Supplemental Noise Study Report

South of Barton Road to North of Barton Road

Cities of Grand Terrace and Colton

08-SBD-215 PM 0.58/1.66

EA No. 08-0J0700

(PN 0800000282)

September 2013

Caltrans

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I-215/Barton Road Interchange Improvement Project

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September 2013

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Summary

The purpose of this Supplemental Noise Study Report (NSR) is to evaluate noise impacts and noise abatement consistent with the requirements of 23 Code of Federal Regulations (CFR) 772.

This Supplemental NSR provides an analysis for the proposed Interstate 215 (I-215)/ Barton Road Interchange Project (project) Modified Alternative 7. Alternatives 3, 6, and 7 were previously analyzed in the approved February 2012 NSR. In March 2013, the Project Development Team (PDT) determined that Alternative 7 would be removed from further consideration due to safety and community concerns. Modified Alternative 7 would replace Alternative 7 as the Locally Preferred Alternative. The noise monitoring and noise model calibrations (K-factors) conducted for the project alternatives (Alternative 1 [No Build] and Build Alternatives 3, 6, and 7), are applicable to Modified Alternative 7 and are included in this report.

The San Bernardino Associated Governments (SANBAG), in cooperation with the California Department of Transportation (Caltrans), the City of Grand Terrace, and the City of Colton, proposes to improve the I-215/Barton Road interchange. The proposed project is located in the City of Grand Terrace and partially in the City of Colton in the County of San Bernardino (County). On Barton Road, the project limits extend from approximately 0.3 mile (mi) west of I-215 to 0.4 mi east of I-215. The project limits on I-215 extend from approximately 0.8 mi south of Barton Road to 0.4 mi north of Barton Road.

The purpose of the proposed project is to reconstruct and improve the interchange in order to improve operation, increase capacity, and reduce congestion at the I-215/ Barton Road interchange and facilities served by the interchange. The proposed project is needed to increase capacity, improve operations, and reduce congestion at the I-215/Barton Road interchange.

Three Build Alternatives and a No Build Alternative were previously evaluated in the February 2012 NSR. This Supplemental NSR evaluates an additional alternative (Modified Alternative 7) for the proposed project. Modified Alternative 7 is the Locally Preferred Alternative.

The proposed project is considered a Type 1 project because it would use federal aid to improve the existing I-215/Barton Road interchange by adding a through lane on

Barton Road and substantially altering the vertical and horizontal alignment of the Barton Road interchange. A noise analysis is required for all Type 1 projects.

Existing land uses in the project area include single-family and multifamily residences; two mobile home parks; a recreational vehicle (RV) park; a fast-food restaurant with an outdoor eating area; a school; a utility facility; office, commercial, and light industrial uses; and vacant land. The primary source of noise in the project area is traffic on I-215.

The terrain within the project area can be separated into three areas: Area 1 is located south of Barton Road; Area 2 is located between Barton Road and Newport Avenue; and Area 3 is located north of Newport Avenue. Land uses located in Area 1 are located up to 20 feet (ft) higher in elevation than I-215. Land uses located in Area 2 are located approximately 20 ft higher in elevation than I-215. Lastly, land uses located in Area 3 are located between 20 and 50 ft higher in elevation than I-215.

Twelve short-term noise level measurements and one exterior/interior noise level measurement were conducted at representative locations to document the existing noise environment. All 12 short-term noise level measurements were used to calibrate the noise prediction model with concurrent traffic counts and measured vehicle speeds. A total of 144 representative existing sensitive receivers were modeled and evaluated for potential noise impacts resulting from traffic noise. The results of the modeled noise levels for existing, future No Build, and Modified Alternative 7 are shown in Table B-1.

Two long-term 24-hour noise level measurements were conducted within the project area. The first long-term 24-hour noise level measurement was conducted to identify the peak traffic noise hour and to adjust existing noise levels to the worst hour. The second long-term 24-hour noise level measurement was conducted to obtain the community background noise level measurement to capture nonvehicular traffic noise sources, such as train noise from Union Pacific Railroad (UPRR), because the ambient noise level is also dominated by existing rail operations. The community background noise level of 58 equivalent continuous sound level measured in A-weighted decibels (dBA L_{eq}) was incorporated into the noise level results for Receivers R-60 through R-130 because they are located in the vicinity of rail operations and the community background noise level measurement. In addition, the 24-hour community background noise level was incorporated into the modeling of sound barriers to ensure that barriers can provide a noise level reduction goal of

5 dBA with the consideration of the community background noise and that the modeled sound barriers do not reduce noise levels below the background noise level.

When traffic noise impacts have been identified, noise abatement measures must be considered. Traffic noise impacts result from one or more of the following occurrences: (1) an increase of 12 dBA or more over their corresponding existing noise levels, or (2) predicted noise levels approach or exceed the Noise Abatement Criteria (NAC).

Implementation of the proposed project would result in potential short-term noise impacts during construction and long-term noise impacts from use of the completed project. No substantial noise increase of 12 dBA or more over the corresponding existing noise level would result under Modified Alternative 7. Of the 144 modeled receivers, 23 receivers would approach or exceed the 67 dBA L_{eq} NAC.

The potential interior noise impact was evaluated for Grand Terrace Elementary School, which is located on the east side of I-215, north of Barton Road. The predicted future classroom interior noise level would approach or exceed the 52 dBA L_{eq} NAC under Activity Category D under Modified Alternative 7. Sound Barrier (SB) Nos. 23a and 23b were analyzed to shield classroom buildings closest to I-215.

Noise abatement measures were evaluated for receivers located within the project limits that would be or would continue to be exposed to traffic noise levels approaching or exceeding the NAC. A total of five sound barriers were evaluated. Four sound barriers were evaluated along the State right-of-way (ROW) or the edge of shoulder, and one sound barrier was evaluated along the residential property line. The results of the sound barrier modeling along the State ROW or the edge of shoulder are shown in Table B-1. Also, the results of the sound barrier modeling along residential property lines are shown in Table B-2.

Of the five sound barriers evaluated, all five sound barriers were capable of reducing noise levels by 5 dBA or more, as required to be considered feasible. Tables 12 through 16 provide the following information regarding the feasible sound barriers: noise level reductions, the number of benefited residences, the reasonable allowances per benefited residence, and the total reasonable allowance for each barrier height.

