Noise Assessment for Banyan Street Homes
City of Rancho Cucamonga

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1.0 EXISTING SETTING

1.1 Project Description

The proposed project consists of 9 single family homes on 5.18 gross acres. The project site is bordered on the north by Banyan Street and is approximately 0.32 miles north of the Foothill Freeway. Existing residences are located on the west, south, and east sides of the project. The project includes solar panels per California requirements. A vicinity map is presented as Exhibit 1 and a site plan is presented as Exhibit 2.

This report focuses on the potential noise impacts associated with the construction and operation of this project.

1.2 Background Information on Noise

1.2.1 Noise Criteria Background

Sound is technically described in terms of the loudness (amplitude) of the sound and frequency (pitch) of the sound. The standard unit of measurement of the loudness of sound is the decibel (dB). Decibels are based on the logarithmic scale. The logarithmic scale compresses the wide range in sound pressure levels to a more usable range of numbers in a manner similar to the Richter scale used to measure earthquakes. In terms of human response to noise, a sound 10 dB higher than another is judged to be twice as loud; and 20 dB higher four times as loud; and so forth. Everyday sounds normally range from 30 dB (very quiet) to 100 dB (very loud).

Since the human ear is not equally sensitive to sound at all frequencies, a special frequency-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (dBA) performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear. Community noise levels are measured in terms of the "A-weighted decibel," abbreviated dBA. Exhibit 3 provides examples of various noises and their typical A-weighted noise level.

Sound levels decrease as a function of distance from the source as a result of wave divergence, atmospheric absorption and ground attenuation. As the sound wave travels away from the source, the sound energy is dispersed over a greater area, thereby dispersing the sound power of the wave. Atmospheric absorption also influences the levels that are received by the observer. The greater the distance traveled, the greater the influence and the resultant fluctuations. The degree of absorption is a function of the frequency of the sound as well as the humidity and temperature of the air. Intervening topography can also have a substantial effect on the effective perceived noise levels.

