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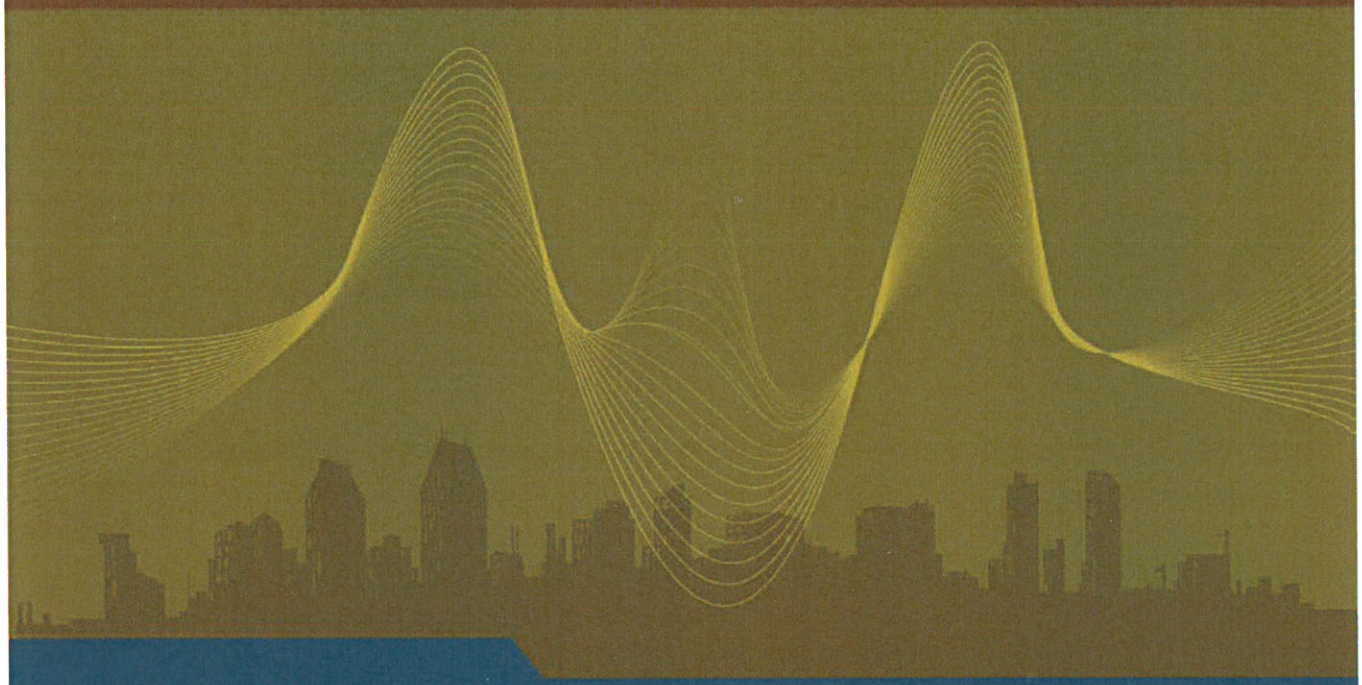

Exterior Noise Analysis

Tract 18938

County of San Bernardino, 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 level 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 *Tract 18938* with the County of San Bernardino's exterior noise standards for single family residential. Refer to Figure 1 for the location of the project. Refer to Figure 2 for the project site plan showing home lot numbers.

