NOISE STUDY

Avocado TSM Residential Development
City of El Cajon, CA

Prepared For:

Salim A. Chagan
301 Cajon View Drive
El Cajon, CA 92020

Prepared By:

Ldn Consulting, Inc.
23811 Washington Ave, C110-333
Murrieta, CA 92562

October 12, 2023

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ATTACHMENTS

GLOSSARY OF COMMON TERMS

Sound Pressure Level (SPL): a ratio of one sound pressure to a reference pressure (L_{ref}) of 20 µPa. Because of the dynamic range of the human ear, the ratio is calculated logarithmically by 20 log (L/L_{ref}).

A-weighted Sound Pressure Level (dBA): Some frequencies of noise are more noticeable than others. To compensate for this fact, different sound frequencies are weighted more.

Minimum Sound Level (L_{min}): Minimum SPL or the lowest SPL measured over the time interval using the A-weighted network and slow time weighting.

Maximum Sound Level (L_{max}): Maximum SPL or the highest SPL measured over the time interval the A-weighted network and slow time weighting.

Equivalent sound level (L_{eq}): the true equivalent sound level measured over the run time. Leq is the A-weighted steady sound level that contains the same total acoustical energy as the actual fluctuating sound level.

Day Night Sound Level (Ldn): Representing the Day/Night sound level, this measurement is a 24 –hour average sound level where 10 dB is added to all the readings that occur between 10 pm and 7 am. This is primarily used in community noise regulations where there is a 10 dB "Penalty" for nighttime noise. Typically, Ldn's are measured using A weighting.

Community Noise Exposure Level (CNEL): The accumulated exposure to sound measured in a 24-hour sampling interval and artificially boosted during certain hours. For Ldn, samples taken between 7 pm and 10 pm are boosted by 5 dB; samples taken between 10 pm and 7 am are boosted by 10 dB.

Octave Band: An octave band is defined as a frequency band whose upper band-edge frequency is twice the lower band frequency.

Third-Octave Band: A third-octave band is defined as a frequency band whose upper band-edge frequency is 1.26 times the lower band frequency.

Response Time (F, S,I): The response time is a standardized exponential time weighting of the input signal according to fast (F), slow (S) or impulse (I) time response relationships. Time response can be described with a time constant. The time constants for fast, slow and impulse responses are 1.0 seconds, 0.125 seconds and 0.35 milliseconds, respectively.

EXECUTIVE SUMMARY

This noise study has been completed to determine the noise impacts associated with the development of the proposed Avocado TSM residential project. The proposed project is located along the west side of Avocado Avenue, between Chase Avenue and Cajon View Drive in the City of El Cajon, California. The community would be situated on an approximately 2.1-acre site and would consist of 5 single-family residential lots. Each lot is proposed with stormwater tree well.

Construction Noise Levels

The City of El Cajon does not have a specific noise threshold for construction activities. At this time, no construction is anticipated between the hours of 7:00 p.m. and 7:00 a.m. Therefore, no noise impacts are anticipated. Additionally, to achieve compliance with the City's noise ordinance for construction within 500 feet of off-site residential lots, the following should be incorporated in the project's construction plan, as necessary.

- Equipment and trucks used for the project construction shall use the best the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically attenuating shields or shrouds).

- Construction contractors shall use "quiet" gasoline-powered compressors or other electric-powered compressors and use electric rather than gasoline or diesel-powered forklifts for small lifting.

- Stationary noise sources, such as temporary generators, shall be located as far from nearby receptors as possible, and they shall be muffled and enclosed within temporary sheds, incorporate insulation barriers, or other measures to the extent feasible.

Based on location and incorporation of the recommended measures above the construction activities will not expose nearby sensitive receptors to noise levels above 75 dBA.

Onsite Transportation Related Noise Levels

The results of this analysis indicate that future vehicle noise from adjacent Avocado Avenue is the principal source of community noise that could impact the project site. Based upon the findings, the private rear yards were determined to be above the City's 60 dBA CNEL threshold without mitigation. Noise mitigation in the form of 6-foot barriers located at the top of pads of Lots 1 through 4 would be necessary to comply with the City of El Cajon Noise standards for single-family residences based on transportation related noise. The barriers must be constructed of a non-gapping material consisting of masonry, wood, plastic, fiberglass, glass, vinyl, steel, or a combination of those materials, with no cracks or gaps through or below the enclosure walls.

Additionally, a final noise assessment is required prior to the issuance of the first building permit since the building facades are above 60 dBA CNEL. This final report would identify the interior noise requirements based upon architectural and building plans. It should be noted; interior noise levels of 45 dBA CNEL can be obtained with conventional building construction methods and providing a closed window condition requiring a means of mechanical ventilation (e.g., air conditioning) and upgraded windows for all sensitive rooms (e.g., bedrooms and living spaces).

1.0 PROJECT INTRODUCTION

1.1 Purpose of this Study

The purpose of this noise study is to determine noise impacts associated with the development of proposed project (i.e., traffic and construction). Should impacts be determined, the intent of this study would be to recommend suitable mitigation measures to reduce impacts to below a level of significance.

