

Environmental Noise Assessment

Manager's Residence at Rocklin Self Storage Facility

Rocklin, California

BAC Job # 2018-047

Prepared For:

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Introduction

The Manager's Residence at Rocklin Self Storage Facility project is located south of West Stanford Ranch Road and east of Sunset Boulevard in the City of Rocklin. The project proposes the development of a 4.7 acre site that will include a managers unit on the second story close to the West Stanford Ranch Roadway. Figures 1 and 2 show the project area the site plan, respectively.

The project developer, has retained Bollard Acoustical Consultants, Inc. (BAC) to prepare a noise assessment for this project. This analysis focuses on future interior traffic noise levels at the proposed managers unit. Where the City of Rocklin transportation noise level standards are predicted to be exceeded, this analysis recommends appropriate noise mitigation measures.

Noise Fundamentals and Terminology




Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard, and thus are called sound. 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 allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in levels (dB) correspond closely to human perception of relative loudness. Appendix A contains definitions of Acoustical Terminology. Figure 3 shows common noise levels associated with various sources.

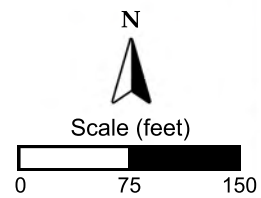
The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighing the frequency response of a sound level meter by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. 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 in decibels.

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 noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}) over a given time period (usually one hour). The L_{eq} is the foundation of the Day-Night Average Level noise descriptor, L_{dn} , and shows very good correlation with community response to noise.



Legend

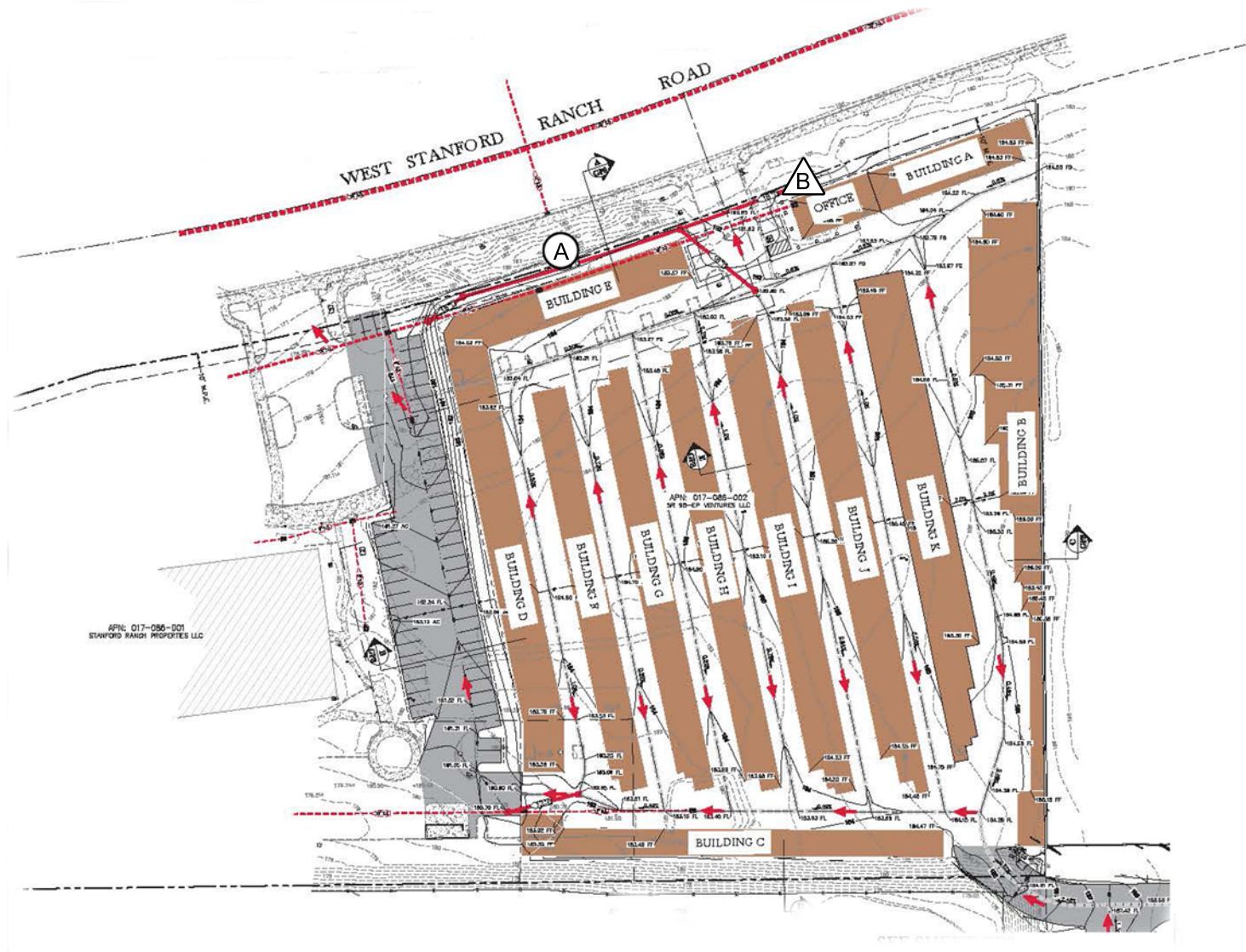
-  Project Border (Approximate)
-  Long-Term Noise Level Measurement Location
-  Short-Term Noise Level Measurement Location






