

Exterior Noise Analysis

The Village

City of Arcata, California

Prepared for:

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1.0 Definitions

- **Noise** is undesired sound.
- **Sound** is an oscillation in pressure, stress, particle displacement, particle velocity, etc., in a medium with internal forces.
- **Decibel (dB)** is a unit of level when the base of the logarithm is the tenth root of ten, and the quantities concerned are proportional to power.
- **Level** in acoustics is the logarithm of the ratio of a quantity to a reference quantity of the same kind.
- **Time-Weighted** refers to the fact that noise occurring during certain time periods is given more significance because it occurs at times when people are more sensitive to noise.
- **“A-Weighting”** is a frequency correction that correlates overall sound pressure levels with the frequency response of the human ear.
- **Leq** is the equivalent sound pressure level or “energy” average noise level during a specific time period. It can be measured for any time period, but is typically measured for fifteen minutes, 1 hour, or twenty-four hours.
- **Community Noise Equivalent Level (CNEL)** is a 24-hour, time-weighted, average noise level based on the “A-weighted” decibel. In the calculation process, noise occurring in the evening time period (7 p.m. to 10 p.m.) is penalized by adding 5 dB, while noise occurring in the nighttime period (10 p.m. to 7 a.m.) is penalized by adding 10 dB. These time periods and decibel increases were selected to reflect a person's increased sensitivity to noise during late-night and early morning hours.
- **L(N), or L%**, is a statistical method of describing noise which accounts for the variance in noise levels throughout a given measurement period. L(N), where N equals a percentage, is a way of expressing the noise level exceeded for a percentage of time in a given measurement period. For example, since 15 minutes is 25% of 60 minutes, L(25) is the noise levels that is exceeded for 15 minutes of a 60 minute measurement period.

2.0 Introduction

The purpose of this report is to determine compliance of *The Village* with the City of Arcata’s exterior noise standard for multi-family residential. Refer to Figure 1 for the location of the project. Refer to Figure 2 for the project site plan with building numbers.

The project will be exposed to noise from the 101 Freeway and St. Louis Road. The scope of this study includes the noise generated by traffic on the adjacent freeway and arterial roadway and the measures necessary to mitigate the exterior noise exposure levels to within the applicable noise standards.

