# Appendix D
# Noise Impact Analysis

# Memorandum

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| **To:** | Dallas Pugh, Land Use Environmental Planner III, Department of Parks and Recreation, County of San Diego |
| **From:** | Jonathan Higginson, INCE<br>Senior Noise Analyst |
| **Date:** | April 5, 2019 |
| **Re:** | **Lakeside Equestrian Center, Noise Impact Analysis** |

# 1. Introduction

The purpose of this memorandum is to support the County of San Diego (County) Department of Parks and Recreation (DPR) environmental review process and provide information regarding potential noise and vibration effects associated with the proposed Lakeside Equestrian Facility (project). The analysis provided in this memorandum evaluates the potential for short- and long-term noise and vibration impacts associated with construction and operation of the project. The analysis includes a description of the environmental setting for the project, including existing noise conditions, as well as applicable laws and regulations. It also documents the assumptions, methodologies, and findings used to evaluate the impacts. Lastly, it includes best practices and operational controls the analyses assume would be in place during the operation of the project, as well as additional suggested measures.

# 2. Project Description

The proposed project is an equestrian facility with two arenas that would be available to serve local residents, equestrian owners, and visitors. It would be located on a 13.91-acre site at the corner of Willow Road and Moreno Avenue on County-owned land in the community of Lakeside within unincorporated San Diego County. (Please see Figure 1, Regional Map, and Figure 2, Project Vicinity.) The General Plan land use designation for the site is Open Space-Recreation (OS-R). Zoning for the site is S80 (Open Space).

The proposed project site encompasses the parcels identified by Assessor's Parcel Numbers (APNs) 392-030-370-0 and 760-141-190-0. Access to the project site would be from two driveways, one on the south end of Moreno Avenue near the trail staging area, and one off Moreno Avenue near the outside arena. The proposed development on the project site is generally concentrated to the north and to the east. The outside arena and livestock corrals are in the northern portion of the proposed site, and the covered arena is in the eastern portion. (Please see Figure 3, Proposed Project.)

The northern portion of the project site would consist of an outside arena (150 x 300 feet), bleachers, announcer's booth, livestock corrals, shade structure (40 x 150 feet), compost area, and water truck filling station. The eastern portion of the site would consist of a covered arena (150 x 300 feet), bleachers, announcer's booth, electric scoreboard, patio area, meeting room/kitchen (40 x 80 feet max.), dumpster area (20 x 10 feet), shop/storage (30 x 60 feet), restroom and showers, volunteer pad with built-in shade structure (50 x 50 feet), wash racks, and five overnight recreational vehicle (RV) camping sites with utility hookups. Sewer and water connections would occur along the southern border of the site along Moreno Avenue. Electric and natural gas connection points are to be determined.

In the center of the site there would be an open decomposed granite parking area (2,400 cubic yards) capable of accommodating approximately 74 trucks/trailers and approximately 35 single vehicle spaces with 30 solar powered parking lot lights. Within the parking area and main entrance off Moreno Avenue, a paved fire lane will be constructed within the facility to accommodate emergency vehicles. The estimated square footage of the paved fire lane or emergency vehicle lane is 42,000 sf of pervious pavement (concrete, asphalt, pavers). A publicly accessible multi-use trail will be developed around the perimeter of the site between the southeast property corner and the northwest property corner (with a fence on the perimeter). A separate equestrian warm up track would also be developed around the facility. A water truck/fire emergency vehicle fill-up station will be located east of the warm up track fence.

The equestrian facility will generate an estimated 170 cubic feet (about six cubic yards) of manure and soiled bedding per week, or 130 tons per year. The exact amount of manure generated will depend on the number of animals, frequency of events, and types of stall beddings used.

An onsite composting area will manage manure and other compostable materials generated at the facility. At times manure and soiled bedding may be hauled offsite for processing or beneficial reuse. Due to anticipated manure volumes and uses, the proposed Project would likely not require composting permits. It will be the leaseholder's responsibility to comply with all regulations and obtain all composting permits, if required.

The manure will be sustainably managed utilizing both manure management and composting best management practices (BMPs) that will virtually eliminate negative environmental impacts and nuisances. BMPs will be listed in the Facility Manure Management Plan and will include practices to minimize odors and vectors and protect receiving water quality. The Facility Manure Management Plan BMPs may include (not limited to) the following:

- The facility, including animal stalls, warmup and training areas, will be cleaned at least once per day including the removal of manure and soiled bedding.
- Manure and soiled bedding will either be incorporated into composting by the end of the day or temporarily stockpiled prior to incorporation into the composting system.

- Stockpiled material in containment vessels will be covered with a lid or tarp. Containment vessels will be located at the furthest feasible distance from nearby residents and/or sensitive receptors.

Compost will undergo processes to further reduce pathogens that results in a beneficial soil amendment that is free of pathogens, parasites and weed seeds. The composting process also destroys fly larvae.

The manure storage and composting area will be located in the northeast corner of the Project site. The manure storage and composting area will be contained in a semi-open structure with roof, which will help minimize odor migration and runoff from stormwater flows. The area is located at the highest elevation of the property and design features such as berms and grading will be incorporated to direct any oncoming stormwater flows around the manure storage and composting area. BMPs will be implemented to minimize leachate generation and runoff from the manure storage and composting area.

The proposed Project will also include educational interpretive and informational signage to inform facility users about the benefits of sustainable manure management and the BMPs being implemented. A contact and phone number will be listed in case of complaints or emergencies.

A day-use public equestrian trail staging area with a shade pavilion (24 x 24 feet) would be provided in the southwestern portion of the site. This area would be improved with picnic tables, hitching posts, temporary irrigation, trash receptacles, and drought-tolerant landscape.

All permanent exterior lighting would be installed such that lamps and reflectors would not be visible from beyond the project site; lighting would not cause excessive reflective glare; directed lighting would not illuminate the nighttime sky, except for required Federal Aviation Administration aircraft safety lighting; illumination of the project facility and its immediate vicinity would be minimized; and the lighting plan would comply with local policies and ordinances.

The community facility would be used for a variety of equestrian and livestock-related activities—such as practices, training, and contests, including shows—and non-equestrian events—such as wedding receptions and dog shows. A typical equestrian event would likely draw between 50 and 125 attendees, with large events attracting as many as 300 attendees (spectators and participants). The large events are anticipated to take place a few times each year. A three-way stop would be installed at the corner of Willow Road and Moreno Avenue to ensure the safety of patrons and users of the perimeter trails.

Construction would occur over 11 to 12 months. Construction equipment would include tractors, excavators, backhoes, water truck, drill rig, bobcat, fork lift, rollers, a rubber tire loader, wheel tractor scrapers, an air compressor, a generator set, a crane, and a concrete truck. Approximately 12,700 cubic yards of material would be imported to the project site for the public trail, parking lot, biofiltration basin, and arenas. No material would be transported off site. Offsite improvements include paving two driveways entering the site from Moreno Avenue.

The County Department of Parks and Recreation (DPR) would contract with a third-party operator for managing daily operations and maintaining the equestrian facility. One supervising park ranger would be available, and there would be one point of contact from the County that would act as a liaison between the County and the property tenant. The facility would be open from approximately sunrise to sunset, and until 10:00 p.m. when large events take place. The facility would follow all standard County rules and regulations, including, but not limited to, the following:

- No smoking is allowed anywhere in County parks per Section 41.118.5.
- No person is allowed to use, transport, carry, fire, or discharge any fireworks, firearm, weapon, air gun, archery device, slingshot, or explosive of any kind across, in, or into a County park.

The proposed project is in the northern portion of the community of Lakeside, west of the Lake Jennings/Wildcat Canyon–El Cajon Mountain Multiple Species Conservation Program Core Resource Area and approximately 0.25 mile north of the San Diego River. The project site is specifically northeast of the Moreno Avenue and Willow Road intersection. Surrounding land uses include commercial and industrial development to the west, El Capitan Equestrian Center and semi-rural residential development to the south, a mix of agricultural and semi-rural residential development to the north and east, and rural lands and open space beyond the semi-rural development to the east. The topography of the equestrian site is relatively flat, with elevations ranging from 403 to 410 feet above mean sea level. The site is 0.5 mile east of Highway 67.

# 3. Noise Fundamentals

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

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receptor, and the propagation path between the two. The loudness of the noise source and the obstructions or atmospheric factors, which affect the propagation path to the receptor, determine the sound level and the characteristics of the noise perceived by the receptor.

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

## Frequency, Amplitude, and Decibels

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

The amplitude of pressure waves generated by a sound source determines the loudness of that source. The amplitude of a sound is typically described in terms of *sound pressure level*, which refers to the root-mean-square pressure of a sound wave and can be measured in units called microPascals (µPa). One µPa is approximately one hundred-billionth (0.00000000001) of normal atmospheric pressure. Sound pressure levels for different kinds of noise environments can range from less than 100 to over 100,000,000 µPa. Because of this large range of values, sound is rarely expressed in terms of μPa. Instead, a logarithmic scale is used to describe the sound pressure level (also referred to simply as the sound level) in terms of decibels, abbreviated dB. Specifically, the decibel describes the ratio of the actual sound pressure to a reference pressure and is calculated as follows:

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

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

## Decibel Addition

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

# Perception of Noise and A-Weighting

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

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the sound pressure level in that range. In general, people are most sensitive to the frequency range of 1,000 to 8,000 Hz and perceive sounds within that range better than sounds of the same amplitude at higher or lower frequencies. To approximate the response of the human ear, sound levels in various frequency bands are adjusted (or “weighted”), depending on human sensitivity to those frequencies. The resulting sound pressure level is expressed in A-weighted decibels, abbreviated dBA. When people make judgments regarding the relative loudness or annoyance of a sound, their judgments correlate well with the A-weighted sound levels of those sounds. Table 1 describes typical A-weighted sound levels for various noise sources.

**Table 1. Typical Noise Levels in the Environment**

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

Source: California Department of Transportation 2013.

## Human Response to Noise

Noise-sensitive receptors (also called “receivers”) are locations where people reside or where the presence of unwanted sound may adversely affect the use of the land. The effects of noise on people can be listed in three general categories.

- Subjective effects of annoyance, nuisance, or dissatisfaction
- Interference with activities such as speech, sleep, learning, or working
- Physiological effects such as startling and hearing loss

In most cases, effects from sounds typically found in the natural environment (compared to an industrial or an occupational setting) would be limited to the first two categories: creating an annoyance or interfering with activities. (Further discussion of health-related effects is provided below.) No completely satisfactory method exists to measure the subjective effects of sound or the corresponding reactions of annoyance and dissatisfaction. This lack of a common standard arises primarily from the wide variation in individual thresholds of annoyance and habituation to sound. Therefore, an important way of determining a person's subjective reaction to a new sound is by comparing it to the existing baseline or "ambient" environment to which that person has adapted. In general, the more the level or tonal (frequency) variations of a sound exceed the previously existing ambient sound level or tonal quality, the less acceptable the new sound will be, as judged by the exposed individual.

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

# Noise Descriptors

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

**Equivalent Sound Level ($L_{eq}$)** is the most common metric used to describe short-term average noise levels. Many noise sources produce levels that fluctuate over time; examples include mechanical equipment that cycles on and off or construction work, which can vary sporadically. The $L_{eq}$ describes the average acoustical energy content of noise for an identified period of time, commonly 1 hour. Thus, the $L_{eq}$ of a time-varying noise and that of a steady noise are the same if they deliver the same acoustical energy over the duration of the exposure. For many noise sources, the $L_{eq}$ will vary, depending on the time of day. A prime example is traffic noise, which rises and falls, depending on the amount of traffic on a given street or freeway.

**Maximum Sound Level ($L_{max}$)** and **Minimum Sound Level ($L_{min}$)** refer to the maximum and minimum sound levels, respectively, that occur during the noise measurement period. More specifically, they describe the root-mean-square sound levels that correspond to the loudest and quietest 1-second intervals that occur during the measurement.

