ATTACHMENT 7

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Mr. Barry Freeland
Project Manager

VIA E-Mail: BFree18469@aol.com

SUBJECT: **1665 Guerneville Road, Santa Rosa, CA – Environmental Noise Assessment**

Dear Mr. Freeland:

This report presents the results of the environmental noise assessment conducted for the Guerneville Road Homes Project proposed at 1665 Guerneville Road in Santa Rosa, California. This assessment evaluated the project's compatibility with the existing and future noise environment expected at the project site. Included in the report are the fundamentals of environmental noise, applicable local noise regulations and guidelines, and a description of existing noise levels at the project site. The report summarizes the results of calculations of future noise levels at proposed noise sensitive receptors and describes measures to control noise levels to acceptable levels.

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more

intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (L_{dn} or *DNL*) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit 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. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	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 frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

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

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

Regulatory Background

The City of Santa Rosa's General Plan[1] establishes noise and land use compatibility standards to evaluate a project's compatibility with the noise environment and General Plan policies designed to minimize the effects of noise throughout the community. Single-family residential land uses are considered "normally acceptable" in noise environments of 60 dBA DNL or less.

The City of Santa Rosa also establishes policies in the Noise and Safety Element of the General Plan to achieve the goal of maintaining an acceptable community noise level. The following policies are applicable to the proposed project:

NS-B-1 Do not locate noise-sensitive uses in proximity to major noise sources.

NS-B-2 Encourage residential developers to provide buffers other than sound walls, where practical. Allow sound walls only when projected (2020) noise levels at a site exceed land use compatibility standards…

NS-B-4 Require new projects in the following categories to submit an acoustical study, prepared by a qualified acoustical consultant:

- All new projects proposed for areas with existing noise above 60 dBA DNL. Mitigation shall be sufficient to reduce noise levels below 45 dBA DNL in habitable rooms and 60 dBA DNL in private and shared recreational facilities.

NS-B-5 Pursue measures to reduce noise impacts primarily through site planning. Engineering solutions for noise mitigation, such as sound walls, are the least desirable alternative.

NS-B-9 Encourage developers to incorporate acoustical site planning into their projects. Recommended measures include:

- Incorporating buffers and/or landscaped earth berms;
- Orienting windows and outdoor living areas away from unacceptable noise exposure;
- Using reduced-noise pavement (rubberized-asphalt);
- Incorporating traffic calming measures, alternative intersection designs, and lower speed limits; and
- Incorporating state-of-the-art structural sound attenuation and setbacks.

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1 *Santa Rosa 2020: General Plan*, 2002.

Existing Noise Environment

The project site lies north of Guerneville Road, between Marlow Road to the west and Ridley Avenue to the east. The noise environment at the project site is dominated by vehicular traffic along Guerneville Road. The daily trend in noise levels along Guerneville Road was measured by Illingworth & Rodkin, Inc. between Friday, November 16, 2018 and Tuesday, November 20, 2018 at Site LT-1. This measurement location was 60 feet from the centerline of Guerneville Road as indicated on Figure 1. The day-night average noise level (DNL) measured at this location was 69 to 70 dBA over the weekend and 71 dBA during weekdays. Hourly average noise levels at this site ranged from 56 dBA to 73 dBA L_{eq} during the noise measurement period. Figures 2-6 present a summary of the data collected at LT-1 during the noise monitoring survey.

Figure 1 Aerial Image Showing Site and Long-Term Noise Monitoring Location

Source: Google Earth, 2018.

Noise Levels at Noise Measurement Site LT-1
~60 feet from the Centerline of Guerneville Road
Friday, November 16, 2018