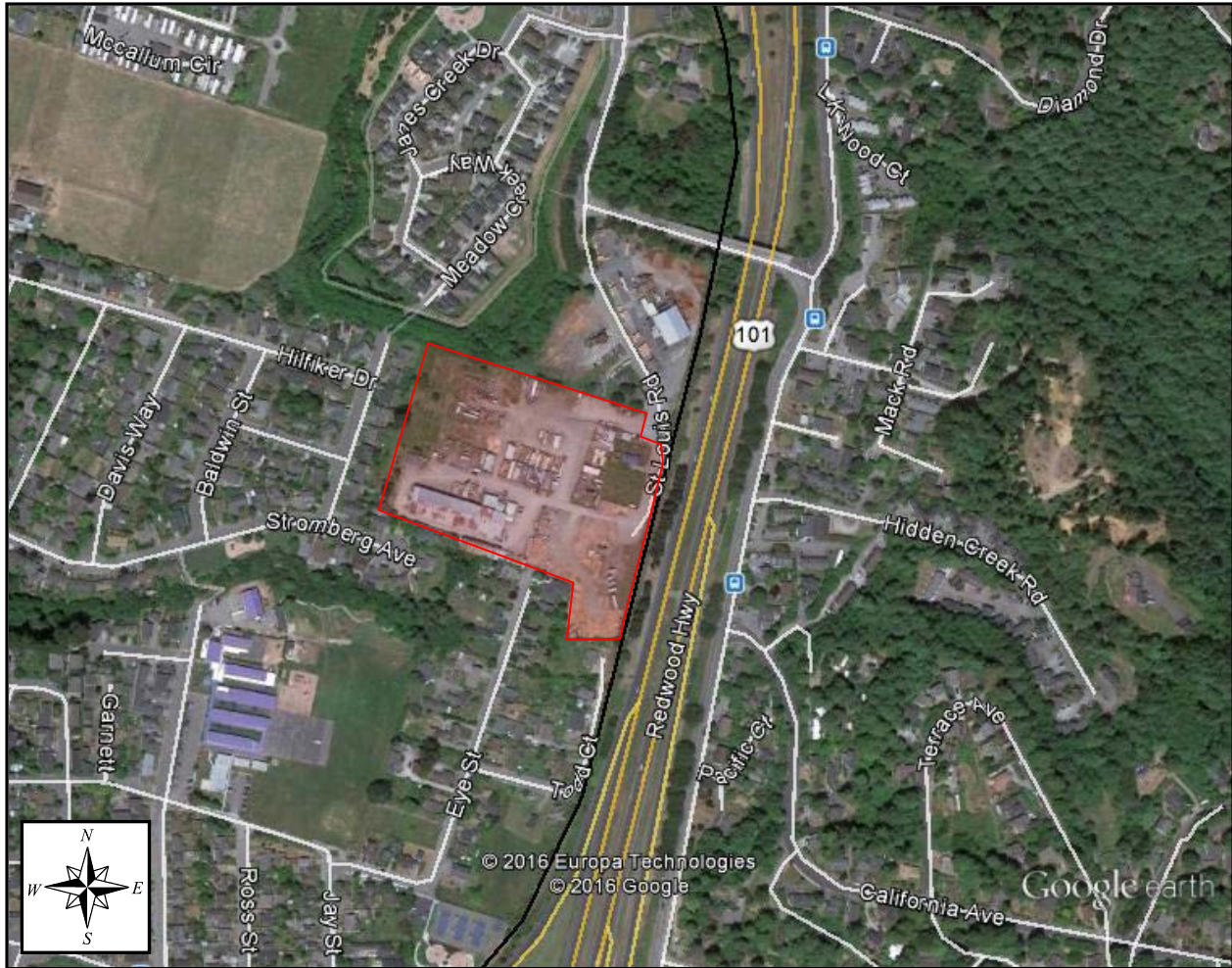


Figure 1 – Location of the Project

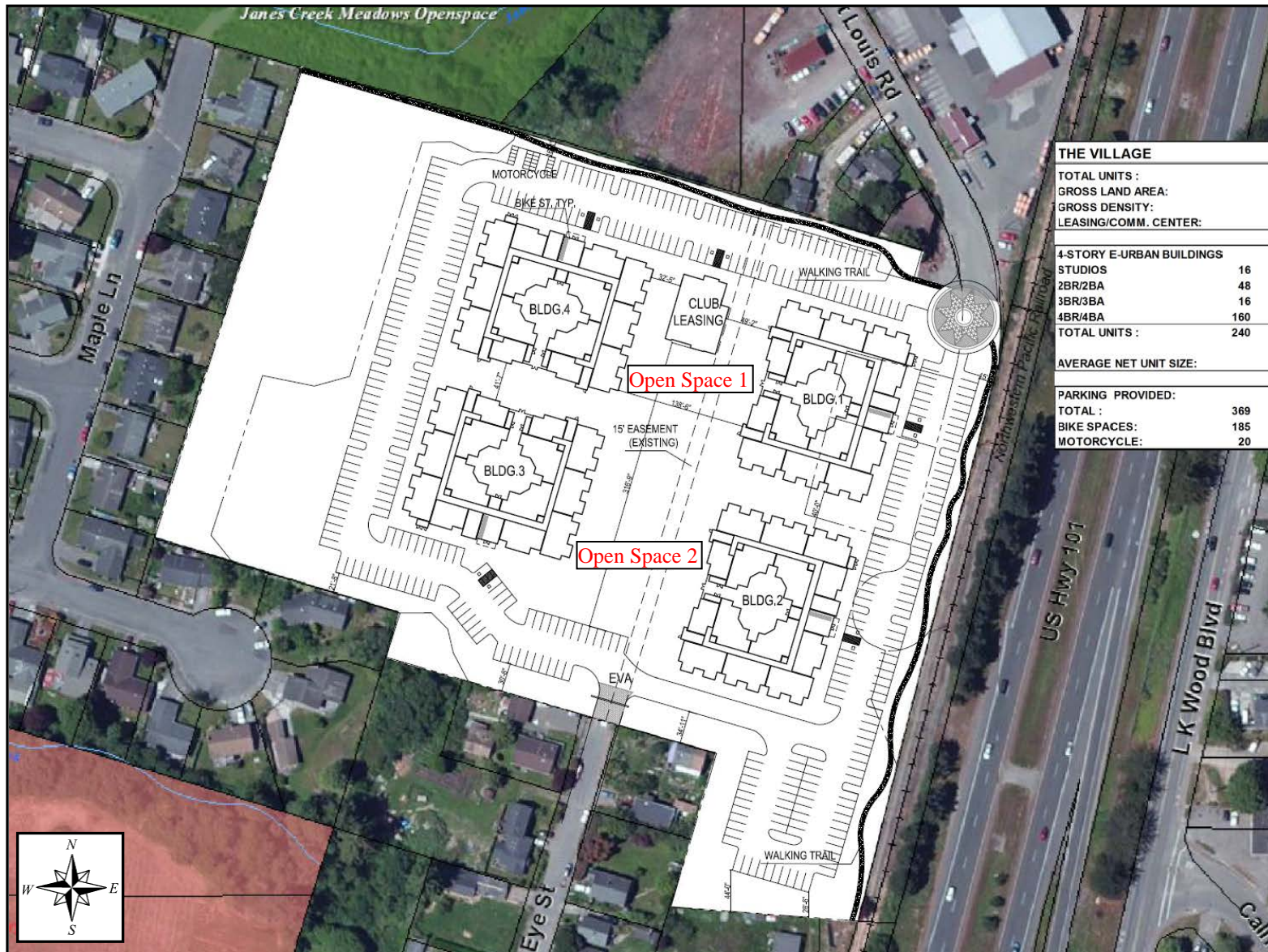


Figure 2 – Project Site Plan with Building Numbers

3.0 Noise Exposure Standards

3.1 City of Arcata, CA

3.1.1 Noise Element of the General Plan (Transportation Noise Sources)

Within the Noise Element of the General Plan (adopted October 2008) it specifies an exterior noise standard of 60 dB CNEL and an interior noise standard of 45 dB CNEL for multi-family residential. Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use. 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 45 dB Ldn/CNEL.

3.1.2 Noise Element of the General Plan (Stationary Noise Sources, Non-Transportation)

Within the Noise Element of the General Plan (adopted October 2008) it specifies exterior noise interior noise standards for stationary noise sources. Refer to Table 1 for the exterior and interior noise standard for multi-family residential. The standard will be applied at the outdoor activity areas of the receiving land use and at the building façade for upper floor receivers, which do not have an outdoor activity area facing the noise source. Where no outdoor activity area is identified, the City has the option to apply only the interior noise level performance standards.

Table 1 – Stationary Noise Source Exterior and Interior Noise Standards

	Exterior Noise Standards for Multi-Family Residential			Interior Noise Standards for Multi-Family Residential		
	7 a.m. to 7 p.m.	7 p.m. to 10 p.m.	10 p.m. to 7 a.m.	7 a.m. to 7 p.m.	7 p.m. to 10 p.m.	10 p.m. to 7 a.m.