The effects of parallel barriers were considered in areas where sound barriers are located on both sides of the roadway because reflective noise would have the potential to increase noise levels and degrade the performance of the modeled sound barriers (i.e., parallel barrier degradation). Parallel barrier configurations that have a roadway width to sound barrier height ratio of 15:1 or less (width/height) would degrade the performance of sound barriers. Parallel barriers within the project area are located along I-215, north of Barton Road. The minimum parallel barrier ratio along the I-215 north of Barton Road would be 11:1. Therefore, to avoid this effect, Caltrans standard practice would require sound barriers along I-215 north of Barton Road to be provided with an acoustically absorptive surface with a Noise Reduction Coefficient (NRC) of 0.80 or greater.

A Noise Abatement Decision Report (NADR) will be prepared for the proposed project. The NADR is a design responsibility and is prepared to compile information from the NSR, other relevant environmental studies, and design considerations into a single, comprehensive document before public review of the proposed project. The NADR is prepared after completion of the NSR and prior to publication of the draft environmental document. The NADR includes noise abatement construction cost estimates that have been prepared and signed by the project engineer based on site-specific conditions. Construction cost estimates are compared to reasonable allowances in the NADR to identify which sound barrier configurations are reasonable from a cost perspective. The reasonableness determination of the feasible sound barriers shown in Tables 12 through 16 will be reported in the NADR for the proposed project.

The design of sound barriers presented in this report is preliminary and has been conducted at a level appropriate for environmental review and not for final design of the proposed project. If pertinent parameters change substantially during the final project design, preliminary sound barrier designs may be modified or eliminated from the final project. A final decision on the construction of the noise abatement will be made upon completion of the public involvement process during the final project design process.

The closest sensitive receivers are located within 50 ft from project construction areas. Therefore, these receiver locations may be subject to short-term noise higher than 95 dBA maximum noise level (L_{max}) generated by construction activities with the project area. Compliance with the construction hours specified in the City of Grand Terrace Municipal Code, the City of Colton’s Bid and Contract template for work within City ROW, and Caltrans Standard Specifications for work within State ROW will be required to minimize construction noise impacts on sensitive land uses adjacent to the project site. Construction noise is regulated by Caltrans Standard Special Provisions (SSP) in Section 14-8.02. Noise control shall conform to the provisions in Section 14-8.02. The noise level from the Contractor’s operations, between the hours of 9:00 p.m. and 6:00 a.m., shall not exceed 86 dBA at a distance of 50 ft. The Contractor should use an alternative warning method instead of a sound signal unless required by safety laws. In addition, the Contractor shall equip all internal combustion engines with the manufacturer-recommended muffler and shall not operate any internal combustion engine on the job site without the appropriate muffler.

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List of Abbreviated Terms

°F	degrees Fahrenheit
µPa	micro-Pascals
23 CFR 772	Title 23, Part 772 of the Code of Federal Regulations
ADT	average daily traffic
BNSF	Burlington Northern Santa Fe
CAD	computer-aided design
Caltrans	California Department of Transportation
CFR	Code of Federal Regulations
CNEL	Community Noise Equivalent Level
County	County of San Bernardino
dB	decibels
dBA	A-weighted decibels
dBA L_{eq}	equivalent continuous sound level measured in A-weighted decibels
EW	Existing Wall
FHWA	Federal Highway Administration
ft	foot/feet
GPS	Global Positioning System
HOT	high-occupancy toll
HOV	high-occupancy vehicle
Hz	Hertz
I.L.	Insertion Loss
I-15	Interstate 15
I-215	Interstate 215
kHz	kilohertz
L_{dn}	day-night level
L_{eq}	equivalent continuous sound level
L_{eq}(h)	1-hour A-weighted equivalent sound level
L_{max}	maximum sound level
LOS	level(s) of service
L_{xx}	percentile-exceeded sound level
mi	miles/miles
mph	miles per hour

NAC	Noise Abatement Criteria
NADR	Noise Abatement Decision Report
NEPA	National Environmental Policy Act
NRC	Noise Reduction Coefficient
NSR	Noise Study Report
PDT	Project Development Team
PM	Post Mile
project	I-215/Barton Road Interchange Improvement Project
Protocol	Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects
ROW	right-of-way
RTP	Regional Transportation Plan
RV	recreational vehicle
SANBAG	San Bernardino Associated Governments
SB	Sound Barrier
SCAG	Southern California Association of Governments
SPL	sound pressure level
SSP	Standard Special Provisions
STA	Station
STAA	Surface Transportation Assistance Act
TeNS	Caltrans Technical Noise Supplement
TNM	Traffic Noise Model
UPRR	Union Pacific Railroad
vplph	vehicles per lane per hour

Chapter 1. Introduction

The San Bernardino Associated Governments (SANBAG), in cooperation with the California Department of Transportation (Caltrans), City of Grand Terrace, and City of Colton, proposes to improve the Interstate 215 (I-215)/Barton Road interchange. The proposed I-215/Barton Road Interchange Improvement Project (project) is located in the City of Grand Terrace and partially in the City of Colton in the County of San Bernardino (County). On Barton Road, the project limits extend from approximately 0.3 mile (mi) west of I-215 to 0.4 mi east of I-215. The project limits on I-215 extend from approximately 0.8 mi south of Barton Road to 0.4 mi north of Barton Road. Figure 1 shows project location and vicinity maps.

I-215 is a major north-south freeway facility that begins at the southern junction of Interstate 15 (I-15) in the City of Murrieta in Riverside County and terminates at the northern junction with I-15, near Devore in San Bernardino County. It is an alternative route of I-15. The portion of I-215 within the project limits currently provides three through lanes in each direction and a paved median.

The existing I-215/Barton Road interchange is a compact diamond interchange with single-lane entrance and exit ramps. Both of the exit ramp approaches expand to two lanes to accommodate turning traffic. The existing northbound ramp intersection and southbound ramp intersection are spaced approximately 350 feet (ft) apart. The existing overcrossing is a single lane in each direction with back-to-back left-turn pockets for the entrance ramps.