Exhibit 1 - Vicinity Map

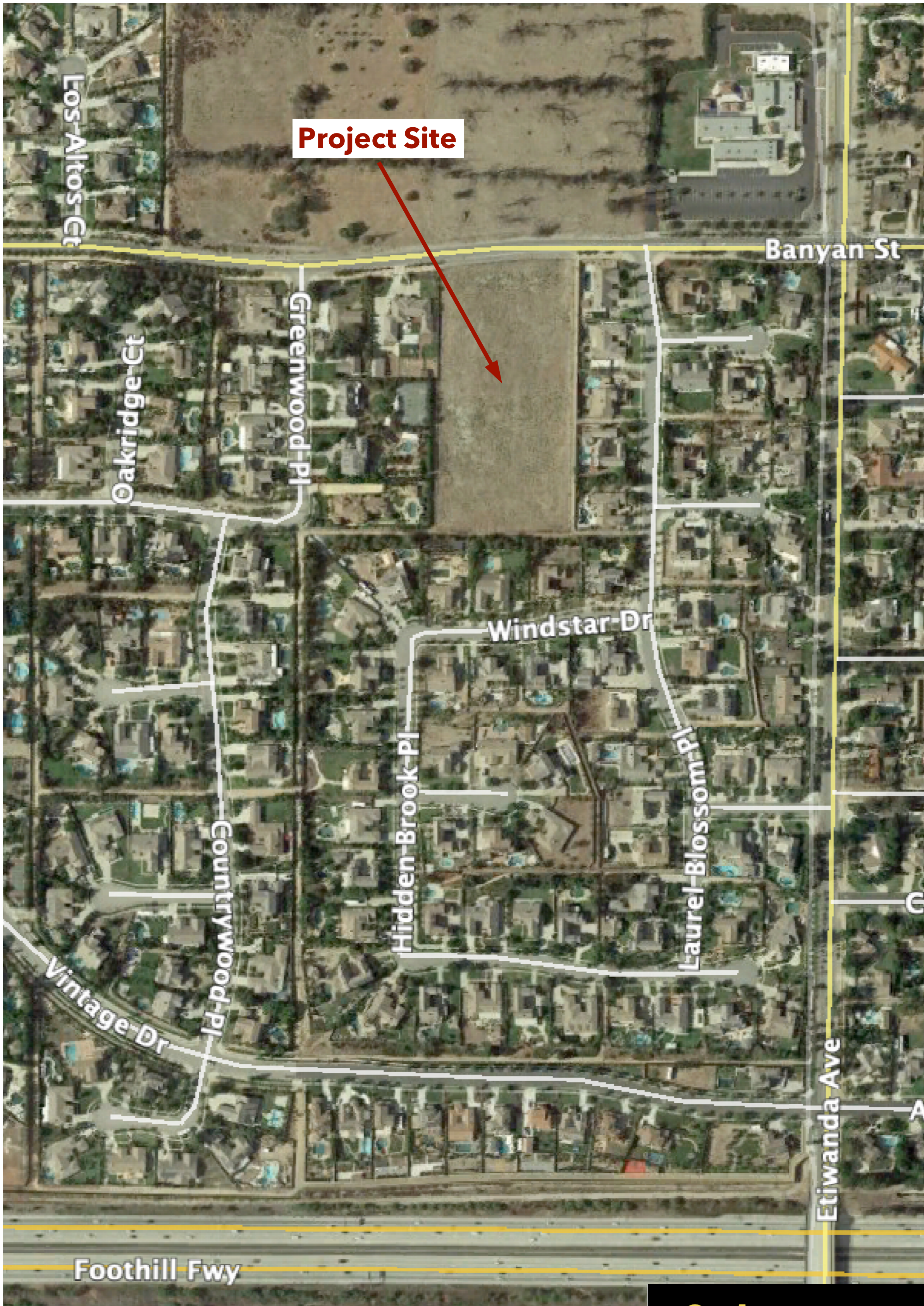

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Exhibit 2 - Site Plan

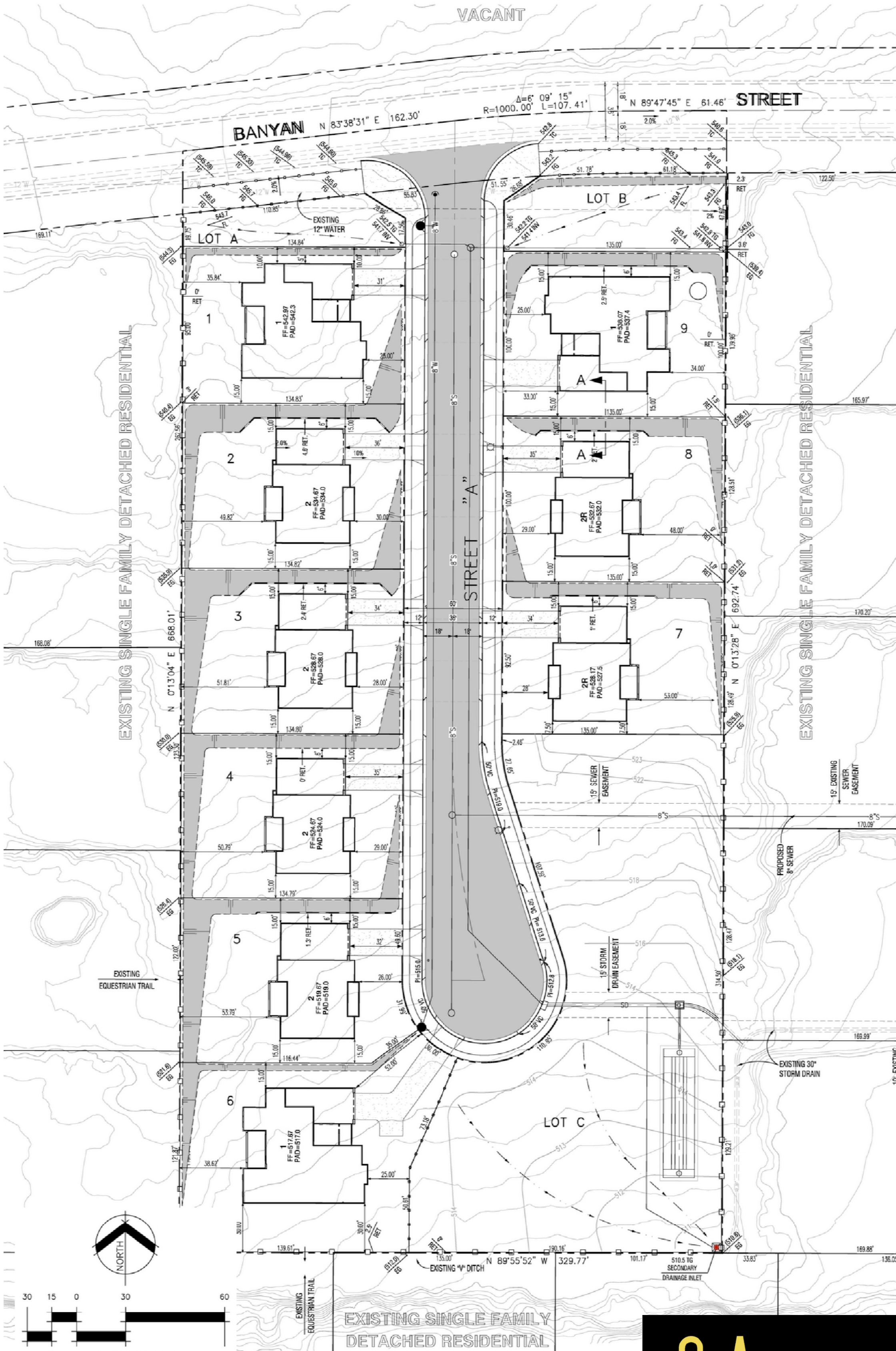

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Exhibit 3 - Typical Noise Levels

	Outdoor	Indoor
0 dBA	threshold of hearing (0 dBA)	
20	rustling of leaves (20 dBA)	whispering at 5 feet (20 dBA)
40	quiet residential area (40 dBA)	refrigerator (50 dBA)
60	air-conditioner at 100 feet (60 dBA) car at 25 feet at 65 mph (77 dBA)	sewing machine (60 dBA) normal conversation (60 to 65 dBA) dishwasher (55-70 dBA) living room music or TV (70 -75 dBA)
80	diesel truck at 50 feet at 40 mph (84 dBA) propeller airplane flyover at 1000 feet (88 dBA) motorcycle at 25 feet (90 dBA) lawnmower (96 dBA) backhoe at 50 feet (75-95 dBA)	garbage disposal (80 dBA) ringing telephone (80 dBA) vacuum cleaner (60-85 dBA) shouted conversation (90 dBA)
100	snowmobile (100 dBA) pile driver at 50 feet (90-105 dBA) car horn (110 dBA) rock concert (110 dBA) leaf blower (110 dBA)	baby crying on shoulder (110 dBA)
120	ambulance siren (120 dBA) stock car races (130 dBA) jackhammer (130 dBA)	
140		

Sources: League For The Hard Of Hearing, www.lhh.org
<u>Handbook of Noise Control</u>, McGraw Hill, Edited by Cyril Harris, 1979

Noise has been defined as unwanted sound and it is known to have several adverse effects on people. From these known effects of noise, criteria have been established to help protect the public health and safety and prevent disruption of certain human activities. This criterion is based on such known impacts of noise on people as hearing loss, speech interference, sleep interference, physiological responses and annoyance. Each of these potential noise impacts on people are briefly discussed in the following narratives:

Hearing loss is not a concern in community noise situations of this type. The potential for noise induced hearing loss is more commonly associated with occupational noise exposures in heavy industry or very noisy work environments. Noise levels in neighborhoods, even in very noisy airport environs, are not sufficiently loud to cause hearing loss.