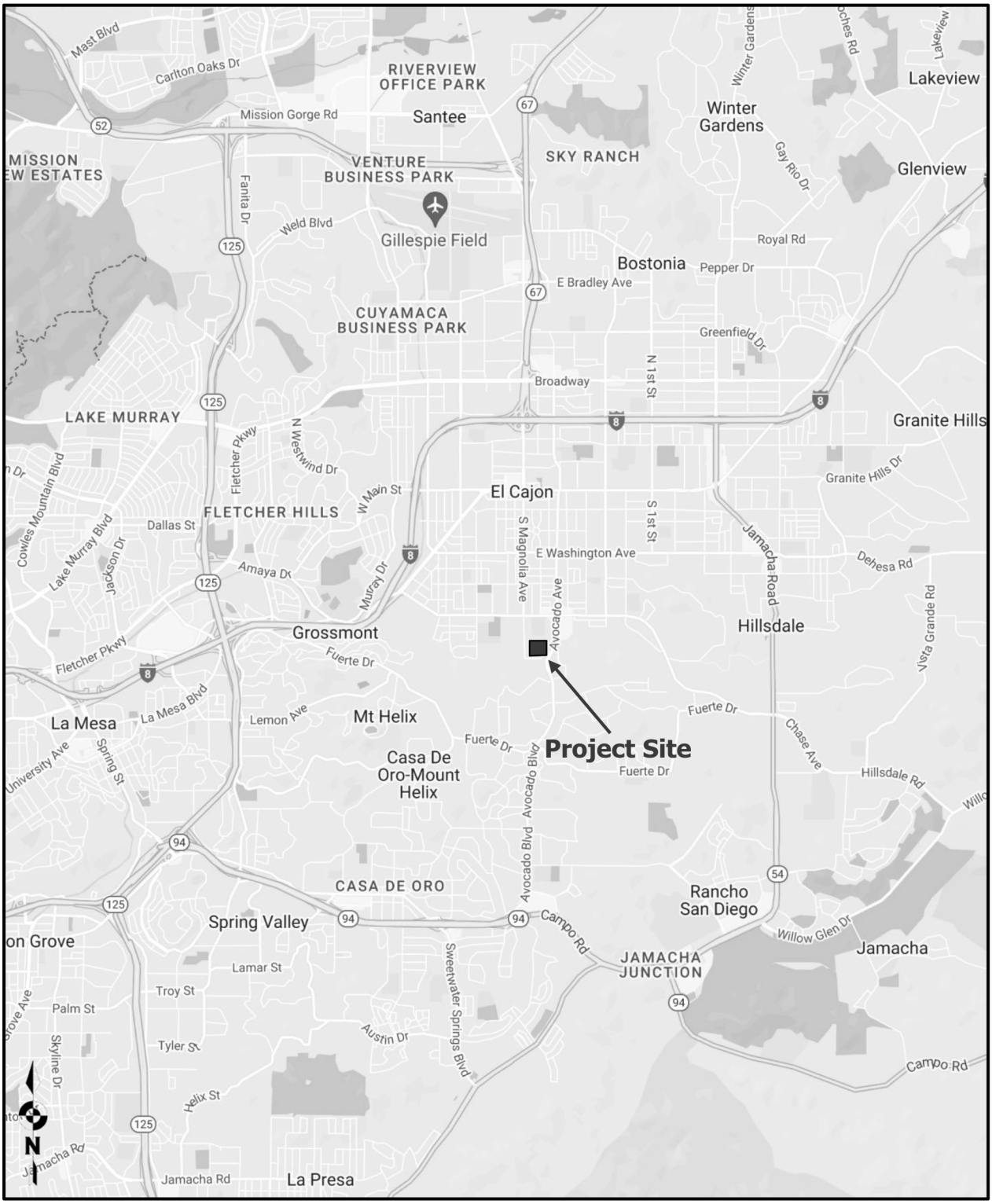
1.2 Project Location

The proposed Avocado TSM residential project is located on an approximately 2.1-acre project site located along the west side of Avocado Avenue, between Chase Avenue and Cajon View Drive in the City of El Cajon, California. The project site is bordered by existing residential uses to the north, west, and south, and Avocado Avenue to the east. A general project vicinity map is shown in Figure 1–A on the following page.

1.3 Project Description

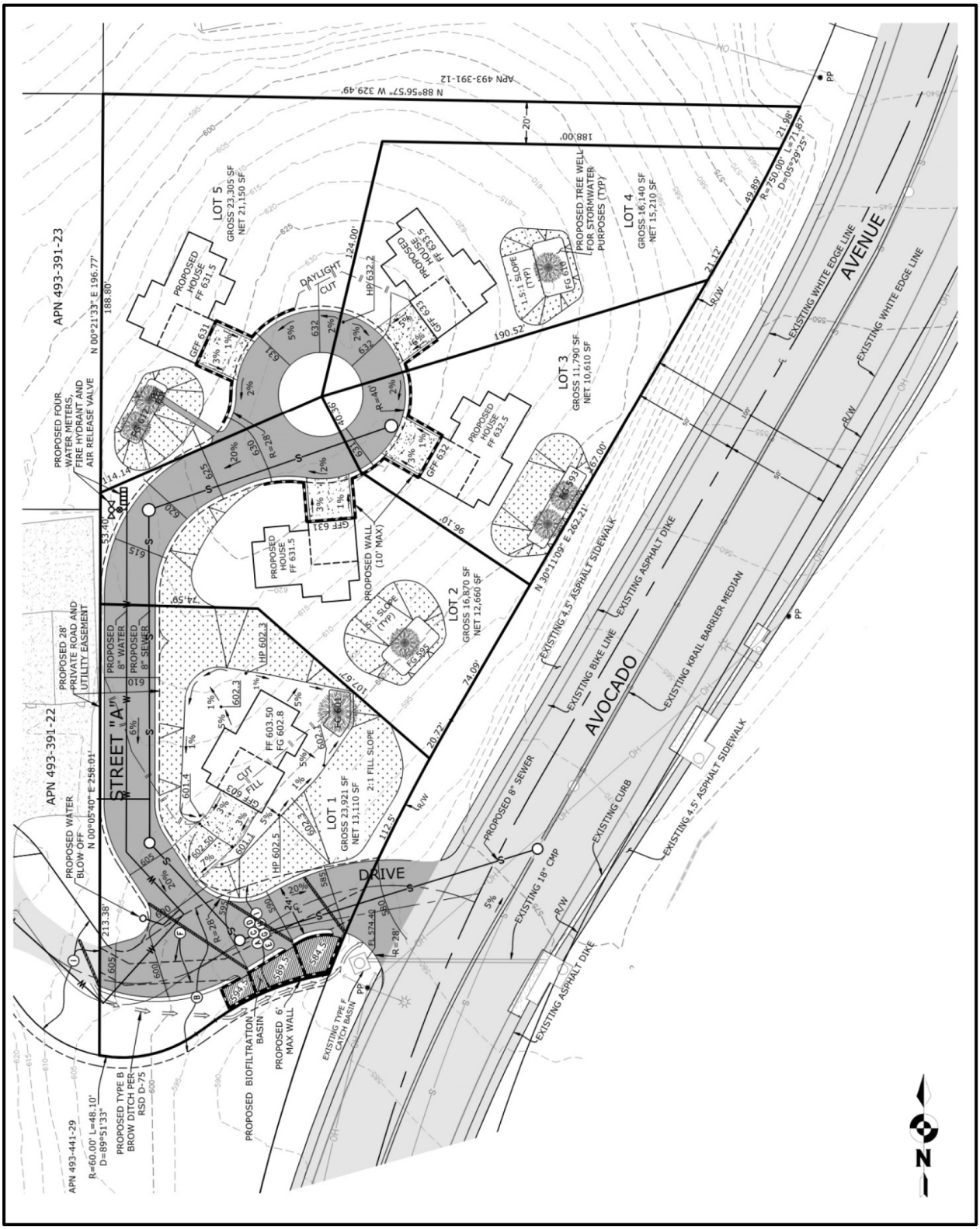
The community would be situated on a 2.1-acre site and would consist of 5 single-family residential lots. Each lot is proposed with stormwater tree well. A project site plan is shown in Figure 1-B on Page 3 of this report.

