Noise Analysis

Las Pilitas Rock Quarry

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Prepared for

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Introduction

This report describes the existing acoustic environmental setting of the Las Pilitas Rock Quarry project and estimates of the noise levels that will be produced during quarrying operations. The quarry site is located adjacent to Highway 58 east of the town of Santa Margarita (APN #'s 070-141-070 & 071). Residents of the town of Santa Margarita will not be impacted by sound produced by quarry operations but there is a concern about potential impacts associated with increases in truck traffic. The report will address this concern.

The following reports and sources were used in preparation of this study:

1. Quarry Project Overview, Las Pilitas Resources, March 2009.
2. Las Pilitas Rock Quarry Traffic Impact Study, TPG Consulting, May 2009.
3. General Blast Plan and Vibration Predictions, Gasch & Associates, 2009.
4. County of San Luis Obispo General Plan Noise Element; Policy Document / Acoustical Design Manual. 1992.
5. County of San Luis Obispo General Plan Noise Element, Technical Reference Document. 1992.
6. County of San Luis Obispo, County Code, Title 22 Land Use, Surface Mining and Reclamation, Chapter 22.36.
7. County of San Luis Obispo, County Code, Title 22 Land Use, Noise Standards, Chapter 22.10.120.
8. FHWA Roadway Construction Noise Model. U.S. Department of Transportation. 2006.
9. Transportation and Construction Induced Vibration Guidance Manual, California Department of Transportation, June 2004.
10. Federal Agency Review of Selected Airport Noise Analysis Issues, FICON, 1992.
11. Assessment of Rock Blasting Impacts and Recommended Practices for Roblar Road Quarry, Sonoma County, CA, Revey Associates, Inc. 2006

Noise Fundamentals

Noise is often defined as, “unwanted sound”. The physics of sound transmission is well understood but evaluating the ways that sounds intrude on human activity is more subjective. Some people have a high tolerance for noise while others are extremely sensitive to it.

Fluctuations in air pressure at certain intensities and frequencies are experienced as sound. People hear sounds when the air pressure fluctuations exceed the rate of 20 per second. The range of hearing spans from 20 to 20,000 cycles per second (abbreviated Hz). Because the range of audible sound levels is enormous, sound intensity is measured using a logarithmic “decibel” scale (abbreviated dB). The range of audibility starts at zero dB. Normal conversation takes place at around 65 dB and when sounds reach the 130 dB level they become painful.

There is a special arithmetic associated with sounds because of the logarithmic decibel scale. For example, a 70 dB sound added to a 70 dB sound sums logarithmically to 73 dB, a three decibel increase. When a 70 dB sound is added to an 80 dB sound the combined dB level only rises incrementally, to 80.4 dB. The reason for this is that there is far more noise energy in the higher level sound than the lesser one.

The frequency of a sound also affects what people experience. People hear sounds in the 1,000 to 5,000 cycle per second range better than they hear very high or low frequencies. The blue line on Figure 1 shows relative sensitivity of people to sounds at different frequencies. For example, the graph indicates that people experience a sound at a frequency of 100 Hz as being 20 decibels less than a sound at 1000 Hz. A sound level meter can be adjusted to filter sounds so that its sensitivity to different frequencies corresponds to the way people hear things, Such filtered readings are described as being "A-weighted"; abbreviated dB(A). This is the most common metric used in community noise studies and the county's noise regulations are entirely based on A-weighted sound.

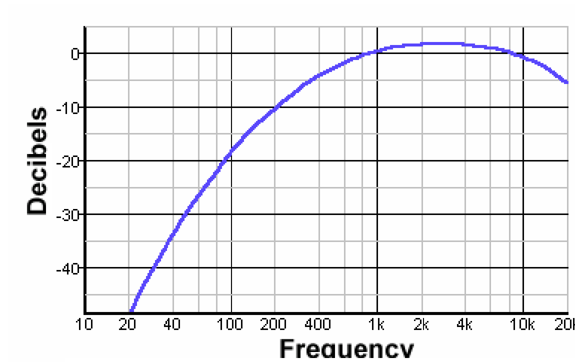

Figure 1: The A-weighted scale

Figure 2 shows typical sound levels associated with a number of different activities as they would be measured in A-weighted decibels.

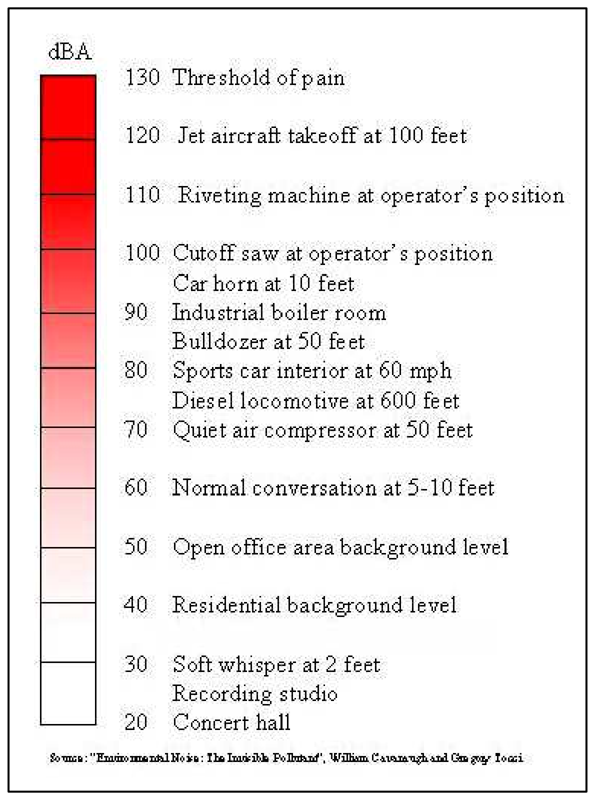

Figure 2: Decibel levels of common sounds

Community noise studies make use of multiple metrics, all based on A-weighted decibels:

- One descriptive metric is *Lmax* which represents the loudest instant during an event.
- The sound environment might also be characterized by its energy average over a period of time. This metric is *Leq*.
- An environment can also be described by the percentage of time that sound levels are above or below some specific values. The metrics *L10* and *L90* represent the decibel levels that are exceeded 10% of the time or exceeded 90% of the time respectively.
- Still another metric *SEL* compresses all of the noise energy in an event as if it occurred in a single second. Such normalization makes it possible to add sounds from multiple events on a common basis.

- Community planners make use of such combinations to characterize noise exposure over an average day. The metric *DNL* (representing Day Night Level) is a noise descriptor that combines all noise events over a 24 hour period with a 10 dB penalty added to night time sounds (10 PM – 7 AM) to account for their greater potential for community disruption.
- California studies sometimes use a variant of DNL, CNEL. This adds an evening period (7PM-10PM) with a 5 dB penalty weighting. In practice, this addition has a minor effect on the 24 hour evaluation and CNEL and DNL are considered to be equivalents.
- All of these metrics are most commonly presented using A-weighted decibels but un-weighted or differently weighted metrics are also used. Un-weighted sound is described as dB(L) for "linear" or dB with no following letter. An alternate weighting, dB(C), is sometimes used to characterize very loud sounds.

A sound level meter can be used to measure the levels of noise exposure according to any of the metrics described above. An extended description of these noise metrics and acoustic terminology is included in Appendix A.

Sound levels, however measured, attenuate with distance from the source. For single point sources the attenuation rate is around 6 dB with each doubling of distance. For a line source, such as a road, the attenuation is less, 3.5 dB with each doubling of distance. These are theoretical numbers based on the basic physics of sound propagation. In community settings the attenuation will vary with the frequency content of the noise, surface character, reflections, and atmospheric conditions. Wind and temperature inversions can significantly effect how sound travels.

Planners and acoustical engineers have developed technical tools that describe how sound propagates. These "models" are used to estimate sound exposure levels associated with future projects and to evaluate the effectiveness of possible mitigations. Noise environments and forecasts are often depicted on maps using contour lines Figures 9,10 and 11 are examples of such mapping.

The Quarry Project[1]

The initial phase of work involves clearing the vegetation and surface soil from the area that is to be mined and stored for later use in reclamation. The initial stage includes installing a truck scale, portable office, entrance road construction, and landscaping. During operations, the rock will then be removed by wheel loader, hydraulic excavator or bulldozer the material, crushed and then sorted by size and stockpiled for sale.

Where the rock is too consolidated to be removed by an excavator it will be loosened by blasting. A rock drilling machine will drill a pattern of holes in the rock and explosives

[1] This is an abridged version of the project description provided in the "Quarry Project Overview" prepared by Las Pilitas Resources.

will be loaded in the holes, then detonated. The process is conducted in a way that limits and controls the resulting vibration and noise. Blasting will be overseen by a California Licensed Blaster.

The mining is done by cutting benches in to the granite material. Figure 3. After the initial excavation, work starts on the highest bench and steps downward to lower benches. Loosened rock is pushed by a bulldozer from the working bench to a wheeled loader or excavator for stockpiling or to be fed into the portable rock crushing plant. The rock is screened to separate the material into different sizes. Rock that is still too large for sale as a finished product, will be reduced by the secondary crusher and again screened into saleable sizes. Portable crushing and screening equipment will be brought to the site on an as-needed basis.

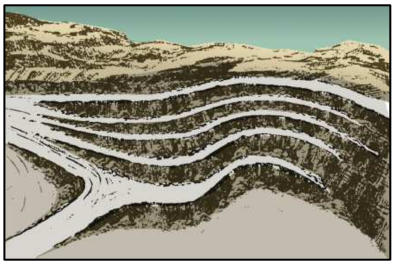

Figure 3: A bench quarry

A portion of high quality aggregate will be washed and sorted for use in the manufacturing of Portland Concrete Cement as well as being sold to customers for other specialty applications.

The project also includes the recycling of concrete. The materials that are to be recycled will be brought to the site by the trucks coming to pick up quarried materials and processed by the same equipment used to process the granite rock.

Stockpiled materials will be loaded onto trucks for delivery to customers using a front end loader. Larger rocks will be loaded by an excavator. The project traffic study indicates that daily round trip truck traffic to and from the site will be 100 vehicles. Practically all of the traffic will be on Highway 58 between the site and El Camino Real. The peak hour of travel will be in the morning as trucks transport materials to construction sites.

