APPENDIX K

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May 20, 2016

Mr. Scott Robertson
Associate and Landscape Architect
Omini Means
943 Reserve Dr., Suite 100
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Subject: Sierra Gateway Apartments Noise Analysis Addendum – City of Rocklin, California

Dear Mr. Robertson;

At the request of the City of Rocklin Economic and Community Development Department, j.c. brennan & associates, Inc. is providing additional analysis of noise impacts for the Sierra Gateway Apartments project. This is an addendum to the original Environmental Noise Analysis which was prepared by j.c. brennan & associates, Inc., dated October 23, 2015 *(Environmental Noise Assessment, Sierra Gateway Apartments, City of Rocklin California, Job # 2015-208, Prepared for Omini-Means Lte., Prepared by: j.c. brennan & associates, Inc., October 23 2015*). Specifically, this analysis identifies noise levels due to construction, and the noise levels associated with multi-family residential located adjacent to single-family residential uses. The following is a discussion of noise associated with the two primary questions which have been asked.

Increased Noise Due to Construction

A temporary increase in noise levels may occur during project construction. However, construction is prohibited by the City of Rocklin before 7 a.m. or after 7 p.m. on weekdays and before 8 a.m. or after 7 p.m. on weekends.[1] These exemptions are typical of many jurisdictions and reflect the recognition that construction-related noise is temporary in character, is generally acceptable when limited to daylight hours, and is part of what residents of urban areas expect as part of a typical urban noise environment (along with emergency vehicle sirens, etc.). In addition to the restrictions on hours of operation, the project developer may agree to additional project conditions to also reduce the potential for annoyance by offering the following types of noise control options:

- Locate fixed construction equipment such as compressors and generators as far as physically and commercially reasonable from sensitive receptors. Educate and encourage the use of shrouding or shielding on all impact tools, and muffling or shielding intake and exhaust ports on power construction equipment would also reduce noise generation.

[1] City of Rocklin. *Construction Noise Guidelines.*
http://www.rocklin.ca.us/depts/develop/housing/code_enforcement/construction_noise_guidelines.asp

- Ensure that no pieces of equipment (tractors, trucks, generators, radios, etc.) are delivered, started or idled prior to 7 a.m. on weekdays and 8 a.m. on weekends.
- Ensure that delivery vehicles arrive to the project site after 7 a.m. on weekdays and 8 a.m. on weekends.
- Designate a disturbance coordinator to respond to perceived noise violations. 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 and required measures to be taken to alleviate the problem.
- Require heavy trucks to refrain from using engine brakes (jake brakes).

Increased Noise Due to New Multi-Family Residential Uses Located Adjacent to Single Family Residential Uses

From a land use perspective, the City of Rocklin considers residential land uses to be compatible with other residential uses. Examples of uses which are not compatible with neighboring residential uses include various commercial and industrial type uses, and in some cases congregate care facilities which may provide residential living for elderly residents. In these cases, the City specifically requires that a 6-foot tall masonry sound wall be constructed between the uses.[2] In these instances, such land uses have daily large truck deliveries, large HVAC equipment, outdoor announcements, etc. However, no such requirement would exist for residential uses as the degree of noise generated from one residence to the next does not warrant special noise attenuation measures. In general noise generated by new residential uses, regardless of whether they are multi-family or single family would include passenger vehicle traffic, people talking, kids playing, air-conditioners, pool pumps, property maintenance, garbage collection, etc. These are all noise sources associated with any residential community and are the same types of noise sources which currently exist at the residences located around the project site.

In the case of the Sierra Gateway Apartment project, the main outdoor activity area faces existing multi-family uses and is shielded and has a significant setback from the existing single family residential to the south.

