Appendix K

Noise Technical Report for The Harmon Ranch Project

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for The Harmon Ranch Project

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
AC	acre
Caltrans	California Department of Transportation
City	City of Poway
County	County of San Diego
CNEL	Community Noise Equivalent Level
CNMP	construction noise management plan
dB	decibel
dBA	A-weighted decibel
DU	dwelling unit
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HP	horsepower
ips	inches per second
Ldn	day–night average noise level
Leq	equivalent noise level over a given period
Lmax	sound energy level averaged over a specified time period
Ln	statistical sound level
MM	Mitigation Measure
PPV	peak particle velocity
proposed project	Harmon Ranch
RCNM	Roadway Construction Noise Model
RMS	Root mean square
ST	short-term noise measurement locations
VdB	Velocity decibel

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1 Introduction and Background

This assessment was conducted to address potential noise impacts from the proposed The Harmon Ranch Project (proposed project), a residential subdivision with a variety of open spaces to be located in the City of Poway (City). The assessment includes examination of noise generation from project construction and project related traffic, and also evaluates future potential noise exposure levels at sample locations of proposed future residences. Construction activity vibration is also evaluated as part of this assessment.

Project Description

The Harmon Ranch project entails the development of 63-single family dwelling units on a currently vacant site in the City of Poway that is currently designated Residential Single Family 7 (RS-7). The Proposed Project is located north of Oak Knoll Road, south of Poway Road, and in between Pomerado Road and Carriage Road. Proposed amenities will include approximately 2.2 acres of natural open space, approximately 1 acre of open space recreational and a trail approximately 1,000 feet in length connecting to the existing commercial center north of the site for residents to utilize.

Noise Characteristics

Sound is mechanical energy transmitted by pressure waves in a compressible medium, such as air. Noise is defined as sound that is loud, unpleasant, unexpected, or undesired. The sound pressure level (SPL) has become the most common descriptor used to characterize the loudness of an ambient sound level. The unit of measurement of sound pressure is a decibel (dB). Under controlled conditions in an acoustics laboratory, the trained, healthy human ear is able to discern changes in sound levels of 1 dB when exposed to steady, single-frequency signals in the mid-frequency range. Outside such controlled conditions, the trained ear can detect changes of 2 dB in normal environmental noise. It is widely accepted that the average healthy ear, however, can barely perceive noise level changes of 3 dB. A change of 5 dB is readily perceptible, and a change of 10 dB is perceived as twice or half as loud (Caltrans 2013a). A doubling of sound energy results in a 3-dB increase in sound, which means that a doubling of sound energy (e.g., doubling the number of daily trips along a given road) would result in a barely perceptible change in sound level.

Sound may be described in terms of level or amplitude (measured in decibels), frequency or pitch (measured in hertz, or cycles per second), and duration (measured in seconds or minutes). Because the human ear is not equally sensitive to sound at all frequencies, a special frequency-dependent rating scale is used to relate noise to human sensitivity. The A-weighted decibel (dBA) scale performs this compensation by discriminating against low and very high frequencies in a manner approximating the sensitivity of the human ear.

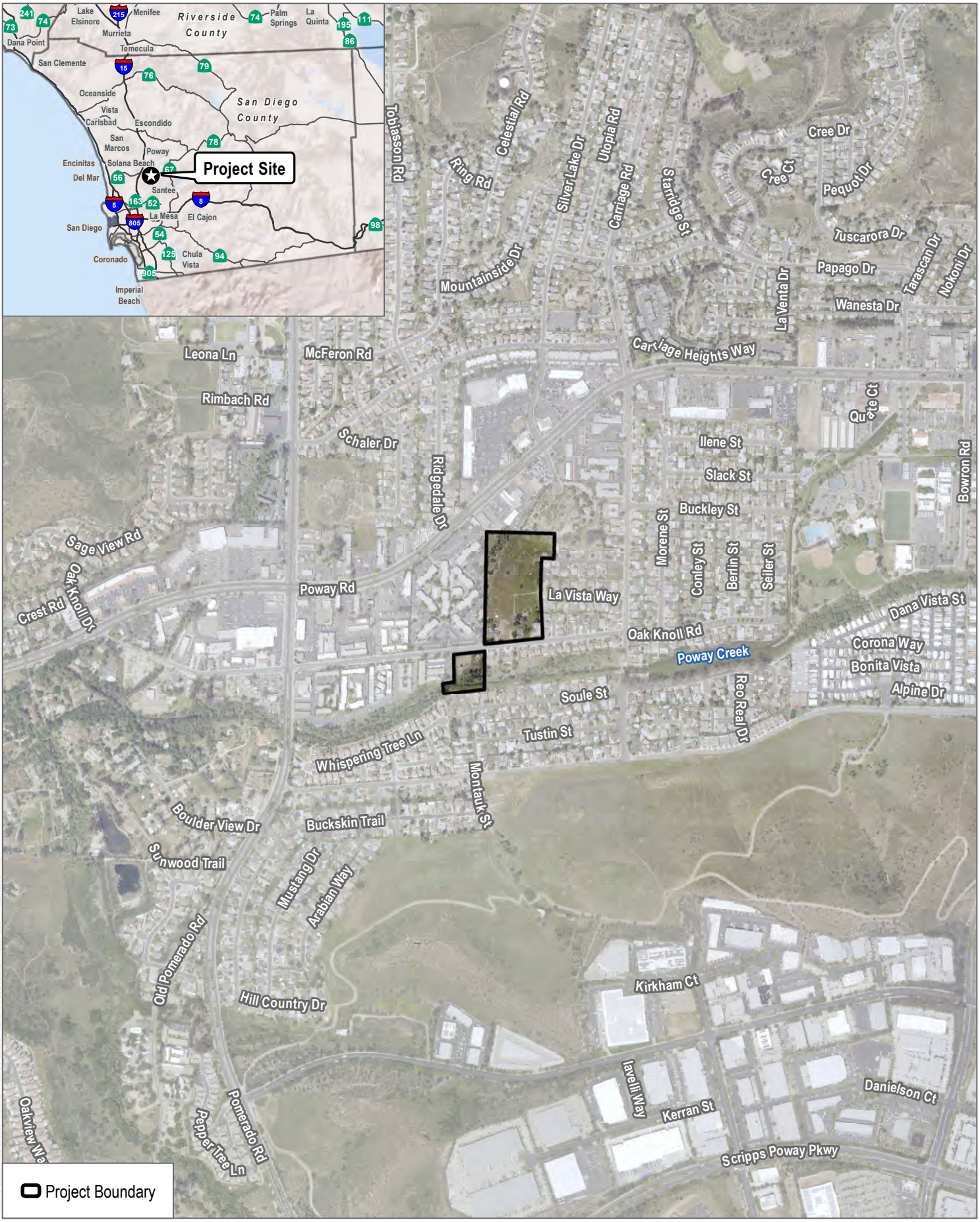
Several descriptors of noise (noise metrics) exist to help predict average community reactions to the adverse effects of environmental noise, including traffic-generated noise. These descriptors include the equivalent noise level over a given period (L_{eq}), the statistical sound level (L_n), the day–night average noise level (L_{dn}), and the Community Noise Equivalent Level (CNEL). Each of these descriptors uses units of dBA.

L_{eq} is a sound level energy-averaged over a specified time period, represented by a single constant value equivalent to the variable sound energy received at a location. For example, a 1-hour L_{eq} measurement would represent the average amount of energy contained in all the noise that occurred in that hour. L_{eq} is an effective noise descriptor because it allows convenient comparison of time-varying sound levels at different locations. L_{max} is the greatest sound level measured during a designated time interval or event.

Unlike the L_{eq} metrics, L_{dn} and CNEL metrics always represent 24-hour periods. L_{dn} and CNEL also differ from L_{eq} because they apply a time-weighted factor designed to emphasize noise events that occur during the evening and nighttime hours (when speech and sleep disturbance is of more concern). “Time weighted” refers to the fact that

L_{dn} and CNEL penalize noise that occurs during certain sensitive periods. In the case of CNEL, noise occurring during the daytime (7:00 a.m. to 7:00 p.m.) receives no penalty. Noise during the evening hours (7:00 p.m. to 10:00 p.m.) is penalized by adding 5 dB to the measured or predicted L_{eq} values, and nighttime (10:00 p.m. to 7:00 a.m.) noise is penalized by adding 10 dB. L_{dn} differs from CNEL in that the daytime period is defined as 7:00 a.m. to 10:00 p.m., thus eliminating the evening period. L_{dn} and CNEL are the predominant criteria used to measure roadway noise affecting residential receptors. These two metrics generally differ from one another by no more than 0.5–1 dB, and are thus often considered comparable or even equivalent and interchangeable by many jurisdictions.

Vibration is the oscillatory movement of solid mass. Like sound, it is described in terms of frequency and amplitude, which can be expressed as displacement, velocity, or acceleration. For purposes of this analysis and consistent with environmental assessment, vibration is presented and discussed herein as units of velocity (inches per second [ips]) and their decibel equivalents as appropriate. Vibration impacts to buildings are generally discussed in terms of peak particle velocity (PPV), while human annoyance or disturbance is often discussed with root-mean-square (RMS) vibration velocity levels that are converted to decibels (VdB). But for purposes of this analysis, PPV will be used to describe all vibration for ease of reading and comparison. Vibration can impact people, structures, and sensitive equipment or processes (Caltrans 2020). Common sources of vibration within communities include construction activities and railroad operations. Groundborne vibration generated by construction projects exhibits highest amplitudes during pile driving, rock blasting, soil compacting, jack hammering, and demolition-related activities that involve sudden impacts or other transient impulses of energy delivered to soil and rock strata. Vibration can also be more regularly occurring or even continuous in nature, such as the steady operation of mechanical equipment featuring reciprocating or rotating components that are slightly imbalanced. The maximum vibration level standard used by the California Department of Transportation (Caltrans) for the prevention of structural damage to typical residential buildings is 0.3 ips PPV (Caltrans 2020).



SOURCE: SAN GIS 2017

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0 500 1,000 Feet

FIGURE 1

Project Location

Harmon Ranch

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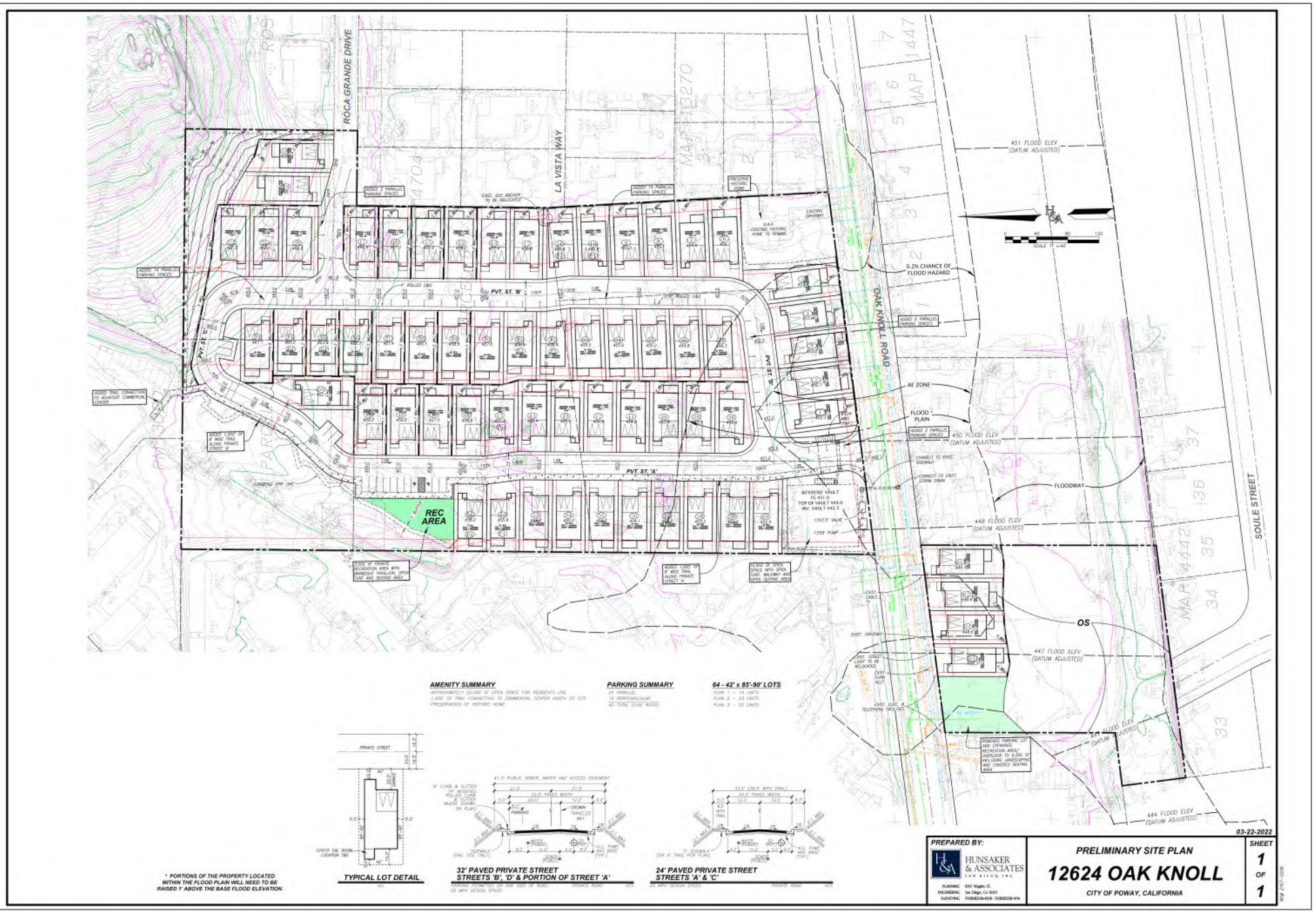

SOURCE: Hunksaker 2022

FIGURE 2
Site Plan
Harmon Ranch

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2 Regulatory Setting

Federal

Federal Transit Administration

In its Transit Noise and Vibration Impact Assessment guidance manual, the Federal Transit Administration (FTA) recommends a daytime construction noise level threshold of 80 dBA L_{eq} over an 8-hour period (FTA 2018) when "detailed" construction noise assessments are performed to evaluate potential impacts to community residences surrounding a project. Although this FTA guidance is not a regulation, it can serve as a quantified standard in the absence of such limits at the State and local jurisdictional levels.

