ATTACHMENT 13

BRSP NOISE ASSESSMENT

Environmental Noise Assessment

Bickford Ranch

Placer County, California

Job # 2014-136

Prepared For:

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INTRODUCTION

This report has been prepared to address the noise impacts due to and upon the proposed Bickford Ranch development located approximately four miles north of Interstate 80 and south of State Route 193 (SR 193), between Lincoln and Penryn in Placer County, California. The western boundary of the site is Sierra College Boulevard between SR 193 on the north to English Colony Way on the south.

PROJECT OVERVIEW

The proposed project would consist of 1,927.9-acres, consisting of Residential, Public Facilities, and open space and recreation uses. A total of 1,890 residential units are proposed. Figure 1 shows the proposed site plan.

Bickford Ranch

Figure 1: Project Land Use Map

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ENVIRONMENTAL SETTING

Background Information on Noise and Vibration

Fundamentals of Acoustics

Acoustics is the science of sound. Sound may be thought of as mechanical energy of a vibrating object transmitted by pressure waves through a medium to human (or animal) ears. If the pressure variations occur frequently enough (at least 20 times per second), then they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second or Hertz (Hz).

Noise is a subjective reaction to different types of sounds. Noise is typically defined as (airborne) sound that is loud, unpleasant, unexpected or undesired, and may therefore be classified as a more specific group of sounds. Perceptions of sound and noise are highly subjective from person to person.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals), as a point of reference, defined as 0 dB. Other sound pressures are then compared to this reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB, and changes in levels (dB) correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by A-weighted sound levels. There is a strong correlation between A-weighted sound levels (expressed as dBA) and the way the human ear perceives sound. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels, but are expressed as dB, unless otherwise noted.

The decibel scale is logarithmic, not linear. In other words, two sound levels 10 dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted, an increase of 10 dBA is generally perceived as a doubling in loudness. For example, a 70 dBA sound is half as loud as an 80 dBA sound, and twice as loud as a 60 dBA sound.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}), which corresponds to a steady-state A weighted sound level containing the same total energy as a time varying signal over a given time period (usually one hour). The L_{eq} is the foundation of the composite noise descriptor, L_{dn}, and shows very good correlation with community response to noise.

The day/night average level (L_{dn}) is based upon the average noise level over a 24-hour day, with a +10 decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment.

Table 1 lists several examples of the noise levels associated with common situations. Appendix A provides a summary of acoustical terms used in this report.

Table 1: Typical Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	--110--	Rock Band
Jet Fly-over at 300 m (1,000 ft)	--100--	
Gas Lawn Mower at 1 m (3 ft)	--90--	
Diesel Truck at 15 m (50 ft), at 80 km/hr (50 mph)	--80--	Food Blender at 1 m (3 ft) Garbage Disposal at 1 m (3 ft)
Noisy Urban Area, Daytime Gas Lawn Mower, 30 m (100 ft)	--70--	Vacuum Cleaner at 3 m (10 ft)
Commercial Area Heavy Traffic at 90 m (300 ft)	--60--	Normal Speech at 1 m (3 ft)
Quiet Urban Daytime	--50--	Large Business Office Dishwasher in Next Room
Quiet Urban Nighttime	--40--	Theater, Large Conference Room (Background)
Quiet Suburban Nighttime	--30--	Library
Quiet Rural Nighttime	--20--	Bedroom at Night, Concert Hall (Background)
	--10--	Broadcast/Recording Studio
Lowest Threshold of Human Hearing	--0--	Lowest Threshold of Human Hearing
Source: Caltrans, Technical Noise Supplement, Traffic Noise Analysis Protocol. November 2009.		

Effects of Noise on People

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

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as hearing loss or sudden startling

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience noise in the last category. There is no completely satisfactory way to measure the subjective effects of noise or the corresponding reactions of annoyance and dissatisfaction. A wide variation in individual thresholds of annoyance exists and different tolerances to noise tend to develop based on an individual's past experiences with noise.

Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the so-called ambient noise level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it.

With regard to increases in A-weighted noise level, the following relationships occur:

- Except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived;
- Outside of the laboratory, a 3 dBA change is considered a just-perceivable difference;
- A change in level of at least 5 dBA is required before any noticeable change in human response would be expected; and
- A 10 dBA change is subjectively heard as approximately a doubling in loudness, and can cause an adverse response.

Stationary point sources of noise – including stationary mobile sources such as idling vehicles – attenuate (lessen) at a rate of approximately 6 dB per doubling of distance from the source, depending on environmental conditions (i.e. atmospheric conditions and either vegetative or manufactured noise barriers, etc.). Widely distributed noises, such as a large industrial facility spread over many acres, or a street with moving vehicles, would typically attenuate at a lower rate.

Existing Conditions

The project site consists of gently rolling topography vegetated with oak woodland and grassland communities. Large granite boulders protrude above the site's surface soils in multiple locations throughout the site.

Sensitive Receptors

Some land uses are considered more sensitive to ambient noise levels than others. Land uses often associated with sensitive receptors generally include residences, schools, libraries, hospitals, and passive recreational areas. Sensitive noise receptors may also include threatened or endangered noise sensitive biological species, although many jurisdictions have not adopted noise standards for wildlife areas. Noise sensitive land uses are typically given special attention in order to achieve protection from excessive noise.

In the vicinity of the project site, sensitive land uses consist of rural residential uses located at varying distances around the project site.

Existing Ambient Noise Levels

To quantify existing ambient noise levels in the vicinity of the project site, j.c. brennan & associates, Inc. staff conducted short-term noise level measurements at 3 locations on the project site, and continuous 24-hour noise level measurements at three locations. See Figure 2 for noise measurement locations. The noise level measurements were conducted between Thursday May 8 and Saturday May 10, 2014. The noise level measurements were conducted to determine typical background noise levels and for comparison to the project related noise levels. Table 2 shows a summary of the noise measurement results. Appendix B provides the complete results of the 24-hr hour noise measurements.

The sound level meters were programmed to record the maximum, median, and average noise levels at each site during the survey. The maximum value, denoted L_{max}, represents the highest noise level measured. The average value, denoted L_{eq}, represents the energy average of all of the noise received by the sound level meter microphone during the monitoring period. The median value, denoted L_{50}, represents the sound level exceeded 50 percent of the time during the monitoring period.

Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters were used for the ambient noise level measurement survey. The meters were calibrated before and after use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4).

Bickford Ranch

Figure 2: Noise Monitoring Sites

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Legend:

: Continuous Noise Measurement Site

: Short Term Noise Measurement Site

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Table 2: Existing Ambient Noise Monitoring Results

Site	Location	Date - Time	Average Measured Hourly Noise Levels, Low-High (Average), dBA						
				Daytime (7:00 am - 10:00 pm)			Nighttime (10:00 pm – 7:00 am)		
			L_{dn}	L_{eq}	L_{50}	L_{max}	L_{eq}	L_{50}	L_{max}
Continuous 24-hour Noise Measurement Site									
LT-1	West side of site. 90 feet to centerline of Sierra College Blvd.	Friday 5/9/2014- (24 hour)	65	58-64 (62)	48-61 (57)	72-84 (78)	47-62 (57)	34-56 (41)	69-85 (75)
		Saturday 5/10/2014- (24 hour)	64	59-63 (62)	50-61 (57)	72-87 (77)	49-60 (56)	33-50 (41)	71-80 (74)
LT-2	LDR 22, 240 feet to centerline of UPRR	Friday 5/9/2014- (24 hour)	54	37-61 (54)	31-37 (34)	54-83 (70)	30-54 (45)	29-35 (33)	41-80 (53)
		Saturday 5/10/2014- (24 hour)	60	34-60 (54)	30-46 (36)	53-81 (69)	30-59 (54)	28-36 (31)	41-80 (62)
LT-3	East side of site, near LDR 26	Friday 5/9/2014- (24 hour)	49	41-50 (47)	35-40 (37)	59-76 (71)	31-45 (41)	30-38 (35)	46-68 (57)
		Saturday 5/10/2014- (24 hour)	53	42-57 (50)	34-52 (40)	64-78 (72)	33-50 (45)	31-39 (35)	44-76 (63)
Short-term Noise Measurement Sites							**Notes:**		
ST-1	NW corner of site at REC-01 Property	May 8, 2014 2:36 pm	NA	50	49	57	Sierra College Boulevard traffic is primary noise source, SR 193 distant, but audible.		
ST-2	At RR-02 Property	May 8, 2014 3:20 pm	NA	68	67	79	Sierra College Boulevard traffic is primary noise source.		
ST-3	At LDR-04 Property	May 8, 2014 3:56 pm	NA	52	51	59	Sierra College Boulevard traffic is primary noise source.		
Source: j.c. brennan & associates, Inc. – 2014									

Existing Roadway Noise Levels

To predict existing noise levels due to traffic, the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA RD-77-108) was used. The model is based upon the Calveno reference noise emission factors for automobiles, medium trucks, and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. The FHWA model was developed to predict hourly L_{eq} values for free-flowing traffic conditions.

Traffic volumes for existing conditions were obtained from the traffic study prepared for the project (Fehr & Peers). Truck percentages and vehicle speeds on the local area roadways were estimated from field observations.

Traffic noise levels are predicted at the sensitive receptors located at the closest typical setback distance along each project-area roadway segment. In some locations sensitive receptors may be located at distances which vary from the assumed calculation distance and may experience shielding from intervening barriers or sound walls. However, the traffic noise analysis is believed to be representative of the majority of sensitive receptors located closest to the project-area roadway segments analyzed in this report.

The actual distances to noise level contours may vary from the distances predicted by the FHWA model due to roadway curvature, grade, shielding from local topography or structures, elevated roadways, or elevated receivers. The distances reported in Table 3 are generally considered to be conservative estimates of noise exposure along the project-area roadways.

Table 3 shows the existing traffic noise levels in terms of L_{dn} at closest sensitive receptors along each roadway segment. This table also shows the distances to existing traffic noise contours. A complete listing of the FHWA Model input data is contained in Appendix C.

Table 3: Existing Noise Levels and Distances to Contours

Roadway	Segment	Exterior Noise Level, L_{dn} (dB)	Distance to Contours (feet)		
			70 dB	65 dB	60 dB
Sierra College Blvd	SR 193 to Penny Ln	62.7	57	123	264
Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	60.7	43	94	202
Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	60.6	46	99	212
Sierra College Blvd	Twelve Bridges Dr to Old Bickford Ranch Rd	61.3	46	99	214
Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	62.0	37	79	170
Sierra College Blvd	English Colony Way to King Rd	64.3	62	135	290
SR 193	Lincoln City Limits to Sierra College Blvd	64.0	52	112	242
SR 193	Sierra College Blvd to Clark Tunnel Rd	63.4	47	102	219

Notes: Distances to traffic noise contours are measured in feet from the centerlines of the roadways.
Source: FHWA-RD-77-108 with inputs from Fehr & Peers, Caltrans, and j.c. brennan & associates, Inc. 2014.

