REPORT 2987

NOISE IMPACTS AND MITIGATION IN CONNECTION WITH THE PROPOSED MEADOWS KENNEL, 6445 HIGHWAY 12 SONOMA COUNTY, CALIFORNIA (UPE 11-0020)

REPORT PREPARED BY:

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I INTRODUCTION AND SUMMARY

The existing Meadows Kennel currently provides day care for up to ten dogs. The owner proposes to add boarding, grooming and training services, and to increase the kennel capacity to up as many as 50 dogs. An acoustical analysis has been performed to evaluate potential offsite noise impacts due to the proposed operations.

Measurements in the vicinity of the site have been utilized to determine existing ambient sound levels. Sound levels due to barking dogs have also been measured. The data has been used to calculate the sound levels which could occur at noise sensitive locations in the vicinity. The estimated sound levels and their implications are discussed in the remaining report sections.

Section II defines the acoustical terminology used.

In Section III, estimated sound levels are presented and discussed. The levels associated with the proposed operations are assessed through comparisons with existing ambient sound levels, and with noise exposure standards utilized by the County of Sonoma.

Mitigation of possible noise impacts is discussed in Section IV.

The conclusions are summarized in Section V.

The Appendix contains the sound level data and a description of the analysis methodology.

II GLOSSARY

The acoustical terms and abbreviations defined below shall be used to discuss sound levels in this report.

- **dBA Sound Level Units** Sound levels are conventionally measured in units of decibels, abbreviated "dB". "A" indicates that the sound signal is electronically processed to mimic the response of the human ear before the level in decibels is determined. A change in sound level by three dBA usually corresponds to a barely perceivable change in loudness. A 10 dBA increase or decrease in sound level is usually perceived as a doubling or halving of loudness.

- **Equivalent Sound Level, L_{eq}** L_{eq} is a type of average sound level. An L_{eq} value is the level, in dBA units, of a fictitious steady state sound which would deliver the same acoustic energy during a given period of time as a time-varying, measured sound actually does deliver during the same period. In more technical terms, the Leq is the result of calculating the level associated with the time averaged root mean square sound pressure variations measured at the receiver.

- **Annual Day/Night Level, L_{dn}** An L_{dn} value is the equivalent level, in dBA units, during a one year period which results when 10 dBA are added to levels measured during nighttime hours (10 PM to 7 AM). Essentially, L_{dn} is a type of weighted average sound level which emphasizes noise levels measured during the more sensitive nighttime hours. This descriptor is used as a measure of community noise exposure in many federal, state and local noise regulations and standards.

- **Percentile Sound Level, L_p** An L_p is the sound level, in dBA units, which is exceeded p percent of the measurement period. For example, L_{50} is the sound level exceeded 50% of the time, sometimes referred to as the median level. If the measurement period is one hour, L_{50} is equivalent to the level exceeded for a cumulative period of 30 minutes. This is one of the five descriptors appearing in the intermittent noise standards given in the Napa County Noise Ordinance.

- **Maximum Level, L_{max}** This is the highest sound level, in dBA, found during a specified period of time when the sound level meter is set on "slow" response. Since the maximum level is never exceeded, L_{max} is equivalent to L_0.

III SOUND LEVELS AND NOISE IMPACTS

The Meadows Kennel and vicinity are shown in Figure 1. The figure includes the locations of the existing kennel building, and the various areas around the kennel property where dogs could be active outdoors (Exercise Areas, Yard and Garden). As Figure 1 indicates, a number of dwellings exist south of Highway 12. These are considered to be the nearest noise sensitive locations.

Figure 1 includes a Sound Receiver Location at which sound levels have been analyzed in depth. This receiving location is typical of areas meeting the following criteria: (1) outdoor residential activities could occur there, (2) unobstructed sound paths to the kennel property exist, and (3) the distance to Highway 12 is relatively large, so that ambient traffic sound levels are relatively low. Given these factors, the receiving location studied is considered to be a worst case. At points closer to the highway, the level of any sound produced at the kennel could be higher than that at the receiving location studied, but traffic sound levels would also be higher, tending to mask kennel sounds.

The data gathered and the analysis procedures leading to the results presented below are described in the Appendix. It should be noted that the assumptions regarding sound production and propagation which form the bases of the analysis are conservative in the sense that they are likely to result in somewhat overestimated sound levels. The sound levels present after the proposed activities begin could be lower than the estimates. In this sense also, worst case conditions have been considered.