State

California Code of Regulations, Title 24

Title 24 of the California Code of Regulations sets standards which new development in California must meet. According to Title 24, interior noise levels are not to exceed 45 dB CNEL for new multifamily residences, hotels, and other attached residences.

Title 24 also requires that an interior acoustical study demonstrating that interior noise levels due to exterior sources will be less than or equal to 45 CNEL be performed for affected multifamily structures and hotels that are exposed to exterior noise levels in excess of 60 CNEL.

California Department of Health Services Guidelines

The State Department of Health Services has developed guidelines of community noise acceptability for use by local agencies (OPR 2003). Selected relevant levels are listed here:

- Below 60 dBA CNEL: normally acceptable for low-density residential use
- 50 to 70 dBA: conditionally acceptable for low-density residential use
- Below 65 dBA CNEL: normally acceptable for high-density residential use and transient lodging
- 60 to 70 dBA CNEL: conditionally acceptable for high-density residential, transient lodging, churches, educational, and medical facilities.

The normally acceptable exterior noise level for transient lodging use is up to 65 dBA CNEL. Conditional acceptable exterior noise levels range up to 70 dBA CNEL for transient lodging.

California Department of Transportation

In its Transportation and Construction Vibration Guidance Manual, Caltrans recommends a vibration velocity threshold of 0.2 ips PPV (Caltrans 2020) for assessing "annoying" vibration impacts to occupants of residential structures. Although this Caltrans guidance is not a regulation, it can serve as a quantified standard in the absence of such limits at the local jurisdictional level. Similarly, thresholds to assess building damage risk due to construction vibration vary with the type of structure and its fragility but tend to range between 0.3 ips and 0.4 ips PPV for typical residential structures (Caltrans 2020).

Local

City of Poway Noise Municipal Code

Section 8.08.040 and 8.08.100 of the Poway Municipal Code establishes sound level limits within the City and describes regulations on construction equipment, respectively. These sections are reproduced or summarized below.

8.08.040 Sound Level Limits

Unless a variance has been applied for and granted pursuant to this chapter, it is unlawful for any person to cause or allow the creation of any noise to the extent that the one-hour average sound level, at any point on or beyond the boundaries of the property on which the sound is produced, exceeds the applicable limits set forth below, except that construction noise level limits shall be governed by PMC 8.08.100. In addition, the Noise Element addresses nuisance noise and states that it should be unlawful for any person to make or continue any loud, unnecessary noise that causes annoyance to any reasonable person of normal sensitivity.

Zone or Land Use Designation	Allowable Time	Applicable Limit One-Hour Average Sound Level (In decibels)
OS-RM, OS, OS/1du, RR-A, RR-B, RR-C, RS-2, RS-3, RS-4, RS-7, and Specific Plan, PRD and PC regulations with a density of 11 dwelling units or less per acre	10:00 p.m. to 7:00 a.m.	40
	7:00 a.m. to 10:00 p.m.	50
PF, RA, RC, MHP, and Specific Plan, PRD and PC regulations with a density of 11 or more dwelling units per acre	7:00 a.m. to 7:00 p.m.	55
	7:00 p.m. to 10:00 p.m.	50
	10:00 p.m. to 7:00 a.m.	45
SPC, MU, CO, CN, CB, CG, TC, A/GC and HC	7:00 a.m. to 7:00 p.m.	60
	7:00 p.m. to 10:00 p.m.	55
	10:00 p.m. to 7:00 a.m.	50
MRE, SC, LI, LI/S and IP	Anytime	70

The sound level limit at a location on a boundary between two zoning districts is the arithmetic mean of the respective limits for the two districts

Fixed location public utility distribution or transmission facilities located on or adjacent to a property line shall be subject to the noise level limits of this section, measured at or beyond six feet from the boundary of the easement upon which the equipment is located.

8.08.100 Construction Equipment

Except for emergency work, it is unlawful for any person, including the City, to operate any single or combination of powered construction equipment at any construction site, except as outlined in subsections A and B of this section:

A. It is unlawful for any person, including the City, to operate any single or combination of powered construction equipment at any construction site before 7:00 a.m. or after 5:00 p.m. on Mondays through Saturdays or at any time on a Sunday or holiday except as provided below. For purposes of this section, "construction" does not include minor home repairs, lawn mowing, gardening and similar types of routine maintenance as identified in PMC 8.08.170(D).

1. The City Engineer may permit, in writing, the use of powered construction equipment during specific hours before 7:00 a.m. or after 5:00 p.m. Monday through Saturday, or any time on a Sunday or holiday, if he or she determines that such operations are not detrimental to the health, safety, or welfare of the surrounding community, that the conduct of the activity is limited by the nature of the work, and that it is in the best interest of the public to perform the work outside of normal hours and days of work.
2. A residential property owner constructing a single-family residence, or constructing an addition to, or otherwise modifying, a single-family residence for personal occupancy may operate powered construction equipment on Sundays or holidays between the hours of 10:00 a.m. and 5:00 p.m. in compliance with the requirements of subsection B of this section; provided, that:
    a. The type of equipment used is limited to handheld construction equipment or equipment powered by small electrical motors, including, but not limited to, small cement mixers, table saws, and similar small equipment; and
    b. The construction is not carried out for profit or livelihood. Upon request of the City, a property owner shall provide documentation, to the satisfaction of the Director of Development Services, of personal occupancy of the residence, or the intent to personally occupy the residence.

B. No such equipment, or combination of equipment regardless of age or date of acquisition, shall be operated so as to cause noise at a level in excess of 75 decibels for more than eight hours during any 24- hour period when measured at or within the property lines of any property which is developed and used either in part or in whole for residential purposes. These sound levels shall be corrected for time duration in accordance with the following table:

Total Duration in 24 Hours	Decibel Level Allowance	Total Decibel Level
Up to 15 Minutes	+15	90
Up to 30 Minutes	+12	87
Up to 1 Hour	+9	84
Up to 2 Hours	+6	81
Up to 4 Hours	+3	78
Up to 8 Hours	0	75

In the event that lower noise limit standards are established for construction equipment pursuant to State or Federal law, said lower limits shall be used as a basis for revising and amending the noise level limits specified in subsection B of this section.

Poway General Plan

The General Plan EIR Section 5.10 establishes the following mitigation measure related to noise. Development within the City of Poway, including the Specific Plan planning area, is subject to these measures: "6. The City of Poway shall ensure a safe and pleasant acoustical environment for the residents of Poway through site planning, zoning regulations, architectural design standards, and building construction regulations."

3 Existing Conditions

Noise measurements were conducted on and near the project site on May 4, 2022, to quantify and help characterize the existing pre-project outdoor sound environment. Table 1 provides the locations, date, and times these noise measurements were performed. The noise measurements were taken using a Rion NL-52 sound level meter equipped with a 0.5-inch, pre-polarized condenser microphone with pre-amplifier. The sound level meter meets the current American National Standards Institute standard for a Type 1 (Precision Grade) sound level meter. The accuracy of the sound level meter was verified using a field calibrator before and after the measurements, and the measurements were conducted with the microphone positioned approximately 5 feet above the ground.

The four short-term (ST) noise measurement locations were selected to represent existing noise-sensitive receivers on and near the project site. These locations are depicted as receivers ST1–ST4 on Figure 3, Noise Measurement and Modeling Locations. The measured energy-averaged (L_{eq}) and maximum (L_{max}) noise levels at these field survey locations are provided in Table 1.

Table 1. Measured Community Outdoor Noise Levels

Receptor	Location/Address	Date (mm/dd/yy)	Time (hh:mm)	L_{eq} (dBA)	L_{max} (dBA)
ST1	North of 12643 Oak Knoll Rd, Poway, CA 92064	05/04/22	09:10–09:20 a.m.	58.5	76.2
ST2	South of 12710 La Vista Way, Poway, CA 92064	05/04/22	09:30–09:40 a.m.	51.1	70.6
ST3	Eastern property line of Countryside Apartments	05/04/22	09:50–10:00 a.m.	56.9	65.7
ST4	Southern Property line of Poway Towne Center Shopping Mall, approximately 200 feet south of Poway Road	05/04/22	10:10–10:20 a.m.	53.8	66.3

Source: Appendix A.
Notes: L_{eq} = equivalent continuous sound level (time-averaged sound level); L_{max} = maximum sound level during the measurement interval; dBA = A-weighted decibels; ST = short-term noise measurement locations.

The primary noise sources at the sites identified during the noise measurements presented in Table 1 consisted of traffic along adjacent roadways and unrelated construction activity. The sounds of rustling leaves, aircraft overflights, distant conversation, and birdsong were also documented but to a lesser degree. As shown in Table 1, the measured sound levels ranged from approximately 51.1 dBA L_{eq} at ST2 to 58.5 dBA L_{eq} at ST1. More details of the collected noise measurement data can be found in Appendix A, Noise Measurement Field Data.

4 Thresholds of Significance

The following significance criteria are based on Appendix G of the California Environmental Quality Act Guidelines (14 CCR 15000 et seq.) and will be used to determine the significance of potential noise impacts. Impacts to noise would be significant if the proposed project would result in:

a. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.

b. Generation of excessive groundborne vibration or groundborne noise levels.

c. Expose people residing or working in the project area to excessive noise levels (for a project located within the vicinity of a private airstrip or an airport land use plan, or where such a plan has not been adopted, within 2 miles of a public airport or public use airport).

5 Impact Discussion

a) Would the project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Short-Term Construction

Construction noise and vibration are temporary phenomena. Construction noise and vibration levels vary from hour to hour and day to day, depending on the equipment in use, the operations performed, and the distance between the source and receptor.

Equipment that would be in use during the proposed project construction would include, in part, graders, backhoes, rubber-tired dozers, loaders, cranes, forklifts, cement mixers, pavers, rollers, and air compressors. The typical maximum noise levels for various pieces of construction equipment at a distance of 50 feet are presented in Table 2. The listed maximum noise levels in Table 2 are, when downwardly adjusted by 6 dB to account for doubling the assessment distance to 100 feet, all compliant with the City's 85 dBA at 100 feet criterion per General Plan Noise Element.

It is anticipated that construction activities associated with the proposed project would take place primarily within the allowable hours of the City of Poway (7:00 a.m. and 5:00 p.m. Monday through Saturday). In the event that construction is required to extend beyond these times, extended hours permits would be required and would be obtained by the applicant.

Note that the equipment noise levels presented in Table 2 are maximum noise levels. Usually, construction equipment operates in alternating cycles of full power and low or no power, producing average noise levels over time that are less than the maximum noise level. This is accounted for through the use of an "acoustical usage factor", expressing the percentage of time a piece of equipment is typically operational. The sound level produced by the construction activity also depends on where the equipment actually operates onsite and the intensity of construction activities.

SOURCE: SAN GIS 2017

DUDEK

0 100 200 Feet

FIGURE 3

Noise Measurement and Modeling Locations

Harmon Ranch

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Table 2. Typical Construction Equipment Maximum Noise Levels

Equipment Type	Typical Equipment (L_{max}, dBA at 50 Feet)
All Other Equipment > 5 HP	85
Backhoe	78
Compressor (air)	78
Concrete Saw	90
Crane	81
Dozer	82
Excavator	81
Flat Bed Truck	74
Front End Loader	79
Generator	72
Grader	85
Man Lift	75
Paver	77
Roller	80
Scraper	84
Welder / Torch	73

Source: DOT 2006. FTA 2018.
Note: L_{max} = maximum sound level; dBA = A-weighted decibels.

Aggregate noise emission from proposed project construction activities, broken down by sequential phase, was predicted at two distances to the nearest existing noise-sensitive receptor: 1) from the nearest position of the construction site boundary and 2) from the geographic center of the construction site, which serves as the time-averaged location or geographic *acoustical centroid* of active construction equipment for the phase under study. The intent of the former distance is to help evaluate anticipated construction noise from a limited quantity of equipment or vehicle activity expected to be at the boundary for some period of time, which would be most appropriate for phases such as site preparation, grading, and paving. At the site boundary distance, the analysis assumes that up to only one piece of equipment, for each listed type per phase, will be involved in the construction activity for a limited portion of the 8-hour period. In other words, at such proximity along the boundary of the site, the operating equipment cannot "stack" or crowd the vicinity and still be able to operate.

The distance to the acoustical centroid is used in a manner similar to the general assessment technique as described in the FTA guidance for construction noise assessment (FTA 2018), where the location of individual equipment for a given construction phase is uncertain and where construction equipment is anticipated to operate over some extent of the construction site, near and far. For the acoustical centroid case, which intends to be a geographic average position for all equipment during the indicated phase, this analysis assumes that the equipment may be operating up to all 8 hours per day. Table 3 summarizes these distances to the apparent closest noise-sensitive receptor for each of the seven sequential construction phases.

Table 3. Estimated Distances between Construction Activities and the Nearest Noise-sensitive Receptors

Construction Phase (and Equipment Types Involved)	Distance from Nearest Noise-Sensitive Receptor to Construction Site Boundary (Feet)	Distance from Nearest Noise-Sensitive Receptor to Acoustical Centroid of Site (Feet)
Demolition (concrete saw, excavator, dozer)	25	160
Site Preparation (dozer, backhoe)	25	160
Grading (excavator, grader, dozer, backhoe)	25	160
Building construction (crane, man-lift, generator, backhoe, welder)	25	160
Paving (paver, roller, concrete mixer truck)	25	160
Architectural Coating (compressor)	25	160

A Microsoft Excel–based noise prediction model, emulating and using reference data from the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM) (FHWA 2008) was used to estimate construction noise levels at the nearest occupied noise-sensitive land use. (Although the RCNM was funded and promulgated by the FHWA, it is often used for non-roadway projects, because the same types of construction equipment used for roadway projects are often used for other types of construction.) Input variables for the predictive modeling consist of the equipment type and number of each (e.g., two graders, a loader, a tractor), the duty cycle for each piece of equipment, and the distance from the noise-sensitive receiver. The RCNM has default duty-cycle values for the various pieces of equipment, which were derived from an extensive study of typical construction activity patterns. Those default duty-cycle values were used for this noise analysis, which are detailed in Appendix B, Construction Noise Modeling Input and Output. Conservatively, no topographical or structural shielding was assumed in the construction noise modeling. The predicted results from the construction noise modeling for the proposed project are displayed in Table 4.

