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Noise Study

Anthem Winery P14-00320-MOD and Exception to Road and Street Standards,
Variance P14-00321-VAR and Viewshed, and
Agricultural Erosion Control Plan P14-00322-ECPA
Planning Commission Hearing Date (Wednesday, October 3, 2018)

***ANTHEM WINERY
USE PERMIT MODIFICATION
ENVIRONMENTAL NOISE ASSESSMENT***

Napa County, California

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INTRODUCTION

This report provides an assessment of noise resulting from the proposed modification of the existing use permit for Anthem Winery with regard to the regulatory criteria established by the Noise Policy of the Napa County General Plan. This report includes a summary of applicable noise regulations, the results of a noise monitoring survey conducted for the project, and an assessment of noise impacts and mitigation measures necessary to meet the applicable County standards at adjacent noise sensitive land uses. Persons not familiar with environmental noise analysis are referred to Appendix A for additional discussion.

PROJECT DESCRIPTION

The Anthem Winery is located on hilly terrain between Redwood Road and Dry Creek Road north of the City of Napa in unincorporated Napa County. The winery is bordered on all sides by rural residential and agricultural uses.

Figure 1 shows the site vicinity. The project will involve the following modifications to the existing use permit;



Figure 1: Project Site and Vicinity

1. Build a 12,350 square foot winemaking facility, an 1800 square foot tasting room/hospitality building, a 1,735 square foot administration/office building, approximately 24,414 square feet of underground wine caves, and a 2509 square foot outdoor event area.
2. Re-route the entry road for the winery, tasting room and offices from the Redwood Road entrance to the existing driveway at 3123 Dry Creek Road, which will be widened and improved.
3. Increase the winery's permitted production limit from 30,000 gallons to 50,000 gallons of wine per year and crush grapes of its winemaker's three other brands,
4. Allow tours and tastings by prior appointment of 48 people per day on weekends, and 32 people per day on weekdays, for a maximum of 256 guests per week, and
5. Conduct the following marketing events;
 - a. Two food and wine events per month with a maximum of 30 people with no more than one of these events in the evening,
 - b. Ten events per year with a maximum of 100 people,
 - c. One 200 person event per year,
 - d. One 300 person event per year, and
 - e. Participation in the Wine Auction.

NAPA COUNTY NOISE REGULATIONS

The Anthem Winery lies north of the Napa City Limits and is contained entirely within Napa County as do the surrounding properties and as a result, the County regulations apply. Section

8.16.070 of the Napa County Noise Ordinance regulates exterior noise levels within the unincorporated area of the county due to operational related noise as follows;

No person shall operate, or cause to be operated, any source of sound at any location within the unincorporated area of the county, or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which causes the noise level, when measured on any other property, either incorporated or unincorporated, to exceed:

- a. The noise standard for that land use as specified in Table 8.16.070 for a cumulative period of more than thirty minutes in any hour [equivalent to the L₅₀ noise metric]; or
- b. The noise standard plus five dB for a cumulative period of more than fifteen minutes in any hour [equivalent to the L₂₅ noise metric]; or
- c. The noise standard plus ten dB for a cumulative period of more than five minutes in any hour [equivalent to the L₀₈ noise metric]; or
- d. The noise standard plus fifteen dB for a cumulative period of more than one minute in any hour [equivalent to the L₀₂ noise metric];
- e. The noise standard plus twenty dB or the maximum measured ambient level, for any period of time [equivalent to the L_{max} noise metric].

Table 8.16.070: EXTERIOR NOISE LIMITS
(Levels not to be exceeded more than 30 minutes in any hour)

Receiving Land Use Category	Time Period	Noise Level (dBA) Noise Zone Classification		
		Rural	Suburban	Urban
Residential: Single and double	10 p.m. to 7 a.m.	45	45	50
	7 a.m. to 10 p.m.	50	55	60
Residential: multiple and country	10 p.m. to 7 a.m.	45	50	55
	7 a.m. to 10 p.m.	50	55	60
Commercial	10 p.m. to 7 a.m.	60		
	7 a.m. to 10 p.m.	65		
Industrial, including wineries	10 p.m. to 7 a.m.	75		
	7 a.m. to 10 p.m.	45		

Based on the exterior noise limits shown in Table 8.16.070 and the cumulative hourly noise levels described above for rural residential and commercial uses are as shown in Table 1, below:

Table 1: County Noise Ordinance Standards

Hourly Noise Metric	Rural Residential		Commercial	
	Daytime Level	Nighttime Level	Daytime Level	Nighttime Level
L ₅₀ (30 Min.)	50 dBA	45 dBA	65 dBA	60 dBA
L ₂₅ (15 Min.)	55 dBA	50 dBA	70 dBA	65 dBA
L ₀₈ (5 Min.)	60 dBA	55 dBA	75 dBA	70 dBA
L ₀₂ (1 Min.)	65 dBA	60 dBA	80 dBA	75 dBA
L _{max}	70 dBA	65 dBA	85 dBA	80 dBA

If the measured ambient noise level differs from that permissible within any of the first four noise categories (L₅₀, L₂₅, L₀₈, L₀₂), the allowable noise exposure standard shall be the ambient noise level.

Another provision is included to correct the allowable noise standard for the character of the sound as follows,

“In the event the alleged offensive noise, as judged by the noise control officer, contains a steady, audible tone such as a whine, screech or hum, or is a repetitive noise such as hammering or riveting, or contains music or speech, the standard limits set forth in Tables 8.16.060 and 8.16.070 shall be reduced by five dB, but not lower than forty-five.”

EXISTING NOISE ENVIRONMENT

To quantify the existing noise levels on the site and at the closest noise sensitive (residential) uses, an ambient noise monitoring survey was conducted between noon on Thursday, March 24th to the late afternoon of Monday, March 28th, 2016. For this survey long-term monitoring was conducted at two locations, identified in Figure 2 as LT-1 and LT-2, and short term monitoring was conducted at three locations, identified in Figure 2 as ST-1, ST-2, and ST-3.