**Percentile-Exceeded Sound Level ($L_{xx}$)** describes the sound level exceeded for a given percentage of a specified period (e.g., $L_{10}$ is the sound level exceeded 10 percent of the time, and $L_{90}$ is the sound level exceeded 90 percent of the time).

**Community Noise Equivalent Level (CNEL)** is a measure of the cumulative 24-hour noise level that considers not only the variation of the A-weighted noise level but also the duration and the time of day of the disturbance. The CNEL is derived from the 24 A-weighted 1-hour $L_{eq}$s that occur in a day, with "penalties" applied to the level occurring during the evening hours (7 p.m. to 10 p.m.) and nighttime hours (10 p.m. to 7 a.m.) to account for increased noise sensitivity during these hours. Specifically, the CNEL is calculated by adding 5 dBA to the evening $L_{eq}$, adding 10 dBA to the nighttime $L_{eq}$, and then taking the average value for all 24 hours.

**Day-Night Average Sound Level ($L_{dn}$)** is a measure of the cumulative 24-hour noise that is very similar to CNEL (described above); the only difference is that $L_{dn}$ does not apply a "penalty" to evening noise levels. The $L_{dn}$ is derived from the 24 A-weighted 1-hour $L_{eq}$s that occur in a day. A 5-dBA "penalty" is added to the levels occurring during the nighttime hours (10 p.m. to 7 a.m.), and then the average is calculated for all 24 hours.

## Sound Propagation

When sound propagates over a distance, it changes in both level and frequency content. The manner in which noise is reduced with distance depends on the following important factors.

- **Geometric Spreading**. Sound from a single source (i.e., a *point source*) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates (or drops off) at a rate of 6 dBA for each doubling of distance. Highway noise is not a single stationary point source of sound. The movement of vehicles on a highway makes the source of the sound appear to emanate from a line (i.e., a *line source*) rather than from a point. This results in cylindrical spreading rather than the spherical spreading resulting from a point source. The change in sound level (i.e., attenuation) from a line source is 3 dBA per doubling of distance.
- **Ground Absorption**. Usually the noise path between the source and the observer is very close to the ground. The excess noise attenuation from ground absorption occurs due to acoustic energy losses on sound wave reflection. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is done for simplification only; for distances of less than 200 feet, prediction results based on this scheme are sufficiently accurate. For acoustically "hard" sites (i.e., sites with a reflective surface, such as a parking lot or a smooth body of water, between the source and the receptor), no excess ground attenuation is assumed because the sound wave is reflected without energy losses. For acoustically absorptive or "soft" sites (i.e., sites with an absorptive ground surface, such as soft dirt, grass, or scattered bushes and trees), an excess ground attenuation value of 1.5 dBA per doubling of distance is normally assumed. When added to the geometric spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dBA per doubling of distance for a line source and 7.5 dBA per doubling of distance for a point source.
- **Atmospheric Effects**. Research by the California Department of Transportation (2013) and others has shown that atmospheric conditions can have a major effect on noise levels. Wind has been shown to be the single most important meteorological factor within approximately 500 feet, whereas vertical air temperature gradients are more important over longer distances. Other factors, such as air temperature, humidity, and turbulence, also have major effects. Receptors downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lower noise levels. Increased sound levels can also occur because of temperature inversion conditions (i.e., increasing temperature with elevation, with cooler air near the surface—where the sound source tends to be—and the warmer air above that acts as a cap, causing a reflection of ground level–generated sound).
- **Shielding by Natural or Human-Made Features**. A large object or barrier in the path between a noise source and a receptor can substantially attenuate noise levels at the receptor. The amount of attenuation provided by this shielding depends on the size of the object, proximity to

the noise source and receptor, surface weight, solidity, and the frequency content of the noise source. Natural terrain features (such as hills and dense woods) and human-made features (such as buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receptor, with the specific purpose of reducing noise. A barrier that breaks the line of sight between a source and a receptor will typically result in at least 5 dB of noise reduction. A higher barrier may provide as much as 20 dB of noise reduction.

# Environmental Vibration Fundamentals

Ground-borne vibration is an oscillatory motion of the soil with respect to the equilibrium position and can be quantified in terms of *velocity* or *acceleration*. The velocity describes the instantaneous speed of the motion, and acceleration is the instantaneous rate of change of the speed. Each of these measures can be further described in terms of *frequency* and *amplitude*.

In contrast to airborne sound, groundborne vibration is not a phenomenon that most people experience every day. The background vibration velocity level in residential areas is usually much lower than the threshold of human perception. Most perceptible indoor vibration is caused by sources within buildings, such as mechanical equipment while in operation, people moving, or doors slamming. Typical outdoor sources of perceptible groundborne vibration are heavy construction equipment (such as blasting and pile driving), railroad operations, and heavy trucks on rough roads. If a roadway is smooth, the groundborne vibration from traffic is rarely perceptible. Ground-borne vibration can be a serious concern for neighbors of nearby sources, causing buildings to shake and rumbling sounds to be heard. If a person is engaged in any type of physical activity, vibration tolerance increases considerably. Vibration can result in effects that range from annoyance to structural damage. Variations in geology and distance result in different vibration levels with different frequencies and amplitudes.

# Vibration Descriptors

Various descriptors, or “metrics,” can be used to quantify groundborne vibration. The metrics used in the assessment of environmental impacts are generally focused on the short-term maximum vibration levels. The two metrics considered in this study are described below.

**Peak particle velocity (PPV)** is defined as the maximum instantaneous positive or negative peak amplitude of the vibration velocity. The unit of measurement for PPV is inches per second (in/s).

**Vibration velocity level ($L_v$)** describes the root-mean-square (rms) velocity amplitude of the vibration. This rms value may be thought of as a “smoothed” or “magnitude-averaged” amplitude. The maximum $L_v$ describes the maximum rms velocity amplitude that occurs over a 1-second period during a vibration measurement (in this way, $L_v$ is analogous to the $L_{max}$ metric used to describe maximum noise levels). $L_v$ can be measured in in/s but is typically expressed on a logarithmic scale using decibels. To avoid confusion with decibels used to describe sound levels, the abbreviation “VdB” is used to denote vibration velocity level decibels. Specifically, a vibration velocity level ($L_v$), in decibels (VdB), is calculated as follows:

$$L_V = 20\log_{10}\left(\frac{V}{1\times10^{-6}\,in./s}\right),$$

where $V$ is the actual 1-second rms velocity amplitude and $1\times10^{-6}$ in/s is the standard reference velocity amplitude.

# 4. Existing Noise Environment

The existing noise-sensitive receivers in the vicinity of the proposed project consist of low density residential uses in all directions. The homes are generally on fairly large lots, several of which contain existing equestrian facilities such as fields, paddocks, stables, and riding arenas. Residential properties to the north are separated from the project site by an existing open field approximately 200 feet wide; residential properties to the east are separated from the project site by an existing easement approximately 80 feet wide; residential properties to the south are separated from the project site by Willow Road; and residential properties to the west are separated from the project site by Moreno Avenue. Other land uses in the vicinity include commercial and industrial development to the west, El Capitan Equestrian Center to the south, and a mix of agricultural/rural lands and open space to the east.

The existing noise environment in the project vicinity is generally quiet. The primary sources of noise are traffic on Willow Road and Moreno Avenue. Other noise sources observed in the area include traffic on more distant roadways, including State Route (SR-) 67, aircraft overflights, birds, and landscaping activity; toward the north end of the project site, distinctive electrical buzzing was also audible from overhead power lines.

In order to document existing noise levels in the study area, three short-term (ST) measurements and two long-term (LT) measurements were obtained in the project vicinity (see Figure 4) between Thursday, March 17 and Monday, March 20, 2017. These locations were selected to document the existing noise levels at the closest noise-sensitive receptors to the north, east, south, and west. Each short-term measurement was conducted over a period of at least 15 minutes. The long-term measurements were conducted over a period of approximately 96 hours.

The instrumentation used to obtain the noise measurements consisted of a Type 1 Larson Davis (Model 831) integrating sound level meter (SLM) for short-term noise measurements, two Type 2 RION (Model NL-21) integrating SLMs for long-term noise measurements, and a Larson Davis (Model CAL200) acoustical calibrator used to field-calibrate all SLMs before and after each measurement for accuracy. The instruments are maintained to manufacturer specifications to ensure accuracy, in accordance with American National Standards Institute (ANSI) standard S1.4-2006. For all measurements, the SLM microphone was mounted at a height of 5 feet above the ground.

Noise measurements indicate that the daytime ambient hourly noise levels were generally in the range of 46 to 60 dBA equivalent noise level ($L_{eq}$) at land uses surrounding the project site (LT1, LT2, ST1, and ST3), with overall average daytime noise levels of 52 to 56 dBA. A slightly higher noise level of 63 dBA was measured at ST2, which is farther west of the project site, closer to the busier west end of Willow Road prior to its terminus intersection with SR-67. Nighttime ambient hourly noise levels were generally in the range of 39 to 59 dBA $L_{eq}$ at land uses surrounding the project site (LT1 and LT2), with overall average nighttime noise levels of 46 to 49 dBA. Additional details and a summary of the measurement results are provided in Table 2. Field photos and field noise survey sheets are included in Appendix A to this memorandum.

**Table 2. Measured Existing Noise Levels in Study Area**

| | Weekday Hourly Leq, dBA | | Weekend Hourly Leq, dBA | |
|---|---|---|---|---|
| **Location Number, Description (date, time)** | **Daytime** | **Nighttime** | **Daytime** | **Nighttime** |
| LT1: 11036 Moreno Avenue, adjacent to driveway, approximately 100 feet west of roadway<br>(03/16/2017, 1:00 p.m. – 03/20/2017, 2:00 p.m.) | Range: 53–60<br>Average: 56 | Range: 43–59<br>Average: 53 | Range: 51–56<br>Average: 55 | Range: 41–52<br>Average: 49 |
| LT2: 12620 Willow Road, on west property fence line, approximately 330 feet north of roadway<br>(03/16/2017, 2:00 p.m. – 03/20/2017, 2:00 p.m.) | Range: 46–55<br>Average: 52 | Range: 41–55<br>Average: 49 | Range: 46–57<br>Average: 52 | Range: 39–50<br>Average: 46 |
| ST1: Behind homes on Mary Lane, approximately 370 feet east of Moreno Avenue<br>(03/16/2017, 2:07 p.m. – 2:23 p.m.) | 52 | N/A | N/A | N/A |
| ST2: 12403 Willow Road, approximately 60 feet southeast of roadway<br>(03/16/2017, 3:04 p.m. – 3:19 p.m.) | 63 | N/A | N/A | N/A |
| ST3: Opposite 10825 Redlander Way, approximately 60 feet southeast of roadway<br>(03/16/2017, 3:04 p.m. – 3:19 p.m.) | 56 | N/A | N/A | N/A |

Notes: Daytime = 7 a.m. to 10 p.m.; Nighttime = 10 p.m. to 7 a.m.; ST = short-term; LT = long-term; dBA = A-weighted sound level, the sound pressure level in decibels as measured using the A-weighting filter network, which 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; $L_{eq}$ = equivalent sound level, the average of the sound energy occurring over the measurement period; N/A = no measurement was obtained at the corresponding location and timeframe.

# 5. Regulatory Setting

## State

California requires each local government entity to perform noise studies and implement a noise element as part of its general plan. The purpose of the noise element is to limit the exposure of the community to excessive noise levels; the noise element must be used to guide decisions concerning land use. The County of San Diego General Plan is discussed below.

## County of San Diego

The County maintains applicable noise and vibration impact thresholds of significance in its document *County of San Diego, Guidelines for Determining Significance, Noise* (County of San Diego 2009). These guidelines define a noise sensitive land use (NSLU) as "[a]ny residence, hospital, school, hotel, resort, library, or similar facility where quiet is an important attribute of the environment" and summarize standards from various sources to address the various types of impact that could potentially occur with implementation of a given project. The sources of the noise and vibration thresholds include the City's Noise Ordinance and Noise Element of the General Plan Division, and the U.S Department of Transportation, Federal Transit Administration (FTA). Each of the thresholds that are applicable to the proposed project are described in further detail below.