A. Intermittent Sound Levels

The only potentially significant sound sources associated with the proposed operations are barking dogs. According to the proposal, some of the dogs on site could be outdoors at any given time between the hours of 7 AM and 7 PM. Between 7 PM and 7 AM, all dogs would be kept indoors. Should barking occur, the associated sound levels are expected to vary substantially with time. Such intermittent sound levels are subject to the Sonoma County General Plan Noise Exposure Standards[1]. The standards are expressed, in part, as limits on four sound descriptors, each of which is a sound level exceeded during a specified portion of a one hour period.

The county standards contain nominal limits on intermittent noise during daytime (7 AM – 10 PM) and nighttime (10 PM - 7 AM) hours. In addition, Paragraph NE-1c of the standards specifies adjustments to the limits which are to be applied as needed to take into account the nature of the sounds in question and existing ambient conditions.

Table 1 contains sound level estimates resulting from the analysis. The table includes daytime and nighttime sound level limits drawn from the Sonoma County General Plan.

The sound sources of interest are discussed separately in the following subsections, and potential impacts are assessed in Section III.B.

1. Ambient Sounds

Motor vehicle traffic on Highway 12 is the primary source of ambient sound in the vicinity of the receiving location studied. Secondary sources include occasional distant aircraft overflights and birds.

The daytime ambient levels given in Table 1 are those typical of 6 PM - 7 PM. This is the hour within the timeframe when dogs could be outdoors (7 AM - 7 PM) during which ambient sound levels are expected to be lowest. The nighttime ambient levels tabulated during the 3 AM - 4 AM hour represent the quietest time of the night. These hours were selected because potential noise impacts from added sound sources are higher when ambient levels are lower.

All entries in Table 1 include ambient sound contributions, and therefore represent the net sounds to which the receiving location could be exposed.

Whenever a sound level attributed to one of the sources tabulated is about equal to the corresponding ambient level, the implication is that the source in question is not expected to produce a significant change in existing ambient conditions.

2. Dogs

Although dogs on the kennel property could bark, in principle, virtually no barking is expected in practice. To minimize dog barking and its effects, the applicant intends to implement the following measures:

a. All dogs being considered for care will be screened through preliminary observation to determine whether they (i) are well behaved, (ii) are compatible with other dogs, and (iii) are content when away from their owners. Only dogs which are well behaved in the absence of their owners will be accepted at the kennel.

b. Only neutered dogs will be accepted at the kennel.

c. A kennel attendant will always be present in the vicinity of any dogs outdoors. With such supervision, any unwanted behavior can be quickly suppressed.

d. Disciplining collars will be used as needed. Such collars vibrate, spray or administer a small electric shock in response to barking.

e. Except for regular exercise/play periods, the dogs will be kept indoors.

f. No client dog will be outdoors between 7 PM and 7 AM.

Under the conditions listed, there would be virtually no barking dogs outdoors, ambient sound levels at the nearest dwellings would remain unchanged, no noise impact would exist, and no further acoustical analysis would be needed.

The latter outcome is highly likely. However, for the sake of completeness, an analysis of an unlikely worst case scenario is considered in the remainder of this section, a case in which measures such as those above are not implemented. The sound levels in Table 1 represent this worst case scenario.

The worst case scenario assumes that during daytime hours 10 dogs (total) would be outdoors in the four "Exercise Areas" shown in Figure 1, and 10 dogs (total) would be in the "Yard" and "Garden" areas labeled in the figure. The scenario assumes further that all 20 outdoor dogs would bark throughout a given hour.

During nighttime hours the worst case scenario assumes that 50 barking dogs are inside kennel buildings. To actually board 50 dogs, additional kennel space would be needed. It has been assumed in the analysis that any additional kennel buildings would be no closer to Highway 12 (and the dwellings to the south) than the existing kennel building, and would be similar in structure to the existing building.

B. Noise Impact Assessment of Intermittent Sound

Comparisons of the existing ambient sound levels in Table 1 with the levels associated with barking dogs show that, even in the worst case, little change in sound level is expected to result from the proposed kennel. However, it should be noted that, if barking were to occur to the degree considered, dog barks may be occasionally perceptible over the ambient traffic sounds.

Noise impacts are determined by comparing expected sound levels with the limits given in the Sonoma County Noise Exposure Standards. Noise impacts are considered possible if expected sound levels exceed the General Plan limits.

