APPENDIX G

NOISE

DEER CREEK VILLAGE SHOPPING CENTER – NOISE STUDY

PETALUMA, CALIFORNIA

8 December 2009

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CSA Project No. 09-0428

INTRODUCTION

This report summarizes our traffic noise study for the Deer Creek Village Shopping Center in Petaluma. We have analyzed noise from the 101 freeway and noise from project traffic. This report summarizes the noise criteria, the noise environment at the site, and the calculated project traffic noise.

The project site is located on the west side of North McDowell Boulevard, just east of the 101 freeway and north of Lynch Creek Way.

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 ranges between L_{dn}[1] 65 and 75 dB. The City considers this noise level to be Conditionally Acceptable for commercial uses.

- In general, noise from project traffic will not increase the noise level at the surrounding land uses. Along Professional Drive, east of North McDowell Boulevard, the L_{dn} will increase by L_{dn} 1 dB, which is considered less than significant.

- Delivery truck noise level will be more than 10 dB below the US-101 L_{dn} of 65 dB; therefore, noise from delivery trucks will not increase the existing noise level. Noise from delivery trucks will be less than significant.

- Overall, project traffic noise will not exceed the City's criteria; therefore, no mitigation is necessary.

- Due to the shielding provided by the project buildings, US-101 noise levels at the residential areas directly east of the project (across North McDowell Boulevard) will be reduced by 2 to 3 dB. A change of 3 dB is considered "just noticeable."

- The project mechanical equipment shall be installed per Section 22-301 of the City's Municipal Code which stipulates a property line noise limit of L_{eq}[2] 60 dB for fixed mechanical equipment (e.g., HVAC).

[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.

[2] L_{eq} – The equivalent steady-state A-weighted sound level that, in a stated period of time, would contain the same acoustic energy as the time-varying sound level during the same time period.

SECTION 1: NOISE CRITERIA

General Plan

The City of Petaluma's 2025 General Plan contains noise criteria applicable to the project (Policy 10-P-3), summarized below:

- Require placement of fixed equipment, such as air condition units and condensers, inside or in the walls of new buildings or on roof-tops of central units in order to reduce noise impacts on any nearby sensitive receivers

- As part of development review, use Figure 10-2: Land Use Compatibility Standards (included below) to determine acceptable uses and installation requirements in noise-impacted areas

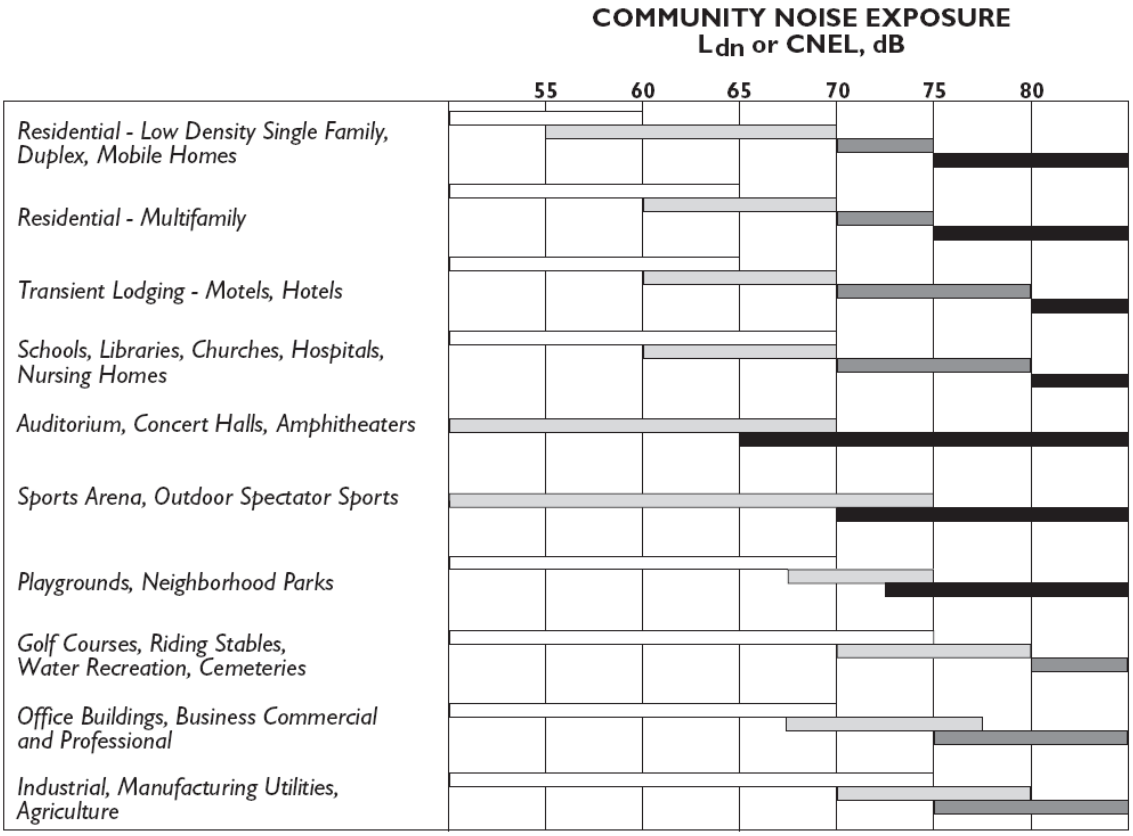
- Discourage the use of sound walls anywhere except along Highway 101 and/or along the NWPRA corridor, without findings that such walls will not be detrimental to community character. When sound walls are deemed necessary, integrate them into the streetscape