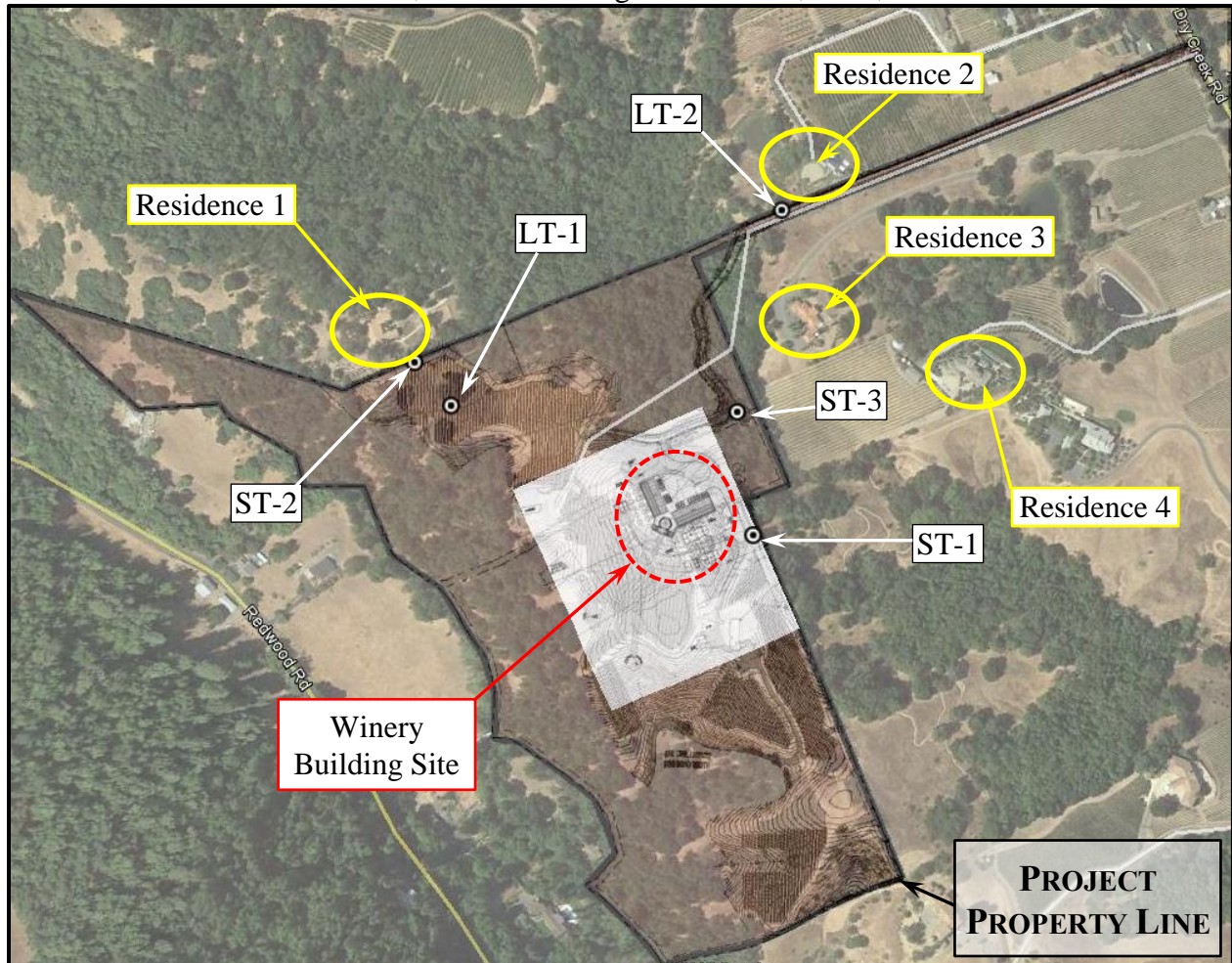


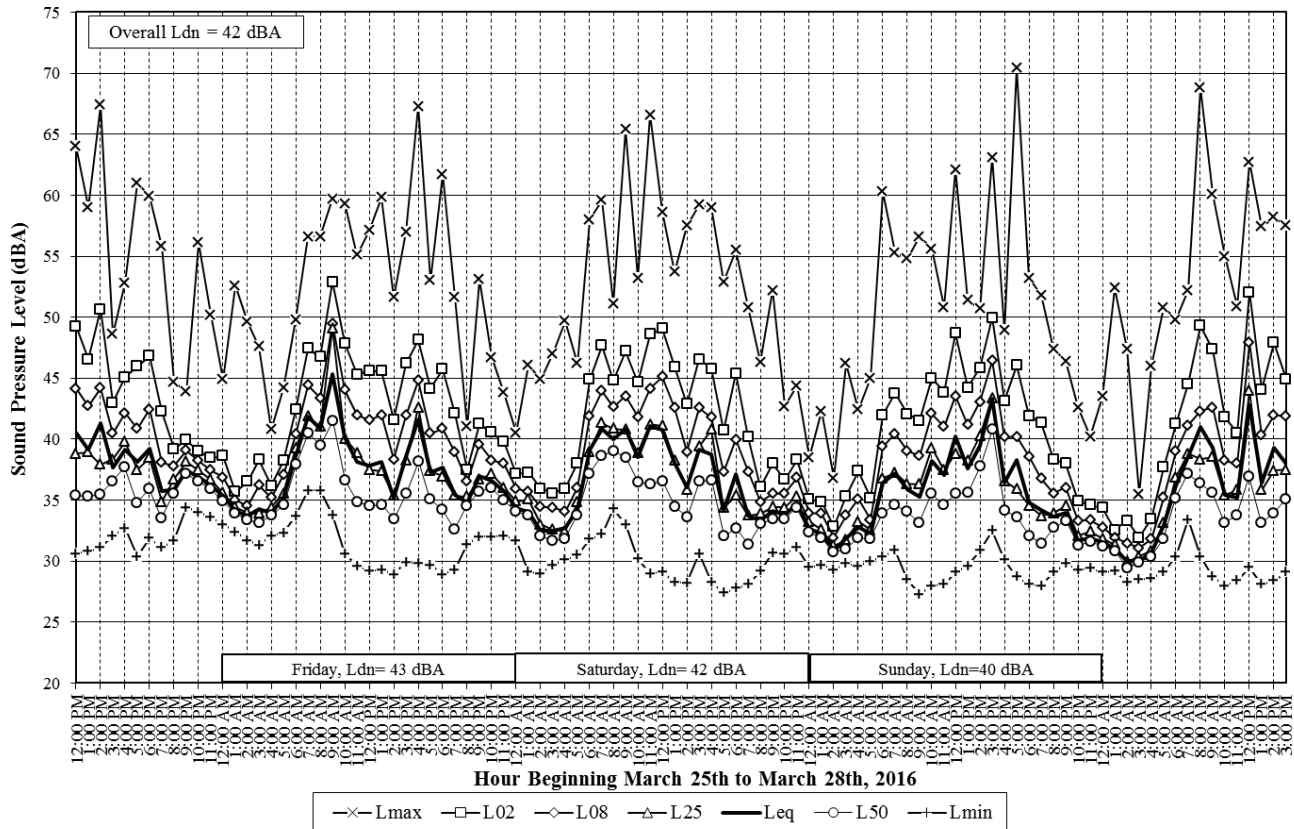
Figure 2: Site Plan, Measurement Locations, and Adjacent Residences

The measurements were made using Larson-Davis Laboratories (LDL) precision Type 1 model meters fitted with a ½-inch pre-polarized condenser microphones and windscreens. The time signatures of all meters were synchronized to allow simultaneous measure periods between the various locations and all meters were calibrated before and after installation with an LDL acoustical calibrator. During the measurement period the weather was clear with no precipitation.

The first long-term sound level measurement (LT-1) was made in the vicinity of the residence closest to the proposed outdoor event area northwest of the site development area (Residence 1) as shown in Figure 2. The monitoring equipment was installed in tree in a meadow

approximately 150 feet from the residential property line and 570 feet from the proposed outdoor event area. Noise levels measured at this site were primarily produced by wind in trees, distant traffic on Redwood Road, aircraft overflights, and bird chirps, insects, and other noise associated with woodlands. The hourly trend in noise levels at this location, including the energy equivalent noise level (L_{eq}), maximum (L_{max}), minimum (L_{min}), and the noise levels exceeded 2, 8, 25, and 50 percent of the time (indicated as L_2 , L_8 , L_{25} , and L_{50}) are shown on Chart 1.

Chart 1: Measured Noise Levels at LT-1



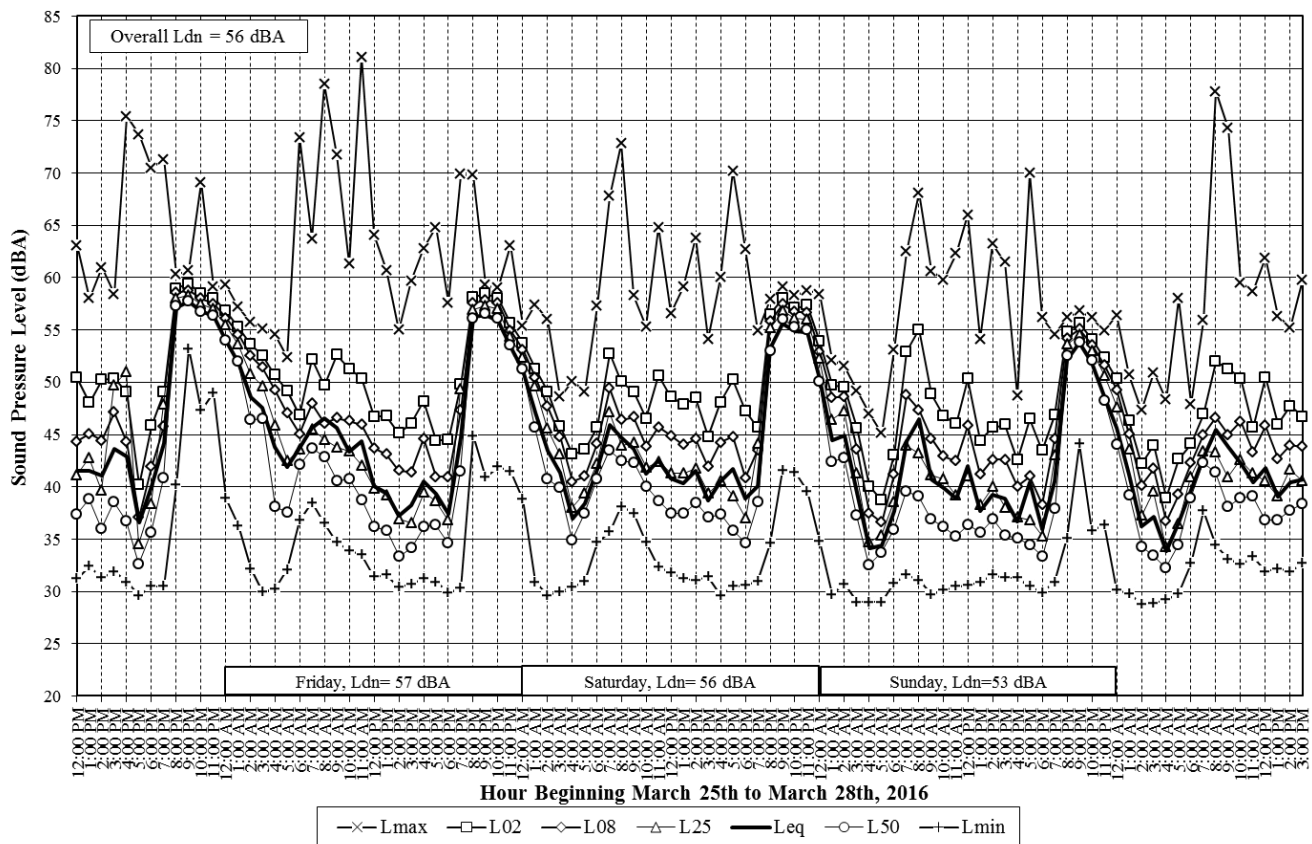
The average weekday noise levels ranged from 35 to 45 dBA L_{eq} during the day, and 30 to 39 dBA L_{eq} at night, and average weekend noise levels ranged from 33 to 43 dBA L_{eq} during the day and 31 to 39 dBA L_{eq} at night. The calculated average day/night noise level (L_{dn}) at this location was 42 dBA on weekdays and 41 dBA on the weekend. The overall L_{dn} at this location was found to be 42 dBA. The average, maximum, minimum levels measured for the daytime and nighttime periods for the entire LT-1 measurement along with the corresponding Napa County Noise Standard Limits are shown in Table 2.