An inspection of Table 1 shows that some of the existing ambient sound levels already exceed the nominal county limits. In such an instance, the General Plan provides that the ambient levels become the limits, within a tolerance of ±1.5 dBA. In the present case, this condition is applied by limiting sound levels to no higher than one dBA above the existing ambient levels whenever the existing levels exceed the nominal limits.

The General Plan also provides that the nominal limits are to be adjusted downward if the sound source is impulsive in nature. Dog barks are considered to be in this category.

The "Adjusted County Limits" given in Table 1 result when ambient conditions and the impulsive nature of the sounds of concern are both taken into account.

All of the sound levels in Table 1 associated with dogs comply with the adjusted county limits, with a single exception. The L_{50} value due to 20 dogs barking outdoors exceeds the adjusted limit by one dBA. This is not considered significant because, (1) the estimation method is conservative, and likely to overestimate sound levels due to dogs, (2) a one decibel variation in one metric value is not perceptible. The sound levels tabulated are considered to be compliant with the intent of the General Plan standards.

However, it should be noted that all of the sound levels associated with dogs barking are close to or at the adjusted limits. This implies that if the numbers of dogs were increased, levels exceeding the limits could arise.

Measures to insure that compliance with the county limits is maintained are given in Section IV.

C. Long Term Average Sound Levels (L_{dn})

The Sonoma County General Plan contains an additional noise exposure standard

which is expressed as a limit on the long term average sound descriptor L_{dn}[2]. Specifically, the General Plan designates areas as noise impacted if they are exposed to L_{dn} values exceeding 60 dBA.

From measurements of typical ambient sound levels, it is inferred that the existing ambient L_{dn} value falls in the range 55 dBA - 60 dBA in the vicinity of the sound receiving location studied. Given the estimated sound levels associated with dogs, the intermittent nature of the sound, and the fact that the dogs will be kept indoors during nighttime hours, no significant change in the existing L_{dn} value is expected to be attributable to the proposed operations. Specifically, an L_{dn} value at or below 60 dBA is expected at the Sound Receiving Location. It follows that the proposed kennel would produce no noise impact according to the county L_{dn} criterion.

Figure 1. THE MEADOWS KENNEL AND VICINITY. The sound receiving location marked is discussed in Section III.

SOUND SOURCE OR STANDARD	HOURLY NOISE METRICS (SOUND LEVEL VALUES IN dBA)			
	L50	L25	L8	L2
Typical Evening Ambient (6 PM - 7 PM)	56	58	60	64
Typical Early Morning Ambient (3 AM - 4 AM)	34	42	53	64
20 Barking Dogs Outdoors (daytime)	58	59	61	64
50 Barking Dogs Inside Kennel Building(s) (nighttime)	38	43	53	64
Nominal Daytime County Limits (7 AM - 10 PM)	50	55	60	65
Adjusted Daytime County Limits (6 PM - 7 PM)	57	59	61	65
Nominal Nighttime County Limits (10 PM - 7 AM)	45	50	55	60
Adjusted Nighttime County Limits (3 AM - 4 AM)	40	45	54	65

Table 1. ESTIMATED SOUND LEVELS. The sound receiver location is shown in Figure 1. The sound levels tabulated are composites which include contributions from the source named and ambient sounds. The sound level limits are drawn from the standards in the Sonoma County General Plan.

The sound levels associated with barking dogs represent an unlikely worst case scenario discussed in Section III.A.2.

IV NOISE IMPACT MITIGATION

Given the measures with which the applicant proposes to control the behavior of dogs on the kennel property (see Section III.A.2), virtually no barking is expected. In that case, no significant noise impact could occur.

However, should the proposed measures not be applied, dog barking would normally be expected. This might occur, for example, if kennel ownership changed in the future, and the new owner applied a different operation model. In order to insure compliance with the Sonoma County noise exposure standards in that case, the mitigation measures below are recommended.

A. Dogs Outdoors

1. *No client dogs shall be permitted outdoors between the hours of 7 PM and 7 AM.*

2. *At any one time, no more than 10 dogs total shall be permitted in the four "Exercise Areas" combined (see Figure 1).*

3. *At any one time, no more than 10 dogs total shall be permitted in the "Yard" and "Garden" areas combined (see Figure 1).*

4. *As implied by Measures 2 and 3 above, no more than 20 dogs shall be permitted outdoors at any one time. The remainder of the dogs on site shall be housed within kennel buildings.*

As indicated in the discussion in Section III.B, Measures 1 – 4 above are expected to result in sound levels which comply with the daytime county standards, even if all outdoor dogs bark.

