NOISE IMPACT ANALYSIS

4660 SIERRA COLLEGE BOULEVARD COMMERCIAL PROJECT

CITY OF ROCKLIN, CALIFORNIA

LSA

February 2017

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LSA

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TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

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NOISE IMPACT ANALYSIS

A. INTRODUCTION

LSA Associates, Inc. (LSA) has completed a noise impact analysis for the proposed 4660 Sierra College Boulevard Commercial Project (project) located at 4660 Sierra College Boulevard in the City of Rocklin. The project location and a detailed vicinity map are shown in Figure 1.

This noise impact analysis examines potential impacts from noise sources in the project vicinity, including local roadways though noise monitoring and analysis. Noise monitoring was conducted using the Larson Davis SoundTrack LxT sound level meter to assess the ambient noise environment on the project site. Construction and operational noise levels were analyzed. Once operational, the project would generate noise through mobile and stationary sources. Mobile sources include the additional project-related traffic on the local streets and stationary sources include the proposed drive-through windows, car wash, restaurants, and auto service facilities. The City provides hourly noise standards not to exceed 55 dBA L_{eq} during daytime hours, 7:00 a.m. to 10:00 p.m. and 45 dBA L_{eq} during nighttime hours, 10:00 p.m. to 7:00 a.m. for stationary sources at receiving land uses. The City's Municipal Code establishes acceptable operation hours for automobile repair shops to be between 7:00 a.m. and 10:00 p.m.

B. PROJECT DESCRIPTION

Thomas Properties, in coordination with the City of Rocklin, proposes to construct a new retail space on the west side of Sierra College Boulevard in the City of Rocklin, Placer County, California. The approximately 6.64-acre project site is currently proposed to include the following:

- Two fast food restaurants (Chick-Fil-A and Del Taco) with drive-throughs and a total of 6,964 square feet;
- Three fast casual food restaurants (Habit Burger, Pancheros, and an unassigned restaurant); one with a drive through (Habit Burger) and two without drive-throughs, and a total of 7,400 square feet; and
- One auto service facility and one full service car wash[1] (not yet assigned) with a total of 11,731 square feet. The auto service facility is expected to have a private hand car wash area for customers.

The project site is located southwest of the intersection of Sierra College Boulevard and the I-80 eastbound ramps. The project area is bounded by Sierra College Boulevard to the east, the Interstate 80 Sierra College Boulevard off ramp to the north and west, and Assessor's Parcel Number (APN) 045-052-029-000 to the south. The project area consist of APNs 045-052-021-000, 045-052-015-000, 045-052-020-000, and 045-052-019-000.

[1] Represents the worst case scenario of allowable uses relative to potential noise impacts.

The area is zoned as Planned Development-Commercial (PD-C) and has a General Plan designation of Retail Commercial (RC). The project site is currently vacant; the only remains of the pre-existing residence include: a concrete foundation, a well that has been capped, and a dilapidated shack. Vegetation on the site consists of oak woodlands and annual grasslands.

Surrounding land uses include a church to the south, retail uses to the east, and the I-80 freeway along the northern and western project boundaries. Lands in the vicinity of the project site are predominantly developed.

Construction is scheduled to begin in Spring 2016. At maximum, construction of the project is expected to take 24 months.

FIGURE 1

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FEET

SOURCE: ESRI STREETMAP NORTH AMERICA (2012).

4660 Sierra College Boulevard Project Noise Impact Assessment
Project Location and Regional Vicinity Map

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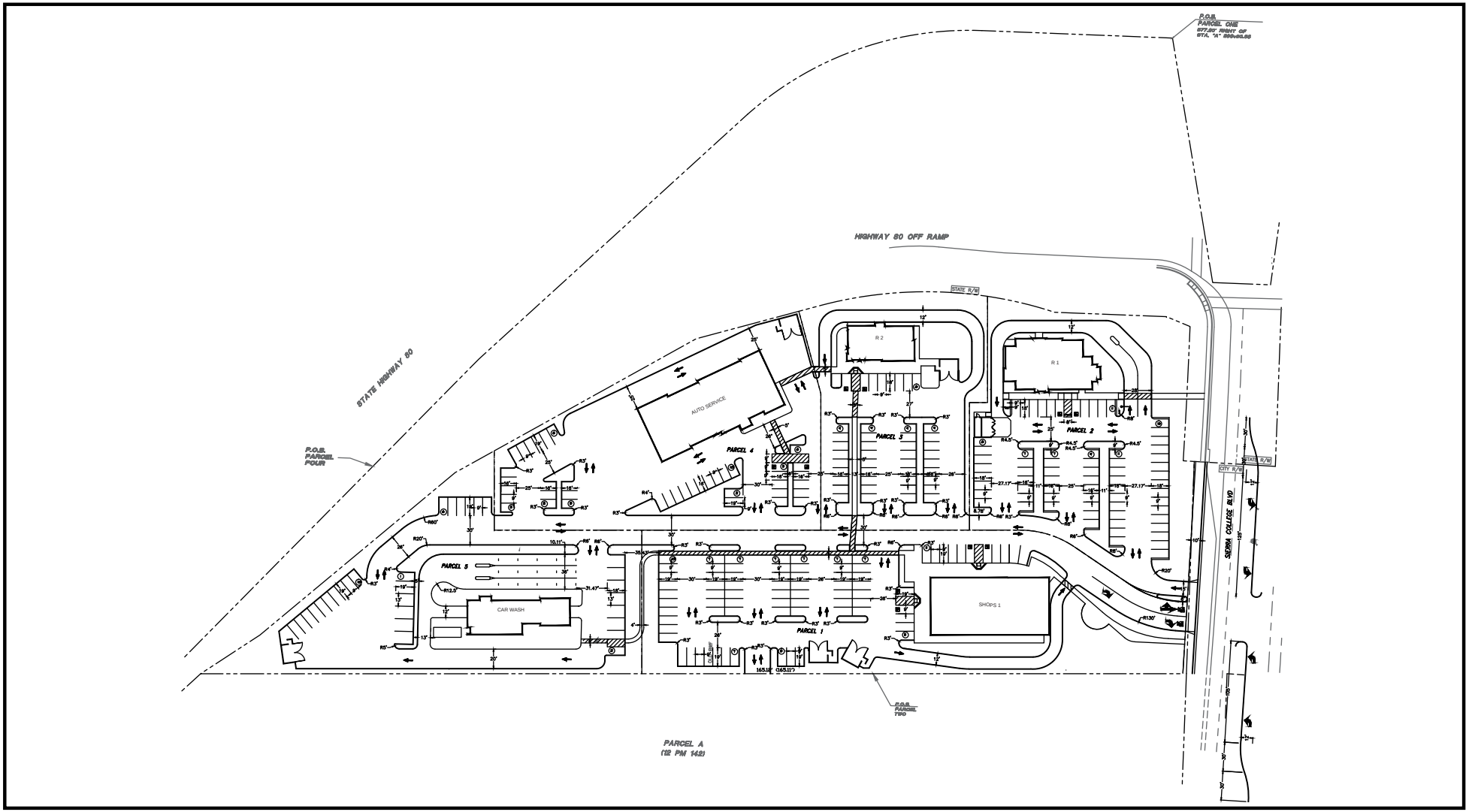

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FIGURE 2

Not To Scale

SOURCE: LSA Associates, Inc. 2015

4660 Sierra College Boulevard Project Noise Impact Assessment

Site Plan

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C. BACKGROUND

This section provides background information on the evaluation of noise impacts including the characteristics of sound, measurement of sound, physiological effects of noise, and the regulatory framework for this analysis.

1. Characteristics of Sound

Noise is usually defined as unwanted sound and consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, or sleep. To the human ear, sound has two significant characteristics: pitch and loudness. Pitch is generally an annoyance, while loudness can affect our ability to hear. Pitch is the number of complete vibrations, or cycles per second, of a wave resulting in the tone's range from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment and is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves, combined with the reception characteristics of the human ear. Sound intensity refers to how hard the sound wave strikes an object, which in turn produces the sound's effect. This characteristic of sound can be measured precisely with instruments. The project analysis defines the noise environment of the project area in terms of sound intensity and the project's effect on adjacent sensitive land uses.

2. Measurement of Sound

Sound intensity is measured through the A-weighted scale to correct for the relative frequency response of the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound similar to the human ear's de-emphasis of these frequencies. Unlike linear units (e.g., inches or pounds), decibels are measured on a logarithmic scale representing points on a sharply rising curve.

For example, 10 decibels (dB) are 10 times more intense than 1 dB; 20 dB are 100 times more intense than 1 dB; and 30 dB are 1,000 times more intense than 1 dB. Thirty decibels (30 dB) represent 1,000 times as much acoustic energy as 1 dB. The decibel scale increases as the square of the change, representing the sound pressure energy. A sound as soft as human breathing is about 10 times greater than 0 dB. The decibel system of measuring sound gives a rough connection between the physical intensity of sound and its perceived loudness to the human ear. A 10 dB increase in sound level is perceived by the human ear as only a doubling of the loudness of the sound. Ambient sounds generally range from 30 A-weighted decibels (dBA) (very quiet) to 100 dBA (very loud).

Sound levels are generated from a source, and their decibel level decreases as the distance from that source increases. Sound dissipates exponentially with distance from the noise source. For a single point source, sound levels decrease approximately 6 dBA for each doubling of distance from the source. This drop-off rate is appropriate for noise generated by stationary equipment. If noise is produced by a line source (e.g., highway traffic or railroad operations), the sound decreases 3 dBA for each doubling of distance in a hard-site environment, and the sound decreases 4.5 dBA for each doubling of distance in a relatively flat environment with absorptive vegetation.