Interior Noise Analysis for Self Storage
 Managers Unit
 Rocklin, California
 Project Area

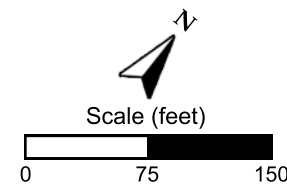
Figure 1





Legend

-  Project Border (Approximate)
-  Long-Term Noise Level Measurement Location
-  Short-Term Noise Level Measurement Location



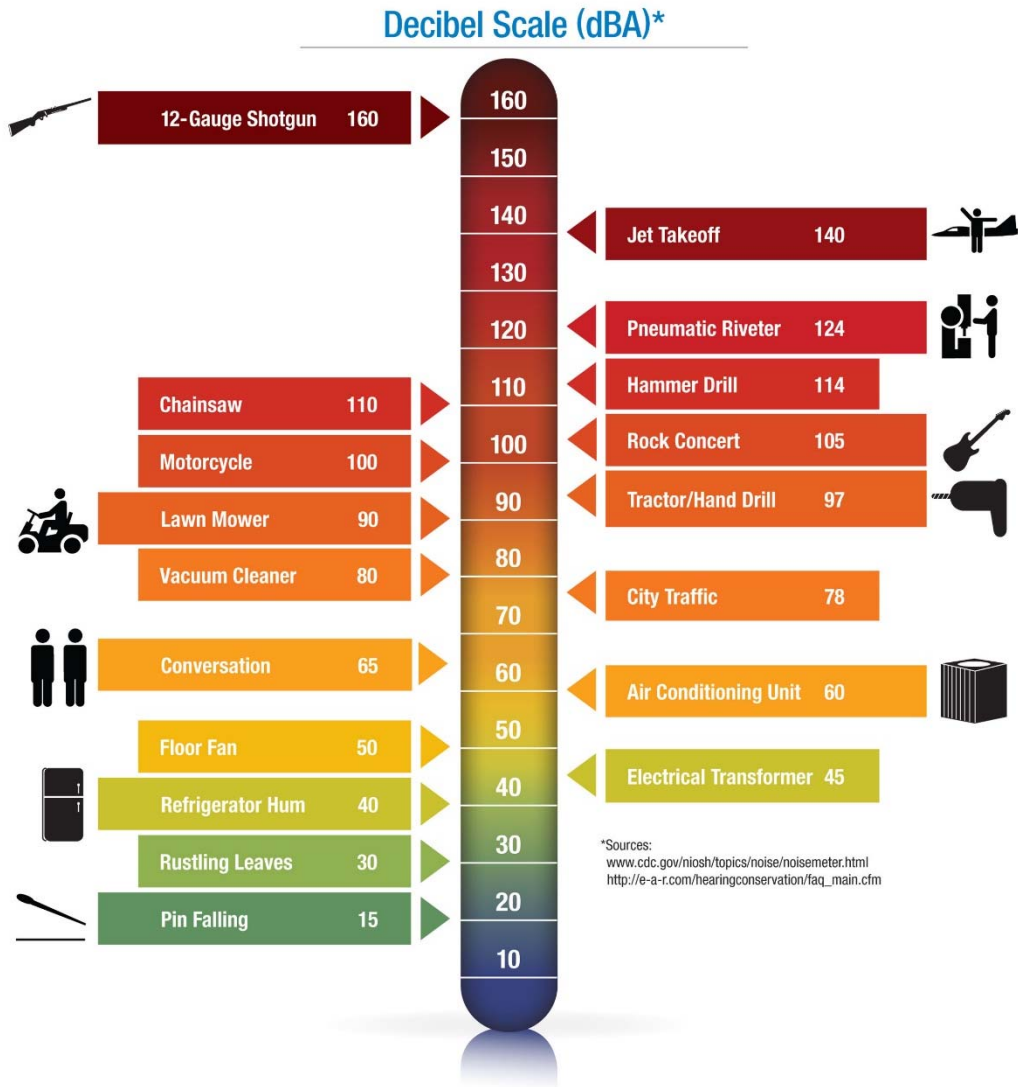
Interior Noise Analysis for Self Storage
Managers Unit
Rocklin, California
Site Plan