On May 8th, 2014 j.c. brennan & associates, Inc. conducted short-term noise level measurements and concurrent counts of traffic for Sierra College Boulevard on the project site. The purpose of the short-term traffic noise level measurement is to determine the accuracy of the FHWA model in describing the existing noise environment on the project site, while accounting for existing site conditions such as intervening structures, actual travel speeds, and roadway grade. Noise measurement results were compared to the FHWA model results by entering the observed traffic volume, speed, and distance as inputs to the FHWA model. Noise measurement sites are shown on Figure 2.

Instrumentation used for the measurement was a Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meter which was calibrated in the field before use with an LDL CAL200 acoustical calibrator. Table 4 shows the results of the traffic noise calibration.

Table 4: Comparison of FHWA Model to Measured Traffic

Vehicles				Speed (mph)	Dist. (Feet)*	Measured L_{eq}, dB	Modeled L_{eq}, dB**	Difference
Site	Autos	Med. Trk.	Hvy.Trk.					
Sierra College Boulevard								
ST-2	205	7	6	60	90	68 dBA	67 dBA	-1 dBA

*The noise measurement location is from the roadway centerline.
**Acoustically "soft" site assumed

Based upon the calibration results, the FHWA Model was found to accurately-predict Sierra College Boulevard traffic noise levels within 1 dB. Therefore, no offsets were added to the FHWA model for predicted future traffic noise levels for this roadway segment.

Railroad Noise Levels

Railroad activity in the project vicinity occurs on the Union Pacific Railroad (UPRR) line which parallels portions of the southern boundary of the project site.

In order to quantify noise exposure from existing train operations, a continuous (24-hour) noise level measurement survey was conducted adjacent the railroad line. The purpose of the noise level measurements was to determine the typical Sound Exposure Level (SEL) for railroad line operations, while accounting for the effects of travel speed, warning horns, and other factors which may affect noise generation. In addition, the noise level measurement equipment was programmed to identify individual train events, so that the typical number of train operations could be determined.

Locations of continuous noise monitoring sites are shown on Figure 2. Table 5 shows a summary of the continuous noise measurement results.

Table 5 : Railroad Noise Measurement Results

Measurement Location	Railroad Track	Grade Crossing/ Warning Horn	Average Train Events Per 24-hr period	Distance to CL	SEL
LT-2	UPRR	No	10	240’	93 dB
Source: j.c. brennan & associates, Inc - 2014					

Noise measurement equipment consisted of Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters equipped with LDL ½" microphones. The measurement systems were calibrated using an LDL Model CAL200 acoustical calibrator before and after testing. The measurement equipment meets all of the pertinent requirements of the American National Standards Institute (ANSI) for Type 1 (precision) sound level meters.

To determine the distances to the day/night average (L_{dn}) railroad contours, it is necessary to calculate the L_{dn} for typical train operations. This was done using the SEL values and above-described number and an even day/night distribution of daily freight train operations. The L_{dn} may be calculated as follows:

$$L_{dn} = SEL + 10 \log N_{eq} - 49.4 \text{ dB, where:}$$

SEL is the mean Sound Exposure Level of the event, N_{eq} is the sum of the number of daytime events (7 a.m. to 10 p.m.) per day, plus 10 times the number of nighttime events (10 p.m. to 7 a.m.) per day, and 49.4 is ten times the logarithm of the number of seconds per day.

Based upon the above-described noise level data, number of operations and methods of calculation, the L_{dn} value for railroad line operations have been calculated, and the distances to the L_{dn} noise level contours are shown in Table 6.

Table 6: Approximate Distances to the Railroad Noise Contours

Exterior Railroad Noise Level at Measurement Site, L_{dn}	Distance to L_{dn} Contour		
	60 dB	65 dB	70 dB
UPRR Line			
60 dB @ 240 feet – No Warning Horns	226 feet	105 feet	49 feet
Source: j.c. brennan & associates, Inc. 2014			

REGULATORY CONTEXT

Federal

There are no federal regulations related to noise that apply to the Proposed Project.

State

California Environmental Quality Act

The California Environmental Quality Act (CEQA) Guidelines, Appendix G, indicate that a significant noise impact may occur if a project exposes persons to noise levels in excess of local general plans or noise ordinance standards, or cause a substantial permanent or temporary increase in ambient noise levels.

California State Building Codes

The State Building Code, Title 24, Part 2 of the State of California Code of Regulations establishes uniform minimum noise insulation performance standards to protect persons within new buildings which house people, including hotels, motels, dormitories, apartment houses and dwellings other than single-family dwellings. Title 24 mandates that interior noise levels attributable to exterior sources shall not exceed 45 dB L_{dn} or CNEL in any habitable room.

Title 24 also mandates that for structures containing noise-sensitive uses to be located where the L_{dn} or CNEL exceeds 60 dB, an acoustical analysis must be prepared to identify mechanisms for limiting exterior noise to the prescribed allowable interior levels. If the interior allowable noise levels are met by requiring that windows be kept closed, the design for the structure must also specify a ventilation or air conditioning system to provide a habitable interior environment

Placer County General Plan

The Goals and Policies of the Placer County General Plan Noise Element which are relative to this project are listed below:

Goal 9.A: To protect County residents from the harmful and annoying effects of exposure to excessive noise.

Policies:

9.A.1. The County shall not allow development of new noise-sensitive uses where the noise level due to non-transportation noise sources will exceed the noise level standards of Table 7 as measured immediately within the property line of the new development, unless effective noise mitigation measures have been incorporated into the development design to achieve the standards specified in Table 7.

9.A.2. The County shall require that noise created by new non-transportation noise sources be mitigated so as not to exceed the noise level standards of Table 7 as measured immediately within the property line of lands designated for noise-sensitive uses.

9.A.3. The County shall continue to enforce the State Noise Insulation Standards (California Code of Regulations, Title 24) and Chapter 35 of the Uniform Building Code (UBC).

9.A.5. Where proposed non-residential land uses are likely to produce noise levels exceeding the performance standards of Table 7 at existing or planned noise-sensitive uses, the County shall require submission of an acoustical analysis as part of the environmental review process so that noise mitigation may be included in the project design. The

requirements for the content of an acoustical analysis are listed in Table 9-2 of the Placer County General Plan.

9.A.6. The feasibility of proposed projects with respect to existing and future transportation noise levels shall be evaluated by comparison to Table 8.

9.A.8. New development of noise-sensitive land uses shall not be permitted in areas exposed to existing or projected levels of noise from transportation noise sources, including airports, which exceed the levels specified in Table 8, unless the project design includes effective mitigation measures to reduce noise in outdoor activity areas and interior spaces to the levels specified in Table 8.

9.A.11. The County shall implement one or more of the following mitigation measures where existing noise levels significantly impact existing noise-sensitive land uses, or where the cumulative increase in noise levels resulting from new development significantly impacts noise-sensitive land uses:

a. Rerouting traffic onto streets that have available traffic capacity and that do not adjoin noise sensitive land uses;

b. Lowering speed limits, if feasible and practical;

c. Programs to pay for noise mitigation such as low cost loans to owners of noise-impacted property or establishment of developer fees;

d. Acoustical treatment of buildings; or

e. Construction of noise barriers.

Table 7: Allowable L_{dn} Noise Levels Within Specified Zone Districts Applicable to New Projects Affected by or Including Non-Transportation Noise Sources (Table 9-1 of the Placer County General Plan)

Zone District of Receptor	Property Line of Receiving Use	Interior Space[1]
Residential adjacent to industrial	60 dBA	45 dBA
Other Residential	50 dBA	45 dBA
Office/Professional	70 dBA	45 dBA
Open Space	---	---
Neighborhood Commercial	70 dBA	45 dBA

Notes for Table 7:

- *Except where noted otherwise, noise exposures will be those which occur at the property line of the receiving use.
- *Where existing transportation noise levels exceed the standards of this table, the allowable L_{dn} shall be raised to the same level as that of the ambient level.
- *If the noise source generated by, or affecting, the uses shown above consists primarily of speech or music, or if the noise source is impulsive in nature, the noise standards shown above shall be decreased by 5 dB.
- [1]Interior spaces are defined as any locations where some degree of noise sensitivity exists. Examples include all habitable rooms of residences, and areas where communication and speech intelligibility are essential, such as classrooms and offices.

Table 9-1 of the Placer County General Plan Noise Element has been summarized for use on this project; please see the Placer County General Plan Noise Element for the full Table and Footnotes.

Table 8: Maximum Allowable Noise Exposure (L_{dn}) for Transportation Noise Sources (Table 9-2 of the Placer County General Plan)

Land Use	Outdoor Activity Areas [1]	Interior Spaces	
	L_{dn}/CNEL, dB	L_{dn}/CNEL, dB	L_{eq}, dB [2]
Residential	60 [3]	45	--
Transient Lodging	60 [3]	45	--
Hospitals, Nursing Homes	60 [3]	45	--
Theaters, Auditoriums	--	--	35
Churches, Meeting Halls	60 [3]	--	40
Office Buildings	--	--	45
Schools, Libraries, Museums	--	--	45
Playgrounds, Neighborhood Parks	70	--	--

Notes:

[1] Where the location of outdoor activity areas is unknown the exterior noise level standard shall be applied to the property line of the receiving land use.

[2] As determined for a typical worst-case hour during periods of use.

[3] Where it is not possible to reduce noise in outdoor activity areas to 60 L_{dn}/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 65 dB L_{dn}/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

Placer County Noise Ordinance

The Placer County Code, Section 9.36.060 establishes sound limits for sensitive receptors, as shown in Table 9. The standards are measures at the property line of the receiving sensitive receptor. It should be noted that the County also applies a limit of 5 dB over the existing ambient noise level or the Table 9 standards, whichever is greater.

Section 9.36.020 of the code defines a sensitive receptor as “a land use in which there is a reasonable degree of sensitivity to noise. Such uses include single-family and multi-family residential uses, frequently used outbuildings, schools, hospitals, churches, rest homes, cemeteries, public libraries and other sensitive uses as determined by the enforcement officer.” The purpose of the Noise Ordinance is to implement the Noise Standards identified in the *Placer County General Plan*. The County Noise Ordinance is enforced with the Penal Code to establish standards for reported nuisance abatement and enforcement within the County.

The Table 9 criteria are based upon hourly average (L_{eq}) and maximum (L_{max}) noise level descriptors.

Table 9: Hourly Exterior Noise Performance Standards for Stationary (Non-Transportation) Noise Sources

Noise Metric	Acceptable Noise Level, dBA	
	Daytime (7 a.m. – 10 p.m.)	Nighttime (10 p.m. – 7 a.m.)
L_{eq}	55	45
L_{max}	70	65

Summary of Placer County Noise Standards

The Placer County General Plan Noise Element applies 60 dB L_{dn}/CNEL exterior and 45 dB L_{dn}/CNEL noise level standards for residential uses affected by transportation noise sources.

