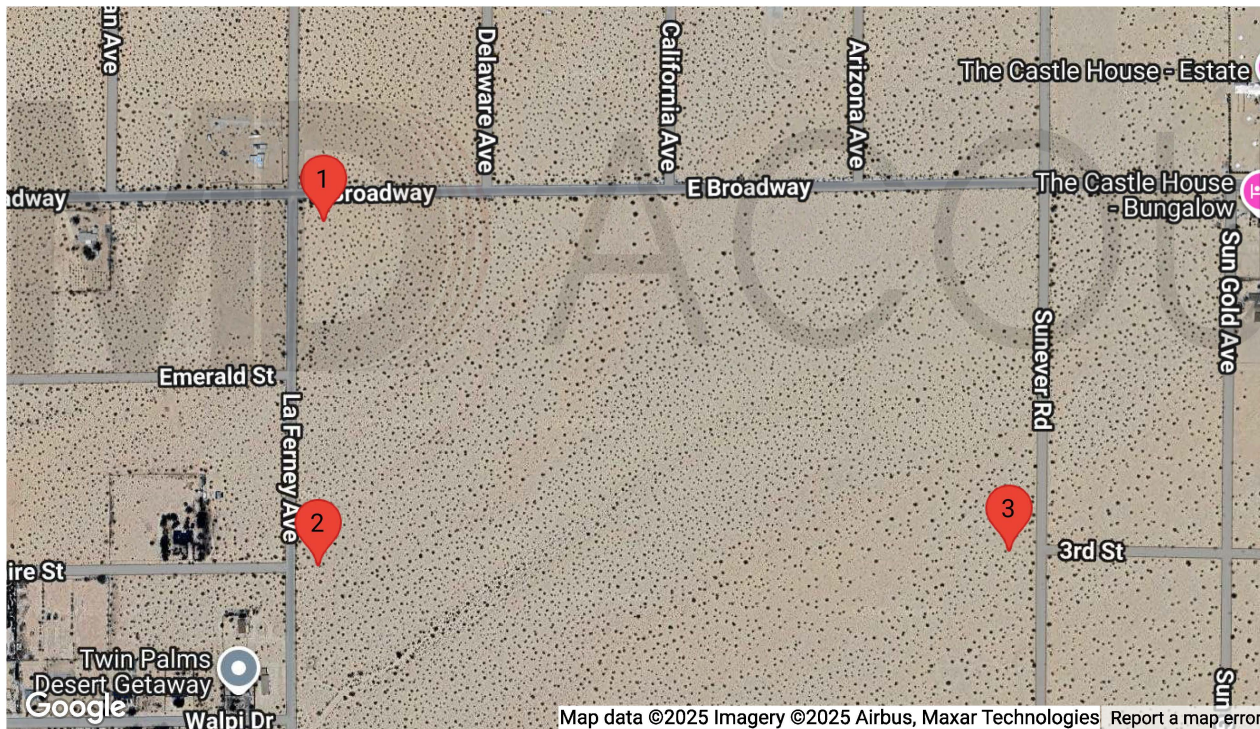
Appendix A:
Photographs Field Measurement Data

15-Minute Continuous Noise Measurement Datasheet - NM1 , NM2, NM3

Project Name: TTM 20668 Joshua Tree Estates Noise
Project: #/Name: 1616-2025-001
Site Address/Location: E Broadway and La Ferney Avenue
Date: 11/26/2025
Field Tech/Engineer: Dennis Jordan / Bethany Wu

Site Observations:
53° to 58°, sunny clear and cool, winds 0 to 5 mph, vehicle traffic very light, no foot or air traffic

Sound Meter: XL2, NT1 **SN:** A2A-05967-E0
Settings: A-weighted, slow, 1-sec, 15-minute interval
Site Id: NM1 , NM2, NM3



STICS

15-Minute Continuous Noise Measurement Datasheet - Cont. - NM1 , NM2, NM3

Project Name: TTM 20668 Joshua Tree Estates Noise
Site Address/Location: E Broadway and La Ferney Avenue
Site Id: NM1 , NM2, NM3