Figure 2



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. L_{dn}-based noise standards are commonly used to assess noise impacts associated with traffic, railroad and aircraft noise sources.

**Figure 3
Noise Levels Associated with Common Noise Sources**



Criteria for Acceptable Noise Exposure

Transportation Noise Sources (Interior)

The City of Rocklin utilizes an interior noise level standard of 45 dB L_{dn} or less within noise-sensitive project dwellings. The intent of this interior noise limit is to provide a suitable environment for indoor communication and sleep.

Existing Traffic Noise Environment at the Project Site

The existing ambient noise environment at the project site is primarily defined by traffic on West Stanford Ranch Road and to a lesser extent traffic on Sunset Boulevard. To generally quantify existing noise levels at the project site, BAC conducted long-term (24-hour) noise level measurements at the project site. Noise level measurements at Site A, along the northwest portion of the project site, were conducted from March 19, 2018 to March 20, 2018.

Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters were used to conduct the noise level 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). The results of the measurements are shown numerically and graphically in Appendices B and C, and are summarized in Table 1. Noise measurement locations are shown in Appendix D.

As shown in Table 1, measured ambient day-night average noise levels at the measurement site were 71 dB L_{dn} .

Table 1 Summary of Long-Term Ambient Noise Monitoring Results¹ Managers Residence at Rocklin Self Storage Facility – Rocklin, California								
Site	Date	L_{dn} , dB	Average Measured Hourly Noise Levels (dB)					
			Daytime (7 a.m. to 10 p.m.)			Nighttime (10 p.m. to 7 a.m.)		
			L_{eq}	L_{50}	L_{max}	L_{eq}	L_{50}	L_{max}
A	3/19 – 3/20	71	64	62	83	64	54	78
Notes: ¹ Long-term ambient noise monitoring locations are identified on Figure 1. Source: Bollard Acoustical Consultants, Inc. (2018)								

Evaluation of Future Traffic Noise Levels at the Project Site

Traffic Noise Prediction Methodology

The Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA-RD-77-108) was used to predict traffic noise levels at the project site. 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. The FHWA Model was developed to predict hourly L_{eq} values for free flowing traffic conditions, and is considered to be accurate within 1.5 dB in most situations.