Figure 1 - Location of the Project

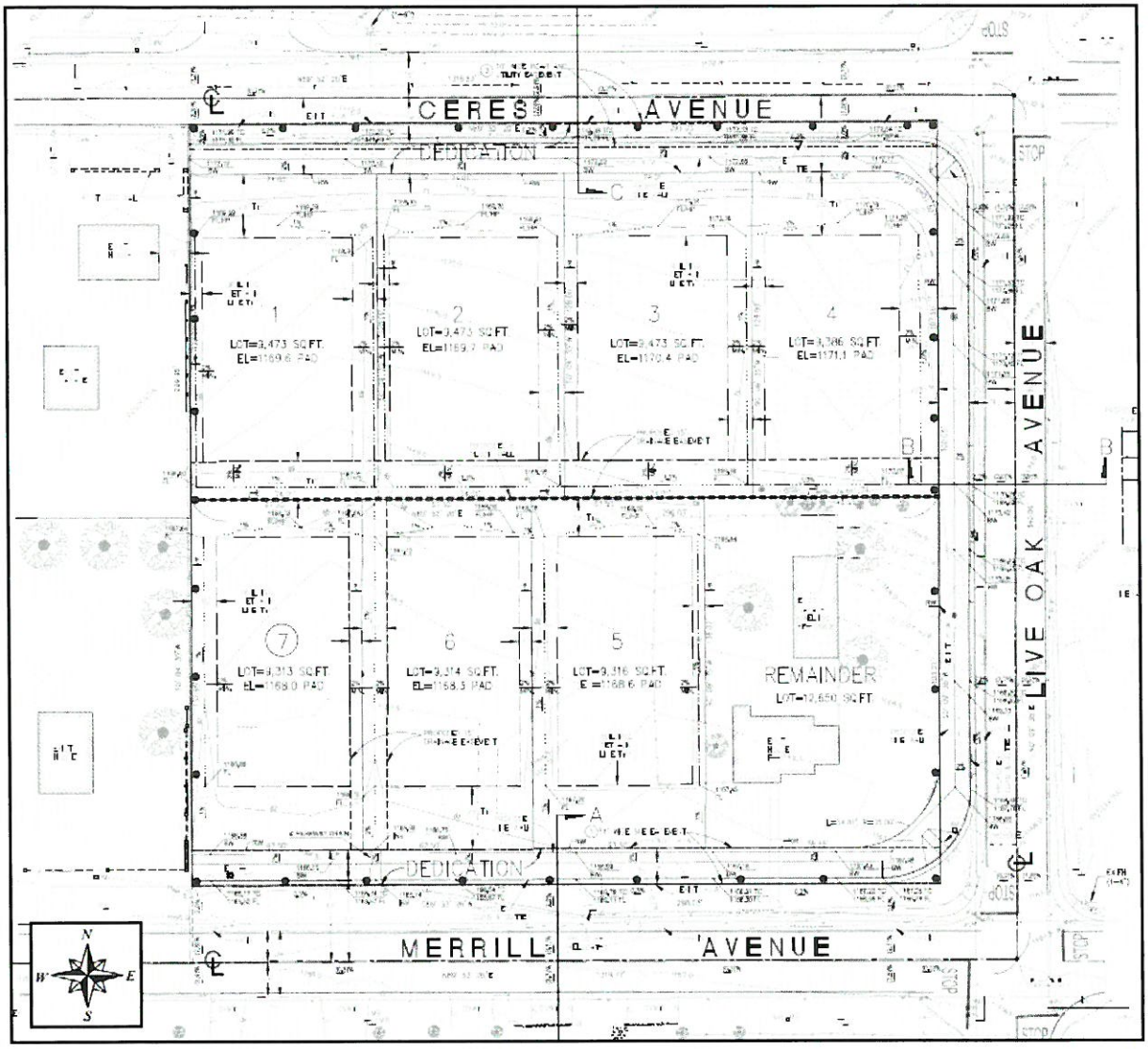

Figure 2 – Project Site Plan with Home Lot Numbers

3.0 Noise Exposure Standards

3.1 County of San Bernardino, California

3.1.1 Noise Ordinance of the Municipal Code (Transportation Noise Sources)

The County of San Bernardino specifies an exterior noise standard of 65 dB CNEL and an interior noise standard of 45 dB CNEL with closed windows and doors for single family residential land use. The exterior noise standard for single residential land use is limited to private yards. The interior environment excludes bathrooms, kitchens, toilets, closets and corridors.