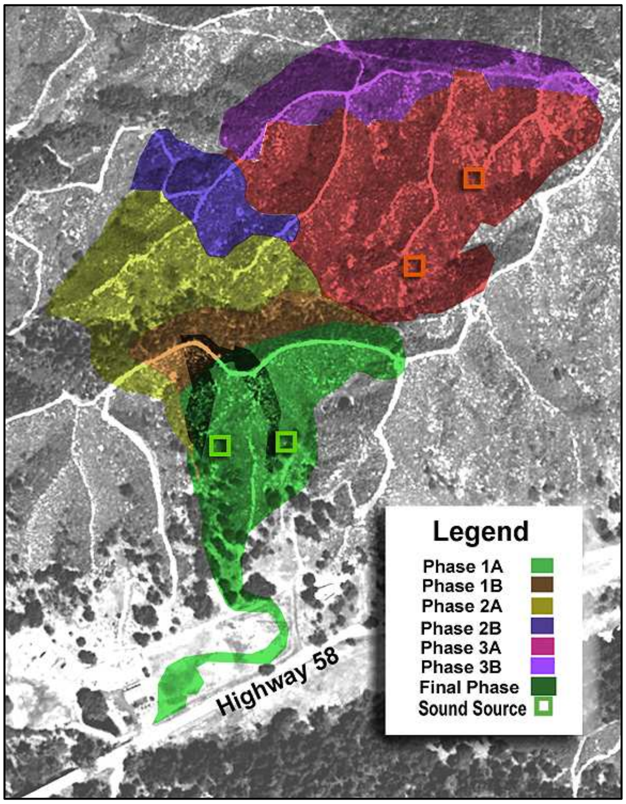

Figure 4: Phases of quarry operations

The quarry operation will be implemented in stages over a period of approximately thirty years. An estimated 500,000 tons of material will be shipped annually. The pace of the activity will vary with the demand for construction materials. Site reclamation is ongoing after the initial stages of work are completed.

Figure 4 indicates the pattern of excavation. The progression moves from south to north. Over time, the work will cut through to the far side of the present ridge line.

During the thirty years of quarry operations there will be continuing alterations in the topography and the acoustic setting will be changing too. As work progresses the deepening excavation will block noise exposure for some receivers. In other cases, as work moves to higher benches, there will be increased exposure. The piles of materials that are produced during quarrying operations can act as noise barriers but the height and location of these changes periodically.

While the noise impacts on neighboring properties varies over time they will be at their greatest during Phases 1B and 3A. These are examined in this report as “worst case” scenarios. During Phase 1A, the cut into the south side of the ridge is at its deepest and the highest bench of the excavation will have reached its maximum elevation. Sound from extraction operations will be the least sheltered by adjacent topography. Once work has progressed to the north facing ridge the sound exposure situation changes significantly. Lands that were previously sheltered by the ridge line will receive increased noise exposure. During Phase 3A, work will also be taking place on the highest bench of the northwest facing slope. The faint squares on Figure 4 show where sound sources were located in estimating noise production.

This study gives separate consideration to a number of topics. It describes the present acoustic setting, noise exposure under the two “worst case” scenarios, noise from blasting activities, traffic noise increases in Santa Margarita and traffic noise at the residence of Charles Kleeman, a nearby resident who is concerned about additional truck traffic. These six topics will be described along with associated noise estimates. Following this, there is a discussion of how each of these scenarios relates to the County’s noise standards.

The Present Acoustic Setting

There are presently two significant noise sources in the vicinity of the proposed Las Pilitas Quarry. The site fronts on Highway 58 and an existing quarry, the Hanson Quarry, is located to the north and west. Figure 5 shows the Hanson Quarry excavation at the upper left and Highway 58 shows at the lower right.

An aerial view of the plan for the quarry excavation is draped over a 3D representation of the topography (using Google Earth). The lines within the light colored area delineate the layering of the quarry operations. The faint red highlights on the image traces the route that was followed during our initial site survey conducted on November 10, 2009. The path ran from the base of the hill and followed the ridgeline that frames the project site. The lower portion of the site is presently exposed to the sound of occasional vehicles passing on Highway 58. When there are no vehicles in the vicinity of the project, the background sound is at a very low level, around 30 dB. But along the ridge line activities at the Hanson Quarry are audible whenever there is a direct line of site to the sources of the sound. These sounds are faint, at or just above the background levels. Audible

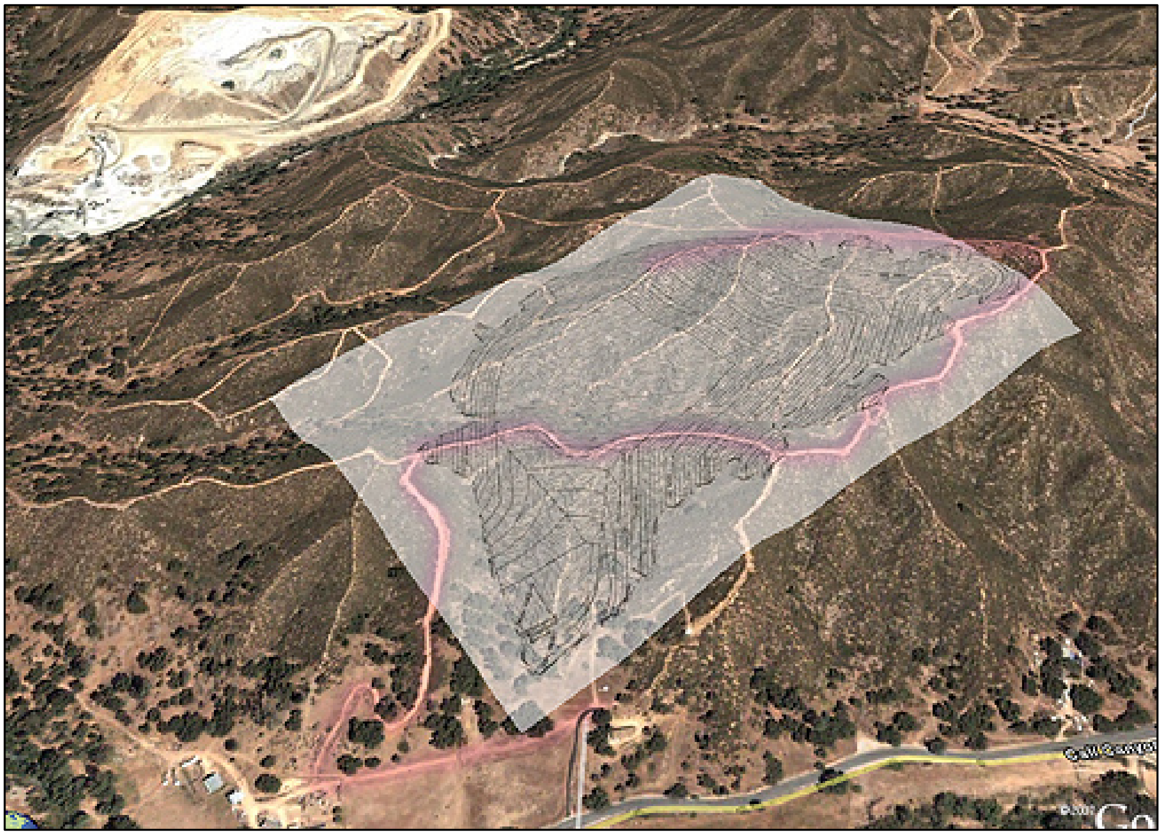

Figure 5: Quarry plan superimposed on 3D landscape

activities include the backup warning beepers of loaders and occasional diesel engine runups by trucks hauling materials from the face of the quarrying to the lower levels where the processing takes place. The sounds of the rock crushing which takes place at lower elevations are mostly blocked by intervening topography.

The Regulatory Setting

The county's regulatory standards are divided in two segments; one relates to the *exposure* of projects to transportation noise and the other to the allowable levels of noise that can be *produced* by projects[2]. There is also a section describing classes of activities that are exempt from the regulations.

A table showing compatibility standards for land uses exposed to different levels of transportation noise is shown in Appendix B. The quarry is not a noise sensitive activity and its location adjacent to a highway poses no compatibility problems. However, the project does generate traffic which adds to traffic noise experienced off-site. While the county's transportation noise guidelines are not directly relevant they are useful guidelines for evaluating the significance of these off-site impacts.

[2] The County's standards are described in the Noise Element of the General Plan and detailed in Chapter 22.10 of the County Code.

The county standards for project generated exterior noise levels are expressed in both an hourly energy average (LEQ) and a not-to-be-exceeded peak level (Lmax).[3] There are daytime and nighttime standards as well as a consideration of the added annoyance of certain noise sources including the production of "recurring impulsive noises". The not-to-exceed levels are lowered by 5 decibels for such noises. Quarry blasting activities would produce impulsive noise.

	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Hourly Leq, dB	50	45
Maximum level, dB	70	65
Maximum level, dB-Impulsive Noise*	65	60

Table 1: County exterior noise standards

The county's implementing ordinance provides for situations where the existing noise levels exceed the standards. Here, the test is whether the new use will increase noise levels by more than 1 dB over present levels. Noise levels are to be measured at the property line of the residential uses or other noise sensitive receiver.

There are a number of exceptions and exemptions to the County standards. Several of these are relevant to the Quarry project. The initial phase of work involving clearing of the site, construction of access ways, and stockpiling of surface materials represents a construction period. Noise associated with "construction" is exempted by the ordinance as long as it occurs between 7 AM and 9 PM weekdays and 8 AM and 5 PM on weekends.

The site of the proposed quarry operations is designated as rural land (RL) in the county general plan. It is within a larger area that has an "Extractive Area" overlay. The purpose of this combining designation is to: "protect significant resource extraction and energy production areas identified by the Land Use Element from encroachment by incompatible land uses that could hinder resource extraction or energy production operations, or land uses that would be adversely affected by extraction or energy production" (Land Use Ordinance section 22.14.040). The properties closest to the quarry site are within the same extractive area overlay. The county's policies recognize the economic benefits of resource extraction and call for a balanced assessment of compatibility concerns.

The County's noise standards do not apply to "agricultural land uses" listed in Section 22.06.030 of the Land Use code. Table 2-2 of this section includes "mines and quarries" among the allowable uses for Agriculture, Rural Lands and Rural Residential lands.

Quarry operations are subject to a land use permit that is to be issued in according to standards described in Section 22.30. This section includes no specific standards related to noise production and is largely concerned with site restoration. The County standards

[3] Leq is a measure of the average noise energy level over a stated period of time – in this case a one-hour period. Lmax is a measurement of the loudness of a sound.

for the levels of ground vibration from blasting exempt quarry operations as long as they occur between 7 AM and 9 PM (Section 22.10.170).

One might interpret this to say that quarry operations are exempt from the County's noise regulations but issuance of a permit to conduct mining operations is discretionary. It is assumed that the county will be guided by its noise standards in evaluating the significance of project impacts.

Forecasting Noise

Four different noise models were used to estimate the project's acoustic impacts. The NMSim model developed by Wyle Laboratories for the US Park Service was used to evaluate noise from general quarry operations. The Federal Highway Administration's Traffic Noise Model (TNM) was used to estimate the impacts of added truck traffic on Highway 58. A program, BNoise2 developed by the US Army was used in evaluation the impacts of blasting supplemented by an equation published in the Blaster's Handbook developed from data developed by the US Bureau of Mines.