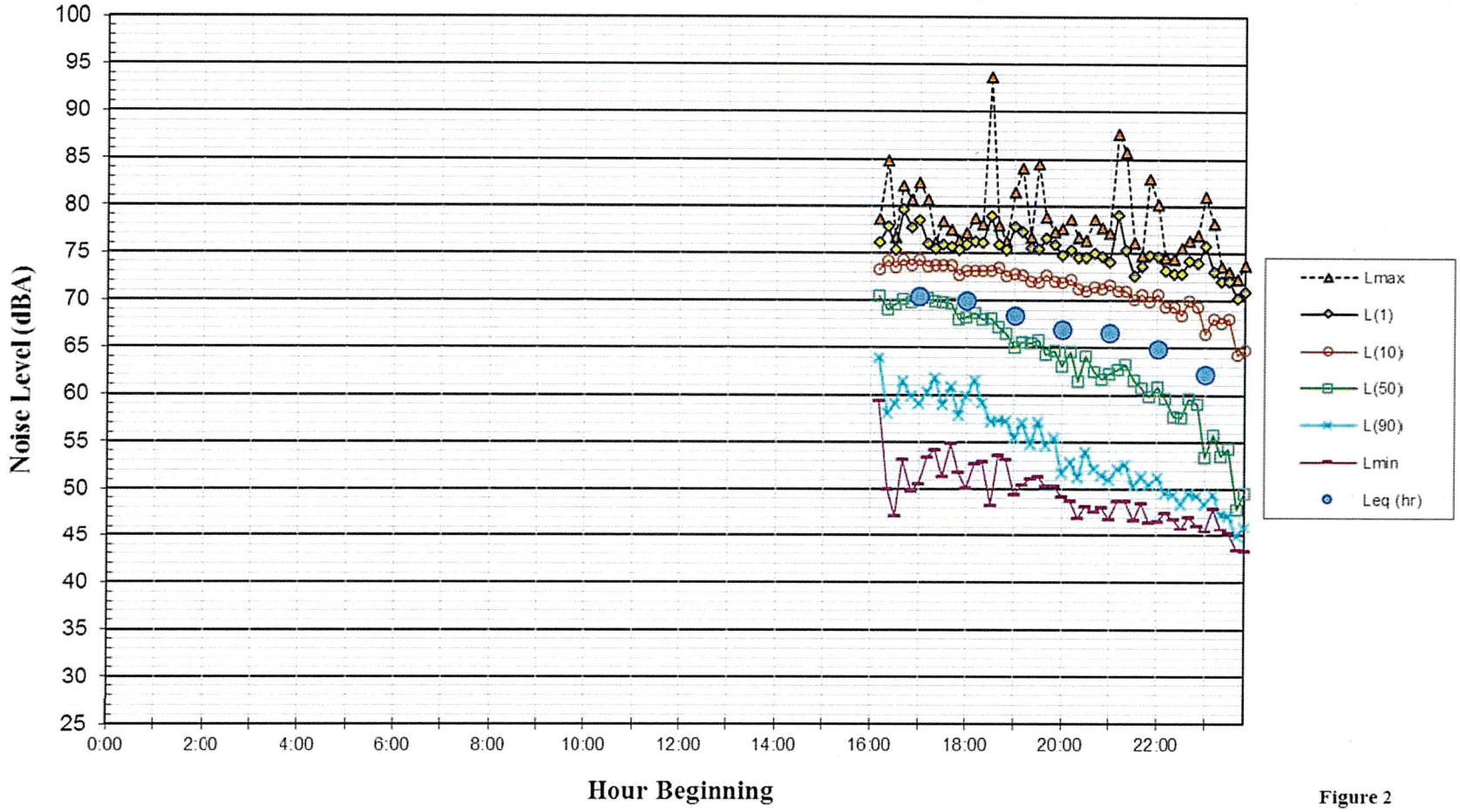


Figure 2

Noise Levels at Noise Measurement Site LT-1
~60 feet from the Centerline of Guerneville Road
Saturday, November 17, 2018

