AGEMARK AT WILDER – ENVIRONMENTAL NOISE STUDY

ORINDA, CALIFORNIA

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Prepared for:

Richard Westin
Agemark
2614 Telegraph Avenue
Berkeley, CA 94704
Email: Richard@agemark.com

Prepared by:

CHARLES M. SALTER ASSOCIATES, INC.
Randy D. Waldeck, P.E., Principal Consultant
130 Sutter Street, Suite 500
San Francisco, CA 94104
Phone: (415) 397-0442
Fax: (415) 397-0454

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INTRODUCTION

This report summarizes our environmental noise study for the Agemark at Wilder assisted living facility in Orinda. We have analyzed traffic noise intrusion from Highway 24 and Gateway Boulevard to the project. This report summarizes the noise criteria, the noise environment at the site, and the recommended mitigation measures.

The project site is located just south of Highway 24 at Gateway Boulevard. The site is bound by Gateway Boulevard to the south and east and the on-ramp to eastbound Highway 24 to the north. Figure 1 shows the project site.

For those unfamiliar with the fundamental concepts of environmental acoustics, please refer to Appendix A and Figure A1.

EXECUTIVE SUMMARY

- The future noise environment at the site will range between L_{dn}[1] 64 and 71 dB.
- Up to STC 35 windows and exterior doors will be necessary to meet the interior L_{dn} 45 dB noise criterion.
- During the design phase, a qualified acoustical consultant should review the planned noise-generating equipment (e.g., rooftop mechanical units) and provide recommendations as necessary for compliance with the City's property line noise limits.

[1] Day-Night Average Sound Level (L_{dn} or DNL) – A descriptor established by the U.S. Environmental Protection Agency to represent a 24-hour average noise level with a 10 dB penalty applied to noise occurring during the nighttime hours (10 p.m. to 7 a.m.) to account for the increased sensitivity of people during sleeping hours.

SECTION 1: NOISE CRITERIA

State of California – California Building Code (CBC)

The California Building Code (Appendix Chapter 12) contains acoustical requirements for interior sound levels in habitable rooms of new multi-family residences. In summary, the CBC requires an interior noise level no higher than L_{dn} 45 dB at projects exposed to an exterior L_{dn} of greater than 60 dB. These projects require an acoustical analysis showing that the proposed design will limit interior levels to the prescribed allowable interior level. Additionally, if windows must be in the closed position to meet the interior noise level standard, the design must include a ventilation or air-conditioning system to provide fresh air to the habitable interior environment.

City of Orinda – General Plan

The City of Orinda's 1987 General Plan contains noise criteria applicable to the project (Policy 4.3.2), summarized below:

- Require an acoustical study and any necessary noise level mitigation where new residential or commercial development is proposed along Highway 24 corridor and adjacent to major arterials where projected noise contours are 60 L_{dn} or more.

- Review all multi-family development proposals within the projected 60 L_{dn} contour for compliance with noise standards (45 L_{dn} in any habitable room) as required by State law.

City of Orinda – Municipal Code

Section 17.15.2 of the City's Municipal Code stipulates a daytime (7:00 a.m. to 10:00 p.m.) property line noise limit of L_{eq} 60 dB and a nighttime (10:00 p.m. to 7:00 a.m.) property line noise limit of L_{eq} 55 dB for project-generated noise (e.g., fixed mechanical equipment). If the noise lasts less than five minutes but more than one minute in any hour, the limits above can be increased by 5 dB. If the noise lasts for less than one minute in any hour, the limits above can be increased by 10 dB.

SECTION 2: EXISTING NOISE ENVIRONMENT

To quantify the existing noise environment at the project site, we conducted two continuous, two-day noise measurements from 3 to 4 December 2009. We also conducted one short-term (i.e., 60 minute) measurement at the project setback. Table 1 shows a summary of the measured data; Figure 1 shows the measurement locations and measured L_{dn}.

The dominant noise source is Highway 24 traffic. Upon build-out of the Wilder subdivision, noise from Gateway Boulevard will be a minor noise source. We calculated the future Gateway Boulevard noise level based upon the traffic data contained in the Montanera Project Amendment 2nd Supplemental EIR.[2] Based on the Federal Highway Administration's (FHWA-RD-77-108) prediction method, the noise level at a distance of 50 feet from the Gateway Boulevard centerline will be L_{dn} 64 dB.