3.1.2 Noise Ordinance of the Municipal Code (Stationary or Non-Transportation Noise Sources)

The County of San Bernardino has established exterior and interior noise standards within Division 3 – Chapter 83.01 – Section 83.01.080 (Countywide Development Standards – General Performance Standards – Noise). The noise ordinance is designed to control unnecessary, excessive and annoying sounds generated on one piece of property from impacting an adjacent property and to protect residential areas from noise sources other than transportation sources.

The daytime (7 a.m. to 10 p.m.) exterior noise standard for residential is 55 dBA Leq and the nighttime (10 p.m. to 7 a.m.) exterior noise standard is 45 dBA Leq. Temporary construction, maintenance, repair or demolition activities between 7 a.m. and 7 p.m., except on Sundays and Federal holidays is exempt.

It also states corrections for time characteristics. No person shall create noise or allow the creation of noise on property owned, leased, occupied, or otherwise controlled by such person, with causes the noise level measured on any other residential property to exceed:

1) The exterior noise standard for a cumulative period of more than 30 minutes in any hour (L50);
2) The exterior noise standard plus 5 dBA for a cumulative period of more than 15 in any hour (L25);
3) The exterior noise standard plus 10 dBA for a cumulative period of more than 5 minutes in any hour (L8);
4) The exterior noise standard plus 15 dBA for a cumulative period of more than 1 minute in any hour (L2); or
5) The exterior noise standard plus 20 dBA for any time period (LMax).

If the measured ambient level exceeds any of noise limit categories 1-4 above, the cumulative period applicable to said category shall be increased to reflect said ambient noise level.

3.2 State of California

Within the 2013 California Building Code (CBC) (California Code of Regulations, Title 24, Part 2, Volume 1, Chapter 12 – Interior Environment, Section 1207 – Sound Transmission), it is stated 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, October 8, 2014 from the hours of 7 a.m. to 11 a.m. and 3 p.m. to 7 p.m. The goal for these noise measurements was to determine the existing ambient noise environment without any Auto Club Speedway events occurring. The noise measurements recorded one second A-weighted noise values at Locations 1 and 2 around the projects property line. Refer to Figure 3 for noise measurement Locations 1 and 2.

A noise measurement survey was also conducted on Thursday, October 9, 2014 from the hours of 9 a.m. to 5 p.m. The goal of this noise measurement was to determine the noise level from the Auto Club Speedway. The events occurring at the Auto Club Speedway during the noise measurement were drag racing and Nascar racing schools. This day was chosen specifically because both events were occurring at the same time. Aside from the two biggest events of the year which occur in March, these are the loudest events according to Auto Club Speedway. The noise measurements recorded one second A-weighted noise values at Location 3 around the projects property line. Refer to Figure 3 for the noise measurement Location 3.

The monitors used to measure the noise levels were 01dB FUSION sound level meters. The microphones used were 01dB 1/2" condenser microphones. The equipment used meets the American National Standards Institute (ANSI) S1.4 specification 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 railroad to the north of the project site. The sound level meter at this location was placed at a distance of 10 feet from the nearest property line.

Noise measurement Location 2 was selected for its close proximity to Merrill Avenue to the south of the project site. The sound level meter at this location was placed at a distance of 10 feet from the sidewalk.

Noise measurement Location 3 was selected for its close proximity to the Auto Club Speedway to the west of the project site. 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 results for noise measurement Location 1 are presented in Table 1. The table lists the resulting average noise values in terms of dBA Leq for each hour of the noise measurement. The noise at this location was dominated by traffic on Ceres Avenue and the railroad to the north of the project. These results were used to calibrate the roadway and railroad noise model.

Table 1 – Location 1 Noise Measurement Results (dBA)

Date	Start Time	End Time	Leq
10/8/2014	7:00 AM	8:00 AM	64.7
10/8/2014	8:00 AM	9:00 AM	60.6
10/8/2014	9:00 AM	10:00 AM	60.3
10/8/2014	10:00 AM	11:00 AM	64.1
10/8/2014	3:00 PM	4:00 PM	64.5
10/8/2014	4:00 PM	5:00 PM	62.6
10/8/2014	5:00 PM	6:00 PM	62.3
10/8/2014	6:00 PM	7:00 PM	61.0

The noise measurement results for noise measurement Location 2 are presented in Table 2. The table lists the resulting average noise values in terms of dBA Leq for each hour of the noise measurement. The noise at this location was dominated by traffic on Merrill Avenue. These results were used to calibrate the roadway noise model.