Traffic Noise Prediction Model Calibration

According to traffic volume data obtained from the City of Rocklin General Plan Update Draft Environmental Impact Report (DEIR), the segment of West Stanford Ranch Road adjacent to the project site is estimated to experience a future average daily traffic (ADT) volume of 24,900 vehicles. Assuming vehicle speeds of 45 MPH, medium- and heavy-truck mix of 2%/2%, and a future volume of 24,900, the FHWA Model predicts a roadway noise level of 68 dB L_{dn} at a distance of 95 feet from the centerline of West Stanford Ranch Road. However, the traffic noise level measurement results presented in Table 1, conducted 80 feet from the centerline of West Stanford Ranch Road, indicate existing traffic noise levels were 71 dB L_{dn} . These results indicate that the FHWA Model is under-predicting traffic noise levels at the project site by approximately 4 dB. As a result, a calibration offset of +4 dB was applied to the FHWA Model in order to provide a conservative assessment of future traffic noise levels at the project site.

Predicted Future Interior Traffic Noise Levels

The predicted future L_{dn} at the exterior facade of the manager's residence is estimated to be 72 dB. Given a future exterior noise level of 72 dB L_{dn} , a building facade noise reduction of 27 dB would be required to achieve an interior noise level of 45 dB L_{dn} .

Standard residential construction (wood siding, STC-27 windows, door weather-stripping, exterior wall insulation, composition plywood roof), results in an exterior to interior noise reduction of at least 25 dB with windows closed and approximately 15 dB with windows open. Therefore, standard construction would be unacceptable for the exterior facade of the manager's unit located nearest to Stanford Ranch Road and acoustic upgrades would be required. Specifically, all exterior windows of the manager's unit from which the roadway would be visible should be upgraded to STC 32. In addition, air conditioning should be provided to allow the occupants to close doors and windows as desired for additional acoustical isolation.

Conclusions and Recommendations

The preceding analysis focused interior traffic noise levels at the proposed manager's unit of the Rocklin Self Storage facility. In order to ensure compliance with the City of Rocklin General Plan transportation noise level standards, the following mitigation measures are recommended:

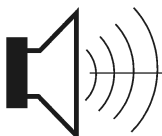
- 1) All windows of the Manager's unit from which West Stanford Ranch Road would be visible should be upgraded to an STC 32.
- 2) Mechanical ventilation (air conditioning) should be provided for the manager's residence to allow the occupants to close doors and windows as desired to achieve compliance with the applicable interior noise level criteria.

These conclusions are based on the collected noise level data at the project site, the site plan shown on Figure 2, and on noise reduction data for standard residential dwellings and for typical STC rated window data. Deviations from the project site plan shown on Figure 2, could cause future traffic noise levels to differ from those predicted in this analysis. Bollard Acoustical Consultants, Inc. is not responsible for degradation in acoustic performance of the building construction due to poor construction practices, failure to comply with applicable building code requirements, or for failure to adhere to the minimum building practices cited in this report.

This concludes BAC's noise assessment for the proposed Managers Residence at Rocklin Self Storage Facility in Rocklin, California. Please contact BAC at (916) 663-0500 or paulb@bacnoise.com with any questions regarding this assessment.

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.
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.
Loudness	A subjective term for the sensation of the magnitude of sound.
Masking	The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.
Noise	Unwanted sound.
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.
RT₆₀	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	A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.
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.



B O L L A R D

Acoustical Consultants

Appendix B
Managers Residence at Rocklin Self Storage Facility
Ambient Noise Monitoring Results - Site A
3/19/2018 - 3/20/2018