TABLE 1: NOISE MEASUREMENT DATA

Monitor	Location	Measured L_{dn}*
LT 1	Approximately 350-feet south of the Highway 24 centerline, just east of the beginning of the Highway 24 eastbound onramp; 12-feet above grade	65 dB
LT 2	Approximately 160-feet south of the Highway 24 centerline, at the approximate midpoint of Highway 24 eastbound onramp; 12-feet above grade	69 dB
ST 1	Approximately 175-feet south of the Highway 24 centerline, at the project north property line near the northeast corner of the project site; 8-feet above grade	71 dB

* *We have reported the average L_{dn} from the two days of monitoring; there was little variability in L_{dn} from day to day (i.e., less than one dB).*

SECTION 3: ASSESSMENT OF INTERIOR NOISE ENVIRONMENT

We have calculated STC[3] ratings for windows and exterior doors in Table 2 to meet the State and City standard of an interior L_{dn} 45 dB noise level. The STC ratings are based upon the 12 November 2009 architectural plans.

We have incorporated an increase in traffic noise of 1 dB for Highway 24 to account for future traffic volume growth.[4] If the unit plans and elevations change significantly (e.g., bigger/smaller

[2] Table 4.2 on Page 4-9 of the Supplemental EIR contains peak hour trips for the subdivision.

[3] Sound Transmission Class (STC) – A single-figure rating standardized by ASTM and used to rate the sound insulation properties of building partitions. Higher STC ratings correspond to greater noise reduction.

windows or significant floor plan changes), we are available to provide updated window and exterior door STC recommendations.

TABLE 2: WINDOW AND EXTERIOR DOOR STC RATINGS

Floor	Unit(s)	STC Rating
Lower	1	35
	2 through 6, 8, and 9	31
	7	31*
	10 through 15	26
Main	Units 1 through 6	31
	Units 7 through 10, 17 through 20	26
	Units 12, 13, and 16	33
	Units 11 and 15	Living Room – 33 Bedroom – 33*
	Unit 14	35*
Upper	Units 21 through 26	34
	Units 27 through 30	26

* Additional layers of gypsum board or sheathing needed at exterior wall; wall should incorporate a total of four layers of 5/8-inch thick gypsum board, plywood, and/or siding.

Our calculations are based on conventional wood-frame construction with cementitious or stone siding. If the exterior wall design changes, the window and exterior door ratings might need to be increased.

Standard dual-pane construction-grade windows typically achieve an STC rating of 28. Gasketed solid-core wood doors typically achieve an STC rating of 26. It is important to note that the STC ratings are for full window and door assemblies (glass-and-frame) rather than just the glass itself. Laboratory tested sound-rated assemblies should be used.

Where sound-rated windows need to be closed to meet L_{dn} 45 dB, the California Building Code requires an alternative form of ventilation to provide fresh air (e.g., mechanical ventilation). The project mechanical engineer should review this requirement.

[4] The increase of one dB is based on Caltrans expected traffic growth of 1.1% per year specified in the Caltrans 2007 Traffic Volumes document; over 20 years this corresponds to a one dB increase in traffic noise.

SECTION 5: PROPERTY LINE NOISE

When the project design is far enough along, a qualified acoustical consultant should review the planned noise-generating equipment (e.g., rooftop mechanical units) and provide recommendations as necessary for compliance with the property line noise limits contained in the City's Municipal Code.

Charles M Salter Associates Inc 130 Sutter Street San Francisco California 94104 Tel: 415 397 0442 Fax: 415 397 0454

A P P E N D I X A

FUNDAMENTAL CONCEPTS OF ENVIRONMENTAL NOISE

This section provides background information to aid in understanding the technical aspects of this report.

Three dimensions of environmental noise are important in determining subjective response. These are:

a) The intensity or level of the sound;
b) The frequency spectrum of the sound;
c) The time-varying character of the sound.

Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB), with 0 dB corresponding roughly to the threshold of hearing.

The "frequency" of a sound refers to the number of complete pressure fluctuations per second in the sound. The unit of measurement is the cycle per second (cps) or hertz (Hz). Most of the sounds which we hear in the environment do not consist of a single frequency, but of a broad band of frequencies, differing in level. The name of the frequency and level content of a sound is its sound spectrum. A sound spectrum for engineering purposes is typically described in terms of octave bands which separate the audible frequency range (for human beings, from about 20 to 20,000 Hz) into ten segments.