Calibrator:
Cal Check: Pre-test: **Post Test:**

Figure 1: NM1



Figure 2: NM2



Figure 3: NM3

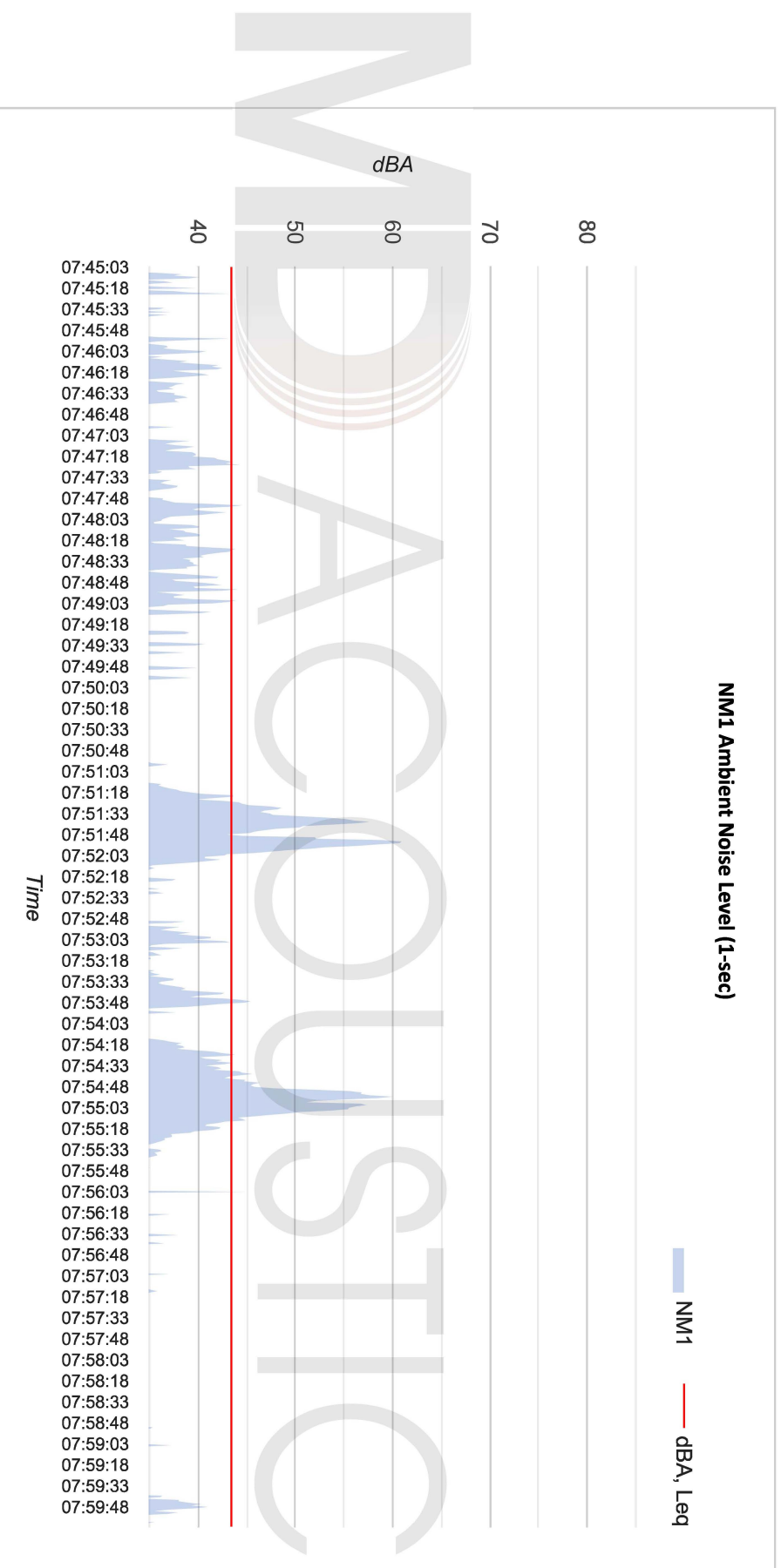


Table 1: Baseline Noise Measurement Summary

Location	Start	Stop	Leq	Lmax	Lmin	L2	L8	L25	L50	L90
NM1	7:45 AM	8:00 AM	43.4	60.7	28.4	55.4	44.2	38.7	34.6	30.3
NM2	8:11 AM	8:26 AM	44.2	66.6	28.5	51.2	43.8	35.6	33.7	31
NM3	8:47 AM	9:02 AM	35.7	49.4	31.4	41	38.5	35.9	34.4	32.7

15-Minute Continuous Noise Measurement Datasheet - Cont. - NM1

Project Name: TTM 20668 Joshua Tree Estates Noise **Site Topo:** Open Field with a few single sto **Noise Source(s) w/ Distance:**
Site Address/Location: E Broadway and La Ferney Avenue **Meteorological Cond.:** 53°, sunny clear and cool, winds 0 to 5 mph **Broadway & La Ferney - Roadway / 25 ft**
Site Id: NM1 **Ground Type:** Dirt and Vegetation

