Exhibit L

ACOUSTICAL ANALYSIS

COPPER RIVER RANCH OUTLOT N
FRESNO, CALIFORNIA

WJVA Project No. 17-031

PREPARED FOR

GRANVILLE HOMES
1396 WEST HERNDON AVENUE, SUITE 101
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PREPARED BY

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SEPTEMBER 26, 2017

INTRODUCTION

The project is a proposed 44-lot residential development to be located southeast of North Friant Road, within the City of Fresno. Since the project site is located adjacent to North Friant Road, the City of Fresno has required an acoustical analysis to quantify project site noise exposure and determine noise mitigation requirements. This analysis, prepared by WJV Acoustics, Inc. (WJVA), is based upon project site plan provided by the project applicant (Granville Homes), on-site noise measurements conducted by WJVA and traffic data provided by Fresno COG. Revisions to the site plan may affect the findings and recommendations of this report.

Appendix A provides a description of the acoustical terminology used in this report. Unless otherwise stated, all sound levels reported are in A-weighted decibels (dB). A-weighting de-emphasizes the very low and very high frequencies of sound in a manner similar to the human ear. Most community noise standards utilize A-weighting, as it provides a high degree of correlation with human annoyance and health effects.

NOISE EXPOSURE CRITERIA

The City of Fresno Noise Element of the General Plan (adopted 12/18/14) sets noise compatibility standards for transportation noise sources in terms of the Day-Night Average Level (L_{dn}). Implementing Policy NS-1-a of the noise element establishes a land use compatibility criterion as 65 dB L_{dn} for exterior noise exposure within outdoor activity areas of residential land uses. Outdoor activity areas generally include backyards of single-family residences, individual patios or decks of multi-family developments and common outdoor recreation areas of multi-family developments. The intent of the exterior noise level requirement is to provide an acceptable noise environment for outdoor activities and recreation.

Additionally, Implementing Policy NS-1-h of the noise element requires that interior noise levels attributable to exterior transportation noise sources not exceed 45 dB L_{dn}. The intent of the interior noise level standard is to provide an acceptable noise environment for indoor communication and sleep.

PROJECT SITE NOISE EXPOSURE

The project site is located southeast of North Friant Road in northeast Fresno. The distance from center of the backyards of the closest proposed lots to the centerline of North Friant Road is approximately 80 feet. There is an existing berm approximately 5-feet above project site elevation that runs along the Friant Road frontage, the length of the project site. Noise exposure from traffic on North Friant Road was calculated for existing and future (2035) conditions using noise level data obtained by WJVA at the project site, the FHWA Traffic Noise Model and traffic data obtained from the Fresno Council of Governments (Fresno COG).

WJVA utilized the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA-RD-77-108). The FHWA Model is a standard analytical method used for roadway traffic noise calculations. The model is based upon reference energy emission levels for

automobiles, medium trucks (2 axles) and heavy trucks (3 or more axles), with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. The FHWA Model was developed to predict hourly L_{eq} values for free-flowing traffic conditions, and is generally considered to be accurate within ±1.5 dB. To predict CNEL values, it is necessary to determine the hourly distribution of traffic for a typical day and adjust the traffic volume input data to yield an equivalent hourly traffic volume.

Noise level measurements and concurrent traffic counts were conducted by WJVA staff within the project site on September 12, 2017 at two (2) individual locations. The purpose of the measurements was to evaluate the accuracy of the FHWA Model in describing traffic noise exposure within the project site. The measurement sites were located within the project site at a distance of approximately 100 feet from the centerline of North Friant Road. The posted speed limit along North Friant Road is 55 mph (miles per hour). The project site plan is provided as Figure 1. The project vicinity and noise monitoring sites are provided as Figure 2.

Noise monitoring equipment consisted of Larson-Davis Laboratories Model LDL-820 sound level analyzers equipped with B&K Type 4176 1/2" microphones. The equipment complies with the specifications of the American National Standards Institute (ANSI) for Type I (Precision) sound level meters. The meters were calibrated in the field prior to use with a B&K Type 4230 acoustic calibrator to ensure the accuracy of the measurements. The microphones were located on a tripod at 5 feet above the ground. The project site presently consists of a tilled undeveloped soil.

Noise measurements were conducted in terms of the equivalent energy sound level (L_{eq}). Measured L_{eq} values were compared to L_{eq} values calculated (predicted) by the TNM Model using as inputs the traffic volumes, truck mix and vehicle speed observed during the noise measurements. The results of that comparison are shown in Table I.