Speech interference is one of the primary concerns in environmental noise problems. Normal conversational speech is in the range of 60 to 65 dBA and any noise in this range or louder may interfere with speech. There are specific methods of describing speech interference as a function of distance between speaker and listener and voice level.

Sleep interference is a major noise concern for traffic noise. Sleep disturbance studies have identified interior noise levels that have the potential to cause sleep disturbance. Note that sleep disturbance does not necessarily mean awakening from sleep, but can refer to altering the pattern and stages of sleep.

Physiological responses are those measurable effects of noise on people that are realized as changes in pulse rate, blood pressure, etc. While such effects can be induced and observed, the extent is not known to which these physiological responses cause harm or are sign of harm.

Annoyance is the most difficult of all noise responses to describe. Annoyance is a very individual characteristic and can vary widely from person to person. What one person considers tolerable can be quite unbearable to another of equal hearing capability.

1.2.2 Noise Assessment Metrics

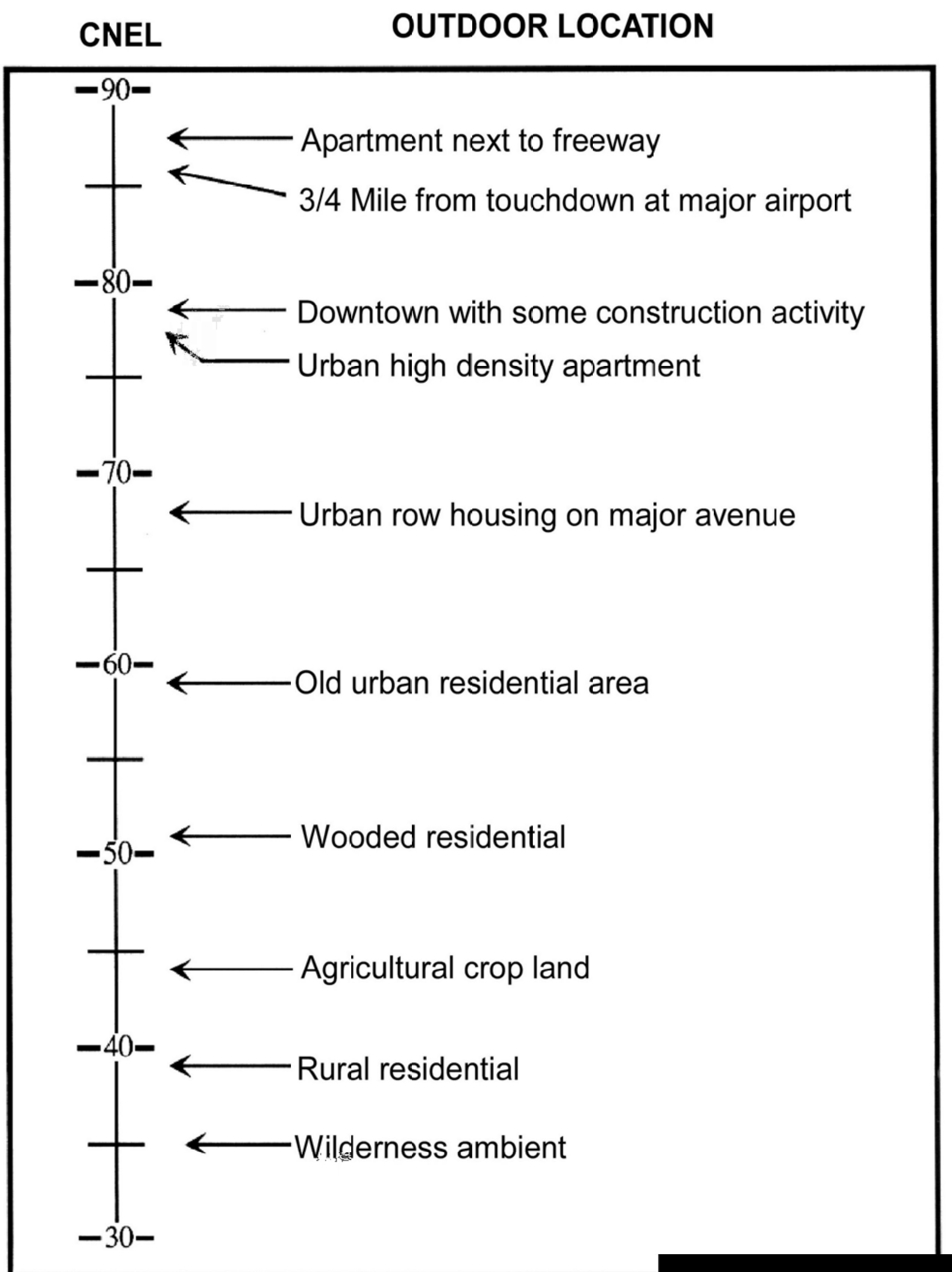
The description, analysis and reporting of community noise levels around communities is made difficult by the complexity of human response to noise and the myriad of noise metrics that have been developed for describing noise impacts. Each of these metrics attempts to quantify noise levels with respect to community response. Most of the metrics use the A-Weighted noise level to quantify noise impacts on humans. A-weighting is a frequency weighting that accounts for human sensitivity to different frequencies.