Table 2: Comparison of LT-1 noise measurements results and Napa County Standards

Type of Level		Noise Level, dBA				
		L_{50}	L_{25}	L_8	L_2	L_{max}
Daytime Levels	County Noise Standard	50	55	60	65	70
	Average Level Measured	35	38	41	44	56
	Range (Max/Min)	31/42	34/49	35/49	36/53	41/70
Nighttime Levels	County Noise Standard	45	50	55	60	65
	Average Level Measured	33	34	35	37	46
	Range (Max/Min)	29/38	30/39	31/42	32/45	36/60

The second long-term sound level measurement (LT-2) was made near the property line of the residence closest to the new entry road from Dry Creek Road (Residence 2) as shown in Figure 2. The monitoring equipment was installed in tree over the fence line adjacent to the driveway. Noise levels measured at this site were primarily produced by insects and other noise associated with riparian and woodland areas, distant traffic on Dry Creek Road and Hwy 29, aircraft overflights, bird chirps, activities at the adjacent residential use, and the passby of occasional vehicles on the Dry Creek access driveway. The hourly trend in noise levels at this location, including the energy equivalent noise level (L_{eq}), maximum (L_{max}), minimum (L_{min}), and the noise levels exceeded 2,8,25, and 50 percent of the time (indicated as L_2 , L_8 , L_{25} , and L_{50}) are shown on Chart 2, following.

Chart 2: Measured Noise Levels at LT-2



The average weekday noise levels ranged from 37 to 58 dBA L_{eq} during the day, and 34 to 57 dBA L_{eq} at night, and average weekend noise levels ranged from 36 to 56 dBA L_{eq} during the day and 34 to 55 dBA L_{eq} at night. In reviewing the measurement results shown in Chart 2, it is interesting to note a fairly constant noise source between about 8pm and ending at about 4am each 24 hour period. This sound, which begins at about 56 to 58 dBA each day and ends at levels of about 34 to 37 dBA, is judged to be a result of insect, frog, or other natural noise sources based on experience with similar wooded and riparian areas. The calculated average day/night noise level (L_{dn}) at this location was 57 dBA on weekdays and 55dBA on the weekend. The overall L_{dn} at this location was found to be 56 dBA. The average, maximum, minimum levels for the daytime and nighttime levels for the entire LT-2 measurement period are shown in Table 3, along with the Napa County Noise Standards.

Table 3: Comparison of LT-2 noise measurements results and Napa County Standards

Type of Level		Noise Level, dBA				
		L ₅₀	L ₂₅	L ₈	L ₂	L _{max}
Daytime Levels	County Noise Standard	50	55	60	65	70
	Average Level Measured	40	44	46	50	63
	Range (Max/Min)	33/58	34/58	37/59	40/59	49/81
Nighttime Levels	County Noise Standard	45	50	55	60	65
	Average Level Measured	44	46	48	49	55
	Range (Max/Min)	32/57	34/57	37/58	37/58	45/73

Short-term noise measurements were made simultaneously with the long-term measurements on a 10-minute basis at three locations to evaluate ambient conditions at property project lines of adjacent sensitive uses based on the change in noise levels from the long term to the short term position. The measurement locations are described as follows:

- Measurement location ST-1 made near the property line at the edge of current production area between 4:10 and 4:20 pm on March 28th, 2016.
- Measurement location ST-2 was made near the property line of the home at the northwest edge of the project site (Residence 1) near measurement location LT-2 between 4:30 and 4:40 pm on March 28th, 2016.
- Measurement location ST-3 was made near the property line shared with the two homes east of the site and south of the Dry Creek access road (Residences 3 and 4) between 4:50 and 5:00 pm on March 28th, 2016.

The average day-night noise level (L_{dn}) at each short-term measurement location was estimated at this site by correlating the short-term measurement data to the data gathered during the corresponding time period at the long-term sites. As at the long term locations, noise levels measured at these sites were produced by wind in trees, distant traffic, aircraft overflights, and bird chirps, insects, and other noise associated with woodlands. The measurement results and estimated L_{dn} levels at these locations are shown in Table 4, following.

Table 4: Summary of Short-Term Noise Measurement Data, dBA

Noise Measurement Location	L ₅₀	L ₂₅	L ₀₈	L ₀₂	L _{max}	L _{dn}
ST-1: Property line at the edge of current production area.	37	37	38	41	51	44
ST-2: Property line of the home at the northwest edge of the project site near measurement location LT-2.	39	41	45	50	56	46
ST-3: Property line shared with the two homes east of the site and south of the Dry Creek access road.	36	37	38	40	47	41

Note: L_{dn} is approximated by correlation to the corresponding measurement period at the long-term sites.

PROJECT SPECIFIC NOISE LEVEL CRITERIA

Based on the results of the long and short term noise measurement data the existing levels do not exceed the Napa County Noise Limits for L₂, L₈, L₂₅, and L₅₀ for either the daytime or nighttime. For LT-1, the averaged measured levels range from 14 dB to 21 dB below the limit and for LT-2, the averages range from 1 to 15 dB below the limits. The ambient noise levels at the short term positions are also well below the County noise limits. For assessment purposes, the Noise Ordinance allows the individual L_N limit to be raised to the ambient level, however, from these data, this is not appropriate. Further, for music or speech, the limits are to be lowered by 5 dB. Thus for assessing

the non-vehicular event noise the noise limits should be lower by the 5 dB. The project specific noise criteria are given in Table 5 for event noise and vehicular related noise.

Table 5: Project Specific Noise Criteria for Specific Types of Noise

Hourly Noise Metric	Maximum Exterior Noise Level Standards, dBA			
	Event Noise (music or speech)		Operations, Equipment & Vehicular Noise	
	Daytime	Nighttime	Daytime	Nighttime
L ₅₀ (30 Min.)	45	40	50	45
L ₂₅ (15 Min.)	50	45	55	50
L ₀₈ (5 Min.)	55	50	60	55
L ₀₂ (1 Min.)	60	55	65	60
L _{max}	65	60	70	65

NOISE ASSESSMENT

Estimating the expected noise produced by, and impacts from, the proposed project at adjacent noise sensitive uses requires three elements; the first is an assessment of what noise producing operations are likely to occur, the second is typical noise source levels for those operations, and the third is to determine the temporal nature of the operations.

I. Identification of Noise Producing operations/uses

There are a number of operations associated with wine production and events at the proposed facility that will produce noise. These include:

1. Winery operations and seasonal production activities,
2. Maintenance and forklift operations,
3. Promotional event noise and,
4. Project traffic.