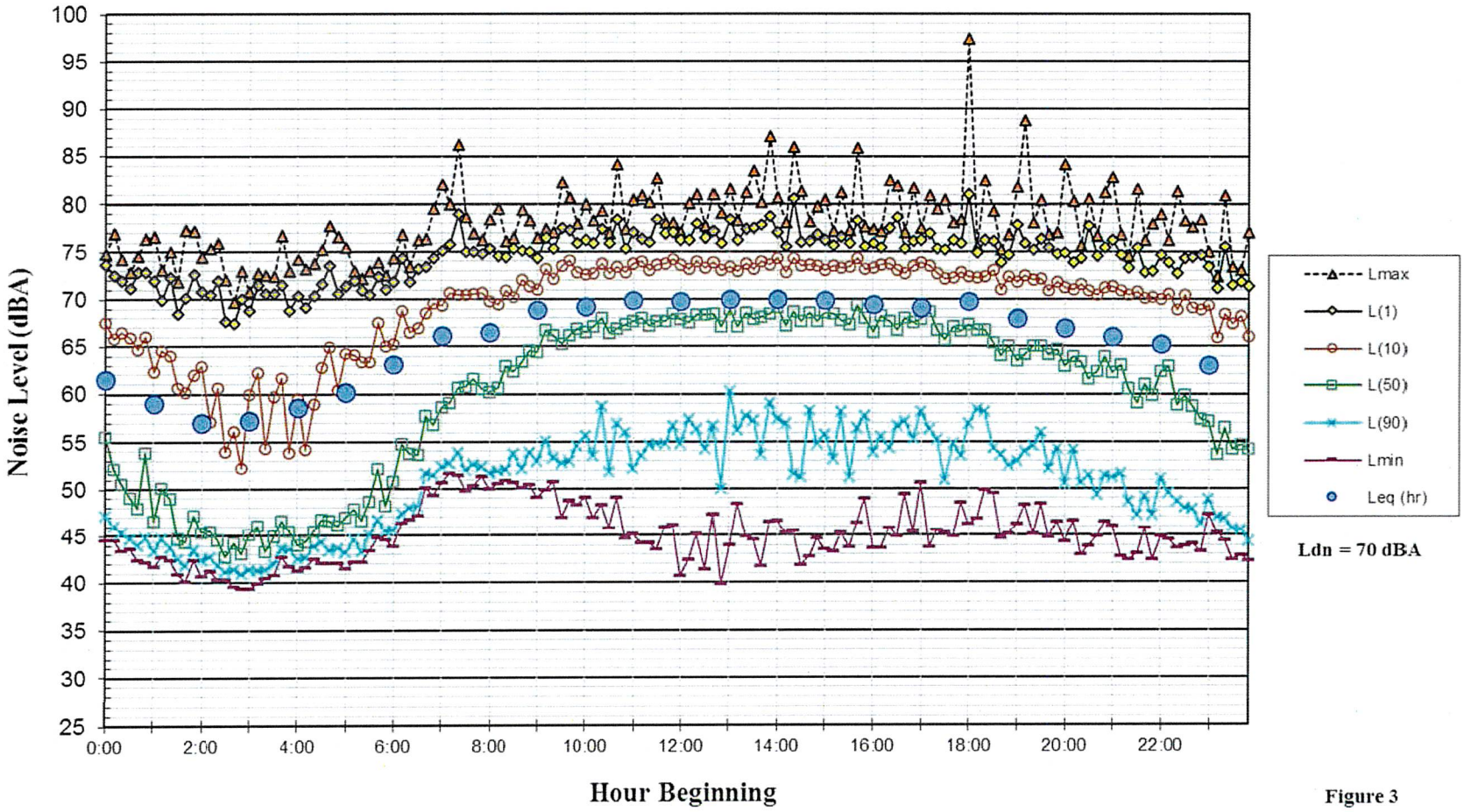