From Table I it may be determined that the traffic noise levels predicted by the FHWA Model were 5.8 and 6.2 dB higher than those measured for the traffic conditions observed at the time of the noise measurements. This over-prediction by the model is expected, and is due to the above-referenced acoustic shielding provided by the existing 5-foot earthen berm. The FHWA model was therefore adjusted for existing acoustic shielding to calculate annual average traffic noise exposure from North Friant Road within the project site. A conservative adjustment of 5 dB was made to the modeled project site traffic noise exposure.

TABLE I

COMPARISON OF MEASURED AND PREDICTED (FHWA MODEL) NOISE LEVELS COPPER RIVER RANCH OUTLOT N, FRESNO

	Site 1	Site 2
Measurement Date	September 12, 2017	
Measurement Start Time	11:10 a.m.	
Observed # Autos/Hr.	552	
Observed # Medium Trucks/Hr.	12	
Observed # Heavy Trucks/Hr.	24	
Posted Speed (MPH)	55	
Distance, ft. (from center of roadway)	100	
L_{eq}, dBA (Measured)	58.0	57.6
L_{eq}, dBA (Predicted)	63.8	
Difference between Measured and Predicted L_{eq}, dBA	**-5.8**	**-6.2**

Note: FHWA "soft" site assumed for calculations.
Source: WJV Acoustics, Inc.

Annual Average Daily Traffic (AADT) data for North Friant Road adjacent to the project site were obtained from the Fresno COG. Truck percentages and the day/night distribution of traffic was estimated by WJV Acoustics, Inc. (WJVA), based upon previous studies conducted along local roadways in the project vicinity. Table II summarizes annual average traffic data used to model noise exposure within the project site.

TABLE II

TRAFFIC NOISE MODELING ASSUMPTIONS COPPER RIVER RANCH OUTLOT N, FRESNO

	NORTH FRIANT ROAD	
	EXISTING	**2035**
Annual Avenue Daily Traffic (AADT)	14,210	24,375
Day/Night Split (%)	90/10	
Posted Vehicle Speed (mph)	55	
% Medium Trucks (% AADT)	2	
% Heavy Trucks (% AADT)	4	

Sources: Fresno COG
WJV Acoustics, Inc.

Using data from Table II, FHWA Model and the above-described 5 dB of topographic acoustic shielding at the project site, annual average traffic noise exposure was calculated for the project site. The calculated noise exposures for existing and future (2035) traffic conditions was calculated to be 63.1 dB L_{dn} and 65.4 dB L_{dn}, respectively. Future (2035) traffic noise exposure

within the closest lots adjacent to North Friant Road exceed the City's applicable exterior noise level standard of 65 dB L_{dn}. Further mitigation is therefore required.

NOISE MITIGATION

Exterior Noise Mitigation:

The project site traffic noise exposure for future (2035) traffic conditions was calculated to be approximately 65.4 dB L_{dn}. Such levels exceed the City's 65 dB L_{dn} exterior noise level standard for residential land uses.

To mitigate exterior traffic noise exposure, it will be necessary to construct a sound wall or raise the existing earthen berm along the North Friant project site frontage. The sound wall or earthen berm will provide acoustical shielding of the outdoor activity areas (backyards) that would otherwise be exposed to exterior noise levels exceeding the City's standard.

WJVA utilized the FHWA Traffic Noise Model Version 2.5 (TNM 2.5) to calculate the insertion loss (noise reduction) provided by the proposed sound wall. TNM 2.5 is a computer model based on two FHWA reports: FHWA-PD-96-009 and FHWA-PD-96-010 (FHWA 1998a, 1998b). Key inputs to the traffic noise model were the locations of roadways, shielding features (e.g., topography and buildings), noise barriers, ground type, and receivers. The model calculates the insertion loss of a wall of a given height based on the effective height of the noise source, height of the receiver, distance from the receiver to the wall, and distance from the noise source to the wall. The standard assumptions used in the sound wall calculations are effective source heights of 8, 2 and 0 feet above the roadway for heavy trucks, medium trucks and automobiles, respectively. The standard height of a residential receiver is five feet above the ground elevation.