Table 4. Predicted Construction Noise Levels per Activity Phase

Construction Phase (and Equipment Types Involved)	8-Hour Leq at Nearest Noise-Sensitive Receptor to Construction Site Boundary (dBA)	8-Hour Leq at Nearest Noise-Sensitive Receptor to Acoustical Centroid of Site (dBA)
Demolition (concrete saw, excavator, dozer)	84.9	73.1
Site Preparation (dozer, backhoe)	79.4	70.8
Grading (excavator, grader, dozer, backhoe)	84.2	71.5
Building construction (crane, man-lift, generator, backhoe, welder)	78.2	66.7
Paving (paver, roller, concrete mixer truck)	83.6	70.8
Architectural Coating (compressor)	78.7	59.1

Notes: L_{eq} = equivalent noise level; dBA = A-weighted decibels.

As presented in Table 4, the estimated construction noise levels are predicted to be as high as 85 dBA equivalent continuous sound level (L_{eq}) over an 8-hour period at the nearest existing residences (as close as 25 feet away) when demolition activities take place near the project boundary. Construction equipment noise levels for other activity phases are modeled to range from approximately 78 to 84 dBA L_{eq8h} at the nearest existing noise-sensitive receptor when construction operations take place near the project boundary. Note that these estimated noise levels

at a source-to-receiver distance of 25 feet with the assumption that the heavy equipment associated with each phase is operating along the project boundary for a cumulative period of 2 hours a day with equipment performing work at more distant location or simply not operating the remaining time during the day. As such, this would result in an exceedance of the City of Poway construction noise limit of 75 dBA L_{eq8h}.

In order to avoid potentially significant construction noise impacts upon existing residences in the project vicinity, mitigation measure **MM-NOI-1** shall be implemented as indicated site conditions may warrant. Proper application of temporary noise barriers, or comparable sound abatement, that may arise as a result of **MM-NOI-1** implementation has the ability to realize a reduction in noise levels of 10 dB or more, that would correspondingly reduce the predicted 85 dBA eight-hour L_{eq} for the construction phases to a level of 75 dBA L_{eq8h} or less, and thus compliant with the 75 dBA threshold. With implementation of **MM-NOI-1**, impacts would be reduced to being **less than significant**.

Long-Term Operational

Off-Site Traffic Noise Exposure

Less-Than-Significant Impact. The proposed project would result in the creation of additional vehicle trips on local arterial roadways, which could result in increased traffic noise levels at adjacent noise-sensitive land uses. Appendix C, Traffic Noise Modeling Input and Output, contains a spreadsheet with traffic volume data (average daily traffic). In particular, the proposed project would create additional traffic along Oak Knoll Road, which according to the Traffic Impact Assessment prepared for the proposed project (Intersecting Metrics, 2022) would add 640 total average daily trips adjacent to the project site.

According to Caltrans, a 3 dB change in sound is the beginning at which humans generally notice a barely perceptible change in sound, a 5 dB change is generally readily perceptible, and a 10 dB increase is perceived by most people as a doubling of the existing noise level (Caltrans 2013a). Due to the existing and proposed urban setting of the project area, a readily perceptible change in traffic noise levels (5 dBA change) would be the appropriate threshold to determine significant increases in traffic noise.

Potential noise effects from vehicular traffic were assessed using the Federal Highway Administration's Traffic Noise Model version 2.5 (FHWA 2004). Information used in the model included the roadway geometry, existing (year 2022), existing plus project, near-term (opening day) and near-term (opening day) plus project traffic volumes and posted vehicular speed limits. Traffic noise levels were modeled at representative noise-sensitive receivers ST1 through ST4, as shown in Figure 3. The receivers were modeled to be 5 feet above the local ground elevation. The noise model results are summarized in Table 5. Based on results of the model, implementation of the proposed project would not result in readily perceptible increases in traffic noise.

Table 5. Traffic Noise Modeling Results

Modeled Receiver No.	Modeled Traffic Noise Levels (dBA CNEL)				Maximum Project-Related Noise Level Increase (dB)
	Existing (2022)	Existing (2022) with Project	Near-Term (Opening Day) without Project	Near-Term (Opening Day) with Project	
ST1	58.7	59.4	59.3	59.7	0.7
ST2	46.3	46.6	47.0	46.0	0.3
ST3	50.6	50.7	51.2	51.2	0.1
ST4	58.8	58.8	59.4	59.4	0

Source: Appendix C.
Notes: dBA = A-weighted decibel; CNEL = community noise equivalent level; dB = decibel.

Table 5 shows that at all four listed representative receivers, the addition of proposed project's traffic to the roadway network would result in an increase of less than 3 dB CNEL, which is below the perceptible level of change for the average healthy human ear. Thus, long-term traffic noise increases associated with the proposed project, affecting existing residences in the vicinity would be a **less-than-significant** impact.

On-site Traffic Interior Noise Exposure

The City and the state require that interior noise levels not exceed a CNEL of 45 dB within residences. Typically, with the windows open, building shells provide approximately 15 dB of noise reduction; with windows closed, residential construction generally provides a minimum of 25 dB attenuation. Therefore, rooms exposed to an exterior CNEL not greater than 60 dB would result in an interior CNEL of 45 dB or less even with windows open. But when exterior CNEL values range from 60-70 dBA, the windows would need to be closed and thus require that the occupied structure feature mechanical ventilation for interior comfort.

The FHWA TNM model was further implemented to determine the future exterior noise levels at a representative sample of the proposed new homes on lots parallel with Oak Knoll Road. The receivers corresponding to the exterior building façade of the proposed new homes were calculated at modeled building positions B1, B3, B5, B23, B62, and B64, as shown below in Table 6 and on Figure 3.

Table 6. Future Traffic Noise Levels at Residential Facades

Building	Noise Level (CNEL)	
	1st Floor	2nd Floor
B1	56.1	56.4
B3	56.9	57.1
B5	56.2	56.5
B23	53.9	57.3
B62	58.8	58.9
B64	58.8	58.8

Traffic noise results displayed in Table 6 indicate that future traffic noise exposure levels at the closest building facades to Oak Knoll would all be under the maximum exterior noise level threshold for single-family residences (60 CNEL dBA) and would consequently be anticipated to result in an interior CNEL of 45 dB or less, even with the windows open (i.e., 59 dBA CNEL minus 15 dB = 44 dBA CNEL). Therefore, future roadway traffic noise levels at the interior of the proposed residences would be a **less-than-significant** impact.

b) Would the project result in generation of excessive groundborne vibration or groundborne noise levels?

Construction activities may expose persons to excessive groundborne vibration or groundborne noise, causing a potentially significant impact. Caltrans has collected groundborne vibration information related to construction activities (Caltrans 2020). Information from Caltrans indicates that continuous vibrations with a PPV of approximately 0.2 ips is considered "annoying." For context, heavier pieces of construction equipment, such as a bulldozer that may be expected on the project site, have peak particle velocities of approximately 0.089 ips or less at a reference distance of 25 feet (DOT 2006).

Groundborne vibration attenuates rapidly—even over short distances. And when groundborne vibration encounters a building foundation, a coupling loss occurs depending on the mass and design. For typical wood-framed houses, like those near the proposed project, this coupling loss is 5 vibration velocity decibels according to FTA guidance (FTA 2006). The attenuation of groundborne vibration as it propagates from source to receptor through intervening

soils and rock strata can be estimated with expressions found in FTA and Caltrans guidance. By way of example, for a bulldozer operating on site and as close as the western project boundary (that is 25 feet from the nearest receiving sensitive land use) the estimated vibration velocity level would be 0.089 ips and thus no greater than the annoyance threshold recommended by Caltrans. Therefore, vibration-induced annoyance to occupants of nearby existing homes would be **less-than-significant**.

Construction vibration, at sufficiently high levels, can also present a building damage risk. However, anticipated construction vibration from conventional heavy equipment associated with this proposed project would not yield levels that surpass this risk. Per Caltrans, the recommended PPV threshold for newer residential structures is 0.5 ips and 0.3 ips for older residential structures—both of which are less stringent that the aforementioned threshold to annoy occupants of such structures; thus vibration damage risk to nearby structures is considered **less-than-significant.**

Once operational, the proposed project is not anticipated to include major producers of groundborne vibration. On this basis, vibration due to proposed project operation should be **less than significant**.

C. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

Less-Than-Significant Impact. There are no private airstrips within the vicinity of the project site. The closest airport to the proposed project site is the Marine Corps Air Station Miramar, approximately 6.75 miles northeast of the site and would therefore not expose people residing or working in the project area to excessive noise levels. Impacts would be **less than significant**.

6 Mitigation Measures

The following mitigation measures would be implemented to reduce potentially significant impacts to less than significant.

MM-NOI-1 Prior to the issuance of a Construction Permit, the project applicant/owner or construction contractor shall prepare and submit to the City of Poway Planning Division for its review and approval a Construction Noise Management Plan (CNMP). Prior to the issuance of a Construction Permit, construction plans shall also include a note indicating compliance with the CNMP is required. The CNMP shall be prepared or reviewed by a qualified acoustician (retained at the project applicant/owner or construction contractor's expense) and feature the following:

1) A detailed construction schedule, at daily (or weekly, if activities during each day of the week are typical) resolution and correlating to areas or zones of on-site project construction activities and the anticipated equipment types and quantities involved. Information shall include expected hours of actual operation per day for each type of equipment per phase and indication of anticipated concurrent construction activities on site.

2) Suggested locations for noise level monitoring, attended by a qualified acoustician or another party under his/her supervision or direction, at which sample outdoor ambient noise levels will be measured and collected over a sufficient sample period and subsequently analyzed to ascertain compliance with the eight-hour City of Poway threshold of 75 dBA equivalent noise level. Sampling shall be performed, at a minimum, on the first (or otherwise considered typical construction operations) day of each distinct construction phase (e.g., each of the six listed phases in Table 3, Construction Phase Distance to Nearest Pre-Existing Noise-Sensitive Receptors).

3) If sample collected noise level data indicates that the eight-hour noise threshold has or will be exceeded, construction work shall be suspended (for the activity or phase of concern) and the project applicant/owner or construction contractor shall implement one or more of the following measures as detailed or specified in the CNMP:

    a) Administrative controls (e.g., reduce operating time of equipment and/or prohibit usage of equipment type[s] within certain distances of noise-sensitive receptors).

    b) Engineering controls (upgrade noise controls, such as install better engine exhaust mufflers, silencers, engine bay dampening, etc.).

    c) Install noise abatement on the project site boundary fencing (or within the project site, as practical and appropriate) in the form of sound blankets or comparable temporary barriers to occlude construction noise transmission between the project site (or specific equipment operation as the situation may define) and the noise-sensitive receptor(s) of concern.

The implemented measure(s) shall be reviewed or otherwise inspected and approved by the qualified acoustician (or another party under his/her supervision or direction) prior to resumption of the construction activity or process that caused the measured noise of concern or need for noise mitigation. Noise levels shall be re-measured, after installation of said measures, to ascertain post-mitigation compliance with the noise threshold. As needed, this process shall be repeated and refined until noise level compliance is demonstrated and

documented. A report of this implemented mitigation and its documented success shall be provided to the City of Poway Planning Division.

4) The project applicant/owner or construction contractor shall make available a telephone hotline so that concerned neighbors in the community may call to report noise complaints. The CNMP shall include a process to investigate these complaints and, if determined to be valid, detail efforts to provide a timely response and resolution to the complainant—with copy of resolution provided to the City of Poway Planning Division.

7 Summary of Findings

This noise report was conducted for the proposed project. The results indicate that potential impacts during construction would be **less than significant with mitigation**. Noise impacts due to long-term operation of the proposed project (including traffic noise) would be a **less than significant** impact. No further mitigation beyond what has been described herein for construction noise is anticipated at this time.

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8 References Cited

Berger, E., Neitzel, R., and Kladden, C. (Berger *et al*). 2015. Noise Navigator™ Sound Level Database with Over 1700 Measurement Values. E-A-R 88-34/HP, version 1.8. June 26.

Caltrans (California Department of Transportation). 2013a. *Technical Noise Supplement to the Traffic Noise Analysis Protocol*. September 2013.

Caltrans. 2020. *Transportation and Construction Vibration Guidance Manual*. Division of Environmental Analysis, Environmental Engineering, Hazardous Waste, Air, Noise, Paleontology Office. Sacramento, California. September 2013.

City of Poway. 2019. Poway Municipal Code

DOT (U.S. Department of Transportation). 2006.

Federal Highway Administration (FHWA). 2008. Roadway Construction Noise Model (RCNM), Software Version 1.1. U.S. Department of Transportation, Research and Innovative Technology Administration, John A. Volpe National Transportation Systems Center, Environmental Measurement and Modeling Division. Washington, D.C. December 8

FHWA. 2006. *Roadway Construction Noise Model: User's Guide*. Final Report. FHWA-HEP-06-015. DOT-VNTSC-FHWA-06-02. Cambridge, Massachusetts: DOT, Research and Innovative Technology Administration. Final Report. August.

FHWA. 2004. FHWA Traffic Noise Model Version 2.5.

FTA (Federal Transit Administration). 2006. *Transit Noise and Vibration Impact Assessment*. Final Report. FTA-VA-90-1003-06. May.

Intersecting Metrics. 2022. Transportation Impact Analysis Study – Oak Knoll *(aka Harmon Ranch)*. Prepared for: Lennar Communities. La Mesa, California, May 20, 2022.

OPR (Governor's Office of Planning and Research). 2017. State of California 2017 General Plan Guidelines. Accessed May 10, 2019. http://www.opr.ca.gov/docs/OPR_COMPLETE_7.31.17.pdf.