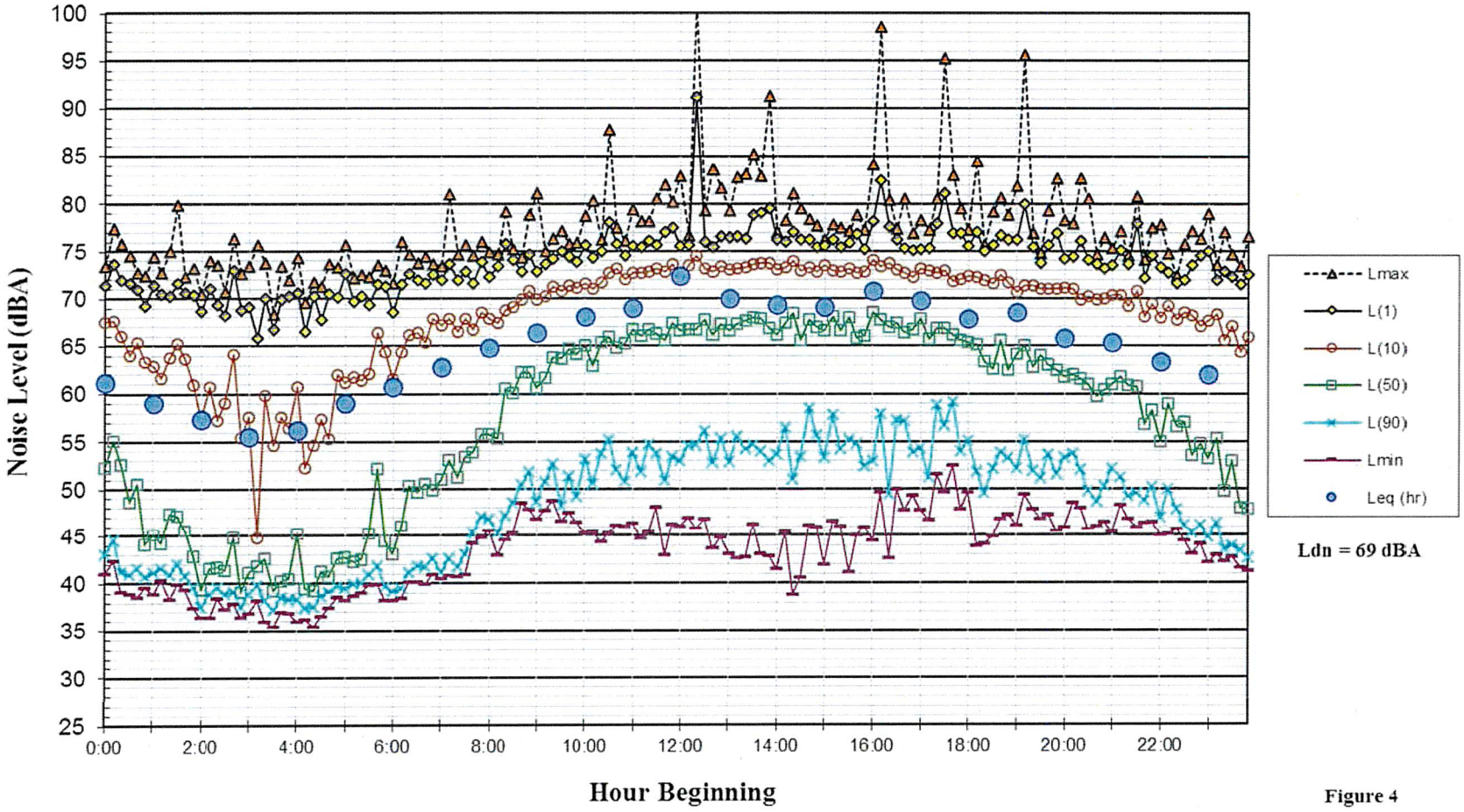