Hourly Leq (dBA)	55	50	45	45	40	35
Lmax (dBA)	75	75	70	65	65	60

3.2 State of California

3.2.1 2013 California Building Code (CBC) for Multi-Family Residential

Within the 2013 CBC (California Code of Regulations, Title 24, Part 2, Volume 1, Chapter 12 – Interior Environment, Section 1207 – Sound Transmission), it states that residential structures located in noise critical areas shall be designed to prevent the intrusion of exterior noises beyond prescribed levels and should be consistent with the local land-use standards. Interior noise levels attributable to exterior sources shall not exceed 45 dB CNEL in any habitable room and should be consistent with the noise element of the local general plan.

Worst-case noise levels, either existing or future, shall be used as the basis for determining compliance. Future noise levels shall be predicted for a period of at least 10 years from the time of the building permit application.

Residential structures to be located where the CNEL exceeds 60 dB shall require an acoustical analysis showing that the proposed design will limit the exterior noise to the prescribed allowable interior noise level.

4.0 Noise Measurement Survey

A noise measurement survey was conducted on Wednesday January 13, 2016 and Thursday January 14, 2016 from the hours of 9 a.m. to 5 p.m. The goal of the noise measurement survey was to determine the existing ambient noise environment. Noise measurements recorded one second A-weighted noise values at three locations around the projects property line. Refer to Figure 3 for the noise measurement locations.