Figure 1-A: Project Vicinity Map



Source: (Google, 2023)

Figure 1-B: Proposed Project Site Plan



Source: (Walsh Engineering & Surveying, Inc., 2023)

2.0 FUNDAMENTALS

Noise is defined as unwanted or annoying sound which interferes with or disrupts normal activities. Exposure to high noise levels has been demonstrated to cause hearing loss. The individual human response to environmental noise is based on the sensitivity of that individual, the type of noise that occurs, and when the noise occurs.

Sound is measured on a logarithmic scale consisting of sound pressure levels known as a decibel (dB). The sounds heard by humans typically do not consist of a single frequency but of a broadband of frequencies having different sound pressure levels. The method for evaluating all the frequencies of the sound is to apply an A-weighting to reflect how the human ear responds to the different sound levels at different frequencies. The A-weighted sound level adequately describes the instantaneous noise whereas the equivalent sound level depicted as Leq represents a steady sound level containing the same total acoustical energy as the actual fluctuating sound level over a given time interval.

The Community Noise Equivalent Level (CNEL) is the 24 hour A-weighted average for sound, with corrections or penalties for evening and nighttime hours. The corrections require an addition of 5 decibels to sound levels in the evening hours between 7 p.m. and 10 p.m. and an addition of 10 decibels to sound levels at nighttime hours between 10 p.m. and 7 a.m. These additions are made to account for the increased sensitivity during the evening and nighttime hours when sounds appears louder.

A vehicles noise level is a combination of the noise produced by a vehicle's engine, exhaust, and tires. The cumulative traffic noise levels along a roadway segment are based on three primary factors: the amount of traffic, the travel speed of the traffic, and the vehicle mix ratio or number of medium and heavy trucks. The intensity of traffic noise is increased by higher traffic volumes, greater speeds, and increased number of trucks.

Because mobile/traffic noise levels are calculated on a logarithmic scale, a doubling of the traffic noise or acoustical energy results in a noise level increase of 3 dBA. Therefore, the doubling of the traffic volume, without changing the vehicle speeds or mix ratio, results in a noise increase of 3 dBA. Mobile noise levels radiate in an almost oblique fashion from the source and drop off at a rate of 3 dBA for each doubling of distance under hard site conditions and at a rate of 4.5 dBA for soft site conditions. Hard site conditions consist of concrete, asphalt, and hard pack dirt while soft site conditions exist in areas having slight grade changes, landscaped areas, and vegetation. Alternately, fixed/point sources radiate outward uniformly as it travels away from the source. Their sound levels attenuate or drop off at a rate of 6 dBA for each doubling of distance.

The most effective noise reduction methods consist of controlling the noise at the source and blocking the noise transmission with barriers. Any or all of these methods may be required to reduce noise levels to an acceptable level. To be effective, a noise barrier must have enough mass to prevent significant noise transmission through it and high enough and long enough to shield the receiver from the noise source. A safe minimum surface weight for a noise barrier is 3.5 pounds/square foot (equivalent to 3/4-inch plywood), and the barrier must be carefully constructed so that there are no cracks or openings.

Barriers constructed of wood or as a wooden fence must have minimum design considerations as follows: the boards must be ¾ inch thick and free of any gaps or knot holes. The design must also incorporate either overlapping the boards at least 1 inch or utilizing a tongue-and-grove design for this to be achieved.

3.0 SIGNIFICANCE THRESHOLDS AND STANDARDS

3.1 Construction Noise

Section 17.115.130 of the City of El Cajon Municipal Code states that it is unlawful for any person within any residential zone, or within a radius of five hundred (500) feet from any residential zone, to operate equipment or perform any outside construction, maintenance or repair work on buildings, structures, landscapes or related facilities, or to operate any pile driver, power shovel, pneumatic hammer, power hoist, leaf blower, mower, or any other mechanical device, between the hours of 7 p.m. of one (1) day and 7 a.m. of the next day in such a manner that a reasonable person of normal sensitivities residing in the area is caused discomfort or annoyance. This subsection shall also apply to any property in the Mixed-Use zone having one or more residential units. This restriction does not apply to emergency work made necessary to restore property to a safe condition, restore utility service, or to protect persons or property from imminent exposure to danger.