### Noise Sensitive Land Uses Affected by Airborne Noise

For the potential impact of airborne noise on NSLU, the thresholds are based largely on the County's Noise Element and state that a significant impact would occur if project implementation would result in the exposure of any on- or off-site existing or reasonably foreseeable future NSLU to exterior or interior noise in excess of any of the following:

A. Exterior Locations:
   i. 60 dB (CNEL)
   ii. An increase of 10 dB (CNEL) over pre-existing noise

B. Interior Locations:

   45 dB (CNEL) except for the following cases:

   i. For rooms that are usually occupied only a part of the day (schools, libraries, or similar facilities), the interior 1-hour average sound level due to noise outside should not exceed 50 dBA.
   ii. Corridors, hallways, stairwells, closets, bathrooms, or any room with a volume less than 490 cubic feet.

### Project–Generated Airborne Noise

For the potential impact of project-generated noise on surrounding NSLU, the thresholds are based on the County's Noise Ordinance, which provides separate noise standards for construction and non-construction activities, as discussed below.

#### Construction Noise

A significant noise impact would occur if noise generated by construction activities related to the project would exceed the limit specified in San Diego County Code Section 36.409, *Sound Level Limitations on Construction Equipment*. Section 36.409 states that "[e]xcept for emergency work, it will be unlawful for any person to operate construction equipment or cause construction equipment to be operated, that exceeds an average sound level of 75 decibels for an eight-hour period, between

7 a.m. and 7 p.m., when measured at the boundary line of the property where the noise source is located or on any occupied property where the noise is being received."

## Non-Construction Noise

A significant noise impact would occur if noise generated by operational activities related to the project would exceed the limit specified in San Diego County Code Section 36.404, *General Sound Level Limits*, at the property line of the property on which the noise is produced or at any location on a property that is receiving the noise. Section 36.404 provides the following limits:

**Table 3. San Diego County Code Section 36.404 Noise Limits**

| Zone | Time | One-Hour Average ($L_{eq}$) Sound Level Limits, dBA [a,b] |
|---|---|---|
| (1) R-S, R-D, R-R, R-MH, A-70, A-72, S-80, S-81, S-87, S-90, S-92, and R-V and R-U with a density of less than 11 dwelling units per acre. | 7 a.m. to 10 p.m. | 50 |
| | 10 p.m. to 7 a.m. | 45 |
| (2) R-RO, R-C, R-M, S-86, V5, and R-V and R-U with a density of 11 or more dwelling units per acre. | 7 a.m. to 10 p.m. | 55 |
| | 10 p.m. to 7 a.m. | 50 |
| (3) S-94, V4, and all other commercial zones. | 7 a.m. to 10 p.m. | 60 |
| | 10 p.m. to 7 a.m. | 55 |
| (4) V1, V2 | 7 a.m. to 7 p.m. | 60 |
| | 7 p.m. to 10 p.m. | 55 |
| V1 | 10 p.m. to 7 a.m. | 55 |
| V2 | 10 p.m. to 7 a.m. | 50 |
| V3 | 7 a.m. to 10 p.m. | 70 |
| | 10 p.m. to 7 a.m. | 65 |
| (5) M-50, M-52, and M-54 | Anytime | 70 |
| (6) S-82, M-56, and M-58 | Anytime | 75 |

a. If the measured ambient level exceeds the applicable limit noted above, the allowable 1-hour average sound level will be the ambient noise level, plus 3 decibels.

b. The sound level limit at a location on a boundary between two zones is the arithmetic mean of the respective limits for the two zones, provided, however, that the 1-hour average sound level limit applicable to extractive industries, including but not limited to borrow pits and mines, will be 75 decibels at the property line regardless of the zone which the extractive industry is actually located.

Notes: dBA = A-weighted sound level; Leq = equivalent sound level.

It is noted that the zoning of the project site and the surrounding uses is a mix of S-80 (open space), R-R (rural residential), and A-70 (limited agricultural use), which all fall under Zone 1. Therefore, the applicable base sound level limits (before any corrections for ambient noise levels) are 50 dBA $L_{eq}$ between 7 a.m. and 10 p.m. and 45 dBA $L_{eq}$ between 10 p.m. and 7 p.m. However, as noted in the table, the limits would be increased where existing daytime ambient noise levels exceed 50 dBA or existing nighttime ambient noise levels exceed 45 dBA.

## Groundborne Vibration

A significant vibration impact would occur if vibration generated by construction or operational activities related to the project would exceed limits specified in the FTA guidelines *Transit Noise and Vibration Impact Assessment* (FTA 2018) at NSLUs or other vibration-sensitive uses (such as certain research and manufacturing facilities). This includes new development that creates or locates NSLUs or other vibration-sensitive uses in a location where they would be affected by groundborne vibration and noise (such as developing a new residential project close to a railroad). The manual provides guidance for two types of potential impact: (1) damage to structures and (2) annoyance to people. Guideline criteria for each are provided in Table 4 and

Table 5. It is noted that potential building damage is assessed using PPV, whereas potential annoyance is assessed using $L_v$.

**Table 4. FTA Guideline Vibration Damage Criteria**

| Building Category (Structure and Condition) | PPV, in/s |
|---|---|
| I. Reinforced-concrete, steel, or timber buildings (no plaster) | 0.5 |
| II. Engineered concrete and masonry buildings (no plaster) | 0.3 |
| III. Non-engineered timber and masonry buildings | 0.2 |
| IV. Buildings that are extremely susceptible to vibration damage | 0.12 |

Source: Federal Transit Administration 2018.

**Table 5. FTA Guideline Vibration Annoyance Criteria**

| | Ground-borne Vibration Level, $L_v$ | | |
|---|---|---|---|
| Land Use Category | Frequent Events (VdB)[1] | Occasional Events (VdB)[2] | Infrequent Events (VdB)[3] |
| **Category 1:** Buildings where vibration would interfere with interior operations | 65[4] | 65[4] | 65[4] |
| **Category 2:** Residences and buildings where people normally sleep | 72 | 75 | 80 |
| **Category 3:** Institutional land uses with primarily daytime use | 75 | 78 | 83 |

Source: Federal Transit Administration 2018.

[1] "Frequent Events" is defined as more than 70 vibration events from the same source per day.

[2] "Occasional Events" is defined as between 30 and 70 vibration events from the same source per day.

[3] "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day.

[4] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes.

Accurate calculation of groundborne noise is a complex process typically reserved for assessing long-term impacts from rail projects. For the purposes of analyzing the proposed project, it is assumed that compliance with the groundborne vibration thresholds would also achieve compliance with the groundborne noise thresholds. Because the vibration sources during construction, such as graders and bulldozers, would operate continuously for extended periods of time, the applicable vibration thresholds would be those for *frequent events*.

# 6. Methodology

## Construction Noise and Vibration

The evaluation of potential noise and vibration impacts associated with project construction was based on the construction equipment schedule and phasing assumptions developed by the County, along with the methods described below.

### Noise

Construction-related noise was analyzed using data and modeling methodologies from the Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM) (Federal Highway Administration 2008), which predicts noise levels at nearby receptors by analyzing the type of equipment, the distance from source to receptor, usage factor, and the presence or absence of intervening shielding between source and receptor. RCNM is the most recent and comprehensive construction noise model developed and published by the federal government. Although the proposed project is not specifically a roadway construction project, the model is broad enough to be applicable, providing noise data for all of the equipment types typically required during conventional construction. Therefore, it is considered appropriate for use in analyzing the proposed project.

Project construction would be broken down into phases. Each phase of construction was assessed (refer to Appendix B), and the worst-case noise levels were identified during Phase 3, which assumed a combination of material import, grading/compaction, and paving activity. Noise levels from this worst-case phase were then analyzed at each of the closest NSLUs. To reflect the assumed distribution of equipment across the site, source-to-receptor distances used in the analysis were the acoustical average distances between the construction site and each receptor.[1]

Noise levels were conservatively assumed to decrease at a rate of 6 dB per doubling of distance, which is the standard assumption for acoustically hard (i.e., reflective) surfaces such as asphalt or concrete. In reality, the attenuation rate would likely be somewhat higher due to the high proportion of acoustically soft ground conditions in the project area (i.e., mostly unpaved with ground cover such as packed dirt, soft dirt, grass, or other vegetation).

### Vibration

Construction-related vibration was analyzed using data and modeling methodologies provided by the FTA guidance manual (FTA 2018), as required by the County of San Diego CEQA guidelines.

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

Although the proposed project is not a transit project, the model provides vibration data for all of the equipment types typically required during conventional construction as well as methods for estimating the propagation of groundborne vibration over distance. Therefore, it is considered appropriate for use in analyzing the proposed project. Because vibration is of concern at structures, as opposed to areas of outdoor use, the distances used in the analysis are the closest distances from the construction areas to the nearest buildings.

The following equation from the guidance manual was used to estimate PPV for the assessment of potential building damage impacts:

$$PPV_{rec} = PPV_{ref} \times (25/D)^{1.5}$$

where $PPV_{rec}$ is the PPV at a receptor; $PPV_{ref}$ is the reference PPV at 25 feet from the equipment; D is the distance from the equipment to the receiver, in feet; and 1.5 is a default value related to the vibration attenuation rate through the ground.

The following equation from the guidance manual was used to estimate $L_v$ for the assessment of potential annoyance to people:

$$L_{v,rec} = L_{v,ref} - 30 \times \log(D/25)$$

where $L_{v,rec}$ is the $L_v$ at a receptor; $L_{v,ref}$ is the reference $L_v$ at 25 feet from the equipment; and D is the distance from the equipment to the receiver, in feet.

The project would not require high-impact construction methods, such as pile driving or blasting. Therefore, the highest groundborne vibration levels would be associated with conventional heavy construction equipment such as bulldozers, excavators, and backhoes. FTA provides vibration source data for this type of equipment of 0.089 in/s PPV at a reference distance of 25 feet.

# Operational Noise

## Traffic Noise

The analysis of traffic noise in the study area was based on data from the Transportation Impact Analysis for the proposed project (Chen Ryan 2019). The analysis was conducted using a proprietary traffic noise model, with calculations based on data from the FHWA Traffic Noise Model, Version 2.5, Look-Up Tables (FHWA 2004). The inputs used in the traffic noise modeling included average daily traffic (ADT) volumes, assumed traffic mix and daily distribution (the percentage of automobiles versus medium trucks and heavy trucks during each hour of the day), and traffic speeds based on the posted speed limits. To quantify the effects of the proposed project, traffic noise was analyzed at a reference distance of 50 feet from the roadway centerline using four different scenarios: (1) existing, (2) existing with project, (3) cumulative without project, and (4) cumulative with project.

## Onsite Operations

The project description allows for a broad range of potential activities to occur at the site. To quantify a reasonable range of typical activities, three different scenarios were considered in the analysis: (1) an equestrian event, (2) a wedding ceremony conducted at the exterior patio adjacent to the meeting room, and (3) a wedding reception inside the meeting room. To gather representative noise levels for each scenario, a series of noise measurements were obtained of similar events occurring at similar venues in Southern California. The specifics of these events and the noise measurements conducted are described in greater detail below.

## Equestrian Event

Noise measurements were obtained at the east fence line of the George Ingalls Equestrian Event Center in the City of Norco on Saturday, March 18, 2017, between approximately 10:30 a.m. and 12:30 p.m. The event center has two covered arenas (roof only, no walls) with bleacher seating, announcers' booths, and public address (PA) systems. The closest arena was approximatively 375 feet from the measurement location. During the measurements, two events were occurring simultaneously and both arenas were being used. One event was the National Police Rodeo, and the other was the Norco Ranglers Gymkhana Horse Show. Noise from the arenas included buzzers/bells, PA announcements, and occasional crowd noise. Other noise sources included horses, people, and vehicles in the parking lot on the east side of the arenas. At least 70 to 80 vehicles (cars and pickup trucks) were visible on site, along with approximately 20 horse trailers and RVs. An unconfirmed number of additional vehicles were parked on the opposite (west) side of the arenas. The measured noise levels were up to 46.5 dBA $L_{eq}$.