OPR. 2003. State of California General Plan Guidelines. October 2003.

Appendix A

Noise Measurement Field Data

FORMS DUDEK FIELD DATA REPORT

Field Noise Measurement Data

Record: 1419	
Project Name	*Oak knoll*
Observer(s)	*Connor Burke*
Date	*2022-05-04*

Meteorological Conditions	
Temp (F)	*64*
Humidity % (R.H.)	*63*
Wind	*Calm*
Wind Speed (MPH)	*4*
Wind Direction	*East*
Sky	*Sunny*

Instrument and Calibrator Information	
Instrument Name List	*(ENC) Rion NL-52*
Instrument Name	*(ENC) Rion NL-52*
Instrument Name Lookup Key	*(ENC) Rion NL-52*
Manufacturer	*Rion*
Model	*NL-52*
Serial Number	*553896*
Calibrator Name	*(ENC) LD CAL150*
Calibrator Name	*(ENC) LD CAL150*
Calibrator Name Lookup Key	*(ENC) LD CAL150*
Calibrator Manufacturer	*Larson Davis*
Calibrator Model	*LD CAL150*
Calibrator Serial #	*5152*
Pre-Test (dBA SPL)	*94*
Post-Test (dBA SPL)	*94*
Windscreen	*Yes*
Weighting?	*A-WTD*
Slow/Fast?	*Slow*
ANSI?	*Yes*

Monitoring	
Record #	*1*
Site ID	*ST1*
Site Location Lat/Long	*32.950567, -117.056818*
Begin (Time)	*09:10:00*
End (Time)	*09:20:00*
Leq	*58.5*
Lmax	*76.2*
Lmin	*40.6*
Other Lx?	*L90, L50, L10*
L90	*43.1*
L50	*48.9*
L10	*58.9*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*Onsite construction*
Other Noise Sources (Background)	*Birds, Distant Traffic, Rustling Leaves*
Other Noise Sources Additional Description	*Front loader moving*
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

Description / Photos

Site Photos

Photo	
	

Monitoring

Record #	*2*
Site ID	*ST2*
Site Location Lat/Long	*32.951712, -117.056119*
Begin (Time)	*09:30:00*
End (Time)	*09:40:00*
Leq	*51.1*
Lmax	*70.6*
Lmin	*41*
Other Lx?	*L90, L50, L10*
L90	*44.8*
L50	*49*
L10	*54.2*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*On site construction*
Other Noise Sources (Background)	*Birds, Distant Aircraft, Distant Traffic*
Other Noise Sources Additional Description	*Front loader moving. Back up alarm*
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

Description / Photos

Site Photos

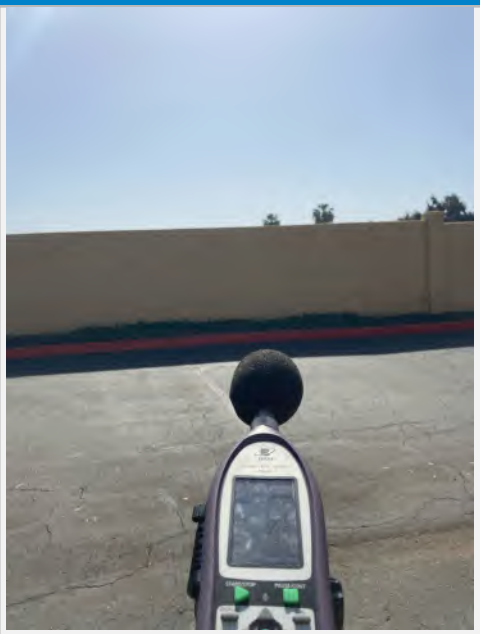
Photo	
	

Monitoring

Record #	*3*
Site ID	*ST3*
Site Location Lat/Long	*32.951742, -117.057539*
Begin (Time)	*09:50:00*
End (Time)	*10:00:00*
Leq	*56.9*
Lmax	*65.7*
Lmin	*48.9*
Other Lx?	*L90, L50, L10*
L90	*49.2*
L50	*52.8*
L10	*61.8*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*On site construction*
Other Noise Sources (Background)	*Birds, Distant Aircraft*
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

Description / Photos

Site Photos

Photo	
	

Monitoring

Record #	*4*
Site ID	*ST4*
Site Location Lat/Long	*32.953278, -117.057138*
Begin (Time)	*10:10:00*
End (Time)	*10:20:00*
Leq	*53.8*
Lmax	*66.3*
Lmin	*47.4*
Other Lx?	*L90, L50, L10*
L90	*49.6*
L50	*52.2*
L10	*56.2*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*Traffic*
Other Noise Sources (Background)	*Distant Conversations / Yelling, Distant Traffic*
Other Noise Sources Additional Description	
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

FORMS FIELD DATA REPORT

Source Info and Traffic Counts

Number of Lanes	*4*
Lane Width (feet)	*10*
Roadway Width (feet)	*40*
Roadway Width (m)	*12.2*
Distance to Roadway (feet)	*200*
Distance to Roadway (m)	*61*
Estimated Vehicle Speed (MPH)	*45*
Speeds Estimated by:	*Driving the Pace*

Traffic Counts

Vehicle Count Summary	*A 260, MT 6, HT 2, B 2, MC 0*
Select Method for Recording Count Duration	*Enter Manually*
Counting Both Directions?	*Yes*
Count Duration (minutes)	*10*
Vehicle Count Tally	
Select Method for Vehicle Counts	*Enter Manually*
Number of Vehicles - Autos	*260*
Number of Vehicles - Medium Trucks	*6*
Number of Vehicles - Heavy Trucks	*2*
Number of Vehicles - Buses	*2*
Number of Vehicles - Motorcyles	*0*

Description / Photos

Site Photos

Photo

Appendix B

Construction Noise Modeling Input and Output

To User: bordered cells are inputs, unbordered cells have formulae

noise level limit for construction phase at "occupied property", per County of San Diego 36.409 = 75
allowable hours over which Leq is to be averaged = 8

= temporary barrier (TB) of input height inserted between source and receptor

Construction Activity	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	*Temporary Barrier Insertion Loss (dB)*	*Additional Noise Reduction*	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 8-hour Leq	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Demolition	concrete saw	1	20	90		25	0.1		95.9	2	120	83	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	excavator	1	40	81		25	0.1		86.9	2	120	77	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	dozer	1	40	82		25	0.1		87.9	2	120	78	5	5	0	30	5	25	30.4	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
									Total for Demolition Phase:			84.9																
Site Preparation	dozer	1	40	82		25	0.1		87.9	2	120	78	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	1	40	78		25	0.1		83.9	2	120	74	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
									Total for Site Preparation Phase:			79.4																
Grading	excavator	1	40	81		25	0.1		86.9	2	120	77	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	grader	1	40	85		25	0.1		90.9	2	120	81	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	dozer	1	40	82		25	0.1		87.9	2	120	78	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	1	40	78		25	0.1		83.9	2	120	74	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
									Total for Grading Phase:			84.2																
Building Construction	crane	1	16	81		25	0.1		86.9	2	120	73	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	man lift	1	20	75		25	0.1		80.9	2	120	68	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	generator	1	50	72		25	0.1		77.9	2	120	69	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	1	40	78		25	0.1		83.9	2	120	74	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	welder / torch	1	40	73		25	0.1		78.9	2	120	69	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
									Total for Building Construction Phase:			78.2																
Paving	concrete mixer truck	1	40	79		25	0.1		84.9	2	120	75	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	paver	1	50	77		25	0.1		82.9	2	120	74	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	all other equipment > 5 HP	1	50	85		25	0.1		90.9	2	120	82	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	roller	1	20	80		25	0.1		85.9	2	120	73	5	5	0	20	5	25	20.6	7.1	25.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
									Total for Paving Phase:			83.6																

To User: bordered cells are inputs, unbordered cells have formulae

noise level limit for construction phase at "occupied property", per County of San Diego 36.409 = 75

allowable hours over which Leq is to be averaged = 8

= temporary barrier (TB) of input height inserted between source and receptor

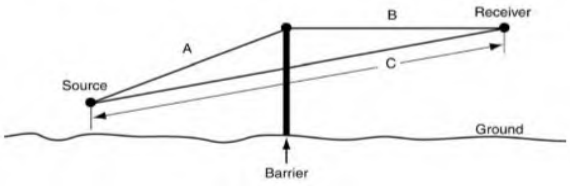
Construction Activity	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	*Temporary Barrier Insertion Loss (dB)*	*Additional Noise Reduction*	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 8-hour Leq	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Demolition	concrete saw	1	20	90		160	0.1		76.3	8	480	69	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	excavator	3	40	81		160	0.1		67.3	8	480	68	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	dozer	2	40	82		160	0.1		68.3	8	480	67	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
									Total for Demolition Phase:			**73.1**																
Site Preparation	dozer	3	40	82		160	0.1		68.3	8	480	69	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	4	40	78		160	0.1		64.3	7	420	66	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
									Total for Site Preparation Phase:			**70.8**																
Grading	excavator	2	40	81		160	0.1		67.3	8	480	66	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	grader	1	40	85		160	0.1		71.3	8	480	67	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	dozer	1	40	82		160	0.1		68.3	7	420	64	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	2	40	78		160	0.1		64.3	7	420	63	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
									Total for Grading Phase:			**71.5**																
Building Construction	crane	1	16	81		160	0.1		67.3	8	480	59	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	man lift	3	20	75		160	0.1		61.3	7	420	59	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	generator	1	50	72		160	0.1		58.3	8	480	55	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	3	40	78		160	0.1		64.3	6	360	64	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	welder / torch	1	40	73		160	0.1		59.3	8	480	55	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
									Total for Building Construction Phase:			**66.7**																
Paving	concrete mixer truck	1	40	79		160	0.1		65.3	8	480	61	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	paver	2	50	77		160	0.1		63.3	8	480	63	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	all other equipment > 5 HP	1	50	85		160	0.1		71.3	8	480	68	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	roller	2	20	80		160	0.1		66.3	8	480	62	5	5	0	155	5	160	155.1	7.1	160.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
									Total for Paving Phase:			**70.8**																

Equipment Description	Impact Device?	Acoustical Use Factor (%)	Lesser of or available Lmax	Spec. 721 Lmax	Measured L_{max} @50ft (dBA, slow)
All Other Equipment > 5 HP	No	50	85	85	-- N/A --
Auger Drill Rig	No	20	84	85	84
Backhoe	No	40	78	80	78
Bar Bender	No	20	80	80	-- N/A --
Blasting	Yes	-- N/A --	94	94	-- N/A --
Boring Jack Power Unit	No	50	80	80	83
Chain Saw	No	20	84	85	84
Clam Shovel (dropping)	Yes	20	87	93	87
Compactor (ground)	No	20	80	80	83
Compressor (air)	No	40	78	80	78
Concrete Batch Plant	No	15	83	83	-- N/A --
Concrete Mixer Truck	No	40	79	85	79
Concrete Pump Truck	No	20	81	82	81
Concrete Saw	No	20	90	90	90
Crane	No	16	81	85	81
Dozer	No	40	82	85	82
Drill Rig Truck	No	20	79	84	79
Drum Mixer	No	50	80	80	80
Dump Truck	No	40	76	84	76
Excavator	No	40	81	85	81
Flat Bed Truck	No	40	74	84	74
Front End Loader	No	40	79	80	79
Generator	No	50	72	72	81
Generator (<25KVA, VMS signs)	No	50	70	70	73
Gradall	No	40	83	85	83
Grader	No	40	85	85	-- N/A --
Grapple (on backhoe)	No	40	85	85	87
Horizontal Boring Hydr. Jack	No	25	80	80	82
Hydra Break Ram	Yes	10	90	90	-- N/A --
Impact Pile Driver	Yes	20	95	95	101
Jackhammer	Yes	20	85	85	89
Man Lift	No	20	75	85	75
Mounted Impact Hammer (hoe ram)	Yes	20	90	90	90
Pavement Scarafier	No	20	85	85	90
Paver	No	50	77	85	77
Pickup Truck	No	40	55	55	75
Pneumatic Tools	No	50	85	85	85
Pumps	No	50	77	77	81
Refrigerator Unit	No	100	73	82	73
Rivit Buster/chipping gun	Yes	20	79	85	79
Rock Drill	No	20	81	85	81
Roller	No	20	80	85	80
Sand Blasting (Single Nozzle)	No	20	85	85	96
Scraper	No	40	84	85	84
Shears (on backhoe)	No	40	85	85	96
Slurry Plant	No	100	78	78	78
Slurry Trenching Machine	No	50	80	82	80
Soil Mix Drill Rig	No	50	80	80	-- N/A --
Tractor	No	40	84	84	-- N/A --
Vacuum Excavator (Vac-truck)	No	40	85	85	85
Vacuum Street Sweeper	No	10	80	80	82
Ventilation Fan	No	100	79	85	79
Vibrating Hopper	No	50	85	85	87
Vibratory Concrete Mixer	No	20	80	80	80
Vibratory Pile Driver	No	20	95	95	101
Warning Horn	No	5	83	85	83
Welder / Torch	No	40	73	73	74

$Source_{elev}$	5.0	A_{horiz}	24.0	A	25.0
$Receiver_{elev}$	10.0	B_{horiz}	38.0	B	38.1
C	62.2	C_{horiz}	62.0		
P	0.85				
$Barrier_{elev}$	12				
Abarr	12.3				

The above calculations, refering to inputs from the figure at right, helps a user estimate what barrier attenuation (Abarr) to expect (i.e., up to 15 per formula to right) based upon source height (above grade), barrier height, and receiver height, and the horizontal distances between the source and receiver to the barrier. The FTA-based formula in the worksheets use these path length (P) and Abarr values to determine the barrier's insertion loss.