Barton Road is an east-west primary arterial in the County of San Bernardino. It extends from La Cadena Drive in the City of Colton to east of San Mateo Street in the City of Redlands. Within the project limits, Barton Road is a two-lane roadway west of I-215. East of I-215, Barton Road is a four-lane facility with turn lanes at various intersections. Within the project limits, there are several intersections:

- Grand Terrace Road (unsignalized T-intersection)
- Southbound ramps and La Crosse Avenue intersection (signalized)
- Northbound ramps intersection (signalized)
- Michigan Avenue intersection (signalized T-intersection)
- Vivienda Avenue intersection (unsignalized T-intersection)

1.1. Purpose of the Noise Study Report

The purpose of Title 23, Part 772 of the Code of Federal Regulations (23 CFR 772), "Procedures for Abatement of Highway Traffic Noise," is to provide procedures to help protect public health and welfare, supply Noise Abatement Criteria (NAC), and establish requirements for information to be given to local officials for use in the planning and design of highways approved pursuant to 23 CFR 772.1. As such, 23 CFR 772 provides procedures for preparing operational and construction noise impact studies and evaluating noise abatement considered for federal and federal-aid highway projects. According to 23 CFR 772.3, all highway projects that are developed in conformance with this regulation are deemed to be in conformance with Federal Highway Administration (FHWA) noise standards.

Caltrans Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol) (Caltrans 2011) provides Caltrans policy for implementing 23 CFR 772 in California. The Protocol outlines the requirements for preparing Noise Study Reports (NSRs). The purpose of this NSR is to evaluate noise impacts and noise abatement consistent with the requirements of 23 CFR 772.

1.2. Project Purpose and Need

1.2.1. Purpose

The purpose of the proposed project is to improve the operation, increase the capacity, and reduce the existing and future congestion at the I 215/Barton Road interchange, and improve access to facilities served by the interchange.

1.2.2. Need

Based on traffic projections and the existing and planned land uses in the vicinity, the facility is forecast to degrade to level of service (LOS) F (breakdown condition) by 2040 without improvements.

1.2.2.1 Capacity and Transportation Demand

The study area intersections currently operate at LOS B or C during the a.m. and p.m. peak hours. Without improvements, in 2016, the Barton Road/Grand Terrace Road intersection would operate at LOS F during the a.m. peak hour and LOS E during the p.m. peak hour. Because of the projected demand, without improvements, by 2040 all seven study area intersections would operate at LOS F during both the a.m. and p.m.

peak hours, with the exception of Barton Road/La Cadena Drive during the a.m. peak hour, which would operate at LOS C.

The demand for interchange access is also represented in traffic volumes. Traffic projections for 2040 show that the average daily traffic (ADT) volumes on I-215 will increase by more than 200 percent. The 2009 Barton Road interchange ramp volumes are forecast to double by 2040. Additional capacity is needed to accommodate projected traffic volumes and improve LOS.

1.2.2.2 Roadway Deficiencies

The existing I-215 southbound off-ramp at Barton Road is nonstandard per the Highway Design Manual (Sixth Edition) because it intersects with a local street (La Crosse Avenue) before reaching Barton Road. The southbound off-ramp at Barton Road is a five-legged intersection with a two-way frontage road adjacent to the southbound on-ramp. The existing interchange does not have adequate space for Surface Transportation Assistance Act (STAA) truck-turning movements, a sidewalk on the south side, or bicycle lanes. Therefore, the existing interchange restricts large truck movements and pedestrian and bicyclist access to local streets. Reconstruction of the interchange is needed to improve access to the freeway and local streets.

In the existing condition, the left-turn lane on westbound Barton Road at the I-215 southbound on-ramp does not have sufficient vehicle capacity during the a.m. and p.m. peak hours. This prevents left-turning and through traffic from moving through the interchange. Queue lengths are forecasted to increase substantially by 2040 without interchange improvements. Additional turn-pocket capacity is needed in order to reduce delays at the interchange.

1.2.2.3 Social Demand and Economic Development

The I-215/Barton Road interchange is the primary regional access for the City of Grand Terrace. It also serves the southwestern portion of the City of Colton and provides direct access to the City of Loma Linda. The City of Colton is projected to experience substantial population growth through 2035 according to the Southern California Association of Governments (SCAG) 2012 Adopted Regional Transportation Plan (RTP) Growth Forecasts. The build out of the area in accordance with the City of Grand Terrace General Plan and the Barton Road Specific Plan will result in increased traffic congestion on the freeway and the local street networks leading to the interchange. Reconstruction of the interchange is needed to relieve additional congestion.

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Chapter 2. Project Description

This chapter describes the proposed action and the Locally Preferred Alternative, Modified Alternative 7 (Modified Cloverleaf/Diamond). Alternatives 3, 6, and 7 were previously analyzed in the approved February 2012 NSR. In March 2013, the Project Development Team (PDT) determined that Alternative 7 would be removed from further consideration due to safety and community concerns. Modified Alternative 7 would replace Alternative 7 as the Locally Preferred Alternative. The noise monitoring and noise model calibrations (K-factors) conducted for the project alternatives (Alternative 1 [No Build] and Build Alternatives 3, 6, and 7), are applicable to Modified Alternative 7 and are included in this report.

The proposed project is located in the City of Grand Terrace and partially in the City of Colton in San Bernardino County, California. Within the limits of the proposed project, I-215 currently provides three lanes in each direction. Barton Road is a two-lane roadway west of I-215 and a four-lane facility with turn lanes at various intersections east of I-215. Barton Road provides four ramps that connect to I-215: southbound on- and off-ramps, and northbound on- and off-ramps. The project location map is shown in Figure 1.

The purpose of the proposed project is to reconstruct and improve the interchange in order to improve operation, increase capacity, and reduce congestion at the I-215/ Barton Road interchange. The existing interchange has a nonstandard southbound off-ramp, and the existing interchange restricts large truck movements and pedestrian and bicyclist access. Without the interchange improvement, the operation of this facility will deteriorate over time to reach unacceptable LOS in the future.