Figure 3

Noise Levels at Noise Measurement Site LT-1
~60 feet from the Centerline of Guerneville Road
Sunday, November 18, 2018



Ldn = 69 dBA

Figure 4

Noise Levels at Noise Measurement Site LT-1
~60 feet from the Centerline of Guerneville Road
Monday, November 19, 2018

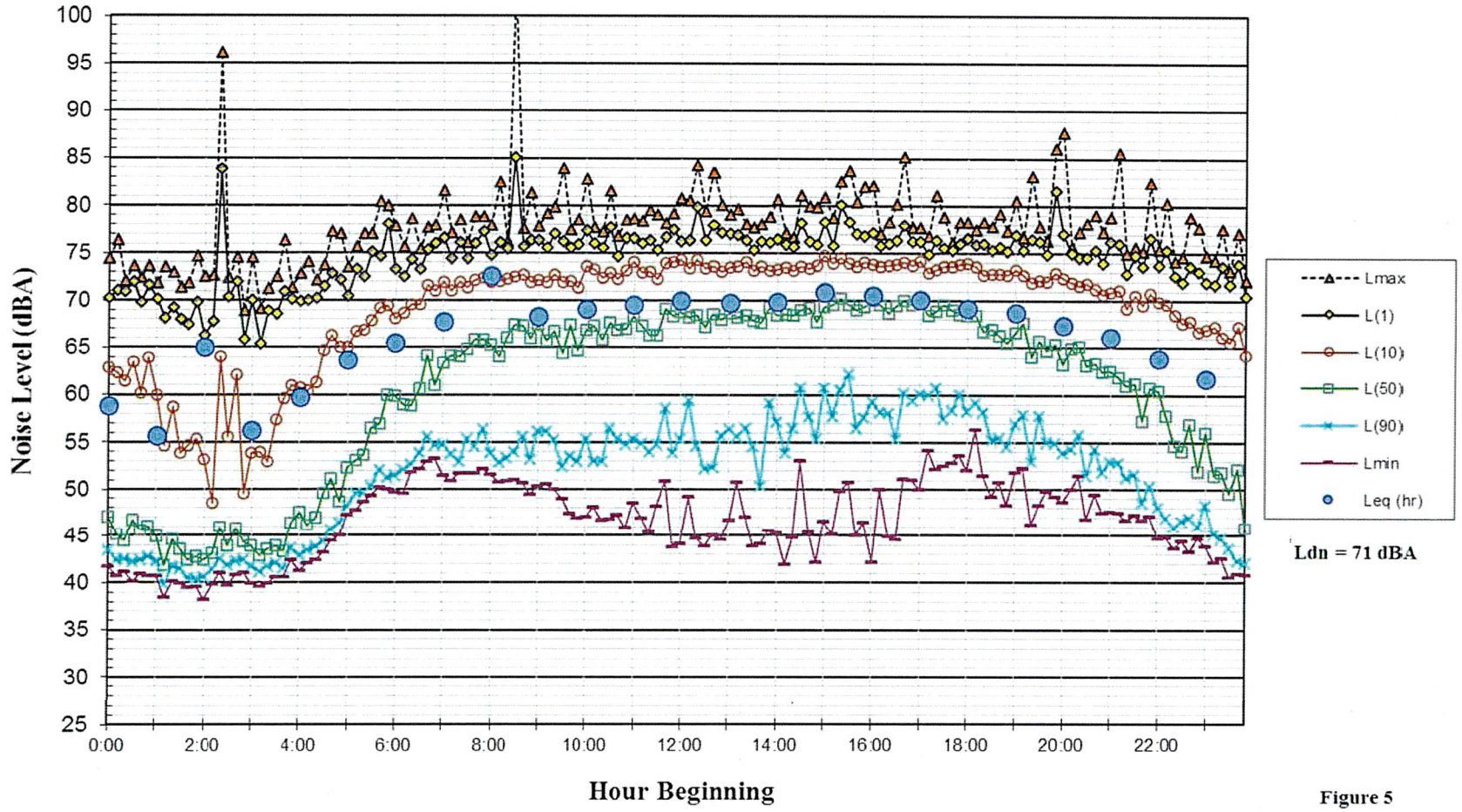


Figure 5

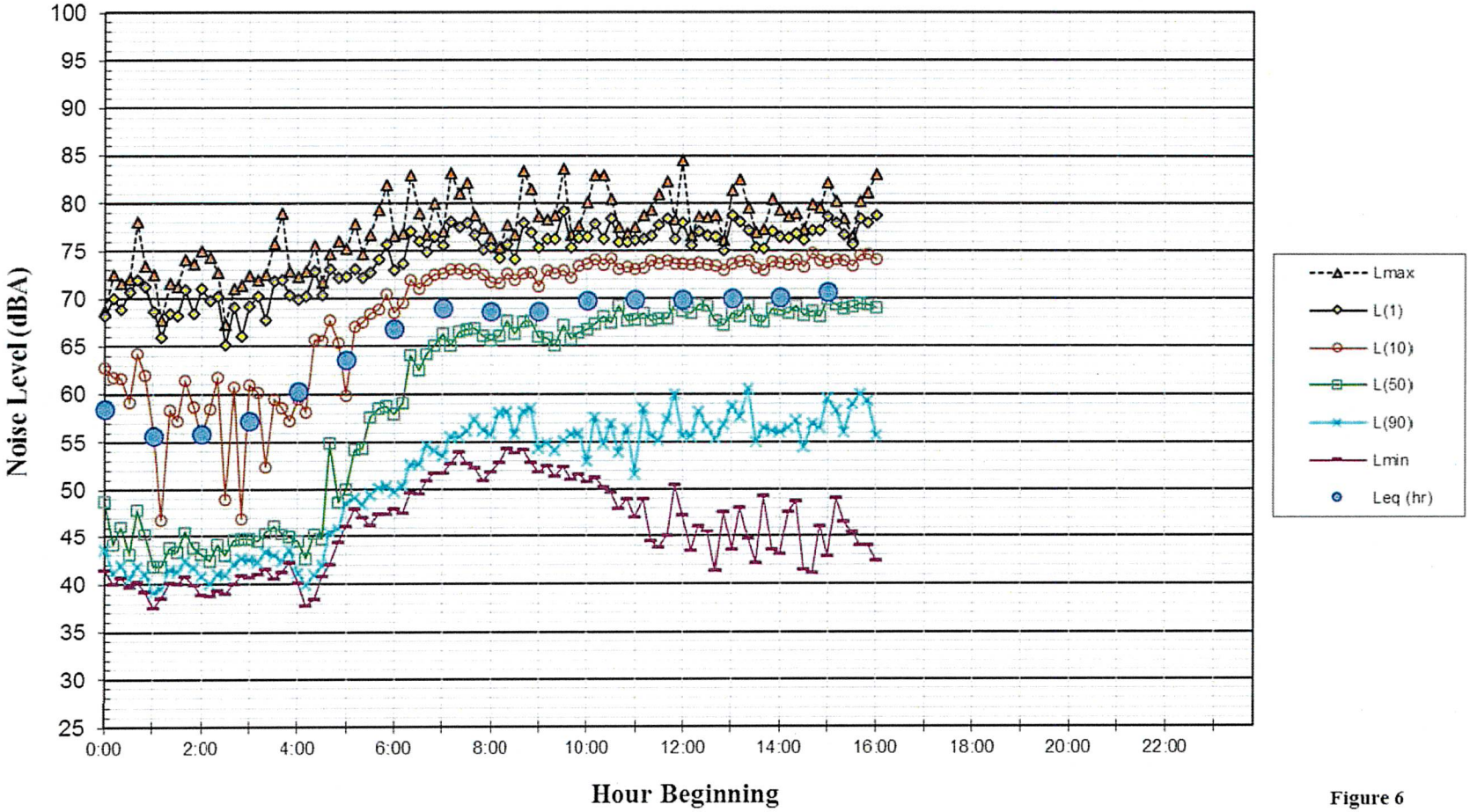

Noise Levels at Noise Measurement Site LT-1
~60 feet from the Centerline of Guerneville Road
Tuesday, November 20, 2018
Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 6

Future Exterior Noise Environment

The compatibility of proposed exterior use areas is assessed against the Land Use Compatibility Standards established in the General Plan. Exterior use areas in low density single-family, duplex, or mobile home developments are considered "normally acceptable" in noise environments of 60 dBA DNL or less. Duplex units proposed nearest Guerneville Road (Lots 6 and 7) would have rear yards located approximately 60 feet from the roadway centerline.

FHWA's Traffic Noise Model (TNM v. 2.5) was used in the noise analysis for this project. Roadway, barrier, terrain features, and receiver locations were digitized and input into the traffic noise model in a three-dimensional reference coordinate system. The model input was based on the project's Tentative Map dated December 4, 2018. Vehicular traffic volumes, including the vehicle mix ratio, and traffic speeds were also input into the model. Future traffic projections along the roadway were not available from the Santa Rosa Traffic Engineering Division. For the purposes of this assessment, we have assumed a 1-2% increase in traffic volumes along the roadway over the next 15 to 20 years. These projections would be typical assuming a standard rate of growth in the City. As a result, future noise levels are predicted to increase by approximately 1 decibel over existing conditions. Exterior noise levels would be as high as 72 dBA DNL at the southernmost facades of the residences proposed nearest to Guerneville Road (ADUs 6A and 7A).