Placer County may conditionally allow exterior noise levels between 60-65 dB L_{dn} for residential uses, provided that practical noise reduction measures have been implemented and interior noise levels remain in compliance with the 45 dB L_{dn} interior standard.

For parks and playgrounds, the County applies an exterior noise level standard of 70 dB L_{dn}.

Substantial Increase Criteria

The noise standards applicable to the project include the relevant portions of Placer County General Plan, the Placer County Noise Ordinance described in the Regulatory Framework section above, and the following common practice guidelines.

Generally, a project may have a significant effect on the environment if it will substantially increase the ambient noise levels for adjoining areas or expose people to measurably severe noise levels. In practice, a noise impact may be considered significant if it would generate noise that would conflict with local project criteria or ordinances, or substantially increase noise levels at noise sensitive land uses. The potential increase in traffic noise from the project is a factor in determining significance. Research into the human perception of changes in sound level indicates the following[1]:

- A 3-dB change is barely perceptible,
- A 5-dB change is clearly perceptible, and
- A 10-dB change is perceived as being twice or half as loud.

Placer County, like many jurisdictions, does not have an adopted policy regarding significant increases in ambient noise. A common practice in many jurisdictions is to use a 3-5 dB increase as a threshold of significance. In Placer County, a 4-5 dB threshold is typically applied. For this project, the lower threshold of 4 dB will be applied.

Vibration Standards

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that in that noise is generally considered to be pressure waves transmitted through air, whereas vibration usually consists of the excitation of a structure or surface. As with noise, vibration consists of an amplitude and frequency. A person's perception to the vibration will depend on their individual sensitivity to vibration, as well as the amplitude and frequency of the source and the response of the system which is vibrating.

Vibration can be measured in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration measures in terms of peak particle velocities in inches per second. Standards pertaining to perception as well as damage to structures have been developed for vibration levels defined in terms of peak particle velocities.

Placer County does not have specific policies pertaining to vibration levels. However, vibration

[1] California Department of Transportation. *Technical Noise Supplement to the Traffic Analysis Protocol.* September 2013.

levels associated with construction activities and project operations are addressed as potential noise impacts associated with project implementation.

Human and structural response to different vibration levels is influenced by a number of factors, including ground type, distance between source and receptor, duration, and the number of perceived vibration events. Table 10 indicates that the threshold for damage to structures ranges from 0.2 to 0.6 peak particle velocity in inches per second (in/sec p.p.v). The general threshold at which human annoyance could occur is noted as 0.1 in/sec p.p.v.

Table 10: Effects of Vibration on People and Buildings

Peak Particle Velocity		Human Reaction	Effect on Buildings
mm/sec.	in./sec.		
0.15-0.30	0.006-0.019	Threshold of perception; possibility of intrusion	Vibrations unlikely to cause damage of any type
2.0	0.08	Vibrations readily perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
2.5	0.10	Level at which continuous vibrations begin to annoy people	Virtually no risk of “architectural” damage to normal buildings
5.0	0.20	Vibrations annoying to people in buildings (this agrees with the levels established for people standing on bridges and subjected to relative short periods of vibrations)	Threshold at which there is a risk of “architectural” damage to normal dwelling - houses with plastered walls and ceilings. Special types of finish such as lining of walls, flexible ceiling treatment, etc., would minimize “architectural” damage
10-15	0.4-0.6	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges	Vibrations at a greater level than normally expected from traffic, but would cause “architectural” damage and possibly minor structural damage.
Source: Caltrans. Transportation Related Earthborne Vibrations. TAV-02-01-R9601 February 20, 2002.			

IMPACTS AND MITIGATION MEASURES

Thresholds of Significance

Consistent with Appendix G of the CEQA Guideline, and the County's General Plan and Noise Ordinance, the project will have a significant impact related to noise if it will result in:

A. 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. Specifically, an exterior noise level of 60 dB L_{dn} and an interior noise level of 45 dB L_{dn} for residential uses exposed to transportation noise sources and an exterior noise level standard of 70 dB L_{dn} for park uses.

B. Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels. Specifically, a limit of 0.1 in/sec p.p.v., as discussed above;

C. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project, defined as 4 dB for this project;

D. A substantial temporary or periodic increase in ambient noise levels in the project vicinity, defined as 4 dB, beyond levels permissible under the County's General Plan and Noise Ordinance;

E. 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, expose people residing or working in the project area to excessive noise levels within two miles of a public airport or public use airport; or

F. For a project within the vicinity of a private airstrip, expose people residing or working in the project area to excessive noise levels.

The proposed project is not located within two miles of a public or private airport or airstrip. Therefore, aircraft noise is not discussed further in this analysis.

Project-Specific Impacts and Mitigation Measures

Impact 1 Construction Noise at Sensitive Receptors

Construction of the Proposed Project would temporarily increase noise levels during construction. This would be a ***potentially significant*** impact.

During the construction of the project including roads, water and sewer lines and related infrastructure, noise from construction activities would add to the noise environment in the project vicinity. Activities involved in construction would generate maximum noise levels, as indicated in Table 11, ranging from 76 to 90 dB at a distance of 50 feet. Construction activities would be temporary in nature and are anticipated to occur during normal daytime working hours.

Noise would also be generated during the construction phase by increased truck traffic on area roadways. A substantial project-generated noise source would be truck traffic associated with transport of heavy materials and equipment to and from construction sites. This noise increase would be of short duration, and would likely occur primarily during daytime hours.

Table 11 : Construction Equipment Noise

Type of Equipment	Maximum Level, dB at 50 feet
Backhoe	78
Compactor	83
Compressor (air)	78
Concrete Saw	90
Dozer	82
Dump Truck	76
Excavator	81
Generator	81
Jackhammer	89
Pneumatic Tools	85
Source: *Roadway Construction Noise Model User's Guide*. Federal Highway Administration. FHWA-HEP-05-054. January 2006.	

Construction activities are conditionally exempt from the Noise Ordinance during certain hours. Construction activities are exempt from the noise standard from 6 a.m. to 8 p.m. Monday through Friday, and from 7 a.m. to 8 p.m. on Saturdays and Sundays.

Mitigation Measures

The following mitigation measures are required for the Proposed Project to minimize construction noise impacts.

MM1a Construction activities shall comply with the Placer County Noise Ordinance.

MM1b Locate fixed construction equipment such as compressors and generators as far as possible from sensitive receptors. Shroud or shield all impact tools, and muffle or shield all intake and exhaust ports on power construction equipment.

MM1c Designate a disturbance coordinator and conspicuously post this person's number around the project site and in adjacent public spaces. The disturbance coordinator will receive all public complaints about construction noise disturbances and will be responsible for determining the cause of the complaint, and implement any feasible measures to be taken to alleviate the problem.

Significance after Mitigation

Less than significant

Impact 2 Transportation Noise at Existing Sensitive Receptors

Traffic generated by the Proposed Project could generate traffic noise increases exceeding the substantial increase criteria, as outlined in the Thresholds of Significance criteria above. This would be a ***less-than-significant*** impact.

Table 12 shows the predicted traffic noise level increases on the local roadway network for existing and existing plus project conditions. Table 13 shows the predicted traffic noise level increases on the local roadway network for cumulative and cumulative plus project conditions.

Appendix C provides the complete inputs and results of the FHWA traffic noise modeling.

TABLE 12: PREDICTED TRAFFIC NOISE LEVELS AND PROJECT-RELATED TRAFFIC NOISE LEVEL INCREASES (EXISTING TRAFFIC CONDITIONS)

Roadway	Segment	Predicted L_{dn} @ Closest Sensitive Receptors – 1st Floor Outdoor Activity Areas				
		Existing	Existing + Project	Change	Criteria	Significant?
Sierra College Blvd	SR 193 to Penny Ln	62.7	64.1	1.4	+4 dB	No
Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	60.7	64.3	3.5	+4 dB	No
Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	60.6	64.1	3.5	+4 dB	No
Sierra College Blvd	Twelve Bridges Dr to Old Bickford Ranch Rd	61.3	63.6	2.2	+4 dB	No
Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	62.0	64.3	2.2	+4 dB	No
Sierra College Blvd	English Colony Way to King Rd	64.3	66.4	2.1	+4 dB	No
SR 193	Lincoln City Limits to Sierra College Blvd	64.0	64.9	0.9	+4 dB	No
SR 193	Sierra College Blvd to Clark Tunnel Rd	63.4	64.1	0.7	+4 dB	No

Source: j.c. brennan & associates, Inc., Inc., FHWA RD-77-108 Traffic Noise Prediction Model, Caltrans, and Fehr & Peers. 2014.

TABLE 13: PREDICTED TRAFFIC NOISE LEVELS AND PROJECT-RELATED TRAFFIC NOISE LEVEL INCREASES (CUMULATIVE TRAFFIC CONDITIONS)

Roadway	Segment	Predicted L_{dn} @ Closest Sensitive Receptors – 1st Floor Outdoor Activity Areas				
		Cumulative	Cumulative + Project	Change	Criteria	Significant?
Sierra College Blvd	SR 193 to Penny Ln	64.9	66.0	1.1	+4 dB	No
Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	63.0	65.2	2.2	+4 dB	No
Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	65.1	66.5	1.4	+4 dB	No
Sierra College Blvd	Twelve Bridges Dr to Old Bickford Ranch Rd	64.9	66.0	1.1	+4 dB	No
Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	65.8	66.9	1.0	+4 dB	No
Sierra College Blvd	English Colony Way to King Rd	68.4	68.9	0.5	+4 dB	No
SR 193	Lincoln City Limits to Sierra College Blvd	66.5	67.2	0.7	+4 dB	No
SR 193	Sierra College Blvd to Clark Tunnel Rd	65.5	65.9	0.3	+4 dB	No

Source: j.c. brennan & associates, Inc., Inc., FHWA RD-77-108 Traffic Noise Prediction Model, Caltrans, and Fehr & Peers. 2014.

Some noise sensitive receptors located along the project-area roadways are currently exposed to exterior traffic noise levels exceeding the Placer County 60 dB L_{dn} exterior noise level standard for residential uses, as shown in Table 12 and Table 13. As shown by Table 12 and Table 13, these receptors will continue to experience elevated exterior noise levels with implementation of the proposed project. The proposed project's contribution to traffic noise increases is predicted to be 3.5 dBA L_{dn}, or less. This is less than the County's substantial increase criteria of 4 dB. Therefore, the increase of 3.5 dB L_{dn} is considered less than significant relative to the County's substantial increase threshold.

The proposed project would not cause increased noise levels exceeding the Placer County 60 dB L_{dn} exterior noise level standard at existing noise-sensitive residential receptors. Therefore, this would be a less-than-significant impact relative to the CEQA checklist threshold (a). Additionally, the noise level increases associated with the proposed project do not exceed the County's substantial increase criteria outlined above. Therefore, this would be a less-than-significant impact relative to the CEQA checklist threshold (b).