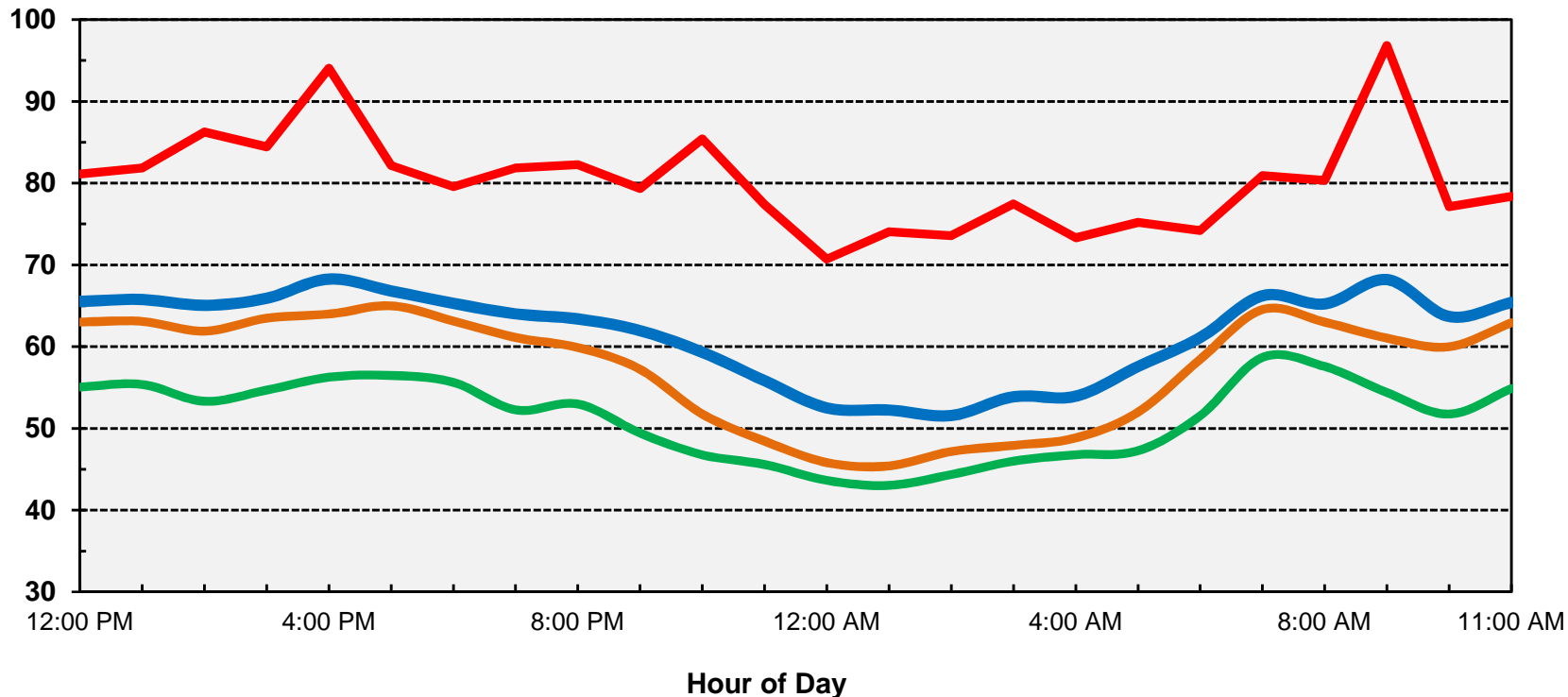
Hour	Leq	Lmax	L50	L90
12:00	66	81	63	55
13:00	66	82	63	55
14:00	65	86	62	53
15:00	66	84	63	55
16:00	68	94	64	56
17:00	67	82	65	56
18:00	65	80	63	56
19:00	64	82	61	52
20:00	63	82	60	53
21:00	62	79	57	49
22:00	59	85	52	47
23:00	56	77	48	46
0:00	53	71	46	44
1:00	52	74	45	43
2:00	52	74	47	44
3:00	54	77	48	46
4:00	54	73	49	47
5:00	58	75	52	47
6:00	61	74	58	52
7:00	66	81	65	59
8:00	65	80	63	58
9:00	68	97	61	54
10:00	64	77	60	52
11:00	65	78	63	55

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	68	62	64	68	52	64
Lmax (Maximum)	94	79	83	97	71	78
L50 (Median)	65	57	62	65	45	54
L90 (Background)	56	49	54	59	43	49

Computed Ldn, dB	71
% Daytime Energy	60%
% Nighttime Energy	40%

**Appendix C
Managers Residence at Rocklin Self Storage Facility
Ambient Noise Monitoring Results - Site A
3/19/2018 - 3/20/2018**

Sound Level, dBA



— Average (Leq)
 — Maximum (Lmax)
 — L50
 — L90

Ldn: 71 dB

Appendix D

Photos of Noise Level Measurement Sites

Interior Noise Analysis for Self Storage Managers Unit - Rocklin, California