As a means of reinforcing this analysis, j.c. brennan & associates, Inc. conducted noise measurements of multi-family timeshare units and cottages at the Hyatt Regency in Incline Village on the Saturday of Labor Day Weekend 2007. The measurements were conducted between the hours of 6:00 p.m. and 10:00 p.m. There were a total of 77 units in a "horseshoe" configuration, and all units had balconies facing to the interior courtyard. It was determined that up to 80% of the units were occupied, and up to 11% of the balconies were occupied at any given time. In addition, there were groups of individuals gathering, and there was small wedding reception occurring in the interior courtyard. The measured maximum noise levels were 55 dBA Lmax, and hourly measured noise levels were 45 dBA Leq, at distances of 15-feet

[2] City of Rocklin. *Municipal Code*. Section 17.08.080.

to 20-feet from several occupied decks and balconies. These levels are considerably less than traffic noise in the project vicinity, and would comply with the City of Rocklin General Plan noise level standards at the adjacent single family residential to the south.

It should also be noted that nuisance noise from residential uses is a police enforcement issue. Complaints of nuisance noise can be reported to the City of Rocklin Police Department and if appropriate, and officer will respond to the noise complaint.[3] Additionally, noise from dog barking is specifically prohibited in the City's Animal ordinance.[4] Therefore, the potential for disturbance due to these types of activities is not something that can be addressed from a land planning perspective.

I hope this information is helpful. If you have any questions, please contact me at (530) 823-0960 or JBrennan@jcbrennanassoc.com.

Respectfully submitted,

j.c. brennan & associates, Inc.

Jim Brennan
President
Member: Institute of Noise Control Engineering

[3] City or Rocklin. *General Complaints*. https://rocklin.ca.us/faq/categoryqna.asp?id=8#227
[4] City of Rocklin. *Municipal Code*. Section 6.12.100

Environmental Noise Assessment

Sierra Gateway Apartments

City of Rocklin, California

Job # 2015-208

Prepared For:

Omni-Means, Ltd

943 Reserve Drive, Ste. 100
Roseville, CA 95678

Attn: Mr. Scott A. Robertson

Prepared By:

j.c. brennan & associates, Inc.

Jim Brennan
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October 23, 2015

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INTRODUCTION

The Sierra Gateway Apartment is located east of Sierra College Boulevard and south of Rocklin Road in the City of Rocklin, California. The proposed project includes the construction of a 195 unit multi-family residential units consisting of two and three story buildings. Figure 1 shows the site plan. Previously, j.c. brennan & associates, Inc. conducted an Environmental Noise Analysis for this site and was previously known as the Rocklin Manor Apartment project *(Environmental Noise Analysis, Rocklin Manor Apartments, City of Rocklin California, Prepared by: j.c. brennan & associates, Inc., Prepared for: Omni-Means, Ltd, March 12, 2014).*

The project is located adjacent to existing residential uses to the east and south of the project. Vacant land is located to the north across Rocklin Road, and commercial uses directly across Sierra College Boulevard to the west.

Traffic noise associated with Sierra College Boulevard and Rocklin Road may affect the project design. Therefore, the City of Rocklin has required an analysis to determine if the project will comply with the exterior and interior noise level criteria standards for transportation noise sources. This analysis will assess the traffic noise levels, and will compare them to the noise level standards of the City of Rocklin General Plan Noise Element. If necessary, noise control measures will be recommended for the proposed project.

ENVIRONMENTAL SETTING

BACKGROUND INFORMATION ON NOISE

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, unless otherwise noted.