Based upon the above-described assumptions and method of analysis, the noise level insertion loss values for sound walls of various heights were calculated. The calculations indicated that a sound wall or earthen berm (or combination) constructed along the southern portion of the project site, with a minimum height of six (6) feet relative to the project site elevation would reduce traffic noise exposure within the backyards of the proposed lots to below 65 dB L_{dn}, for future (2035) traffic conditions. It should be noted, the above-described sound wall or earthen berm would be effective at first-floor receivers only. Therefore, second-floor exterior balconies facing North Friant Road should not be constructed along the first row of houses along North Friant Road.

Interior Noise Mitigation:

The City of Fresno interior noise level standard is 45 dB L_{dn}. With the proposed sound wall or earthen berm in place, the proposed single-family residences would need to be capable of providing a minimum outdoor-to-indoor noise level reduction (NLR) of approximately 19 dB (64-45=15) at first-floor receiver locations and 25 dB (70-45=25) at second-floor receiver locations.

A specific analysis of interior noise levels was not performed. However, it may be assumed that residential construction methods complying with current building code requirements will reduce exterior noise levels by a minimum of 25 dB if windows and doors are closed. This will be sufficient for compliance with the City's 45 dB L_{dn} interior standard. Requiring that it be possible for windows and doors to remain closed for sound insulation means that air conditioning or mechanical ventilation will be required.

CONCLUSIONS AND RECOMMENDATIONS

The proposed Copper River Ranch Outlot N residential development will comply with applicable City of Fresno exterior and interior noise level requirements provided that the following noise mitigation measures are included in the proposed project design.

1. A sound wall or earthen berm (or combination) with a minimum height of six (6) feet above finished lot grade is constructed along the property line separating the backyards from North Friant Road frontage. Suitable construction materials include concrete blocks, masonry or stucco on both sides of a wood or steel stud wall. It should be noted; the existing earthen berm is approximately 5-feet above project site grade. The applicant could increase the height of the existing berm to a height of 6-feet above project site grade (one additional foot) to comply with the City's applicable exterior noise level standard.

2. Exterior second-floor balconies should not be constructed facing North Friant Road along the first row of houses facing North Friant Road.

3. Air conditioning or mechanical ventilation should be installed in the home so that it will be possible for windows and doors to remain closed for sound insulation purposes.

The conclusions and recommendations of this acoustical analysis are based upon the best information known to WJV Acoustics Inc. (WJVA) at the time the analysis was prepared concerning the proposed site plan, traffic volumes, project site elevation and roadway configurations. Any significant changes in these factors will require a reevaluation of the findings of this report. Additionally, any significant future changes in motor vehicle technology, noise regulations or other factors beyond WJVA's control may result in long-term noise results different from those described by this analysis.