Barrier Parameter P
P= A+B-C



For all other barriers, and for protrusion of terrain above the line of sight:	$A_{barrier} = \min\left\{15 or\left[20\times\log\left(\frac{2.51\sqrt{P}}{\tanh\left[4.46\sqrt{P}\right]}\right)+5\right]\right\}$
Barrier Insertion Loss	$IL_{barrier} = \max\left\{0 or\left[A_{barrier} - 10(G_{NB} - G_B)\log\left(\frac{D}{50}\right)\right]\right\}$

D = closest distance between the receiver and the source, in feet
P = path length difference, in feet (see figure below)
G_{NB} = Ground factor G computed *without barrier* (see Figure 6-5)
G_B = Ground factor G computed *with barrier* (see Figure 6-5)

† The term "tanh(variable)" stands for hyperbolic tangent, available on many scientific calculators. If "tanh" is not available, then compute E = exp(variable), and set tanh(variable) = (E - 1/E) / (E + 1/E), where exp(variable) is the "exponential" function, also written as e^x on calculator keypads.

Sources: Transit Noise & Vibration Impact Assessment (FTA 2006)

Appendix C

Traffic Noise Modeling Input and Output

Dudek 16 June 2022
CB TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: Oak Knoll
RUN: Existing

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway Name	Width	Points Name	No.	Coordinates (pavement) X	Y	Z	Flow Control Control Device	Speed Constraint	Percent Vehicles Affected	Segment Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
Poway West	40.0	point1	1	6,849,802.0	1,442,273.6	0.00				Average	
		point2	2	6,850,057.0	1,442,343.2	0.00				Average	
		point3	3	6,850,171.0	1,442,396.2	0.00				Average	
		point4	4	6,850,274.5	1,442,458.6	0.00				Average	
		point5	5	6,850,406.5	1,442,561.6	0.00				Average	
		point6	6	6,850,521.0	1,442,663.1	0.00				Average	
		point7	7	6,850,683.0	1,442,811.1	0.00				Average	
		point8	8	6,850,813.5	1,442,935.8	0.00				Average	
		point9	9	6,850,912.0	1,443,021.1	0.00				Average	
		point10	10	6,851,056.5	1,443,154.2	0.00				Average	
		point11	11	6,851,260.5	1,443,340.2	0.00				Average	
		point12	12	6,851,396.5	1,443,469.9	0.00				Average	
		point13	13	6,851,546.0	1,443,606.4	0.00				Average	
		point14	14	6,851,608.0	1,443,664.5	0.00				Average	
		point15	15	6,851,703.0	1,443,749.0	0.00				Average	
		point16	16	6,851,857.5	1,443,865.8	0.00				Average	
		point17	17	6,851,984.0	1,443,929.9	0.00					
Poway East	40.0	point18	18	6,851,993.0	1,443,883.6	0.00				Average	
		point19	19	6,851,914.5	1,443,848.8	0.00				Average	
		point20	20	6,851,801.0	1,443,778.1	0.00				Average	
		point21	21	6,851,720.0	1,443,703.9	0.00				Average	
		point22	22	6,851,583.5	1,443,581.2	0.00				Average	
		point23	23	6,851,441.0	1,443,448.9	0.00				Average	
		point24	24	6,851,268.5	1,443,288.5	0.00				Average	
		point25	25	6,851,107.0	1,443,145.9	0.00				Average	

		point26	26	6,850,914.5	1,442,967.1	0.00				Average	
		point27	27	6,850,738.5	1,442,803.9	0.00				Average	
		point28	28	6,850,585.0	1,442,662.0	0.00				Average	
		point29	29	6,850,428.0	1,442,519.0	0.00				Average	
		point30	30	6,850,308.5	1,442,425.4	0.00				Average	
		point31	31	6,850,161.5	1,442,338.0	0.00				Average	
		point32	32	6,850,000.5	1,442,279.0	0.00				Average	
		point33	33	6,849,812.0	1,442,228.5	0.00					
Oak Knoll	40.0	point34	34	6,852,005.5	1,441,920.5	0.00				Average	
		point35	35	6,851,941.0	1,441,912.5	0.00				Average	
		point36	36	6,851,618.5	1,441,872.0	0.00				Average	
		point37	37	6,851,269.5	1,441,829.4	0.00				Average	
		point38	38	6,850,870.0	1,441,781.9	0.00				Average	
		point39	39	6,850,430.5	1,441,724.9	0.00				Average	
		point40	40	6,849,817.0	1,441,645.2	0.00					
Carriage Road	40.0	point41	41	6,852,012.5	1,443,861.8	0.00				Average	
		point42	42	6,852,024.0	1,443,362.1	0.00				Average	
		point43	43	6,852,022.5	1,442,903.9	0.00				Average	
		point44	44	6,852,028.5	1,442,349.2	0.00				Average	
		point45	45	6,852,023.0	1,441,893.8	0.00					

Dudek **16 June 2022**
CB **TNM 2.5**

INPUT: TRAFFIC FOR LAeq1h Volumes
PROJECT/CONTRACT: **Oak Knoll**
RUN: **Existing**

Roadway	Points											
Name	Name	No.	Segment									
			Autos		MTrucks		HTrucks		Buses		Motorcycles	
			V	S	V	S	V	S	V	S	V	S
			veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph
Poway West	point1	1	1285	35	26	35	13	35	0	0	0	0
	point2	2	1285	35	26	35	13	35	0	0	0	0
	point3	3	1285	35	26	35	13	35	0	0	0	0
	point4	4	1285	35	26	35	13	35	0	0	0	0
	point5	5	1285	35	26	35	13	35	0	0	0	0
	point6	6	1285	35	26	35	13	35	0	0	0	0
	point7	7	1285	35	26	35	13	35	0	0	0	0
	point8	8	1285	35	26	35	13	35	0	0	0	0
	point9	9	1285	35	26	35	13	35	0	0	0	0
	point10	10	1285	35	26	35	13	35	0	0	0	0
	point11	11	1285	35	26	35	13	35	0	0	0	0
	point12	12	1285	35	26	35	13	35	0	0	0	0
	point13	13	1285	35	26	35	13	35	0	0	0	0
	point14	14	1285	35	26	35	13	35	0	0	0	0
	point15	15	1285	35	26	35	13	35	0	0	0	0
	point16	16	1285	35	26	35	13	35	0	0	0	0
	point17	17										
Poway East	point18	18	1285	35	26	35	13	35	6	35	0	0
	point19	19	1285	35	26	35	13	35	6	35	0	0
	point20	20	1285	35	26	35	13	35	6	35	0	0
	point21	21	1285	35	26	35	13	35	6	35	0	0
	point22	22	1285	35	26	35	13	35	6	35	0	0
	point23	23	1285	35	26	35	13	35	6	35	0	0

	point24	24	1285	35	26	35	13	35	6	35	0	0
	point25	25	1285	35	26	35	13	35	6	35	0	0
	point26	26	1285	35	26	35	13	35	6	35	0	0
	point27	27	1285	35	26	35	13	35	6	35	0	0
	point28	28	1285	35	26	35	13	35	6	35	0	0
	point29	29	1285	35	26	35	13	35	6	35	0	0
	point30	30	1285	35	26	35	13	35	6	35	0	0
	point31	31	1285	35	26	35	13	35	6	35	0	0
	point32	32	1285	35	26	35	13	35	6	35	0	0
	point33	33										
Oak Knoll	point34	34	360	25	7	25	3	25	0	0	0	0
	point35	35	360	25	7	25	3	25	0	0	0	0
	point36	36	360	25	7	25	3	25	0	0	0	0
	point37	37	360	25	7	25	3	25	0	0	0	0
	point38	38	360	25	7	25	3	25	0	0	0	0
	point39	39	360	25	7	25	3	25	0	0	0	0
	point40	40										
Carriage Road	point41	41	0	0	0	0	0	0	0	0	0	0
	point42	42	0	0	0	0	0	0	0	0	0	0
	point43	43	0	0	0	0	0	0	0	0	0	0
	point44	44	0	0	0	0	0	0	0	0	0	0
	point45	45										

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INPUT: RECEIVERS
PROJECT/CONTRACT: Oak Knoll
RUN: Existing

Receiver Name	No.	#DUs	Coordinates (ground) X	Y	Z	Height above Ground	Input Sound Levels and Criteria Existing LAeq1h	Impact Criteria LAeq1h	Impact Criteria Sub'l	NR Goal	Active in Calc.
			ft	ft	ft	ft	dBA	dBA	dB	dB	
ST1	1	1	6,851,142.5	1,441,781.1	0.00	4.92	58.50	66	10.0	8.0	Y
ST2	2	1	6,851,350.0	1,442,204.1	0.00	4.92	51.10	66	10.0	8.0	Y
ST4	3	1	6,851,026.5	1,442,778.0	0.00	4.92	53.80	66	10.0	8.0	Y
ST3	4	1	6,850,863.0	1,442,198.2	0.00	4.92	56.90	66	10.0	8.0	Y

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16 June 2022
TNM 2.5

INPUT: BARRIERS
PROJECT/CONTRACT: Oak Knoll
RUN: Existing

Barrier									Points										
Name	Type	Height		If Wall	If Berm			Add'tnl	Name	No.	Coordinates (bottom)			Height	Segment				
		Min	Max	$ per Unit Area	$ per Unit Vol.	Top Width	Run:Rise	$ per Unit Length			X	Y	Z	at Point	Seg Ht Incre-ment	#Up	#Dn	On Struct?	Important Reflec-tions?
		ft	ft	$/sq ft	$/cu yd	ft	ft:ft	$/ft			ft	ft	ft	ft	ft				
Condo wall	W	0.00	99.99	0.00				0.00	point1	1	6,850,681.5	1,442,709.5	0.00	8.00	0.00	0	0		
									point2	2	6,850,914.5	1,442,702.0	0.00	8.00	0.00	0	0		
									point3	3	6,850,913.5	1,442,502.8	0.00	8.00	0.00	0	0		
									point4	4	6,850,910.0	1,442,233.8	0.00	8.00	0.00	0	0		
									point5	5	6,850,903.0	1,441,817.1	0.00	8.00					

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16 June 2022
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Oak Knoll
RUN: Existing
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
ST1	1	1	58.5	58.7	66	0.2	10	----	58.7	0.0	8	-8.0
ST2	2	1	51.1	46.3	66	-4.8	10	----	46.3	0.0	8	-8.0
ST4	3	1	53.8	58.8	66	5.0	10	----	58.8	0.0	8	-8.0
ST3	4	1	56.9	50.6	66	-6.3	10	----	50.6	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	4	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Dudek 16 June 2022
CB TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: Oak Knoll
RUN: Existing + Project

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway Name	Width	Points Name	No.	Coordinates (pavement) X	Y	Z	Flow Control Control Device	Speed Constraint	Percent Vehicles Affected	Segment Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
Poway West	40.0	point1	1	6,849,802.0	1,442,273.6	0.00				Average	
		point2	2	6,850,057.0	1,442,343.2	0.00				Average	
		point3	3	6,850,171.0	1,442,396.2	0.00				Average	
		point4	4	6,850,274.5	1,442,458.6	0.00				Average	
		point5	5	6,850,406.5	1,442,561.6	0.00				Average	
		point6	6	6,850,521.0	1,442,663.1	0.00				Average	
		point7	7	6,850,683.0	1,442,811.1	0.00				Average	
		point8	8	6,850,813.5	1,442,935.8	0.00				Average	
		point9	9	6,850,912.0	1,443,021.1	0.00				Average	
		point10	10	6,851,056.5	1,443,154.2	0.00				Average	
		point11	11	6,851,260.5	1,443,340.2	0.00				Average	
		point12	12	6,851,396.5	1,443,469.9	0.00				Average	
		point13	13	6,851,546.0	1,443,606.4	0.00				Average	
		point14	14	6,851,608.0	1,443,664.5	0.00				Average	
		point15	15	6,851,703.0	1,443,749.0	0.00				Average	
		point16	16	6,851,857.5	1,443,865.8	0.00				Average	
		point17	17	6,851,984.0	1,443,929.9	0.00					
Poway East	40.0	point18	18	6,851,993.0	1,443,883.6	0.00				Average	
		point19	19	6,851,914.5	1,443,848.8	0.00				Average	
		point20	20	6,851,801.0	1,443,778.1	0.00				Average	
		point21	21	6,851,720.0	1,443,703.9	0.00				Average	
		point22	22	6,851,583.5	1,443,581.2	0.00				Average	
		point23	23	6,851,441.0	1,443,448.9	0.00				Average	
		point24	24	6,851,268.5	1,443,288.5	0.00				Average	
		point25	25	6,851,107.0	1,443,145.9	0.00				Average	

		point26	26	6,850,914.5	1,442,967.1	0.00				Average	
		point27	27	6,850,738.5	1,442,803.9	0.00				Average	
		point28	28	6,850,585.0	1,442,662.0	0.00				Average	
		point29	29	6,850,428.0	1,442,519.0	0.00				Average	
		point30	30	6,850,308.5	1,442,425.4	0.00				Average	
		point31	31	6,850,161.5	1,442,338.0	0.00				Average	
		point32	32	6,850,000.5	1,442,279.0	0.00				Average	
		point33	33	6,849,812.0	1,442,228.5	0.00					
Oak Knoll	40.0	point34	34	6,852,005.5	1,441,920.5	0.00				Average	
		point35	35	6,851,941.0	1,441,912.5	0.00				Average	
		point36	36	6,851,618.5	1,441,872.0	0.00				Average	
		point37	37	6,851,269.5	1,441,829.4	0.00				Average	
		point38	38	6,850,870.0	1,441,781.9	0.00				Average	
		point39	39	6,850,430.5	1,441,724.9	0.00				Average	
		point40	40	6,849,817.0	1,441,645.2	0.00					
Carriage Road	40.0	point41	41	6,852,012.5	1,443,861.8	0.00				Average	
		point42	42	6,852,024.0	1,443,362.1	0.00				Average	
		point43	43	6,852,022.5	1,442,903.9	0.00				Average	
		point44	44	6,852,028.5	1,442,349.2	0.00				Average	
		point45	45	6,852,023.0	1,441,893.8	0.00					

Dudek **16 June 2022**
CB **TNM 2.5**

INPUT: TRAFFIC FOR LAeq1h Volumes
PROJECT/CONTRACT: **Oak Knoll**
RUN: **Existing + Project**