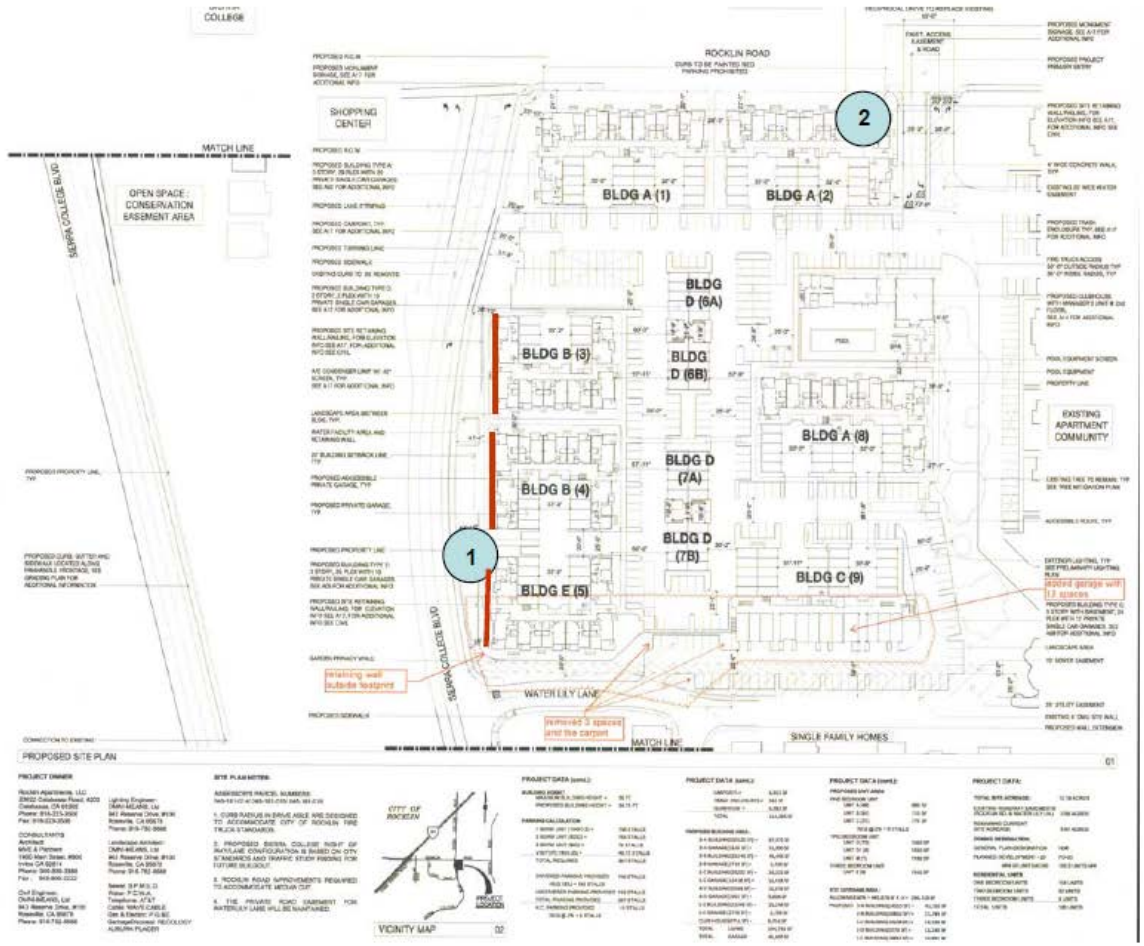
The decibel scale is logarithmic, not linear. In other words, two sound levels 10 dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted, an increase of 10 dBA is generally perceived as a doubling in loudness. For example, a 70 dBA sound is half as loud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

Figure 1
Sierra Gateway Apartments
Site Plan and Noise Measurement Site



# Traffic Noise Measurement Sites	2nd & 3rd Floor Facades Which Require STC 32 Rated Windows

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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.

REGULATORY CONTEXT

City of Rocklin General Plan Noise Element

The City of Rocklin General Plan Noise Element includes criteria for transportation noise sources. Table 2 shows the transportation noise source criteria contained in the General Plan Noise Element (Table 2-2 of the General Plan) are applicable to the project.

Based upon the Table 2 criteria, the Sierra Gateway Apartments can apply the noise level criteria at the patios of each apartment, or the standards could be applied at the common outdoor area, which would include the pool area and the clubhouse.