There are many ways to rate noise for various time periods, an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. Equivalent continuous sound level

(L_{eq}) is the total sound energy of time varying noise over a sample period. However, the predominant rating scales for communities in the State of California are the L_{eq} and Community Noise Equivalent Level (CNEL) or the day-night average level (L_{dn}) based on dBA. CNEL is the time varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as evening hours) and a 10 dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale, but without the adjustment for events occurring during the evening hours. CNEL and L_{dn} are within 1 dBA of each other and are normally interchangeable. The City uses L_{eq} for noise impact assessments.

Other noise rating scales are important when assessing the annoyance factor include the maximum noise level (L_{max}), which is the highest exponential time averaged sound level that occurs during a stated time period. The noise environments discussed in this analysis for short-term noise impacts are specified in terms of maximum levels denoted by L_{max}, which reflects peak operating conditions and addresses the annoying aspects of intermittent noise. It is often used together with another noise scale, or noise standards in terms of percentile noise levels, in noise ordinances for enforcement purposes. For example, the L_{10} noise level represents the noise level exceeded 10 percent of the time during a stated period. The L_{50} noise level represents the median noise level. Half of the time the noise level exceeds this level, and half of the time it is less than this level. The L_{90} noise level represents the noise level exceeded 90 percent of the time and is considered the background noise level during a monitoring period. For a relatively constant noise source, the L_{eq} and L_{50} are approximately the same.

Noise impacts can be described in three categories. The first category includes audible impacts that refer to increases in noise levels noticeable to humans. Audible increases in noise levels generally refer to a change of 3.0 dB or greater since this level has been found to be the lowest audible change perceptible to humans in outdoor environments. The second category, potentially audible, refers to a change in the noise level between 1.0 and 3.0 dB, which is only noticeable in laboratory environments. The last category includes changes in noise levels of less than 1.0 dB, which are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

3. Physiological Effects of Noise

Physical damage to human hearing begins at prolonged exposure (typically more than 8 hours, as defined by the Occupational Safety and Health Administration [OSHA]) to noise levels higher than 85 dBA. Exposure to high noise levels affects our entire system, with prolonged noise exposure in excess of 75 dBA increasing body tensions (thereby, affecting blood pressure and functions of the heart and the nervous system). In comparison, extended periods of noise exposure above 90 dBA would result in permanent cell damage. When the noise level reaches 120 dB, a tickling sensation occurs in the human ear, even with short-term exposure. This level of noise is called the threshold of feeling. As the sound reaches 140 dB, the tickling sensation is replaced by the feeling of pain in the ear. This is called the threshold of pain. A sound level of 160 to 165 dB will result in dizziness or loss of equilibrium. The ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying less developed areas.

Table 1 lists “Definitions of Acoustical Terms”, and Table 2 displays “Common Sound Levels and Their Noise Sources”.

Table 1: Definitions of Acoustical Terms

Term	Definitions
Decibel, dB	A unit of level that denotes the ratio between two quantities proportional to power; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.
Frequency, Hz	Of a function periodic in time, the number of times that the quantity repeats itself in one second (i.e., number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless reported otherwise.
L_{01}, L_{10}, L_{50}, L_{90}	The fast A-weighted noise levels equaled or exceeded by a fluctuating sound level for 1 percent, 10 percent, 50 percent, and 90 percent of a stated time period.
Equivalent Continuous Noise Level, L_{eq}	The level of a steady sound that, in a stated time period and at a stated location, has the same A-weighted sound energy as the time varying sound.
Community Noise Equivalent Level, CNEL	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 5 dB to sound levels occurring in the evening from 7:00 p.m. to 10:00 p.m. and after the addition of 10 dB to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
Day/Night Noise Level, L_{dn}	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 10 dB to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
L_{max}, L_{min}	The maximum and minimum A-weighted sound levels measured on a sound level meter, during a designated time interval, using fast time averaging.
Ambient Noise Level	The all-encompassing noise associated with a given environment at a specified time, usually a composite of sound from many sources at many directions, near and far; no particular sound is dominant.
Intrusive	The noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content, as well as the prevailing ambient noise level.

Source: Harris, Cyril M., *Handbook of Acoustical Measurements and Noise Control*, 1991.

Table 2: Common Sound Levels and Their Noise Sources

Noise Source	A-Weighted Sound Level in Decibels	Noise Environment	Subjective Evaluation
Near Jet Engine	140	Deafening	128 times as loud
Civil Defense Siren	130	Threshold of Pain	64 times as loud
Hard Rock Band	120	Threshold of Feeling	32 times as loud
Accelerating Motorcycle a few feet away	110	Very Loud	16 times as loud
Pile Driver; Noisy Urban Street/ Heavy City Traffic	100	Very Loud	8 times as loud
Ambulance Siren; Food Blender	95	Very Loud	
Garbage Disposal	90	Very Loud	4 times as loud
Freight Cars; Living Room Music	85	Loud	
Pneumatic Drill; Vacuum Cleaner	80	Loud	2 times as loud
Busy Restaurant	75	Moderately Loud	
Near Freeway Auto Traffic	70	Moderately Loud	Reference Level
Average Office	60	Quiet	½ as loud
Suburban Street	55	Quiet	
Light Traffic; Soft Radio Music in Apartment	50	Quiet	¼ as loud
Large Transformer	45	Quiet	
Average Residence Without Stereo Playing	40	Faint	⅛ as loud
Soft Whisper	30	Faint	
Rustling Leaves	20	Very Faint	
Human Breathing	10	Very Faint	Threshold of Hearing
	0	Very Faint	

Source: Compiled by LSA Associates, Inc., 2015.

4. Regulatory Framework

The City of Rocklin has established standards in their 2010 General Plan and Municipal Code for land use projects that could potentially expose sensitive receptors to excessive noise levels. The City's Construction Noise Guidelines establish permissible construction hours.

a. City of Rocklin's General Plan. The Noise Element of the City's General Plan was established to limit the exposure of the community to excessive noise levels by guiding decisions regarding land use.[1] The Noise Element includes goals and policies that address community noise exposure and permitted noise activities. These goals address noise generating activities that could adversely affect noise-sensitive land uses. According to the City's exterior noise standards for new projects, stationary noise sources are not to exceed an hourly L_{eq} of 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and 45 dBA during nighttime hours (10:00 p.m. to 7:00 a.m.) as measured at the property line of the receiving land use. A list of stationary sources and allowable noise levels are included in Table 3.

[1] Rocklin, City of, 2012. *City of Rocklin General Plan: Noise Element.* October.

Table 3: Exterior Noise Level Design Standards for New Projects Affected by or Including Stationary Noise Sources

Noise Level Descriptor	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Hourly L_{eq} (dBA)	55	45

The City can impose noise level standards that are more restrictive than those specified above based upon determination of existing low ambient noise levels.

"Fixed" noise sources which are typically of concern include, but are not limited to the following:

HVAC Systems	Cooling Towers/Evaporative Condensers
Pump Stations	Lift Stations
Emergency Generators	Boilers
Steam Valves	Steam Turbines
Generators	Fans
Air Compressors	Heavy Equipment
Conveyor Systems	Transformers
Pile Drivers	Grinders
Drill Rigs	Gas or Diesel Motors
Welders	Cutting Equipment
Outdoor Speakers	Blowers

The types of uses which may typically produce the noise sources described above include but are not limited to: industrial facilities including pump stations, trucking operations, tire shops, auto maintenance shops, metal fabricating shops, shopping centers, drive-up windows, businesses using amplified sound systems, car washes, loading docks, batch plants, bottling and canning plants, recycling centers, electric generating stations, race tracks, landfills, sand and gravel operations, schools, playgrounds, and athletic fields.

NOTE: The point of measurement for noise levels is at a location at least 5 feet inside the property line of the receiving land use and at a point 5 feet above ground level. In the case of lots where the noise-sensitive use has a reasonable outdoor activity area for outdoor enjoyment, the stationary noise source criteria can be applied at a designated outdoor activity area (at the discretion of the City).

The General Plan also addresses land use compatibility standards with respect to maximum allowable noise exposure from transportation noise sources. The allowable noise exposure standards are included in Table 4. The City does not have exposure standards for commercial land uses.

Table 4: Maximum Allowable Noise Exposure – Transportation Noise Sources

Affected/Receiving Land Use	Outdoor Activity Areas[a] L_{dn}/CNEL	Interior Spaces	
		L_{dn}/CNEL	L_{eq} dB[b]
Residential	60[c]	45	--
Transient Lodging	65	45	--
Hospitals, Nursing Homes	60[c]	45	--
Theaters, Auditoriums, Music Halls	--	--	35
Non-Commercial Places of Public Assembly	60[c]	--	40
Office Buildings	--	--	45
Schools, Libraries, Museums	--	--	45
Playgrounds, Neighborhood Parks	70	--	--

[a] The outdoor activity area is generally considered to be the location where individuals may generally congregate for relaxation, or where individuals may require adequate speech intelligibility. Such places may include patios of residences, picnic facilities, or instructional areas. Where it is not practical to mitigate exterior noise levels at patio or balconies of apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area. At the discretion of the City, where no outdoor activity areas are provided or known, only the interior noise level criteria can be applied to the project.