Respectfully submitted,

Walter J. Van Groningen
President

WJV:wjv

FIGURE 1: PROJECT SITE PLAN

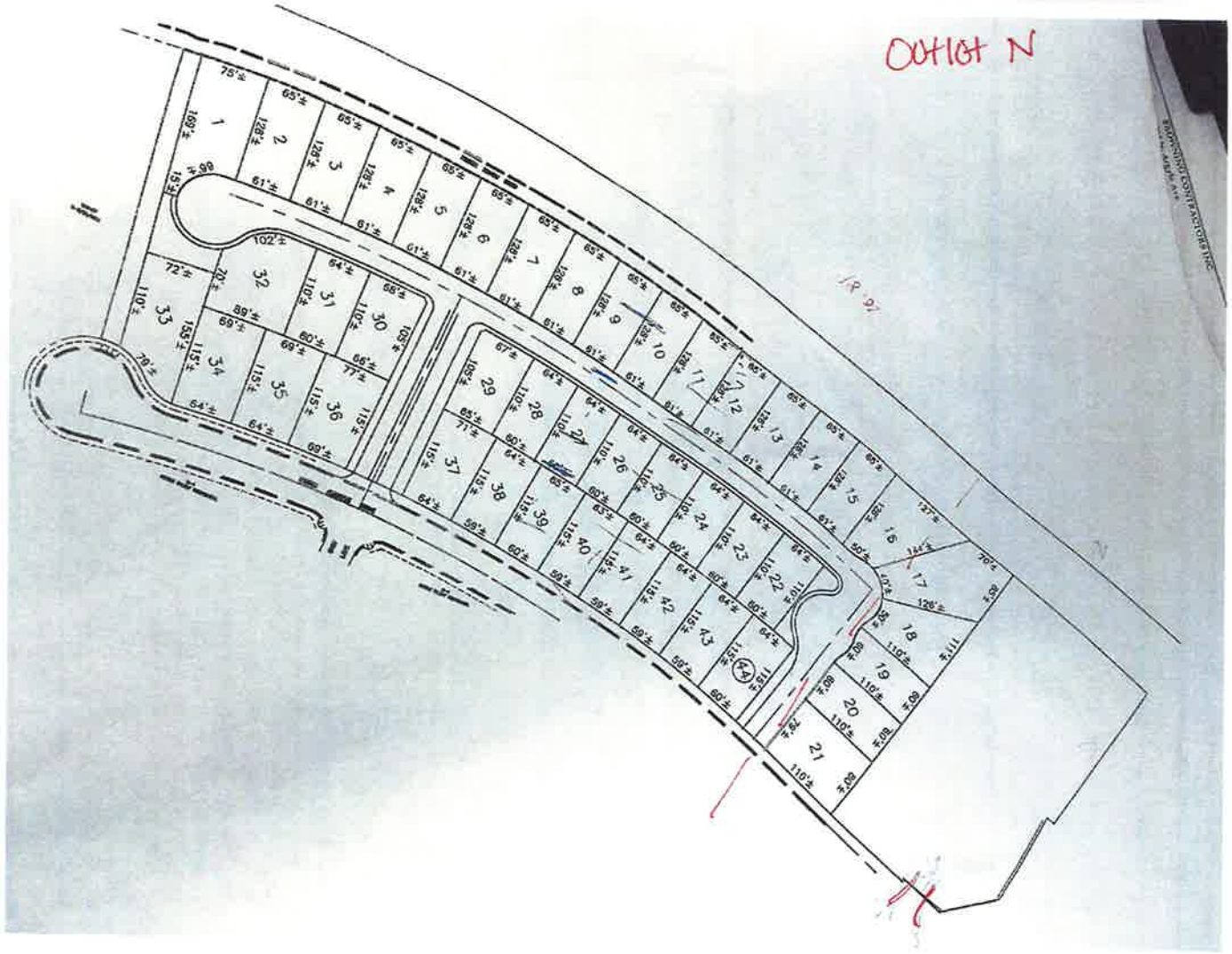

FIGURE 2: PROJECT VICINITY AND NOISE MONITORING SITE LOCATIONS

APPENDIX A

ACOUSTICAL TERMINOLOGY

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

CNEL: Community Noise Equivalent Level. The average equivalent sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m.

DECIBEL, dB: A unit for describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).

DNL/L_{dn}: Day/Night Average Sound Level. The average equivalent sound level during a 24-hour day, obtained after addition of ten decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.

L_{eq}: Equivalent Sound Level. The sound level containing the same total energy as a time varying signal over a given sample period. L_{eq} is typically computed over 1, 8 and 24-hour sample periods.

NOTE: The CNEL and DNL represent daily levels of noise exposure averaged on an annual basis, while L_{eq} represents the average noise exposure for a shorter time period, typically one hour.

L_{max}: The maximum noise level recorded during a noise event.

L_n: The sound level exceeded "n" percent of the time during a sample interval (L_{90}, L_{50}, L_{10}, etc.). For example, L_{10} equals the level exceeded 10 percent of the time.

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ACOUSTICAL TERMINOLOGY

NOISE EXPOSURE CONTOURS: Lines drawn about a noise source indicating constant levels of noise exposure. CNEL and DNL contours are frequently utilized to describe community exposure to noise.

NOISE LEVEL REDUCTION (NLR): The noise reduction between indoor and outdoor environments or between two rooms that is the numerical difference, in decibels, of the average sound pressure levels in those areas or rooms. A measurement of "noise level reduction" combines the effect of the transmission loss performance of the structure plus the effect of acoustic absorption present in the receiving room.

SEL or SENEL: Sound Exposure Level or Single Event Noise Exposure Level. The level of noise accumulated during a single noise event, such as an aircraft overflight, with reference to a duration of one second. More specifically, it is the time-integrated A-weighted squared sound pressure for a stated time interval or event, based on a reference pressure of 20 micropascals and a reference duration of one second.

SOUND LEVEL: The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and gives good correlation with subjective reactions to noise.

SOUND TRANSMISSION CLASS (STC): The single-number rating of sound transmission loss for a construction element (window, door, etc.) over a frequency range where speech intelligibility largely occurs.