TABLE 2
MAXIMUM ALLOWABLE NOISE EXPOSURE
TRANSPORTATION NOISE SOURCES

Land Use	Outdoor Activity Areas[1] L_{dn}/CNEL, dB	Interior Spaces	
		L_{dn}/CNEL,dB	L_{eq}, dB[2]
Residential	60[3]	45	--
Transient Lodging	65[4]	45	--
Hospitals, Nursing Homes	60[3]	45	--
Theaters, Auditoriums, Music Halls	–	--	35
Non-Commercial Places of Public Assembly	60[3]	–	40
Office Buildings	–	--	45
Schools, Libraries, Museums	–	--	45
Playgrounds, Neighborhood Parks	70	–	--

1 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.

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 dB 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.

EVALUATION OF EXISTING AND FUTURE TRAFFIC NOISE LEVELS

Traffic Noise Prediction Methodology

j.c. brennan & associates, Inc. employs the Federal Highway Administration (FHWA) Traffic Noise Prediction Model (FHWA RD-77-108) for the prediction of traffic noise levels. The model is based upon the CALVENO 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.

On Thursday, October 31, 2013 j.c. brennan & associates, Inc., staff conducted short-term noise level measurements and concurrent counts of traffic on Sierra College Boulevard and Rocklin Road, adjacent to the project site.

The purpose of the short-term traffic noise level measurements was 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. Figure 1 shows the noise measurement sites.

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 CAL-200 acoustical calibrator. Table 3 shows the results of the traffic noise calibration. Appendix B provides the complete inputs and results of the FHWA model calibration procedures.

TABLE 3
COMPARISON OF FHWA MODEL TO MEASURED EXISTING TRAFFIC NOISE LEVELS

Vehicles.						Speed (mph)	Dist. (Feet)	Measured, L_{eq}	Modeled, L_{eq}*	Difference
Site	Time	Roadway	Autos	Med. Trk.	Hvy.Trk.					
1	1:40 pm	Sierra College	383	12	8	50	87	68.5 dB	67.5 dB	-1.0 dB
2	2:00 pm	Rocklin Road	98	9	0	40	81	60.8 dB	59.9 dB	-0.9 dB

* Acoustically "soft" site assumed
Source: j.c. brennan & associates, Inc. - 2013

The FHWA model was found to accurately predict traffic noise levels at Sites 1 and 2 within +/- 1 dB, as shown in Table 3. Therefore, no adjustments were made to the FHWA traffic noise prediction model.

Future and Future + Project Traffic Noise Levels

To determine the Future and the Future + Project traffic noise levels on the project site and adjacent roadways, j.c. brennan & associates, Inc., utilized traffic volume predictions provided by Omni-Means, Ltd.

Table 4 shows the predicted Future and Future + Project traffic noise levels at the nearest building facades and the common outdoor activity areas. A complete listing of the FHWA Traffic Noise Prediction Model inputs is provided in Appendix B.

TABLE 4
PREDICTED FUTURE AND FUTURE PLUS PROJECT TRAFFIC NOISE LEVELS

Roadway	Traffic Noise Level, Ldn		Distance to Noise Contours	
	At Nearest Building Facade	*At Common Outdoor Activity Area*	*60 dB Ldn*	*65 dB Ldn*
Future Traffic Noise Levels				
Sierra College Boulevard Rocklin Road	*69 dB* *65 dB*	*60 dB* *57 dB*	*442'* *153'*	*205'* *71'*
Future Plus Project Traffic Noise Levels				
Sierra College Boulevard Rocklin Road	*69 dB* *65 dB*	*60 dB* *57 dB*	*446'* *157'*	*207'* *73'*
Sources: j.c. brennan & associates, Inc., Omni-Means, and FHWA RD-77-108				

Analysis of Compliance with the City of Rocklin Exterior Noise Level Standards:

Based upon Table 4, the project will not result in a significant increase in traffic noise levels along Sierra College Boulevard or Rocklin Road.

The Table 4 data indicates that the Future + Project traffic noise levels at the nearest building facades will exceed the 60 dB Ldn exterior noise level standard. Although barriers are a means of reducing traffic noise levels at first floor patios, they would not be practical to reduce traffic noise levels at 2nd and 3rd floor patios. If the City of Rocklin applies the exterior noise level standard at all patios, there is no practical means of reducing traffic noise levels to 60 dB Ldn at the second and third floor patios. A barrier 8-feet in height located along the property lines adjacent to Sierra College Boulevard would reduce traffic noise levels to 60 dB Ldn at the first floor patios. A barrier 6-feet in height located along the property lines adjacent to Rocklin Road would reduce traffic noise levels to 60 dB Ldn at the first floor patios.