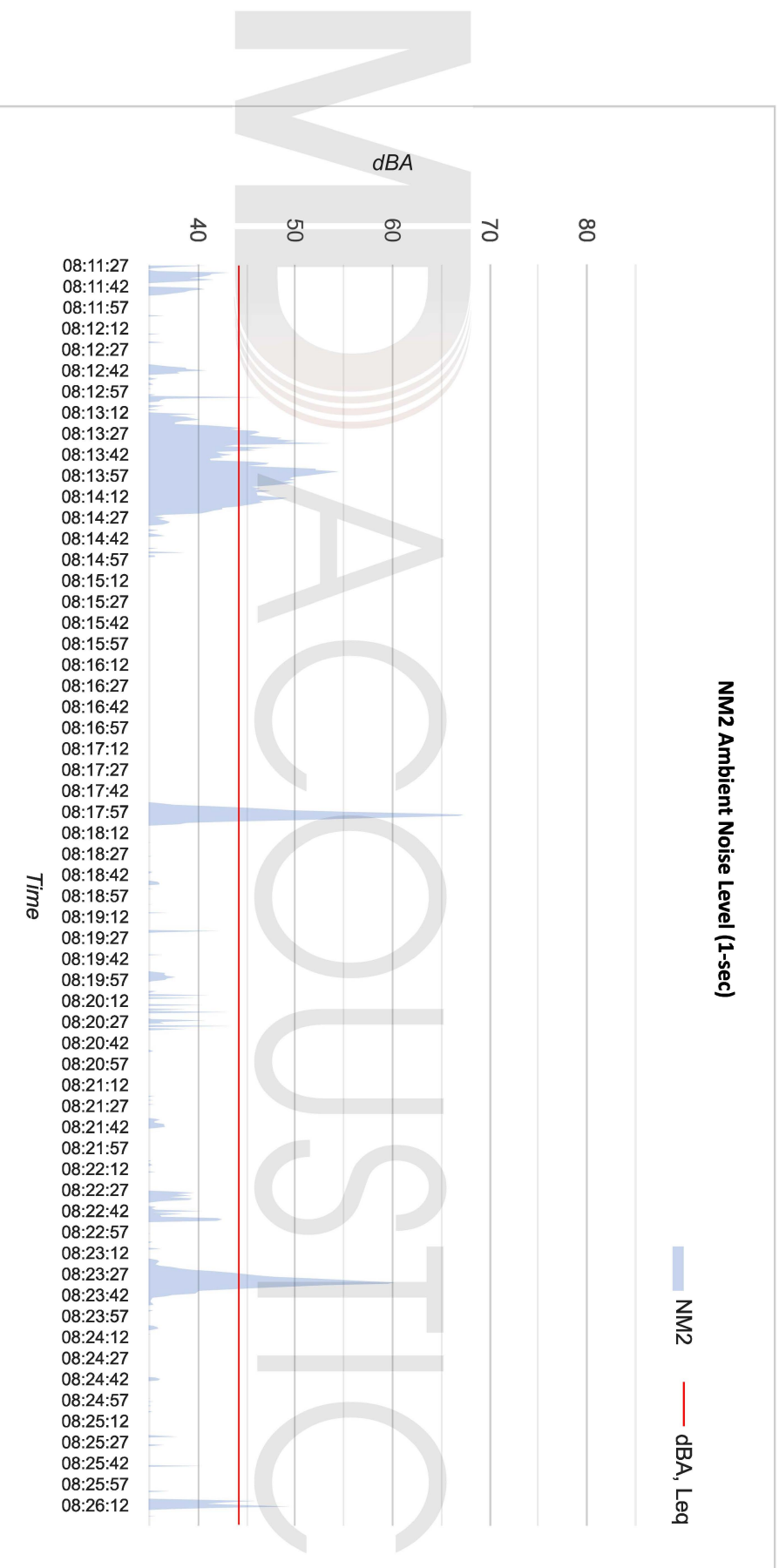


15-Minute Continuous Noise Measurement Datasheet - Cont. - NM2

Project Name: TTM 20668 Joshua Tree Estates Noise Site Topo: Open Field with a few single sto Noise Source(s) w/ Distance:

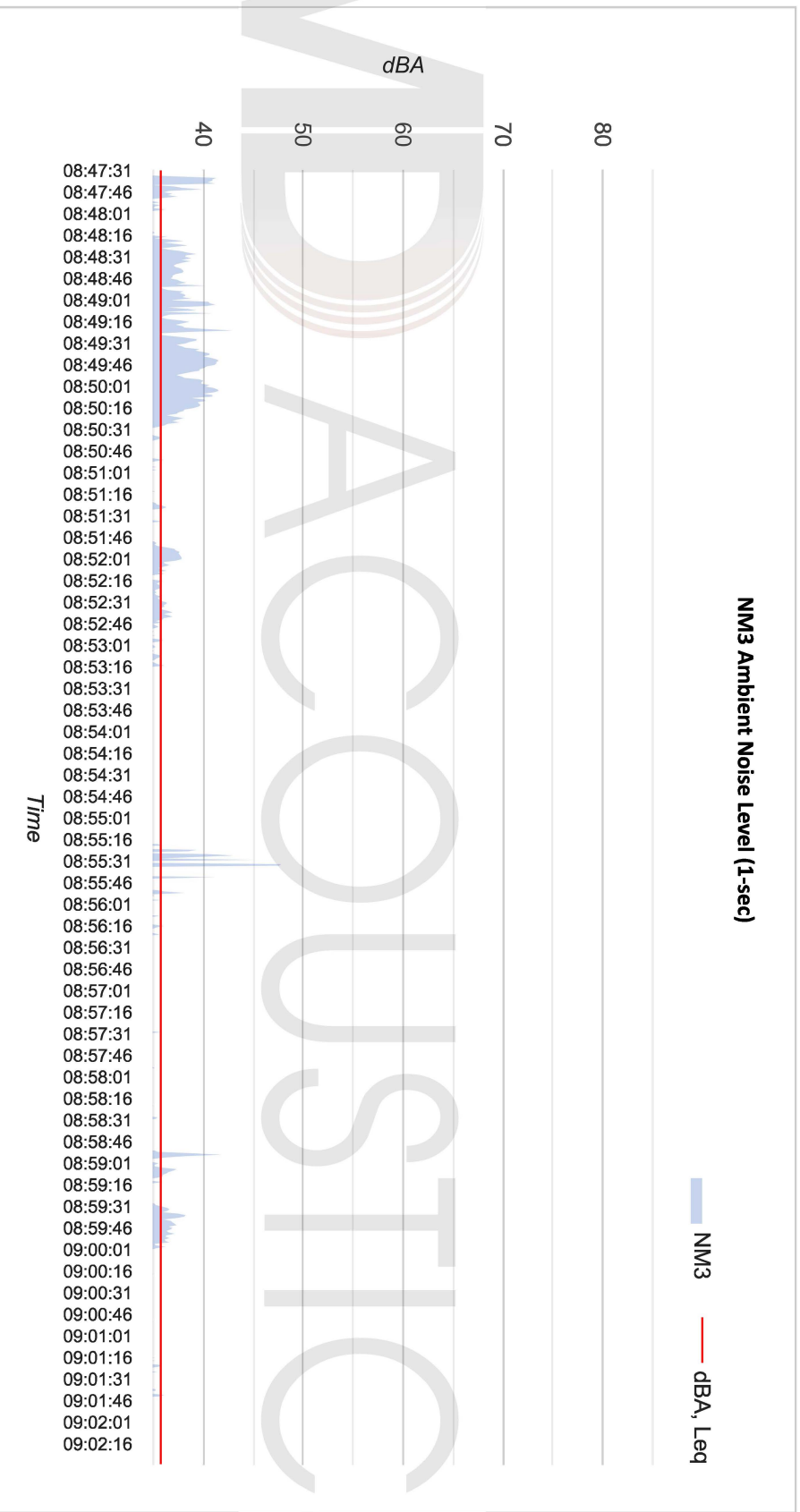
Site Address/Location: E Broadway and La Ferney Avenue Meteorological Cond.: 55°, sunny clear and cool, winds 0 to 5 mph Broadway & Sapphire - Roadway / 25 ft