The NMSim noise forecasting model is designed for use in complex topographic settings. It has been used in studies for the Grand Canyon and Grand Teton National Parks and variants of the model are being used by the US Military. In addition to topography, the model inputs include surface conditions, reflections, and source directivity and source movement. The NMSim model was used to create the maps displayed in this study. The Traffic Noise Model (TNM) is the national standard for analysis of roadway noise. The model includes considerations of vehicle mix, speeds, surface conditions, topography and distance. However, the model is not well suited for estimating noise exposure over large areas. The NMSim model includes the capability of estimating roadway noise and is better suited for larger scale mapping. The BNoise2 model was developed by the Army's Construction Engineering Research Lab for evaluating the noise produced by training activities and demolition. The model data base includes the explosive materials used in blasting for quarry operations as well as features dealing with surface and weather variations and buried charges. Additional information was incorporated based on the US Bureau of Mines studies. An extended discussion of the modeling approaches and analysis is included in Appendix C.

Transitory atmospheric effects; wind, humidity and temperature and temperature gradients affect sound transmission and these become increasingly significant with distance. Noise forecasting models developed by the US military include not just a single estimate of noise levels but an estimate of the range of variability around an average. This study does *not* include estimates of these variations but it is certain that there will be variations and that these will increase with distance from the source.

Applying the Most Appropriate Noise Metrics

There is a multiplicity of metrics used in the County's noise regulations. The noise ordinance and the General Plan Noise Element use several; DNL, CNEL, Leq and Lmax.

While all of these could be applied individually, there are some equivalencies that can simplify the analysis. As noted, there is little difference between DNL and CNEL and the state of California treats them as being equivalent. There is an additional rule of thumb; in suburban settings, the Leq (energy average) for peak hour traffic noise is typically similar to the daily DNL value. Also, when a noise is relatively constant, such as the sound of quarry operations heard from a distance, the energy average (Leq) is the same as the maximum sound level (Lmax). In this study these equivalencies will be adopted to simplify the application of the County standards.

There an issue in that the County's noise standards are not well suited for evaluating noise from blasting. They are based on the A-weighted metric. But much of the acoustic energy released by blasting is in the form of very low frequency sound that is inaudible to humans. Still, the pressure change can rattle windows and produce a startle effect. Figure 6 shows a comparison of decibel levels for a blast event heard at an 800 foot distance[4]. The histogram on the left shows the frequency spectrum for the unweighted sound level and the right hand image shows the A-weighted counterpart. The majority of the blast energy is at frequencies that are 2 to 25 cycles per second; below the range of hearing. The unweighted peak noise level is 120 decibels, while the A-weighted level is 85 dB. In outlining questions to be addressed in noise impact analysis CEQA makes reference to standards established by "other agencies" and this study will consider standards have been proposed by Caltrans and the US Bureau of Mines for dealing with low frequency blast noise.

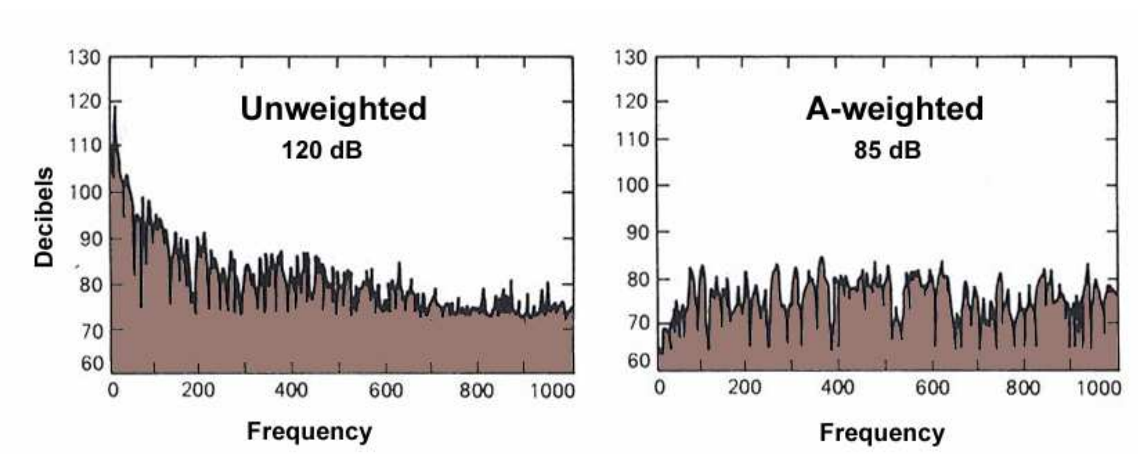

Figure 6: Un-weighted and A-weighted sound associated with blasting

The terminology used in the technical literature on blasting differs from that used in community noise studies[5]. Measures of "air-overpressure", the transient change in air pressure, are analogous to measurement of noise energy represented in un-weighted decibels, dBL. Values can be mathematically translated from one metric to the other. To maintain continuity within this report "air-overpressure" is described in decibel format.

[4] Based on a study by Siskind and Summers (1974)
[5] The discussion of air-overpressure draws from materials developed by Gordon Revey Used with permission.

Both the un-weighted dBL values and the A-weighted values will be presented. The A-weighted values (the frequencies within the range of human hearing) are about 35decibels below the un-weighted values (the total sound energy released in a blast)[6].

There is an additional issue that has to do with evaluation of acoustic impacts in a rural setting. The County's Noise Element and implementing ordinances are oriented to development in suburban settings. Sounds that are masked by ambient noise in urbanized areas become more noticeable in the country. This raises aesthetic questions that are difficult to resolve. (The county's current attempt to establish guidelines for management of events in agricultural areas is a reflection of this quandary). Sounds that are judged to be inappropriate for a country setting become a problem for some people once they reach the threshold of audibility. People have the capacity to selectively attend to individual sounds and pick them out from background sounds even when they are below the ambient level. Sounds that can't be separated from background sound levels and measured with a sound level meter can be distinguished and be bothersome to people who wish to maintain a preferred soundscape. There is no technological way to make distinctions between sounds that are appropriate or inappropriate for rural settings. It can only be noted that there will be some level of community annoyance whenever the sounds of quarry operations are audible and that sounds will be audible even when they are within the limits set by County standards.

There is also a question of how to best characterize noise from thirty years of quarrying activity since the location of sources changes over time and the topography changes too. There is nothing in the County's regulatory structure that gives guidance on how to deal with this, nor is there agreement on a best approach. One strategy (adopted for regulation of construction noise) is to average out impacts according to the percentage of time different equipment will be operating in different locations. However, this understates what happens at any point in time[7]. In this study we evaluate worst case situations that, in reality, will only exist for periods of limited duration.

Evaluating Sound Levels

Sound levels for gravel extraction activities were measured at the neighboring Hanson quarry on December 8, 2009 and January 7, 2010. Table 2 shows noise levels for various pieces of quarry equipment. All measurements were made from positions at a five foot height above the surface level at locations with a direct line of site to the source[8]. The distance to the sources varied from 60 to 125 feet but these have been normalized in the

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[6] The 35 decibel difference shown the Siskind and Summers table has a counterpart in a noise prediction model developed by the US Army. The Army's prediction equation for assessing the sound from a 500 pound bomb blast puts the difference between un-weighted and A-weighted sound at -34.6.

[7] The EIR for one quarry project adopted this approach, concluding that noise from intermittent blasting activities would average 35 dBA over time and was therefore less than significant. *Liberty Quarry Draft EIR* (Riverside County) 2009.

[8] Measurements were made using a Brüel & Kjær Precision Integrating Sound Level Meter, Type 2230. The meter was calibrated before and after the survey using a B&K Acoustic Calibrator Model 4231. The readings were determined to be accurate. Both the meter and the calibrator were laboratory calibrated in February, 2009.

table to equate to levels as they would be heard at a listener position that is 50 feet from the source[9].

The last two columns on the table show noise measurements made for similar equipment at two other quarry operations as reported in the literature[10]. The measurements made at the Hanson Quarry are in line with noise levels recorded at other quarry operations.

Source	Measured Distance	Measured Level	@50 ft*	Laku Landing	Liberty Quarry
Jaws	112	79	86	94	86.3
Excavator only	125	69	77	73	
With beeper on	125	74	82		82.8
Load drop to truck	125	72	80		
Screen	100	79	85	86	80.8
2nd Crusher	70	81	84		
Final Crusher	45	83	82		
Truck Loader	125	70	78		
Asphalt production	90	81	86		77**
Truck @ 30 mph	60	79	81		

*Assuming 6 dB distance doubling. ** Measured at Papitch plant east of Paso Robles

Table 2: Noise levels for quarry equipment

While rock crushing involves use of very heavy equipment the sound character is not "heavy" in its low frequency content. It is a mid-range clicking of rock against rock. The low frequency content of operations comes with the diesel trucks and excavators. The higher register sounds are the OSHA warning beepers with their intermittent tones in the 1000 - 3000 Hz range..

The rock crushing and sorting operations, when heard up close, have a rhythmic quality. But with increasing distance, sounds from multiple activities blend together with the echoes and reflections. At a ¾ mile distance, such as along Highway 58 near Digger Pine Road, the sounds from quarry operations become a continuous mid-level shuffling tone. The level varies over time in the range of 41 to 48 decibels. Sounds of traffic on El Camino Real are sometimes audible. On occasion, sounds from quarry operations can be clearly distinguished from the background; a distant backup beeper, a thump when a load of stone is dropped into an empty truck bed or the run-up of a diesel engine. These events have a marginal effect on noise level as measured by a sound level meter but they are a continuing reminder of the ongoing excavation activity.

Sound from Blasting

At times, blasting will be used to loosen rock prior to excavation. However, it should be stressed that contemporary technologies greatly reduce the levels of noise and vibration

[9] The 6 dB distance doubling formula was applied.
[10] Laku Landing is in Windsor, Colorado and the Liberty Quarry is in Colton, California.

associated with such activities. A series of blast holes are drilled, each about 30 to 60 feet deep. Explosives are put into the holes and capped by six or eight feet of rock to confine the blast energy and minimize noise (called "stemming"). The explosions take place in sequence, separated by milliseconds. This releases sufficient energy to fracture rock but, with the temporal spacing of the detonations, does not multiply the strength of the ground borne vibration or the release of acoustic energy into the air. Nearly all the energy is used in fracturing rock and only a small portion escapes as acoustic energy.

Blasting takes place periodically at the Hanson Quarry. An event was monitored on January 7, 2010. Figure 7 shows the setting and the event as seen from the monitoring location. The blast site was at the base of the extraction area which was partially filled with water from recent rains. The vertical distance between the site and the monitoring position is about 150 feet. The straight line distance from the blast location to the monitoring site is 1,400 feet allowing for the change in elevation.

Figure 7: Hanson quarry blast.

Two Type I "precision" meters were used to record the event. One was a Larson Davis integrating sound level meter, Model 870 and the other was a Brüel & Kjær Integrating Sound Level Meter, Model 2230[11].

A pattern of charges was arranged as described above with the individual charge weights at 160 pounds. Two holes were paired so the total charge in any "delay" increment was 320 pounds. Table 3 shows the he readings for the event. The readings were the same on both meters and are assumed to be accurate.