Roadway	Points		Segment									
Name	Name	No.	Autos		MTrucks		HTrucks		Buses		Motorcycles	
			V	S	V	S	V	S	V	S	V	S
			veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph
Poway West	point1	1	1285	35	26	35	13	35	0	0	0	0
	point2	2	1285	35	26	35	13	35	0	0	0	0
	point3	3	1285	35	26	35	13	35	0	0	0	0
	point4	4	1285	35	26	35	13	35	0	0	0	0
	point5	5	1285	35	26	35	13	35	0	0	0	0
	point6	6	1285	35	26	35	13	35	0	0	0	0
	point7	7	1285	35	26	35	13	35	0	0	0	0
	point8	8	1285	35	26	35	13	35	0	0	0	0
	point9	9	1285	35	26	35	13	35	0	0	0	0
	point10	10	1285	35	26	35	13	35	0	0	0	0
	point11	11	1285	35	26	35	13	35	0	0	0	0
	point12	12	1285	35	26	35	13	35	0	0	0	0
	point13	13	1285	35	26	35	13	35	0	0	0	0
	point14	14	1285	35	26	35	13	35	0	0	0	0
	point15	15	1285	35	26	35	13	35	0	0	0	0
	point16	16	1285	35	26	35	13	35	0	0	0	0
	point17	17										
Poway East	point18	18	1285	35	26	35	13	35	6	35	0	0
	point19	19	1285	35	26	35	13	35	6	35	0	0
	point20	20	1285	35	26	35	13	35	6	35	0	0
	point21	21	1285	35	26	35	13	35	6	35	0	0
	point22	22	1285	35	26	35	13	35	6	35	0	0
	point23	23	1285	35	26	35	13	35	6	35	0	0

	point24	24	1285	35	26	35	13	35	6	35	0	0
	point25	25	1285	35	26	35	13	35	6	35	0	0
	point26	26	1285	35	26	35	13	35	6	35	0	0
	point27	27	1285	35	26	35	13	35	6	35	0	0
	point28	28	1285	35	26	35	13	35	6	35	0	0
	point29	29	1285	35	26	35	13	35	6	35	0	0
	point30	30	1285	35	26	35	13	35	6	35	0	0
	point31	31	1285	35	26	35	13	35	6	35	0	0
	point32	32	1285	35	26	35	13	35	6	35	0	0
	point33	33										
Oak Knoll	point34	34	415	25	8	25	4	25	0	0	0	0
	point35	35	415	25	8	25	4	25	0	0	0	0
	point36	36	415	25	8	25	4	25	0	0	0	0
	point37	37	415	25	8	25	4	25	0	0	0	0
	point38	38	415	25	8	25	4	25	0	0	0	0
	point39	39	415	25	8	25	4	25	0	0	0	0
	point40	40										
Carriage Road	point41	41	0	0	0	0	0	0	0	0	0	0
	point42	42	0	0	0	0	0	0	0	0	0	0
	point43	43	0	0	0	0	0	0	0	0	0	0
	point44	44	0	0	0	0	0	0	0	0	0	0
	point45	45										

Dudek
CB

16 June 2022
TNM 2.5

INPUT: RECEIVERS
PROJECT/CONTRACT: Oak Knoll
RUN: Existing + Project

Receiver Name	No.	#DUs	Coordinates (ground) X	Y	Z	Height above Ground	Input Sound Levels and Criteria Existing LAeq1h	Impact Criteria LAeq1h	Impact Criteria Sub'l	NR Goal	Active in Calc.
			ft	ft	ft	ft	dBA	dBA	dB	dB	
ST1	1	1	6,851,142.5	1,441,781.1	0.00	4.92	58.50	66	10.0	8.0	Y
ST2	2	1	6,851,350.0	1,442,204.1	0.00	4.92	51.10	66	10.0	8.0	Y
ST4	3	1	6,851,026.5	1,442,778.0	0.00	4.92	53.80	66	10.0	8.0	Y
ST3	4	1	6,850,863.0	1,442,198.2	0.00	4.92	56.90	66	10.0	8.0	Y

Dudek
CB
16 June 2022
TNM 2.5

INPUT: BARRIERS
PROJECT/CONTRACT: Oak Knoll
RUN: Existing + Project

Barrier									Points										
Name	Type	Height		If Wall	If Berm			Add'tnl	Name	No.	Coordinates (bottom)			Height	Segment				
		Min	Max	$ per Unit Area	$ per Unit Vol.	Top Width	Run:Rise	$ per Unit Length			X	Y	Z	at Point	Seg Ht Incre-ment	#Up	#Dn	On Struct?	Important Reflec-tions?
		ft	ft	$/sq ft	$/cu yd	ft	ft:ft	$/ft			ft	ft	ft	ft	ft				
Condo wall	W	0.00	99.99	0.00				0.00	point1	1	6,850,681.5	1,442,709.5	0.00	8.00	0.00	0	0		
									point2	2	6,850,914.5	1,442,702.0	0.00	8.00	0.00	0	0		
									point3	3	6,850,913.5	1,442,502.8	0.00	8.00	0.00	0	0		
									point4	4	6,850,910.0	1,442,233.8	0.00	8.00	0.00	0	0		
									point5	5	6,850,903.0	1,441,817.1	0.00	8.00					

Dudek
CB

16 June 2022
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Oak Knoll
RUN: Existing + Project
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
ST1	1	1	58.5	59.4	66	0.9	10	----	59.4	0.0	8	-8.0
ST2	2	1	51.1	46.6	66	-4.5	10	----	46.6	0.0	8	-8.0
ST4	3	1	53.8	58.8	66	5.0	10	----	58.8	0.0	8	-8.0
ST3	4	1	56.9	50.7	66	-6.2	10	----	50.7	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	4	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Dudek 16 June 2022
CB TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: Oak Knoll
RUN: Near Term

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway Name	Width	Points Name	No.	Coordinates (pavement) X	Y	Z	Flow Control Control Device	Speed Constraint	Percent Vehicles Affected	Segment Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
Poway West	40.0	point1	1	6,849,802.0	1,442,273.6	0.00				Average	
		point2	2	6,850,057.0	1,442,343.2	0.00				Average	
		point3	3	6,850,171.0	1,442,396.2	0.00				Average	
		point4	4	6,850,274.5	1,442,458.6	0.00				Average	
		point5	5	6,850,406.5	1,442,561.6	0.00				Average	
		point6	6	6,850,521.0	1,442,663.1	0.00				Average	
		point7	7	6,850,683.0	1,442,811.1	0.00				Average	
		point8	8	6,850,813.5	1,442,935.8	0.00				Average	
		point9	9	6,850,912.0	1,443,021.1	0.00				Average	
		point10	10	6,851,056.5	1,443,154.2	0.00				Average	
		point11	11	6,851,260.5	1,443,340.2	0.00				Average	
		point12	12	6,851,396.5	1,443,469.9	0.00				Average	
		point13	13	6,851,546.0	1,443,606.4	0.00				Average	
		point14	14	6,851,608.0	1,443,664.5	0.00				Average	
		point15	15	6,851,703.0	1,443,749.0	0.00				Average	
		point16	16	6,851,857.5	1,443,865.8	0.00				Average	
		point17	17	6,851,984.0	1,443,929.9	0.00					
Poway East	40.0	point18	18	6,851,993.0	1,443,883.6	0.00				Average	
		point19	19	6,851,914.5	1,443,848.8	0.00				Average	
		point20	20	6,851,801.0	1,443,778.1	0.00				Average	
		point21	21	6,851,720.0	1,443,703.9	0.00				Average	
		point22	22	6,851,583.5	1,443,581.2	0.00				Average	
		point23	23	6,851,441.0	1,443,448.9	0.00				Average	
		point24	24	6,851,268.5	1,443,288.5	0.00				Average	
		point25	25	6,851,107.0	1,443,145.9	0.00				Average	

		point26	26	6,850,914.5	1,442,967.1	0.00				Average	
		point27	27	6,850,738.5	1,442,803.9	0.00				Average	
		point28	28	6,850,585.0	1,442,662.0	0.00				Average	
		point29	29	6,850,428.0	1,442,519.0	0.00				Average	
		point30	30	6,850,308.5	1,442,425.4	0.00				Average	
		point31	31	6,850,161.5	1,442,338.0	0.00				Average	
		point32	32	6,850,000.5	1,442,279.0	0.00				Average	
		point33	33	6,849,812.0	1,442,228.5	0.00					
Oak Knoll	40.0	point34	34	6,852,005.5	1,441,920.5	0.00				Average	
		point35	35	6,851,941.0	1,441,912.5	0.00				Average	
		point36	36	6,851,618.5	1,441,872.0	0.00				Average	
		point37	37	6,851,269.5	1,441,829.4	0.00				Average	
		point38	38	6,850,870.0	1,441,781.9	0.00				Average	
		point39	39	6,850,430.5	1,441,724.9	0.00				Average	
		point40	40	6,849,817.0	1,441,645.2	0.00					
Carriage Road	40.0	point41	41	6,852,012.5	1,443,861.8	0.00				Average	
		point42	42	6,852,024.0	1,443,362.1	0.00				Average	
		point43	43	6,852,022.5	1,442,903.9	0.00				Average	
		point44	44	6,852,028.5	1,442,349.2	0.00				Average	
		point45	45	6,852,023.0	1,441,893.8	0.00					

Dudek **16 June 2022**
CB **TNM 2.5**

INPUT: TRAFFIC FOR LAeq1h Volumes
PROJECT/CONTRACT: **Oak Knoll**
RUN: **Near Term**

Roadway	Points											
Name	Name	No.	Segment									
			Autos		MTrucks		HTrucks		Buses		Motorcycles	
			V	S	V	S	V	S	V	S	V	S
			veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph
Poway West	point1	1	1488	35	30	35	15	35	0	0	0	0
	point2	2	1488	35	30	35	15	35	0	0	0	0
	point3	3	1488	35	30	35	15	35	0	0	0	0
	point4	4	1488	35	30	35	15	35	0	0	0	0
	point5	5	1488	35	30	35	15	35	0	0	0	0
	point6	6	1488	35	30	35	15	35	0	0	0	0
	point7	7	1488	35	30	35	15	35	0	0	0	0
	point8	8	1488	35	30	35	15	35	0	0	0	0
	point9	9	1488	35	30	35	15	35	0	0	0	0
	point10	10	1488	35	30	35	15	35	0	0	0	0
	point11	11	1488	35	30	35	15	35	0	0	0	0
	point12	12	1488	35	30	35	15	35	0	0	0	0
	point13	13	1488	35	30	35	15	35	0	0	0	0
	point14	14	1488	35	30	35	15	35	0	0	0	0
	point15	15	1488	35	30	35	15	35	0	0	0	0
	point16	16	1488	35	30	35	15	35	0	0	0	0
	point17	17										
Poway East	point18	18	1488	35	30	35	15	35	6	35	0	0
	point19	19	1488	35	30	35	15	35	6	35	0	0
	point20	20	1488	35	30	35	15	35	6	35	0	0
	point21	21	1488	35	30	35	15	35	6	35	0	0
	point22	22	1488	35	30	35	15	35	6	35	0	0
	point23	23	1488	35	30	35	15	35	6	35	0	0

	point24	24	1488	35	30	35	15	35	6	35	0	0
	point25	25	1488	35	30	35	15	35	6	35	0	0
	point26	26	1488	35	30	35	15	35	6	35	0	0
	point27	27	1488	35	30	35	15	35	6	35	0	0
	point28	28	1488	35	30	35	15	35	6	35	0	0
	point29	29	1488	35	30	35	15	35	6	35	0	0
	point30	30	1488	35	30	35	15	35	6	35	0	0
	point31	31	1488	35	30	35	15	35	6	35	0	0
	point32	32	1488	35	30	35	15	35	6	35	0	0
	point33	33										
Oak Knoll	point34	34	388	25	8	25	4	25	0	0	0	0
	point35	35	388	25	8	25	4	25	0	0	0	0
	point36	36	388	25	8	25	4	25	0	0	0	0
	point37	37	388	25	8	25	4	25	0	0	0	0
	point38	38	388	25	8	25	4	25	0	0	0	0
	point39	39	388	25	8	25	4	25	0	0	0	0
	point40	40										
Carriage Road	point41	41	0	0	0	0	0	0	0	0	0	0
	point42	42	0	0	0	0	0	0	0	0	0	0
	point43	43	0	0	0	0	0	0	0	0	0	0
	point44	44	0	0	0	0	0	0	0	0	0	0
	point45	45										

Dudek 16 June 2022
CB TNM 2.5

INPUT: RECEIVERS
PROJECT/CONTRACT: Oak Knoll
RUN: Near Term

Receiver Name	No.	#DUs	Coordinates (ground) X	Y	Z	Height above Ground	Input Sound Levels and Criteria Existing LAeq1h	Impact Criteria LAeq1h	Impact Criteria Sub'l	NR Goal	Active in Calc.
			ft	ft	ft	ft	dBA	dBA	dB	dB	
ST1	1	1	6,851,142.5	1,441,781.1	0.00	4.92	58.50	66	10.0	8.0	Y
ST2	2	1	6,851,350.0	1,442,204.1	0.00	4.92	51.10	66	10.0	8.0	Y
ST4	3	1	6,851,026.5	1,442,778.0	0.00	4.92	53.80	66	10.0	8.0	Y
ST3	4	1	6,850,863.0	1,442,198.2	0.00	4.92	56.90	66	10.0	8.0	Y

Dudek
CB

16 June 2022
TNM 2.5

INPUT: BARRIERS
PROJECT/CONTRACT: Oak Knoll
RUN: Near Term

Barrier									Points										
Name	Type	Height		If Wall	If Berm			Add'tnl	Name	No.	Coordinates (bottom)			Height	Segment				
		Min	Max	$ per Unit Area	$ per Unit Vol.	Top Width	Run:Rise	$ per Unit Length			X	Y	Z	at Point	Seg Ht Incre-ment	#Up	#Dn	On Struct?	Important Reflec-tions?
		ft	ft	$/sq ft	$/cu yd	ft	ft:ft	$/ft			ft	ft	ft	ft	ft				
Condo wall	W	0.00	99.99	0.00				0.00	point1	1	6,850,681.5	1,442,709.5	0.00	8.00	0.00	0	0		
									point2	2	6,850,914.5	1,442,702.0	0.00	8.00	0.00	0	0		
									point3	3	6,850,913.5	1,442,502.8	0.00	8.00	0.00	0	0		
									point4	4	6,850,910.0	1,442,233.8	0.00	8.00	0.00	0	0		
									point5	5	6,850,903.0	1,441,817.1	0.00	8.00					