Noise metrics can be divided into two categories: single event and cumulative. Single-event metrics describe the noise levels from an individual event such as an aircraft fly over or perhaps a heavy equipment pass-by. Cumulative metrics average the total noise over a specific time period, which is typically 1 or 24-hours for community noise problems.

Several rating scales have been developed for measurement of community noise. These account for: (1) the parameters of noise that have been shown to contribute to the effects of noise on man, (2) the variety of noises found in the environment, (3) the variations in noise levels that occur as a person moves through the environment, and (4) the variations associated with the time of day. They are designed to account for the known effects of noise on people described previously. Based on these effects, the observation has been made that the potential for a noise to impact people is dependent on the total acoustical energy content of the noise. A number of noise scales have been developed to account for this observation. Two of the predominate noise scales are the: Equivalent Noise Level (LEQ) and the Community Noise Equivalent Level (CNEL). These scales are described in the following paragraphs.

> **LEQ** is the sound level corresponding to a steady-state sound level containing the same total energy as a time-varying signal over a given sample period. LEQ is the "energy" average noise level during the time period of the sample. LEQ can be measured for any time period, but is typically measured for 1 hour. This 1-hour noise level can also be referred to as the Hourly Noise Level (HNL). It is the energy sum of all the events and background noise levels that occur during that time period.
>
> **CNEL**, Community Noise Equivalent Level, is the predominant rating scale now in use in California for land use compatibility assessment. The CNEL scale represents a time weighted 24-hour average noise level based on the A-weighted decibel. Time weighted refers to the fact that noise that occurs during certain sensitive time periods is penalized for occurring at these times. The evening time period (7 p.m. to 10 p.m.) penalizes noises by 5 dBA, while nighttime (10 p.m. to 7 a.m.) noises are penalized by 10 dBA. These time periods and penalties were selected to reflect people's increased sensitivity to noise during these time periods. A CNEL noise level may be reported as a "CNEL of 60 dBA," "60 dBA CNEL," or simply "60 CNEL." Typical noise levels in terms of the CNEL scale for different types of communities are presented in Exhibit 4.
>
> **L(%)** (also sometimes represented as L(N)) is a statistical method of describing noise which accounts for variance in noise levels throughout a given measurement period. L(%) is a way of expressing the noise level exceeded for a percentage of time in a given measurement period. For example, since 15 minutes is 25% of one hour, L(25) is the noise level that is equal to or exceeded for 15 minutes in a one-hour period. It is L(%) that is used for most Noise Ordinance standards. For example, most daytime County, state and City Noise Ordinances use an ordinance standard of 55 dBA for 30 minutes per hour or an L(50) level of 55 dBA. In other words, the Noise Ordinance states that no noise level should exceed 55 dBA for more than fifty percent of a given period.

Exhibit 4 - Examples of CNEL Noise Levels



1.3 Noise Criteria

The Noise Element of the General Plan and the Noise Ordinance contain the City's policies and regulations on noise. The Noise Element of the General Plan presents limits on noise levels at proposed land uses from transportation noise sources, vehicles on public roadways, railroads and aircraft. Additionally, the General Plan provides guidance to ensure that noise and land use compatibility are integrated into the development process.

The Noise Ordinance regulates noise on one property impacting a neighboring property. Typically, it sets limits on noise levels that can be experienced at the neighboring property. The Noise Ordinance is part of the City's Municipal Code (Article IV, Chapter 17.66.050 Noise Standards) and is enforceable throughout the City. The City's Noise Ordinance and Noise Element policies are presented below.

1.3.1 City of Rancho Cucamonga Noise Element

The City of Rancho Cucamonga has adopted Land Use Noise Standards to be applied to all new developments. The standards are reproduced in Exhibit 5. The guidelines basically state that if the noise standards for a proposed land use can be met, then the land use is compatible with the noise environment. The City also uses the State guidelines for indoor and outdoor noise standards. Again, these standards are aimed at public noise sources such as roadways and aircraft, and are not applicable to noise sources that the City can control through the Noise Ordinance. The standards for residential uses for outdoor areas are 55 dBA from 10 p.m. to 7 a.m. (nighttime) and 60 dBA from 7 a.m. to 10 p.m. (daytime). Splitting the noise criteria into a day portion and a nighttime portion is unique to Rancho Cucamonga. The more common approach is to use the CNEL scale described in Section 1.2.2. Additionally, the State requires that indoor noise levels be addressed using the CNEL noise scale. If the noise level is 55 dBA from 10 p.m. to 7 a.m. and 60 dBA from 7 a.m. to 10 p.m., the equivalent CNEL level would be 63.2. The City's indoor noise standard for residential is 40 dBA from 10 p.m. to 7 a.m. and 45 dBA from 7 a.m. to 10 p.m. and this is equivalent to 48.2 CNEL. However, the State requirement is slightly lower at 45 CNEL. To simplify matters for this analysis, we will use the 63.2 CNEL for the outdoor noise standard and 45 CNEL for the indoor noise standard.

Exhibit 5 - Land Use Noise Standards

TABLE V-3
LAND USE NOISE STANDARDS

Land Use	*Interior Standards*	*Exterior Standard*
Residential		
— 10pm to 7am	40dBA	55dBA
— 7am to 10pm	45dBA	60dBA
Commercial/Office		
— 10pm to 7am	None identified	60dBA
— 7am to 10pm	None identified	65dBA
Industrial		
— Class A (industrial park)	60Ldn	65Ldn
— Class B (general industrial)	65Ldn	75Ldn
— Class C (heavy industrial)	65Ldn	85Ldn

dBA = Decibel
Ldn = Day-night average sound level.