B. Dogs Indoors

1. *No more than 50 dogs total shall be permitted on the kennel site. In particular, no more than 50 dogs shall be housed in the kennel building(s).*

2. *Any new kennel building added to the property shall not be closer to Highway 12 than the existing kennel building shown in Figure 1.*

3. *Any new kennel building added to the property shall incorporate a building shell with interior/exterior sound insulation equal to or better than the shell of the existing building. An acceptable building shell would include: (a) wood siding, (b) composition roof, (c) gypsum board interior walls and ceiling, (d) total window area less than 10% of the net wall area.*

4. *All doors and windows of any kennel building shall be kept closed, except as needed for entry and egress.*

As suggested by the discussion in Section III.B, Measures 1 - 4 above are expected to result in sound levels which comply with the daytime and nighttime county standards, even if all dogs bark.

V SUMMARY AND CONCLUSIONS

The applicant plans to operate the proposed kennel in such a way that virtually no dog barking is expected. Therefore no noise impact would result. Nonetheless, a worst case scenario has also been considered, in which substantial dog barking could occur.

Even if dog barking were not controlled, the analysis results indicate that sound levels at the residential properties nearest the kennel are expected to comply with the Sonoma County General Plan noise exposure standards if the measures in Section IV are implemented. Section IV.A specifies verifiable administrative measures to control the sounds of dogs outdoors. Specifications for the construction of any new kennel buildings are given in Section IV.B. Any exception to these conditions should be reviewed by the acoustical consultant to insure sufficient acoustical performance of the building shells.

APPENDIX. SOUND LEVEL ANALYSIS

A. Sound Level Measurements and Data

Calibrated tape recordings were made of sound sources of interest. The recordings were calibrated before and after the measurements using a calibration signal traceable to the National Bureau of Standards. The tape recording was played back into a Model IE-30A Audio Analyzer manufactured by IVIE Electronics Inc. This device meets recommended ANSI S1.4 Type 1 and IEC 179 Standards for community noise measurements. The output of the analyzer was fed into a computer which recorded the sound levels and provided the necessary statistical analysis.

Table A-1 contains the sound level data. As suggested in the Table, the sound levels due to two dogs barking, both at a distance of 50' from the measurement point, were calculated from the data collected with dogs at different distances. The calculated levels were used as inputs of the analysis.

B. Analysis

Ambient levels at the sound receiving location considered (see Figure 1) are due to motor vehicle traffic on Highway 12. Evening (6 PM - 7 PM) ambient sound levels there were estimated from the levels at the measurement location, taking into account the difference in distances from the traffic lanes.

Early morning (3 AM - 4 AM) ambient levels were calculated from measured daytime levels by taking into account the changes in hourly traffic volume with time of day.

Sound levels at the receiving location due to two barking dogs were calculated from the levels at 50 feet by taking account of the distances to possible locations of dogs on the kennel property. A level decrease of six dBA per doubling of distance has been assumed.

Percentile levels associated with larger numbers of dogs were calculated from the assumption that the number of sound events (barks) increases in proportion to the number of dogs present. This implies that any given sound level is exceeded more often as the number of dogs rises. If the number dogs (and barks) were doubled, any given percentile exceedance level would be exceeded twice as often. This implies, for example, that the L_{25} value due to two dogs is about equal to the L_{50} due to four dogs. This algorithm was applied to estimate the sound levels presented in the text.

Levels of diffuse sound inside a kennel building housing barking dogs were calculated from the data in Table A-1 and the assumption that little sound is absorbed by the interior surfaces (average absorption coefficient .05). Sound levels outside a closed kennel were calculated from interior levels by applying the ray model of diffuse sound, and assuming a wall transmission loss of 30 dBA.

DATE	TIME	SOUND SOURCE(S) AND MEASUREMENT LOCATIONS	SOUND LEVEL DESCRIPTORS IN dBA					
			Leq	L50	L25	L8.33	L1.67	L0
12 Jul 11	3:28 PM	Ambient	59.3	58.1	59.6	61.7	66.2	74.8
14 Jul 11	6:48 PM	Ambient	59.3	57	59.6	62.1	66.1	77.8
12 Jul 11	2:15 PM	1 Dog Barking at 55'	60.2	59.7	61.7	63.2	64.7	65.7
12 Jul 11	2:15 PM+	2 Barking Dogs, 1 at 55' and 1 at 40'	64.1	61.4	64.4	68.5	71.5	75.1
Calculated		2 Barking Dogs at 50'	63	61	64	68	71	74

Table A-1. SOUND LEVEL DATA. The ambient measurement location is shown in Figure A–1. The microphone was mounted about five feet above grade. The dog barking measurements were conducted in the "Garden" area of the existing kennel.