The project area for the I-215/Barton Road Interchange Improvement Project overlaps the project area with the I-215 Bi-County High-Occupancy Vehicle (HOV) Lane Gap Closure Project at the Burlington Northern Santa Fe (BNSF) Railway two-track underpass (bridge over the freeway) and the Union Pacific Railroad (UPRR) single-track underpass between the Iowa Avenue/La Cadena Drive interchange and the Barton Road interchange. Both projects would require the reconstruction of these two structures. For the I-215/Barton Road Interchange Improvement Project, the reconstruction is needed to accommodate an auxiliary lane that is proposed between the northbound La Cadena entrance ramp and the proposed Barton Road exit ramp. The underpass replacements are required for I-215/Barton Road interchange Modified

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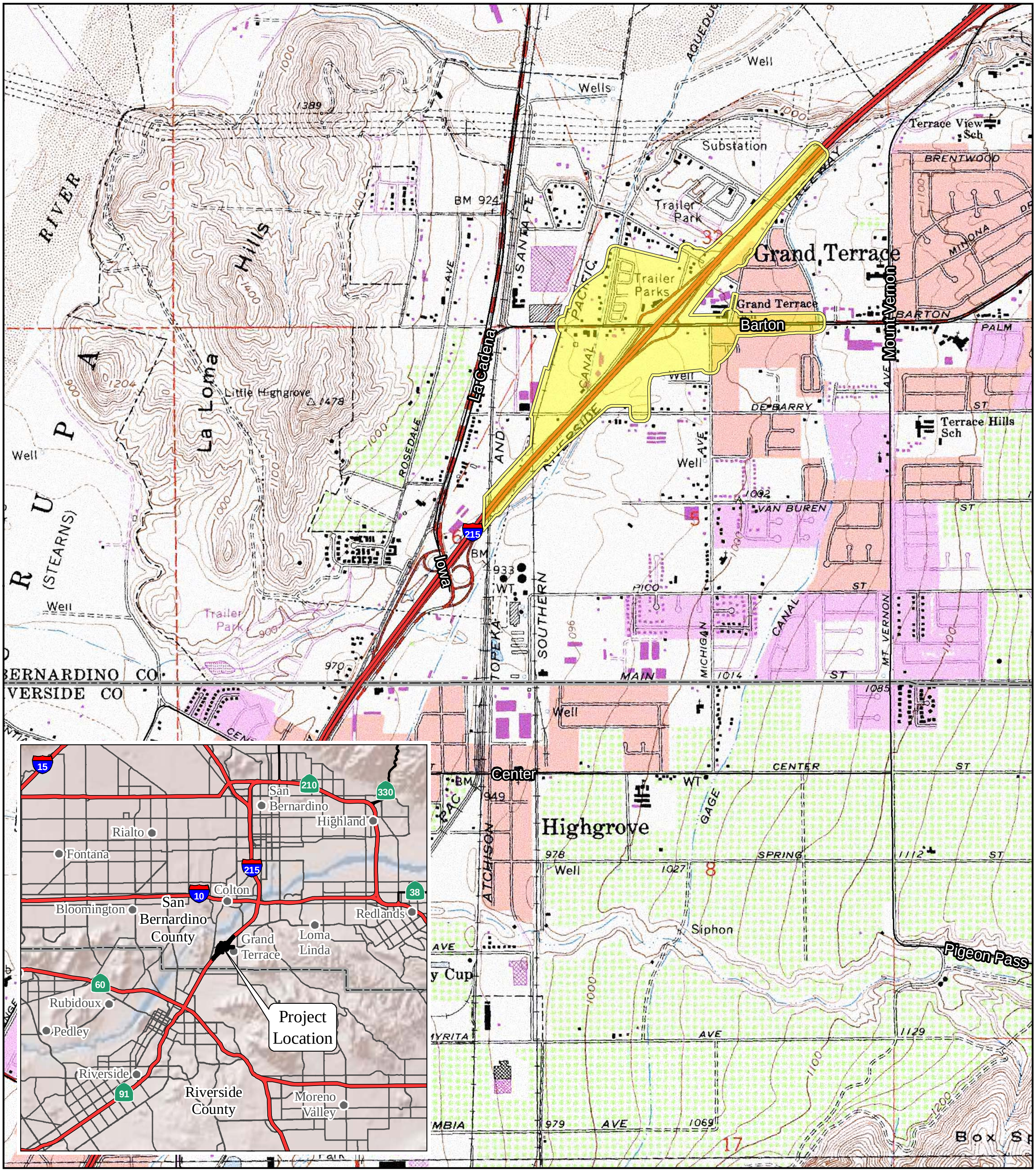

LEGEND

Project Area

FIGURE 1

N

0 1000 2000

FEET

I-215/Barton Road Interchange Improvement Project

Project Location

SOURCE: USGS 7.5 min. quad. (San Bernardino South, 1980)

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Alternative 7. For the I-215 Bi-County HOV Lane Gap Closure Project, the reconstruction is necessary due to inadequate horizontal clearance between the existing structure supports and the proposed HOV lane addition. The reconstructed bridges would be raised to provide adequate vertical clearance with the freeway.

Because the I-215 Bi-County HOV Lane Gap Closure Project analyzed the environmental impacts of reconstruction of the two railroad structures, as well as construction of temporary railroad bridges to be utilized during reconstruction of the existing structures (railroad shooflies), and this project is currently under construction, these impacts are not evaluated as part of this document.

2.1. Modified Alternative 7 (Roundabout/Diamond) (Locally Preferred Alternative)

Modified Alternative 7 would provide a tight diamond configuration for the northbound ramps. The southbound ramps would have a modified cloverleaf configuration with a roundabout at the intersection of the southbound ramps, Barton Road, and La Crosse Avenue. Barton Road would be widened to two through lanes in each direction plus one left-turn and one right-turn lane east of the southbound ramps. The existing overcrossing would be replaced with a new structure with four through lanes and one turn lane. This alternative also includes the improvements listed below.

- The new southbound loop on-ramp would provide two lanes at Barton Road in a roundabout configuration.
- The new southbound off-ramp would make a connection at Barton Road and transition into a roundabout which would provide one right-turn lane, and one shared through/left-turn lane; La Crosse Avenue north of Barton Road would be removed.
- The new northbound off-ramp would terminate at Barton Road with one left-turn lane, one shared through/right-turn lane and one dedicated right-turn lane.
- The new northbound on-ramp would have two lanes at the Barton Road intersection.
- A portion of the I-215 Bi-County HOV Lane Gap Closure Project sound barrier in the northwest quadrant would be removed to accommodate the new southbound off-ramp.
- Commerce Way would be reconfigured to intersect with Barton Road at Vivienda Avenue.