- In making a determination of impact under the California Environmental Quality Act (CEQA), consider an increase of [L_{dn}] four or more dBA to be "significant" if the resulting noise level would exceed that described as normally acceptable for the affected land use in Figure 10-2: Land Use Compatibility Standards

Municipal Code

Section 22-301 of the City's Municipal Code stipulates a property line noise limit of L_{eq} 60 dB for fixed mechanical equipment (e.g., HVAC). This limit may be raised in 5 dB increments if the ambient (background) noise level is above L_{eq} 60 dB; however, the property line noise limit may not exceed L_{eq} 75 dB.

Figure 10-2: Land Use Compatibility Standards (from General Plan)



INTERPRETATION:

NORMALLY ACCEPTABLE
Specified land use is satisfactory, based upon the assumption that any building involved is of normal conventional construction, without any special noise insulation requirements.

CONDITIONALLY ACCEPTABLE
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

NORMALLY UNACCEPTABLE
New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

CLEARLY UNACCEPTABLE
New construction or development should generally not be undertaken.

SECTION 2: EXISTING NOISE ENVIRONMENT

We have reviewed the 2025 noise contours shown in Figure 10-1 of the City's General Plan to quantify the noise environment at the project site. The DNL noise levels at the site range from 65 dB to 75 dB, primarily from US-101 traffic noise.

SECTION 3: ANALYSIS

Auto Traffic Noise

We have reviewed the traffic volumes presented in the Wood Rodgers traffic impact study[3] for the "baseline" and "baseline plus project" scenarios. We calculated the increase in noise level due to the project using the Federal Highway Administration's (FHWA) RD-77-108 noise prediction method.

We have evaluated the road segments that will be most impacted by project traffic; the results of our calculations are presented in Table 1.

Table 1: Traffic Volumes and Noise Level Increase

	Baseline					*Baseline plus Project*						
Road Segment	**PM Peak Volume**	**PM Peak Hour L_{eq} at 100 feet (dB)**	**Estimated L_{dn} at 100 feet (dB)**	**US-101 L_{dn} (dB)**	**Cumulative L_{dn} (dB)**	**PM Peak Volume**	**PM Peak Hour L_{eq} at 100 feet (dB)**	**Estimated L_{dn} at 100 feet (dB)**	**US-101 L_{dn} (dB)**	**Cumulative L_{dn} (dB)**	**Increase in L_{dn} (dB)**	**Significant Increase?**
North McDowell Boulevard, south of Rainier Avenue	2911	68	68	65	70	3354	69	69	65	70	-	No
North McDowell Boulevard, north of South Project Driveway	2921	68	68	65	70	3358	69	69	65	70	-	No
Rainier Avenue, west of North McDowell Boulevard	-	-	-	65	65	257	58	58	65	65	-	No
Rainier Avenue, east of North McDowell Boulevard	825	63	63	60	65	874	63	63	60	65	-	No
Professional Drive, east of North McDowell Boulevard	180	54	54	60	61	389	57	57	60	62	1	No
North Project Driveway, east of North McDowell Boulevard	-	-	-	65	65	171	54	54	65	65	-	No
South Project Driveway, east of North McDowell Boulevard	-	-	-	65	65	95	51	51	65	65	-	No

As shown in Table 1, project traffic will generally not increase the noise environment at the surrounding land uses. Along Professional Drive, east of North McDowell Boulevard, the L_{dn} will increase by L_{dn} 1 dB. The City's General Plan considers increases of less than L_{dn} 4 dB to not be significant.

[3] Deer Creek Village Shopping Center Traffic Impact Study, prepared by Wood Rogers, November 2009.

Delivery Truck Noise

We understand that up to 10 to 12 delivery trucks are expected per day, during off-peak hours. The majority of delivery trucks will service the four major stores which are located on the western portion of the site adjacent to US-101. Assuming all of the deliveries occur between the hours of 8:00 p.m. and 12:00 a.m. and between 5:00 a.m. and 7:00 a.m., the delivery trucks will generate a noise level of L_{dn} 52 dB at a distance of 100 feet. The delivery truck noise level will be more than 10 dB below the US-101 L_{dn} of 65 dB; therefore, noise from delivery trucks will not increase the existing noise level. The impact from delivery trucks is less than significant.