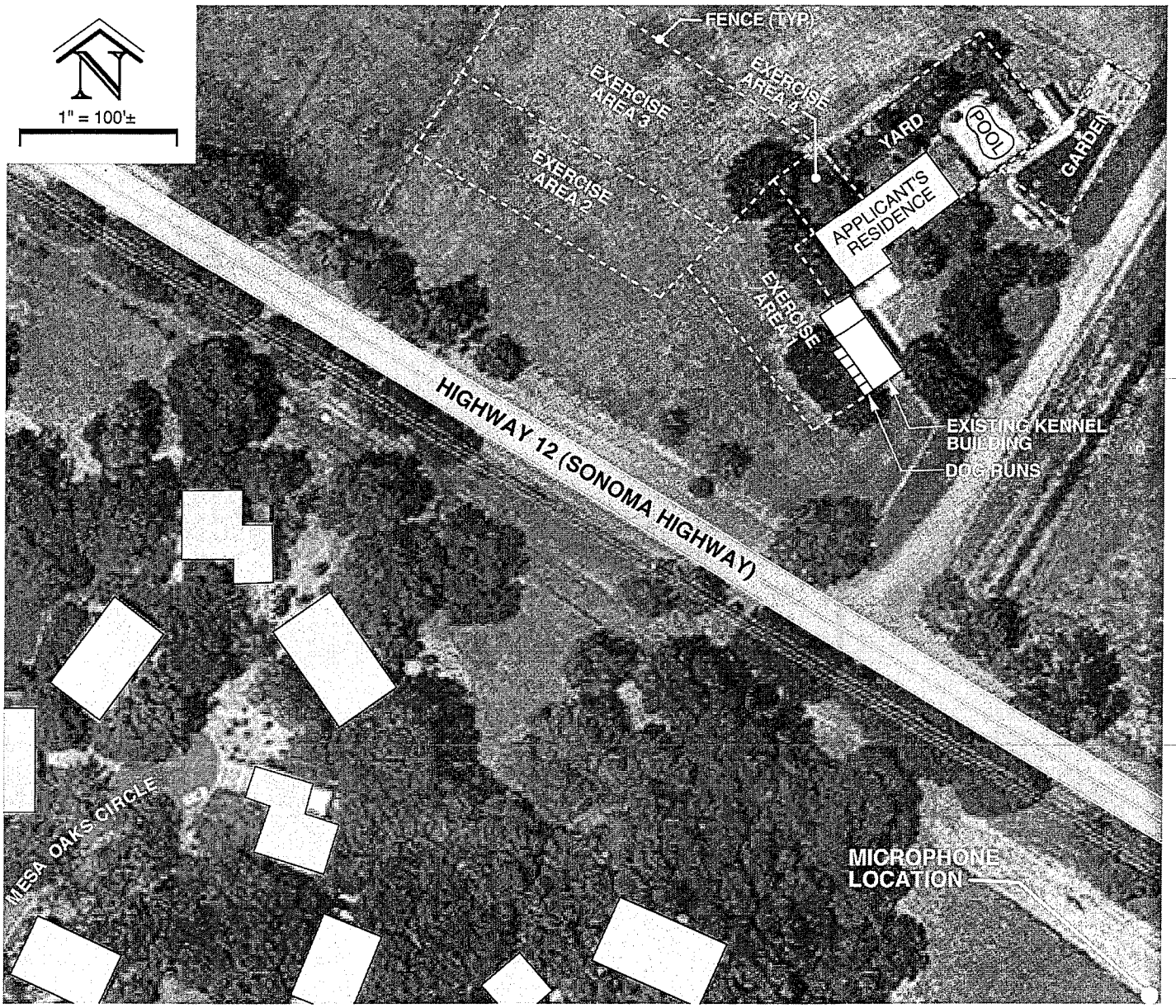

Figure 1. AMBIENT SOUND LEVEL MEASUREMENT LOCATION.

REFERENCES

1. Table NE-2 and Policy NE-1c, Noise Element, Sonoma County General Plan 2020, adopted 23 September 2008

2. Policy NE-1b, Noise Element, Sonoma County General Plan 2020, adopted 23 September 2008