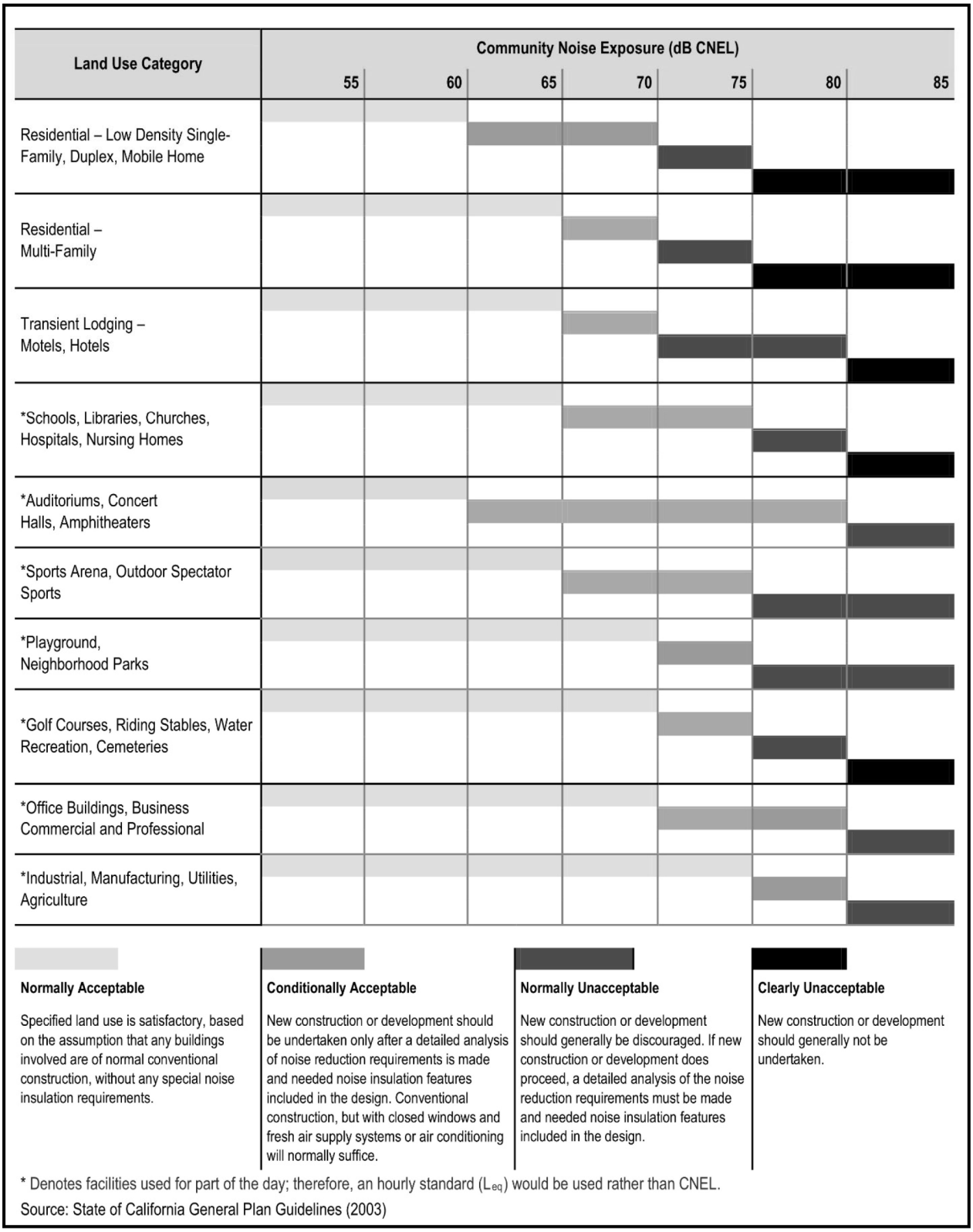
3.2 Transportation Noise Standards

The City of El Cajon General Plan Noise Element has adopted the State of California Land Use Compatibility Guidelines (provided in Figure 3-A on the following page) to determine the compatibility of land use when evaluating proposed development projects. The Land Use Compatibility Guidelines indicate ranges of compatibility and are intended to be flexible enough to apply to a range of projects and environments. For example, a commercial project would be evaluated differently than a residential project in a rural area or a mixed-use project in a more densely developed area of the County.

The goal for maximum outdoor noise levels in residential areas is a CNEL of 60 dBA. This level is a requirement for the design and location of future development and a goal for the reduction of noise in existing development. However, 60 dBA CNEL is a goal that cannot necessarily be reached in all residential areas within the realm of economic or aesthetic feasibility. The goal is applied where outdoor use is a major consideration (e.g., backyards in single-family housing developments, recreation areas in multi-family housing projects). The outdoor standard should not be applied to balconies and patios associated with apartments or condominiums due to the general lack of use of these balconies and patios even in quiet areas. Based upon these guidelines, single-family residential areas are considered normally acceptable with maximum exterior noise levels of up to 60 dBA CNEL.

Additionally, interior noise levels should be mitigated to a maximum of 45 dBA CNEL in all habitual rooms when the exterior of the residence is exposed to levels of 60 dBA CNEL or more. If windows and doors are required to be closed to meet the interior noise standard, then mechanical ventilation shall be provided per City requirements.

Figure 3-A: Land Use Compatibility Guidelines



* Denotes facilities used for part of the day; therefore, an hourly standard (L_{eq}) would be used rather than CNEL.

Source: State of California General Plan Guidelines (2003)