II. Typical Noise Source Levels

To estimate the noise levels associated with project operations, some attention must be given to the temporal nature of the noise produced. Below each of the major winery related noise producing operations outlined above are discussed:

Winery and seasonal production operations would produce the following type and range of noise levels:

- Refrigeration equipment, as a maximum condition, is assumed operate under constant conditions day and night. Though the model, type and capacities of the cooling compressors for the facility are not specified, field measurements of such equipment shows that sound levels from such equipment can produce levels of between 50 dBA to 65 dBA at 50 feet, with average (L_{eq}) noise levels of 60 dBA at 50 feet.
- Air compressors, used for various processes in the facility, typically cycle on and off based on the need for compressed air. Though the model, type and capacities of the cooling compressors for the facility are not specified, from field measurements of cooling compressors at other wineries, we expect this equipment to produce average (L_{eq}) sound levels of 62 dBA at 50 feet.
- Bottling would be constant on an hourly basis although it is likely to occur for only a few weeks each year. Based on sound level measurements of mobile (truck based) and fixed bottling lines at other wineries, we would expect bottling operations to produce average (L_{eq}) sound levels of between 65 and 70 dBA at 50 feet.

- Crush activities typically occur for about two weeks each year. The majority of the noise sources associated with the crush include the operation of hoppers, presses, destemmers, separators, crushers, air compressors, forklifts, conveyors, etc. Average noise levels resulting from the crush are typically constant on an hourly basis. Individual pieces of crush-specific equipment such as the separators and destemmers are relatively quiet with sound levels of around 50 dBA L_{eq} at about 50 feet, however the composite crush activities at a small sized winery, such as the proposed 50,000 gallon (21,000 case) capacity facility, typically generate noise levels of about 63 dBA L_{eq} , at a distance of 50 feet from the center of operations. During the crush, discrete maximum noise events, such as the setting of empty bins, may reach 70 to 80 dBA L_{max} at 50 feet from the center of operations.

Maintenance and forklift operations would produce intermittent noise depending on the exact nature of the operation. These would likely occur at a much less than a daily rate although operations may span several hours once initiated. Backup alarms (or beepers), which are repetitive and irritating by design, will also produce noise during these activities, and as with forklift operations themselves are expected to be intermittent by nature. Based on experience with other winery operations, we estimate that non-attenuated L_{25} noise levels from these operations may reach levels of 66 to 67 dBA at 50 feet.

Marketing Event Noise

The use permit for the winery requests up to a total of 36 marketing events per year. These events would consist of two (2) food and wine events per month (up to 24 events annually) with a maximum of 30 participants, ten (10) events per year with a maximum of 100 people, one (1) event per year with a maximum of 200 people, one (1) event per year with a maximum of 300 people, and participation in the Wine Auction. Table 5 lists typical average noise levels generated by events at distances of 50 feet from the source.

Table 5: Typical Noise Source Levels for Events (A-Weighted L_{eq} Levels)

Event or Activity	Typical Noise Level @ 50 ft.
Non-amplified (acoustic) Music Band Performance	67 dBA ¹
300 Guests in Raised Conversation with Background Music	71 dBA
200 Guests in Raised Conversation with Background Music	68 dBA
100 Guests in Raised Conversation with Background Music	60 dBA

¹Based on the results of measurements conducted at wineries and other event venues, I&R has found that Non-amplified Acoustic Music is louder than multiple (100 person) guests with background music. In general we have found that when music is only used as a background for dinner, tasting, and similar events it is played at a lower level to encourage conversation. Conversely, where Acoustic Music performances are a focal point of an event, they typically produce higher sound levels than simple background music.

Events will occur both inside and outside the winery and hospitality buildings and may include food service. Evening events (including clean-up) are proposed to cease by 10:00 p.m. on weekdays and by midnight on weekends. All events will be by appointment or invitation. Parking for events will be in front of the winery, on site next to the vineyard blocks, and off site utilizing shuttle service.

Project Traffic would produce the following type and range of traffic noise levels:

- Automobile and light vehicle traffic accessing the tasting room would occur during the daytime hours and noise produced is expected to include the sounds of vehicles traveling on the access road maneuvering in parking areas, engine starts, door slams. Automobile and other light vehicle traveling at 15 to 25 mph typically produce sound levels of between 51 to

59 dBA at 50 feet. Parking lot activities such as engine starts, door slams and low speed vehicle movements typically produce maximum sounds levels ranging from 53 dBA to 63 dBA at 50 feet.

- Truck traffic on the project site will access the winery via the reoriented Dry Creek Road Entrance. Due to the grades and turn radii of the access road, heavy duty (semi-tractor trailer type) trucks, will not be used. Trucks entering or exiting the winery will thus be limited to medium body trucks, such as box trucks, flat beds, and delivery vans. Noise levels generated by truck traffic are dependent on the size and speed of trucks, with typical noise levels generated by medium body trucks ranging from 65 to 70 dBA when traveling at constant speeds and up to 70 to 75 dBA when stopping/starting and maneuvering at a distance of 50 feet.

III. Propagation of sound

The final step in estimating the project noise levels is assessing the propagation of sound to the sensitive receptors. To do this, it is necessary to assume some rate of sound attenuation between the operations and receiver locations. Typically, the most dominant physical effect is due to the spreading out of sound waves with distance. Sound from localized sources, such as the winery production and tasting room areas at the project, spreads out (diverges) as it travels away from the source with the sound level (acoustic energy) dropping off with distance according fundamental geometric relationships. This type of sound loss occurs independent of the barrier or terrain losses. Other effects can modify these fall-off rates such as partial shielding from buildings or topography, atmospheric attenuation of sound, ground absorption, and meteorological effects. If present, these effects reduce the noise in addition to that due to sound divergence.

Sound sources may be treated as a “point source” when the distance from the source to the receiver is large compared to the dimension of the source. For the size to distance relationships present for this project, it can be assumed that sound at the adjacent residences from sources at the production and hospitality facilities would be considered as a point source. With point sources sound levels are reduced with distance in accordance with the “inverse square law”, which yields a six (6) dB sound level reduction for each doubling of the distance¹ from the source. For moving sources of noise, such as auto traffic or truck movements, which are considered linear sources of noise, the divergence of the sound wave is cylindrical in nature producing a reduction of 3 to 4 ½ dB with each doubling of distance.

A review of the topography of the Winery site and surroundings shows that the elevations of the closest adjacent residences are either roughly at level with, or below, the proposed winery modifications, with the line of sight to the new uses blocked in some areas and open in others by intervening terrain features.

The closest noise sensitive uses to the proposed site improvements and use modifications at the Anthem Winery are homes to the northwest and northeast of the site identified as Residences 1, 2, 3, and 4 in Figure 2. There are other homes to the west of the site, but these homes are situated over a ridgeline from the winery site, would receive significant terrain shielding, and thus would be exposed to winery generated noise levels much lower than those on or east of the ridgeline.

¹ Mathematically expressed as $L_{rec} = L_{source} - 20 \times \text{Log}(D_{rec}/D_{source})$

IMPACT ASSESSMENT

Impact 1: Vehicular Noise on Access Road and On-site.

Automobile traffic on Access Road

Visitor and employee traffic to and from the winery would use the existing driveway at 3123 Dry Creek Road, which will be widened and improved. Based on distance information obtained via Google Earth², the closest noise sensitive uses will be Residences 1, 2, 3 and 4 as shown in Figure 2. The closest outdoor use areas of these residences will, respectively, be approximately 800, 35, 210, and 580 feet from the new access roadway. Considering these distances and that automobile speeds will be limited to 15 to 20 mph on the access roadway, the highest average noise generated by automobile and light vehicles passing closest to these homes at 20 mph would be³;

- 32 dBA at the closest outdoor use area of Residence 1,
- 59 dBA at the closest outdoor use area of Residence 2,
- 43 dBA at the closest outdoor use area of Residence 3, &
- 34 dBA at the closest outdoor use area of Residence 4

All of these noise levels would be below the hourly project specific daytime noise criteria for vehicular noise as shown in Table 5. Automobile passby noise at Residence 2 could however exceed the L_{08} threshold, if such noise were to occur for 5 minutes per hour or more. Based on a review of the project traffic study, the peak hour use of the access road will be 27 vehicular trips during the midday period on Saturdays. Assuming an average speed of 20 mph (approximately 29 feet/second), noise from each automobile passing by the closest residence (Residence 2) would produce noise levels exceeding 49 dBA (10 dBA below the peak level)⁴ for approximately 7 seconds.