This impact is considered **less-than-significant** relative to the project's significance criteria.

Mitigation for Impact 2: **None required**

Impact 3: Transportation Noise at New Sensitive Receptors

*The proposed project could expose new noise-sensitive uses to transportation noise levels that exceed the Placer County exterior and interior noise level standards. This is considered to be a **potentially significant** impact.*

Exterior Traffic Noise Level Impacts:

The FHWA traffic noise prediction model was used to predict Cumulative + Project traffic noise levels at the proposed residential land uses associated with the project. Table 14 shows the predicted traffic noise levels at the proposed residential uses adjacent to the major project-area arterial roadways. Table 14 also indicates the property line noise barrier heights required to achieve compliance with an exterior noise level standard of 60 dB L_{dn}.

Appendix D provides the complete inputs and results to the FHWA traffic noise prediction model and barrier calculations. The modeled noise barriers assume flat site conditions where roadway elevations, base of wall elevations, and building pad elevations are approximately equivalent.

Union Pacific Railroad Line (UPRR) Noise Levels

Based upon the Table 6 data, the UPRR line was measured to generate an exterior noise levels of 60 dBA L_{dn} at a distance of up to 226 feet. Based upon this measurement, railroad noise levels at the project site were predicted, as shown in Table 14. Railroad noise level are not predicted to exceed the Placer County 60 dB L_{dn} exterior noise level standards, the use of noise barrier is not required, as shown in Table 14.

Table 14: Transportation Noise Levels at Proposed Residential Uses

Noise Source	Receptor Description	Approximate Distance to Center of Outdoor Activity Area, feet[1]	ADT	Predicted Noise Levels, dB L_{dn}[2]			
Traffic Noise				No Wall	6' Wall	7' Wall	8' Wall
Sierra College Blvd.	BR Park Sites	490'	29,770	60	--	--	--
Sierra College Blvd.	LDR-02 Residential	750'	29,770	57	--	--	--
Sierra College Blvd.	RR-07 Residential	200'	31,040	66	60	60	59
Sierra College Blvd.	LDR-03 Residential	200'	31,040	66	60	60	59
Railroad Noise				No Wall	6' Wall	7' Wall	8' Wall
UPRR	RR06 Residential	430'	N/A	56	--	--	--
UPRR	LDR 22 Residential	1,050'	N/A	50	--	--	--
UPRR	LDR 24-26 Residential	750'	N/A	52	--	--	--
UPRR	LDR 18A Residential	220'	N/A	60	--	--	--
UPRR	LDR 16 Residential	550'	N/A	54	--	--	--

[1] Setback distances are measured in feet from the centerlines of the roadways to the center of residential backyards.
[2] The modeled noise barriers assume flat site conditions where roadway elevations, base of wall elevations, and building pad elevations are approximately equivalent.
-- Meets the Placer County exterior noise standard without mitigation. Standard does not apply to second floor facades.
Source: FHWA-RD-77-108 with inputs from Fehr & Peers, and j.c. brennan & associates, Inc. 2014.

The Table 14 data indicate that noise barriers 6-feet in height would be required to reduce exterior noise levels to 60 dB L_{dn} or less at the sensitive receptors located along closest to Sierra College Boulevard. Because grading plans are not currently available, noise barrier height and placement should be reviewed when such plans are available.

Interior Noise Impacts:

Modern construction typically provides a 25 dB exterior-to-interior noise level reduction with windows closed. Therefore, sensitive receptors exposed to exterior noise of 70 dB L_{dn}, or less, will typically comply with the Placer County 45 dB L_{dn} interior noise level standard. Additional noise reduction measures, such as acoustically rated windows are generally required for exterior noise levels exceeding 70 dB L_{dn}.

It should be noted that exterior noise levels are typically 2-3 dB higher at second floor locations. Additionally, noise barriers do not reduce exterior noise levels at second floor locations. The proposed residential uses are predicted to be exposed to unmitigated first floor exterior traffic noise levels ranging between 57-66 dB L_{dn} and railroad noise levels of 50-60 dB L_{dn}. Therefore, second floor facades are predicted to be exposed to exterior traffic noise levels of up to 60-69 dB L_{dn} and railroad noise levels of 53-63 dB L_{dn}. Based upon a 25 dB exterior-to-interior noise level reduction, interior traffic noise levels are predicted to range between 35-44 dB L_{dn} and railroad noise levels of 28-38 dB L_{dn}. Therefore, no interior noise control measures would be required for traffic or railroad noise.

Mitigation for Impact 3:

MM 3a: Sound walls and/or landscaped berms shall be constructed along Sierra College Boulevard at proposed residential uses located at RR-07 and LDR-03. This requirement would specifically apply to residential uses located within 501 feet of the centerline of Sierra College Boulevard. Noise barrier walls shall be constructed of concrete panels, concrete masonry units, earthen berms, or any combination of these materials. Wood is not recommended due to eventual warping and degradation of acoustical performance. Barrier heights and locations should be reviewed once grading plans are available for these locations.

MM 3c: Mechanical ventilation shall be installed in all residential uses to allow residents to keep doors and windows closed, as desired for acoustical isolation.

Significance after Mitigation: **Less-than-significant**.

Impact 4: Construction Vibration at Sensitive Receptors

The proposed project has the potential to expose sensitive receptors to substantial vibration associated with construction activities. This would be a ***less-than-significant*** *impact.*

The primary vibration-generating activities associated with the proposed project would occur during construction when activities such as grading and utility placement.

Construction vibration impacts include human annoyance and building structural damage. Human annoyance occurs when construction vibration rises significantly above the threshold of perception. Building damage can take the form of cosmetic or structural. Table 15 shows the typical vibration levels produced by construction equipment.

Sensitive receptors could be impacted by construction related vibrations, especially vibratory compactors/rollers. The nearest receptors are located approximately 50 feet or further from any areas of the project site that might require grading or paving. At this distance construction vibrations are not predicted to exceed acceptable levels. Additionally, construction activities would be temporary in nature and would likely occur during normal daytime working hours.

Table 15: Vibration Levels for Varying Construction Equipment

Type of Equipment	Peak Particle Velocity @ 25 feet (inches/second)	Peak Particle Velocity @ 50 feet (inches/second)	Peak Particle Velocity @ 100 feet (inches/second)
Large Bulldozer	0.089	0.031	0.011
Loaded Trucks	0.076	0.027	0.010
Small Bulldozer	0.003	0.001	0.000
Auger/drill Rigs	0.089	0.031	0.011
Jackhammer	0.035	0.012	0.004
Vibratory Hammer	0.070	0.025	0.009
Vibratory Compactor/roller	0.210	0.074	0.026

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

The Table 15 data indicate that construction vibration levels anticipated for the project are less than the 0.1 in/sec criteria at distances of 50 feet. Therefore, construction vibrations are not predicted to cause damage to existing buildings or cause annoyance to sensitive receptors. Implementation of the proposed project would have a **less than significant** impact.

Mitigation for Impact 4: **None required**

Cumulative Impacts and Mitigation Measures

Impact 5 Cumulative Noise Levels

The cumulative context for noise impacts associated with the Proposed Project consists of the existing and future noise sources that could affect the project or surrounding uses. Noise generated by construction would be temporary, and would not add to the permanent noise environment or be considered as part of the cumulative context. The total noise impact of the Proposed Project would be fairly small and would not be a substantial increase to the existing future noise environment. Thus, the Proposed Project would result in a ***less-than-significant cumulative impact.***

Traffic

Cumulative noise impacts would occur primarily as a result of increased traffic on local roadways due to the Proposed Project and on-site activities resulting from operation of the proposed project. Table 13 above shows cumulative traffic noise levels with and without the Proposed Project. As discussed, the project would not result in significant increases in traffic noise levels at existing sensitive receptors. New residential uses will be constructed to comply with the applicable Placer County exterior and interior noise level standards.

Cumulative Conclusion

The traffic noise from the Proposed Project is not expected to produce noise levels that would exceed County standards. Increased project related traffic would increase traffic noise levels by less than the County's 4 dB increase criteria outlined in the Thresholds of Significance section, at existing sensitive receptors. Consequently, the total noise impact of the Proposed Project would not be a substantial increase to the future noise environment. The Proposed Project would result in a **less-than-significant cumulative impact**.

Mitigation for Impact 5: **None required**

Appendix A
Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz (Hz).
L_{dn}	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
L_{max}	The highest root-mean-square (RMS) sound level measured over a given period of time.
$L_{(n)}$	The sound level exceeded a described percentile over a measurement period. For instance, an hourly L_{50} is the sound level exceeded 50% of the time during the one hour period.
Loudness	A subjective term for the sensation of the magnitude of sound.
Noise	Unwanted sound.
NRC	Noise Reduction Coefficient. NRC is a single-number rating of the sound-absorption of a material equal to the arithmetic mean of the sound-absorption coefficients in the 250, 500, 1000, and 2,000 Hz octave frequency bands rounded to the nearest multiple of 0.05. It is a representation of the amount of sound energy absorbed upon striking a particular surface. An NRC of 0 indicates perfect reflection; an NRC of 1 indicates perfect absorption.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the “Maximum” level, which is the highest RMS level.
RT_{60}	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 Sabin.
SEL	Sound Exposure Level. SEL is s rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy into a one-second event.
STC	Sound Transmission Class. STC is an integer rating of how well a building partition attenuates airborne sound. It is widely used to rate interior partitions, ceilings/floors, doors, windows and exterior wall configurations.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.
Impulsive	Sound of short duration, usually less than one second, with an abrupt onset and rapid decay.
Simple Tone	Any sound which can be judged as audible as a single pitch or set of single pitches.