There is a widely accepted technology for estimating air overpressure based on charge weight and distance[12]. Using the Driller Handbook equation, the estimated unweighted

dBL (unweighted)	dBA (A-weighted
134.9	98.6

Table 3: Noise levels for blast

[11] The equipment descriptions and calibration dates are as follows: Larson Davis Integrating SLM Model 870 SN# 0177. Meter, preamp, and microphone calibrated Nov 16, 2009; Brüel & Kjær Integrating SLM Model 2230 SN # 1033493. Meter and microphone calibrated Sep 29, 2009; Brüel & Kjær Calibrator Model 4231 SN # 2052124, calibrated Sep 29, 2009. The laboratory reports on the calibration of each of the instruments and its components are available.

[12] The equation is in from the 17th Edition ISEE Blasters Handbook,, 1998. This formulation is repeated with minor variations in the Caltrans Highway Construction Manual referenced in the introduction.

dBL at the Hanson charge weight and distance is 115 dB. The A-weighted dBA is 80. The reason there is such a divergence in estimates has to do with the physical location where our quarry measurements were made, and the explosives that were used. A light wind blowing toward the equipment also increased the noise readings. The handbook equation does not include a consideration of topography, the relative power of the blasting materials, or atmospheric conditions However, a blast equation developed by the US Army *does* include considerations of topography and explosive type. The Army equation can be used to add a consideration of the effect of the reflective surface of the water in the base of the quarry and the power of the explosive material that was employed. With the Bnoise2 formulation the predicted level for dBL is 139 and the dBA is 100. This is close to what was recorded. If the surface and weather conditions are altered in the Army model it is possible to approximate forecasts made using the model from the Blasters Handbook. Two Army researchers, George Luz and Paul Schomer, evaluated the sounds of multiple artillery shots heard at significant distances. Using their formulation, the predicted level for dBL is 114.5 and the dBA value is 75.5. The Army prediction system includes estimates of the expected variation of readings and notes that 66% (one standard deviation) of events will be within four decibels of the estimate. Army modeling also includes considerations of the directionality of noise from artillery firing. It is possible that measuring sound at an elevation that was above the blast holes would have produced a similar directional effect that would increase the noise readings.

The central point is that surface qualities, topography and atmospheric conditions have a substantial effect on the propagation of blast noise. Caltrans' manual for estimating vibration and blast effects reviewed several different formulations of blast propagation and concluded; *"the difference [between models] does not become a major factor until a considerable distance has been reached. Atmospheric variables such as wind and temperature inversions have a greater effect on attenuation"*. In this analysis we will estimate effects on nearby properties using the attenuation equation from the Blaster's Handbook, keeping in mind the likelihood that, at a distance, blast noise can vary substantially from the predicted levels.

The blasting plan proposed for the Las Pilitas Quarry differs in an important respect from the blast monitored at the Hanson Quarry. This difference forms project mitigation and requires some explanation. The Las Pilitas quarry will use electronic delay detonators rather than the pyrotechnic detonators used at the Hanson Quarry. With the pyrotechnic system there is a detonator atop each hole. When the firing signal is received via a detonating cord (shock tube) the surface detonator fires a charge after a controlled delay. The shot of detonator fires the main charge. At each hole there are actually two explosions. The first one is the detonator, producing a sharp report, like a rifle shot. The following explosion is the deeper rumble that comes with the ignition of the main charge.

Figure 8 is a graphic showing the time history of the Hanson Quarry blast. The blue tinted portion shows the exploding detonators and the gold tinted portion shows the subsequent explosion of the main charges. The sound trails off with the echoes and as displaced rock falls to the quarry floor. Figure 8 also shows the frequency spectrum for the two different noise events; the blue is for the detonators and the gold for the main charges. The green tinted area indicates the portion of the frequency spectrum most important to humans (based on the A-weighted scale). People are more sensitive to sound at the frequencies represented by the detonators than they are to sounds from the main charge.

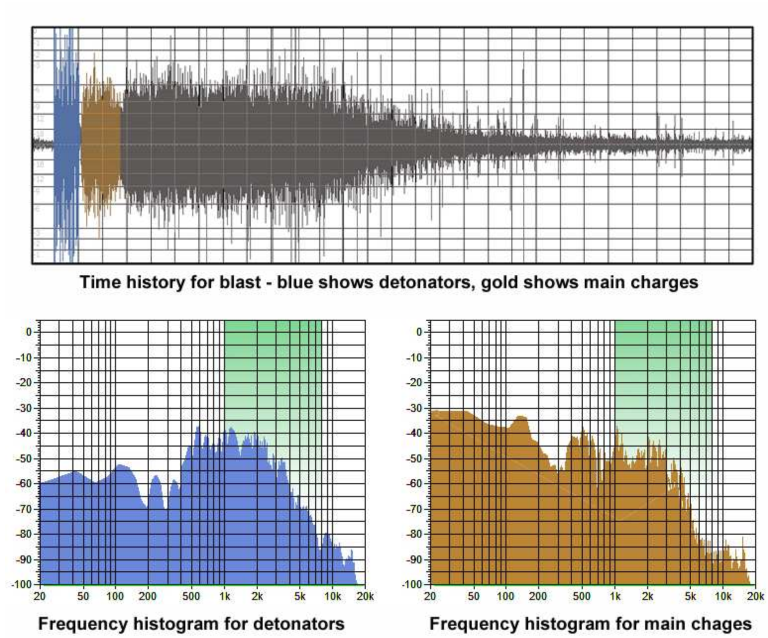


Figure 8: Time and frequency histograms

With the electronic delays the only the sound is that produced by the buried main charges is heard and there are no surface explosions. The sudden percussive crack of the detonators is absent. Eliminating the detonator component from the blast plan for the Las Pilitas Quarry has a significant mitigating effect. Electronic delays have an additional advantage in that the microsecond timing is more precise than that of the pyrotechnic detonators. With variations in pyrotechnic timing it is possible for there to be an unintended simultaneous firing of charges magnifying the acoustic output of the blast.

Blast Noise

The General Blast Plan prepared for the Las Pilitas quarry proposes limiting the individual timed charge units to 263 pounds. There may be dual charges of this weight so the blast calculations are based on a charge weight of 526 pounds. As described previously, charges are sequenced over a period of several seconds to minimize the total impacts. The table below shows how the levels of blast noise vary with distance from the source. It depicts several metrics; sound pressure change in pounds per square inch (PSI), un-weighted decibels (dB(L)), and decibels that are A-weighted, (dB(A)). The calculations include no allowance for topographic shielding.

Distance	PSI	dB(L)	dB(A)
100	0.0487	144.5	109.5
500	0.0212	137.3	102.3
1000	0.0031	120.5	85.5
2000	0.0013	113.3	78.3
5000	0.0004	103.8	68.8
10000	0.0002	96.5	61.5

The closest residence is 1,699 feet away (Residence 2); more than one-quarter mile distant. The table below shows the air-overpressure and dB levels at these distances. Sounds are likely to be less than shown on the table because in most cases there is topography separating quarry operations from the residences.

Residence	Distance	PSI	dB(L)	dB(A)
1	1,920	0.0014	113.7	78.7
2	1,688	0.0016	115.1	80.1
3	1,822	0.0015	114.3	79.3
4	1,861	0.0015	114.1	79.1
5	1,920	0.0014	113.7	78.7

Noise Analysis and Projections – Quarry Activities

This section of the report describes the existing and two "worst case" phases of quarrying operations. It also includes a section focused on noise from blasting operations and an examination of traffic noise increases in Santa Margarita and at a nearby residence. In a following section the predicted noise levels will be evaluated against county standards.

The Existing Noise Setting

Figure 9 depicts the existing noise exposure in the project area as represented by the Leq metric. The sources that were included are contributions of noise from operations at the Hanson quarry and traffic on Highway 58. Several noise sources were not evaluated in the mapping: railroad noise and traffic on El Camino Real[13]. For the modeling, four sound sources were placed on the quarry sited in the vicinity of the asphalt plant, the recycling facility, the jaws crusher and excavation work on the highest bench. Each was assumed to produce noise consistent with the measured levels in Table 1. The non-inclusion of additional sources has little effect on the overall noise production because the noisiest sources are modeled and, in decibel arithmetic, the lesser noise sources have little influence on the total. It also is noted that the other noise producing operations were present when the noise readings of specific operations were made and the nearby activities would have influenced the measurements. The roadway noise estimates shown in the diagram were developed from traffic counts for existing traffic that were collected for the project traffic study. The metric represents A-weighted Leq.

[13] Predicted noise exposure from these sources is mapped in the Noise Element of the County's General Plan, Section Map S-36.