The noise level standards shown in Table 2 indicate that the exterior noise level standard can be applied at a common outdoor area. The Table 4 data indicates that the traffic noise levels will comply with the 60 dB Ldn exterior noise level standard at the common outdoor activity area (clubhouse / pool area). This does not account for shielding of traffic noise levels from proposed building facades.

Analysis of Compliance with the City of Rocklin Interior Traffic Noise Levels:

Standard construction practices, consistent with the uniform building code typically provides an exterior-to-interior noise level reduction of approximately 25 dB, assuming that air conditioning

is included for each unit, which allows residents to close windows for the required acoustical isolation. Therefore, as long as exterior noise levels at the building facades do not exceed 70 dB L_{dn}, the interior noise levels will typically comply with the interior noise level standard of 45 dB L_{dn}.

The predicted future plus project traffic noise levels for 1st floor residential façades facing Sierra College Boulevard and Rocklin Road are 69 dB L_{dn} and 65 dB Ldn, respectively. Therefore, the interior noise levels are expected to comply with the interior noise level standard of 45 dB L_{dn}. However, due to the loss of ground attenuation a +3 dB offset is generally applied to 2nd and 3rd floor building facades. The predicted exterior traffic noise levels for 2nd and 3rd floor building facades of the first row of buildings facing Sierra College Boulevard and Rocklin Road are 72 dB L_{dn} and 68 dB Ldn, respectively. Therefore, it is expected that 2nd and 3rd floor units of the first row of buildings facing Sierra College Boulevard could exceed the 45 dB Ldn interior noise level standard.

As a means of mitigating interior traffic noise, it is recommended that 2nd and 3rd floor windows of the first row of buildings facing Sierra College Boulevard include windows with a minimum STC rating of 32. This only applies to the building facades which are parallel to Sierra College Boulevard, as shown on Figure 1. As an alternative, j.c. brennan & associates, Inc. can calculate the interior noise levels when construction plans, floor plans and building elevations are available.

CONCLUSIONS

The proposed project is predicted to comply with the City of Rocklin 60 dB L_{dn} exterior and 45 dB L_{dn} interior noise level standards, provided that the following mitigation measures are included in the project design:

1. If the City of Rocklin applies the exterior noise level standard at all patios, there is no practical means of reducing traffic noise levels to 60 dB Ldn at the second and third floor patios. A barrier 8-feet in height located along the property lines adjacent to Sierra College Boulevard would reduce traffic noise levels to 60 dB Ldn at the first floor patios. A barrier 6-feet in height located along the property lines adjacent to Rocklin Road would reduce traffic noise levels to 60 dB Ldn at the first floor patios.

   As an alternative, the City of Rocklin can apply the exterior noise level standard at the common outdoor activity area (pool and clubhouse). If the standard is applied at the common outdoor activity area, no exterior mitigation is required.

2. Standard construction practices, consistent with the uniform building code typically provides an exterior-to-interior noise level reduction of approximately 25 dB, assuming that air conditioning is included for each unit, which allows residents to close windows for the required acoustical isolation. Therefore, as long as exterior noise levels at the building facades do not exceed 70 dB L_{dn}, the interior noise levels will typically comply with the interior noise level standard of 45 dB L_{dn}. The predicted exterior traffic noise

levels for 2nd and 3rd floor building facades of the first row of buildings facing Sierra College Boulevard and Rocklin Road are 72 dB L_{dn} and 68 dB Ldn, respectively. Therefore, it is expected that 2nd and 3rd floor units of the first row of buildings facing Sierra College Boulevard could exceed the 45 dB Ldn interior noise level standard.