Based on a review of the project traffic study, the peak hour use of the access road will be 27 vehicular trips during the midday period on Saturdays. Under these peak hour traffic conditions, the total duration of time per hour where noise levels would exceed 49 dBA would be about 189 seconds, or 3 minutes and 9 seconds. Therefore, even under peak hour weekend conditions, automobile traffic on the new access roadway could affect the adjacent residences for more than one minute, but less than 5 minutes in any hour. Therefore, the L_{02} would be the regulatory threshold applicable to the assessment of automobile traffic on the new access roadway. Noise resulting from automobile traffic on the new access roadway therefore would not exceed the Table NE-2 noise limits contained in the Project Specific Noise Criteria. Table 6, following, summarizes the assessment of automobile noise on the new access roadway.

² The distances determined from Google Earth are the line of sight distances, not the distances over intervening terrain, which are typically greater.

³ Reported sound levels are calculated using California Vehicle Noise Reference Energy Mean Emissions Levels (REMELS), Cal Trans Technical Advisory, Noise TAN 95-03, Page 2.

⁴ A 10 dBA sound level reduction represents an approximate halving of a given sound level and is commonly considered the point where the noise has diminished to a point of irrelevance.

Table 6: Access Road Automobile Noise Levels

	L₀₂ (Noise Level Exceeded 1 Minute in any Hour), dBA			
	Residence 1	Residence 2	Residence 3	Residence 4
Daytime L ₀₂ Noise Limit	65	65	65	65
Noise levels due to Automobiles on the Access Road at Residence	32	59	43	35
<i>Access Road Noise Exceeds L₀₂ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>

Considering this finding, noise levels associated with automobiles and light vehicles using the project access road would not exceed the project specific noise standards at the closest noise sensitive uses.

Truck Traffic on Access Road

Trucks visiting the winery site will also use the new access road. This will take trucks within the same distance of the closest outdoor use areas of these residences as automobiles on the access road, or approximately 800 feet from the closest outdoor use area of Residence 1, 35 feet from the closest outdoor use area of Residence 2, 210 feet from the closest outdoor use area of Residence 3, and 580 feet from the closest outdoor use area of Residence 4. Considering these distances and that truck speeds on the access roadway are expected to be limited to 15 mph, the highest average noise generated by medium and heavy trucks passing closest to these homes would be;

- 41 dBA at the closest outdoor use area of Residence 1,
- 69 dBA at the closest outdoor use area of Residence 2,
- 53 dBA at the closest outdoor use area of Residence 3, and
- 44 dBA at the closest outdoor use area of Residence 4

Based on a review of the project traffic report, the winery would have an average of one truck trip per day. Though not addressed in the traffic report, it can be expected that during crush season, this average number of daily trip trips would increase. However given the relatively small size of the facility we expect that fewer than ten truck trips would be necessary to deliver grapes for processing during crush. Such deliveries would likely occur at a rate of two or three per week. All truck trips are expected to take place during daytime hours. With a maximum truck speed of 15 mph (approximately 22 feet/second), noise from each truck passing by the closest residence (Residence 2) would produce noise levels exceeding 59 dBA (10 dBA below the peak level) for approximately 11 to 12 seconds. Thus, truck operations would fall in the Project Specific Noise Criteria L_{max} criterion of 70 dBA at the adjacent residential uses. Table 7, summarizes the assessment of truck traffic noise on the access roadway.

Table 7: Access Road Truck Noise Levels

	L₀₂ (Noise Level Exceeded 1 Minute in any Hour), dBA			
	Residence 1	Residence 2	Residence 3	Residence 4
Daytime L _{max} Noise Limit	70	70	70	70
Noise levels due to Trucks on the Access Road at Residence	41	69	53	44
<i>Trucks Noise Exceeds L₀₂ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>

Considering this finding, noise associated with truck traffic would comply with the project specific standards at all adjacent residences.

Auto and Trucks in On-Site Parking/Delivery Areas

A review of the project site development plan (see Figure 3) and distance information obtained via Goggle Earth, indicates that the new visitor parking area will, respectively, be situated approximately 810, 960, 470, and 740 feet from the closest outdoor use areas of Residences 1, 2, 3 and 4 as shown in Figure 2. Additionally the new shipping & receiving area will, respectively, be situated approximately 880, 980, 500, and 800 feet from the closest outdoor use areas of Residences 1, 2, 3 and 4. Considering these distances in combination with typical visitor parking lot noise levels of 53 to 63 dBA at 50 feet and noise from stopping/starting and maneuvering trucks of between 70 to 75 dBA at 50 feet, the noise generated by automobile and light vehicles in the parking area and trucks in the shipping & receiving area would be;

- Residence 1: 29 to 39 dBA from parking lot activity,
40 to 50 dBA from shipping & receiving activity
- Residence 2, 27 to 37 dBA from parking lot activity,
39 to 49 dBA from shipping & receiving activity
- Residence 3, 34 to 44 dBA from parking lot activity,
45 to 55 dBA from shipping & receiving activity, and
- Residence 4 30 to 40 dBA from parking lot activity,
41 to 51 dBA from shipping & receiving activity.

Given the expected visitor and employee use, parking lot activities are expected to occur for less than 5 minutes out of an hour on a typical day and fall in the 5 minutes per hour or L₀₈ daytime project specific criterion of 60 dBA (see Table 5). However, during events or on busy weekends, such activities may occur more frequently and fall in the 15 minutes per hour or L₂₅NE-2 daytime category of 55 dBA. Table 8 summarizes the assessment of Visitor and Employee Parking Lot Activity noise at the outdoor use areas of the closest noise sensitive uses.

Table 8: Visitor and Employee Parking Lot Activity Noise Levels

	Noise Levels, dBA			
	Residence 1	Residence 2	Residence 3	Residence 4
Daytime L ₀₈ Noise Limit	60	60	60	60
Daytime L ₂₅ Noise Limit	55	55	55	55
Parking Lot Activity Noise Levels at Residence	29 to 39	27 to 37	34 to 44	30 to 40
<i>Activity Noise Level Exceeds L₀₈ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
<i>Activity Noise Level Exceeds L₂₅ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>

Given the size of the proposed winery, shipping & receiving truck activities are expected occur on a maximum basis for 5 minute per hour or less, since it is unlikely that more than one truck would be loaded or unloaded in any given hour. Thus, as a worst case condition truck shipping & receiving activities operations are judged to fall in the L₀₈ daytime project specific criterion of 60 dBA. Table 9, following, summarizes the assessment of on-site Truck Activity noise at the outdoor use areas of the closest noise sensitive uses.

Table 9: On-site Truck Shipping & Receiving Noise Levels

	Noise Levels, dBA			
	Residence 1	Residence 2	Residence 3	Residence 4
Daytime L_{08} Noise Limit	60	60	60	60
On-site Truck Activity Noise Levels at Residence	40 to 50	39 to 49	45 to 55	41 to 51
<i>Activity Exceeds L_{08} Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>

Considering the findings shown in Table 8 and 9, noise levels associated with automobile and visitor parking lot noise along with trucks using the on-site parking and delivery areas would not exceed the project specific noise standards at the closest noise sensitive uses.