Table 2 – Location 2 Noise Measurement Results (dBA)

Date	Start Time	End Time	Leq
10/8/2014	7:00 AM	8:00 AM	63.1
10/8/2014	8:00 AM	9:00 AM	59.8
10/8/2014	9:00 AM	10:00 AM	59.9
10/8/2014	10:00 AM	11:00 AM	60.2
10/8/2014	3:00 PM	4:00 PM	61.0
10/8/2014	4:00 PM	5:00 PM	60.8
10/8/2014	5:00 PM	6:00 PM	60.9
10/8/2014	6:00 PM	7:00 PM	59.7

The noise measurement results for noise measurement Location 3 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 County of San Bernardino's daytime exterior noise standards are listed on the bottom row of the table for comparison and values that exceed these standards are shown in red within the table. The noise at this location was dominated by traffic on Ceres Avenue. Noise from the Auto Club Speedway to the west of the project site was barely audible.

Table 3 – Location 3 Noise Measurement Results (dBA)

Date	Start Time	End Time	L50	L25	L8	L2	LMax	Leq
10/9/2014	9:00 AM	10:00 AM	55.6	59.1	65.6	72.4	84.3	62.5
10/9/2014	10:00 AM	11:00 AM	52.0	55.6	60.5	70.0	81.2	59.3
10/9/2014	11:00 AM	12:00 PM	54.1	57.9	63.9	71.6	85.0	61.4
10/9/2014	12:00 PM	1:00 PM	50.9	54.6	61.2	70.2	76.7	59.1
10/9/2014	1:00 PM	2:00 PM	57.9	63.3	66.8	72.9	92.7	65.5
10/9/2014	2:00 PM	3:00 PM	53.7	57.4	65.4	71.9	87.1	62.2
10/9/2014	3:00 PM	4:00 PM	52.1	57.3	65.8	71.8	78.7	61.1
10/9/2014	4:00 PM	5:00 PM	51.5	55.6	64.9	71.9	81.4	61.1
Daytime Exterior Noise Standards:			**55.0**	**60.0**	**65.0**	**70.0**	**75.0**	-

The existing ambient noise environment around the project site was dominated by traffic noise emanating from Merrill Avenue, Ceres Avenue and the railroad to the north of the project. Noise from the Auto Club Speedway to the west of the project were barely audible and therefore should have a less than significant impact to the project site. Exterior and interior mitigation measures will not be required for the project to comply with the County of San Bernardino's Noise Ordinance of the Municipal Code 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 7.3). 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 4[1] lists the arterial vehicle mix percentages for day, evening, and night time periods. The vehicles are divided into automobiles, medium trucks and heavy trucks.

Table 4 – Arterial Roadway Vehicle Mix Percentages

	Day	Evening	Night
Automobiles	75.51%	12.57%	9.34%
Medium Trucks	1.56%	0.09%	0.19%
Heavy Trucks	0.64%	0.02%	0.08%

6.0 Roadway Exterior Noise Exposure

The proposed project will be subject to noise from traffic on the arterial roadways closest to the site: Merrill Avenue, Ceres Avenue and Live Oak Avenue.

The latest existing (2014) ADT volumes for Merrill Avenue was obtained from the County of San Bernardino's Transportation Department. The future (2024) ADT volume for Merrill Avenue was estimated using the existing (2014) ADT volume with a 1% annual growth rate.

The latest existing (2013) ADT volume for Ceres Avenue was obtained from the County of San Bernardino's Transportation Department. The future (2024) ADT volume for Ceres Avenue was estimated using the existing (2013) ADT volume with a 1% annual growth rate.