As a means of mitigating interior traffic noise, it is recommended that 2nd and 3rd floor windows of the first row of buildings facing Sierra College Boulevard include windows with a minimum STC rating of 32. This only applies to the building facades which are parallel to Sierra College Boulevard, as shown on Figure 1. As an alternative, j.c. brennan & associates, Inc. can calculate the interior noise levels when construction plans, floor plans and building elevations are available.

3. Air-conditioning or mechanical ventilation needs to be provided to allow windows to remain closed for acoustical isolation.

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.

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Appendix B

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

Project Information:	Job Number:	2013-198
	Project Name:	Rocklin Manor Apartments
	Roadway Tested:	Sierra College Boulevard
	Test Location:	Site 1, SW Property Corner on Project Site
	Test Date:	October 31, 2013
Weather Conditions:	Temperature (Fahrenheit):	70
	Relative Humidity:	Dry
	Wind Speed and Direction:	0-5 from West
	Cloud Cover:	Clear
Sound Level Meter:	Sound Level Meter:	LDL Model 820
	Calibrator:	LDL Model CA200
	Meter Calibrated:	Immediately before and after test
	Meter Settings:	A-weighted, slow response
Microphone:	Microphone Location:	On Project Site
	Distance to Centerline (feet):	87
	Microphone Height:	5 feet above ground
	Intervening Ground (Hard or Soft):	**Soft**
	Elevation Relative to Road (feet):	6
Roadway Condition:	Pavement Type	Asphalt
	Pavement Condition:	Good
	Number of Lanes:	5
	Posted Maximum Speed (mph):	50
Test Parameters:	Test Time:	1:40 PM
	Test Duration (minutes):	15
	Observed Number Automobiles:	383
	Observed Number Medium Trucks:	12
	Observed Number Heavy Trucks:	8
	Observed Average Speed (mph):	50
Model Calibration:	Measured Average Level (L_{eq}):	68.5
	Level Predicted by FHWA Model:	67.5
	Difference:	***-1.0 dB***

Conclusions:

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Appendix B

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

Project Information:	Job Number:	2013-198
	Project Name:	Rocklin Manor Apartments
	Roadway Tested:	Rocklin Road
	Test Location:	Site 2, NE Property Corner on Project Site
	Test Date:	October 31, 2013
Weather Conditions:	Temperature (Fahrenheit):	70
	Relative Humidity:	Dry
	Wind Speed and Direction:	0-5 from West
	Cloud Cover:	Clear
Sound Level Meter:	Sound Level Meter:	LDL Model 820
	Calibrator:	LDL Model CA200
	Meter Calibrated:	Immediately before and after test
	Meter Settings:	A-weighted, slow response
Microphone:	Microphone Location:	On Project Site
	Distance to Centerline (feet):	81
	Microphone Height:	5 feet above ground
	Intervening Ground (Hard or Soft):	**Soft**
	Elevation Relative to Road (feet):	5
Roadway Condition:	Pavement Type	Asphalt
	Pavement Condition:	Good
	Number of Lanes:	4
	Posted Maximum Speed (mph):	40
Test Parameters:	Test Time:	2:00 PM
	Test Duration (minutes):	15
	Observed Number Automobiles:	98
	Observed Number Medium Trucks:	9
	Observed Number Heavy Trucks:	0
	Observed Average Speed (mph):	40
Model Calibration:	Measured Average Level (L_{eq}):	60.8
	Level Predicted by FHWA Model:	59.9
	Difference:	***-0.9 dB***

Conclusions:

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Appendix B-1

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

Data Input Sheet

Project #: 2013-198 Rocklin Manor Apartments
Description: Future Traffic Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Location	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Sierra College Boulevard	Outdoor Activity Areas	43,910	87		13	2	0.5	50	450	
2	Rocklin Road	Outdoor Activity Areas	15,920	87		13	2	0.5	40	255	
1	Sierra College Boulevard	1st Floor Building Façade	43,910	87		13	2	0.5	50	110	
2	Rocklin Road	1st Floor Building Façade	15,920	87		13	2	0.5	40	75	
1	Sierra College Boulevard	2nd-3rd Floor Building Façade	43,910	87		13	2	0.5	50	110	3
2	Rocklin Road	2nd-3rd Floor Building Façade	15,920	87		13	2	0.5	40	75	3