Mitigation 1: No mitigation required

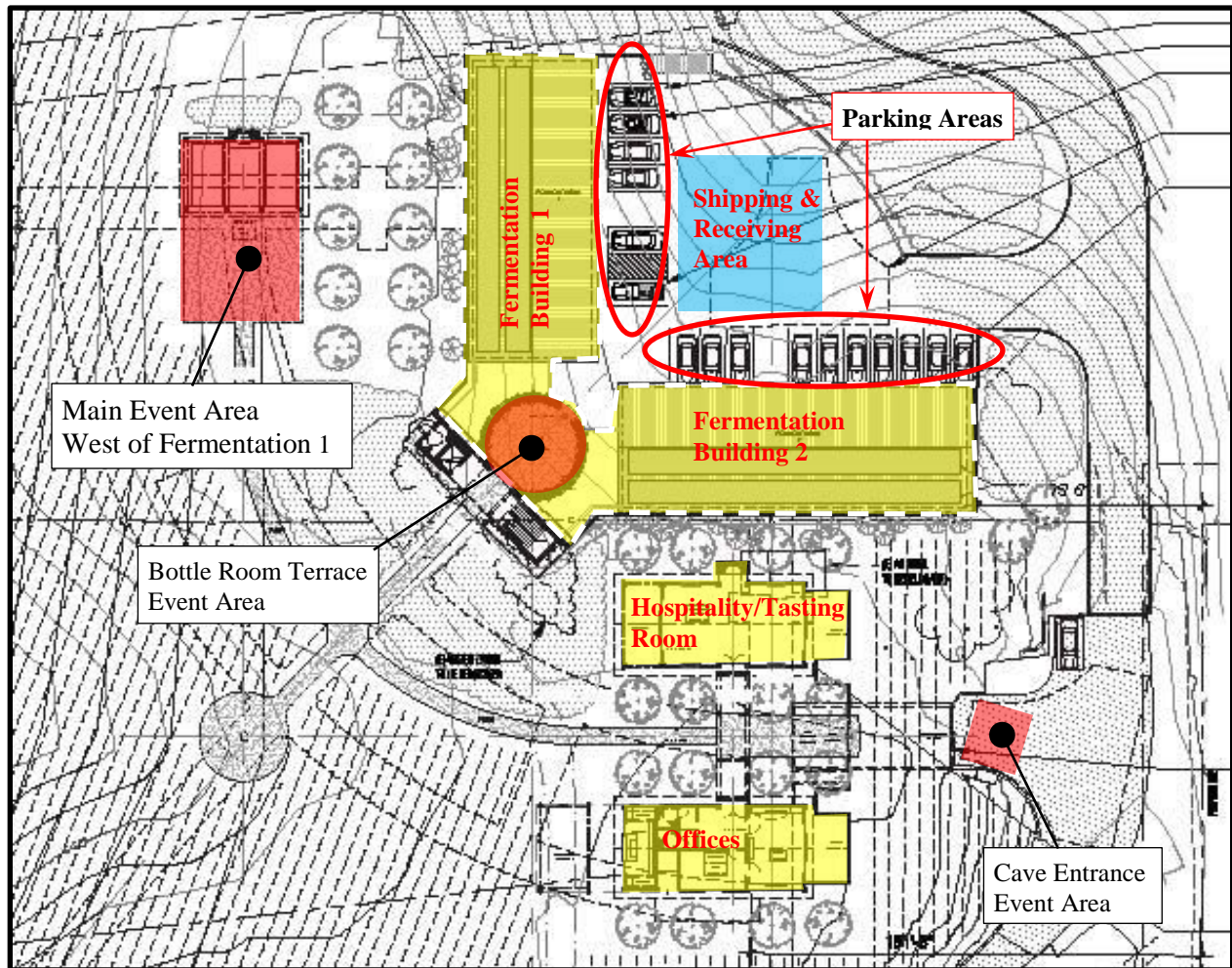


Figure 3: Site Development Plan

Impact 2: Mechanical Equipment Noise

The project would likely include noise-generating mechanical equipment such as air-cooled condensing units, pumps, and compressors at the Fermentation Buildings as well as less significant sources of noise, such as air-conditioning systems and exhaust fans at these and the other buildings on site. The project drawings indicate mechanical equipment rooms within Fermentation Building 2, the existing wine cave, and the Bottle Room. However, some equipment, such as cooling compressors, will likely need to be located outside of a structure due

to air flow considerations. Equipment may also be placed on the building rooftop. Considering these possibilities, and distance information obtained via Goggle Earth, the equipment may be as close as 470 feet from the closest outdoor use area of Residence 3. Distances to all other residences would be farther (approximately 780 feet from Residence 1, 980 feet from Residence 2, and 740 feet from Residence 4). Some terrain and/or building acoustical shielding is expected between the mechanical equipment and these closest noise sensitive uses. However, under the worst case condition with the equipment located outside and unshielded by the building structures or intervening terrain, constant L₅₀ noise levels from mechanical equipment outside the eastern portion of Fermentation Building 2 could produce an L₅₀ level of 43 dBA at Residence 3. The levels at other residences would be lower. Table 10, below, presents and summarizes the assessment of this worst case mechanical equipment noise versus the L₅₀ daytime project specific criterion of 50 dBA at the outdoor use areas of the closest noise sensitive uses.

Table 10: Mechanical Equipment Noise Levels

	L ₅₀ (Noise Level Exceeded 1 Minute in any Hour), dBA			
	Residence 1	Residence 2	Residence 3	Residence 4
Daytime L ₅₀ Noise Limit	50	50	50	50
Mechanical Equipment Noise Levels at Residence	38	36	43	39
<i>Mechanical Noise Exceeds L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>

Considering the findings shown in Table 10, noise levels associated with winery mechanical equipment would not exceed the project specific noise standards at the closest noise sensitive uses.

The winery currently has permitted outdoor equipment in front of the existing wine cave. Though the operational noise of this equipment was not measured for this survey, based on our experience with winery operations we would expect the source levels to be the same as those used in our analysis of the new equipment. Considering these levels, and the distance from the front area of the existing wine cave to the outdoor use areas of the closest noise sensitive uses, the L₅₀ noise levels resulting from the currently permitted outdoor equipment, would be equal to, or 1 to 2 dBA lower than, those shown in Table 10 at the outdoor use areas of the closest noise sensitive uses. As discussed in Appendix A, typically a 3 dB change in sound levels is judged to be just perceptible to persons of normal sensitivity to noise. Therefore, we find that the addition of the new outdoor equipment would not result in a noticeable change in noise levels at the outdoor use areas of the closest noise sensitive uses.

Mitigation 2: No mitigation required

Impact 3: Crush Related Noise

Unlike the Winery’s already permitted crush activities, which occur outdoors, annual crush related activities under the modified use permit would take place indoors, within the winemaking buildings. Crush activities occurring within the winemaking buildings would receive noise shielding from building structure estimated at 12 dBA (assuming open windows and/or doors). Considering that crush activities could occur in the winery building and distance information obtained via Goggle Earth, crush activities may be as close as 810 feet from the closest outdoor use area of Residence 1, 960 feet from the closest outdoor use area of Residence 2, 470 feet from the closest outdoor use area of Residence 3, and 740 feet from the closest outdoor use area of

Residence 4. As discussed previously noise from crush activities are largely made up of relatively constant noise, with occasional discrete maximum noise events, such as the setting of empty bins. Noise from crush activities would therefore fall in the Project Specific Noise Criteria L_{50} of 50 dBA and L_{max} of 70 dBA at the adjacent residential uses. Table 11, below, presents and summarizes the assessment of indoor crush noise against the L_{50} noise criteria noise standard and outdoor maximum noise events, such as the setting of empty bins against the L_{max} noise criteria noise standard, without the benefit of sound losses from intervening terrain.

Table 11: Crush Noise Levels

	Noise Levels, dBA			
	Residence 1	Residence 2	Residence 3	Residence 4
Daytime L_{50} Noise Limit	50	50	50	50
L_{50} Crush Noise Levels at Residence	26	25	30	26
<i>Crush Noise Exceeds L_{50} Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
Daytime L_{max} Noise Limit	70	70	70	70
L_{max} Crush Noise Levels at Residence	55	54	59	55
<i>Crush Noise Exceeds L_{max} Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>

Considering the findings shown in Table 11, noise levels associated with annual crush activities would not exceed the project specific noise standards at the closest noise sensitive uses.

The winery is permitted to and currently conducts annual crush operations outdoors in front of the existing wine cave. Considering the noise levels resulting from crush operations discussed above, the lack of noise shielding from building structure, and the distance from the front area of the existing wine cave to the outdoor use areas of the closest noise sensitive uses, the L_{25} noise levels resulting from the current outdoor crush activities are expected to be 10 to 12 dBA higher than those shown in Table 11 at the outdoor use areas of the closest noise sensitive uses. Therefore, we find that the L_{25} noise levels resulting from new crush operations would result in lower noise levels at the outdoor use areas of the closest noise sensitive uses.

Using this same analysis and considering that for existing and new crush operations outdoor bin drops may occur, the L_{max} levels for the existing crush operations are expected to be equal to or 2 dBA lower than those shown in Table 11 at the outdoor use areas of the closest noise sensitive uses. As discussed in Appendix A, typically a 3 dB change in sound levels is judged to be just perceptible to persons of normal sensitivity to noise. Therefore, we find that the setting of empty bins for the new crush operations would not result in a noticeable change in noise levels at the outdoor use areas of the closest noise sensitive uses.

Mitigation 3: No mitigation required

Impact 4: Bottling Noise

The project description or drawings indicate that bottling will occur in the production facility. Based on distance information obtained via Goggle Earth, this facility will be as close as 780 feet from the closest outdoor use area of Residence 1, 980 feet from the closest outdoor use area of Residence 2, 470 feet from the closest outdoor use area of Residence 3, and 740 feet from the closest outdoor use area of Residence 4. As discussed previously noise from bottling is relatively constant noise and would therefore fall in the Project Specific Noise Criteria L_{50} of 50 dBA at the adjacent residential uses. Table 12, below, presents and summarizes the assessment of indoor

bottling noise against the L₅₀ project specific noise criterion, without the benefit of sound losses from intervening terrain.