The sound level meters used to measure the noise levels were 01dB DUO and FUSION sound level meters. The microphones used were 01dB-Mettravib 1/2" condenser microphones. The equipment used meets the American National Standards Institute (ANSI) S1.4 specifications for a Type 1 precision sound level meter. The sound level meters were calibrated before and after the test with a Brüel & Kjær Type 4231 sound level calibrator with calibration traceable to the National Institute of Standards and Technology (NIST).

Noise Measurement Location 1 was selected for its close proximity to the commercial property to the north. The sound level meter at this location was placed at a distance of 5 feet from the nearest property line.

Noise Measurement Location 2 was selected for its proximity to the 101 Freeway. The sound level meter at this location was placed at a distance of 5 feet from the nearest property line. There is an existing chain link fence separating the project from the freeway right of way.

Noise Measurement Location 3 was selected for its close proximity to the residential property to the West. The sound level meter at this location was placed at a distance of 5 feet from the nearest property line.



Figure 3 – Noise Measurement Locations

4.1 Noise Measurement Results

The noise measurement survey results for noise measurement Location 1 are presented in Table 2. The table lists the resulting L50, L25, L8, L2, LMax and Leq noise values in terms of dBA for each hour of the measurement. The noise at this location was dominated by traffic noise from the 101 Freeway. No noise was audible from the commercial property to the north, although the Lumber Mill was active.

Table 2 – Location 1 Noise Measurement Results (dBA)

Date	Start Time	End Time	L50	L25	L8	L2	LMax	Leq
1/14/2016	9:00 AM	10:00 AM	60.8	62	63.4	66	76.6	61.6
1/14/2016	10:00 AM	11:00 AM	61.8	63.1	64.4	66.0	72.6	62.3
1/14/2016	11:00 AM	12:00 PM	61.3	62.8	64.2	66.0	54.0	61.9
1/13/2016	12:00 PM	1:00 PM	60.4	61.8	63.4	65.1	75.9	61.1
1/13/2016	1:00 PM	2:00 PM	60.0	61.4	63.0	66.8	85.7	61.6
1/13/2016	2:00 PM	3:00 PM	62.0	65.3	66.1	72.9	83.9	64.8
1/13/2016	3:00 PM	4:00 PM	59.5	60.8	62.3	64.5	75.0	60.2
1/13/2016	4:00 PM	5:00 PM	60.5	61.6	63.1	66.0	78.3	61.4
Daily Average Leq (dBA)								62.1

The noise measurement survey results for noise measurement Location 2 are presented in Table 3. The table lists the resulting L50, L25, L8, L2, LMax and Leq noise values in terms of dBA for each hour of the measurement. The noise at this location was dominated by traffic noise from the 101 Freeway.

Table 3 – Location 2 Noise Measurement Results (dBA)

Date	Start Time	End Time	L50	L25	L8	L2	LMax	Leq
1/14/2016	9:00 AM	10:00 AM	66.1	67.8	69.5	71.8	84.1	66.9
1/14/2016	10:00 AM	11:00 AM	67.0	68.5	70.1	72.3	76.0	67.5
1/14/2016	11:00 AM	12:00 PM	67.0	68.5	70.2	71.9	75.9	67.5
1/14/2016	12:00 PM	1:00 PM	69.2	71.0	72.9	74.6	85.7	70.0
1/14/2016	1:00 PM	2:00 PM	69.8	71.4	73.2	74.9	78.5	69.9
1/13/2016	2:00 PM	3:00 PM	67.7	69.3	70.8	72.6	78.1	68.3
1/13/2016	3:00 PM	4:00 PM	67.7	69.1	70.5	72.7	76.1	68.1
1/13/2016	4:00 PM	5:00 PM	68.1	69.4	71.0	72.7	76.7	68.5
Daily Average Leq (dBA)								68.5

The noise measurement survey results for noise measurement Location 3 are presented in Table 4. The table lists the resulting L50, L25, L8, L2, LMax and Leq noise values in terms of dBA for each hour of the measurement. The noise at this location was dominated by traffic noise from the 101 Freeway.