Many rating methods have been devised to permit comparisons of sounds having quite different spectra. Surprisingly, the simplest method correlates with human response practically as well as the more complex methods. This method consists of evaluating all of the frequencies of a sound in accordance with a weighting that progressively de-emphasizes the importance of frequency components below 1000 Hz and above 5000 Hz. This frequency weighting reflects the fact that human hearing is less sensitive at low frequencies and at extreme high frequencies relative to the mid-range.

The weighting system described above is called "A"-weighting, and the level so measured is called the "A-weighted sound level" or "A-weighted noise level." The unit of A-weighted sound level is sometimes abbreviated "dBA." In practice, the sound level is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting characteristic. All U.S. and international standard sound level meters include such a filter. Typical sound levels found in the environment and in industry are shown in Figure A-1.

Although a single sound level value may adequately describe environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise is a conglomeration of distant noise sources which results in a relatively steady background noise having no identifiable source. These distant sources may include traffic, wind in trees, industrial activities, etc. and are relatively constant from moment to moment. As natural forces change or as human activity follows its daily cycle, the sound level may vary slowly from hour to hour. Superimposed on this slowly varying background is a succession of identifiable noisy events of brief duration. These may include nearby activities such as single vehicle passbys, aircraft flyovers, etc. which cause the environmental noise level to vary from instant to instant.

To describe the time-varying character of environmental noise, statistical noise descriptors were developed. "L_{10}" is the A-weighted sound level equaled or exceeded during 10 percent of a stated time period. The L_{10} is considered a good measure of the maximum sound levels caused by discrete noise events. "L_{50}" is the A-weighted sound level that is equaled or exceeded 50 percent of a stated time period; it represents the median sound level. The "L_{90}" is the A-weighted sound level equaled or exceeded during 90 percent of a stated time period and is used to describe the background noise.

As it is often cumbersome to quantify the noise environment with a set of statistical descriptors, a single number called the average sound level or "L_{eq}" is now widely used. The term "L_{eq}" originated from the concept of a so-called equivalent sound level which contains the same acoustical energy as a varying sound level during the same time period. In simple but accurate technical language, the L_{eq} is the average A-weighted sound level in a stated time period. The L_{eq} is particularly useful in describing the subjective change in an environment where the source of noise remains the same but there is change in the level of activity. Widening roads and/or increasing traffic are examples of this kind of situation.

In determining the daily measure of environmental noise, it is important to account for the different response of people to daytime and nighttime noise. During the nighttime, exterior background noise levels are generally lower than in the daytime; however, most household noise also decreases at night, thus exterior noise intrusions again become noticeable. Further, most people trying to sleep at night are more sensitive to noise.

To account for human sensitivity to nighttime noise levels, a special descriptor was developed. The descriptor is called the CNEL (Community Noise Equivalent Level) which represents the 24-hour average sound level with a penalty for noise occurring at night.

The CNEL computation divides the 24-hour day into three periods: daytime (7:00 am to 7:00 pm); evening (7:00 pm to 10:00 pm); and nighttime (10:00 pm to 7:00 am). The evening sound levels are assigned a 5 dB penalty and the nighttime sound levels are assigned a 10 dB penalty prior to averaging with daytime hourly sound levels.

For highway noise environments, the average noise level during the peak hour traffic volume is approximately equal to the CNEL.

The effects of noise on people can be listed in three general categories:

a) Subjective effects of annoyance, nuisance, dissatisfaction;
b) Interference with activities such as speech, sleep, and learning;
c) Physiological effects such as startle, hearing loss.

The sound levels associated with environmental noise usually produce effects only in the first two categories. Unfortunately, there has never been a completely predictable measure for the subjective effects of noise nor of the corresponding reactions of annoyance and dissatisfaction. This is primarily because of the wide variation in individual thresholds of annoyance and habituation to noise over time.

Thus, an important factor in assessing a person's subjective reaction is to compare the new noise environment to the existing noise environment. In general, the more a new noise exceeds the existing, the less acceptable the new noise will be judged.