## Wedding Ceremony

Noise measurements were obtained of an outdoor wedding ceremony at the Lakeside Community Center on Saturday, February 23, 2019, between approximately 3:10 and 3:40 p.m. The ceremony took place on the patio located on the east side of the community center building, adjacent to the west side of Lindo Lake. Approximately 200 guests were in attendance at the wedding. The measurement location was approximately 100 feet northwest of the closest wedding guests seated during the ceremony. The primary noise source during the ceremony was the wedding officiant, whose voice was amplified with a microphone and a single loudspeaker that was elevated approximately 6 feet above the ground on a large tripod. Other noise sources from the ceremony included recorded music playing over the loudspeaker and guests clapping. The ceremony was generally quiet, and ambient noise (from traffic, children playing at the nearby park and playgrounds, and birds) contributed to the overall noise level at the measurement location. While these ambient sources were excluded as much as possible from the measurement data, it was impossible to remove its influence completely. As a result, the gathered noise data is considered to be a conservative estimate of the actual wedding ceremony noise levels. The measured noise levels were up to 53.9 dBA $L_{eq}$.

## Wedding Reception

Wedding reception noise measurements were obtained at the same wedding, described above, at the Lakeside Community Center on Saturday, February 23, 2019, between approximately 4:30 and 8:00 p.m. The reception, with approximately 200 guests, took place inside the community center building. The measurement location was approximately 90 feet east of the building. The east façade of the reception hall, which faced the measurement microphone, contained three glass double doors and three large windows. The dominant noise source during the reception was amplified music played by a DJ with a full sound system located just inside the east building façade. The measured noise levels included the effects of wedding guests periodically opening the doors in the east façade in order to enter and exit the reception. During the later portion of the reception, the double doors were secured so that guests could exit through the east façade, but could not reenter. Instead they had to use an alternate door that did not open directly into the main reception; this served to reduce the noise that propagated outside of the building. Occasional noise was audible from guests talking on the patio area outside of the building, but smoking was not permitted on site and large groups did not congregate outside of the reception hall. The measured noise levels were up to 56.0 dBA $L_{eq}$.

To analyze noise from onsite operations, a three-dimensional computer noise model was developed using SoundPLAN software. The model takes into account many important variables, including the sound power of each noise source, the heights of the noise sources and receptors, the distance to noise-sensitive receptors, and the local ground conditions. Because the project vicinity is generally flat and contains few solid barriers to noise (for example properties have picket or chain link fences rather than solid property line walls), site topography and possible barrier effects of walls, buildings, and terrain were not included in the modeling. The geometry for the model was based on the site plans, proposed project plans, and publicly available aerial photography (i.e., Google Earth).

First, a model was developed of each existing scenario (the equestrian event, wedding ceremony, and wedding reception described above) and calibrated to match the measured noise levels. This provided calculated sound powers for the primary noise sources that could to be used in subsequent modeling.

Next, a model was developed of the proposed Lakeside Equestrian Center site and the neighboring land uses. For the equestrian event scenario, it was assumed that events would occur simultaneously at both arenas, as well as general activity associated with people and animals at other areas of the site. In addition, based on data provided by the traffic study, it was assumed that there would be 85 vehicle movements in or out of the parking lot over the course of an hour. For the wedding ceremony scenario, it was assumed that the activity would occur outside at the proposed patio on the north side of the meeting room. For the wedding reception scenario, it was assumed that the activity would occur inside the proposed meeting room with all doors and windows kept closed, except for the occasional opening of doors for guests to enter or exit the building.

# 7. Impacts Analysis

## Construction

### Noise

Two types of short-term noise impacts could occur during project construction. First, construction vehicles would incrementally increase noise levels on access roads. This would include construction worker vehicles and haul trucks traveling to and from the project site. Although there would be a relatively high single-event noise level, which could cause an intermittent noise nuisance (e.g., passing trucks at 50 feet would generate up to 77 dBA), the effect on longer-term ambient noise levels would be small. Therefore, there would be no impacts related to the short-term noise associated with commuting construction workers and transporting equipment and materials to the project site.

The second category of construction noise would be noise generated during on-site project construction. Construction would occur only during the periods permitted by the County's Municipal Code (7 a.m. to 7 p.m.) Detailed construction noise analysis tables are provided in Appendix B of this report. The results are summarized in Table 6.

**Table 6. Predicted Construction Noise during Loudest Phase at the Closest NSLUs**

| **Analysis Location** | **Combined Construction 8-Hour Average Noise Level, dBA, $L_{eq}$** |
|---|---|
| Closest NSLU (residence) north of project site, on Mary Lane | 65 |
| Closest NSLU (residence) west of project site on Moreno Avenue | 71 |
| Closest NSLU (residences at Starwood Ranch) east of project site | 70 |
| Closest NSLU (residence) southwest of project site on Willow Road | 71 |
| Closest NSLU (residence) southeast of project site on Redlander Way | 70 |

The predicted construction noise levels at all of the closest NSLUs exceed the measured ambient noise levels and would be clearly audible at these locations. Nonetheless, all of the predicted construction noise levels comply with the County's 8-hour $L_{eq}$ standard of 75 dBA; as a result, the impact would be less than significant.

## Vibration

Heavy construction equipment would generate groundborne vibration that could affect nearby structures or residents. Each of the potential types of construction impact (building damage and human annoyance) is discussed in further detail below.

### Potential Building Damage

For the purposes of assessing structural vibration sensitivity, the closest structures north and east of the project site are considered to be non-engineered timber and masonry buildings. This is likely to be a conservative assumption but is considered a sensible approach because the construction and condition of the structures have not been inspected or verified. Detailed construction vibration analysis tables are provided in Appendix C of this report. The results are summarized in Table 7. As shown in the table, the predicted PPV at all locations is well below the applicable threshold for potential building damage. The impact would be less than significant.

**Table 7. Predicted Construction Vibration (PPV) at the Closest Sensitive Structures**

| Analysis Location | Applicable Criterion, PPV, in/s | Maximum Predicted PPV, in/s |
|---|---|---|
| Closest sensitive structure (residence) north of project site, on Mary Lane | 0.2 | Less than 0.01 |
| Closest sensitive structure (residence) west of project site on Moreno Avenue | 0.2 | 0.01 |
| Closest sensitive structure (residences at Starwood Ranch) east of project site | 0.2 | 0.01 |
| Closest sensitive structure (residence) southwest of project site on Willow Road | 0.2 | 0.01 |
| Closest sensitive structure (residence) southeast of project site on Redlander Way | 0.2 | 0.01 |

### Human Annoyance

The vibration velocity levels ($L_v$) at the nearest residential buildings were calculated to assess the potential for annoyance to people at those locations. Detailed construction vibration analysis tables are provided in Appendix C of this report. The results are summarized in Table 8. As shown in the table, the predicted $L_v$ at all locations is below the applicable threshold for annoyance. The impact would be less than significant.

**Table 8. Guideline Building Damage Criteria and Impact Distances**

| Analysis Location | Applicable Criterion, $L_v$ (VdB) | Maximum Predicted $L_v$ (VdB) |
|---|---|---|
| Closest sensitive structure (residence) north of project site, on Mary Lane | 72 | 54 |
| Closest sensitive structure (residence) west of project site on Moreno Avenue | 72 | 65 |
| Closest sensitive structure (residences at Starwood Ranch) east of project site | 72 | 67 |
| Closest sensitive structure (residence) southwest of project site on Willow Road | 72 | 67 |
| Closest sensitive structure (residence) southeast of project site on Redlander Way | 72 | 66 |

# Project Operation

## Traffic

The project would generate new vehicle trips that would add to traffic on surrounding streets and change the associated traffic noise. Table 9 summarizes the predicted noise levels both with and without the project, from the roadway segments considered in the Transportation Impact Analysis (refer to Appendix D for the noise modeling). The project does not propose any new NSLUs and would not increase traffic noise levels from below 60 dB CNEL to above 60 dB CNEL at any existing NSLU along the affected roadways. The project also would not cause any traffic noise increase of 10 dB or more. The predicted traffic noise increases of 0 to 0.8 dB would generally be considered imperceptible. Therefore, the impact of project traffic noise on the surrounding community would not be significant.

**Table 9. Estimated Traffic Noise Levels**

| | Estimated Traffic Noise Levels at 50 feet from Roadway Centerline (dB CNEL) | | | | | |
|---|---|---|---|---|---|---|
| **Roadway Segment** | **Existing** | **Existing + Project** | **Increase over Existing** | **Cumulative without Project** | **Cumulative with Project** | **Increase over Cumulative without Project** |
| **SR-67** | | | | | | |
| Kuhner Way to Willow Road | 73.4 | 73.4 | 0.0 | 73.9 | 73.9 | 0.0 |
| Willow Road to Mapleview Street | 74.2 | 74.3 | 0.0 | 74.7 | 74.7 | 0.0 |
| **Moreno Avenue** | | | | | | |
| Mary Lane to Willow Road | 63.3 | 63.6 | 0.2 | 63.3 | 63.6 | 0.2 |
| **Willow Road** | | | | | | |
| SR-67 to Moreno Avenue | 62.7 | 62.9 | 0.1 | 62.7 | 63.5 | 0.8 |

## Onsite Operations

### Noise

Using the noise model described previously, noise levels for each operational scenario were analyzed at multiple points along the property lines of the closest neighboring NSLUs in each direction (north, east, south, and west) from the project site. Complete results are provided in Appendix E. The worst-case noise levels for each of the analyzed operational scenarios are summarized in Table 10 and assessed against the applicable sound level limits. As stated in Section 5 (see Table 3), the base one-hour average ($L_{eq}$) sound level limit for all of the neighboring residential uses is 50 dBA. However, because the measured average ambient noise level at each location was greater than 50 dBA, the actual limits are increased to the ambient level plus 3 dB. For informational purposes, the predicted noise levels are compared to both the unadjusted and the adjusted sound level limits in Table 10, but the assessment of impact is based solely on the comparison with the adjusted limits. All except one of the predicted noise levels comply with both the base (unadjusted) and adjusted sound level limits. Predicted equestrian event noise levels of 50.5 dBA at the NSLU to the east exceed the base sound level limit by 0.5 dB but comply with the adjusted sound level limit of 55 dBA. Therefore, the impact is less than significant.

**Table 10. Predicted Operational Noise Levels at the Closest NSLUs**

| | 1-hour Leq, dBA | | | | Exceeds Sound Level Limits? | | |
|---|---|---|---|---|---|---|---|
| Analysis Location | Predicted | Measured Average Daytime Ambient | Base (Unadjusted) Sound Level Limit | Adjusted Sound Level Limit[1] | Unadjusted | Adjusted | Significant Impact? |
| **Equestrian Event** | | | | | | | |
| NSLU to east | 50.5 | 52 | 50 | 55 | Yes | No | No |
| NSLU to north | 47.3 | 52 | 50 | 55 | No | No | No |
| NSLU to south | 45.4 | 56 | 50 | 59 | No | No | No |
| NSLU to west | 49.6 | 55 | 50 | 58 | No | No | No |
| **Wedding Ceremony** | | | | | | | |
| NSLU to east | 44.7 | 52 | 50 | 55 | No | No | No |
| NSLU to north | 37.3 | 52 | 50 | 55 | No | No | No |
| NSLU to south | 43.5 | 56 | 50 | 59 | No | No | No |
| NSLU to west | 42.2 | 55 | 50 | 58 | No | No | No |
| **Wedding Reception** | | | | | | | |
| NSLU to east | 44.2 | 52 | 50 | 55 | No | No | No |
| NSLU to north | 37.1 | 52 | 50 | 55 | No | No | No |
| NSLU to south | 43.5 | 56 | 50 | 59 | No | No | No |
| NSLU to west | 41.6 | 55 | 50 | 58 | No | No | No |

[1] Adjusted sound level limit = measured average daytime ambient $L_{eq}$ + 3 dB

## Vibration

Once the proposed project is operational, there would be no substantial sources of groundborne vibration at the project site. It is possible that site maintenance would occasionally require mechanized equipment, but such equipment would be no larger than the construction equipment analyzed above. Noting that the construction vibration analysis found vibration levels to be well below adopted thresholds at all sensitive receptors, it is clear that offsite vibration from occasional site maintenance would be negligible. There would be no vibration impacts due to onsite project operations.