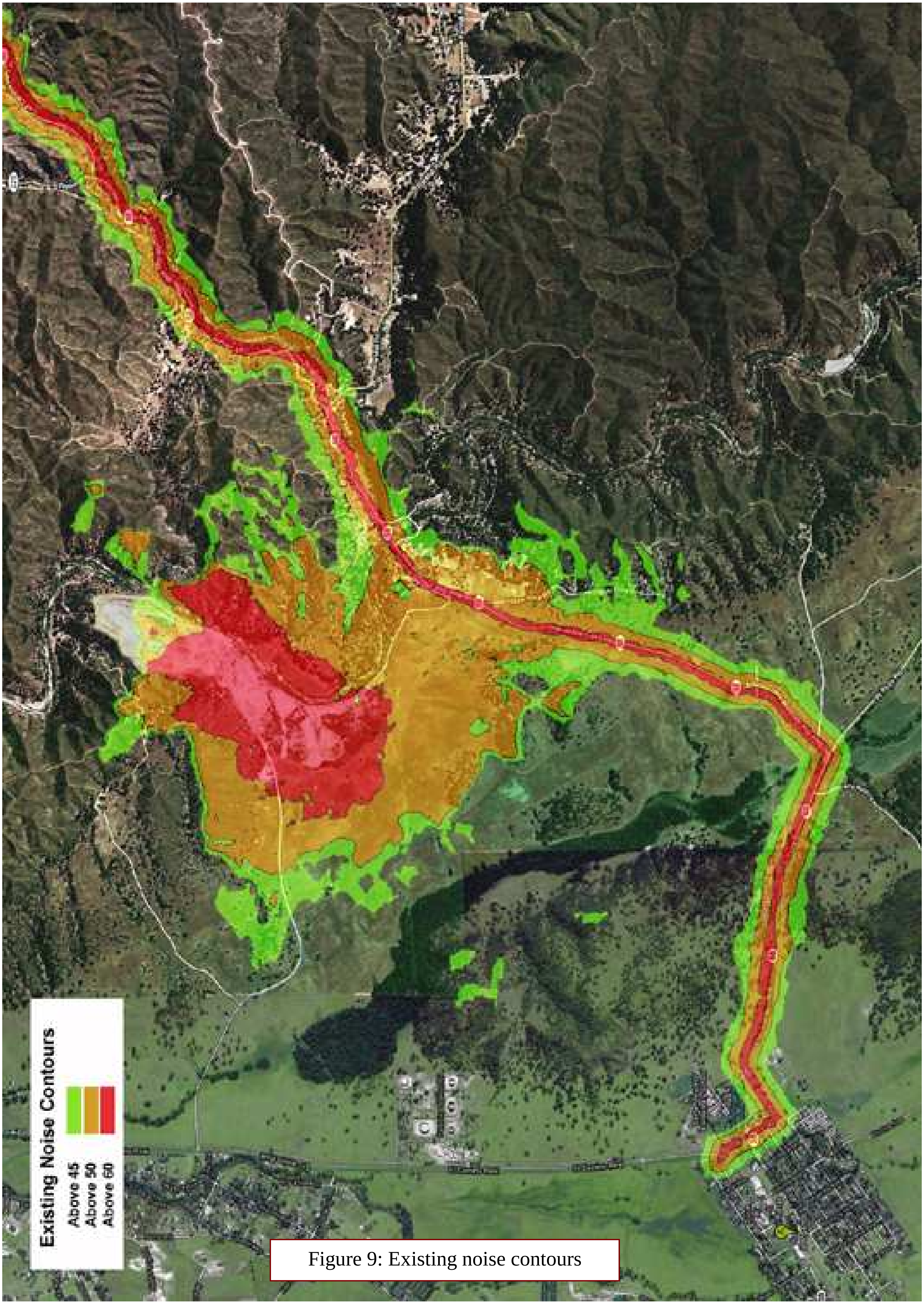


Figure 9: Existing noise contours

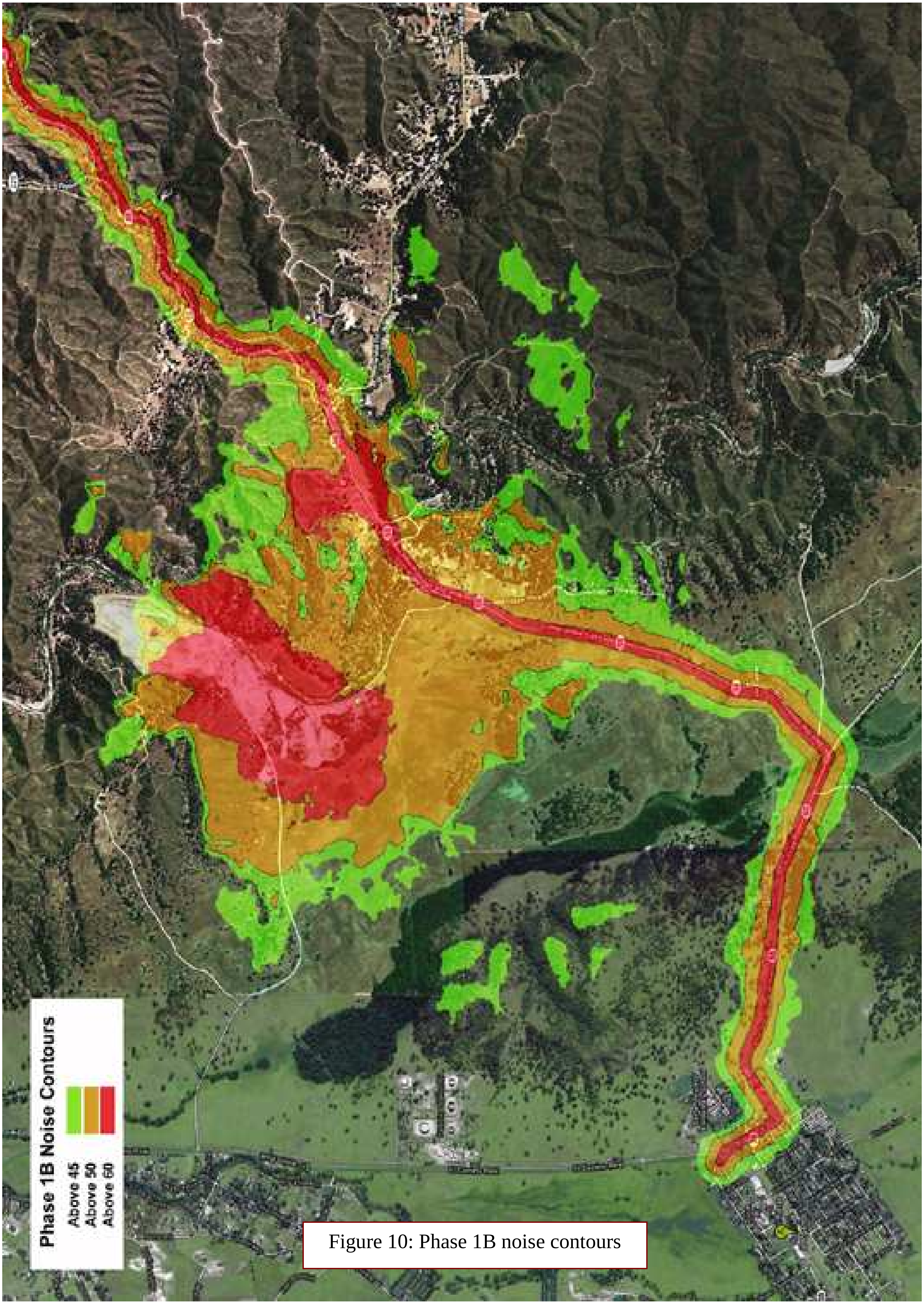


Figure 10: Phase 1B noise contours

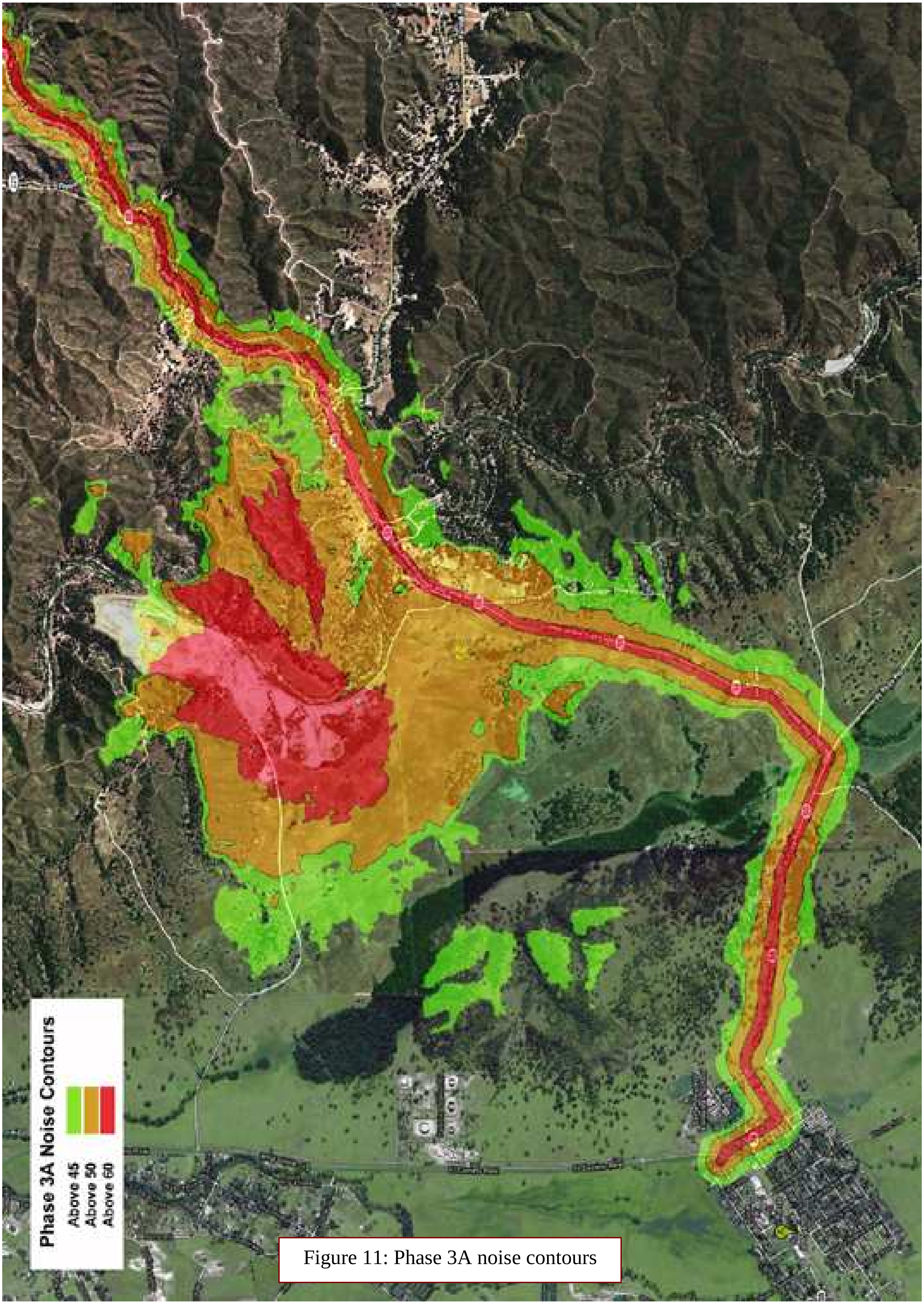


Figure 11: Phase 3A noise contours

The map area highlighted in red depicts noise levels above 60 dB level. The orange area shows the limits of the 50 dB exposure area. This corresponds to the maximum daytime sound level permitted by the County standards depicted in Table 1. The green area shows the limits of the 45 dB exposure area corresponding to the permitted night-time level.

Short term noise readings were taken at several distances from the Hanson quarry to verify the accuracy of the off-site noise predictions.

The Noise Associated with Phase 1B of Quarry Operations

Phase 1B represents a "worst case" situation.. Figure 10 shows a mapping of present background sound levels with the addition of sounds associated with Phase 1B of operations. In making the estimate, two sound sources were placed at the highest bench with noise production levels corresponding to extraction and rock crushing operations measured at the Hanson quarry. In reality, the crushing activity will be taking place on the floor of the quarry where it will be shielded by the topography, so this represents a conservative assumption. The square symbols on the phasing map, Figure 4, show the positioning of the quarry noise sources. The noise from peak hour truck traffic has been added to the segment of Highway 58 from the project site to El Camino Real. The FHWA model was used to assess the added truck traffic. The color legend is the same as in Figure 9, with red showing areas above 60 dB, orange showing areas exceeding 50 dB and green showing the limits of the 45 dB exposure.

The Noise Associated with Phase 3A of Quarry Operations

Figure 11 shows the present background sound levels with the sounds from activities during Phase 3A of quarry operations. Work has moved north of the existing ridge line. Again, two sound sources corresponding to loading and crushing activities were placed at the level of the highest bench as indicated by the square symbols on the phasing map. Truck traffic on Highway 58 was similarly increased to levels matching those for the other work phases. The color legend is the same as for the other figures.

Change in Noise Levels

The blue circles on Figure 12 show the locations of the closest residences to the Las Pilitas Quarry operation[14]. It is apparent from inspection of the previous figures, that the most significant impacts on the project's neighbors take place during Phase 1B. While the later, Phase 3A, operation involves a similar area of impact, there are no nearby homes

[14] There are two residences that are closer to the site but these are part of the quarry property.