4.0 EXISTING NOISE ENVIRONMENT

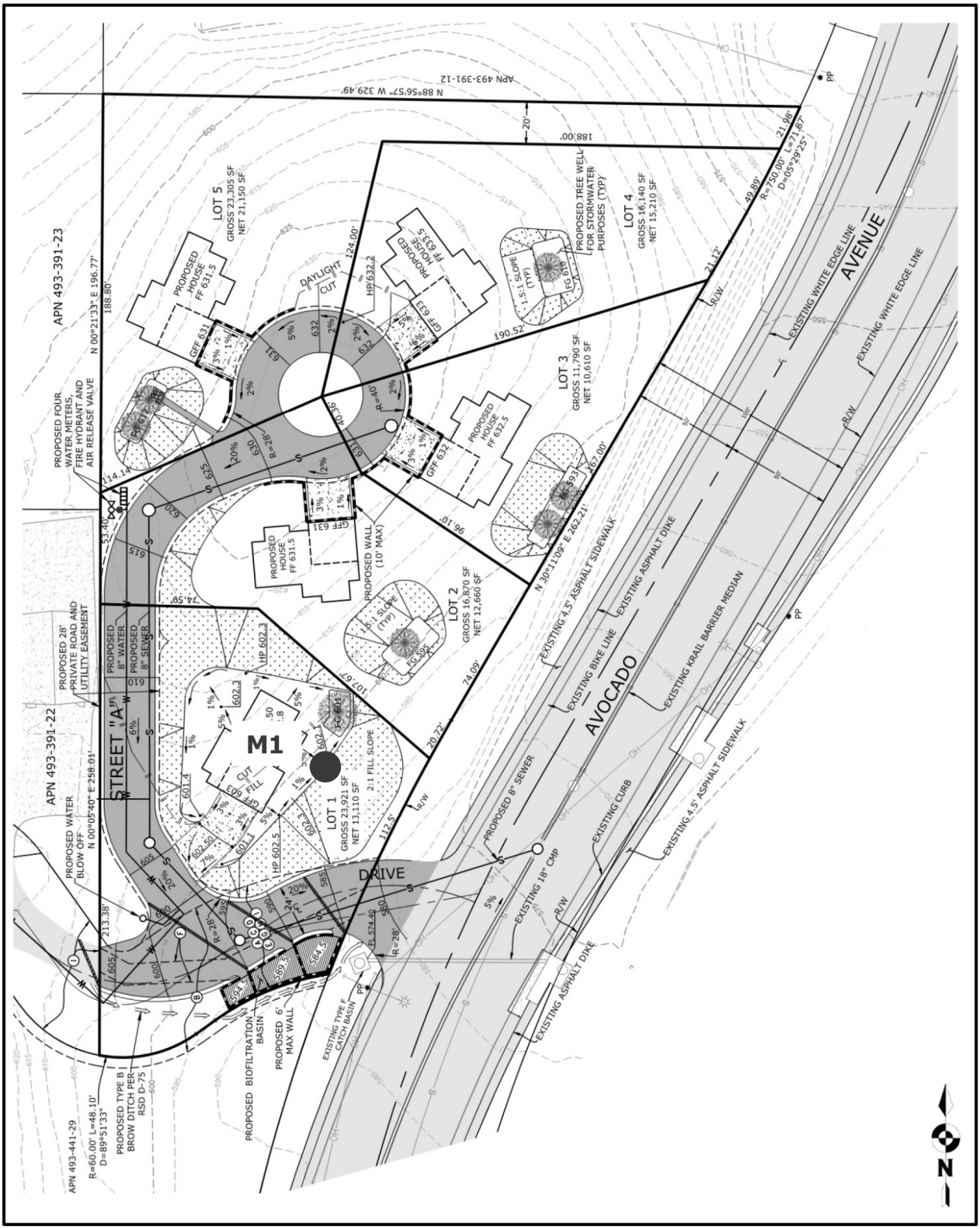
Noise measurements were taken October 4, 2023 using a Larson-Davis Model LxT Type 1 precision sound level meter, programmed, in "slow" mode, to record noise levels in "A" weighted form. The sound level meter and microphone were mounted on a tripod, five feet above the ground and equipped with a windscreen during all measurements. The sound level meter was calibrated before and after the monitoring using a Larson-Davis calibrator, Model CAL 200.

Monitoring Location 1 (M1) was located roughly 100 feet from the centerline of Avocado Avenue near the existing access road. The noise monitoring location is provided graphically in Figure 4-A on the following page. The results of the noise level measurement is presented in Table 4-1. The noise measurement was monitored for a time period of 15 minutes. The existing noise levels in the project area consisted primarily of traffic from adjacent Avocado Avenue. The ambient Leq noise level measured in the area of the project during the afternoon hours was found to be 60.2 dBA Leq based on the proximity to the roadway. The statistical indicators Lmax, Lmin, L10, L50 and L90, are given for the monitoring locations. As can be seen from the L90 data, 90% of the time the noise level is approximately 51.5 dBA from the roadways.

Table 4-1: Measured Ambient Noise Levels

Measurement Identification	Description	Time	Noise Levels (dBA)					
			Leq	Lmax	Lmin	L10	L50	L90
M1	Avocado Ave	2:45pm – 3:00pm	60.2	73.7	48.2	62.3	58.1	51.5
Source: Ldn Consulting, Inc. October 4, 2023								

Figure 4-A: Ambient Noise Monitoring Locations



5.0 POTENTIAL IMPACTS

5.1 Construction Noise Levels

The development construction will consist of grading, building construction, architectural coating, and paving. Noise would typically occur during these phases due to the operation of backhoes, and front-end loaders as well as air compressors and hand-held power tools. The nearest residences to be impacted by construction are the single-family homes located adjacent to the project to the north and west. Noise monitoring was conducted as part of a Noise Control Plan during the construction at a similar construction site to determine the noise levels from the associated equipment. A list of the anticipated noise levels for each phase of construction is shown in Table 5-1.

Table 5-1: Construction List and Noise Levels

Construction Phase	Distance	Source Level (dBA)	Actual Distance from Property Line (Feet)	Noise Reduction from distance (dBA)	Resultant Noise Level (dBA)
Site Grading	50 Feet	75.7	80	-4.1	71.6
Building Construction		68.2	50	--	68.2
Architectural Coating		62.3	50	--	62.3
Paving Equipment		71.6	60	-1.6	70.0

The City of El Cajon does not have a specific noise threshold for construction activities. At this time, no construction is anticipated between the hours of 7:00 p.m. and 7:00 a.m. Therefore, no noise impacts are anticipated. Additionally, to achieve compliance with the City's noise ordinance for construction within 500 feet of off-site residential lot, the following should be incorporated in the project's construction plan, as necessary.

- Equipment and trucks used for the project construction shall use the best the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically attenuating shields or shrouds).

- Construction contractors shall use "quiet" gasoline-powered compressors or other electric-powered compressors and use electric rather than gasoline or diesel powered forklifts for small lifting.