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1.3.2 City of Rancho Cucamonga Noise Ordinance

Within the City of Rancho Cucamonga, the Noise Ordinance governs operational noise generated on one property and impacting another parcel. Article IV, Chapter 17.66.050 of the City code represents the City's Noise Ordinance. The Noise Ordinance standards are in terms of the "A-weighted decibel," abbreviated dBA. The ordinance defines levels that cannot be exceeded for a certain period of time. In terms of a noise metric this represents the L(%) metric. The lowest outdoor noise levels defined in the Noise Ordinance are the levels that cannot be exceeded for more than 15 minutes in an hour. This is equivalent to the L25 metric. Similarly, the Noise Ordinance defines a noise level that cannot be exceeded for more than 5 minute per hour. This is the noise level exceeded 8.3% of the time or the L8.3 metric. The City's Noise Ordinance Standards are presented in Table 1.

Table 1 City of Rancho Cucamonga Noise Ordinance Standards

Maximum Time of Exposure	Noise Metric	Noise Level Not To Be Exceeded 7 a.m. to 10 p.m. (Daytime)	10 p.m. to 7 a.m. (Nighttime)
Exterior Noise Standards			
15 Minutes/Hour	L25	65 dBA	60 dBA
10 Minutes/Hour	L17	70 dBA	68 dBA
5 Minutes/Hour	L8.3	79 dBA	74 dBA
Any period of time	Lmax	80 dBA	85 dBA
Interior Noise Standards			
15 Minutes/Hour	L25	50 dBA	45 dBA
10 Minutes/Hour	L17	55 dBA	50 dBA
5 Minutes/Hour	L8.3	64 dBA	59 dBA
Any period of time	Lmax	65 dBA	60 dBA

Section 17.66.050 (D)(4)(a) of the Rancho Cucamonga Municipal Code regulates construction noise. The code exempts construction activities when occurring adjacent to a residential area under specific circumstances. The code reads as follows:

> a. *When adjacent to a residential land use, school, church or similar type of use, the noise generating activity does not take place between the hours of 8:00 p.m. and 7:00 a.m. on weekdays, including Saturday, or at any time on Sunday or a national holiday, and provided noise levels created do not exceed the noise standard of 65 dBA when measured at the adjacent property line.*

In other words, if the construction noise does not occur at night (i.e., between 8 p.m. and 7 a.m.) on weekdays and Saturday or at any time on Sunday or a national holiday and the noise levels does not exceed 65 dBA then the construction noise is exempt (i.e., acceptable). Put another way, construction should occur during weekday daytime hours and should not exceed

65 dBA. To be consistent with the noise requirements shown in Table 1, it can reasonably be assumed that the noise metric for the 65 dBA limit is L25 (not to be exceeded more than 15 minutes in one hour). Also note, that there is no requirement in the ordinance that construction not exceed a peak or Lmax noise level. As long as construction noise does not exceed 65 dBA (L25) during the appropriate hours, it is exempt from further ordinance requirements.

1.4 Existing Noise Levels

The existing noise levels in the vicinity of the proposed project are needed to establish the current baseline noise levels. A visual survey of the project site and the surrounding area was conducted to determine the location of a set of noise measurements that would provide a noise profile of the area in the vicinity of the project site. Several criteria were used in the site selection process including, but not limited to, the proximity of a measurement site to sensitive land uses as well as its proximity to significant noise generators. Three sites were selected for noise measurements. The measurement sites are displayed in Exhibit 6. The measurements were taken on January 26, 2021. These measurements were taken during the Covid pandemic, and traffic levels may have been slightly lower than during non-Covid times, possibly resulting in slightly lower noise levels.

All noise measurements were performed using a Rion NL-52 Type 1 Sound Level Meter. During the measurements a large windscreen (i.e., Rion WL-10) covered the sound meter's microphone to dampen-out any unwanted wind-generated noise. Both before and after the set of measurements were taken, a Rion NC-74 Class 1 Sound Calibrator was used to check the calibration of the sound meter to ensure that the measured sound levels readings were accurate. Both pieces of equipment have current certification that is traceable to the National Institute of Standards and Technology (NIST). The monitoring system is Type 1, which is the highest rating available for environmental noise measurements. In other words, this system provides the most accurate level of measurements. For each site, two 15-minute measurements were made to ensure that the noise levels measured were consistent. At the conclusion of each set of measurements, the Leq, Lmin, Lmax, L1.7, L8, L25, and L50 values for the full-time period were written down on a data sheet. Prevailing weather conditions were noted along with any other factors that might affect the noise measurements. Table 2 shows the results of the measurements.