Dudek
CB
16 June 2022
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Oak Knoll
RUN: Near Term
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
ST1	1	1	58.5	59.3	66	0.8	10	----	59.3	0.0	8	-8.0
ST2	2	1	51.1	47.0	66	-4.1	10	----	47.0	0.0	8	-8.0
ST4	3	1	53.8	59.4	66	5.6	10	----	59.4	0.0	8	-8.0
ST3	4	1	56.9	51.2	66	-5.7	10	----	51.2	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	4	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Dudek 16 June 2022
CB TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: Oak Knoll
RUN: Near Term + Project

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway Name	Width	Points Name	No.	Coordinates (pavement) X	Y	Z	Flow Control Control Device	Speed Constraint	Percent Vehicles Affected	Segment Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
Poway West	40.0	point1	1	6,849,802.0	1,442,273.6	0.00				Average	
		point2	2	6,850,057.0	1,442,343.2	0.00				Average	
		point3	3	6,850,171.0	1,442,396.2	0.00				Average	
		point4	4	6,850,274.5	1,442,458.6	0.00				Average	
		point5	5	6,850,406.5	1,442,561.6	0.00				Average	
		point6	6	6,850,521.0	1,442,663.1	0.00				Average	
		point7	7	6,850,683.0	1,442,811.1	0.00				Average	
		point8	8	6,850,813.5	1,442,935.8	0.00				Average	
		point9	9	6,850,912.0	1,443,021.1	0.00				Average	
		point10	10	6,851,056.5	1,443,154.2	0.00				Average	
		point11	11	6,851,260.5	1,443,340.2	0.00				Average	
		point12	12	6,851,396.5	1,443,469.9	0.00				Average	
		point13	13	6,851,546.0	1,443,606.4	0.00				Average	
		point14	14	6,851,608.0	1,443,664.5	0.00				Average	
		point15	15	6,851,703.0	1,443,749.0	0.00				Average	
		point16	16	6,851,857.5	1,443,865.8	0.00				Average	
		point17	17	6,851,984.0	1,443,929.9	0.00					
Poway East	40.0	point18	18	6,851,993.0	1,443,883.6	0.00				Average	
		point19	19	6,851,914.5	1,443,848.8	0.00				Average	
		point20	20	6,851,801.0	1,443,778.1	0.00				Average	
		point21	21	6,851,720.0	1,443,703.9	0.00				Average	
		point22	22	6,851,583.5	1,443,581.2	0.00				Average	
		point23	23	6,851,441.0	1,443,448.9	0.00				Average	
		point24	24	6,851,268.5	1,443,288.5	0.00				Average	
		point25	25	6,851,107.0	1,443,145.9	0.00				Average	

		point26	26	6,850,914.5	1,442,967.1	0.00				Average	
		point27	27	6,850,738.5	1,442,803.9	0.00				Average	
		point28	28	6,850,585.0	1,442,662.0	0.00				Average	
		point29	29	6,850,428.0	1,442,519.0	0.00				Average	
		point30	30	6,850,308.5	1,442,425.4	0.00				Average	
		point31	31	6,850,161.5	1,442,338.0	0.00				Average	
		point32	32	6,850,000.5	1,442,279.0	0.00				Average	
		point33	33	6,849,812.0	1,442,228.5	0.00					
Oak Knoll	40.0	point34	34	6,852,005.5	1,441,920.5	0.00				Average	
		point35	35	6,851,941.0	1,441,912.5	0.00				Average	
		point36	36	6,851,618.5	1,441,872.0	0.00				Average	
		point37	37	6,851,269.5	1,441,829.4	0.00				Average	
		point38	38	6,850,870.0	1,441,781.9	0.00				Average	
		point39	39	6,850,430.5	1,441,724.9	0.00				Average	
		point40	40	6,849,817.0	1,441,645.2	0.00					
Carriage Road	40.0	point41	41	6,852,012.5	1,443,861.8	0.00				Average	
		point42	42	6,852,024.0	1,443,362.1	0.00				Average	
		point43	43	6,852,022.5	1,442,903.9	0.00				Average	
		point44	44	6,852,028.5	1,442,349.2	0.00				Average	
		point45	45	6,852,023.0	1,441,893.8	0.00					

Dudek 16 June 2022
CB TNM 2.5

INPUT: TRAFFIC FOR LAeq1h Volumes
PROJECT/CONTRACT: Oak Knoll
RUN: Near Term + Project

Roadway	Points		Segment									
Name	Name	No.	Autos		MTrucks		HTrucks		Buses		Motorcycles	
			V	S	V	S	V	S	V	S	V	S
			veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph
Poway West	point1	1	1488	35	30	35	15	35	0	0	0	0
	point2	2	1488	35	30	35	15	35	0	0	0	0
	point3	3	1488	35	30	35	15	35	0	0	0	0
	point4	4	1488	35	30	35	15	35	0	0	0	0
	point5	5	1488	35	30	35	15	35	0	0	0	0
	point6	6	1488	35	30	35	15	35	0	0	0	0
	point7	7	1488	35	30	35	15	35	0	0	0	0
	point8	8	1488	35	30	35	15	35	0	0	0	0
	point9	9	1488	35	30	35	15	35	0	0	0	0
	point10	10	1488	35	30	35	15	35	0	0	0	0
	point11	11	1488	35	30	35	15	35	0	0	0	0
	point12	12	1488	35	30	35	15	35	0	0	0	0
	point13	13	1488	35	30	35	15	35	0	0	0	0
	point14	14	1488	35	30	35	15	35	0	0	0	0
	point15	15	1488	35	30	35	15	35	0	0	0	0
	point16	16	1488	35	30	35	15	35	0	0	0	0
	point17	17										
Poway East	point18	18	1488	35	30	35	15	35	6	35	0	0
	point19	19	1488	35	30	35	15	35	6	35	0	0
	point20	20	1488	35	30	35	15	35	6	35	0	0
	point21	21	1488	35	30	35	15	35	6	35	0	0
	point22	22	1488	35	30	35	15	35	6	35	0	0
	point23	23	1488	35	30	35	15	35	6	35	0	0

	point24	24	1488	35	30	35	15	35	6	35	0	0
	point25	25	1488	35	30	35	15	35	6	35	0	0
	point26	26	1488	35	30	35	15	35	6	35	0	0
	point27	27	1488	35	30	35	15	35	6	35	0	0
	point28	28	1488	35	30	35	15	35	6	35	0	0
	point29	29	1488	35	30	35	15	35	6	35	0	0
	point30	30	1488	35	30	35	15	35	6	35	0	0
	point31	31	1488	35	30	35	15	35	6	35	0	0
	point32	32	1488	35	30	35	15	35	6	35	0	0
	point33	33										
Oak Knoll	point34	34	442	25	9	25	4	25	0	0	0	0
	point35	35	442	25	9	25	4	25	0	0	0	0
	point36	36	442	25	9	25	4	25	0	0	0	0
	point37	37	442	25	9	25	4	25	0	0	0	0
	point38	38	442	25	9	25	4	25	0	0	0	0
	point39	39	442	25	9	25	4	25	0	0	0	0
	point40	40										
Carriage Road	point41	41	0	0	0	0	0	0	0	0	0	0
	point42	42	0	0	0	0	0	0	0	0	0	0
	point43	43	0	0	0	0	0	0	0	0	0	0
	point44	44	0	0	0	0	0	0	0	0	0	0
	point45	45										

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INPUT: RECEIVERS
PROJECT/CONTRACT: Oak Knoll
RUN: Near Term + Project

Receiver Name	No.	#DUs	Coordinates (ground) X	Y	Z	Height above Ground	Input Sound Levels and Criteria Existing LAeq1h	Impact Criteria LAeq1h	Impact Criteria Sub'l	NR Goal	Active in Calc.
			ft	ft	ft	ft	dBA	dBA	dB	dB	
ST1	1	1	6,851,142.5	1,441,781.1	0.00	4.92	58.50	66	10.0	8.0	Y
ST2	2	1	6,851,350.0	1,442,204.1	0.00	4.92	51.10	66	10.0	8.0	Y
ST4	3	1	6,851,026.5	1,442,778.0	0.00	4.92	53.80	66	10.0	8.0	Y
ST3	4	1	6,850,863.0	1,442,198.2	0.00	4.92	56.90	66	10.0	8.0	Y
OS1	6	1	6,850,717.5	1,441,704.9	0.00	4.92	0.00	66	10.0	8.0	Y
OS2	7	1	6,850,977.5	1,441,884.6	0.00	4.92	0.00	66	10.0	8.0	Y
OS3	8	1	6,850,984.0	1,442,569.9	0.00	4.92	0.00	66	10.0	8.0	Y
B64-1	10	1	6,850,767.0	1,441,734.0	0.00	4.92	0.00	66	10.0	8.0	Y
B64-2	11	1	6,850,767.0	1,441,734.0	0.00	14.92	0.00	66	10.0	8.0	Y
B62-1	12	1	6,850,843.5	1,441,740.1	0.00	4.92	0.00	66	10.0	8.0	Y
B62-1	13	1	6,850,843.5	1,441,740.1	0.00	14.92	0.00	66	10.0	8.0	Y
B1-1	14	1	6,851,086.5	1,441,871.9	0.00	4.92	0.00	66	10.0	8.0	Y
B1-2	15	1	6,851,086.5	1,441,871.9	0.00	14.92	0.00	66	10.0	8.0	Y
B3-1	16	1	6,851,174.5	1,441,875.2	0.00	4.92	0.00	66	10.0	8.0	Y
B3-2	17	1	6,851,174.5	1,441,875.2	0.00	14.92	0.00	66	10.0	8.0	Y
B5-1	18	1	6,851,254.0	1,441,893.1	0.00	4.92	0.00	66	10.0	8.0	Y
B5-2	19	1	6,851,254.0	1,441,893.1	0.00	14.92	0.00	66	10.0	8.0	Y
B23-1	21	1	6,851,151.0	1,442,623.9	0.00	4.92	0.00	66	10.0	8.0	Y
B23-2	22	1	6,851,151.0	1,442,623.9	0.00	14.92	0.00	66	10.0	8.0	Y

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INPUT: BARRIERS
PROJECT/CONTRACT: Oak Knoll
RUN: Near Term + Project

Barrier									Points										
Name	Type	Height		If Wall	If Berm			Add'tnl	Name	No.	Coordinates (bottom)			Height	Segment				
		Min	Max	$ per Unit Area	$ per Unit Vol.	Top Width	Run:Rise	$ per Unit Length			X	Y	Z	at Point	Seg Ht Incre-ment	Perturbs #Up	#Dn	On Struct?	Important Reflec-tions?
		ft	ft	$/sq ft	$/cu yd	ft	ft:ft	$/ft			ft	ft	ft	ft	ft				
Condo wall	W	0.00	99.99	0.00				0.00	point1	1	6,850,681.5	1,442,709.5	0.00	8.00	0.00	0	0		
									point2	2	6,850,914.5	1,442,702.0	0.00	8.00	0.00	0	0		
									point3	3	6,850,913.5	1,442,502.8	0.00	8.00	0.00	0	0		
									point4	4	6,850,910.0	1,442,233.8	0.00	8.00	0.00	0	0		
									point5	5	6,850,903.0	1,441,817.1	0.00	8.00					
Barrier2	W	0.00	99.99	0.00				0.00	point7	7	6,850,746.5	1,441,674.1	0.00	24.00	0.00	0	0		
									point8	8	6,850,747.5	1,441,736.1	0.00	24.00	0.00	0	0		
									point9	9	6,850,759.0	1,441,736.0	0.00	24.00	0.00	0	0		
									point10	10	6,850,758.5	1,441,731.0	0.00	24.00	0.00	0	0		
									point11	11	6,850,761.0	1,441,730.9	0.00	24.00	0.00	0	0		
									point12	12	6,850,761.0	1,441,730.5	0.00	24.00	0.00	0	0		
									point13	13	6,850,777.0	1,441,730.1	0.00	24.00	0.00	0	0		
									point14	14	6,850,777.0	1,441,730.5	0.00	24.00	0.00	0	0		
									point15	15	6,850,779.5	1,441,730.5	0.00	24.00	0.00	0	0		
									point16	16	6,850,778.5	1,441,673.5	0.00	24.00	0.00	0	0		
									point17	17	6,850,746.5	1,441,674.1	0.00	24.00					
Barrier3	W	0.00	99.99	0.00				0.00	point18	18	6,850,788.5	1,441,685.6	0.00	24.00	0.00	0	0		
									point19	19	6,850,790.0	1,441,743.6	0.00	24.00	0.00	0	0		
									point20	20	6,850,795.5	1,441,743.5	0.00	24.00	0.00	0	0		
									point21	21	6,850,795.5	1,441,737.0	0.00	24.00	0.00	0	0		
									point22	22	6,850,801.5	1,441,737.0	0.00	24.00	0.00	0	0		
									point23	23	6,850,801.5	1,441,735.4	0.00	24.00	0.00	0	0		
									point24	24	6,850,803.5	1,441,735.4	0.00	24.00	0.00	0	0		
									point25	25	6,850,803.5	1,441,734.9	0.00	24.00	0.00	0	0		
									point26	26	6,850,819.5	1,441,734.5	0.00	24.00	0.00	0	0		
									point27	27	6,850,819.5	1,441,735.0	0.00	24.00	0.00	0	0		
									point28	28	6,850,821.5	1,441,735.0	0.00	24.00	0.00	0	0		
									point29	29	6,850,820.5	1,441,685.0	0.00	24.00	0.00	0	0		
									point30	30	6,850,788.5	1,441,685.6	0.00	24.00					
Barrier4	W	0.00	99.99	0.00				0.00	point32	32	6,850,862.0	1,441,680.9	0.00	24.00	0.00	0	0		
									point33	33	6,850,863.5	1,441,742.1	0.00	24.00	0.00	0	0		
									point34	34	6,850,853.0	1,441,742.2	0.00	24.00	0.00	0	0		
									point35	35	6,850,853.0	1,441,737.2	0.00	24.00	0.00	0	0		
									point36	36	6,850,851.0	1,441,737.4	0.00	24.00	0.00	0	0		
									point37	37	6,850,851.0	1,441,736.9	0.00	24.00	0.00	0	0		