Table 12: Bottling Noise Levels

	Noise Levels, dBA			
	Residence 1	Residence 2	Residence 3	Residence 4
Daytime L ₅₀ Noise Limit	50	50	50	50
L₅₀ Bottling Noise Levels at Residence	34	32	39	35
<i>Bottling Noise Exceeds L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>

Considering the findings shown in Table 12, noise levels associated with bottling activities would not exceed the project specific noise standards at the closest noise sensitive uses.

The winery is permitted to and currently conducts bottling operations outdoors in front of the existing wine cave. Considering the noise levels resulting from bottling operations discussed above, the lack of noise shielding from a building structure, and the distance from the front area of the existing wine cave to the outdoor use areas of the closest noise sensitive uses, the noise levels resulting from the current bottling operations would be 10 to 12 dBA higher than those shown in Table 11 at the outdoor use areas of the closest noise sensitive uses. Therefore, we find that the noise levels resulting from new bottling operations would result in lower noise levels at the outdoor use areas of the closest noise sensitive uses.

Mitigation 4: No mitigation required

Impact 5: Maintenance and Forklift Operations

Forklift and maintenance operations would likely take place in the covered receiving area, and within the winery buildings. Such activities within the Winery building would receive significant noise shielding from the building and are not analyzed here. It should also be noted that outdoor forklift and maintenance operations are already permitted for existing winery operations. Outdoor forklift and maintenance operations are considered a worst-case condition and are analyzed. Such outdoor operations could be as close as 870 feet from the closest outdoor use area of Residence 1, 960 feet from the closest outdoor use area of Residence 2, 480 feet from the closest outdoor use area of Residence 3, and 780 feet from the closest outdoor use area of Residence 4. Based on experience with other winery operations, and considering that forklift backup alarms are repetitive and irritating by design, this activity noise has been judged against the more stringent L₂₅ project specific noise criterion (reduced by 5 dBA, which is more typically used for event noise) of 50 dBA at the adjacent residential uses. Table 13, following, presents and summarizes the assessment of forklift and maintenance activity against the L₅₀ project specific noise criterion, without the benefit of sound losses from intervening terrain.

Table 13: Forklift and Maintenance Activity Noise Levels

	Noise Levels, dBA			
	Residence 1	Residence 2	Residence 3	Residence 4
Daytime L ₂₅ Noise Limit (5 dB reduction applied for repetitive sound)	50	50	50	50
L₅₀ Forklift and Maintenance Activity Noise Levels at Residence	42	41	46	42
<i>Bottling Noise Exceeds L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>

Considering the findings shown in Table 13, noise levels associated with Forklift and Maintenance Activity activities would not exceed the project specific noise standards at the closest noise sensitive uses.

Mitigation 5: No mitigation required

Impact 6: Marketing Event Noise at adjacent residential uses

The winery requests up to a total of 36 marketing events per year. These events would consist of twenty four (24) food and wine events (which would occur at a rate of two per month) with a maximum of 30 persons, ten (10) events per year with a maximum of 100 persons, one (1) 200 person event per year, and one (1) 300 person event per year. The winery will also participate in the Wine Auction. The events will occur both inside and outside the winery and hospitality buildings. Outside event areas identified in the project plans are include the Main 2509 square foot outdoor event area west of Fermentation Building 1, and 200 square foot outdoor event area east of the existing cave entrance. Another outdoor event area will likely be on the round roof terrace above the Bottling Room. Because of the relative size of the event areas, if held outdoors, the 300 and 200 person events would only occur at the main outdoor event area west of Fermentation Building 1. Evening marketing events (including clean-up) are proposed to cease by 10:00 p.m. on weekdays and by midnight on weekends. Thus, on weekends, events may occur during nighttime hours.

Based on a review of the project site plan and distance information obtained via Goggle Earth, the three identified outdoor event areas could have the following distance relationships with the closest residential uses;

- The Main outdoor event area, west of Fermentation Building 1, could be close as 770 feet from the closest outdoor use area of Residence 1, 1150 feet from the closest outdoor use area of Residence 2, 720 feet from the closest outdoor use area of Residence 3, and 1020 feet from the closest outdoor use area of Residence 4,
- The outdoor event area east of the existing cave entrance could be close as 1090 feet from the closest outdoor use area of Residence 1, 1050 feet from the closest outdoor use area of Residence 2, 540 feet from the closest outdoor use area of Residence 3, and 750 feet from the closest outdoor use area of Residence 4 and,
- The potential outdoor event area on the roof terrace above the Bottling Room could be close as 930 feet from the closest outdoor use area of Residence 1, 1130 feet from the closest outdoor use area of Residence 2, 650 feet from the closest outdoor use area of Residence 3, and 950 feet from the closest outdoor use area of Residence 4

Events occurring within winery buildings would receive noise shielding from building structure estimated at 12 dBA (assuming open windows and/or doors). Outdoor events would also receive varying degrees of acoustical shielding from intervening terrain features and building structures. Based on a review of area topography obtained via Goggle Earth and the project design, the intervening terrain and building structures are expected to provide an estimated minimum of 4 dBA attenuation for outdoor events held at;

- The existing cave entrance at all adjacent residences,
- The Bottling Room roof terrace at the closest outdoor use areas of Residences 1 and 4, and
- The Main outdoor event area west of Fermentation Building 1 at the closest outdoor use areas of Residences 2, 3, and 4.

The closest outdoor use areas of Residence 2 and 3 would receive little or no acoustical shielding from terrain and building structures for noise from outdoor events at Bottling Room roof terrace. Additionally, the closest outdoor use areas of Residence 1 would receive little or no acoustical shielding from terrain and building structures for noise from events held at the Main outdoor event area west of Fermentation Building 1. The applicant does not anticipate using our existing cave entrance area or the top of the proposed bottling room for nighttime events with acoustic music, or for events for 200 people or more given their small size

When underway, events typically produce noise from periods of 30 minutes or more per hour, and thus event noise is judged against the L₅₀ standard. Additionally, a 5 dBA penalty is applied to event noise, because event noise typically contains music or speech. Noise from events concluding at prior to 10 pm is therefore judged against a Project Specific Noise Criteria L₅₀ of 45 dBA, and noise from events concluding at after 10 pm is judged against a Project Specific Noise Criteria L₅₀ of 40 dBA at the adjacent residential uses.

The tables below present and summarize the assessment of marketing event noise versus project specific criterion at the closest outdoor use areas of noise sensitive uses for events occurring; within buildings (Table 14a), at the outdoor event area west of Fermentation Building 1 (Table 14b), at the outdoor event area east of the existing cave entrance (Table 14c), and at the potential outdoor event area on the roof terrace above the Bottling Room (Table 14d).

Table 14a: Indoor Marketing Event Activity Noise Levels

	Noise Levels, dBA			
	Residence 1	Residence 2	Residence 3	Residence 4
Daytime Event L ₅₀ Noise Limit	45	45	45	45
Nighttime Event L ₅₀ Noise Limit	40	40	40	40
Non-amplified Acoustic Music	31	29	35	31
300 Guests with Background Music	35	33	39	35
200 Guests with Background Music	32	30	36	32
100 Guests with Background Music	24	22	28	24
<i>Noise Level Exceeds Daytime L₅₀ Limit?</i>	<i>No (all)</i>	<i>No (all)</i>	<i>No (all)</i>	<i>No (all)</i>
<i>Noise Level Exceeds Nighttime L₅₀ Limit?</i>	<i>No (all)</i>	<i>No (all)</i>	<i>No (all)</i>	<i>No (all)</i>

Table 14b: Outdoor Marketing Event Activity Noise Levels at the Main Outdoor Event Area west of Fermentation Building 1

	Noise Levels, dBA			
	Residence 1	Residence 2	Residence 3	Residence 4
Daytime Event L ₅₀ Noise Limit	45	45	45	45
Nighttime Event L ₅₀ Noise Limit	40	40	40	40
Non-amplified Acoustic Music	43	36	40	37
<i>Noise Level Exceeds Daytime L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
<i>Noise Level Exceeds Nighttime L₅₀ Limit?</i>	Yes	<i>No</i>	<i>No</i>	<i>No</i>
300 Guests with Background Music	47	40	44	41
<i>Noise Level Exceeds Daytime L₅₀ Limit?</i>	Yes	<i>No</i>	<i>No</i>	<i>No</i>
<i>Noise Level Exceeds Nighttime L₅₀ Limit?</i>	Yes	<i>No</i>	Yes	Yes
200 Guests with Background Music	44	37	41	38
<i>Noise Level Exceeds Daytime L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
<i>Noise Level Exceeds Nighttime L₅₀ Limit?</i>	Yes	<i>No</i>	<i>No</i>	<i>No</i>
100 Guests with Background Music	36	29	33	30
<i>Noise Level Exceeds Daytime L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
<i>Noise Level Exceeds Nighttime L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>