### Aircraft Noise

There are no private airstrips within the vicinity (i.e., within 1 mile) of the proposed project site. The closest airport is Gillespie Field, which is more than 4 miles to the southwest. At this distance the site is not exposed to substantial noise levels from aircraft operations. In addition, the project would not change the operations at any airport or airstrip, and would not alter the aircraft noise exposure at any existing NSLUs. As such, the project implementation would not expose people residing or working in the project area to excessive aircraft noise levels. Therefore, the impact is less than significant.

# 8. Mitigation Measures

The analyses above did not identify any significant impacts. However, the analyses assume that a number of best practices and operational controls would be in place during the operation of the Lakeside Equestrian Center. These are based on typical rules and regulations enforced at existing County parks and community centers, as well as controls observed during the representative noise source measurements obtained as part of this study. To ensure these best practices and controls are incorporated into the proposed project, they are listed below as required mitigation measures.

**Mitigation Measure NOI-1. Enforce all applicable standard rules and regulations for DPR facilities including, but not limited to:**

- Quiet Hours are from 10:00 p.m. to 7:00 a.m.
- Dogs must be licensed and restrained on a leash not longer than 6 feet and attended at all times. (This restriction will not apply to dogs while participating in any authorized dog show at the proposed project.)
- No person will disturb the peace and quiet of a County park by any loud or unusual noise, or by the sounding of automobile horns or noise-making devices, or by the use of profane, obscene, or abusive language or gestures.
- No person will use, transport, carry, fire, or discharge any fireworks, firearm, weapon, air gun, archery device, slingshot, or explosive of any kind across, in, or into a County park.
- The applicable requirements of DPR Policy Number C-06, *Noise Regulation in County Parks* will be enforced.

**Mitigation Measure NOI-2. Enforce operational limits and restrictions on all typical events at the project site.** Except for occasional special events conducted pursuant to a specific permit (conditional use permit, special event permit, etc.), enforce the following operational restrictions:

- Limit the maximum number of overnight RVs on site to five.
- Prohibit the use of noise-generating equipment (noise-makers, bullhorns, air horns, amplified stereos/radios, etc.) by spectators. The only exception is for official use of the announcer's PA systems or other devices required for proper operation of the intended and approved activities.
- For weddings, parties, and other events at the meeting room, restrict outdoor noise to low level sources such as unamplified music. Where amplified sound is required at the patio, such as for voice amplification or recorded music playback during a wedding ceremony, the levels will not exceed those necessary for audibility at the patio area.
- Keep all exterior meeting room doors and windows closed when amplified music is being played inside the building.
- End all on site events no later than 10:00 p.m.
- Limit all event sizes so as not to exceed the onsite parking capacity of the project. For any events that are anticipated to exceed this limit, require the organizers to provide off-site parking and shuttle service.

# 9. Additional Noise Control Measures

Either as part of the initial lease conditions for the site, or in the event that the project generates noise complaints once it is operational, DPR may wish to consider additional noise control measures such as:

- Establishing additional restrictions on the start and end times for individual events.
- Establishing maximum duration(s) for onsite events, including weddings and parties at the meeting room.
- Working with user groups to identify and eliminate problematic activities or behaviors.
- Conducting noise measurements to confirm noise levels at sensitive receptors.
- Prohibiting specific events or types of events if they generate ongoing noise violations that cannot be remedied.
- Establishing limits on the number of attendees at various types of events.
- Regulating the alcohol consumption at events. For instance the type of drinks allowed (beer and wine only, no hard liquor with alcohol over 20% by volume), how much can be served, and for how long.

# 10. Summary and Conclusions

Noise and vibration analyses were conducted for the Lakeside Equestrian Center. The analyses address potential affects from both project construction and operation. All evaluated effects were determined to have either no impact or a less-than-significant impacts. However, because these findings were based on a number of important operational assumptions, those assumptions have been included as noise mitigation measures to ensure that they are incorporated into the ultimate project operation. Additional noise control measures have also been provided for consideration by DPR either now or in the future should additional noise reduction be desired.

# 11. References

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**Attachments**: Appendix A. Field Data Sheets and Photos for Ambient Noise Measurements

Appendix B. Construction Noise Analysis

Appendix C. Construction Vibration Analysis

Appendix D. Traffic Noise Modeling

Appendix E. Operational Noise Analysis

Source: ESRI World Map (2012).

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**Figure 1**
**Regional Location**
**Lakeside Equestrian Facility**

Source: Imagery-Bing, 2018.

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**Figure 2**
**Project Location**
**Lakeside Equestrian Facility**

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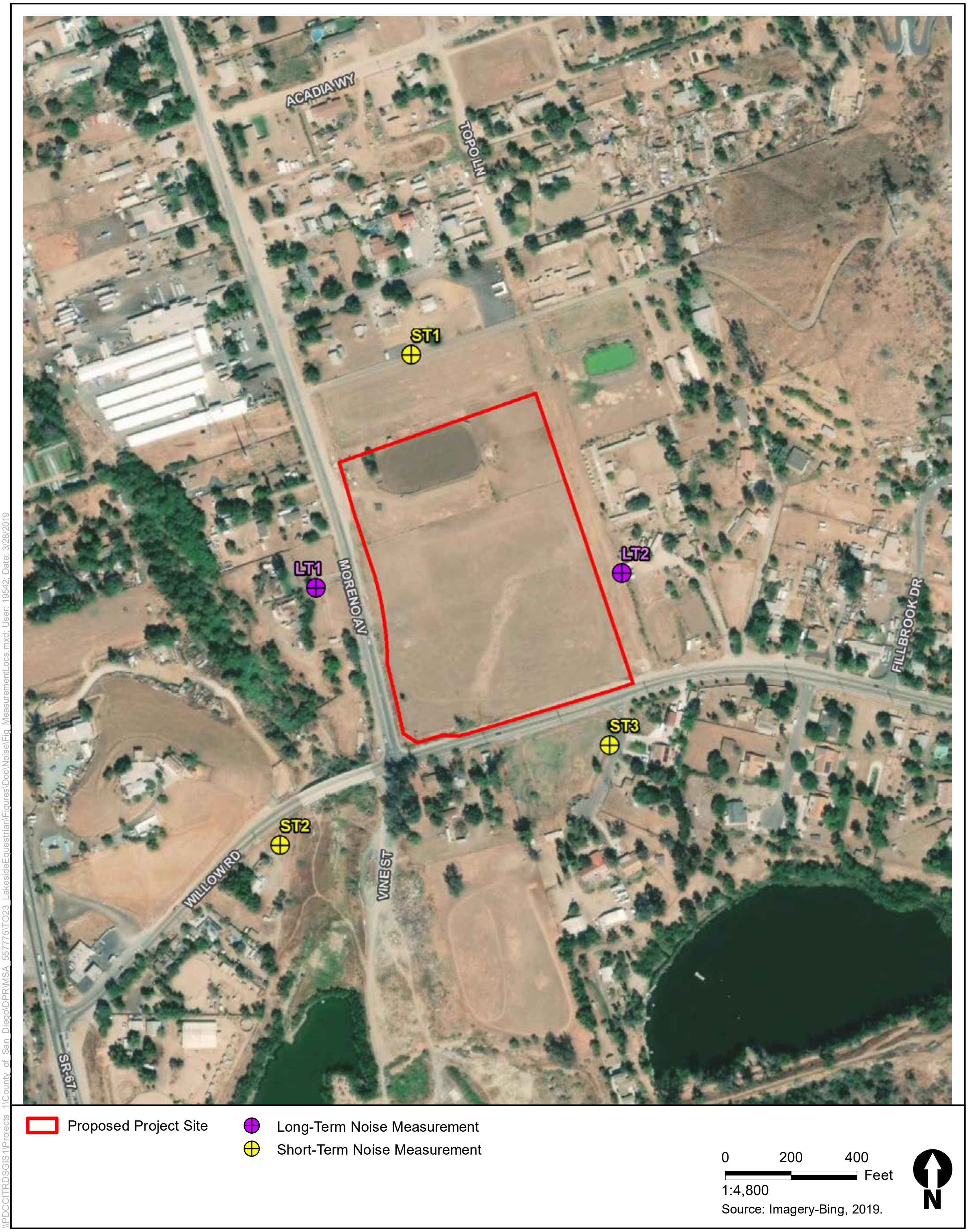
ICF

**Figure 3**
**Proposed Project**
**Lakeside Equestrian Facility**



Source: Imagery-Bing, 2019.

\\PDCCITRDSGIS1\Projects_1\County_of_San_Diego\DPR\MSA_557775\TO23_LakesideEquestrian\Figures\Doc\Noise\Fig_MeasurementLocs.mxd; User: 19542; Date: 3/28/2019

ICF

Figure 4
Ambient Noise Measurement Locations
Lakeside Equestrian Facility

# Appendix A. Field Data Sheets and Photos for Ambient Noise Measurements

# FIELD NOISE MEASUREMENT DATA

PROJECT: Lakeside Equestrian PROJ. # 49.17

**SITE IDENTIFICATION:** LT1 OBSERVER(S): JGM
ADDRESS: 11036 Moreno Ave Lakeside
START DATE / TIME: 1:00 PM 3/16/2017 END DATE / TIME: 3/20/17 2:10 PM

**METEROLOGICAL CONDITIONS:**
TEMP: ______ °F HUMIDITY: ______ %R.H. WIND: **CALM LIGHT MODERATE VARIABLE**
WINDSPEED: ______ MPH DIR: **N NE E SE S SW W NW** **STEADY GUSTY**
SKY: **SUNNY CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:**

**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: Rion NL-21 TYPE: 1 [✓ 2] SERIAL #: 00776887
CALIBRATOR: LD Cal 200 SERIAL #: 6645
CALIBRATION CHECK, BEFORE: 114.0 AFTER 113.9 WINDSCREEN ✓

SETTINGS: **[✓ A-WEIGHTED] [✓ SLOW] FAST FRONTAL [✓ RANDOM] [✓ ANSI]** OTHER: ______

| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | L | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | max | 1.67 | 8.33 | 25 | 50 | 90 | 99 | min |
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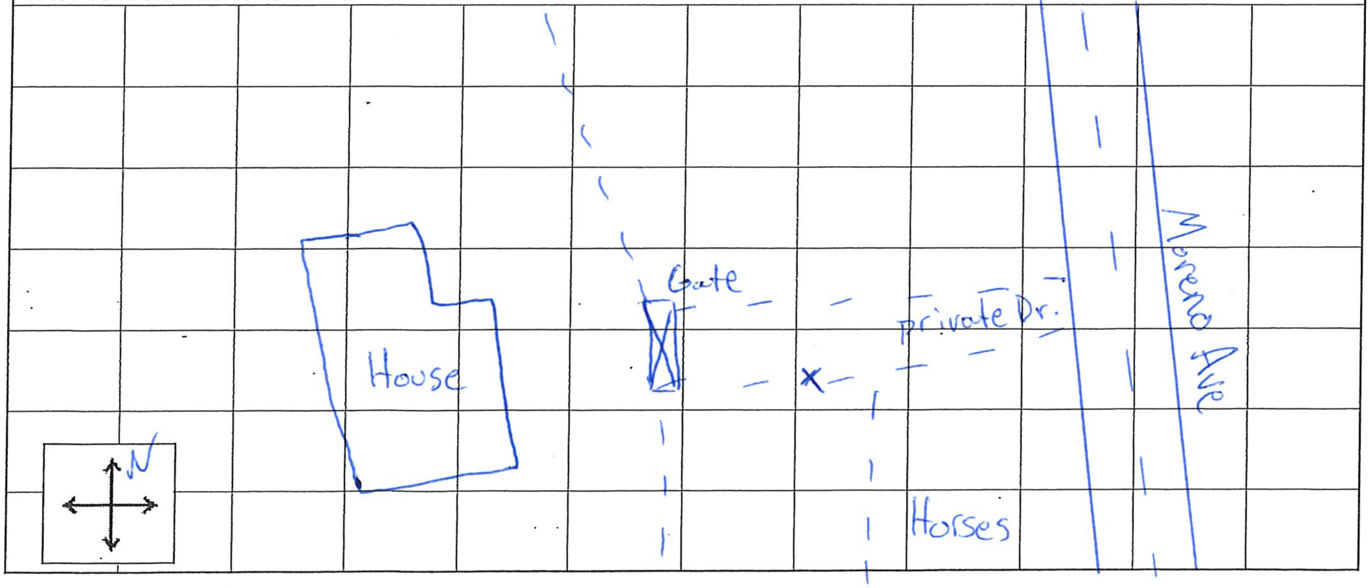
COMMENTS:

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: **TRAFFIC AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:** ______
ROADWAY TYPE: ______
OTHER SOURCES: **DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL**
**DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:**

**DESCRIPTION / SKETCH:**
TERRAIN: **HARD SOFT MIXED FLAT OTHER:** 100ft to Moreno Curb, 110ft to House
PHOTOS: (in front of tree) 24ft to opposite fence (N)
OTHER COMMENTS / SKETCH:



# FIELD NOISE MEASUREMENT DATA

PROJECT: Lakeside Equestrian PROJ. # 49.17

**SITE IDENTIFICATION:** LT2 OBSERVER(S): JGM
ADDRESS: 12620 Willow Rd Lakeside
START DATE / TIME: 2:00PM 3/16/2017 END DATE / TIME: 3/20/17 2:27 PM

**METEROLOGICAL CONDITIONS:**
TEMP: ______ °F HUMIDITY: ______ %R.H. WIND: CALM LIGHT MODERATE VARIABLE
WINDSPEED: ______ MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: SUNNY CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: Rion NL-21 TYPE: 1 2 SERIAL #: 00676771
CALIBRATOR: LD Cal 200 SERIAL #: 6645
CALIBRATION CHECK, BEFORE: 114.0 AFTER ______ WINDSCREEN ✓

SETTINGS: [✓ A-WEIGHTED] [✓ SLOW] FAST FRONTAL [✓ RANDOM] [✓ ANSI] OTHER: ______

| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | max | L 1.67 | 8.33 | 25 | 50 | 90 | 99 | min |
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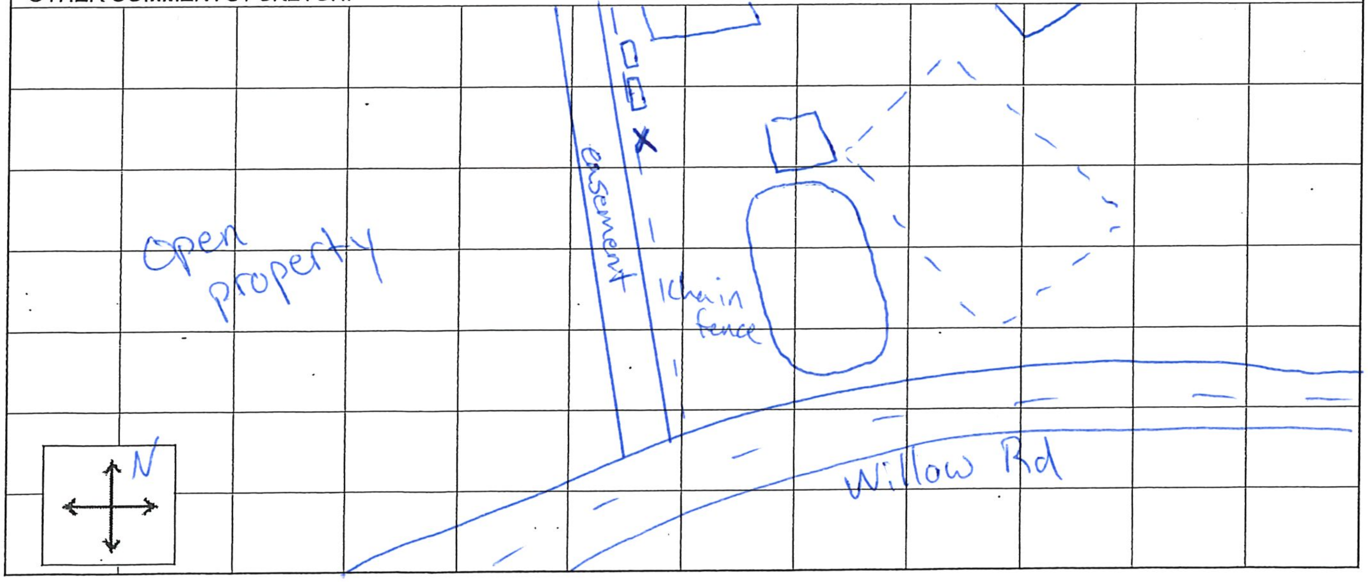
COMMENTS:

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: TRAFFIC AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER: ______
ROADWAY TYPE:
OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

**DESCRIPTION / SKETCH:**
TERRAIN: HARD [✓ SOFT] MIXED FLAT OTHER: 14 ft to nearest Palm Tree,
PHOTOS: 8 ft to nearest shed wall, 30 ft to nearest home
OTHER COMMENTS / SKETCH:



# FIELD NOISE MEASUREMENT DATA

PROJECT: Lakeside Equestrian PROJ. # 49.17

**SITE IDENTIFICATION:** ST1 OBSERVER(S): JGM
ADDRESS: Behind second house on Mary Ln, Lakeside
START DATE / TIME: 2:07PM 3/16/2017 END DATE / TIME: 2:23 3/16/2017

**METEROLOGICAL CONDITIONS:**
TEMP: 85 °F HUMIDITY: 48 %R.H. WIND: [✓ CALM] LIGHT MODERATE VARIABLE
WINDSPEED: 0-2 MPH DIR: toward N [✓ NE] E SE S SW W NW STEADY GUSTY
SKY: [✓ SUNNY] CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: LD 831 TYPE: [✓ 1] 2 SERIAL #: 3786
CALIBRATOR: LD Cal 200 SERIAL #: 6645
CALIBRATION CHECK, BEFORE: 114.0 AFTER 113.98 WINDSCREEN ✓

SETTINGS: [✓ A-WEIGHTED] [✓ SLOW] FAST FRONTAL [✓ RANDOM] [✓ ANSI] OTHER:

| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | max | | | | L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1.67 | 8.33 | 25 | 50 | 90 | 99 | min |
| 371 | 2:07 | 2:23 | 52.0 | 59.4 | 57.3 | 54.5 | 52.6 | 51.3 | 48.3 | 44.8 | 43.9 |
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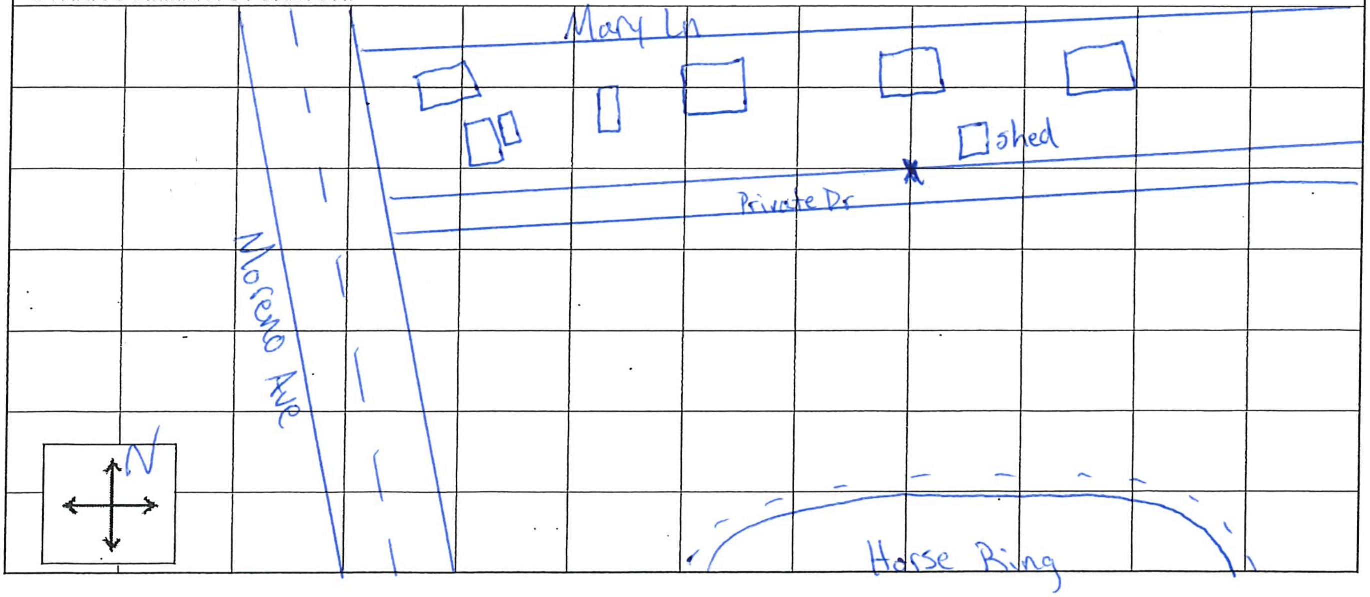
COMMENTS:

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: [✓ TRAFFIC] [✓ AIRCRAFT] RAIL INDUSTRIAL [✓ AMBIENT] OTHER:
ROADWAY TYPE:
OTHER SOURCES: [✓ DIST. AIRCRAFT] / RUSTLING LEAVES / DIST. BARKING DOGS / [✓ BIRDS] / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / [✓ DIST. TRAFFIC] / [✓ DIST. LANDSCAPING ACTIVITIES] / OTHER:
Electric buzzing from power lines

**DESCRIPTION / SKETCH:**
TERRAIN: HARD SOFT [✓ MIXED] FLAT OTHER: 20ft to shed, 90ft to house, 230ft to current horse ring
PHOTOS:
OTHER COMMENTS / SKETCH:



# FIELD NOISE MEASUREMENT DATA

PROJECT: Lakeside Equestrian PROJ. # 49.17

**SITE IDENTIFICATION:** ST2 OBSERVER(S): JGM
ADDRESS: 12403 Willow Rd Lakeside
START DATE / TIME: 3:04 PM 3/16/2017 END DATE / TIME: 3:19PM 3/16/2017

**METEROLOGICAL CONDITIONS:**
TEMP: 85 °F HUMIDITY: 45 %R.H. WIND: [✓ CALM] LIGHT MODERATE VARIABLE
WINDSPEED: 0-2 MPH DIR: toward N [✓ NE] E SE S SW W NW STEADY GUSTY
SKY: [✓ SUNNY] CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: LD 831 TYPE: [✓ 1] 2 SERIAL #: 3786
CALIBRATOR: LD Cal 200 SERIAL #: 6645
CALIBRATION CHECK, BEFORE: 114.0 AFTER 114.09 WINDSCREEN ✓

SETTINGS: [✓ A-WEIGHTED] [✓ SLOW] FAST FRONTAL [✓ RANDOM] [✓ ANSI] OTHER:

| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | max | L 1.67 | L 8.33 | L 25 | L 50 | L 90 | L 99 | min |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 373 | 3:04 | 3:19 | 62.5 | 75.3 | 69.9 | 66.2 | 62.9 | 59.8 | 51.4 | 47.1 | 45.7 |
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COMMENTS:

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: [✓ TRAFFIC] AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:
ROADWAY TYPE:
OTHER SOURCES: DIST. [✓ AIRCRAFT] / RUSTLING LEAVES / DIST. BARKING DOGS / [✓ BIRDS] / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

**DESCRIPTION / SKETCH:**
TERRAIN: HARD [✓ SOFT] MIXED FLAT OTHER: 50 ft to curb, 130 ft to House
PHOTOS: 45 ft to barb wire fence along river bed.
OTHER COMMENTS / SKETCH:

# FIELD NOISE MEASUREMENT DATA

PROJECT: Lakeside Equestrian PROJ. #: 49.17

**SITE IDENTIFICATION:** ST3
OBSERVER(S): JGM
ADDRESS: 10825 Redlander Way, Lakeside
START DATE / TIME: 2:31 PM 3/16/2017
END DATE / TIME: 2:47PM 3/16/2017

**METEROLOGICAL CONDITIONS:**
TEMP: 83 °F HUMIDITY: 46 %R.H. toward WIND: CALM [✓ LIGHT] MODERATE VARIABLE
WINDSPEED: 2-5 MPH DIR: N [✓ NE] E SE S SW W NW STEADY GUSTY
SKY: [✓ SUNNY] CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: LD 831 TYPE: [✓ 1] 2 SERIAL #: 3786
CALIBRATOR: LD Cal 200 SERIAL #: 6645
CALIBRATION CHECK, BEFORE: 114.0 AFTER 114.06 WINDSCREEN ✓

SETTINGS: [✓ A-WEIGHTED] [✓ SLOW] FAST FRONTAL [✓ RANDOM] [✓ ANSI] OTHER:

| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | max | L | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1.67 | 8.33 | 25 | 50 | 90 | 99 | min |
| 372 | 2:31 | 2:47 | 56.2 | 70.0 | 62.8 | 59.6 | 57.0 | 54.3 | 49.1 | 46.8 | 45.9 |
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COMMENTS:

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: [✓ TRAFFIC] [✓ AIRCRAFT] RAIL INDUSTRIAL [✓ AMBIENT] OTHER:
ROADWAY TYPE:
OTHER SOURCES: [✓ DIST. AIRCRAFT] / RUSTLING LEAVES / DIST. BARKING DOGS / [✓ BIRDS] / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / [✓ DIST. TRAFFIC] / DIST. LANDSCAPING ACTIVITIES / OTHER:

**DESCRIPTION / SKETCH:**
TERRAIN: HARD [✓ SOFT] MIXED FLAT OTHER: 15ft to Redlander Curb, 117ft to Willow Curb, 130 ft to nearest home
PHOTOS:
OTHER COMMENTS / SKETCH:

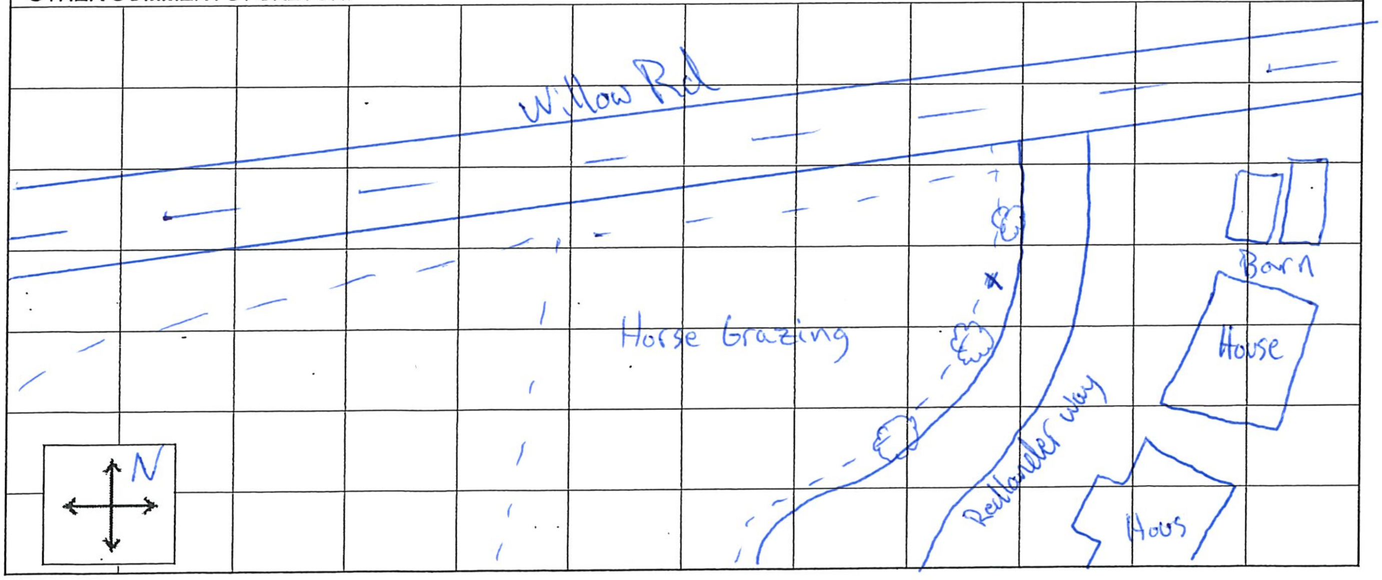

Photo 1. LT1 looking north

Photo 2. LT1 looking east

Photo 3. LT1 looking south

Photo 4. LT1 looking west

Photo 5. LT2 looking north

Photo 6. LT2 looking east

Photo 7. LT2 looking south

Photo 8. LT2 looking west

Photo 9. ST1 looking north

Photo 10. ST1 looking east

Photo 11. ST1 looking south

Photo 12. ST1 looking west

Photo 13. ST2 looking north

Photo 14. ST2 looking east

Photo 15. ST2 looking south

Photo 16. ST2 looking west

Photo 17. ST3 looking north

Photo 18. ST3 looking east

Photo 19. ST3 looking south

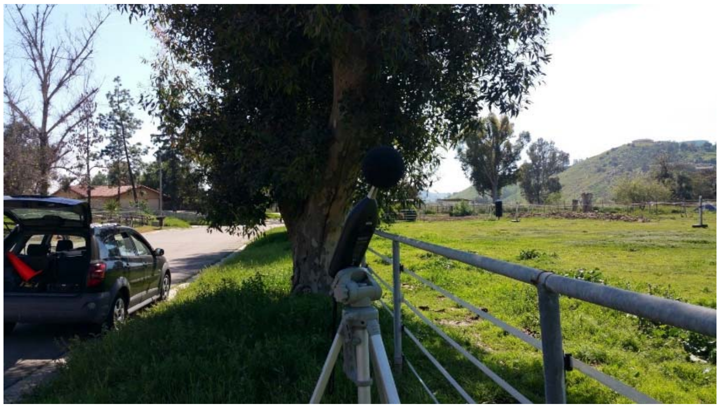

Photo 20. ST3 looking west

# Appendix B. Construction Noise Analysis

## Table B1. Construction Noise Analysis - Phase 1, General Grading

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hours per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | 8-hour Leq, dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 13 | Dozer | 81.7 | 0.4 | 1 | 7 | 50 | hard | 0 | 77 |
| 70 | Water Truck | 74.3 | 0.4 | 1 | 4 | 50 | hard | 0 | 67 |
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| | ***Combined Equipment*** | | | | | | | | ***78*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

**Table B2. Construction Noise Analysis - Phase 2, Utility Improvements**

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hours per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | 8-hour Leq, dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 2 | Backhoe | 77.6 | 0.4 | 1 | 7 | 50 | hard | 0 | 73 |
| 71 | Fork Lift | 79.1 | 0.4 | 1 | 6 | 50 | hard | 0 | 74 |
| 72 | Backhoe w/ Vib. Plate | 77.6 | 0.4 | 1 | 6 | 50 | hard | 0 | 72 |
| 70 | Water Truck | 74.3 | 0.4 | 1 | 4 | 50 | hard | 0 | 67 |
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| | ***Combined Equipment*** | | | | | | | | ***78*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Table B3.  Construction Noise Analysis - Phase 3, D/G Import

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hours per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | 8-hour Leq, dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 61 | Truck, Dump | 76.5 | 0.4 | 1 | 8 | 50 | hard | 0 | 73 |
| 13 | Dozer | 81.7 | 0.4 | 1 | 6 | 50 | hard | 0 | 76 |
| 23 | Grader | 85 | 0.4 | 1 | 4 | 50 | hard | 0 | 78 |
| 70 | Water Truck | 74.3 | 0.4 | 1 | 6 | 50 | hard | 0 | 69 |
| 44 | Roller | 80 | 0.2 | 1 | 4 | 50 | hard | 0 | 70 |
| 31 | Mixer, Concrete (or concrete m | 78.8 | 0.4 | 4 | 6 | 50 | hard | 0 | 80 |
| 34 | Paver | 77.2 | 0.5 | 1 | 7 | 50 | hard | 0 | 74 |
| 44 | Roller | 80 | 0.2 | 1 | 7 | 50 | hard | 0 | 72 |
| 29 | Loader (Front End Loader) | 79.1 | 0.4 | 1 | 7 | 50 | hard | 0 | 75 |
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| | ***Combined Equipment*** | | | | | | | | ***85*** |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971

2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Table B4. Construction Noise Analysis - Phase 4, Fencing (Lodge Pole & Chain Link)

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hours per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | 8-hour Leq, dBA |
|---|---|---|---|---|---|---|---|---|---|
| **Item No.** | **Description** | | | | | | | | |
| 73 | Bobcat w/ Auger | 84.4 | 0.2 | 1 | 6 | 50 | hard | 0 | 76 |
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| | ***Combined Equipment*** | | | | | | | | ***76*** |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Table B5. Construction Noise Analysis - Phase 5, Arena Foundations + Frame + Roofing

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hours per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | 8-hour Leq, dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 15 | Drill Rig, Auger | 84.4 | 0.2 | 1 | 7 | 50 | hard | 0 | 77 |
| 29 | Loader (Front End Loader) | 79.1 | 0.4 | 1 | 6 | 50 | hard | 0 | 74 |
| 74 | Semi-end dump | 76.5 | 0.4 | 1 | 7 | 50 | hard | 0 | 72 |
| 31 | Mixer, Concrete (or concrete m | 78.8 | 0.4 | 1 | 4 | 50 | hard | 0 | 72 |
| 71 | Fork Lift | 79.1 | 0.4 | 1 | 6 | 50 | hard | 0 | 74 |
| 12 | Crane | 80.6 | 0.16 | 1 | 7 | 50 | hard | 0 | 72 |
| 30 | Man Lift | 74.7 | 0.2 | 1 | 7 | 50 | hard | 0 | 67 |
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| | *Combined Equipment* | | | | | | | | *82* |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

**Table B6. Construction Noise Analysis - Phase 6, Covered Arena Amenities**

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hours per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | 8-hour Leq, dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 30 | Man Lift | 74.7 | 0.2 | 1 | 7 | 50 | hard | 0 | 67 |
| 71 | Fork Lift | 79.1 | 0.4 | 1 | 7 | 50 | hard | 0 | 75 |
| 10 | Compressor, Air | 77.7 | 0.4 | 1 | 3 | 50 | hard | 0 | 69 |
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| | ***Combined Equipment*** | | | | | | | | ***76*** |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Table B7. Construction Noise Analysis - Phase 7, Outdoor Arena

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hours per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | 8-hour Leq, dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 10 | Compressor, Air | 77.7 | 0.4 | 1 | 7 | 50 | hard | 0 | 73 |
| 71 | Fork Lift | 79.1 | 0.4 | 1 | 7 | 50 | hard | 0 | 75 |
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| | ***Combined Equipment*** | | | | | | | | ***77*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Table B8. Construction Noise Analysis - Phase 8, Meeting Room/Concession/Restroom

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hours per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | 8-hour Leq, dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 71 | Fork Lift | 79.1 | 0.4 | 1 | 7 | 50 | hard | 0 | 75 |
| 12 | Crane | 80.6 | 0.16 | 1 | 7 | 50 | hard | 0 | 72 |
| 31 | Mixer, Concrete (or concrete m | 78.8 | 0.4 | 1 | 6 | 50 | hard | 0 | 74 |
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| | ***Combined Equipment*** | | | | | | | | ***78*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Table B9. Construction Noise Analysis - Phase 9, Corrals