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

[c] Where it is not possible to reduce noise in outdoor activity areas to 60 dB Ldn/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 65 dB Ldn/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.

b. City of Rocklin Municipal Code. The City of Rocklin's Municipal Code addresses specific construction hours and generally discusses noise for various zoning designations, residential equipment uses, and animals. The Municipal Code defines operational hours for automobile shops to be between 7:00 a.m. and 10:00 p.m. in Section 17.57.050 Permitted Uses. Additionally the shop is required to be fully enclosed within the building with no outdoor repairs or storage of equipment or materials.[1]

c. City of Rocklin Construction Noise Guidelines. According to the City's Construction Noise Guidelines, construction near or within residential areas is permitted on weekdays between 7:00 a.m. and 7:00 p.m. and on weekends between 8:00 a.m. and 7:00 p.m.[2]

D. SETTING

This section describes the existing noise environment in the project site vicinity. Noise monitoring, traffic modeling, and noise modeling were used to quantify existing and future (2040) noise levels at the project site.

[1] Rocklin, City of. *City of Rocklin Municipal Code Section 17.57.050.*

[2] Rocklin, City of. *City of Rocklin Construction Noise Guidelines.* Website: https://www.rocklin.ca.us/depts/develop/housing/code_enforcement/construction_noise_guidelines.asp

1. Existing Sensitive Land Uses in the Project Area

Noise sensitive receptors include residences, schools, hospitals, churches and similar uses that are sensitive to noise. Project construction and operation could adversely affect nearby noise-sensitive land uses. Existing sensitive land uses within the project area include single-family homes located approximately 950 feet to the south, and the Lifehouse Church on Sierra College Boulevard approximately 115 feet to the south of the project site. The commercial retail shops and restaurants located east of Sierra College Boulevard are not considered noise-sensitive uses.

2. Overview of the Existing Noise Environment

Traffic on Sierra College Boulevard and I-80 is the dominant source contributing to the ambient noise levels in the project vicinity. Noise from motor vehicles is generated by engine vibrations, the interaction between the tires and the road, and the exhaust systems. Airport noise does not affect the noise environment of the project site. Airport related noise levels are primarily associated with aircraft engine noise made while aircraft are taking off, landing, or running their engines while still on the ground. The proposed project is not within the 65 dBA CNEL contour of the Sacramento International Airport located approximately 20 miles southwest or the Auburn Municipal Airport located approximately 15 miles northeast. Railway noise is not significant at the project site. The project is located approximately 1 mile east of the UPRR tracks; the project is not within the 60 dBA CNEL contour for railroad noise.[1]

a. Ambient Noise Levels. To assess existing noise levels, LSA conducted two short-term and one long-term noise measurements on the project site between September 17, 2015 and September 18, 2015. The short-term (15-minute) noise measurements were recorded at different locations on-site between 10:00 a.m. and 12:00 p.m. on September 17, 2015. The short-term measurements were taken on the northern and southern property site boundaries near the I-80 off-ramp and Lifehouse Church, respectively. The long-term noise measurement recorded a 24-hour measurement from September 17, 2015 to September 18, 2015 at the southern project site boundary and Lifehouse Church. Noise monitoring locations are shown in Figure 3. Noise measurement data collected during monitoring is summarized in Table 5. The meteorological conditions at the time of the noise monitoring are shown in Table 6. The short-term noise measurements indicate that ambient noise in the project site vicinity ranges from approximately 52.5 dBA to 56.2 dBA L_{eq}. The long-term noise measurement was 62 dBA CNEL. The primary noise sources observed at the project site was the traffic on I-80 and Sierra College Boulevard.

[1] City of Rocklin, 2012. op. cit.

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FIGURE 3

Not To Scale

SOURCE: LSA Associates, Inc. 2015

4660 Sierra College Boulevard Project Noise Impact Assessment

Noise Monitoring Locations

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Table 5: Ambient Noise Monitoring Results, dBA, September 17 through 18, 2015

Location Number	Location Description	Start Time	L_{eq} [a]	L_{max} [b]	L_{min} [c]	Primary Noise Sources
ST-1	Near I-80 off-ramp at northern portion of project site	10:22 a.m.	56.2	60.6	52.5	Vehicles on I-80 off-ramp
ST-2	Southern project site boundary, near Lifehouse Church	10:47 a.m.	52.2	55.6	49.9	Traffic on I-80 and Sierra College Boulevard
LT-1	Southern project site boundary, near Lifehouse Church	11:36 a.m.	55.6	70.7	49.4	Traffic on I-80 and Sierra College Boulevard

[a] L_{eq} represents the average of the sound energy occurring over the measurement time period.
[b] L_{max} is the highest sound level measured during the measurement time period.
[c] L_{min} is the lowest sound level measured during the measurement time period.

Source: LSA Associates, Inc., September 2015.

Table 6: Meteorological Conditions During Ambient Noise Monitoring

Location Number	Maximum Wind Speed (mph)	Average Wind Speed (mph)	Temperature (°F)	Relative Humidity (percent)	Sky Conditions
ST-1	3.6	2.4	70.2	70	Partly cloudy
ST-2	4.5	0.6	74.3	54	Partly cloudy

Source: LSA Associates, Inc., September 2015.

b. Existing Roadway Noise Levels. Documentation of the existing roadway traffic noise levels in the project vicinity were performed using the Federal Highway Administration (FHWA) highway traffic noise prediction model (FHWA RD-77-108). This model uses a typical vehicle mix for urban/suburban areas in California and requires parameters, including traffic volumes, vehicle speed, and roadway geometry to compute typical equivalent noise levels during daytime, evening, and nighttime hours. The resultant noise levels are weighted and summed over 24-hour periods to determine the CNEL values. Existing traffic noise contours along modeled roadway segments are shown in Table 7. Figure 4 shows baseline existing traffic noise levels near the project site.

Table 7: Existing Traffic Noise Levels

Roadway Segment	Average Daily Trips	Centerline to 70 dBA CNEL (feet)	Centerline to 65 dBA CNEL (feet)	Centerline to 60 dBA CNEL (feet)	CNEL (dBA) 50 Feet From Centerline of Outermost Lane
Sierra College Boulevard - Granite Drive to Commons Drive	20,700	< 50	104	216	66.9
Sierra College Boulevard - Commons Drive to Crossings Drive	27,000	63	122	257	68
Sierra College Boulevard - Crossings Drive to Schriber Way	14,800	< 50	87	174	65.1
Sierra College Boulevard – Schriber Way to Dominguez Road	21,400	< 50	112	223	66.1
Sierra College Boulevard - Dominguez Road south	21,700	< 50	104	221	67.9

Source: LSA Associates, Inc., September 2015.

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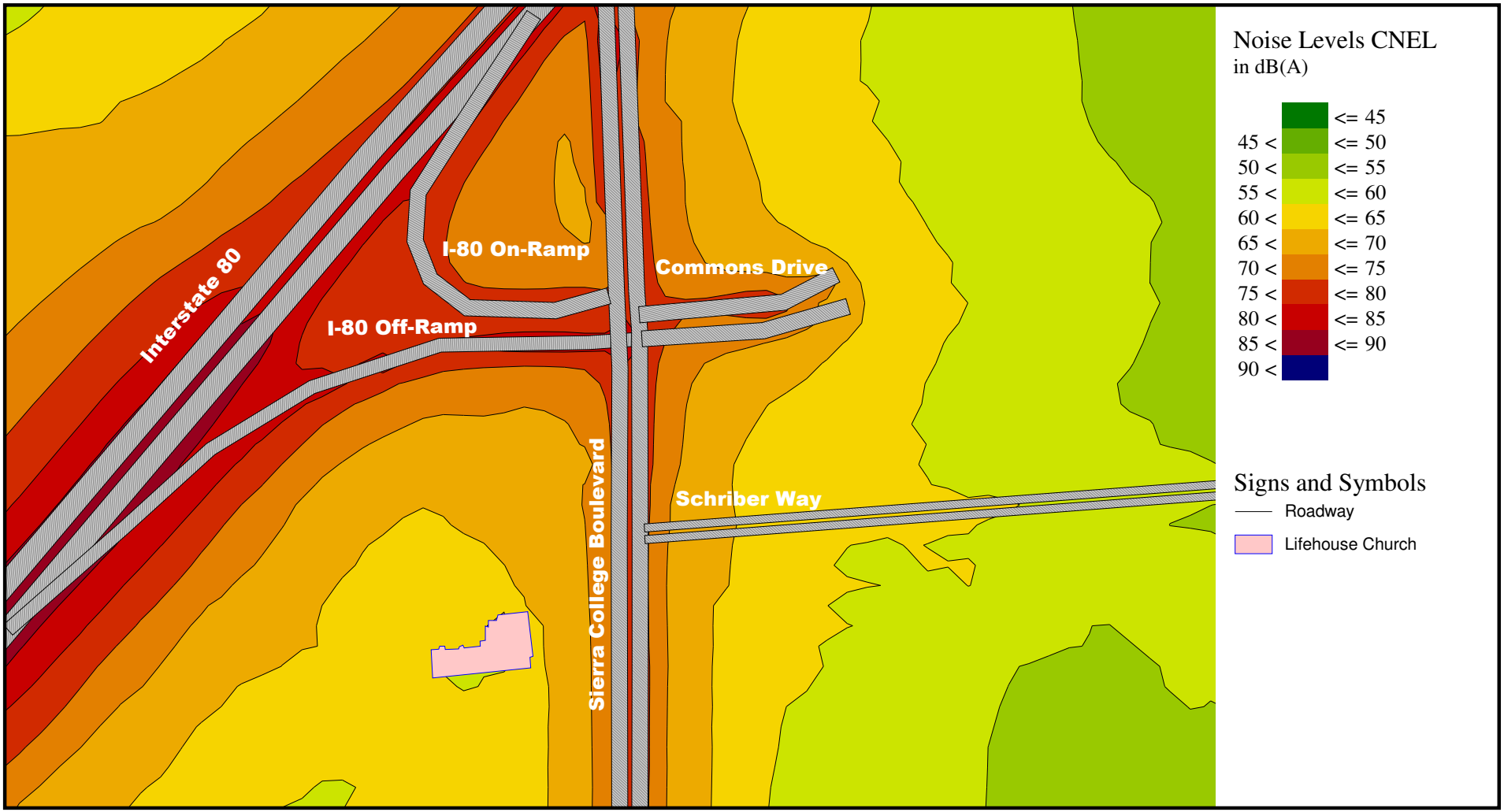