Table 14c: Outdoor Marketing Event Activity Noise Levels at the Outdoor Event Area east of the existing Cave Entrance

	Noise Levels, dBA			
	Residence 1	Residence 2	Residence 3	Residence 4
Daytime Event L ₅₀ Noise Limit	45	45	45	45
Nighttime Event L ₅₀ Noise Limit	40	40	40	40
Non-amplified Acoustic Music	36	37	42	39
<i>Noise Level Exceeds Daytime L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
<i>Noise Level Exceeds Nighttime L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	Yes	<i>No</i>
100 Guests with Background Music	29	30	35	32
<i>Noise Level Exceeds Daytime L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
<i>Noise Level Exceeds Nighttime L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>

Table 14d: Outdoor Marketing Event Activity Noise Levels on the Roof Terrace above the Bottling Room

	Noise Levels, dBA			
	Residence 1	Residence 2	Residence 3	Residence 4
Daytime Event L ₅₀ Noise Limit	45	45	45	45
Nighttime Event L ₅₀ Noise Limit	40	40	40	40
Non-amplified Acoustic Music	38	40	45	37
<i>Noise Level Exceeds Daytime L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
<i>Noise Level Exceeds Nighttime L₅₀ Limit?</i>	<i>Yes</i>	<i>No</i>	Yes	<i>No</i>
100 Guests with Background Music	31	33	38	30
<i>Noise Level Exceeds Daytime L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
<i>Noise Level Exceeds Nighttime L₅₀ Limit?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>

Considering the findings shown in Table 14a, 14b, 14c, and 14d, all events held during daytime (up to 10 pm) or nighttime (after 10 pm) within winery buildings will meet the Project Specific Noise Criteria and will not require mitigation. Additionally, all daytime events with non-amplified music performances or 100 and 200 people with background music, and nighttime events of 100 people with background music will meet the Project Specific Noise Criteria and will not require mitigation. However, outdoor nighttime events with 200 or 300 guests or with non-amplified acoustic band performances will exceed the Project Specific Noise Criteria at one or more adjacent residences. The one 300 person outdoor event, held during daytime or nighttime, would also exceed the Project Specific Noise Criteria at one or more adjacent residence.

Mitigation 6:

To allow sound levels produced by outdoor marketing events to comply with the Project Specific Noise Criteria, the following mitigation measures are recommended:

- A. **The two larger (200 & 300 person) Outdoor Events.** Outdoor events with 200 to 300 persons should either conclude before 10 pm, or be moved indoors by 10 pm to continue within winery buildings beyond 10 pm.
- B. **Outdoor Events with Non-Amplified Acoustic Music Performances.** Acoustic music band performances should either conclude before 10 pm, or be moved indoors by 10 pm to continue performance within winery buildings beyond 10 pm.

C. Main Outdoor Event Area Mitigation.

If non-amplified acoustic music or a 200 person events either end or move indoors by 10pm, no barrier panels are needed. However, if such events continue past 10pm or a 300 person event is held in the main outdoor event area, this event area should be designed so that demountable solid surface 6 foot high wall/barrier panels can be installed between vertical supports on the north and west sides of the developed area, as shown in Figure 5. The panels should have a minimum surface weight of 2.5 lbs. per sq. ft., and be capable of installation at vertical supports without perimeter gaps exceeding more than 1% of the face area. Acceptable materials for this wall include ½” thick visually clear acrylic

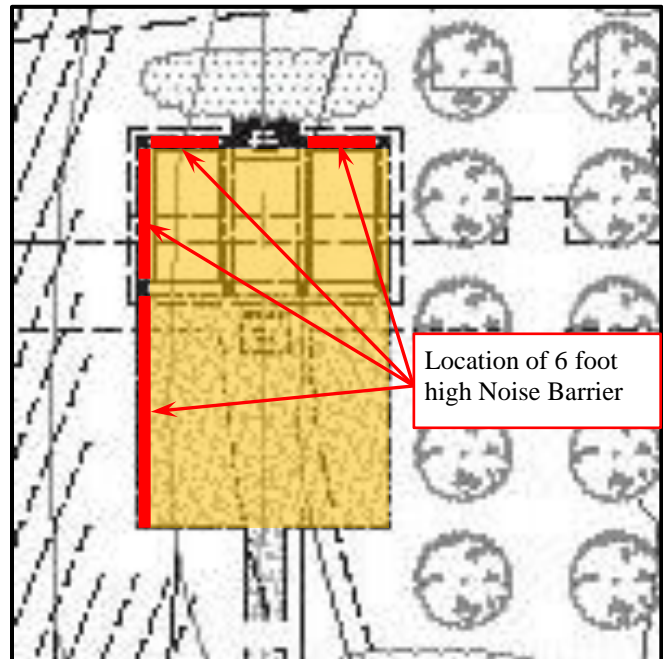


Figure 5: Event Noise Mitigation

(e.g. Plexiglas or Lexan) panels, or wood fence built with a double layer of 1" nominal thickness boards with the second layer of boards installed to cover the joints of the first layer. Examples of the appearance of temporary clear acoustical barrier panels are shown in Figure 6, following. The use of demountable solid surface barrier panels are expected to reduce event noise levels by 7 dBA at Residence 1, resulting in respective L₅₀ sound levels from 300 person and 200 person events of 40 dBA and 37 dBA at this residence.



Figure 6: Examples Clear Acoustical Barrier Panel Installations

APPENDIX A: FUNDAMENTAL CONCEPTS OF ENVIRONMENTAL ACOUSTICS

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound may be caused by either 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 that are used to describe noise in a particular location. A decibel (dB) is a unit of measurement that 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. For lesser increases of sound from the same or similar sources, a 6 dB change is perceived to be a “noticeable” change and a 3 dB change to be just perceptible. 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 or 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 Day/Night Average Sound Level, L_{dn} , is a measure of the cumulative noise exposure in a community, with a 10 dB penalty added to nighttime (10:00 pm - 7:00 am) noise levels. 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.

Effects of Noise

Sleep and Speech Interference: The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noise of sufficient intensity; above 35 dBA, and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn} . Typically, the highest steady traffic noise level during the daytime

is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses.

TERM	DEFINITIONS
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, which is 20 micropascals (20 micronewtons per square meter).
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure.
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. All sound levels in this report are A-weighted, unless reported otherwise.
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.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
Day/Night Noise Level, L_{dn}	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 in the night between 10:00 pm and 7:00 am.
L_{max} , L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
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.

Definitions Of Acoustical Terms

Table 1

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Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA L_{dn} with open

windows and 65-70 dBA L_{dn} if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed, those facing major roadways and freeways typically need windows with special glass.

At a Given Distance From Noise Source	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Impression
	140		
Civil Defense Siren (100')	130		
Jet Takeoff (200')	120		Pain Threshold
	110	Rock Music Concert	
Diesel Pile Driver (100')	100		Very Loud
Freight Cars (50')	90	Boiler Room Printing Press Plant	
Pneumatic Drill (50')	80		
Freeway (100')	70	In Kitchen With Garbage Disposal Running	Moderately Loud
Vacuum Cleaner (10')	60	Data Processing Center	
Light Traffic (100')	50	Department Store	
Large Transformer (200')	40	Private Business Office	Quiet
Soft Whisper (5')	30	Quiet Bedroom	
	20	Recording Studio	
	10		Threshold of Hearing
	0		

Typical Sound Levels in the Environment & Industry

Table 2

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Annoyance: Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a

valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 55 dBA Ldn. At an Ldn of about 60 dBA, approximately 2 percent of the population is highly annoyed. When the Ldn increases to 70 dBA, the percentage of the population highly annoyed increases to about 12 percent of the population. There is, therefore, an increase of about 1 percent per dBA between an Ldn of 60-70 dBA. Between an Ldn of 70-80 dBA, each decibel increase increases by about 2 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the Ldn is 60 dBA, approximately 10 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 2 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 3 percent increase in the percentage of the population highly annoyed.