Appendix B
2014-136
24hr Continuous Noise Monitoring - Site LT-1
Friday, May 09, 2014

Hour	Leq	Lmax	L50	L90
0:00	52	72	34	28
1:00	51	73	34	27
2:00	47	69	35	29
3:00	50	71	34	29
4:00	55	76	35	28
5:00	59	74	47	37
6:00	62	77	55	44
7:00	64	77	61	47
8:00	63	81	59	46
9:00	61	77	56	43
10:00	62	78	56	43
11:00	61	75	55	43
12:00	61	78	56	42
13:00	62	81	56	42
14:00	62	82	57	43
15:00	64	81	60	43
16:00	63	77	60	45
17:00	64	80	61	43
18:00	62	77	58	40
19:00	62	84	55	43
20:00	61	77	53	42
21:00	58	71	48	39
22:00	58	74	47	39
23:00	59	85	45	37

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	64	58	62	62	47	57
Lmax (Maximum)	84	71	78	85	69	75
L50 (Median)	61	48	57	55	34	41
L90 (Background)	47	39	43	44	27	33

Computed Ldn, dB	65
% Daytime Energy	85%
% Nighttime Energy	15%

j.c. brennan & associates
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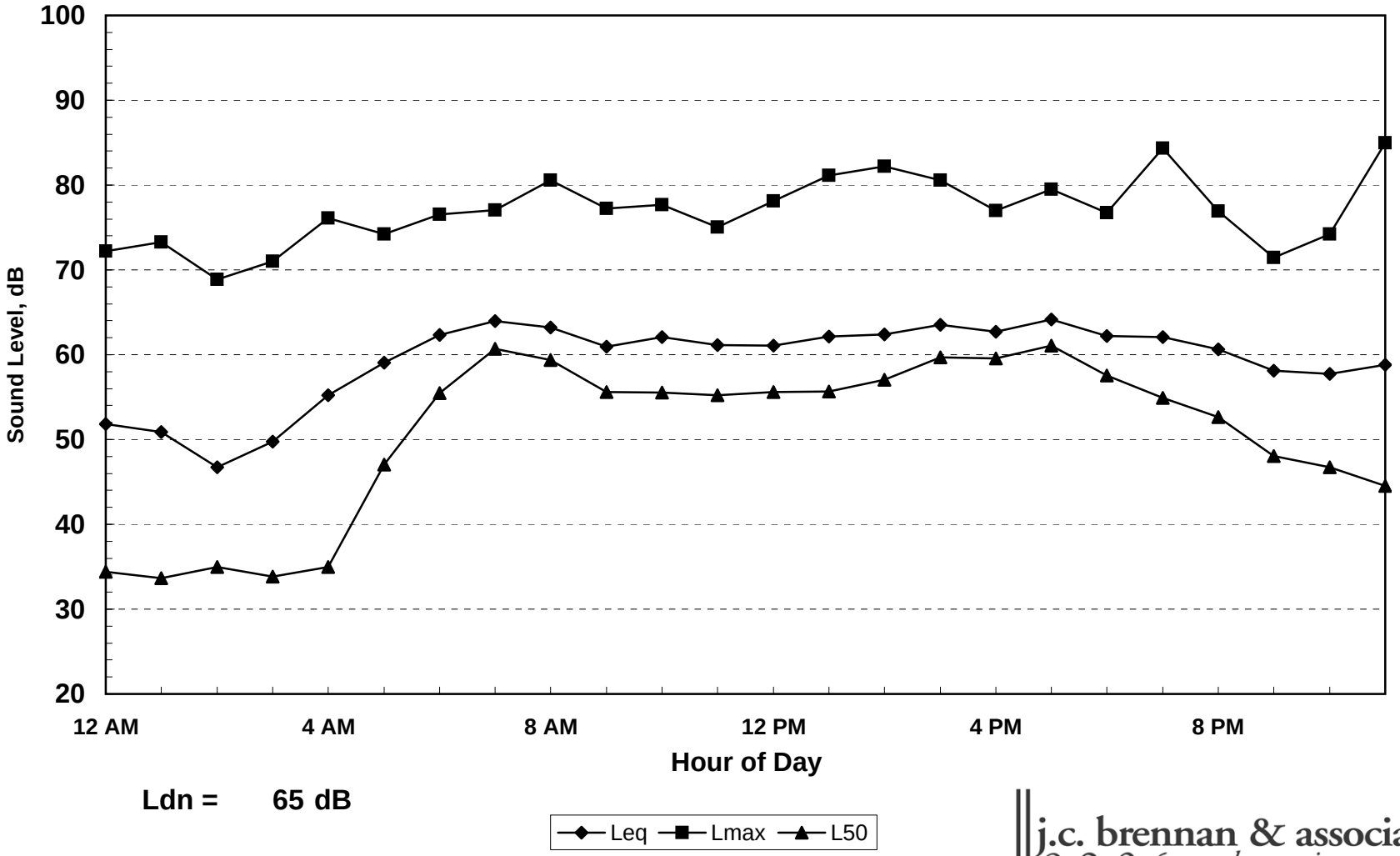
Appendix B
2014-136
24hr Continuous Noise Monitoring - Site LT-1
Friday, May 09, 2014



Ldn = 65 dB

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Appendix B
2014-136
24hr Continuous Noise Monitoring - Site LT-1
Saturday, May 10, 2014

Hour	Leq	Lmax	L50	L90
0:00	55	74	41	34
1:00	53	74	39	33
2:00	51	73	36	30
3:00	49	75	34	30
4:00	51	71	33	27
5:00	55	71	41	32
6:00	60	75	50	37
7:00	59	74	50	38
8:00	62	79	55	41
9:00	61	78	56	41
10:00	61	76	56	44
11:00	62	78	59	50
12:00	63	82	61	52
13:00	63	87	59	51
14:00	63	79	60	51
15:00	63	74	61	52
16:00	63	76	61	52
17:00	61	74	58	48
18:00	61	72	57	45
19:00	60	73	54	40
20:00	60	80	53	42
21:00	60	76	52	38
22:00	58	73	46	30
23:00	57	80	44	30

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	63	59	62	60	49	56
Lmax (Maximum)	87	72	77	80	71	74
L50 (Median)	61	50	57	50	33	41
L90 (Background)	52	38	46	37	27	31

Computed Ldn, dB	64
% Daytime Energy	87%
% Nighttime Energy	13%

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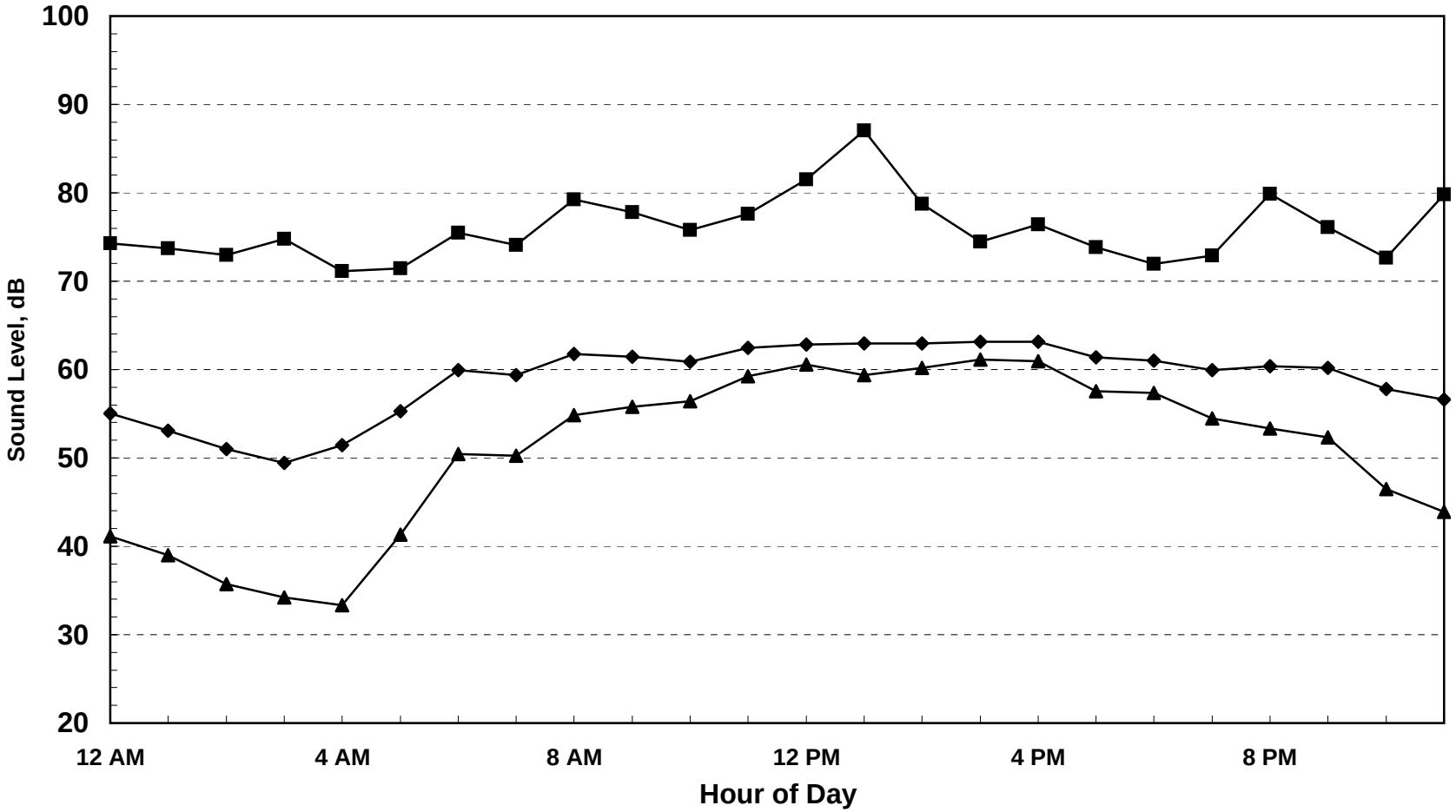
Appendix B
2014-136
24hr Continuous Noise Monitoring - Site LT-1
Saturday, May 10, 2014



Ldn = 64 dB

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Appendix B
2014-136
24hr Continuous Noise Monitoring - Site LT-2
Friday, May 09, 2014

Hour	Leq	Lmax	L50	L90
0:00	41	60	35	32
1:00	36	49	34	31
2:00	33	50	31	29
3:00	32	42	31	29
4:00	30	41	29	28
5:00	35	44	34	31
6:00	41	66	34	32
7:00	53	79	34	32
8:00	44	67	34	31
9:00	42	64	36	33
10:00	41	64	36	32
11:00	51	76	37	32
12:00	42	68	34	30
13:00	57	81	34	29
14:00	38	60	31	29
15:00	61	83	32	30
16:00	42	63	32	29
17:00	39	63	31	28
18:00	59	82	34	28
19:00	45	61	33	29
20:00	59	81	36	33
21:00	37	54	35	33
22:00	35	44	34	32
23:00	54	80	35	32

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	60.7	37.3	54.0	53.6	29.7	44.8
Lmax (Maximum)	83.3	53.9	69.8	79.9	41.3	52.9
L50 (Median)	37.2	31.1	33.9	35.4	28.8	33.2
L90 (Background)	33.3	27.7	30.5	32.4	27.6	30.7