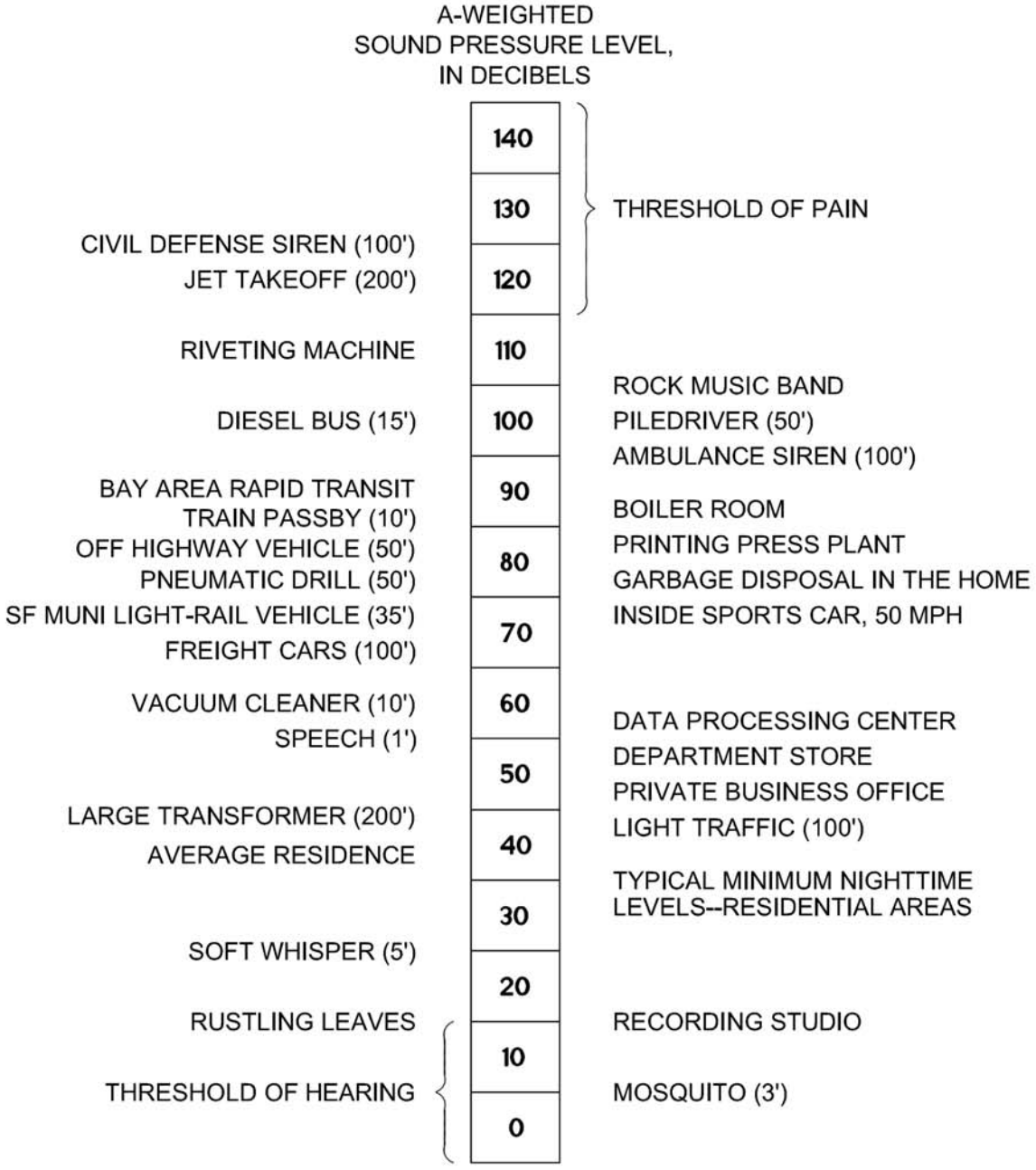
With regard to increases in noise level, knowledge of the following relationships will be helpful in understanding the quantitative sections of this report:

a) Except in carefully controlled laboratory experiments, a change of only 1 dB in sound level cannot be perceived.

b) Outside of the laboratory, a 3 dB change is considered a just-noticeable difference.

c) A change in level of at least 5 dB is required before any noticeable change in community response would be expected.

d) A 10 dB change is subjectively heard as approximately a doubling in loudness, and would almost certainly cause an adverse community response.