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Appendix B-2

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

Project #: 2013-198 Rocklin Manor Apartments
Description: Future Traffic Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Location	Autos	Medium Trucks	Heavy Trucks	Total
1	Sierra College Boulevard	Outdoor Activity Areas	59.1	49.9	48.1	60
2	Rocklin Road	Outdoor Activity Areas	55.6	47.6	46.5	57
1	Sierra College Boulevard	1st Floor Building Façade	68.3	59.0	57.2	69
2	Rocklin Road	1st Floor Building Façade	63.6	55.6	54.4	65
1	Sierra College Boulevard	2nd-3rd Floor Building Façade	71.3	62.0	60.2	72
2	Rocklin Road	2nd-3rd Floor Building Façade	66.6	58.6	57.4	68

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Appendix B-3

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

Project #: 2013-198 Rocklin Manor Apartments
Description: Future Traffic Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Location	75	70	65	60	55
1	Sierra College Boulevard	Outdoor Activity Areas	44	95	205	442	953
2	Rocklin Road	Outdoor Activity Areas	15	33	71	153	330
1	Sierra College Boulevard	1st Floor Building Façade	44	95	205	442	953
2	Rocklin Road	1st Floor Building Façade	15	33	71	153	330
1	Sierra College Boulevard	2nd-3rd Floor Building Façade	70	151	325	701	1510
2	Rocklin Road	2nd-3rd Floor Building Façade	24	52	113	243	523

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Appendix B-1

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

Data Input Sheet

Project #: 2013-198 Rocklin Manor Apartments
Description: Future Plus Project Traffic Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Location	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Sierra College Boulevard	Outdoor Activity Areas	44,495	87		13	2	0.5	50	450	
2	Rocklin Road	Outdoor Activity Areas	16,440	87		13	2	0.5	40	255	
1	Sierra College Boulevard	1st Floor Building Façade	44,495	87		13	2	0.5	50	110	
2	Rocklin Road	1st Floor Building Façade	16,440	87		13	2	0.5	40	75	
1	Sierra College Boulevard	2nd-3rd Floor Building Façade	44,495	87		13	2	0.5	50	110	3
2	Rocklin Road	2nd-3rd Floor Building Façade	16,440	87		13	2	0.5	40	75	3

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Appendix B-2

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

Project #: 2013-198 Rocklin Manor Apartments
Description: Future Plus Project Traffic Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Location	Autos	Medium Trucks	Heavy Trucks	Total
1	Sierra College Boulevard	Outdoor Activity Areas	59.2	49.9	48.1	60
2	Rocklin Road	Outdoor Activity Areas	55.7	47.8	46.6	57
1	Sierra College Boulevard	1st Floor Building Façade	68.3	59.1	57.3	69
2	Rocklin Road	1st Floor Building Façade	63.7	55.8	54.6	65
1	Sierra College Boulevard	2nd-3rd Floor Building Façade	71.3	62.1	60.3	72
2	Rocklin Road	2nd-3rd Floor Building Façade	66.7	58.8	57.6	68

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Appendix B-3

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

Project #: 2013-198 Rocklin Manor Apartments
Description: Future Plus Project Traffic Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Location	75	70	65	60	55
1	Sierra College Boulevard	Outdoor Activity Areas	45	96	207	446	961
2	Rocklin Road	Outdoor Activity Areas	16	34	73	157	337
1	Sierra College Boulevard	1st Floor Building Façade	45	96	207	446	961
2	Rocklin Road	1st Floor Building Façade	16	34	73	157	337
1	Sierra College Boulevard	2nd-3rd Floor Building Façade	71	152	328	707	1523
2	Rocklin Road	2nd-3rd Floor Building Façade	25	53	115	248	535

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