The latest existing (2010) ADT volume for Live Oak Avenue was obtained from the County of San Bernardino's Transportation Department. The future (2024) ADT volume for Live Oak Avenue was estimated using the existing (2010) ADT volume with a 1% annual growth rate.

The speed limits for Merrill Avenue, Ceres Avenue and Live Oak Avenue were obtained from a site visit. The existing and future traffic volumes and speed utilized in calculating the traffic noise exposure are presented in Table 5.

Table 5 – Existing and Future Traffic Volumes and Speeds

Roadway	Type	Traffic Volumes				Speed (mph)
		Existing Year	ADT	Future Year	ADT	
Merrill Avenue	Arterial	2014	6,342	2024	7,006	40
Ceres Avenue	Arterial	2013	908	2024	1,013	25
Live Oak Avenue	Arterial	2010	761	2024	875	25

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

The worst case unmitigated roadway noise exposure at the backyards and 1st-2nd floors of the homes were calculated and are presented in Table 6. Figure 4 shows the results as lines, or contours of equal noise exposure. The figure shows the 40-75 dB CNEL roadway noise exposure contours at ground level.

Table 6 – Worst-Case Exterior Noise Levels (dB CNEL)

Lot	Backyard	1st Floor	2nd Floor
1	57.3	53.6	53.7
2	56.9	53.8	53.6
3	56.7	54.6	54.1
4	59.8	58.1	57.5
5	56.8	62.5	62.2
6	56.7	62.5	62.2
7	56.0	62.1	61.7