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N

0 50 100 200 300 400 feet

FIGURE 4

SOURCE: LSA Assoicates, Inc. 2015

2015 Existing Noise

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3. Noise Model

SoundPlan Version 7.3 (SoundPlan) was used to model potential noise impacts of the proposed project for various scenarios. SoundPlan calculates noise levels at user defined locations for inputted noise sources. Existing 2015 and future 2040 traffic levels included in the *Transportation Impact Analysis*, typical noise levels for the proposed land uses, and noise monitoring levels were entered into the model.[1] Noise contours generated in SoundPlan are included as figures in this noise impact analysis. Calculation and input information is included in Appendix B.

E. PROJECT IMPACTS

A project will normally have a significant effect on the environment related to noise if it will substantially increase the ambient noise levels for adjoining areas or conflict with adopted environmental plans and goals of the community in which it is located. The applicable noise standards governing the project site include the Noise Element of the City's General Plan, the Construction Noise Guidelines, and Municipal Code.

1. Construction Noise

Short-term noise impacts would be associated with excavation, grading, and erecting of buildings on site during construction of the proposed project. Table 8 lists maximum noise levels recommended for noise impact assessments for typical construction equipment, based on a distance of 50 feet between the equipment and a noise receptor. Construction-related short-term noise levels would be higher than existing ambient noise levels currently in the project area but would no longer occur once construction of the project is completed.

Table 8: Typical Construction Equipment Maximum Noise Levels, L_{max}

Type of Equipment	Range of Maximum Sound Levels (dBA at 50 feet)	Suggested Maximum Sound Levels for Analysis (dBA at 50 feet)
Pile Drivers	81 to 96	93
Rock Drills	83 to 99	96
Jackhammers	75 to 85	82
Pneumatic Tools	78 to 88	85
Pumps	74 to 84	80
Scrapers	83 to 91	87
Haul Trucks	83 to 94	88
Cranes	79 to 86	82
Portable Generators	71 to 87	80
Rollers	75 to 82	80
Dozers	77 to 90	85
Tractors	77 to 82	80

[1] Abrams Associates, 2015. *Transportation Impact Analysis – Sierra College Boulevard Commercial Project – City of Rocklin.* August 7.

Type of Equipment	Range of Maximum Sound Levels (dBA at 50 feet)	Suggested Maximum Sound Levels for Analysis (dBA at 50 feet)
Front-End Loaders	77 to 90	86
Hydraulic Backhoe	81 to 90	86
Hydraulic Excavators	81 to 90	86
Graders	79 to 89	86
Air Compressors	76 to 89	86
Trucks	81 to 87	86

Source: Bolt, Beranek & Newman, 1987. Noise Control for Buildings and Manufacturing Plants.

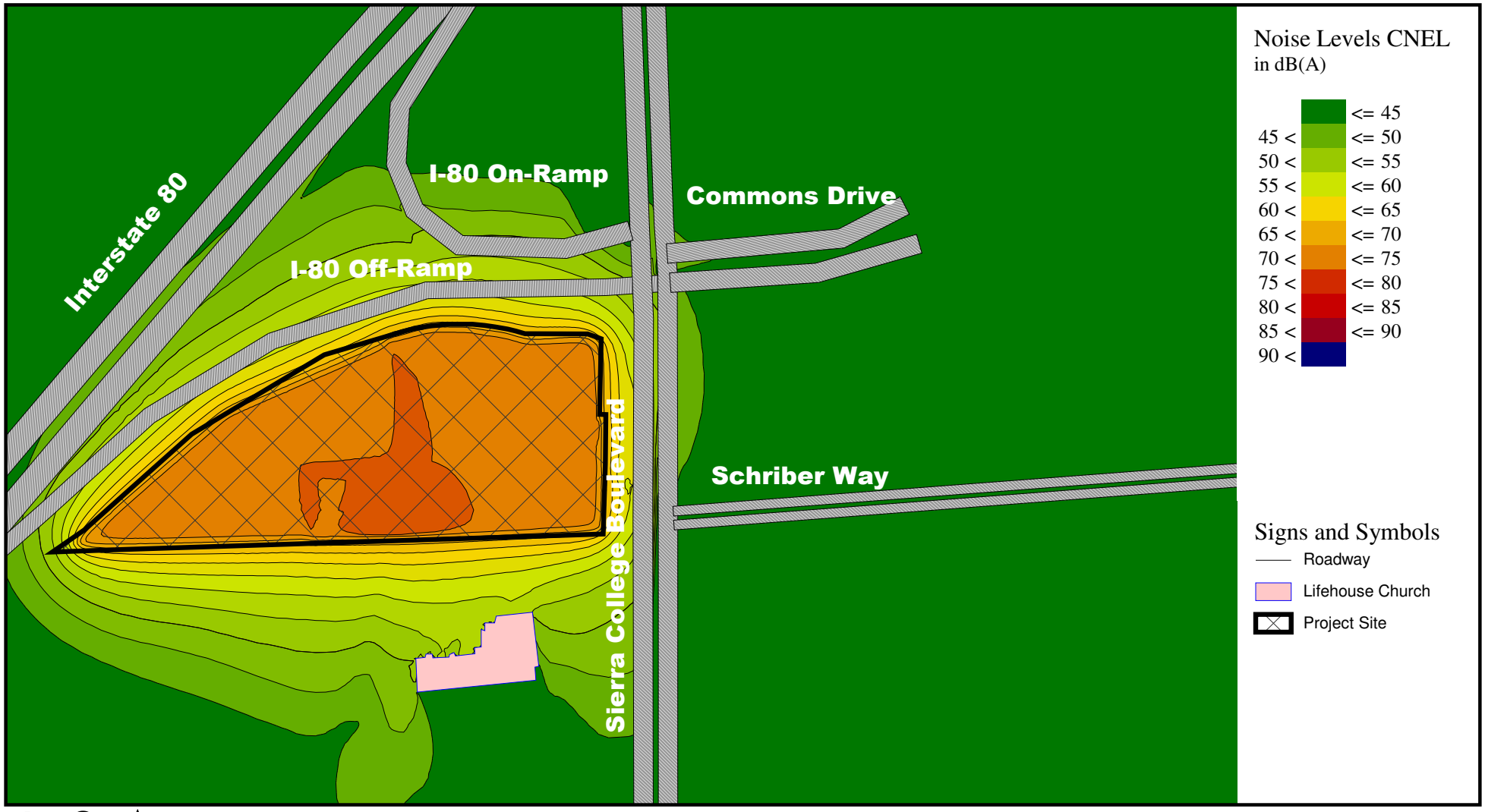
Two types of short-term noise impacts could occur during the construction of the proposed project. The first type involves construction crew commutes and the transport of construction equipment and materials to the site for the proposed project, which would incrementally increase noise levels on roads leading to the site. As shown in Table 8, there would be a relatively high single-event noise exposure potential at a maximum level of 84 dBA L_{max} with trucks passing at 50 feet. However, the projected construction traffic would be minor when compared to the existing traffic volumes on Sierra College Boulevard and I-80, and its associated short-term noise-level changes would not be substantial.

The second type of short-term noise impact is related to noise generated during excavation, grading, and construction on the project site and off-site infrastructural connection areas. Construction is performed in discrete steps, or phases, each of which has its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated on site. Therefore, the noise levels vary as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase.

The proposed project would be developed in two phases. Phase one would include construction of the eastern portion of the site, including R1 and R2 restaurants and Shops 1, as shown in the site plan (Figure 2). The second phase would most likely include developing the western portion of the site, including the auto service shop and the car wash. Construction noise levels for both development phases would be generally the same based on similar site areas and building construction. Construction would last approximately 24 months.

As shown in Table 8, typical maximum noise levels range up to 91 dBA L_{max} at 50 feet during the noisiest construction phases. The site preparation phase, which includes excavation and grading of the site, tends to generate the highest noise levels because earthmoving machinery is the noisiest construction equipment. Earthmoving equipment includes excavating machinery such as tractors, motor graders, excavators, and back hoes. Typical operating cycles for these types of construction equipment may involve 1 or 2 minutes of full-power operation followed by 3 or 4 minutes at lower power settings.