Land Use Compatibility

Based on the 2025 noise contours contained in the City's General Plan and the project traffic noise levels presented in Table 1, the future noise environment at the project site will range from DNL 65 to 75 dB. The City considers this to be Conditionally Acceptable.

US-101 Noise at Residences across North McDowell Boulevard

The project buildings will reduce the noise levels at the residences directly east of the project (across North McDowell Boulevard). We estimate that US-101 noise levels will be reduced by 2 to 3 dB at these residences. For your reference, a change of 3 dB is considered "just noticeable."

Property Line Mechanical Equipment Noise Limits

The City's Municipal Code provides property line noise limits for fixed mechanical equipment (e.g., HVAC); the property line noise limit is summarized in Section 1 of this report. The mechanical engineer should verify that the planned mechanical equipment will not exceed the Code requirements.

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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.

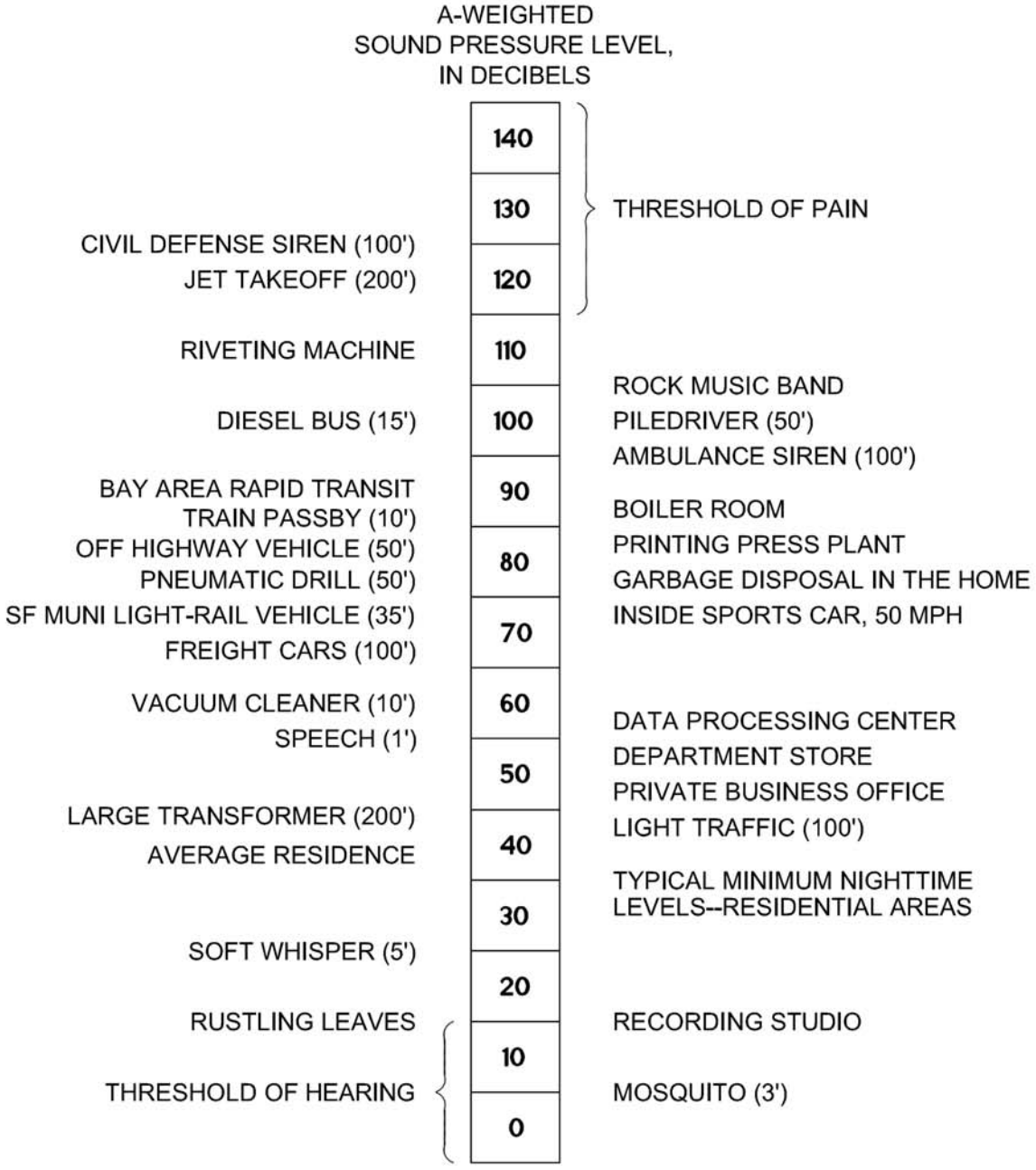
With regard to increases in noise level, knowledge of the following relationships will be helpful in understanding the quantitative sections of this report:

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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