(100') = DISTANCE IN FEET BETWEEN SOURCE AND LISTENER

TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT AND INDUSTRY

FIGURE A1

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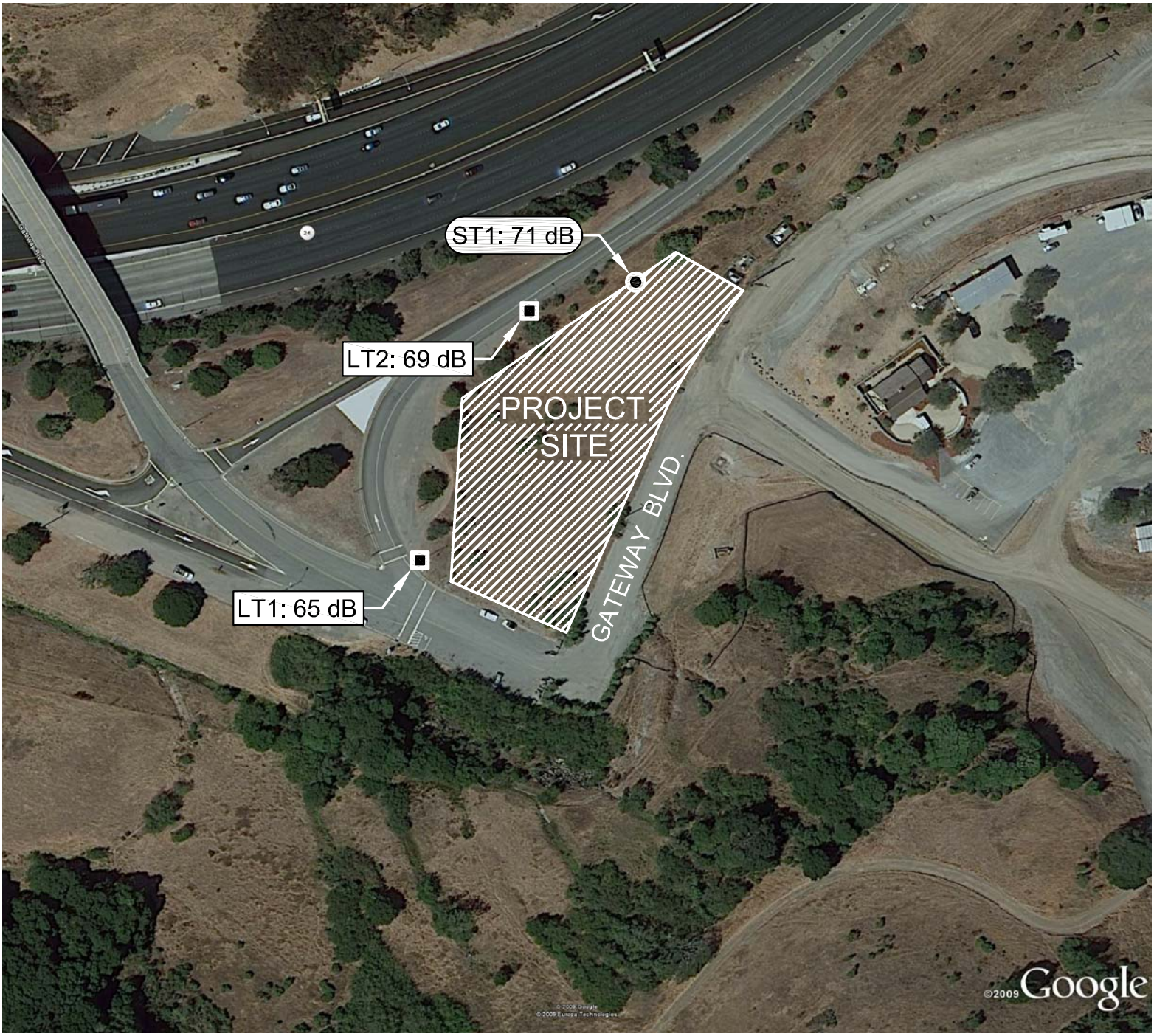

□ = LONG-TERM 48-HOUR NOISE MEASUREMENT LOCATIONS

○ = SHORT-TERM 60-MINUTE NOISE MEASUREMENT LOCATION

AGEMARK AT WILDER: NOISE MEASUREMENT LOCATIONS AND MEASURED Ldn

FIGURE 1

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