Construction noise was modeled as worst-case-scenario with both development phases occurring at once. Construction noise contours are shown in Figure 5. The closest noise-sensitive receptor is the



LSA

N

0 50 100 200 300 400 feet

SOURCE: LSA Assoicates, Inc. 2015

FIGURE 5

4660 Sierra College Boulevard Project Noise Impact Assessment

Total Project Construction Noise

P:\THS1501 4660 Sierra College Blvd\BACKGROUND\Sound Plan (9/17/2015)

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Lifehouse Church located approximately 115 feet to the south of the project site. Based on attenuation the church may be subject to short-term construction noise reaching 84 dBA L_{max} when construction is occurring at the project site boundary. The City does not have maximum noise level standards for construction noise, however the City's Construction Noise Guidelines require normal construction activities to occur between 7:00 a.m. and 7:00 p.m. Monday through Friday and Saturday and Sunday construction times are from 8:00 a.m. to 7:00 p.m. near residential areas. The proposed project is not within a residential area.

2. Operational Noise

The proposed project would include commercial development in a relatively undeveloped area next to I-80 and Sierra College Boulevard. Operational noise can be categorized as mobile source noise and stationary source noise. Mobile source noise is attributable to the additional trips that would be a result of the proposed project. Stationary source noise includes noise generated by the shops, restaurants, and car wash included in the proposed project.

a. Mobile Source Noise. Traffic in the project site vicinity would increase as a result of the proposed project. Project generated average daily traffic (ADT) as documented in the Transportation Impact Analysis[1] (TIA) was used as an input into the FHWA traffic noise model. Based on the results of the model, traffic noise levels associated with the project would increase 0.2 to 2.3 dBA CNEL over the existing 2015 conditions and from 0.1 to 0.4 dBA CNEL over the predicted 2040 future conditions on local roadway segments. The roadway segment between the I-80 off-ramp to Schriber Way would experience the highest traffic noise level increase. However, the increase would be minimal and there are no sensitive receptors near this roadway segment. According to the project TIA, traffic volumes on Sierra College Boulevard between Schriber Way and Dominguez Road would decrease with the project resulting in a noise reduction. Table 9 shows existing and future traffic noise levels on nearby roadways.

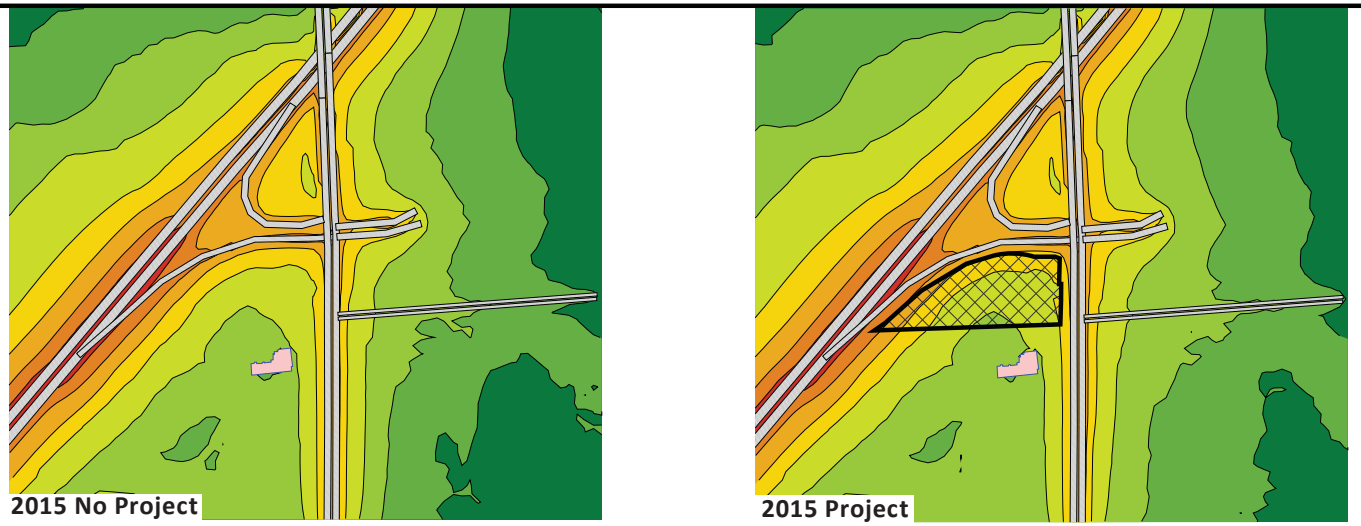
Figure 6 shows traffic noise contours for 2015 and 2040 conditions with and without the project.

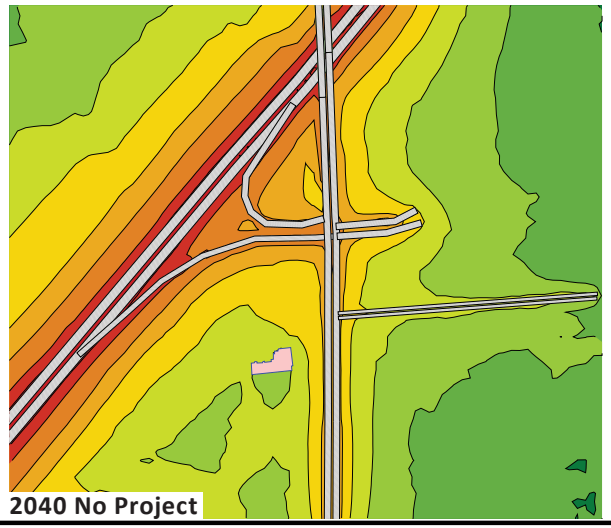
[1] Abrams Associates, 2015, op.cit.

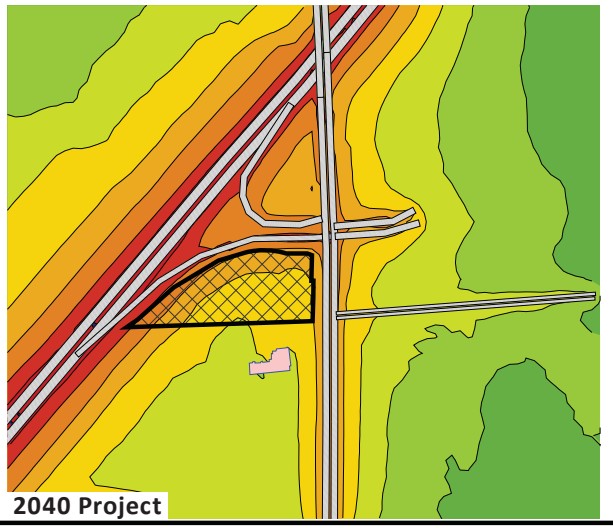
Table 9: FHWA Modeled Traffic Noise Levels

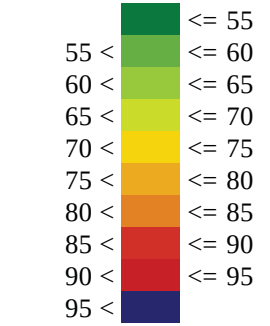
Roadway Segment	Existing 2015	Project 2015		No Project 2040	Project 2040	
	CNEL (dBA) 50 Feet From Centerline of Outermost Lane	CNEL (dBA) 50 Feet From Centerline of Outermost Lane	CNEL Increase Over 2015 Baseline (dBA)	CNEL (dBA) 50 Feet From Centerline of Outermost Lane	CNEL (dBA) 50 Feet From Centerline of Outermost Lane	CNEL Increase Over 2040 Baseline (dBA)
Sierra College Boulevard - Granite Drive to Commons Drive	66.9	67.1	0.2	68.6	68.7	0.1
Sierra College Boulevard - Commons Drive to Crossings Drive	68	68.4	0.4	70	70.2	0.2
Sierra College Boulevard - Crossings Drive to Schriber Way	65.1	67.4	2.3	68.5	68.9	0.4
Sierra College Boulevard – Schriber Way to Dominguez Road	66.1	65.9	-0.2	67.4	67.3	-0.1
Sierra College Boulevard - Dominguez Road south	67.9	68.1	0.2	70.4	70.5	0.1

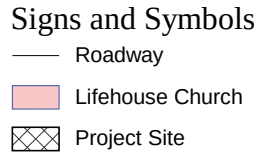
Source: LSA Associates, Inc., September 2015.











LSA

FIGURE 6

Not To Scale

SOURCE: LSA Associates, Inc. 2015

4660 Sierra College Boulevard Project Noise Impact Assessment

Traffic Noise Contours

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b. Stationary Source Noise. The Rocklin General Plan establishes permissible noise levels from stationary sources as measured 5 feet inside the property boundary of the receiving land use. The daytime (7:00 a.m. to 10:00 p.m.) standard is 55 dBA L_{eq} and nighttime (10:00 p.m. to 7:00 a.m.) standard is 45 dBA L_{eq}. The proposed restaurants, shops, auto service shop, and car wash are considered stationary noise sources.

Drive-Through Noise. Typical noise levels associated with drive-through restaurants include the speaker for outside orders, cars idling in the drive-through line. Restaurant noise itself would be contained within the building. Drive-through speakers would produce noise levels up to 72 dBA L_{max} at a distance of 4 feet.[1, 2] A typical drive-through speaker does not generate noise continuously and therefore, when averaged over an hour, the L_{eq} would be 61 dBA L_{eq} at 4 feet. The closest drive-through speaker to a potential receptor location would be at the "Shops 1" pad, located approximately 50 feet from the property line of the Lifehouse Church. The speaker noise at a distance of 50 feet would attenuate to a noise level of 43 dBA L_{eq}. Therefore, the speaker noise would not exceed the City's standard of 55 dBA L_{eq}.