- The intersection of Michigan Avenue at Barton Road would be eliminated; Michigan Avenue would form a T-intersection with Commerce Way.
- A new two-lane road between La Crosse Avenue and Grand Terrace Road would be constructed adjacent to Vivienda Avenue.
- Barton Road would be widened to four through lanes approximately between Grand Terrace Road and Vivienda Avenue.
- Standard sidewalks and a Class II bicycle lane would be provided on both sides of Barton Road within the project limits.
- Bioswales would be constructed in the northwest and southeast quadrants to treat storm water runoff.
- New landscaping would be provided consistent with the I-215 Bi-County Aesthetic Concept.
- Utilities would be relocated or protected in place during construction.
- Drainage facilities would be modified consistent with other project improvements.
- Traffic signal modifications would be made at Barton Road/Grand Terrace Road, I-215 northbound ramps/Barton Road, and Commerce Way/Vivienda Avenue/ Barton Road.

Chapter 3. Fundamentals of Traffic Noise

The following is a brief discussion of fundamental traffic noise concepts. For a detailed discussion, refer to the Caltrans Technical Noise Supplement (TeNS) (November 2009), which is available on the Caltrans website at www.dot.ca.gov/hq/env/noise.

3.1. Sound, Noise, and Acoustics

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is defined as loud, unexpected, or annoying sound.

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receiver, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting the propagation path to the receiver determines the sound level and characteristics of the noise perceived by the receiver. The field of acoustics deals primarily with the propagation and control of sound.

3.2. Frequency and Hertz

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low-frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz. High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hertz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

3.3. Sound Pressure Levels and Decibels

The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascals (µPa). One µPa is approximately one hundred billionth (0.00000000001) of normal atmospheric pressure. Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to 100,000,000 µPa. Because of this huge range of values, sound is rarely expressed in terms of µPa. Instead, a logarithmic scale is used to describe sound pressure level (SPL) in terms of decibels (dB). The threshold of hearing for young people is approximately 0 dB, which corresponds to 20 µPa.

3.4. Addition of Decibels

Because decibels are logarithmic units, SPL cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3 dB increase. In other words, when two identical sources are each producing sounds of the same loudness, the resulting sound level at a given distance would be 3 dB higher than one source under the same conditions. For example, if one automobile produces an SPL of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB—rather, they would combine to produce 73 dB, a difference of 3 dB. Under the decibel scale, three sources of equal loudness together produce a sound level 5 dB louder than one source.

3.5. A-Weighted Decibels

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear.

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz and perceive sounds within that range better than sounds of the same amplitude in higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies. Then, an “A-weighted” sound level (expressed in units of A-weighted decibels [dBA]) can be computed based on this information.

The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments regarding the relative loudness or annoyance of a sound, their judgments correlate well with the A-scale sound levels of those sounds. Other weighting networks have been devised to address high noise levels or other special problems (e.g., B, C, and D scales), but these scales are rarely used in conjunction with highway traffic noise. Noise levels for traffic noise reports are typically reported in terms of dBA. Table 1 shows typical A-weighted noise levels.

Table 1. Typical A-Weighted Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	— 110 —	Rock band
Jet fly-over at 1,000 ft		
	— 100 —	
Gas lawn mower at 3 ft		
	— 90 —	
Diesel truck at 50 ft at 50 mph		Food blender at 3 ft
	— 80 —	Garbage disposal at 3 ft
Noisy urban area, daytime		
Gas lawn mower, 100 ft	— 70 —	Vacuum cleaner at 10 ft
Commercial area		Normal speech at 3 ft
Heavy traffic at 300 ft	— 60 —	
		Large business office
Quiet urban daytime	— 50 —	Dishwasher next room
Quiet urban nighttime	— 40 —	Theater, large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night, concert
	— 20 —	
		Broadcast/recording studio
	— 10 —	
Lowest threshold of human hearing	— 0 —	Lowest threshold of human hearing

Source: Technical Noise Supplement, California Department of Transportation, November 2009.
dBA = A-weighted decibels
ft = feet
mph = miles per hour

3.6. Human Response to Changes in Noise Levels

As discussed above, doubling sound energy results in a 3 dB increase in sound. However, given a sound level change measured with precise instrumentation, the subjective human perception of a doubling of loudness will usually be different than what is measured.

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear is able to discern 1 dB changes in sound levels when exposed to steady, single-frequency (“pure-tone”) signals in the midfrequency range (1,000–8,000 Hz). In typical noisy environments, 1–2 dB changes in noise are generally not perceptible. However, it is widely accepted that people are able to begin to detect sound level increases of 3 dB in typical noisy environments. Further, a 5 dB increase is generally perceived as a distinctly noticeable increase, and a 10 dB increase is generally perceived as a doubling of loudness. Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) that would result in a 3 dB increase in sound would generally be perceived as barely detectable.

3.7. Noise Descriptors

Noise in the daily environment fluctuates over time. Some fluctuations are minor, but some are substantial. Some noise levels occur in regular patterns, but others are random. Some noise levels fluctuate rapidly, but others slowly. Some noise levels vary widely, but others are relatively constant. Various noise descriptors have been developed to describe time-varying noise levels. The following are the noise descriptors most commonly used in traffic noise analysis:

- **Equivalent Continuous Sound Level (L_{eq}):** L_{eq} represents an average of the sound energy occurring over a specified period. In effect, L_{eq} is the steady-state sound level containing the same acoustical energy as the time-varying sound that actually occurs during the same period. The 1-hour A-weighted equivalent sound level (L_{eq}[h]) is the energy average of A-weighted sound levels occurring during a 1-hour period and is the basis for NAC used by Caltrans and FHWA.
- **Percentile-Exceeded Sound Level (L_{xx}):** L_{xx} represents the sound level exceeded for a given percentage of a specified period (e.g., L_{10} is the sound level exceeded 10 percent of the time, and L_{90} is the sound level exceeded 90 percent of the time).
- **Maximum Sound Level (L_{max}):** L_{max} is the highest instantaneous sound level measured during a specified period.
- **Day-Night Level (L_{dn}):** L_{dn} is the energy average of A-weighted sound levels occurring over a 24-hour period, with a 10 dB penalty applied to A-weighted sound levels occurring during the nighttime hours between 10:00 p.m. and 7:00 a.m.
- **Community Noise Equivalent Level (CNEL):** Similar to L_{dn}, CNEL is the energy average of the A-weighted sound levels occurring over a 24-hour period, with a 10 dB penalty applied to A-weighted sound levels occurring during the nighttime hours between 10:00 p.m. and 7:00 a.m., and a 5 dB penalty applied to the A-weighted sound levels occurring during the evening hours between 7:00 p.m. and 10:00 p.m.