Computed Ldn, dB	54.3
% Daytime Energy	93%
% Nighttime Energy	7%

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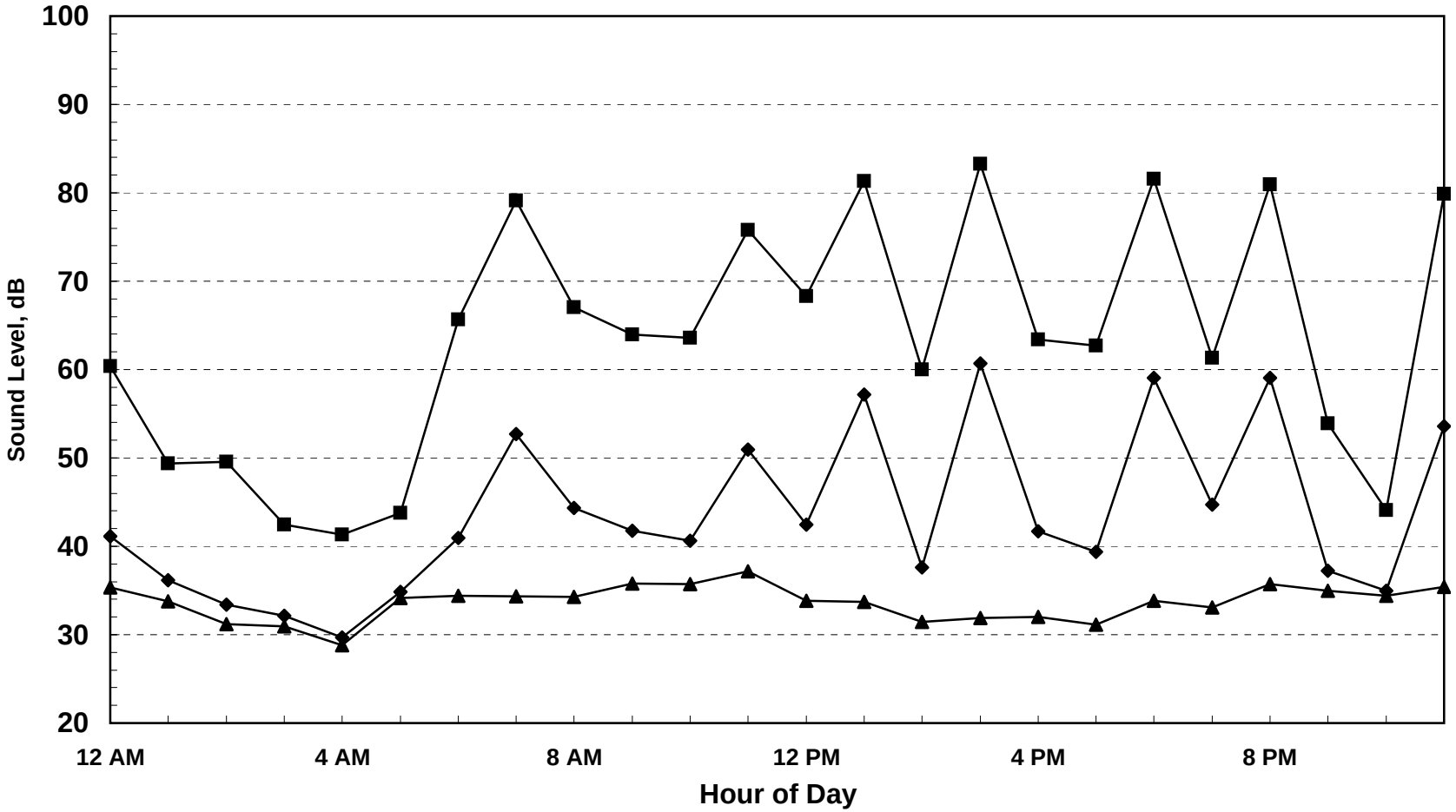
Appendix B
2014-136
24hr Continuous Noise Monitoring - Site LT-2
Friday, May 09, 2014



Ldn = 54.3 dB

Leq Lmax L50

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Appendix B
2014-136
24hr Continuous Noise Monitoring - Site LT-2
Saturday, May 10, 2014

Hour	Leq	Lmax	L50	L90
0:00	59	80	36	32
1:00	32	42	31	30
2:00	58	78	34	29
3:00	43	68	28	27
4:00	30	41	29	27
5:00	42	72	34	31
6:00	34	51	31	29
7:00	55	81	31	29
8:00	41	66	33	29
9:00	37	53	33	30
10:00	40	69	33	29
11:00	40	62	35	30
12:00	56	77	41	35
13:00	41	59	38	33
14:00	58	81	44	39
15:00	49	61	46	42
16:00	59	79	46	39
17:00	39	58	36	31
18:00	53	79	35	29
19:00	33	56	30	28
20:00	46	74	31	29
21:00	60	81	31	28
22:00	56	80	31	27
23:00	30	46	28	27

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	59.6	33.5	53.6	59.3	30.0	53.5
Lmax (Maximum)	81.1	52.6	69.1	80.2	41.2	62.1
L50 (Median)	46.4	30.2	36.3	36.3	28.2	31.3
L90 (Background)	42.3	27.8	32.0	31.8	26.5	28.8

Computed Ldn, dB	59.9
% Daytime Energy	63%
% Nighttime Energy	37%

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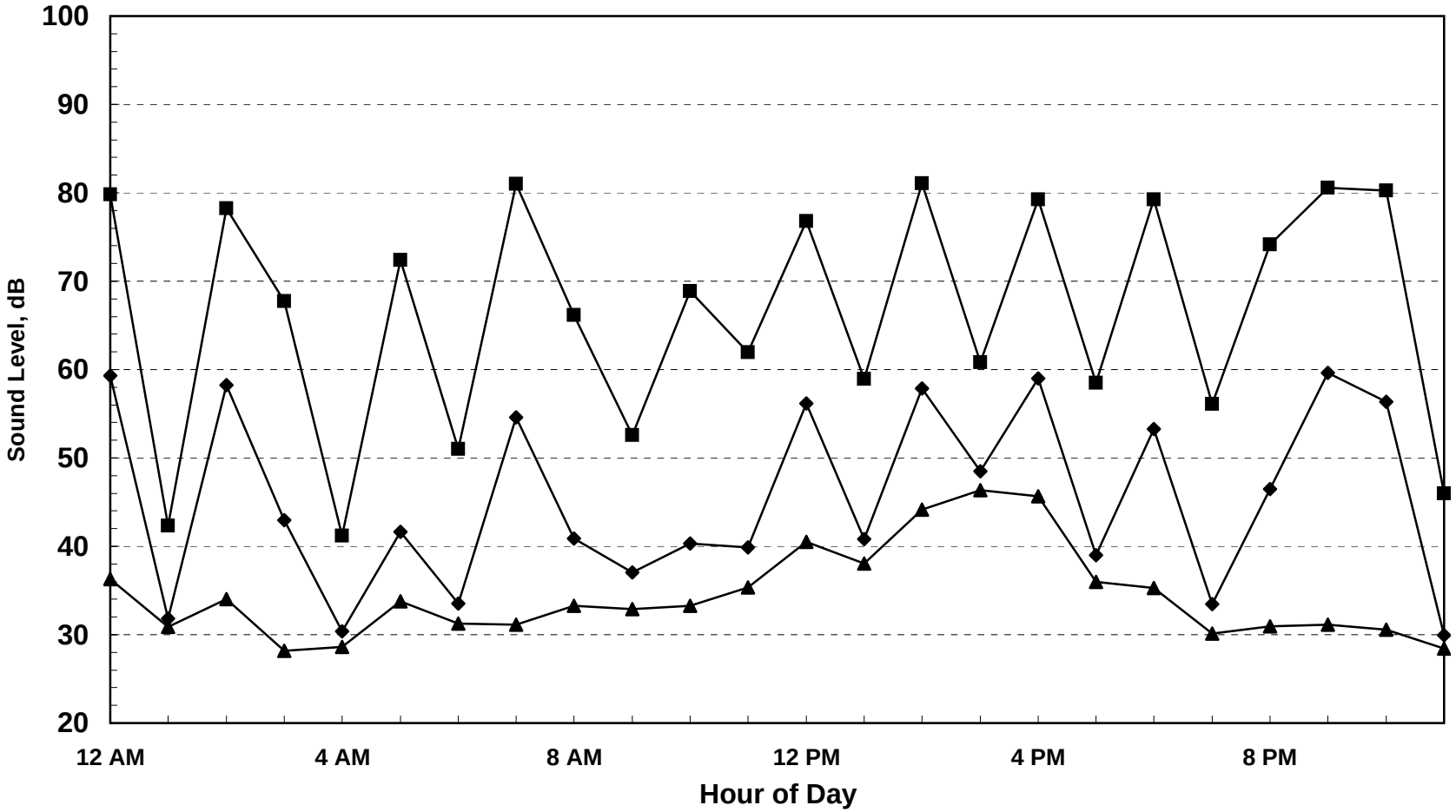
Appendix B
2014-136
24hr Continuous Noise Monitoring - Site LT-2
Saturday, May 10, 2014



Ldn = 59.9 dB

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Appendix B
2014-136
24hr Continuous Noise Monitoring - Site LT-3
Friday, May 09, 2014

Hour	Leq	Lmax	L50	L90
0:00	43	64	35	33
1:00	36	55	33	31
2:00	38	67	31	29
3:00	31	46	30	29
4:00	33	51	32	30
5:00	37	49	36	32
6:00	45	68	38	35
7:00	50	76	38	35
8:00	41	59	37	35
9:00	48	75	39	36
10:00	44	73	37	34
11:00	47	69	38	34
12:00	45	67	40	35
13:00	48	74	40	34
14:00	45	69	38	32
15:00	45	62	38	32
16:00	47	71	35	31
17:00	49	75	36	31
18:00	48	71	35	32
19:00	47	73	37	33
20:00	48	71	37	34
21:00	42	72	37	35
22:00	39	54	38	36
23:00	45	63	38	35

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	50	41	47	45	31	41
Lmax (Maximum)	76	59	70	68	46	57
L50 (Median)	40	35	37	38	30	35
L90 (Background)	36	31	34	36	29	32