Car Wash Noise. The proposed car wash is located near the southern portion of the project site. Typical car wash noises include the sprayers and blowers within the washing building and the vacuum stations located outside. Car wash noise levels near the exit in the blower area can reach up to 100 dBA L_{max}.[3] Shop vacuum cleaners can produce noise levels between 78 to 92 dBA L_{max}.[4] The car wash equipment is enclosed providing additional noise attenuation barriers. The car wash location would be located approximately 325 feet from the property line of the closest receptor property line. At this distance, the combined car wash noise, including both the car wash and the vacuum noise, would be 48 dBA L_{eq} at the nearest receiving land use, which would be below the City's standards for daytime stationary sources. The car wash would not operate during nighttime hours and therefore would not exceed the nighttime standard.

Auto Service Shop Noise. Typical equipment used in an auto service shop could include air grinders, air compressors, and pneumatic floor lifts which could generate noise levels up to 114 dBA L_{max}.[5] Typical operating cycles for the equipment would include one to two minutes of use with three to five minutes of quiet in between. Section 17.57.050 of the City's Municipal Code requires auto service shops to be fully enclosed with a standard building enclosure. With the enclosure and distance attenuation, the auto service shop would be expected to generate a maximum noise level of 41 dBA L_{eq} at the nearest receiving land use, or 51 dBA L_{eq} with shop doors open. Therefore, the auto service shop would meet the City standard of 55 dBA L_{eq}.

[1] HM Electronics, Inc. *Drive-Thru Sound Pressure Level From the Menu Board or Speaker Post.*

[2] Administrative Law, Office of, 1990. *OAL-Guideline No. 33, 1.Edition.* March

[3] Berger, EH, 1994. *Too much tunnel noise? Better listen up, Professional Car washing & Detailing*, 18(2), pg. 39-44.

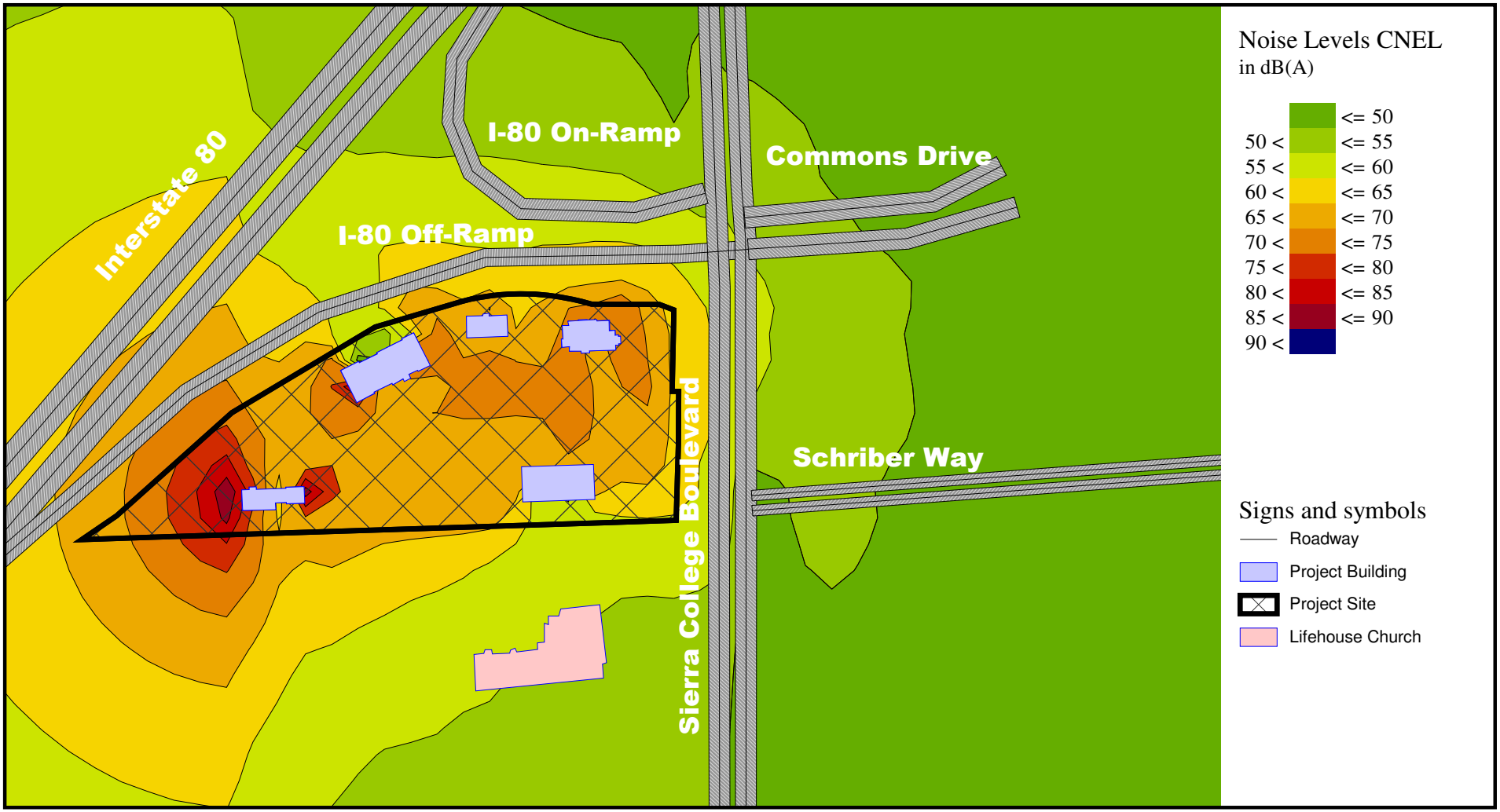
[4] Clark, W. and Bohne, B., 1984. *The Effects of Noise on Hearing and the Ear, Medical Times,* December.

[5] OSHA Requirements 29 CFR 1910.95 Occupational Noise Exposure. http://3mcollision.com/osha-29-cfr-1910-95 (accessed September 16, 2015).

Delivery Noise. Additional on-site stationary noise sources would include delivery trucks and parking lot noise. Of the on-site stationary noise sources, noise generated by delivery truck activity would generate the highest maximum noise levels. While parking activities, such as people conversing or doors slamming, would generate noise levels of approximately 60 dBA to 70 dBA L_{max} at 50 feet, delivery truck loading and unloading activities would result in maximum noise levels from 75 dBA to 85 dBA L_{max} at 50 feet.

There are generally two types of loading that would occur on the site: small deliveries like parcels and packages, and large deliveries such as retail items or weekly food deliveries for dining and market facilities. The former are typically made via passenger car, van, or single-unit truck. These activities are potential noise sources that could affect noise-sensitive receptors in the project site vicinity. The proposed restaurants would generate two to three truck deliveries per day between 4:00 a.m. and 7:00 a.m. occurring for 45 minutes to one hour. Loading and unloading activities could generate noise levels from 68 to 78 dBA L_{max} at the closest receptor, Lifehouse Church. Peak noise levels from loading and unloading would be intermittent and when averaged over a one hour period would be much lower than the peak noise levels and, therefore, would not be expected to exceed the City's nighttime noise standard. In addition, Lifehouse Church would not be operational during 10:00 p.m. and 7:00 a.m.; therefore, delivery noise associated with the project would not affect noise levels at nearby sensitive receptors.

Total Project Noise. Total project generated noise levels were assessed using SoundPlan for the proposed project. Stationary source noise contour results are shown in Figure 7. Noise levels measured during the long-term monitoring were 62 dBA CNEL at the project site. Project operational noise levels would result in 53 dBA CNEL. Operation noise associated with the project would be 6 dBA lower than the existing noise levels in the project site vicinity. Therefore, the project would not substantially increase noise levels at sensitive receptor locations or within the project vicinity.



LSA

N

0 50 100 200 300 400 feet

FIGURE 7

SOURCE: LSA Assoicates, Inc. 2015

4660 Sierra College Boulevard Project Noise Impact Assessment

Project Noise

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APPENDIX A

Noise Monitoring Data

Noise Measurement Survey

Project Number: TH1501
Project Name: 4600 Sierra College Blvd.

Test Personnel: Graham
Equipment: _____

Site Number: ST-1 Date: 9/17/15

Time: From 10:20 AM To 10:36 AM

Site Location: On-Site - Northeast Corner Where "R-1" would be located.

Primary Noise Sources: Vehicles exiting I-80.