									point38	38	6,850,834.0	1,441,737.2	0.00	24.00	0.00	0	0		
									point39	39	6,850,834.0	1,441,737.6	0.00	24.00	0.00	0	0		
									point40	40	6,850,832.0	1,441,737.8	0.00	24.00	0.00	0	0		
									point41	41	6,850,831.0	1,441,681.5	0.00	24.00	0.00	0	0		
									point42	42	6,850,862.0	1,441,680.9	0.00	24.00					
Barrier5	W	0.00	99.99	0.00				0.00	point44	44	6,850,872.5	1,441,687.1	0.00	24.00	0.00	0	0		
									point45	45	6,850,874.0	1,441,748.1	0.00	24.00	0.00	0	0		
									point46	46	6,850,885.0	1,441,747.9	0.00	24.00	0.00	0	0		
									point47	47	6,850,885.0	1,441,743.9	0.00	24.00	0.00	0	0		
									point48	48	6,850,887.0	1,441,743.9	0.00	24.00	0.00	0	0		
									point49	49	6,850,887.0	1,441,743.4	0.00	24.00	0.00	0	0		
									point50	50	6,850,903.0	1,441,743.1	0.00	24.00	0.00	0	0		
									point51	51	6,850,903.5	1,441,743.5	0.00	24.00	0.00	0	0		
									point52	52	6,850,906.0	1,441,743.5	0.00	24.00	0.00	0	0		
									point53	53	6,850,904.5	1,441,686.5	0.00	24.00	0.00	0	0		
									point54	54	6,850,872.5	1,441,687.1	0.00	24.00					
Barrier6	W	0.00	99.99	0.00				0.00	point55	55	6,851,069.5	1,441,872.5	0.00	24.00	0.00	0	0		
									point56	56	6,851,063.5	1,441,929.4	0.00	24.00	0.00	0	0		
									point57	57	6,851,068.5	1,441,929.9	0.00	24.00	0.00	0	0		
									point58	58	6,851,069.0	1,441,923.5	0.00	24.00	0.00	0	0		
									point59	59	6,851,075.0	1,441,924.1	0.00	24.00	0.00	0	0		
									point60	60	6,851,075.0	1,441,922.6	0.00	24.00	0.00	0	0		
									point61	61	6,851,077.0	1,441,922.8	0.00	24.00	0.00	0	0		
									point62	62	6,851,077.0	1,441,922.4	0.00	24.00	0.00	0	0		
									point63	63	6,851,094.0	1,441,924.1	0.00	24.00	0.00	0	0		
									point64	64	6,851,094.0	1,441,924.6	0.00	24.00	0.00	0	0		
									point65	65	6,851,095.0	1,441,924.8	0.00	24.00	0.00	0	0		
									point66	66	6,851,100.5	1,441,875.9	0.00	24.00	0.00	0	0		
									point67	67	6,851,069.5	1,441,872.5	0.00	24.00					
Barrier7	W	0.00	99.99	0.00				0.00	point69	69	6,851,143.5	1,441,873.1	0.00	24.00	0.00	0	0		
									point70	70	6,851,137.0	1,441,934.8	0.00	24.00	0.00	0	0		
									point71	71	6,851,125.5	1,441,933.5	0.00	24.00	0.00	0	0		
									point72	72	6,851,126.0	1,441,928.5	0.00	24.00	0.00	0	0		
									point73	73	6,851,124.0	1,441,928.4	0.00	24.00	0.00	0	0		
									point74	74	6,851,124.0	1,441,927.9	0.00	24.00	0.00	0	0		
									point75	75	6,851,108.0	1,441,926.1	0.00	24.00	0.00	0	0		
									point76	76	6,851,108.0	1,441,926.6	0.00	24.00	0.00	0	0		
									point77	77	6,851,105.5	1,441,926.2	0.00	24.00	0.00	0	0		
									point78	78	6,851,111.5	1,441,869.6	0.00	24.00	0.00	0	0		
									point79	79	6,851,143.5	1,441,873.1	0.00	24.00					
Barrier8	W	0.00	99.99	0.00				0.00	point81	81	6,851,153.5	1,441,874.1	0.00	24.00	0.00	0	0		
									point82	82	6,851,147.0	1,441,934.8	0.00	24.00	0.00	0	0		
									point83	83	6,851,158.0	1,441,936.0	0.00	24.00	0.00	0	0		
									point84	84	6,851,158.5	1,441,932.0	0.00	24.00	0.00	0	0		
									point85	85	6,851,160.5	1,441,932.2	0.00	24.00	0.00	0	0		
									point86	86	6,851,160.5	1,441,931.8	0.00	24.00	0.00	0	0		
									point87	87	6,851,176.5	1,441,933.5	0.00	24.00	0.00	0	0		
									point88	88	6,851,176.5	1,441,934.0	0.00	24.00	0.00	0	0		
									point89	89	6,851,179.0	1,441,934.2	0.00	24.00	0.00	0	0		

									point90	90	6,851,185.0	1,441,877.6	0.00	24.00	0.00	0	0		
									point91	91	6,851,153.5	1,441,874.1	0.00	24.00					
Barrier9	W	0.00	99.99	0.00				0.00	point92	92	6,851,226.0	1,441,889.1	0.00	24.00	0.00	0	0		
									point93	93	6,851,220.0	1,441,946.8	0.00	24.00	0.00	0	0		
									point94	94	6,851,214.0	1,441,946.1	0.00	24.00	0.00	0	0		
									point95	95	6,851,215.0	1,441,939.8	0.00	24.00	0.00	0	0		
									point96	96	6,851,209.0	1,441,939.1	0.00	24.00	0.00	0	0		
									point97	97	6,851,209.0	1,441,937.5	0.00	24.00	0.00	0	0		
									point98	98	6,851,207.0	1,441,937.4	0.00	24.00	0.00	0	0		
									point99	99	6,851,207.0	1,441,936.9	0.00	24.00	0.00	0	0		
									point100	100	6,851,191.0	1,441,935.1	0.00	24.00	0.00	0	0		
									point101	101	6,851,191.0	1,441,935.6	0.00	24.00	0.00	0	0		
									point102	102	6,851,189.0	1,441,935.4	0.00	24.00	0.00	0	0		
									point103	103	6,851,194.5	1,441,885.6	0.00	24.00	0.00	0	0		
									point104	104	6,851,226.0	1,441,889.1	0.00	24.00					
Barrier10	W	0.00	99.99	0.00				0.00	point106	106	6,851,236.5	1,441,892.4	0.00	24.00	0.00	0	0		
									point107	107	6,851,229.5	1,441,953.1	0.00	24.00	0.00	0	0		
									point108	108	6,851,240.0	1,441,954.2	0.00	24.00	0.00	0	0		
									point109	109	6,851,240.5	1,441,949.4	0.00	24.00	0.00	0	0		
									point110	110	6,851,242.5	1,441,949.5	0.00	24.00	0.00	0	0		
									point111	111	6,851,242.5	1,441,949.1	0.00	24.00	0.00	0	0		
									point112	112	6,851,259.5	1,441,950.9	0.00	24.00	0.00	0	0		
									point113	113	6,851,259.5	1,441,951.4	0.00	24.00	0.00	0	0		
									point114	114	6,851,261.5	1,441,951.6	0.00	24.00	0.00	0	0		
									point115	115	6,851,267.5	1,441,895.8	0.00	24.00	0.00	0	0		
									point116	116	6,851,236.5	1,441,892.4	0.00	24.00					
Barrier11	W	0.00	99.99	0.00				0.00	point118	118	6,850,919.5	1,441,954.6	0.00	24.00	0.00	0	0		
									point119	119	6,850,981.5	1,441,952.9	0.00	24.00	0.00	0	0		
									point120	120	6,850,981.5	1,441,964.1	0.00	24.00	0.00	0	0		
									point121	121	6,850,976.5	1,441,964.2	0.00	24.00	0.00	0	0		
									point123	123	6,850,977.0	1,441,966.4	0.00	24.00	0.00	0	0		
									point125	125	6,850,977.0	1,441,982.5	0.00	24.00	0.00	0	0		
									point126	126	6,850,977.5	1,441,985.0	0.00	24.00	0.00	0	0		
									point127	127	6,850,920.5	1,441,986.6	0.00	24.00	0.00	0	0		
									point128	128	6,850,919.5	1,441,954.6	0.00	24.00					
Barrier12	W	0.00	99.99	0.00				0.00	point130	130	6,851,153.5	1,442,601.1	0.00	24.00	0.00	0	0		
									point131	131	6,851,214.5	1,442,599.2	0.00	24.00	0.00	0	0		
									point132	132	6,851,215.0	1,442,609.6	0.00	24.00	0.00	0	0		
									point133	133	6,851,210.0	1,442,609.8	0.00	24.00	0.00	0	0		
									point135	135	6,851,210.0	1,442,611.9	0.00	24.00	0.00	0	0		
									point137	137	6,851,210.0	1,442,628.9	0.00	24.00	0.00	0	0		
									point138	138	6,851,210.5	1,442,630.5	0.00	24.00	0.00	0	0		
									point139	139	6,851,154.5	1,442,632.2	0.00	24.00	0.00	0	0		
									point140	140	6,851,153.5	1,442,601.1	0.00	24.00					
Barrier13	W	0.00	99.99	0.00				0.00	point141	141	6,851,158.5	1,442,558.5	0.00	24.00	0.00	0	0		
									point142	142	6,851,216.5	1,442,556.8	0.00	24.00	0.00	0	0		
									point143	143	6,851,217.0	1,442,562.6	0.00	24.00	0.00	0	0		
									point144	144	6,851,210.5	1,442,562.9	0.00	24.00	0.00	0	0		
									point145	145	6,851,210.5	1,442,568.6	0.00	24.00	0.00	0	0		

									point146	146	6,851,209.0	1,442,568.6	0.00	24.00	0.00	0	0		
									point148	148	6,851,209.0	1,442,570.6	0.00	24.00	0.00	0	0		
									point150	150	6,851,209.0	1,442,586.9	0.00	24.00	0.00	0	0		
									point151	151	6,851,209.5	1,442,589.0	0.00	24.00	0.00	0	0		
									point152	152	6,851,159.5	1,442,590.5	0.00	24.00	0.00	0	0		
									point153	153	6,851,158.5	1,442,558.5	0.00	24.00					
Barrier14	W	0.00	99.99	0.00				0.00	point154	154	6,851,136.0	1,442,510.4	0.00	24.00	0.00	0	0		
									point155	155	6,851,137.5	1,442,567.5	0.00	24.00	0.00	0	0		
									point156	156	6,851,132.5	1,442,567.6	0.00	24.00	0.00	0	0		
									point157	157	6,851,132.0	1,442,561.2	0.00	24.00	0.00	0	0		
									point158	158	6,851,126.5	1,442,561.4	0.00	24.00	0.00	0	0		
									point159	159	6,851,126.5	1,442,559.8	0.00	24.00	0.00	0	0		
									point160	160	6,851,124.5	1,442,559.9	0.00	24.00	0.00	0	0		
									point161	161	6,851,124.5	1,442,559.4	0.00	24.00	0.00	0	0		
									point162	162	6,851,107.5	1,442,559.9	0.00	24.00	0.00	0	0		
									point163	163	6,851,107.5	1,442,560.4	0.00	24.00	0.00	0	0		
									point164	164	6,851,106.0	1,442,560.4	0.00	24.00	0.00	0	0		
									point165	165	6,851,104.5	1,442,511.1	0.00	24.00	0.00	0	0		
									point166	166	6,851,136.0	1,442,510.4	0.00	24.00					

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16 June 2022
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Oak Knoll
RUN: Near Term + Project
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
ST1	1	1	58.5	59.7	66	1.2	10	----	59.7	0.0	8	-8.0
ST2	2	1	51.1	46.0	66	-5.1	10	----	46.0	0.0	8	-8.0
ST4	3	1	53.8	59.4	66	5.6	10	----	59.4	0.0	8	-8.0
ST3	4	1	56.9	51.2	66	-5.7	10	----	51.2	0.0	8	-8.0
OS1	6	1	0.0	56.3	66	56.3	10	----	56.3	0.0	8	-8.0
OS2	7	1	0.0	54.1	66	54.1	10	----	54.1	0.0	8	-8.0
OS3	8	1	0.0	53.4	66	53.4	10	----	53.4	0.0	8	-8.0
B64-1	10	1	0.0	58.8	66	58.8	10	----	58.8	0.0	8	-8.0
B64-2	11	1	0.0	58.8	66	58.8	10	----	58.8	0.0	8	-8.0
B62-1	12	1	0.0	58.8	66	58.8	10	----	58.8	0.0	8	-8.0
B62-1	13	1	0.0	58.9	66	58.9	10	----	58.9	0.0	8	-8.0
B1-1	14	1	0.0	56.1	66	56.1	10	----	56.1	0.0	8	-8.0
B1-2	15	1	0.0	56.4	66	56.4	10	----	56.4	0.0	8	-8.0
B3-1	16	1	0.0	56.9	66	56.9	10	----	56.9	0.0	8	-8.0
B3-2	17	1	0.0	57.1	66	57.1	10	----	57.1	0.0	8	-8.0
B5-1	18	1	0.0	56.2	66	56.2	10	----	56.2	0.0	8	-8.0
B5-2	19	1	0.0	56.5	66	56.5	10	----	56.5	0.0	8	-8.0
B23-1	21	1	0.0	53.9	66	53.9	10	----	53.9	0.0	8	-8.0
B23-2	22	1	0.0	57.3	66	57.3	10	----	57.3	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	19	0.0	0.0	0.0

All Impacted		0	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							