Table 4 – Location 3 Noise Measurement Results (dBA)

Date	Start Time	End Time	L50	L25	L8	L2	LMax	Leq
1/14/2016	9:00 AM	10:00 AM	59.4	61	62.6	65.3	72.7	60.4
1/14/2016	10:00 AM	11:00 AM	60.6	62.1	63.8	65.6	67.8	61.2
1/14/2016	11:00 AM	12:00 PM	59.7	61.6	63.2	65.2	74	60.6
1/13/2016	12:00 PM	1:00 PM	59.9	61.5	63.4	65.5	77.9	60.5
1/13/2016	1:00 PM	2:00 PM	59.7	61.3	62.9	65.2	73.8	60.5
1/13/2016	2:00 PM	3:00 PM	59.3	60.9	62.8	70.0	71.0	60.8
1/13/2016	3:00 PM	4:00 PM	58.8	60.2	61.9	64.2	69.1	59.4
1/13/2016	4:00 PM	5:00 PM	59.2	60.6	62.4	64.3	70.5	59.9
Daily Average Leq (dBA)								60.4

4.2 Noise Impact on the Project

The dominate noise source at Noise Measurement Locations 1, 2 and 3 was the 101 Freeway. There are no stationary noise sources adjacent to the project that will have an impact. Any noise from the commercial property to the North of the project was not audible, although the Lumber Mill was active while conducting the noise measurements. Therefore, the project will comply with the noise element standards for stationary noise sources.

5.0 Roadway Methodology

The roadway noise exposure in this report was computed using an acoustical planning and modeling program called SoundPLAN (Version 7.4). SoundPLAN was created by Braunstein & Berndt GmbH and incorporates the Federal Highway Administration (FHWA) Traffic Noise Model (TNM) (Version 2.5) noise emission and noise prediction methodology. Table 5¹ lists the freeway vehicle mix percentages for day, evening, and night time periods. The vehicles are divided into automobiles, medium trucks and heavy trucks.

Table 5 – Freeway Vehicle Mix Percentages

	Day	Evening	Night
Automobiles	65.83%	17.98%	9.49%
Medium Trucks	2.92%	0.20%	0.50%
Heavy Trucks	2.10%	0.23%	0.75%

¹ County of Orange Environmental Management Agency, *Sound Attenuation Guidelines*, File C54-115, September 4, 1984.

6.0 Roadway Exterior Noise Exposure

The proposed project will be subject to noise from the freeway and arterial roadway closest to the site: the 101 Freeway and St. Louis Road.

The latest existing (2014) average daily traffic (ADT) volume for the 101 Freeway was obtained from the California Department of Transportation (CalTrans) website. The future (2026) ADT volume of the 101 Freeway was estimated using the existing (2014) ADT with a 1% annual growth rate.

The City of Arcata’s Traffic Engineering Department does not have an Average Daily Traffic (ADT) volume for St. Louis Road.

The speed limit for the 101 Freeway was obtained from a site visit. The traffic volumes and speeds utilized in calculating the traffic noise exposure are presented in Table 6.

Table 6 – Traffic Volumes and Speed Limits

Roadway	Type	Traffic Volumes				Speed (mph)
		Existing Year	ADT	Future Year	ADT	
101 Freeway	Freeway	2014	43,500	2026	49,017	65

The worst-case unmitigated exterior noise levels at Open Space 1 and Open Space 2 were calculated to be less than 60 dB CNEL. Therefore, additional mitigation measures will not be required.

Figure 5 shows the results as lines, or contours of equal noise exposure. The figure shows the 40-75 dB CNEL unmitigated roadway noise exposure contours at ground level.

Table 7 – Worst-Case Roadway Exterior Noise Levels (dB CNEL) for the 1st-4th Floors of Buildings 1-3

Building	1st Floor	2nd Floor	3rd Floor	4th Floor
1	72.5	71.8	71.8	71.9
2	73.2	71.7	71.7	71.8
3	64.9	64.4	64.3	64.2
4	65.4	65.3	65.3	65.2