Measurement Results

	dBA
L_{eq}	36.8
L_{max}	~~48~~ 46.8
L_{min}	29.4
L_{peak}	78.0
L_2	
L_8	
L_{10}	
L_{25}	
L_{50}	
L_{90}	
SEL	66.7

Atmospheric Conditions:

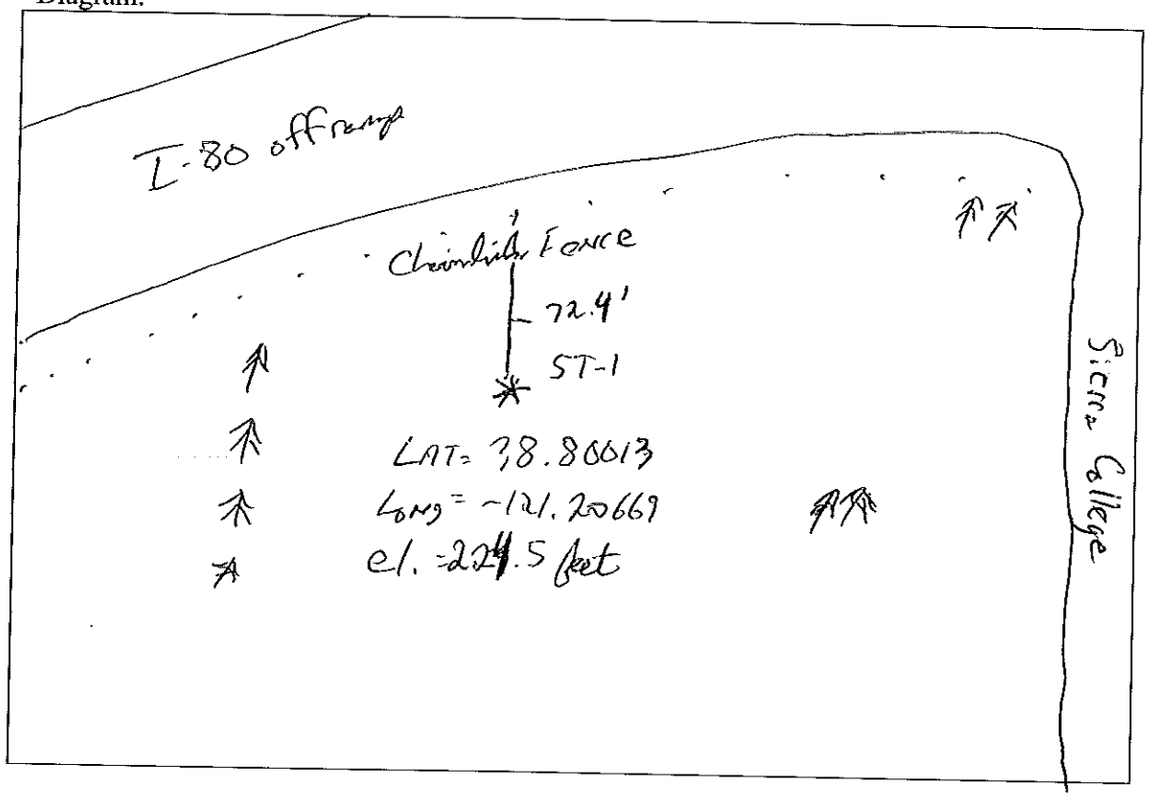
Maximum Wind Velocity (mph)	3.6
Average Wind Velocity (mph)	2.4
Temperature (F)	70.2
Relative Humidity (%)	70%
Comments: Partly Cloudy	

Comments: Primary Noise = Vehicles exiting I-80. Some

Traffic Description:

Roadway	# Lanes	Speeds	NB/EB Counts			SB/WB Counts		
			Auto	MT	HT	Auto	MT	HT
N/A								

Diagram:



Location Photo:

Noise Measurement Survey

Project Number: THN501
Project Name: 4600 Sierra College Blvd

Test Personnel: Graham
Equipment: _____

Site Number: ST-2a Date: 9/17/15 Time: From 10:47 AM To 11:03

Site Location: South side of property - on church parcel (just over parcel line)

Primary Noise Sources: Distant noise from I-80 & Sierra College Blvd.

Measurement Results

	dBA
L_{eq}	33.1
L_{max}	39.5
L_{min}	28.6
L_{peak}	71.0
L_2	
L_8	
L_{10}	
L_{25}	
L_{50}	
SEL	62.9

Atmospheric Conditions:

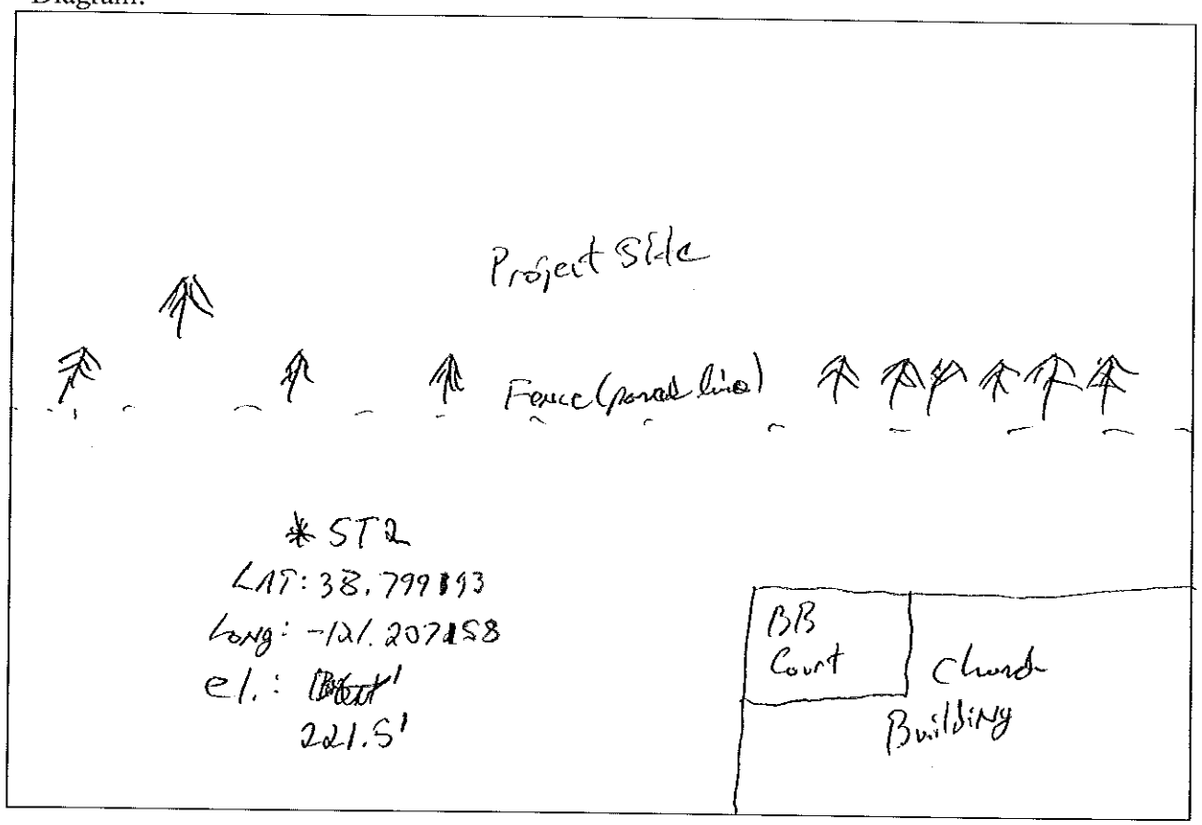
Maximum Wind Velocity (mph)	4.5
Average Wind Velocity (mph)	0.6
Temperature (F)	74.3
Relative Humidity (%)	54.0
Comments: Partly Cloudy	

Comments: Placed monitor on open field on north end of church parcel.

Traffic Description:

Roadway	# Lanes	Speeds	NB/EB Counts			SB/WB Counts		
			Auto	MT	HT	Auto	MT	HT

Diagram:



Location Photo:

Noise Measurement Survey

Project Number: 7H9561 Test Personnel: Graham
Project Name: 4650 Sierra College Blvd. Equipment: _____

Site Number: LT-1 Date: 9/17/15 Time: From 11:36AM To 6:54AM

Site Location: Southern end of parcel Near Church Building 9/17/15

Primary Noise Sources: Vehicle Noise I-80 & Sierra College Blvd

Measurement Results

	dBA
L_{eq}	
L_{max}	
L_{min}	
L_{peak}	
L_2	
L_8	
L_{10}	
L_{25}	
L_{50}	
SEL	

Atmospheric Conditions:

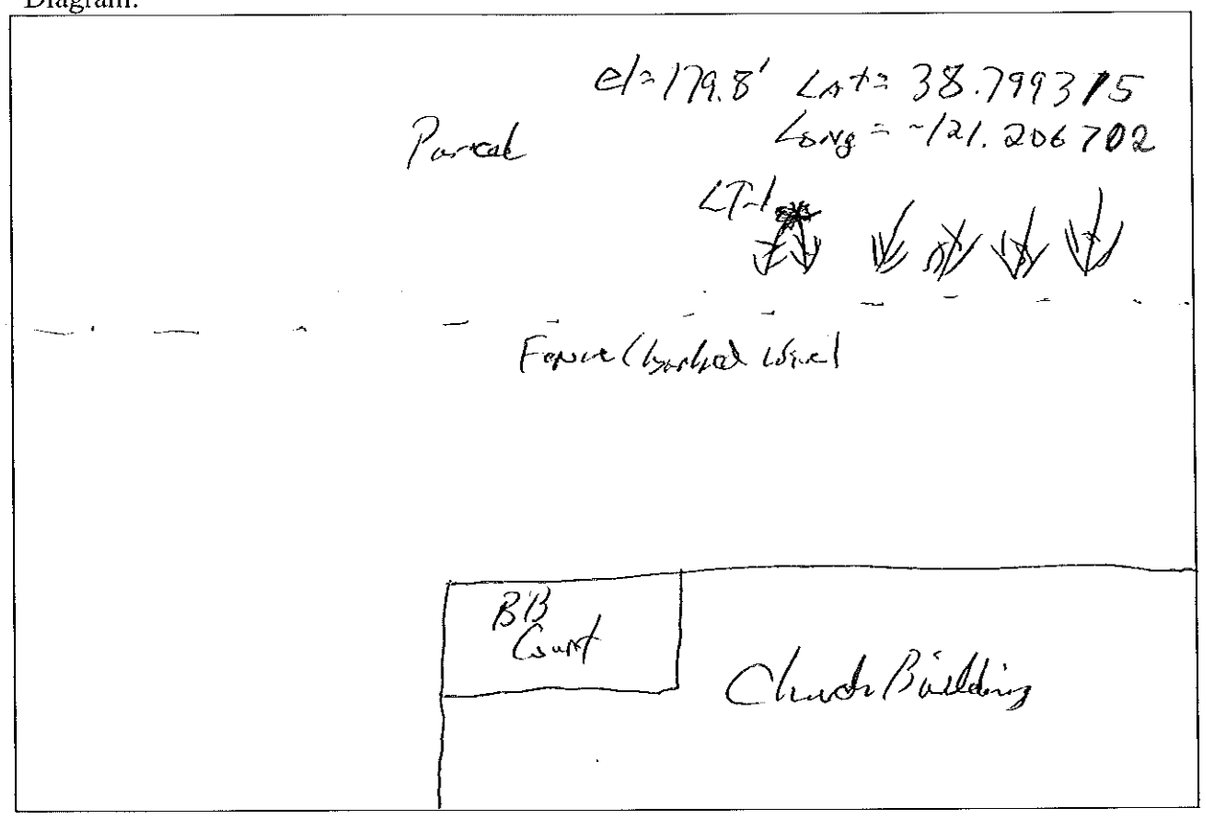
Maximum Wind Velocity (mph)	
Average Wind Velocity (mph)	
Temperature (F)	
Relative Humidity (%)	
Comments:	