Exhibit 6 - Measurement Sites

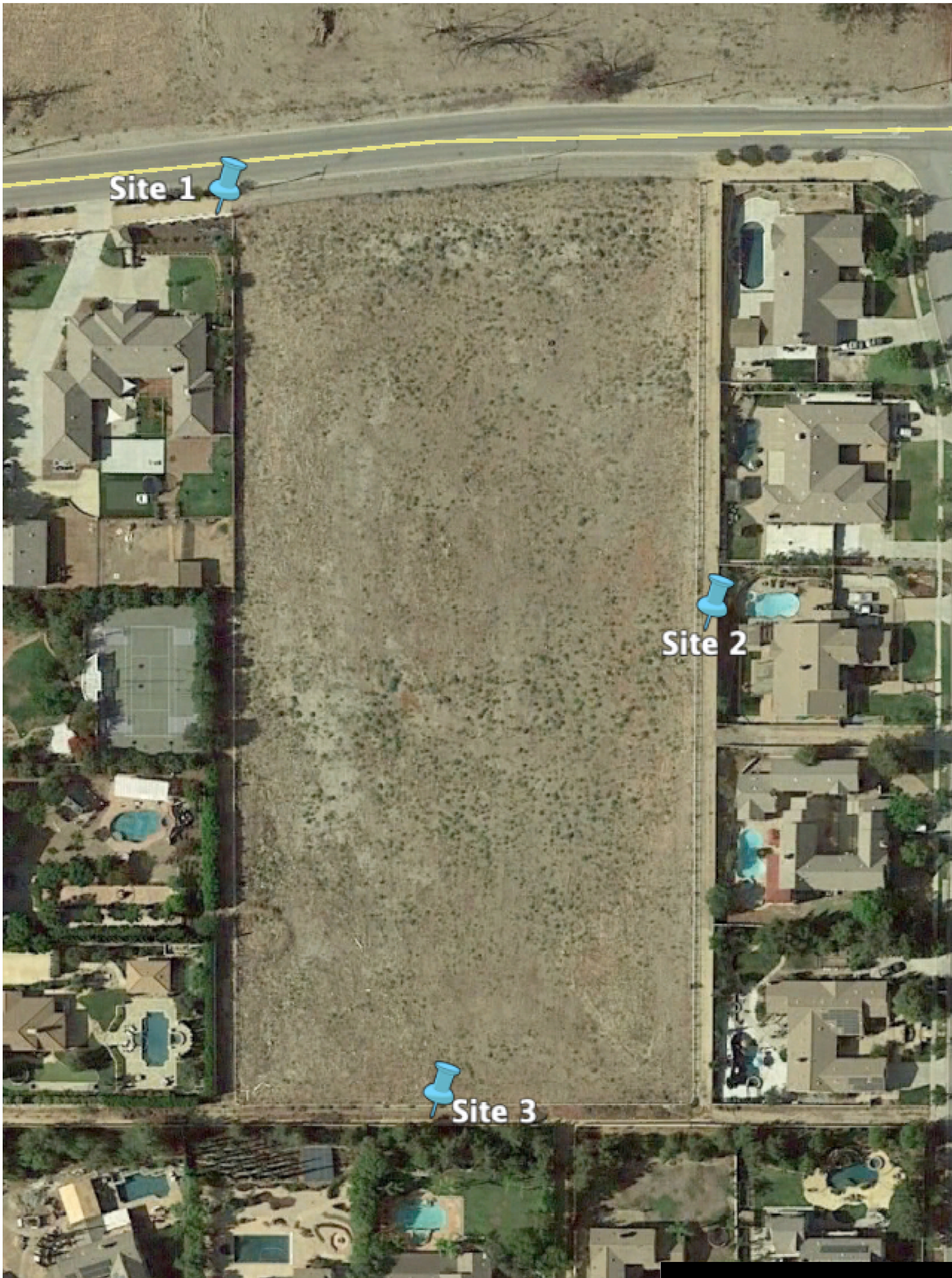

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Table 2 Existing Noise Measurements (dBA)

Site	Start Time	Leq	Lmax	L1.7	L8	L25	L50	Lmin
1	11:37 a.m.	66.0	79.2	75.1	71.9	65.3	56.2	43.5
1	11:54 a.m.	65.1	79.2	75.3	71.1	61.6	53.9	42.2
2	12:14 p.m.	48.1	57.5	53.8	51.6	48.9	46.7	42.6
2	12:31 p.m.	47.1	60.2	53.7	50.2	47.1	45.5	40.4
3	12:53 p.m.	45.6	56.4	53.1	49.2	45.5	43.8	38.7
3	1:10 p.m.	44.0	51.5	47.9	46.1	44.6	43.5	40.1

Site 1 is near the northwest corner of the project site. The noise levels measured at this site were due to traffic on Banyan Street, Etiwanda Avenue, the distant Foothill Freeway, and low flying planes. The noise from the freeway was so faint that it did not add significantly to the noise levels at the site. The average noise level measured was 55.1 dBA (L50). The loudest sounds were from pickup trucks and an occasional industrial truck on Banyan Street.

Site 2 is on the east side of the project site on the equestrian trail. The average noise level measured was 46.1 dBA (L50). The noise levels measured at this site were due to traffic on Banyan St, low lying planes, and the distant freeway. The loudest sounds were coming from the larger vehicles on Banyan Street.

Site 3 is on the south side of the project site, on the equestrian trail. The average noise level measured was 43.7 dBA (L50). The noise levels measured at this site were primarily due to a distant construction site, where several construction workers were digging out an area for a pool. The noise levels at the site were very low. Traffic on Banyan Street could barely be heard.

The noise levels measured for all three sites are typical of quiet suburban areas, and this conclusion would be true for Covid and non-Covid periods.

2.0 POTENTIAL NOISE IMPACTS

Potential noise impacts are commonly divided into two groups; temporary and long term. Temporary impacts are usually associated with noise generated by construction activities. Long-term impacts would be associated with the operation of the proposed project.

Construction noise is the most common temporary impact and traffic noise associated with the project is an example of long term noise. Both types of potential impacts are addressed below.

2.1 Noise Impact Criteria

Off-site impacts from on-site activities, both short-term and long-term, are measured against the Noise Ordinance criteria discussed in Section 1.3, and ambient noise levels. Construction activities for the proposed project will be required to meet the noise ordinance standards along with any noise generating activities associated with the operation of the project.