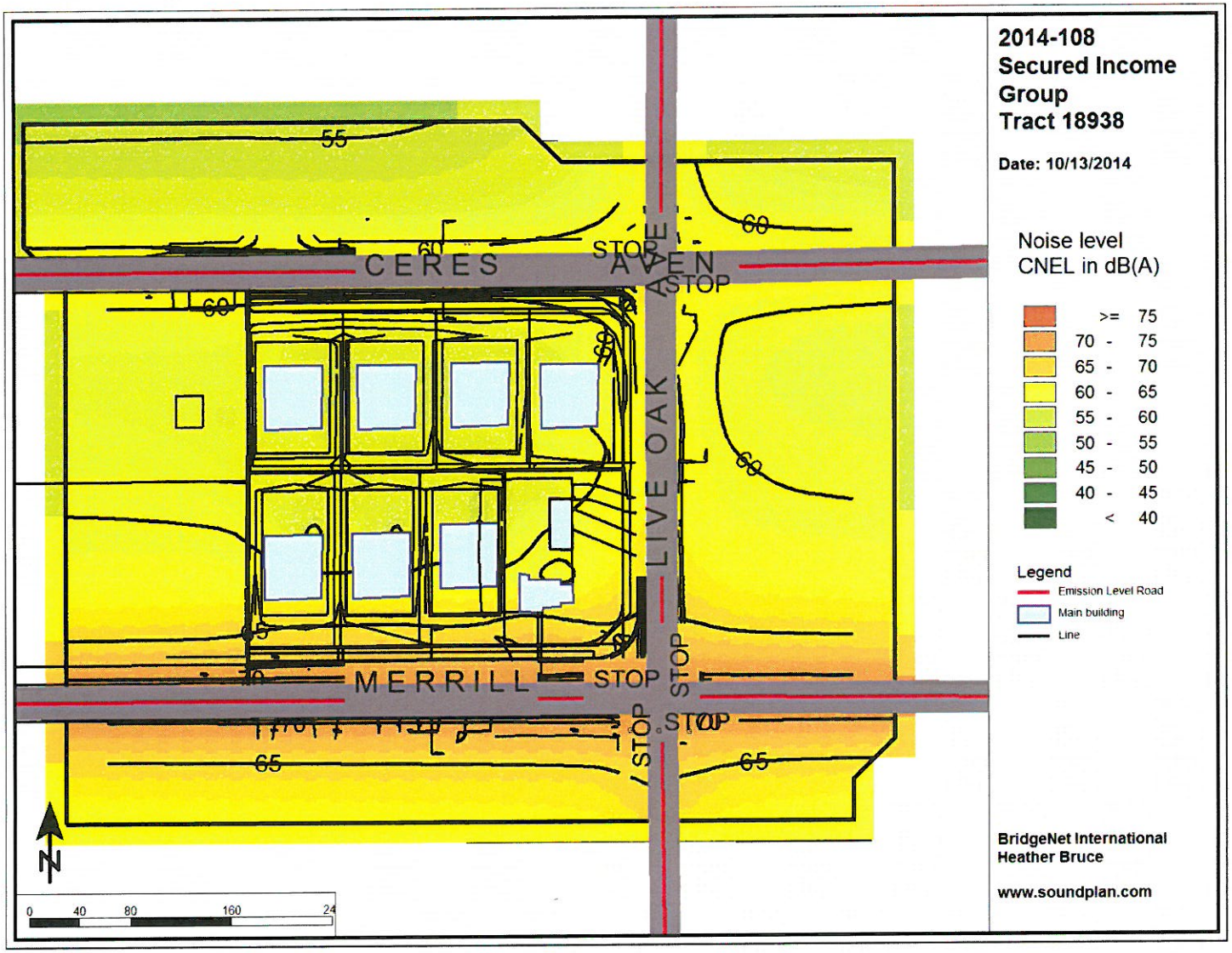

Figure 4 – Roadway Noise Exposure Contours at Ground Level (dB CNEL)

7.0 Railroad Noise Exposure

The project site will be exposed to noise from traffic on the railroad that is to the north. This railroad accommodates local Burlington Northern Santa Fe Corporation (BNSF) freight trains as well as Metrolink commuter trains.

Based upon our experience and information obtained from the noise measurement survey, the average local BNSF freight train has 25 cars that are pulled or pushed by 4 engines. The average car length is 80 feet, the average engine length is 55 feet and the average speed is 20 mph. It was estimated that the railroad currently (2014) accommodates 5 day operations, 3 evening operations and 2 night operations. Day operations are between 7 a.m. and 7 p.m., evening operations are between 7 p.m. and 10 p.m. and night operations are between 10 p.m. and 7 a.m.

Based upon our experience and information obtained from the noise measurement survey, the average Metrolink commuter train has 5 passenger cars that are pulled or pushed by 1 engine. The average passenger car length is 90 feet, the average engine length is 55 feet and the average speed is 39 mph.

According to the latest (2014) schedule of operations on the Metrolink website for Fontana and Rancho Cucamonga Metrolink stations, as well as operational information obtained from the noise measurement survey, the railroad located to the north of the project currently accommodates 26 day operations, 3 evening operations and 7 night operations. Day operations are between 7 a.m. and 7 p.m., evening operations are between 7 p.m. and 10 p.m. and night operations are between 10 p.m. and 7 a.m.

The worst case unmitigated railroad noise exposure will occur at the northern portion of the project at the homes adjacent to the railroad and Ceres Avenue and was calculated to be as high as 61.2 dB CNEL.

8.0 Combined Noise Exposure

The total noise exposure level will consist of the sum of the roadway and railroad noise combined on an energy basis.

The greatest roadway and railroad noise exposure for the project will occur at the homes adjacent to the Ceres Avenue and the railroad. The worst-case exterior noise level at the backyards was calculated to be as high as 63.6 dB CNEL. Since this level does not exceed the San Bernardino's exterior noise standard of 65 dB CNEL, additional exterior mitigation measures will be not be required. The project will comply with the County of San Bernardino's Noise Ordinance of the Municipal Code for transportation noise sources.

9.0 Interior Noise Exposure

The project must comply with the County of San Bernardino's interior noise standard of 45 dB CNEL for single family residential. To comply with the interior noise standard the homes 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.

10.0 References

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

Cornerstone Land Surveying, Inc., Civil Engineering Site Plan for *Tract 18938*, County of San Bernardino, California, August 26, 2014.