To provide a compatible exterior noise environment, noise barriers would be required to shield the rear yards of the four nearest units to Guerneville Road (Lots 5-8). At minimum, an eight-foot noise barrier would be required to reduce exterior noise levels in the rear yards of the two nearest units to Guerneville Road (Lots 6 and 7) to 60 dBA DNL or less. Six-foot noise barriers would be required to reduce exterior noise levels in the rear yards of the next two units closest to Guerneville Road (Lots 5 and 8) to 60 dBA DNL or less. Exterior noise levels at rear yards located further north (Lots 1-4 and 9-12) would be less than 60 dBA DNL and considered "normally acceptable" with the future noise environment without additional mitigation. The proposed barrier design is presented in Figure 7. To be effective, barriers should be constructed solidly over the entire surface and at the base of the barrier. Openings or gaps between barrier materials or the ground decrease the reduction provided by a noise barrier. Suitable materials for barrier construction should have a minimum surface weight of 3 lbs./ft.^{2} (such as one-inch nominal thickness wood, masonry block, concrete, or metal).

Future Interior Noise Environment

Interior noise levels within new residential units are required by the City of Santa Rosa to be maintained at or below 45 dBA DNL. In buildings of typical construction, with the windows partially open, interior noise levels are generally 15 dBA lower than exterior noise levels. With the windows maintained closed, standard residential construction typically provides about 20 to 25 decibels of noise reduction. For example, a unit exposed to exterior noise levels of 72 DNL would be 57 DNL inside with the windows partially open and 47 to 52 DNL with the windows shut. Residential units nearest Guerneville Road (Lots 6 and 7 and Road ADUs 6A and 7A) would require sound-rated window and wall assemblies capable of reducing noise levels in interior spaces to 45 dBA DNL or less. Attaining the necessary noise reduction from exterior to interior spaces is readily achievable with proper wall construction techniques, the selections of proper windows and

doors, and the incorporation of forced-air mechanical ventilation systems to allow occupants to control noise by closing the windows.

Interior noise levels were calculated based on a review of the project's building elevations and floor plans[2]. Building construction is assumed as standard 2x4 stud walls with HardiePlank exterior and sheetrock interior. Based on the results of the calculations, residential units on Lots 6 and 7, and ADUs 6A and 6B would require windows with a minimum Sound Transmission Class rating of 34 STC and doors with a minimum Sound Transmission Class rating of 26 STC. Residential units on Lots 5 and 8 would require windows with a minimum Sound Transmission Class rating of 28 STC and doors with a minimum Sound Transmission Class rating of 26 STC. Standard dual-insulating thermal pane windows (STC 26) would be sufficient for residential units on Lots 1-4, 9-12, and ADU 9A. Table 3, below, summarizes the necessary ratings of windows by lot. Residential units throughout the project site should be provided some form of forced-air mechanical ventilation, satisfactory to the local building official, to adequately ventilate the interior space of the units while windows are closed to control noise.

TABLE 3 Window/Door STC[3] Ratings

Lot	Façade	Minimum STC Rating
6, 7, 6A and 7A	West, South, and East	34 Windows, 26 Doors
5 and 8	West and East	28 Windows, 26 Doors
1-4, 9-12, and 9A	West, South, and East	26 Windows, 26 Doors

The above noise insulation features would adequately reduce interior noise levels in all units to 45 dBA DNL or less, satisfying the interior noise level requirements of the City of Santa Rosa.

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This concludes our environmental noise assessment for the Guerneville Road Homes project. If you have any questions or comments regarding this analysis, please do not hesitate to call.

Sincerely yours,

Michael S. Thill
Principal Consultant
ILLINGWORTH & RODKIN, INC.
(18-219)

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[2] Guerneville Road Homes Building Elevations and Floor Plans, Tierney/Figueiredo Architects, December 17, 2018.

[3] **Sound Transmission Class (STC)** - A single figure rating designed to give an estimate of the sound insulation properties of a partition. Numerically, STC represents the number of decibels of speech sound reduction from one side of the partition to the other. The STC is intended for use when speech and office noise constitute the principal noise problem.

Figure 7 **Preliminary Noise Barrier Design**