- Stationary noise sources, such as temporary generators, shall be located as far from nearby receptors as possible, and they shall be muffled and enclosed within temporary sheds, incorporate insulation barriers, or other measures to the extent feasible.

Based on location and incorporation of the recommended measures above the construction activities will not expose nearby sensitive receptors to noise levels above 75 dBA.

5.2 On-Site Transportation Noise Levels

To determine the future noise environment and impact potentials the Sound32 model was utilized. The critical model input parameters, which determine the projected vehicular traffic noise levels, include vehicle travel speeds, the percentages of automobiles, medium trucks and heavy trucks in the roadway volume, the site conditions and the peak hour traffic volume. The peak hour traffic volumes range between 6-12% of the average daily traffic (ADT) and 10% is generally acceptable for noise modeling.

Table 5-2 presents the roadway parameters used in the analysis including the peak traffic volumes, vehicle speeds and the hourly traffic flow distribution (vehicle mix). The vehicle mix provides the hourly distribution percentages of automobile, medium trucks and heavy trucks for input into the Sound32 Model. The Buildout conditions include the future year 2050 traffic volume forecasts provided by SANDAG Series ABM2+/2021 RP Traffic Prediction Model.

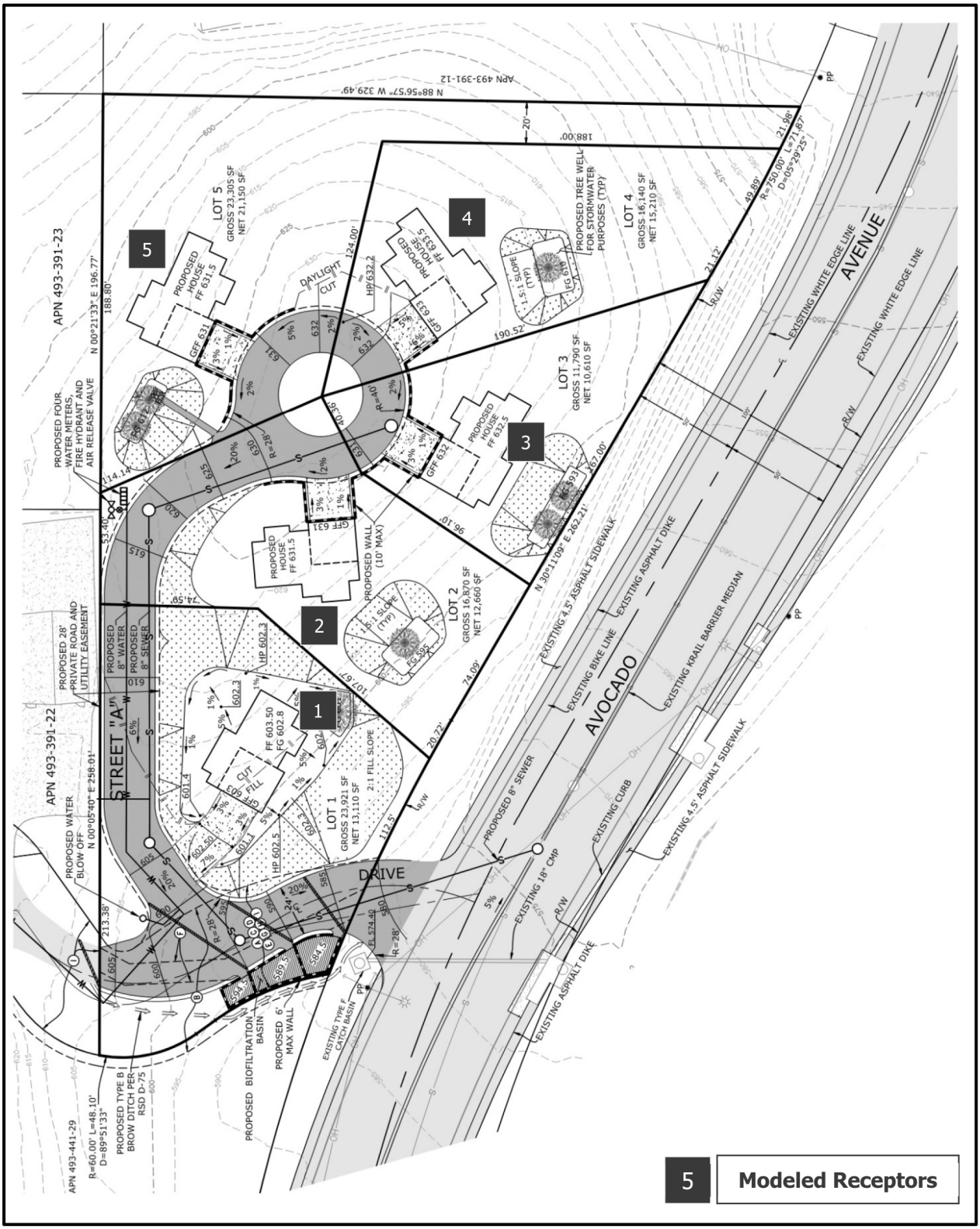
Table 5-2: Future Traffic Parameters

Roadway	Average Daily Traffic (ADT)[1]	Peak Hour Volumes[1]	Modeled Speeds (MPH)	Vehicle Mix %[2]		
				Auto	Medium Trucks	Heavy Trucks
Avocado Avenue	29,200	2,920	45	95	3	2

[1] Source: SANDAG Series ABM2+/2021 RP Traffic Prediction Model
[2] Typical City vehicle mix

The required coordinate information necessary for the Sound32 model input was taken from the Tentative Subdivision Map provided by Walsh Engineering & Surveying, Inc. dated July 2023. The tentative plans were used to identify the pad elevations, roadway elevations, and the relationship between the noise source(s) and the outdoor receptor areas. The modeled observer locations for the potential outdoor use areas for are presented in Figure 5-A.