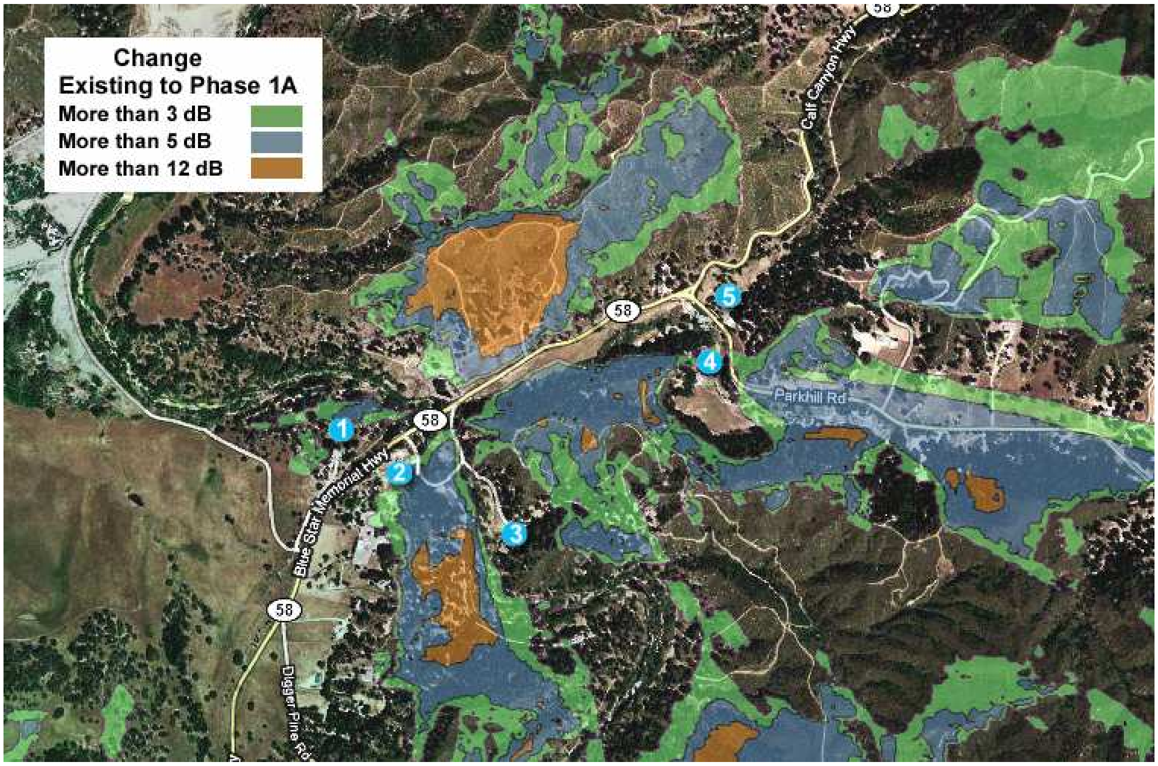


Figure 12: Change in sound level showing the closest residences

that are affected. The contour shadings on the map show the decibel change from existing to future conditions. In this diagram, the green color code shows changes in excess of 3 dB, the blue area changes greater than 5 and the orange shaded area shows the changes exceeding 12 decibels. (These numbers reflect standards used by various agencies for evaluating the significance of changes in noise levels).

As expected there is substantial change in the immediate vicinity of the quarry but changes in the sound environment are also experienced in more distant locations. Areas that are very quiet will become less quiet. But, much of this area is rugged land where there are no residences. The residences closest to Highway 58 have a relatively minor increase in noise because they are presently exposed to traffic noise and the increment of change is less. The present and the future noise exposure levels for the closest residences are shown in Table 4

Residences	1	2	3	4	5
Existing Level	54	50	40	44	51
Phase 1B Level	58	57	43	46	53
Difference	4	7	3	2	2

Table 4: Changes in noise exposure for closest residences.

Roadway Noise in Santa Margarita

Residents of Santa Margarita are concerned about how additional truck traffic could impact their community. The traffic impact study for the project says that, during the morning peak hour of traffic, there will be an additional 26 trips by heavy trucks and 4 worker trips on the segment of roadway along Estrada Avenue (Highway 58) in the vicinity of H Street. In assessing traffic impacts, the consultant made counts of present day traffic and projected future traffic for existing levels plus the project, and the year 2030 without and with the project.

The count numbers and the traffic volume forecasts have been used to estimate changes in traffic noise levels using the FHWA's traffic noise model. This model requires estimates of traffic mix; autos, medium trucks, and heavy trucks. The traffic consultant counted the percentage of heavy trucks in the traffic mix. The count of medium trucks was based on truck count information on Highway 58 provided by Caltrans and on our own observation. All traffic was assumed to be traveling at the posted, in town speed of 35 mph. The surface between the road and the receiver was assumed to be "soft" or grass like.

Table 5 shows the predicted noise levels during the peak hour. The metric is Leq but, as noted previously, the peak hour value approximates the 24 hour metric, DNL.

	Peak Hour Volumes			Leq at Various Distances from Centerline				
	Autos	Medium Trucks	Heavy Trucks	50 ft.	100 ft.	200 ft.	400 ft.	980 ft.[15]
Existing	418	63	21	64	58	52	47	40
Existing Plus Project	422	63	47	65	59	54	49	42
Year 2030 No Project	618	93	31	65	60	54	49	42
Year 2030 With Project	622	93	57	66	61	55	50	44

Table 5: Present and future traffic noise levels in Santa Margarita (Highway 58)

Truck traffic increases are also a concern to one of the residents close to the site (Residence 1 on Figure 12). This residence is near Highway 58 just west of the bridge over the Salinas River. At this location, Highway 58 is on a grade and the question was assessing the noise impact of gravel trucks accelerating from the project driveway located downhill of the bridge and the house. It was arranged to have a loaded gravel truck make several runs along this section of road, beginning from a stopped position at the driveway location. Noise levels were monitored at a roadside location near the west end of the bridge and from atop a berm parallel with the location of the residence. Additionally, several measurements were taken of gravel trucks traveling on an upgrade section of the road that connects Hanson Quarry with El Camino Real.

[15] The 980 foot distance reflects a limit on the model set by the FHWA. This is considered to be the maximum distance where estimates using the model are demonstrably accurate. The model can be used to estimate sounds at greater distances but with less reliability.

The results of the measurement are shown in Table 6, normalized to 160 feet which is the distance from the centerline of Highway 58 to the residence.

	Distance to C/L	East Bound	West Bound	@160 ft. Eastbound	@160 ft. Westbound
West end of bridge 1	65	73.2	75.5	65.4	67.7
West end of bridge 2	65	71.8	75.2	64.0	67.4
West end of bridge 3	65	72.3	79	64.5	71.2
Parallel to residence	63	71.5	72.2	63.4	64.1
Hanson Quarry road	70	70.6	73.2	63.4	66.0
(all different trucks)	70		76.9		69.7
	70		76.7		69.5
Motorcycle @ bridge	65	73		65.2	
Speeding car @ bridge	65	77		69.2	

Table 6: Truck and roadway noise at residence

The truck levels shown in the table are quite similar to the "average heavy truck" level that is incorporated into the FHWA noise prediction model. At the 160 foot distance the truck noise predicted by the model is 72 dB. The FHWA model can be used to estimate the hourly Leq for present and future traffic conditions. Using flow and mix data from Table 5, the Leq estimate for Existing traffic experienced at the 160 foot distance is 56.8 dB. For Existing plus Project conditions it is 58.4 dB, a 1.6 dB increase. The numbers in the table are all from measurement locations with a direct line of site between the source and the monitoring position. A berm has been constructed between "Residence 1" and the roadway that would lessen roadway noise exposure by 6 to 8 dB.

The occupants of "Residence 1" specifically mentioned noise coming from the bridge crossing. There is a substantial gap in the expansion joints at either end of the bridge as well as a section of the bridge with transverse grooving. Both of these create added noise. When a vehicle crosses the expansion joints there are two decided "pops" and the rough grooving creates a rumble like the safety grooving at the edges of a freeway. These sudden sounds are annoying but they produce less noise than the passby sounds of vehicles.

CEQA Concerns

The California Environmental Quality Act (CEQA) includes a list of questions that are to be used to gauge the significance of noise impacts. The questions asked are whether the project results in:

1. ***Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?***
2. *Exposure of persons to or generation of excessive ground borne vibration or ground borne noise levels?*

3. ***A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?***
4. ***A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?***
5. *For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?*
6. *For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?*

The questions highlighted in bold faced type are addressed in this report. Question 2 has to do with ground vibration issues that are the topic of a separate study. The last two questions do not apply to this project since there is no public airport in the area.

Response to the several questions requires; 1) a review of County and other applicable agency standards, 2) a description of the present ambient noise levels, 3) estimates of future noise levels and 4) a comparison of current and future noise levels to existing levels on both a temporary and a permanent basis. CEQA also requires an evaluation of project alternatives, including “no project”.

The first of the CEQA questions asks whether the project conforms to general plan standards. The county’s General Plan and associated Land Use Ordinance standards limiting noise production were given in Table 2. However, as noted, quarries are listed as a permitted use in agricultural and opens space lands and agricultural activities are exempted from noise regulation. Along the same lines, the proposed quarry is within an area with an “Extractive Overlay” that has the purpose of protecting, “significant resource extraction . . . areas from encroachment by incompatible land uses that could hinder resource extraction . . . “

The Land Use Ordinance states that noise levels from activities are to be evaluated at the property line of adjoining uses. But, this is not well-suited to rural residential development and rolling terrain. At the source side, there are problems in pinpointing the source of quarry events since these are dispersed over multiple locations and the intensity of activities changes with time. At the receiver end there can be problems if the property line is shielded by topography and the residence is not. The County’s regulations related to winery events and locations of composting facilities include provisions that measure setback distance to neighboring residential structures as well as property lines. This seems a reasonable perspective to adopt in this analysis.

County Standards: Quarry Activities

The County’s standard for daytime noise measured at neighboring properties is 50 dB day and 45 dB night. An examination of Table 4 and Figures 9-11 shows that the project has a mixed impact on nearby properties based on these standards. Two of the residences (1 and 5) are already exposed to traffic noise that exceeds the County standard of 50 dB .

Property 2 is one dB below the standard and the project will raise its noise level to above the standard. While noise increases at two other residences (3 and 4) the current plus project levels do not exceed standards either for day or night periods.

County Standards: Blast Noise

The county's limit for impulsive noise is 65 dBA during the day and 60 at night. Even with an allowance for topographic shielding it is apparent that blasting activities will be clearly audible at the closest residences and will exceed the County's day/night standard.

County Standards: Traffic Noise – Santa Margarita

The County's compatibility chart for exposure to transportation noise indicates that residential land uses are generally compatible with levels that are less than 60 decibels and "conditionally acceptable" up to 70 decibels[16]. The chart was prepared as a guide for determining land where residential land uses are appropriate including land where residences require noise control features to reduce noise to acceptable levels.

There are a several residences in Santa Margarita that are 50 feet from the centerline of Highway 58. As indicated in Table 5, the level of traffic noise at the front façade of these homes currently exceeds the recommended standard. (One homeowner has erected a wall to serve as a noise barrier). A comparison of present and future conditions with the project in place indicates that the incremental change is about 1 or 2 decibels when project traffic is layered onto current traffic. The acoustical difference between future traffic projected for Santa Margarita and future traffic with project traffic added is around 1 decibel.