3.8. Sound Propagation

When sound propagates over a distance, it changes in level and frequency content. The manner in which noise reduces with distance depends on the following factors.

3.8.1. Geometric Spreading

Sound from a localized source (i.e., a point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 dB for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path and hence can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of 3 dB for each doubling of distance from a line source.

3.8.2. Ground Absorption

The propagation path of noise from a highway to a receiver is usually very close to the ground. Noise attenuation from ground absorption and reflective wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 ft. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, such as a parking lot or body of water), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receiver such as soft dirt, grass, or scattered bushes and trees), an excess ground attenuation value of 1.5 dB per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation results in an overall dropoff rate of 4.5 dB per doubling of distance.

3.8.3. Atmospheric Effects

Receivers located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Sound levels can be increased at large distances (e.g., more than 500 ft) from the highway due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects.

3.8.4. Shielding by Natural or Human-made Features

A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receiver specifically to reduce noise. A barrier that breaks the line of sight between a source and a receiver will typically result in at least 5 dB of noise reduction. Taller barriers provide increased noise reduction. Vegetation between the highway and receiver is rarely effective in reducing noise because it does not create a solid barrier.

Chapter 4. Federal, State, and Local Policies and Procedures

This report focuses on the requirements of 23 CFR 772, as discussed below.

4.1. Federal Regulations

4.1.1. 23 CFR 772

23 CFR 772 provides procedures for preparing operational and construction noise studies and evaluating noise abatement considered for federal and federal-aid highway projects. Under 23 CFR 772.7, projects are categorized as Type 1, Type 2, or Type 3 projects. FHWA defines a Type 1 project as a proposed federal or federal-aid highway project for the construction of a highway on a new location, or the physical alteration of an existing highway where there is either substantial horizontal or substantial vertical alteration, or increases the number of through-traffic lanes. A Type 2 project is a noise barrier retrofit project that involves no changes to highway capacity or alignment. A Type 3 project is a project that does not meet the classifications of a Type 1 or Type 2 project. Type 3 projects do not require a noise analysis.

Type 1 projects include the addition of through traffic lanes that function as HOV lanes, high-occupancy toll (HOT) lanes, bus lanes, or truck climbing lanes. Type 1 projects include the addition of an auxiliary lane (except when an auxiliary lane is a turn lane); addition or relocation of interchange lanes or ramps; restriping existing pavement for the purpose of adding a through-traffic lane or auxiliary lane; and the addition of a new or substantial alteration of a weigh station, rest stop, ride share lot, or toll plaza. Projects unrelated to increased noise levels, such as striping, lighting, signing, and landscaping projects, are not considered Type 1 projects.

Under 23 CFR 772.11, noise abatement must be considered for Type 1 projects if the project is predicted to result in a traffic noise impact. In such cases, 23 CFR 772 requires that the project sponsor “consider” noise abatement before adoption of the final National Environmental Policy Act (NEPA) document. This process involves identification of noise abatement measures that are reasonable, feasible, and likely to be incorporated into the project, and of noise impacts for which no apparent solution is available.

Traffic noise impacts, as defined in 23 CFR 772.5, occur when the predicted noise level in the design year approaches or exceeds the NAC specified in 23 CFR 772, or a predicted noise level substantially exceeds the existing noise level (i.e., a "substantial" noise increase). 23 CFR 772 does not specifically define the terms "substantial increase" or "approach;" these criteria are defined in the Protocol, as described below.

Table 2 summarizes NAC corresponding to various land use activity categories. Activity categories and related traffic noise impacts are determined based on the actual land use in a given area.

Table 2. Activity Categories and Noise Abatement Criteria (NAC)

Activity Category	Activity $L_{eq}(h)$ [1]	Evaluation Location	Description of Activities
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[2]	67	Exterior	Residential
C[2]	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands properties, or activities not included in A–D or F.
F	—	—	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	—	—	Undeveloped lands that are not permitted.

Source: FHWA 23 CFR 772.

[1] The $L_{eq}(h)$ activity criteria values are for impact determination only and are not design standards for noise abatement measures. All values are A-weighted decibels (dBA)

[2] Includes undeveloped lands permitted for this activity category.

dBA = A-weighted decibels

FHWA = Federal Highway Administration

$L_{eq}(h)$ = equivalent continuous sound level per hour

NAC = Noise Abatement Criteria

In identifying noise impacts, primary consideration is given to exterior areas of frequent human use. In situations where there are no exterior activities, or where the exterior activities are far from the roadway or physically shielded in a manner that prevents an impact on exterior activities, the interior criterion (Activity Category D) is used as the basis for determining a noise impact.

4.2. State Regulations and Policies

4.2.1. Traffic Noise Analysis Protocol for New Highway Construction and Reconstruction Projects

The Caltrans Traffic Noise Analysis Protocol specifies the policies, procedures, and practices to be used by agencies that sponsor new construction or reconstruction of federal or federal-aid highway projects. The NAC specified in the Protocol are the same as those specified in 23 CFR 772. The Protocol defines a noise increase as “substantial” when the predicted noise levels with project implementation exceed existing noise levels by 12 dBA. The Protocol also states that a sound level is considered to approach an NAC level when the sound level is within 1 dB of the NAC identified in 23 CFR 772 (e.g., 66 dBA is considered to approach the NAC of 67 dBA, but 65 dBA is not).

Caltrans TeNS (November 2009) and the Protocol provide detailed technical guidance for the evaluation of highway traffic noise. This includes field measurement methods, noise modeling methods, and report preparation guidance.

4.2.2. Section 216 of the California Streets and Highways Code

Section 216 of the California Streets and Highways Code relates to the noise effects of a proposed freeway project on public and private elementary and secondary schools. Under this code, a noise impact occurs if, as a result of a proposed freeway project, noise levels exceed 52 dBA L_{eq}(h) in the interior of public or private elementary or secondary school classrooms, libraries, multipurpose rooms, or spaces. This requirement does not replace the “approach or exceed” NAC criterion for FHWA Activity Category D for classroom interiors, but it is a requirement that must be addressed in addition to the requirements of 23 CFR 772.