Figure 5-A: Modeled Receptor Locations



The modeling results for the Buildout analysis are quantitatively shown in Table 5-3 below for the private rear yards. Based upon these findings, exterior noise from vehicular traffic along Avocado Avenue were determined to be above the City's 60 dBA CNEL threshold for single-family residences without mitigation. Noise mitigation in the form of 6-foot barriers located at the top of pads of Lots 1 through 4 would be necessary to comply with the City of El Cajon Noise standards for single-family residences based on transportation related noise as shown in Figure 5-B. The barriers must be constructed of a non-gapping material consisting of masonry, wood, plastic, fiberglass, glass, vinyl, steel, or a combination of those materials, with no cracks or gaps through or below the enclosure walls. The S32 modeling input parameters and output files for the future conditions with and without mitigation are provided in ***Attachment A***.

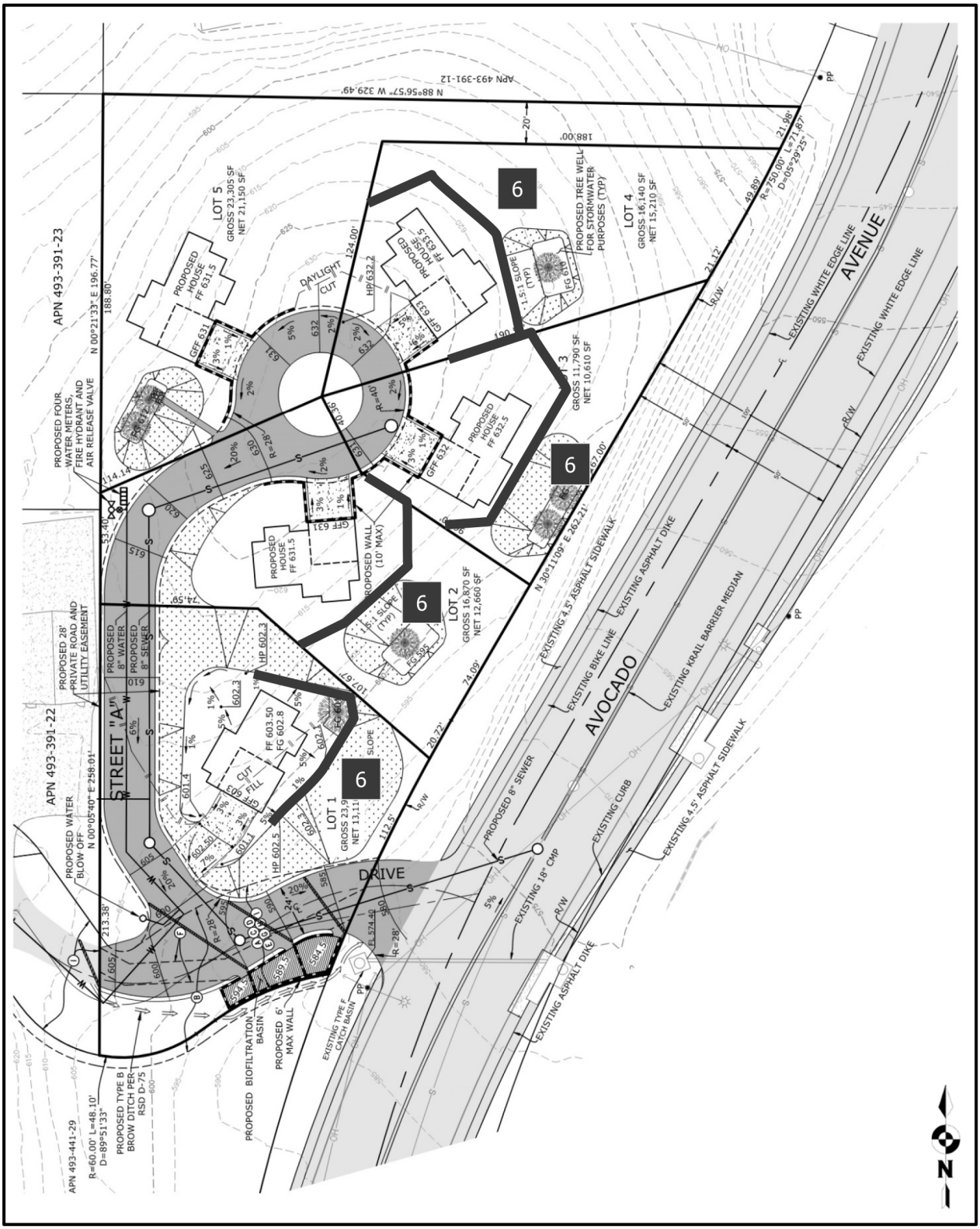
Table 5-3: Future Exterior Noise Levels

Receptor Number	Unmitigated Noise Levels (dBA CNEL)	Mitigation Barrier Height (Feet)	Ground Floor Mitigated Noise Levels (dBA CNEL)[1]	Building Façade Noise Levels (dBA CNEL)[1]
1	**65**	**6**	60	69
2	**64**	**6**	58	69
3	**68**	**6**	60	71
4	**63**	**6**	57	67
5	55	0	55	60

[1] Interior Noise Study required per City Guidelines if building façade is above 60 dBA CNEL.

Additionally, a final noise assessment is required prior to the issuance of the first building permit since the building facades are above 60 dBA CNEL. This final report would identify the interior noise requirements based upon architectural and building plans. It should be noted; interior noise levels of 45 dBA CNEL can be obtained with conventional building construction methods and providing a closed window condition requiring a means of mechanical ventilation (e.g., air conditioning) and upgraded windows for all sensitive rooms (e.g., bedrooms and living spaces).