2.2 Temporary Impacts

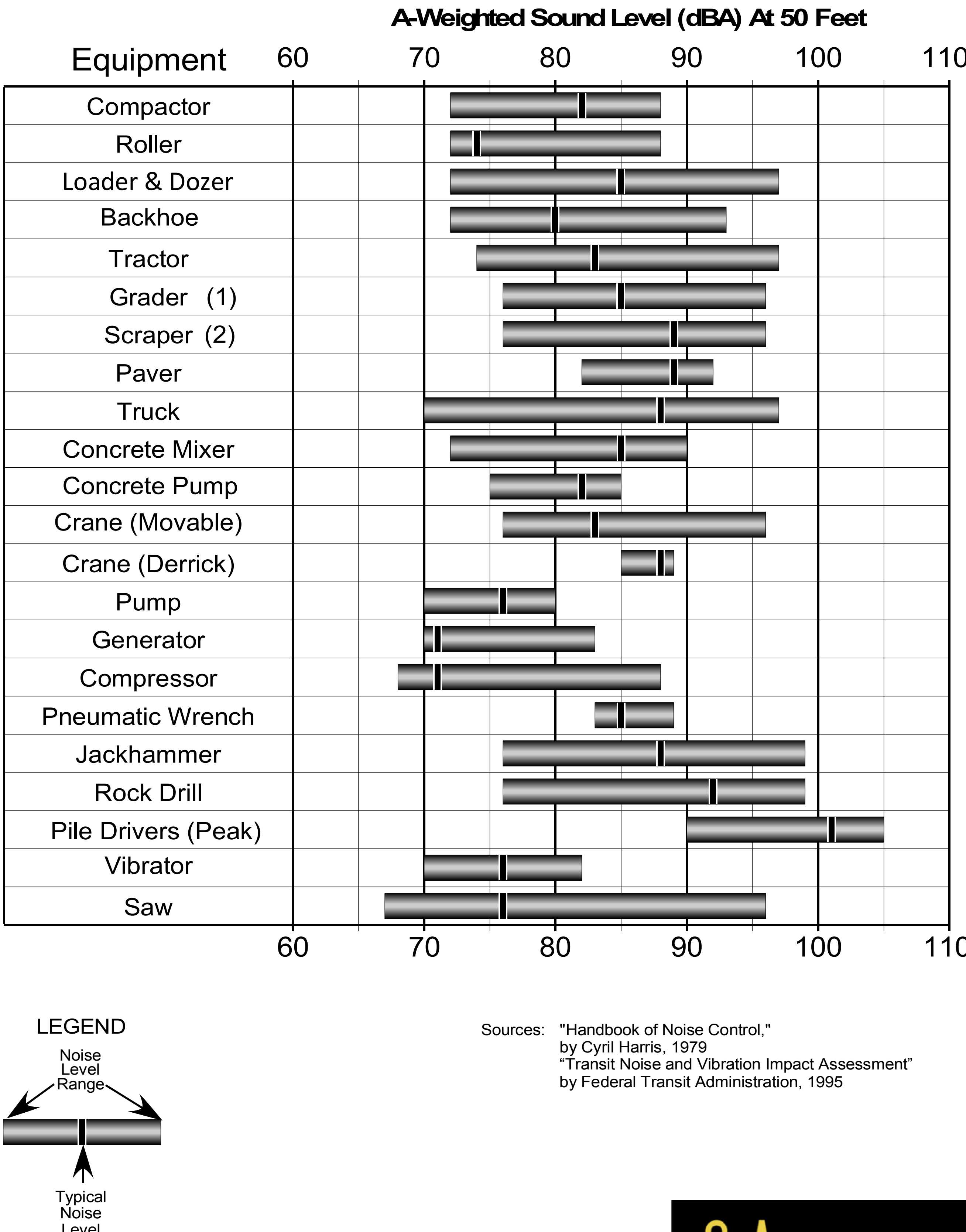
2.2.1 Construction Noise

Construction noise represents a short-term impact on ambient noise levels. Noise generated by construction equipment, including trucks, graders, bulldozers, cranes, and concrete mixers can reach high levels.

Worst-case examples of construction noise at 50 feet are presented in Exhibit 7. Typical equipment that might be employed for this type of project includes graders, scrapers, front loaders, trucks, concrete mixers and concrete pumps. The peak (Lmax) noise level for most of the equipment that will be used during the construction is 70 to 95 dBA at a distance of 50 feet. Noise levels at further distances would be less than this, and intervening noise barriers could reduce noise levels even further. Based on the author's past experience, the noise levels shown in Exhibit 7 are on the high side. However, construction noise levels do vary substantially from one project to another. Therefore, these noise levels will be used as the basis for predicting construction noise, but likely represent the highest noise levels (i.e., worst case conditions) that could be expected.

Residences are about 50 feet from the project where construction will occur. Residences are located to the east, south, and west of the project. Equestrian trails about 15 feet wide separate the site from residences on the east, south, and portions on the west. Construction may occur for short periods closer to the residences. Based on a distance of 50 feet, the worst-case unmitigated peak (Lmax) construction noise levels could be 70 to 95 dBA at the nearest residences.

Exhibit 6 - Construction Noise Levels



Sources: "Handbook of Noise Control," by Cyril Harris, 1979
"Transit Noise and Vibration Impact Assessment" by Federal Transit Administration, 1995

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The average noise levels (L25) are typically 15 dB lower than the peak (Lmax) noise levels. The 15 dB value is based on our general observations during construction noise measurements over the past 20 years. The use of a 15 dB difference is also consistent with most of the values presented in Exhibit 7 that show typical, which can be assumed to be average, and maximum noise levels. Average noise levels (L25) at the two nearest existing residences (50 feet) could be in the range of 55 to 80 dBA (Leq), with the most likely level being right in the middle of that range or 67 dBA. The L25 noise level during construction will most likely be slightly above the 65 dBA specified in the Noise Ordinance. Construction should be limited to the hours contained in the Noise Ordinance. Since there is a certain amount of uncertainty regarding the projection of construction noise, mitigation is presented in Section 3.1 to ensure that noise levels are lowered slightly and result in acceptable levels.