For the residence to the west of the bridge over the Salinas River the peak hour Leq level was estimated to be 56.8. With Phase 1A operations the predicted level was 58.4. Both estimates are within the "conditionally acceptable" category and the 1.6 dB increase does not change the classification. The berm that has been erected to reduce noise exposure is similar to what might be recommended as a condition if a residence were to be proposed for this site and seeking planning approvals.

The Question of Significance and the Standards of Other Agencies

The Governor's Office of Planning and Research (OPR) has published guidelines for the preparation of the Noise Elements that are a required component of a local General Plan. The planning guidelines draw on recommendations by the California Office of Noise Control. In urban areas most noise is produced by transportation noise sources. The County's compatibility standards are patterned after those recommended for California (Appendix D).

Several of the CEQA questions raise the issue of what constitutes a "significant" change in the noise environment. Apart from the numeric levels set in the County's noise

[16] Appendix D

regulations, there are no specific guidelines or thresholds set either by CEQA or the county as to what changes are to be considered “significant”.

Multiple agencies and organizations have proposed standards for evaluating the significance of noise impacts but there is no clear consensus of what the standards should be.

Something resembling the following text is standard for many environmental impact reports - this version is taken from an environmental analysis for a drilling project in San Luis Obispo County[17]:

> ***1 dBA increase*** *in sound level is perceived as a barely audible increase by most people and is usually not judged to be significant.*
> ***3 dBA increase*** *in sound level, is clearly perceived and is a clearly audible increase, considered to be a “significant” impact under some planning standards and threshold evaluations.*
> ***10 dBA increase*** *in sound level, is perceived as a “doubling” of sound levels.*

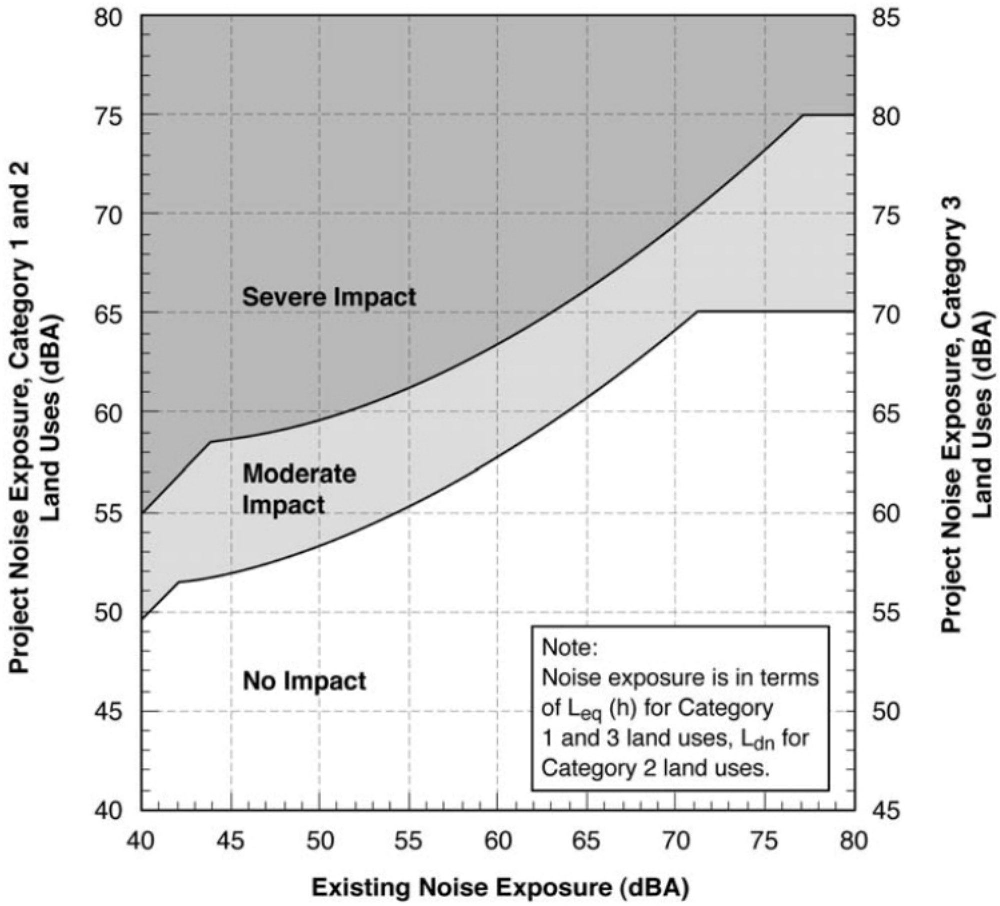
The significance assigned to the 3 dBA increase comes from laboratory experiments where people are provided with several tones and asked to distinguish when they detect a change. It might be applicable to evaluating sound sources that produce a constant level of output but it is not as relevant to variable environmental noise.

There is evidence that the annoyance associated with changes in sound exposure is related to the current level of ambient noise. In evaluating changes in traffic noise, the Washington State Department of Transportation considers an increase in traffic noise of more than 10 decibels over existing sound levels to be a noise impact for which mitigation is appropriate. The FHWA standard for determining if an increase in traffic noise increases warrants construction of a sound wall is a change of 12 dB.

The Federal Interagency Committee on Noise (FICON) has sponsored studies intended to promote consistency of standards among these federal agencies.[18] . The Committee has suggested a sliding scale where the significance of a decibel shift is linked to current noise levels. When the present noise level is at 55 dB level (for DNL), a change of 5 dB or more is considered significant. Where the existing level rises to 60 the significance threshold becomes 3 dB. Above 65 dB DNL a change of 1.5 dB is considered significant. The idea is that people become increasingly sensitive to changes in noise level when levels are already high and they are less sensitive to change at lesser levels of background noise. This conclusion is based on community surveys that show that the rate of reported noise annoyance increases as noise intensifies.

[17] Sound Level Assessment II, Huasna Valley, David Lord Acoustic Consulting, March 19, 2008.
[18] This includes the Department of Defense (Air Force, Navy, and Army), the Environmental Protection Agency, the Department of Transportation, the Department of Housing and Urban Development, and the Department of Veterans Affairs.

The Federal Transit Administration has adopted policies that similarly relate the severity of impact to the change from present noise levels. Figure 13 is taken from the agency's noise assessment manual. The scale on the left side of the table applies to the residential land use category. It suggests that, with an ambient background level of 40 dB, an additional noise begins to have a moderate impact when it adds 10 dB to background and becomes severe when the addition exceeds 15 dB.



Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006

Figure 13: FTA standards for assessing significance of increased noise.

Table 4 indicated that for the residences closest to the quarry, the change in dB exposure ranges from 1 to 7 DB. Under the FICAN standards this change would be considered less than significant for all but one of the properties. The FICAN standard is sometimes represented by a sliding scale format and with this alternate formulation the remaining property would move to the less than significant classification. By the FTA standard, the project would be said to have "moderate impact" on two of the residences and "no impact" on the remaining three.

There is a contrary argument to the FICON and FTA criteria. This relates to the value people place on maintaining the "natural soundscape". Studies by the National Park Service had indicated that people that come to enjoy an outdoor experience are quite bothered by even the smallest intrusion of man made sound. As noted, people can detect individual specific sound sources even when they are less than background levels. As the noted psychoacoustician Hugo Fastel has commented on the fact that, “people can be bothered by sounds if they hear them”.

The absence of definitive County or CEQA standards for gauging the significance of increases in noise is probably related to the diversity of ideas of what constitutes a significant change. CEQA recommends that local agencies develop their own threshold criteria but only a few cities and counties have done this. The environmental staff at Caltrans is quite careful to explain that their standards employ the word “substantial” in describing noise impacts and that the “significance” of any noise impact evaluated under CEQA is a determination made by local agencies.

Caltrans has developed threshold guidelines related to vibration and noise from highway construction activity and blasting. The Caltrans standards include a discussion of the levels of annoyance associated with changes in air-overpressure[19]

	Unweighted	**A-weighted**
Barely to distinctly perceptible	50–70	15–35
Distinctly to strongly perceptible	70–90	35–55
Strongly perceptible to mildly unpleasant	90–120	55–85
Mildly to distinctly unpleasant	120–140	85–105
Distinctly unpleasant to intolerable	140–170	105–135

Table 7: Caltrans guidelines for blast noise

In Table 7 the Caltrans analysis is expressed in the form of un-weighted and A-weighted decibels. The levels of blast noise predicted for the closest houses are in the 79 to 80 decibel range putting them in the realm of sounds that are “strongly perceptible to mildly unpleasant”.

Recommended Mitigations

The noise evaluations and forecasts presented above do not include specific actions to mitigate the noise produced by the project. This section of the report describes actions that may be taken to lessen noise impacts.

Quarry activities

The Las Pilitas quarry project was designed to retain the natural ridgelines on either side of the quarry area (see Figure 4). As work progresses, the excavation into the hillside will deepen, and with this topographic change, provide an opportunity to locate noise producing equipment in locations that are shielded from neighboring property. At the conclusion of the first phase of construction, the floor of the quarry is fifty feet lower than the present elevation at the southwest entry to the quarry. It is recommended that

[19] Transportation- and Construction-Induced Vibration Guidance Manual**,** California Department of Transportation, 2004

noise producing equipment such as crushers, screening equipment and recycling be sited as close as practical to the southwest face of the quarry. Such positioning can substantially block the levels of noise experienced to the west of the site where the most noise impacted residences are located. Similarly, stored materials can serve as noise barriers around noise producing equipment. It is recommended that the Quarry Plan include recommendations for the location of equipment and stored materials to reduce off site noise impacts. It is also recommended that noise production be considered in the selection of quarry equipment.

The backup signals produced by trucks and loaders are designed to be insistently audible. However, there are newer models of beepers that include proximity sensors or variable level controls related to ambient noise. It is recommended that equipment be outfitted with warning beepers that are effective in protecting workers but that produce no more than the necessary amount of noise.

The quarry supervisor should act as project noise manager and if a complaint is received the noise manager should see that it is formally recorded, investigated, and responded to both in writing and, where possible, through corrective action.

Blasting

While blasting produces levels of noise that may be experienced as “strongly perceptible to mildly unpleasant”, there are ways of lessening annoyance. The 2004 Caltrans manual on transportation construction noise includes a section on how to deal constructively with the potential disruption from blasting. The recommendations in the manual are appropriate as mitigations for the Las Pilitas project. These include sponsorship of pre-project meetings with residents who may be impacted or concerned about blasting. At such a meeting the project blast plan would be explained. The warning signals that accompany blasting would be explained so that residents might anticipate the blast and not be startled. People that would like to receive notification of proposed blasting could sign up to receive information. The Caltrans plan even includes a recommendation that people be invited to witness the blasting if they choose to do so. As is that case with other noise issues, there should be a designated contact person at the quarry to deal with issues. The recording, investigation and reporting would be part of the overall noise management plan.