Figure 5-B: Noise Barrier Mitigation



ATTACHMENT A

Modeling Input and Output Files

Avocado TSM - Ground Level Unmitigated
T-PEAK HOUR TRAFFIC CONDITIONS, 1
2774 , 45 , 88 , 45 , 58 , 45
L-Avocado, 1
Y,-299,293,615,
Y,-178,303,605,
Y,-57,294,595,
Y,60,268,585,
Y,165,216,575,
Y,274,154,565,
Y,379,95,555,
Y,488,37,545,
Y,541,17,540,
Y,659,-3,530,
Y,779,-8,520,
Y,900,-7,510,
Y,964,-5,505,
B-LOT 1, 1 , 2 , 0 ,0
178,344,602,602,
215,310,602,602,
242,291,602,602,
257,292,602,602,
266,333,602,602,
B-LOT 2, 2 , 2 , 0 ,0
287,325,630,630,
273,309,630,630,
314,270,630,630,
350,272,630,630,
B-LOT 3, 3 , 2 , 0 ,0
342,259,631,631,
324,233,631,631,
398,193,631,631,
430,200,631,631,
B-LOT 4, 4 , 2 , 0 ,0
417,242,632,632,
426,212,632,632,
498,232,632,632,
518,278,632,632,
B-TOS, 5 , 2 , 0 ,0
163.,332,590,590,
175.,305,585,585,
179.,280,580,580,
245.,245,590,590,
307.,210,595,595,
403.,155,595,595,
514.,93,560,560,
516.,202,605,605,
518.,276,615,615,
R, 1 , 65 ,10
254,316,607.8,R1
R, 2 , 65 ,10
290,311,635.8,R2
R, 3 , 65 ,10
373,213,636.8,R3
R, 4 , 65 ,10
466,229,637.8,R4
R, 5 , 65 ,10
469,348,635.8,R5
D, 4.5

ALL,ALL
C,C

SOUND32 - RELEASE 07/30/91

TITLE:
Avocado TSM - Ground Level Unmitigated

REC	REC ID	DNL	PEOPLE	LEQ(CAL)
1	R1	65.	10.	64.5
2	R2	65.	10.	64.1
3	R3	65.	10.	67.6
4	R4	65.	10.	63.4
5	R5	65.	10.	55.4

Avocado TSM - Ground Level Mitigated
T-PEAK HOUR TRAFFIC CONDITIONS, 1
 2774 , 45 , 88 , 45 , 58 , 45
L-Avocado, 1
Y,-299,293,615,
Y,-178,303,605,
Y,-57,294,595,
Y,60,268,585,
Y,165,216,575,
Y,274,154,565,
Y,379,95,555,
Y,488,37,545,
Y,541,17,540,
Y,659,-3,530,
Y,779,-8,520,
Y,900,-7,510,
Y,964,-5,505,
B-LOT 1, 1 , 2 , 0 ,0
178,344,602,608,
215,310,602,608,
242,291,602,608,
257,292,602,608,
266,333,602,608,
B-LOT 2, 2 , 2 , 0 ,0
287,325,630,636,
273,309,630,636,
314,270,630,636,
350,272,630,636,
B-LOT 3, 3 , 2 , 0 ,0
342,259,631,637,
324,233,631,637,
398,193,631,637,
430,200,631,637,
B-LOT 4, 4 , 2 , 0 ,0
417,242,632,638,
426,212,632,638,
498,232,632,638,
518,278,632,638,
B-TOS, 5 , 2 , 0 ,0
163.,332,590,590,
175.,305,585,585,
179.,280,580,580,
245.,245,590,590,
307.,210,595,595,
403.,155,595,595,
514.,93,560,560,
516.,202,605,605,
518.,276,615,615,
R, 1 , 65 ,10
254,316,607.8,R1
R, 2 , 65 ,10
290,311,635.8,R2
R, 3 , 65 ,10
373,213,636.8,R3
R, 4 , 65 ,10
466,229,637.8,R4
R, 5 , 65 ,10
469,348,635.8,R5
D, 4.5

ALL,ALL
C,C

SOUND32 - RELEASE 07/30/91

TITLE:
Avocado TSM - Ground Level Mitigated

REC	REC ID	DNL	PEOPLE	LEQ(CAL)
1	R1	65.	10.	60.4
2	R2	65.	10.	58.0
3	R3	65.	10.	59.5
4	R4	65.	10.	57.3
5	R5	65.	10.	55.2

Avocado TSM - Second Level Facade
T-PEAK HOUR TRAFFIC CONDITIONS, 1
 2774 , 45 , 88 , 45 , 58 , 45
L-Avocado, 1
Y,-299,293,615,
Y,-178,303,605,
Y,-57,294,595,
Y,60,268,585,
Y,165,216,575,
Y,274,154,565,
Y,379,95,555,
Y,488,37,545,
Y,541,17,540,
Y,659,-3,530,
Y,779,-8,520,
Y,900,-7,510,
Y,964,-5,505,
B-LOT 1, 1 , 2 , 0 ,0
178,344,602,602,
215,310,602,602,
242,291,602,602,
257,292,602,602,
266,333,602,602,
B-LOT 2, 2 , 2 , 0 ,0
287,325,630,630,
273,309,630,630,
314,270,630,630,
350,272,630,630,
B-LOT 3, 3 , 2 , 0 ,0
342,259,631,631,
324,233,631,631,
398,193,631,631,
430,200,631,631,
B-LOT 4, 4 , 2 , 0 ,0
417,242,632,632,
426,212,632,632,
498,232,632,632,
518,278,632,632,
B-TOS, 5 , 2 , 0 ,0
163.,332,590,590,
175.,305,585,585,
179.,280,580,580,
245.,245,590,590,
307.,210,595,595,
403.,155,595,595,
514.,93,560,560,
516.,202,605,605,
518.,276,615,615,
R, 1 , 65 ,10
254,316,617.8,R1
R, 2 , 65 ,10
290,311,645.8,R2
R, 3 , 65 ,10
373,213,646.8,R3
R, 4 , 65 ,10
466,229,647.8,R4
R, 5 , 65 ,10
469,348,645.8,R5
C,C

SOUND32 - RELEASE 07/30/91

TITLE:
Avocado TSM - Second Level Facade

REC	REC ID	DNL	PEOPLE	LEQ(CAL)
1	R1	65.	10.	68.7
2	R2	65.	10.	68.5
3	R3	65.	10.	70.7
4	R4	65.	10.	66.7
5	R5	65.	10.	60.1