Site Id: NM2 Ground Type: Dirt and Vegetation

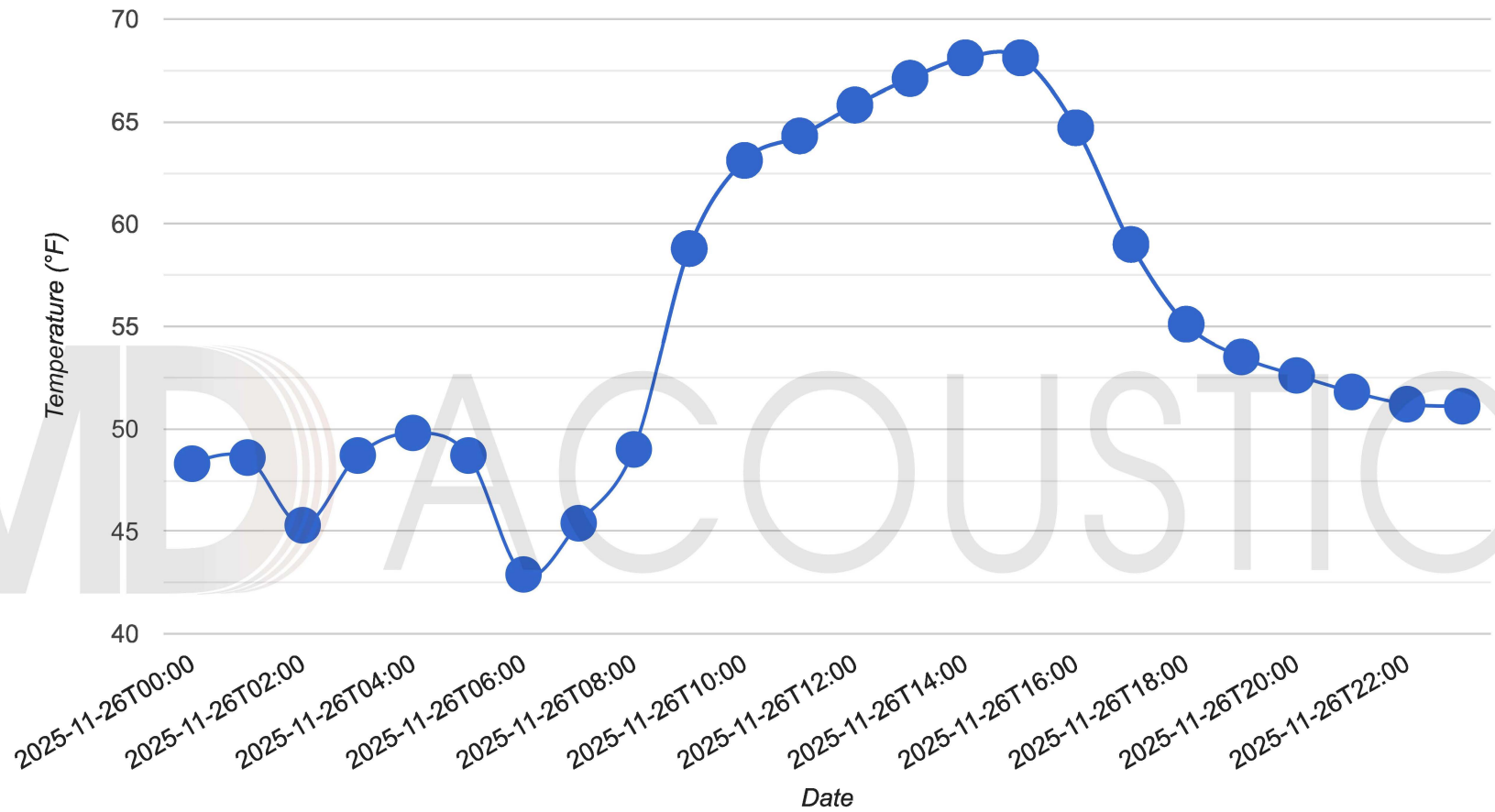


15-Minute Continuous Noise Measurement Datasheet - Cont. - NM3

Project Name: TTM 20668 Joshua Tree Estates Noise **Site Topo:** Open Field with a few single sto **Noise Source(s) w/ Distance:**
Site Address/Location: E Broadway and La Ferney Avenue **Meteorological Cond.:** 58°, sunny clear and cool, winds 0 to 5 mph **Ground Type:** Dirt and Vegetation **Site Id:** NM3