The recommendations for limitation of charge weight and the stemming depth requirements in the quarry’s General Blast Plan should be made conditions of approval. Electronic delay detonators should be used to eliminate the surface level explosions. Blasting is limited to the hours of 7 AM to 6 PM.

Trucks

Mufflers on trucks should be in good condition. The scale house should post a notice that trucks that don’t have effective mufflers will not be admitted to the quarry. When problems are received by the quarry manager, or trucks are observed to have defective mufflers, notice should be given to drivers that repairs are needed in order to maintain access to the site. In measuring truck noise for this project it was noted that the truck used in our sound tests that was equipped with a well functioning exhaust system designed to AB 32 compliance was quieter than “average” trucks (Table 6).

In conclusion, with regard to the several CEQA questions:

The project will not generate noise standards that are in excess of local planning standards because quarry operations are, as permitted uses in agricultural areas, exempted from the provisions of the ordinance. Additionally, the County’s policies are protective of quarry activities in the “extractive areas” overlay zone.

If the standards are used as a guideline, different aspects of the project have different effects under the ordinance. The level of noise predicted for general operations is in excess of the 50 dB standard for daytime activity for several nearby residences (Table 4). These homes are currently exposed to noise generated by Highway 58 traffic that exceeds the standard. The County’s ordinance specifies that in cases where the ambient noise level is already above standards that the standard is to be adjusted to one decibel above ambient. The estimate of existing plus project noise level is in excess of this adjusted standard. The recommended mitigations will lessen the impact on residences west of the project site but the increase in noise level will still exceed 1 dB. The several residences that are further back from the road will experience an increase in ambient noise but not at levels in excess of the standard.

The sound from project blasting will be in excess of the County’s standards for impulsive noise. The standard is 70 Lmax daytime and the predicted levels are in the range of 78 to 80 decibels at the nearest residences (not considering topographic shielding). The blasts not frequent and the events have a duration of a few seconds. The proposed community involvement and notification effort can lessen the startle factor and associated annoyance.

The added truck traffic in Santa Margarita increases noise levels but the changes are not substantial, on the order of one to two decibels Leq/Ldn. This is not considered significant.

The project will bring about a permanent increase in ambient noise above existing levels. The question is whether the increase is “substantial” While the County does not have threshold standards regarding the significance of changes in noise level, to standards used by several state and federal agencies suggest the project has moderate or no impact.

There will be a temporary increase in noise levels during the initial phase of construction and operation. Noise from construction activities is expected for any project and is exempt from County regulation as long as the work takes place between 7 AM and 9 PM weekdays and 8 AM to 6 PM on weekends. The construction noise is therefore, not considered significant. The blasting activity will produce “periodic” increases in noise that are substantial.

Appendix A

DEFINITIONS

A-Weighted Level: The sound level in decibels as measured on a sound level meter using the A-weighted network. The A-weighting deemphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and give good correlation with subjective reactions to noise.

Ambient Noise: The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

CNEL: Community Noise Equivalent Level. The average equivalent A-weighted sound level during a 24hour day, obtained after addition of five decibels to sound levels in the evening from 7 p.m. to 10 p.m. and after addition of 10 decibels to sound levels in the night from 10 p.m. to 7 a.m.

Decibel, dB: A unit of measurement 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).

Intrusive Noise: 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 noise level.

L10: The A-weighted sound level exceeded ten percent of the sample time. Similarly, L50, L90 etc.

Ldn: DayNight Average Level. The average equivalent A-weighted sound level during a 24hour day, obtained after addition of 10 decibels to sound levels in the night after 10 p.m. and before 7 a.m.

Leq: Equivalent energy level. The sound level corresponding to a steady state sound level containing the same total energy as a time varying signal over a given sample period. Leq is typically computed over 1, 8, and 24hour sample periods.

Noise Contours: Lines drawn about a noise source indicating equal levels of noise exposure. CNEL and Ldn are metrics utilized to describe annoyance due to noise and to establish land use planning criteria for noise.

Trip: In traffic planning a “trip” is counted with each origin to destination vehicle movement. A drive to work and a drive back home would count as two trips.

Note: CNEL and Ldn represent daily levels of noise exposure averaged on an annual or daily basis, while Leq represents the equivalent energy noise exposure for a shorter time period, typically one hour.

Appendix B

TRAFFIC NOISE

The vehicle movement data used in the estimating of traffic density and composition are taken from the project's traffic analysis. Vehicle and turning movement counts were made at several intersections in Santa Margarita. The noise study focused on the segment of Highway 58 (Estrada Avenue) between El Camino Real and H Street where traffic is greatest. The project traffic study determined that the heaviest hours of quarry generated traffic would be in the morning as workers drove to the site and trucks were loaded with gravel for delivery to construction sites.

Heavy trucks have a very significant influence on traffic noise production and the assumptions made about the mix of vehicles are important. The traffic count data for intersections included the percentage of heavy trucks for each movement and these numbers were used in the noise study. However, the counts did not specifically identify light and medium trucks. Caltrans publishes detailed estimates of trucks of different sizes on roadway segments. The closest relevant count location is at the intersection of Highways 58 and 229. In the Caltrans counts the heavy trucks averaged 24% of total trucks. Our noise study accepted this 1:3 ratio as a way of estimating the medium truck volumes.

The table shows how the counts made by the traffic study were translated into inputs for the noise analysis.

	Total	% Heavy Trucks	Heavy Trucks	Medium Trucks at 3X Heavy	Autos as Remainder
East Bound	196	6	12	36	148
West Bound	306	3	9	27	270
Total	**502**		**21**	**63**	**418**

We made an independent count of the vehicle mix at Highway 58 and El Camino Real over a 20 minute period starting at 4:30 PM on a weekday. This count was 4% heavy trucks, 11% medium trucks and. 85% Autos. The counts shown in the table sum to 4% heavy trucks, 12% medium trucks and 84% auto. The conformance of the counts suggests that the table depicts a reasonable representation of traffic mix.

According to the traffic noise study, the project contributions an added 26 heavy trucks and 4 autos to the present and projected future noise levels.

Noise from traffic on El Camino Real and H Streets was not considered.

Appendix C

ESTIMATING QUARRY NOISE

The NMSim noise forecasting model developed by Wyle Laboratories was used to develop the numeric and graphic estimates of noise exposure. The noise associated with each source was modeled separately and the estimates summed logarithmically. NMPlot software was used for the math calculations and the mapping.

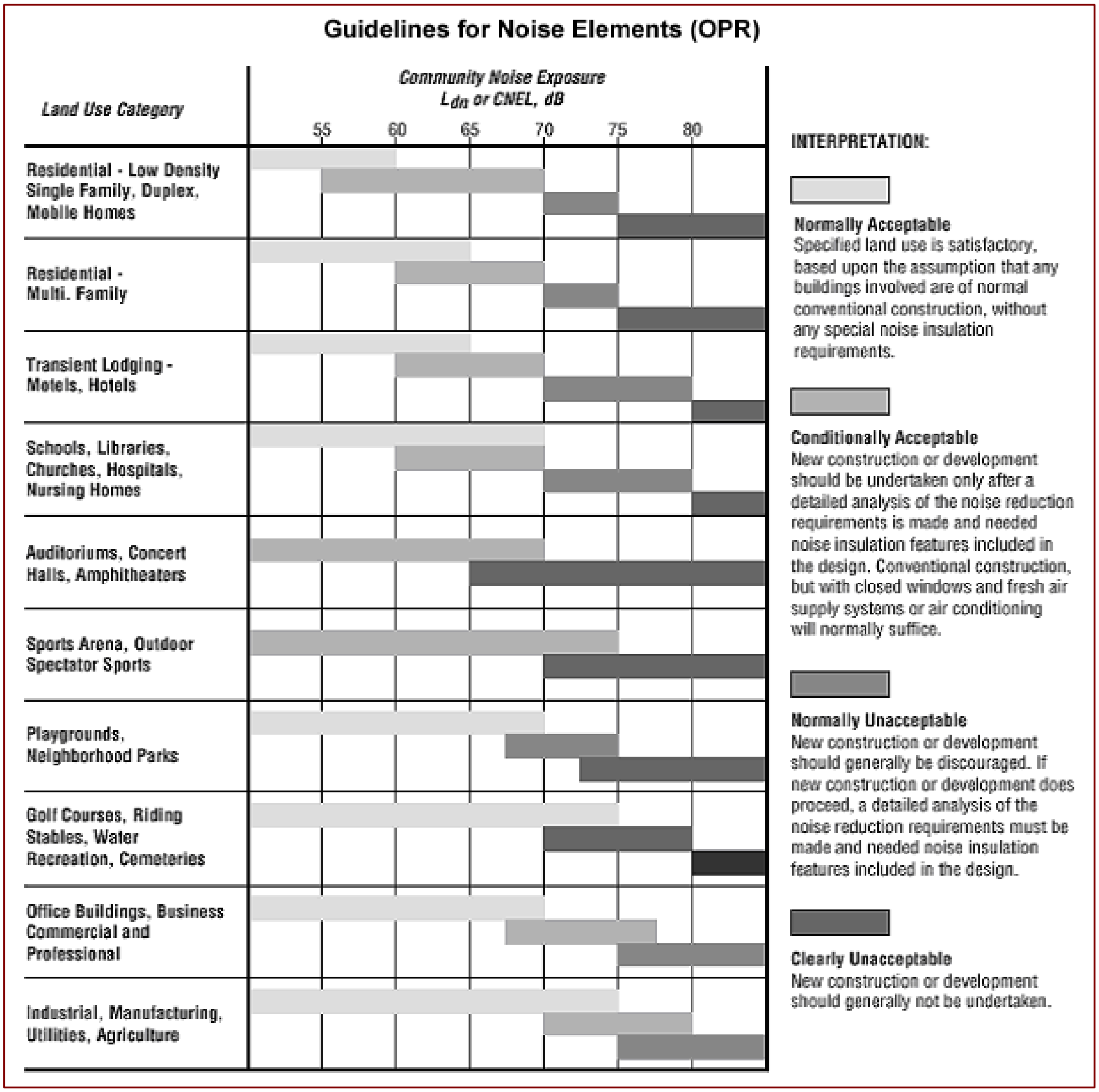
Topographic information was taken from a USGS data set with a mapping resolution of 30 meters (about a hundred feet). Sources were positioned from aerial imagery.

NMSim includes a capacity to adjust distance attenuation factors. Sound attenuation for roadway noise was adjusted to match the noise propagation formulation used in the FHWA's Traffic Noise Model. This approximates a 3.5 dB change with each doubling of distance. The propagation factors for the quarry noise sources were different, approximating a 6 dB doubling factor. The quarry sources were further calibrated to fit them to levels recorded at both the close in locations described in Table 2 but also to levels recorded along Highway 58 at a 4,000 foot distance.

The estimates of change from present to future conditions were made by comparing point estimates for specific locations on the digital grid maps representing existing and future conditions.

Appendix D

CALIFORNIA STANDARDS FOR TRANSPORTATION NOISE



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