Comments: Placed monitor on 24-hour measurement 1-hour intervals on Southern end of parcel

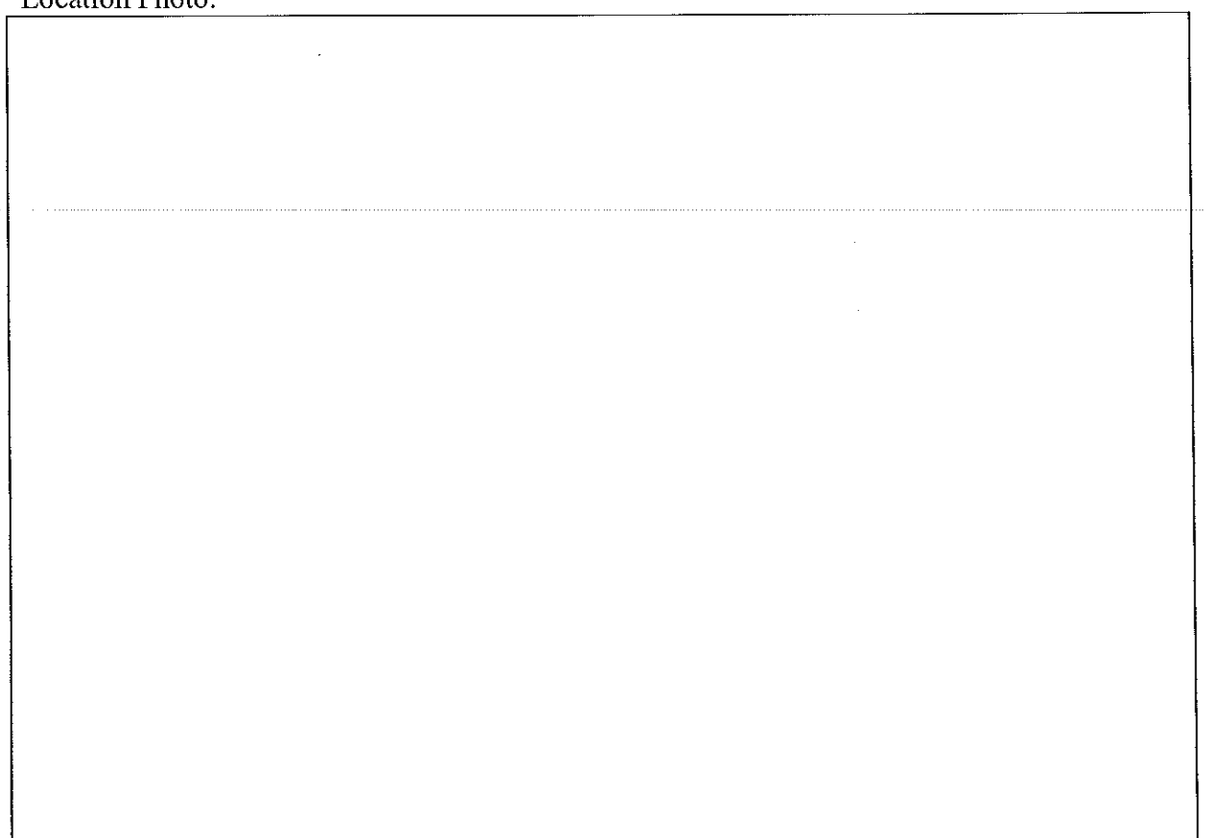
Traffic Description:

Roadway	# Lanes	Speeds	NB/EB Counts			SB/WB Counts		
			Auto	MT	HT	Auto	MT	HT
N/A								

Diagram:



Location Photo:



APPENDIX B

SoundPlan Calculations

4660 Sierra College Boulevard Project
Run Info
2015 Project Noise

Project description

Project title:	4660 Sierra College Boulevard Project
Project No.:	
Engineer:	CLB
Customer:	Thomas Sierra LLC

Description:
4660 Sierra College Boulevard shopping center development project in Rocklin, CA.

Run description

Calculation:	Grid Noise Map
Title:	2015 Project Noise
Group:	Project
Run file:	RunFile.runx
Result number:	7
Local calculation (ThreadCount=8)	
Calculation start:	9/10/2015 2:50:23 PM
Calculation end:	9/10/2015 2:58:52 PM
Calculation time:	08:26:545 [m:s:ms]
No. of points:	4745
No. of calculated points:	4749
Kernel version:	11/15/2013 (64 bit)

Description:
Project noise emissions with stationary sources

Run parameters

Reflection order	3	
Maximal reflection distance to receiver		200 m
Maximal reflection distance to source		50 m
Search radius	5000 m	
Weighting:	dB(A)	
Tolerance:	0.001 dB	

Standards:

Roads:		Traffic Noise Model - FHWA; 1998
Emission according to:	TNM	
Road gradient smoothed with smooth length of:		15 m
Air absorption:	ISO 9613	
Calculation with side screening: No		

4660 Sierra College Boulevard Project
Run Info
2015 Project Noise

Allow changes (bugs) to be conform with TNM 2.5
Environment:
- Air pressure 1013.3 mbar
- rel. Humidity 50.0 %
- Temperature 20.0 °C

Dissection parameters:
- Distance to diameter factor 8
- Minimal Distance [m] 1 m

Attenuation
- Foliage: ISO 9613-2
- Built up area: ISO 9613-2
- Industrial site: ISO 9613-2

Industry: General Prediction Method
Air absorption: ANSI 126
Method for reflection plane definition: GPM 2005
Using roof as potential reflection plane
Limitation of screening loss:
- single/multiple 20.0 dB /40.0 dB

Calculation with side screening: Yes
Environment:
- Air pressure 1013.3 mbar
- rel. Humidity 70.0 %
- Temperature 15.0 °C
- Meteo. Corr. C0(7-19h)[dB]=0.0; C0(19-22h)[dB]=0.0; C0(22-7h)[dB]=0.0;

Dissection parameters:
- Distance to diameter factor 8
- Minimal Distance [m] 1 m
- Max. Difference GND+Diffraction 1.0 dB
- Max. No. of Iterations 4

Attenuation
- Foliage: GPM / ÖAL 28
- Built up area: User defined
- Industrial site: User defined

Parking lots: General Prediction Method
Emission according to: Parkplatzlärmstudie 2007
Air absorption: ANSI 126
Method for reflection plane definition: GPM 2005
Using roof as potential reflection plane
Limitation of screening loss:
- single/multiple 20.0 dB /40.0 dB

Calculation with side screening: Yes
Environment:
- Air pressure 1013.3 mbar
- rel. Humidity 70.0 %
- Temperature 15.0 °C

Meteo. Corr. C0(7-19h)[dB]=0.0; C0(19-22h)[dB]=0.0; C0(22-7h)[dB]=0.0;

Dissection parameters:

Distance to diameter factor	8
Minimal Distance [m]	1 m
Max. Difference GND+Diffraction	1.0 dB
Max. No. of Iterations	4

Attenuation

Foliage:	GPM / ÖAL 28
Built up area:	User defined
Industrial site:	User defined

Assessment:	CNEL (CA)

Grid Map:

Grid space:	10.00 m
Height above ground:	1.500 m

Grid Interpolation:

Field size =
Min/Max =
Difference =

Geometry data

Pro_R1 Road.geo	9/10/2015 11:06:08 AM	
2015 Project.sit	9/10/2015 2:41:32 PM	
- contains:		
Base Map.geo	9/10/2015 2:24:52 PM	
EX_Buildings.geo	9/9/2015 11:31:18 AM	
Pro_Auto Service.geo	9/10/2015 11:49:42 AM	
Pro_Car Wash.geo	9/10/2015 9:30:02 AM	
Pro_R1.geo	9/10/2015 11:42:48 AM	
Project Buildings.geo	9/10/2015 9:53:14 AM	
Project Parking Lot Noise.geo		9/10/2015 11:26:30 AM
Project_ADT.geo	9/10/2015 10:44:44 AM	
RDGM0005.dgm	9/9/2015 10:55:52 AM	