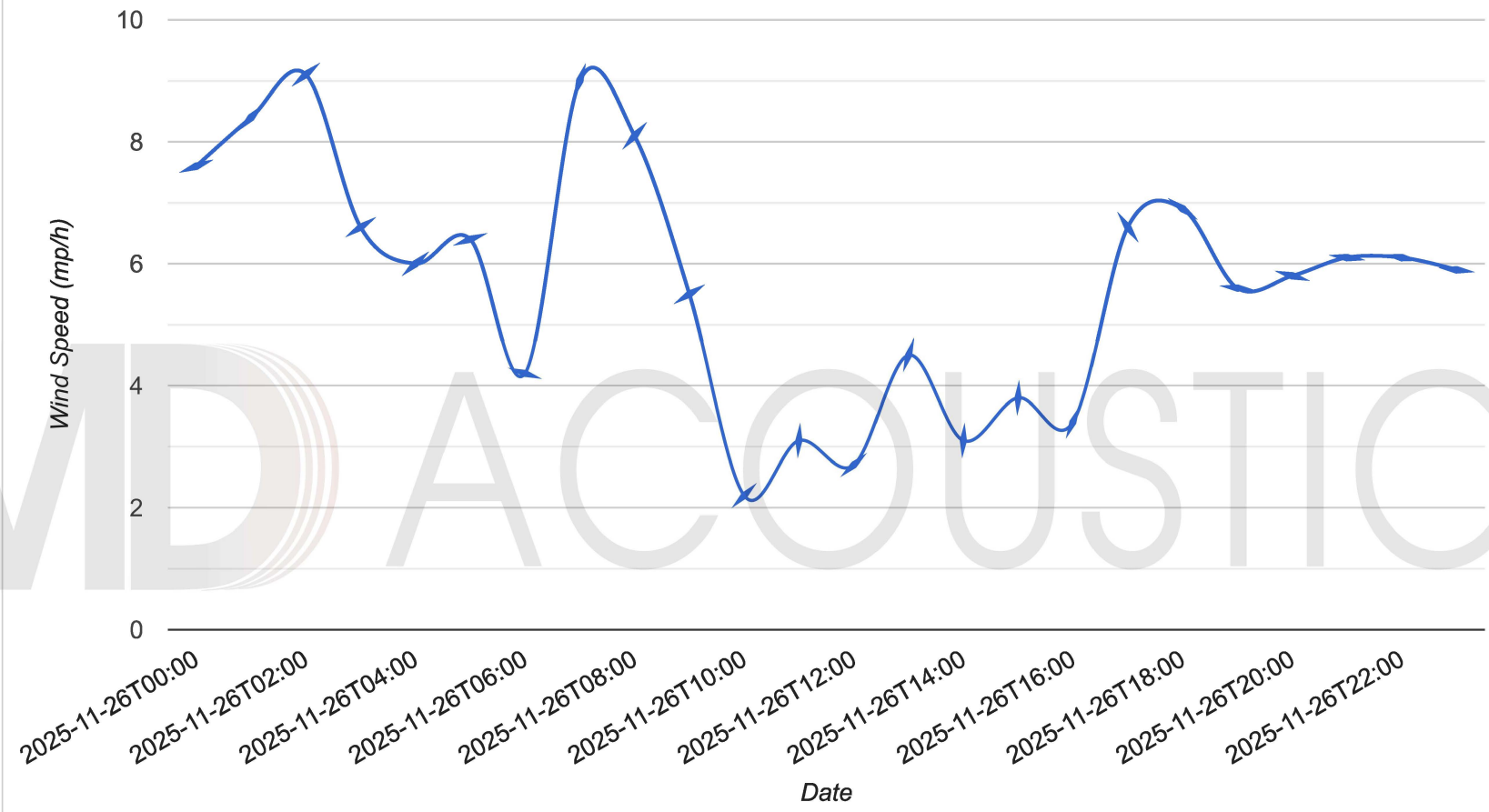


Weather forecast for 2025-11-26



Source: Global Forecast System (GFS) weather forecast model

Wind speed and directions for 2025-11-26



Source: Global Forecast System (GFS) weather forecast model

Appendix B:
Construction Noise Modeling Output

Receptor - Residence 50 ft to the Northwest

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA ¹	Edge of Site to Receptor, feet	Center of Site to Receptor, feet	Item Usage Percent ¹	Ground Factor ²	Usage Factor	Receptor Item Lmax, dBA	Receptor Item Leq, dBA
SITE PREP									
Grader	0	85	50	1500	40	0.66	0.40	0.0	0.0
Tractor	4	84	50	1500	40	0.66	0.40	84.0	40.7
Dozer	3	82	50	1500	40	0.66	0.40	82.0	38.7
Scraper	0	84	50	1500	40	0.66	0.40	0.0	0.0
							Log Sum	84.0	48.4
GRADE									
Dozer	1	82	50	1500	40	0.66	0.40	82.0	38.7