Computed Ldn, dB	49
% Daytime Energy	87%
% Nighttime Energy	13%

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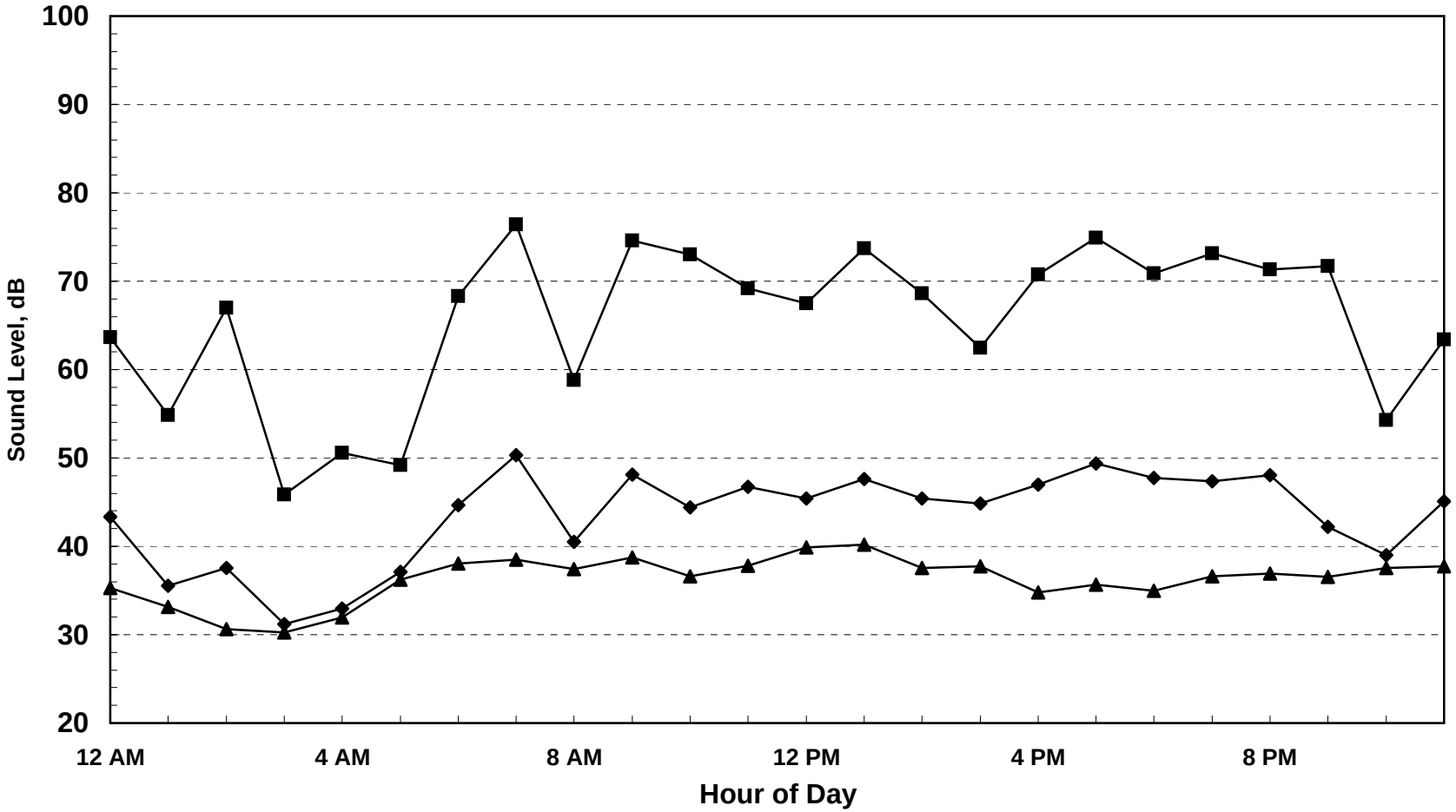
Appendix B
2014-136
24hr Continuous Noise Monitoring - Site LT-3
Friday, May 09, 2014



Ldn = 49 dB

Leq Lmax L50

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Appendix B
2014-136
24hr Continuous Noise Monitoring - Site LT-3
Saturday, May 10, 2014

Hour	Leq	Lmax	L50	L90
0:00	50	75	39	35
1:00	44	71	34	32
2:00	47	68	36	32
3:00	35	55	32	30
4:00	33	44	33	31
5:00	45	62	37	34
6:00	38	51	37	34
7:00	44	66	38	35
8:00	43	67	39	34
9:00	45	71	38	34
10:00	44	72	37	32
11:00	45	73	39	33
12:00	51	73	45	39
13:00	50	77	42	36
14:00	52	76	47	40
15:00	57	76	52	46
16:00	54	74	48	42
17:00	50	77	40	34
18:00	45	69	37	33
19:00	43	67	34	30
20:00	42	64	35	32
21:00	50	72	34	30
22:00	50	72	35	30
23:00	38	68	31	29

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	57	42	50	50	33	45
Lmax (Maximum)	77	64	72	75	44	63
L50 (Median)	52	34	40	39	31	35
L90 (Background)	46	30	35	35	29	32

Computed Ldn, dB	53
% Daytime Energy	83%
% Nighttime Energy	17%

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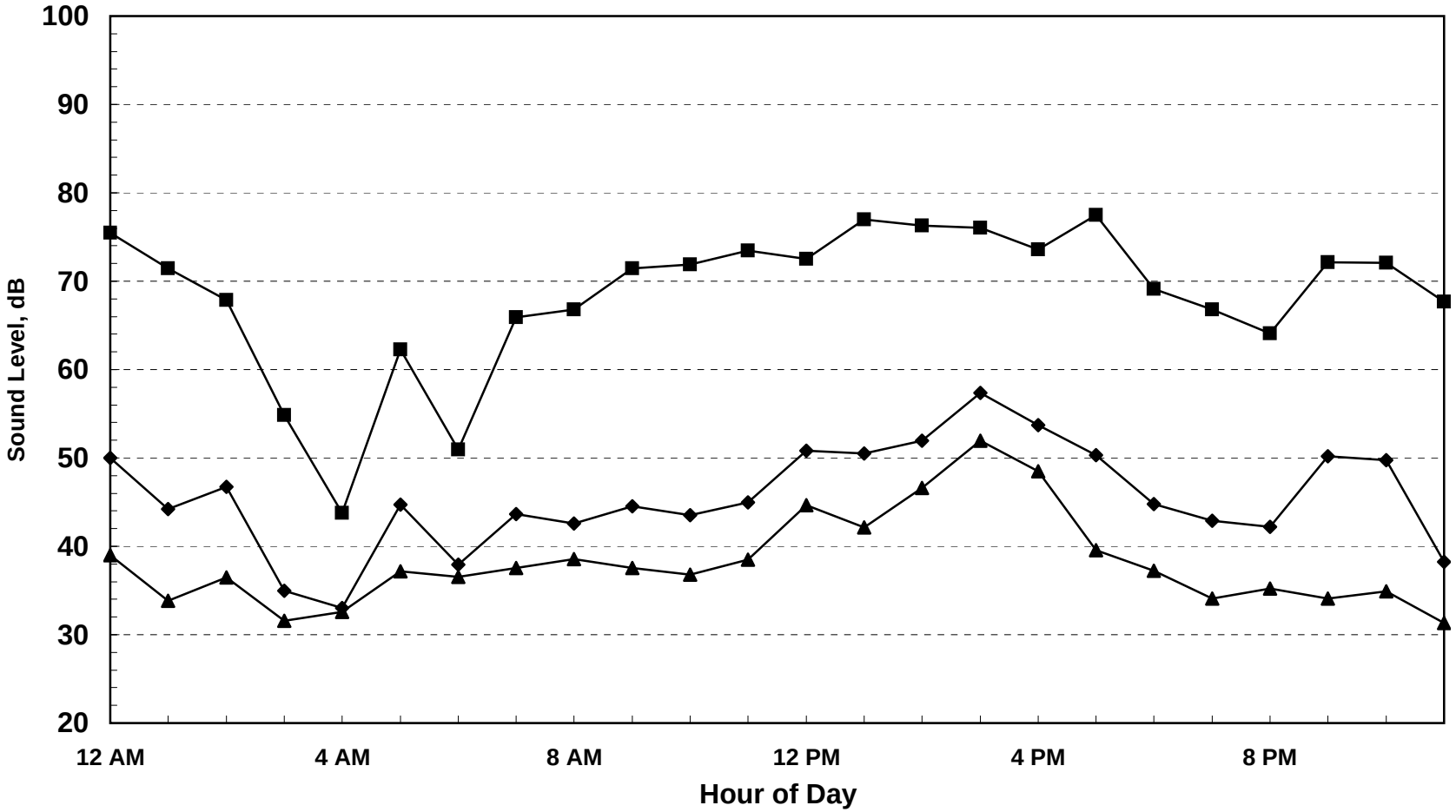
Appendix B
2014-136
24hr Continuous Noise Monitoring - Site LT-3
Saturday, May 10, 2014



Ldn = 53 dB

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Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2014-136 Bickford Ranch Specific Plan
Description: Existing No Project and Existing + Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
		Existing No Project									
1	Sierra College Blvd	SR 193 to Penny Ln	7,600	85		15	2	3	55	130	
2	Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	7,600	85		15	2	3	55	175	
3	Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	7,600	85		15	2	3	55	180	
4	Sierra College Blvd	Twelve Bridges Dr to Old Bickford Ranch Rd	10,200	85		15	2	3	55	195	
5	Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	10,200	85		15	2	3	55	175	
6	Sierra College Blvd	English Colony Way to King Rd	10,400	85		15	2	3	55	125	
7	SR 193	Lincoln City Limits to Sierra College Blvd	9,500	85		15	2	7	55	150	
8	SR 193	Sierra College Blvd to Clark Tunnel Rd	6,600	85		15	2	7	55	130	
		Existing + Project									
1	Sierra College Blvd	SR 193 to Penny Ln	10,350	85		15	2	3	55	130	
2	Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	16,700	85		15	2	3	55	175	
3	Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	16,700	85		15	2	3	55	180	
4	Sierra College Blvd	Twelve Bridges Dr to Old Bicford Ranch Rd	16,670	85		15	2	3	55	195	
5	Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	16,640	85		15	2	3	55	175	
6	Sierra College Blvd	English Colony Way to King Rd	16,340	85		15	2	3	55	125	
7	SR 193	Lincoln City Limits to Sierra College Blvd	11,660	85		15	2	7	55	150	
8	SR 193	Sierra College Blvd to Clark Tunnel Rd	7,200	83		17	2	7	55	130	

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Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2014-136 Bickford Ranch Specific Plan
Description: Existing No Project and Existing + Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment	Autos	Medium Trucks	Heavy Trucks	Total	
		Existing No Project					
1	Sierra College Blvd	SR 193 to Penny Ln	61.0	51.3	56.6	62.7	
2	Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	59.1	49.4	54.6	60.7	
3	Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	58.9	49.2	54.5	60.6	
4	Sierra College Blvd	Twelve Bridges Dr to Old Bickford Ranch Rd	59.6	50.0	55.2	61.3	
5	Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	60.4	50.7	55.9	62.0	
6	Sierra College Blvd	English Colony Way to King Rd	62.6	52.9	58.2	64.3	
7	SR 193	Lincoln City Limits to Sierra College Blvd	60.8	51.4	60.7	64.0	
8	SR 193	Sierra College Blvd to Clark Tunnel Rd	60.2	50.7	60.1	63.4	
		Existing + Project					
1	Sierra College Blvd	SR 193 to Penny Ln	62.3	52.7	58.4	64.1	1.4
2	Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	62.5	52.8	58.5	64.3	3.5
3	Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	62.3	52.6	58.3	64.1	3.5
4	Sierra College Blvd	Twelve Bridges Dr to Old Bicford Ranch Rd	61.8	52.1	57.8	63.6	2.2
5	Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	62.5	52.8	58.5	64.3	2.2
6	Sierra College Blvd	English Colony Way to King Rd	64.6	54.9	60.6	66.4	2.1
7	SR 193	Lincoln City Limits to Sierra College Blvd	61.7	52.3	61.6	64.9	0.9
8	SR 193	Sierra College Blvd to Clark Tunnel Rd	60.9	51.4	60.8	64.1	0.7