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hours per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | 8-hour Leq, dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 71 | Fork Lift | 79.1 | 0.4 | 1 | 7 | 50 | hard | 0 | 75 |
| 10 | Compressor, Air | 77.7 | 0.4 | 1 | 7 | 50 | hard | 0 | 73 |
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| | ***Combined Equipment*** | | | | | | | | ***77*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Table B10. Construction Noise Analysis - Phase 10, Shade Structures

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hours per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | 8-hour Leq, dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 71 | Fork Lift | 79.1 | 0.4 | 1 | 6 | 50 | hard | 0 | 74 |
| 31 | Mixer, Concrete (or concrete m | 78.8 | 0.4 | 1 | 6 | 50 | hard | 0 | 74 |
| 30 | Man Lift | 74.7 | 0.2 | 1 | 6 | 50 | hard | 0 | 66 |
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| | ***Combined Equipment*** | | | | | | | | ***77*** |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

**Table B11. Construction Noise Analysis - Phase 11, Landscaping Improvements**

| Equipment | | Typical Level @ 50', dBA[1] | Usage Factor[1,2] | Number of Units | Hours per Day | Distance to Receiver, ft. | Hard or Soft Site? | Barrier Attenuation, dB | 8-hour Leq, dBA |
|---|---|---|---|---|---|---|---|---|---|
| Item No. | Description | | | | | | | | |
| 55 | Slurry Trenching Machine | 80.4 | 0.5 | 1 | 6 | 50 | hard | 0 | 76 |
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| | ***Combined Equipment*** | | | | | | | | ***76*** |

1. Obtained or estimated from:
   FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
   "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; and/or
   "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

## Table B12. Construction Noise Analysis at Closest NSLU During Loudest Phase (Phase 3, D/G Import)

| Loudest Phase | 8-hour Leq @ 50 feet, dBA | Receiver # | Receiver Location | Distance to Receiver, feet | 8-hour Leq, dBA |
|---|---|---|---|---|---|
| Phase 3: D/G import | 85 | 1 | Closest NSLU to north | 506 | 64.7 |
| | | 2 | Closest NSLU to west | 251 | 70.8 |
| | | 3 | Closest NSLU to east | 286 | 69.7 |
| | | 4 | Closest NSLU to southwest | 238 | 71.3 |
| | | 5 | Closest NSLU to southeast | 290 | 69.5 |

# Appendix C. Construction Vibration Analysis

## Table C1. Construction Vibration Analysis - Potential Building Damage

| | |
|---|---|
| Vibration attenuation constant (n): | 1.5 |
| Vibration source: | Large bulldozer[a] |
| Reference PPV at 25 feet, in/s [b] | 0.089 |

| Receiver | Potential Damage Criterion, PPV, in/s | Distance, ft | PPV @ Receiver | Impact? |
|---|---|---|---|---|
| Closest residences to north | 0.2 | 320 | 0.00 | No |
| Closest residence to west | 0.2 | 135 | 0.01 | No |
| Closest residence to east | 0.2 | 115 | 0.01 | No |
| Closest residence to southwest | 0.2 | 115 | 0.01 | No |
| Closest residence to southeast | 0.2 | 130 | 0.01 | No |

[a] Considered representative of other heavy earthmoving equipment such as excavators, graders, backhoes, etc.

[b] Obtained from "Transit Noise and Vibration Impact Assessment", FTA 2018

## Table C2. Construction Vibration Analysis - Potential Human Annoyance

| | |
|---|---|
| Vibration source: | Large bulldozer[a] |
| Reference Lv at 25 feet, VdB [b] | 87 |

| Receiver | Potential Annoyance Criterion, Lv, VdB | Distance, ft | Lv @ Receiver | Impact? |
|---|---|---|---|---|
| Closest residences to north | 72 | 320 | 54 | No |
| Closest residence to west | 72 | 135 | 65 | No |
| Closest residence to east | 72 | 115 | 67 | No |
| Closest residence to southwest | 72 | 115 | 67 | No |
| Closest residence to southeast | 72 | 130 | 66 | No |

[a] Considered representative of other heavy earthmoving equipment such as excavators, graders, backhoes, etc.

[b] Obtained from "Transit Noise and Vibration Impact Assessment", FTA 2018

# Appendix D. Traffic Noise Modeling

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

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

**Traffic Data:**

● **Enter ADT Traffic**

○ **Enter Loudest-hour Traffic**

**Units:**

○ **Metric**

● **English**

**Calculate**

| Link | Roadway | Segment Location | Hard or Soft Ground (H or S) | BARRIER | | | Total Daily Traffic Volumes **(ADT)** | Traffic Mix | | Vehicle Speed | Sound Levels at Receiver Locations | | **Distance to CNEL Noise Contour (feet)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Present 1=yes | Height min. 7 ft. max. 32 ft. | Distance 35 ft. or 100 ft. | | Number # | Description | mph max. 80 | Distance feet, min. 33 max. 1000 | dB CNEL | 75 dB | 70 dB | 65 dB | 60 dB |
| 1 | **SR 67 (Existing)** | **Kuhner Way - Willow Road** | S | | | | 28,552 | 1 | Generic - Arterial Roadways (From | 55 | 50 | **73.4** | **39** | **74** | **122** | **201** |
| 2 | **SR 67 (Existing)** | **Willow Road - Mapleview Street** | S | | | | 34,685 | 1 | Generic - Arterial Roadways (From | 55 | 50 | **74.2** | **45** | **81** | **132** | **219** |
| 3 | **Moreno Ave (Existing)** | **Mary Lane - Willow Road** | S | | | | 5,094 | 1 | Generic - Arterial Roadways (From | 45 | 50 | **63.3** | | | **39** | **74** |
| 4 | **Willow Rd (Existing)** | **SR-67 - Moreno Avenue** | S | | | | 9,098 | 1 | Generic - Arterial Roadways (From | 35 | 50 | **62.7** | | | **35** | **70** |
| 5 | **SR 67 (Existing + Project Conditions)** | **Kuhner Way - Willow Road** | S | | | | 28,592 | 1 | Generic - Arterial Roadways (From | 55 | 50 | **73.4** | **39** | **74** | **122** | **201** |
| 6 | **SR 67 (Existing + Project Conditions)** | **Willow Road - Mapleview Street** | S | | | | 34,898 | 1 | Generic - Arterial Roadways (From | 55 | 50 | **74.3** | **45** | **81** | **132** | **220** |
| 7 | **Moreno Ave (Existing + Project Conditions)** | **Mary Lane - Willow Road** | S | | | | 5,360 | 1 | Generic - Arterial Roadways (From | 45 | 50 | **63.6** | | | **40** | **76** |
| 8 | **Willow Rd (Existing + Project Conditions)** | **SR-67 - Moreno Avenue** | S | | | | 9,351 | 1 | Generic - Arterial Roadways (From | 35 | 50 | **62.9** | | | **35** | **71** |
| 9 | **SR 67 (Cumulative Conditions)** | **Kuhner Way - Willow Road** | S | | | | 32,030 | 1 | Generic - Arterial Roadways (From | 55 | 50 | **73.9** | **43** | **78** | **128** | **212** |
| 10 | **SR 67(Cumulative Conditions)** | **Willow Road - Mapleview Street** | S | | | | 38,170 | 1 | Generic - Arterial Roadways (From | 55 | 50 | **74.7** | **48** | **84** | **138** | **228** |
| 11 | **Moreno Ave (Cumulative Conditions)** | **Mary Lane - Willow Road** | S | | | | 5,090 | 1 | Generic - Arterial Roadways (From | 45 | 50 | **63.3** | | | **39** | **74** |
| 12 | **Willow Rd (Cumulative Conditions)** | **SR-67 - Moreno Avenue** | S | | | | 9,100 | 1 | Generic - Arterial Roadways (From | 35 | 50 | **62.7** | | | **35** | **70** |
| 13 | **SR 67 (Cumulative Conditions + Proj Conditions)** | **Kuhner Way - Willow Road** | S | | | | 32,070 | 1 | Generic - Arterial Roadways (From | 55 | 50 | **73.9** | **43** | **78** | **128** | **212** |
| 14 | **SR 67(Cumulative Conditions + Proj Conditions)** | **Willow Road - Mapleview Street** | S | | | | 38,380 | 1 | Generic - Arterial Roadways (From | 55 | 50 | **74.7** | **48** | **85** | **139** | **229** |
| 15 | **Moreno Ave (Cumulative Conditions + Proj Condit** | **Mary Lane - Willow Road** | S | | | | 5,360 | 1 | Generic - Arterial Roadways (From | 45 | 50 | **63.6** | | | **40** | **76** |
| 16 | **Willow Rd (Cumulative Conditions + Proj Conditior** | **SR-67 - Moreno Avenue** | S | | | | 10,900 | 1 | Generic - Arterial Roadways (From | 35 | 50 | **63.5** | | | **40** | **76** |

# Appendix E. Operational Noise Analysis

**Table D1. Operational Noise Level Analysis (outputs from SoundPLAN modeling)**

| Receiver | Predicted 1-hour Leq, dBA | Highest Predicted 1-hour Leq in Each Direction, dBA | Measured Average Daytime Ambient 1-hour Leq, dBA | One-Hour Average (Leq) Sound Level Limits, dBA | | Exceeds Sound Level Limits? | | Significant Impact? |
|---|---|---|---|---|---|---|---|---|
| | | | | Unadjusted | Adjusted for Average Ambient | Unadjusted | Adjusted for Average Ambient | |
| ***Equestrian Event*** | | | | | | | | |
| Rec E1 | 47.4 | 50.5 | 52 | 50 | 55 | Yes | No | No |
| Rec E2 | 50.5 | | | | | | | |
| Rec E3 | 49.0 | | | | | | | |
| Rec E4 | 46.9 | | | | | | | |
| Rec N1 | 47.3 | 47.3 | 52 | 50 | 55 | No | No | No |
| Rec N2 | 46.8 | | | | | | | |
| Rec S1 | 44.3 | 45.4 | 56 | 50 | 59 | No | No | No |
| Rec S2 | 45.4 | | | | | | | |
| Rec W1 | 44.4 | 49.6 | 55 | 50 | 58 | No | No | No |
| Rec W2 | 46.0 | | | | | | | |
| Rec W3 | 47.9 | | | | | | | |
| Rec W4 | 49.6 | | | | | | | |
| ***Wedding Ceremony*** | | | | | | | | |
| Rec E1 | 40.0 | 44.7 | 52 | 50 | 55 | No | No | No |
| Rec E2 | 44.0 | | | | | | | |
| Rec E3 | 44.7 | | | | | | | |
| Rec E4 | 43.8 | | | | | | | |
| Rec N1 | 37.0 | 37.3 | 52 | 50 | 55 | No | No | No |
| Rec N2 | 37.3 | | | | | | | |
| Rec S1 | 42.3 | 43.5 | 56 | 50 | 59 | No | No | No |
| Rec S2 | 43.5 | | | | | | | |
| Rec W1 | 41.6 | 42.2 | 55 | 50 | 58 | No | No | No |
| Rec W2 | 42.2 | | | | | | | |
| Rec W3 | 41.7 | | | | | | | |
| Rec W4 | 39.2 | | | | | | | |
| ***Wedding Reception*** | | | | | | | | |
| Rec E1 | 39.5 | 44.2 | 52 | 50 | 55 | No | No | No |
| Rec E2 | 43.2 | | | | | | | |
| Rec E3 | 44.2 | | | | | | | |
| Rec E4 | 43.7 | | | | | | | |
| Rec N1 | 36.8 | 37.1 | 52 | 50 | 55 | No | No | No |
| Rec N2 | 37.1 | | | | | | | |
| Rec S1 | 42.4 | 43.5 | 56 | 50 | 59 | No | No | No |
| Rec S2 | 43.5 | | | | | | | |
| Rec W1 | 41.3 | 41.6 | 55 | 50 | 58 | No | No | No |
| Rec W2 | 41.6 | | | | | | | |
| Rec W3 | 40.9 | | | | | | | |
| Rec W4 | 38.8 | | | | | | | |