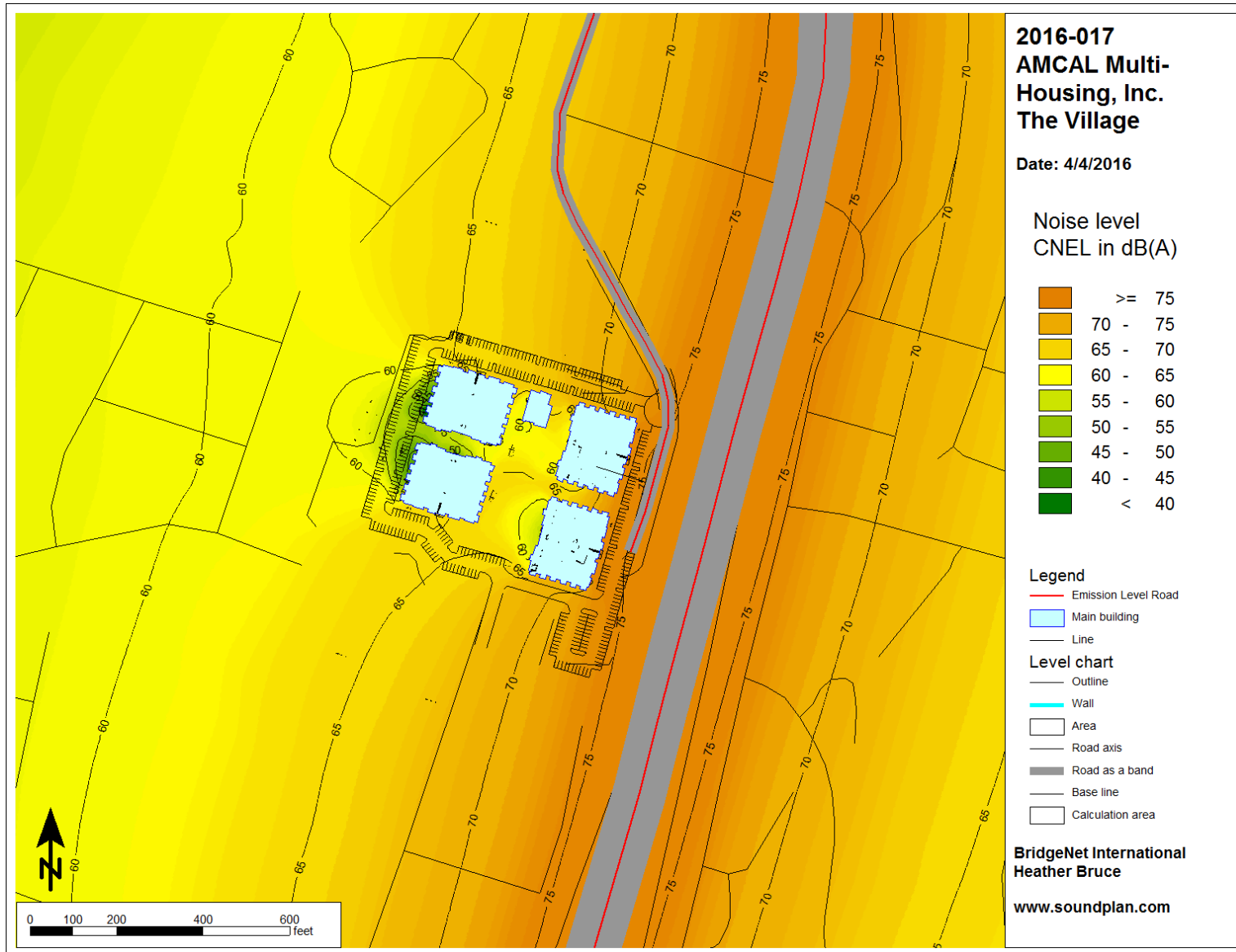


Figure 5 – Unmitigated Roadway Noise Exposure Contours at Ground Level (dB CNEL)

7.0 Interior Noise Exposure

The project must comply with the City of Arcata's and State of California's interior noise standard of 45 dB CNEL for multi-family residential.

To comply with the interior noise standards, the buildings must provide sufficient exterior to interior noise attenuation to reduce the interior noise exposure to acceptable levels. An interior noise analysis will be required for the project when architectural plans become available.

8.0 References

County of Orange Environmental Management Agency, *Sound Attenuation Guidelines*, File C54-115, September 4, 1984.

Manhard Consulting, Civil Engineering Site Plan for *The Village*, City of Arcata, California, March 29, 2016.