Tractor	2	84	50	1500	40	0.66	0.40	84.0	40.7
Grader	1	85	50	1500	40	0.66	0.40	85.0	41.7
Excavator	2	81	50	1500	40	0.66	0.40	81.0	37.7
Scraper	2	84	50	1500	40	0.66	0.40	84.0	40.7
								85.0	49.1
BUILD									
Crane	1	81	50	1500	16	0.66	0.16	81.0	33.7
Man lift	3	75	50	1500	20	0.66	0.20	75.0	28.7
Tractor	3	84	50	1500	40	0.66	0.40	84.0	40.7
Welder/Torch	1	74	50	1500	40	0.66	0.40	74.0	30.7
Generator	1	81	50	1500	50	0.66	0.50	81.0	38.7
								84.0	46.9
PAVE									
Paver	2	77	50	1500	50	0.66	0.50	77.0	34.7
Concrete Mixer Truck	0	79	50	1500	40	0.66	0.40	0.0	0.0
Roller	2	80	50	1500	20	0.66	0.20	80.0	33.7
Tractor	0	84	50	1500	40	0.66	0.40	0.0	0.0
Compactor (ground)	2	83	50	1500	20	0.66	0.20	83.0	36.7
								83.0	43.0
ARCH COAT									
Compressor (air)	1	78	50	1500	40	0.66	0.40	78.0	34.7
								78.0	34.7