2.3 Long-Term Off-Site Impact

Potential long-term sources of noise include the traffic generated by the project. The trips generated by the project were estimated using CalEEMod, which was also used for air quality projections (see "Focused Air Quality and Greenhouse Gas Emission Analysis for Banyan Street Homes," by Greve & Associates, LLC, February 5, 2021). CalEEMod uses trip generation rates developed by the Institute of Transportation Engineers (ITE). The program projects that 88 trips per days (average weekday) will be generated by the project.

Adding 88 vehicles per day to Banyan Street will not have a significant effect on the traffic noise levels. As an example, it was estimated that Banyan Street has a current traffic volume of 3,000 vehicles per day. (Existing traffic volumes were not available, so this estimate is based on our experience with similar roadways.) Homes closest to the roadway (e.g., 60 feet from roadway centerline) would experience a noise level of approximately 60.1 CNEL. The traffic levels would increase by 88 vehicles per day and the resultant noise level would be 60.3 CNEL, or an increase of 0.2 dBA.

In community noise assessment, changes in noise levels greater than 3 dB are often identified as significant, while changes less than 1 dB will not be discernible to local residents. In the range of 1 to 3 dB, residents who are very sensitive to noise may perceive a slight change. Note that there is no scientific evidence available to support the use of 3 dB as the significance threshold. In laboratory testing situations, humans are able to detect noise level changes of slightly less than 1 dB. In a community noise situation, however, noise exposures are over a long time period, and changes in noise levels occur over years, rather than the immediate comparison made in a laboratory situation. Therefore, the level at which changes in community noise levels become discernible is likely to be some value greater than 1 dB, and 3 dB appears to be appropriate for most people. This projected change is noise level is not detectable by the human ear, and the resultant increase would not be significant.

3.0 MITIGATION MEASURES

3.1 Temporary Impacts

The analysis presented in Section 2.2.1 shows that construction activities could generate loud noise levels for adjacent residences. The most effective method of controlling construction noise is through limiting construction hours. Therefore, the following mitigation measures are proposed and is consistent with the City of Rancho Cucamonga Noise Ordinance. Other mitigation measures are also presented to mitigate the noise to the fullest extent that is feasible. It should be noted that the projected noise levels are slightly above 65 dBA (L25), and therefore, construction noise should be lowered 2 dB to be exempt from further requirements of the Noise Ordinance.

> **Mitigation Measure N-1: Control of Construction Hours**. Construction is only allowed between 7:00 a.m. and 8:00 p.m. on weekdays, including Saturdays. Construction is not allowed at any time on Sunday or national holidays.
>
> **Mitigation Measure N-2: Construct Perimeter Walls Expeditiously.** The perimeter walls will be constructed as soon as is feasible. Most commonly, this can occur after rough grading which will be minimal for this project since the site is flat and will need a minimal amount of grading. These walls will reduce noise at the residents for the following construction phases. The perimeter walls would reduce noise by 5 to 8 dBA.
>
> **Mitigation Measure N-3: Route Construction Traffic from East Avenue.** Construction traffic shall be routed from Banyan Street onto 'A' Street which is on the center of the site. This route minimizes the number of homes affected by construction traffic, and keeps the traffic centered on the site which is furthest from existing residences.
>
> **Mitigation Measure N-4: Locate Staging Area in Center of Site.** The staging area shall be located in the center of the project site. This will maximize the distance from the existing residences to the staging area and will reduce the noise from operations at the staging area at the existing residences.
>
> **Mitigation Measure N-5: Post Contact Info for Noise Complaints.** Contact information (i.e., name and phone number) shall be posted at the project site so that residents can call regarding excessive noise. All calls shall receive a response from the designated contact and measures shall be taken to lessen the noise to the extent feasible. The exact form of mitigation would depend on the nature of the resident's complaint.

The measures presented above fall into three categories; (1) those that ensure the project will be in compliance with the City's Noise Ordinance, (2) those that have measurable effect on reducing noise levels, and (3) measures that have an undeterminable effect on reducing the noise levels but make good faith efforts to reduce noise levels to the fullest extent feasible and maintain a positive relationship with the surrounding residents. Measure MN-1 ensures that the project will comply with the City's Noise Ordinance. Measure N-2 will reduce noise levels by 5 to 8 dBA and result in noise levels at nearby residences that will be less than 65 dBA (L25) during construction. Measures N-3, N-4, and N-5 fall into the third category. With these five measures in place, the project will comply with the City's Noise Ordinance requirements and the impacts from construction noise will be less than significant.

3.2 Long Term Off-Site Impacts

No long term impacts will occur with the project and therefore, mitigation will not be required.

4.0 UNAVOIDABLE SIGNIFICANT IMPACTS

The mitigation measures described above will mitigate all significant impacts to a level of insignificance. The project will not result in an unavoidable significant impact.

5.0 REFERENCES

"FHWA Highway Traffic Noise Prediction Model," Federal Highway Administration, FHWA-RD-77-108, December 1978.

"Handbook of Noise Control," edited by Cyril M. Harris, PhD., 1979.

"Insulation of Buildings Against Highway Noise," Federal Highway Administration, FHWA-TS-77-202, 1977.

"Transit Noise and Vibration Impact Assessment Manual," Federal Transit Administration, FTA Report No. 0123, September 2018.