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Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2014-136 Bickford Ranch Specific Plan
Description: Existing No Project and Existing + Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment	-------- Distances to Traffic Noise Contours -------- 75	70	65	60	55
		Existing No Project					
1	Sierra College Blvd	SR 193 to Penny Ln	26	57	123	264	569
2	Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	20	43	94	202	435
3	Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	21	46	99	212	458
4	Sierra College Blvd	Twelve Bridges Dr to Old Bickford Ranch Rd	21	46	99	214	461
5	Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	17	37	79	170	367
6	Sierra College Blvd	English Colony Way to King Rd	29	62	135	290	625
7	SR 193	Lincoln City Limits to Sierra College Blvd	24	52	112	242	521
8	SR 193	Sierra College Blvd to Clark Tunnel Rd	22	47	102	219	472
0	0	0					
		Existing + Project					
1	Sierra College Blvd	SR 193 to Penny Ln	24	53	114	245	528
2	Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	34	73	156	337	726
3	Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	34	73	156	337	726
4	Sierra College Blvd	Twelve Bridges Dr to Old Bicford Ranch Rd	34	73	156	337	725
5	Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	34	72	156	336	724
6	Sierra College Blvd	English Colony Way to King Rd	33	72	154	332	715
7	SR 193	Lincoln City Limits to Sierra College Blvd	32	69	149	320	690
8	SR 193	Sierra College Blvd to Clark Tunnel Rd	24	53	113	244	525

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Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2014-136 Bickford Ranch Specific Plan
Description: Cumulative No Project and Cumulative + Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
		Cumulative No Project									
1	Sierra College Blvd	SR 193 to Penny Ln	12,760	85		15	2	3	55	130	
2	Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	12,760	85		15	2	3	55	175	
3	Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	21,630	85		15	2	3	55	180	
4	Sierra College Blvd	Twelve Bridges Dr to Old Bicford Ranch Rd	23,200	85		15	2	3	55	195	
5	Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	24,570	85		15	2	3	55	175	
6	Sierra College Blvd	English Colony Way to King Rd	26,650	85		15	2	3	55	125	
7	SR 193	Lincoln City Limits to Sierra College Blvd	16,630	85		15	2	7	55	150	
8	SR 193	Sierra College Blvd to Clark Tunnel Rd	10,790	85		15	2	7	55	130	
		Cumulative + Project									
1	Sierra College Blvd	SR 193 to Penny Ln	16,470	85		15	2	3	55	130	
2	Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	21,020	85		15	2	3	55	175	
3	Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	29,770	85		15	2	3	55	180	
4	Sierra College Blvd	Twelve Bridges Dr to Old Bicford Ranch Rd	29,670	85		15	2	3	55	195	
5	Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	31,040	85		15	2	3	55	175	
6	Sierra College Blvd	English Colony Way to King Rd	30,010	85		15	2	3	55	125	
7	SR 193	Lincoln City Limits to Sierra College Blvd	19,500	85		15	2	7	55	150	
8	SR 193	Sierra College Blvd to Clark Tunnel Rd	11,630	85		15	2	7	55	130	

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Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2014-136 Bickford Ranch Specific Plan
Description: Cumulative No Project and Cumulative + Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment	Autos	Medium Trucks	Heavy Trucks	Total	
		Cumulative No Project					
1	Sierra College Blvd	SR 193 to Penny Ln	63.3	53.6	58.8	64.9	
2	Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	61.3	51.6	56.9	63.0	
3	Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	63.4	53.8	59.0	65.1	
4	Sierra College Blvd	Twelve Bridges Dr to Old Bicford Ranch Rd	63.2	53.5	58.8	64.9	
5	Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	64.2	54.5	59.7	65.8	
6	Sierra College Blvd	English Colony Way to King Rd	66.7	57.0	62.3	68.4	
7	SR 193	Lincoln City Limits to Sierra College Blvd	63.3	53.8	63.2	66.5	
8	SR 193	Sierra College Blvd to Clark Tunnel Rd	62.3	52.9	62.2	65.5	
		Cumulative + Project					
1	Sierra College Blvd	SR 193 to Penny Ln	64.4	54.7	59.9	66.0	1.1
2	Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	63.5	53.8	59.1	65.2	2.2
3	Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	64.8	55.1	60.4	66.5	1.4
4	Sierra College Blvd	Twelve Bridges Dr to Old Bicford Ranch Rd	64.3	54.6	59.8	66.0	1.1
5	Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	65.2	55.5	60.7	66.9	1.0
6	Sierra College Blvd	English Colony Way to King Rd	67.2	57.6	62.8	68.9	0.5
7	SR 193	Lincoln City Limits to Sierra College Blvd	64.0	54.5	63.9	67.2	0.7
8	SR 193	Sierra College Blvd to Clark Tunnel Rd	62.7	53.2	62.6	65.9	0.3

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Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2014-136 Bickford Ranch Specific Plan
Description: Cumulative No Project and Cumulative + Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Segment	75	70	65	60	55
		Cumulative No Project					
1	Sierra College Blvd	SR 193 to Penny Ln	37	80	173	373	803
2	Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	28	61	132	285	614
3	Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	43	92	198	427	919
4	Sierra College Blvd	Twelve Bridges Dr to Old Bicford Ranch Rd	37	80	172	370	798
5	Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	31	66	142	306	660
6	Sierra College Blvd	English Colony Way to King Rd	54	117	252	543	1170
7	SR 193	Lincoln City Limits to Sierra College Blvd	35	76	163	352	757
8	SR 193	Sierra College Blvd to Clark Tunnel Rd	30	66	141	304	655
0	0	0					
		Cumulative + Project					
1	Sierra College Blvd	SR 193 to Penny Ln	33	71	152	328	707
2	Sierra College Blvd	Penny Ln to Oak Tree Ln (Future)	39	83	179	386	832
3	Sierra College Blvd	Oak Tree Ln (Future) to Twelve Bridges Dr	49	105	226	487	1050
4	Sierra College Blvd	Twelve Bridges Dr to Old Bicford Ranch Rd	49	105	226	486	1047
5	Sierra College Blvd	Old Bickford Ranch Rd to English Colony Way	50	108	233	501	1079
6	Sierra College Blvd	English Colony Way to King Rd	49	106	227	490	1055
7	SR 193	Lincoln City Limits to Sierra College Blvd	45	97	209	451	972
8	SR 193	Sierra College Blvd to Clark Tunnel Rd	32	69	148	320	689

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Appendix D

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Data Input Sheet

Project #: 2014-136 Bickford Ranch EIR
Description: Cumulative + Proejct Traffic
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name - Location	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Sierra Collage Blvd - Park Sites	29,770	85		15	2	3	55	490	
2	Sierra Collage Blvd - LDR02	29,770	85		15	2	3	55	750	
3	Sierra Collage Blvd - RR-07	31,040	85		15	2	3	55	200	
4	Sierra Collage Blvd - LDR-03	31,040	85		15	2	3	55	200	

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Appendix D

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2014-136 Bickford Ranch EIR
Description: Cumulative + Proejct Traffic
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name - Location	Autos	Medium Trucks	Heavy Trucks	Total
1	Sierra Collage Blvd - Park Site	58	49	54	60
2	Sierra Collage Blvd - LDR02	56	46	51	57
3	Sierra Collage Blvd - RR-07	64	55	60	66
4	Sierra Collage Blvd - LDR-03	64	55	60	66

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Appendix D

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2014-136 Bickford Ranch EIR
Description: Cumulative + Proejct Traffic
Ldn/CNEL: Ldn
Hard/Soft: Soft

		-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name - Location	75	70	65	60	55
1	Sierra Collage Blvd - Park Site	49	105	226	487	1050
2	Sierra Collage Blvd - LDR02	49	105	226	487	1050
3	Sierra Collage Blvd - RR-07	50	108	233	501	1079
4	Sierra Collage Blvd - LDR-03	50	108	233	501	1079

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Appendix D

FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)
Noise Barrier Effectiveness Prediction Worksheet

Project Information:

Job Number: 2014-136 Bickford Ranch EIR
Description Cumulative + Proejct Traffic
Roadway Name: Sierra Collage Blvd - RR-02
Location(s): 3

Noise Level Data:

Year: Future
Auto L_{dn}, dB: 64
Medium Truck L_{dn}, dB: 55
Heavy Truck L_{dn}, dB: 60

Site Geometry:

Receiver Description: Backyard
Centerline to Barrier Distance (C_1): 100
Barrier to Receiver Distance (C_2): 100
Automobile Elevation: 0
Medium Truck Elevation: 2
Heavy Truck Elevation: 8
Pad/Ground Elevation at Receiver: 0
Receiver Elevation[1]: 5
Base of Barrier Elevation: 0
Starting Barrier Height 6

Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height[2] (ft)	---------- L_{dn}, dB ---------- Autos	Medium Trucks	Heavy Trucks	Total	Barrier Breaks Line of Sight to… Autos?	Medium Trucks?	Heavy Trucks?
6	6	58	49	55	**60**	Yes	Yes	No
7	7	58	49	55	**60**	Yes	Yes	Yes
8	8	57	48	55	**59**	Yes	Yes	Yes
9	9	56	47	54	**59**	Yes	Yes	Yes
10	10	56	47	54	**58**	Yes	Yes	Yes
11	11	55	46	53	**58**	Yes	Yes	Yes
12	12	54	45	52	**57**	Yes	Yes	Yes
13	13	54	45	52	**56**	Yes	Yes	Yes
14	14	54	44	51	**56**	Yes	Yes	Yes

Notes: 1.Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s)

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Appendix D

FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)
Noise Barrier Effectiveness Prediction Worksheet

Project Information:

Job Number: 2014-136 Bickford Ranch EIR
Description Cumulative + Proejct Traffic
Roadway Name: Sierra Collage Blvd - LDR-04
Location(s): 4

Noise Level Data:

Year: Future
Auto L_{dn}, dB: 64
Medium Truck L_{dn}, dB: 55
Heavy Truck L_{dn}, dB: 60

Site Geometry:

Receiver Description: Backyard
Centerline to Barrier Distance (C_1): 100
Barrier to Receiver Distance (C_2): 100
Automobile Elevation: 0
Medium Truck Elevation: 2
Heavy Truck Elevation: 8
Pad/Ground Elevation at Receiver: 0
Receiver Elevation[1]: 5
Base of Barrier Elevation: 0
Starting Barrier Height 6

Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height[2] (ft)	---------- L_{dn}, dB ---------- Autos	Medium Trucks	Heavy Trucks	Total	Barrier Breaks Line of Sight to… Autos?	Medium Trucks?	Heavy Trucks?
6	6	58	49	55	**60**	Yes	Yes	No
7	7	58	49	55	**60**	Yes	Yes	Yes
8	8	57	48	55	**59**	Yes	Yes	Yes
9	9	56	47	54	**59**	Yes	Yes	Yes
10	10	56	47	54	**58**	Yes	Yes	Yes
11	11	55	46	53	**58**	Yes	Yes	Yes
12	12	54	45	52	**57**	Yes	Yes	Yes
13	13	54	45	52	**56**	Yes	Yes	Yes
14	14	54	44	51	**56**	Yes	Yes	Yes

Notes: 1.Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s)

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