¹FHWA Construction Noise Handbook: Table 9.1 RCNM Default Noise Emission Reference Levels and Usage Factors

VIBRATION LEVEL IMPACT

Project: Joshua Tree Estates - TTM 20668 Date: 11/26/25
Source: Vibratory Roller
Scenario: Unmitigated
Location: Northwest residential building
Address: SEC of E Broadway & La Ferney Ave, Joshua Tree, CA
PPV = $PPV_{ref}(25/D)^n$ (in/sec)

DATA INPUT

Equipment = 1 Vibratory Roller INPUT SECTION IN BLUE
Type
PPVref = 0.21 Reference PPV (in/sec) at 25 ft.
D = 175.00 Distance from Equipment to Receiver (ft)
n = 1.10 Vibration attenuation rate through the ground

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

DATA OUT RESULTS

PPV = 0.025 IN/SEC OUTPUT IN RED

Appendix C:
HVAC Reference

50PG03-14

Ultra High Efficiency Single Package Electric Cooling with
Optional Electric Heat Commercial Rooftop Units with Puron®
(R-410A) Refrigerant, Optional EnergyX™ (Energy Recovery
Ventilator)
2 to 12.5 Nominal Tons

Carrier

turn to the experts



Product Data



AHRI* CAPACITY RATINGS

50PG03-14

UNIT 50PG	NOMINAL CAPACITY (Tons)	NET COOLING CAPACITY (Btuh)	TOTAL POWER (kW)	SEER	EER†	SOUND RATING (dB)	IEER
03	2.0	24,000	2.1	14.1	11.5	75	—
04	3.0	35,800	3.1	14.1	11.7	73	—
05	4.0	47,500	4.0	15.0	12.2	72	—
06	5.0	58,500	4.9	14.8	12.2	78	—
07	6.0	69,000	5.8	—	12.2	78	13.0
08	7.5	88,000	7.0	—	12.7	80	13.5
09	8.5	102,000	8.4	—	12.4	80	13.4
12	10.0	119,000	9.9	—	12.2	80	13.0
14	12.5	150,000	13.2	—	11.5	83	11.6

LEGEND

EER – Energy Efficiency Ratio

SEER – Seasonal Energy Efficiency Ratio

*Air Conditioning, Heating and Refrigeration Institute.

† AHRI does not require EER ratings for units with capacity below 65,000 Btuh.

NOTES:

1. Tested in accordance with AHRI Standards 210–94 (sizes 03–12), 360–93 (size 14).

2. Ratings are net values, reflecting the effects of circulating fan heat.

3. Ratings are based on:

Cooling Standard: 80°F db, 67°F wb indoor entering–air temperature and 95°F db air entering outdoor unit.

IPLV Standard: 80°F db, 67°F wb indoor entering–air temperature and 80°F db outdoor entering–air temperature.

4. All 50PG units are in compliance with Energy Star® and ASHRAE 90.1 2010 Energy Standard for minimum SEER and EER requirements.

5. Units are rated in accordance with AHRI sound standards 270 or 370.

6. Per AHRI, Integrated Energy Efficiency Ratio (IEER) became effective beginning January 1, 2010. Integrated Part–Load Value (IPLV) was superseded by IEER on January 1, 2010. IEER is intended to be a measure of merit for the part load performance of the unit. Each building may have different part load performance due to local occupancy schedules, building construction, building location and ventilation requirements. For specific building energy analysis, an hour–by–hour analysis program should be used.



Use of the AHRI Certified TM Mark indicates a manufacturer's participation in the program. For verification of certification for individual products, go to www.ahridirectory.org.