If a project results in a noise impact under this code, noise abatement must be provided to reduce classroom noise to a level that is at or below 52 dBA L_{eq}(h). If the noise levels generated from freeway and nonfreeway sources exceed 52 dBA L_{eq}(h) prior to construction of the proposed freeway project, noise abatement must be provided to reduce noise to the level that existed prior to construction of the project.

4.3. Local Regulations and Policies

4.3.1. City of Grand Terrance

Section 8.108.030 of the City of Grand Terrace Municipal Code limits noise sources associated with or vibration created by construction, repair, remodeling, or grading of any real property or during authorized seismic surveys, provided said activities do not take place between the hours of 8:00 p.m. and 7:00 a.m. on weekdays, including Saturday, or at any time on Sunday or a national holiday.

4.3.2. City of Colton

Based on the City of Colton’s Bid and Contracts document template, Article 31 (Hours of Work), it shall be unlawful for any person to operate, permit, use, or cause to operate powered vehicles, construction equipment, loading and unloading vehicles, and domestic power tools at the project site other than between the hours of 7:00 a.m. and 5:00 p.m., Monday through Friday, with no work allowed on City or Colton-observed holidays, unless otherwise approved by the Engineer.

Chapter 5. Study Methods and Procedures

5.1. Methods for Identifying Land Uses and Selecting Noise Measurement and Modeling Receiver Locations

A field investigation was conducted to identify land uses that could be subject to traffic and construction noise impacts from the project. Land uses in the project area were categorized by land use type, activity category (as defined in Table 2), and the frequency of human use. As stated in the Protocol, noise abatement is only considered for areas of frequent human use that would benefit from a lowered noise level. Accordingly, this noise impact analysis focuses on locations with defined outdoor activity areas, such as residential backyards and common-use areas at multifamily residences and recreational vehicle (RV) parks.

The geographical features of the project area relative to nearby existing and planned land uses were also identified.

Short-term measurement locations were selected to represent noise-sensitive land uses within the project area. One long-term measurement site was selected to capture the diurnal traffic noise level pattern in the project area. Another long-term measurement site was selected to capture nonvehicular traffic noise sources, such as train noise from the UPRR because the ambient noise level is also dominated by existing rail operations. Short-term measurement locations were selected to serve as representative modeling locations. Also, other nonmeasurement locations were selected as modeling locations. A total of 144 receiver locations were modeled to represent land uses in the project area. These modeled receiver and monitoring locations are shown on Figure 2.

5.2. Field Measurement Procedures

Short-term noise measurements were taken at sensitive receiver sites classified as Activity Categories B and C within the project area during off-peak traffic hours when traffic was flowing freely. Field measurements were taken at these locations to calibrate the noise prediction model and ambient noise levels. Measurements were taken in accordance with the procedures cited in the Caltrans TeNS document (Caltrans 2009). All short-term noise measurements were made using Larson Davis

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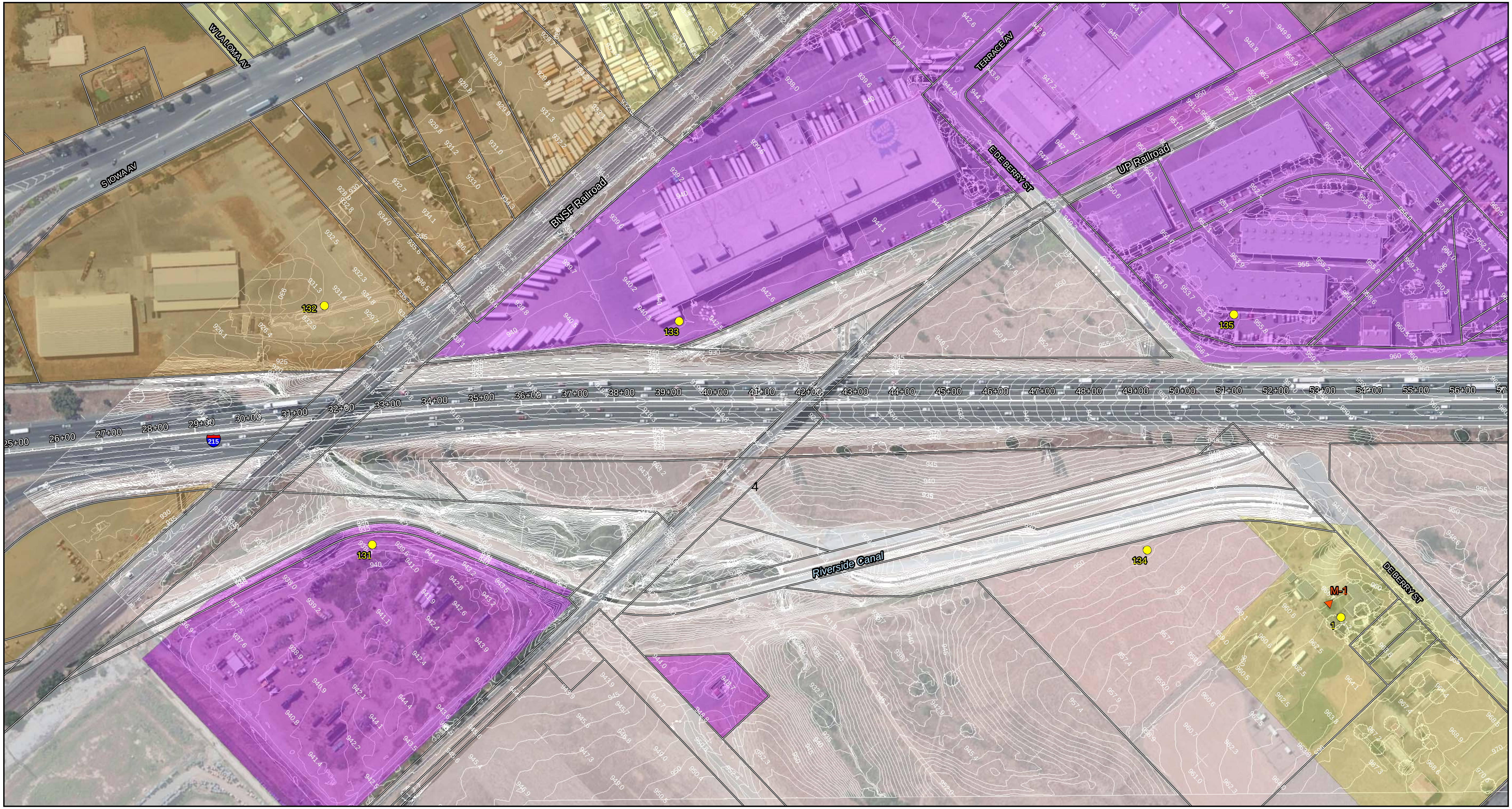

LEGEND

- Existing Sound Barriers
- Monitoring Locations
- Modeled Receiver Locations
- 24-hour Noise Monitoring Location
- Exterior/Interior Noise Monitoring Location

Land Use

- Commercial
- Industrial
- Institutional
- Residential
- Utility
- Vacant

0 100 200
FEET

SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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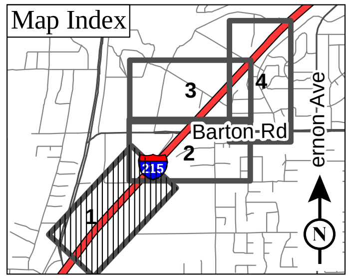

FIGURE 2
Sheet 1 of 4

I-215/Barton Road Interchange Improvement Project

Monitoring and Receiver Locations

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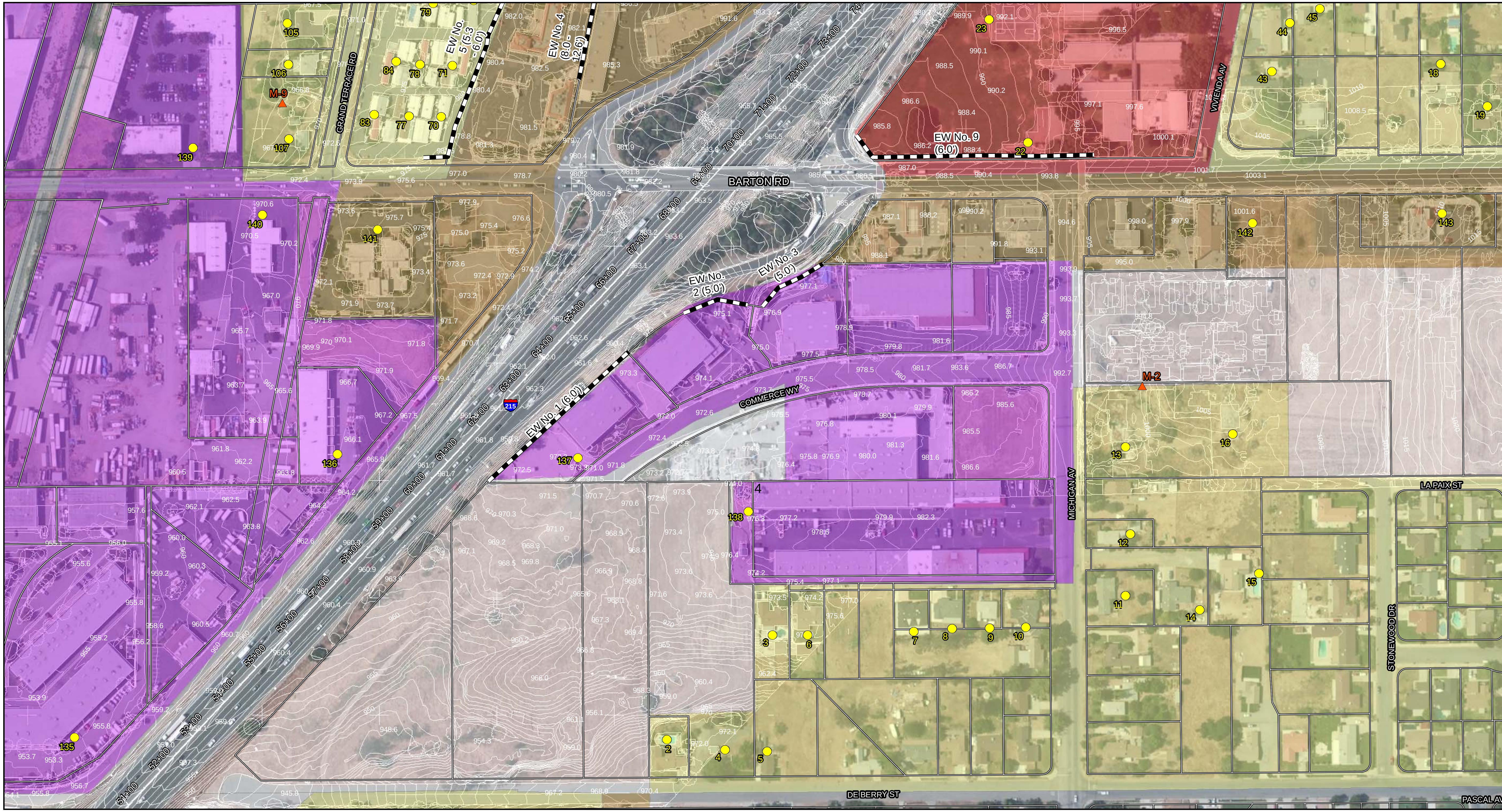

LEGEND

- Existing Sound Barriers
- Monitoring Locations
- Modeled Receiver Locations
- 24-hour Noise Monitoring Location
- Exterior/Interior Noise Monitoring Location

Land Use

- Commercial
- Industrial
- Institutional
- Residential
- Utility
- Vacant

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SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

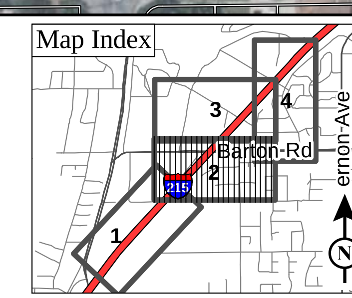

FIGURE 2

Sheet 2 of 4

I-215/Barton Road Interchange Improvement Project

Monitoring and Receiver Locations

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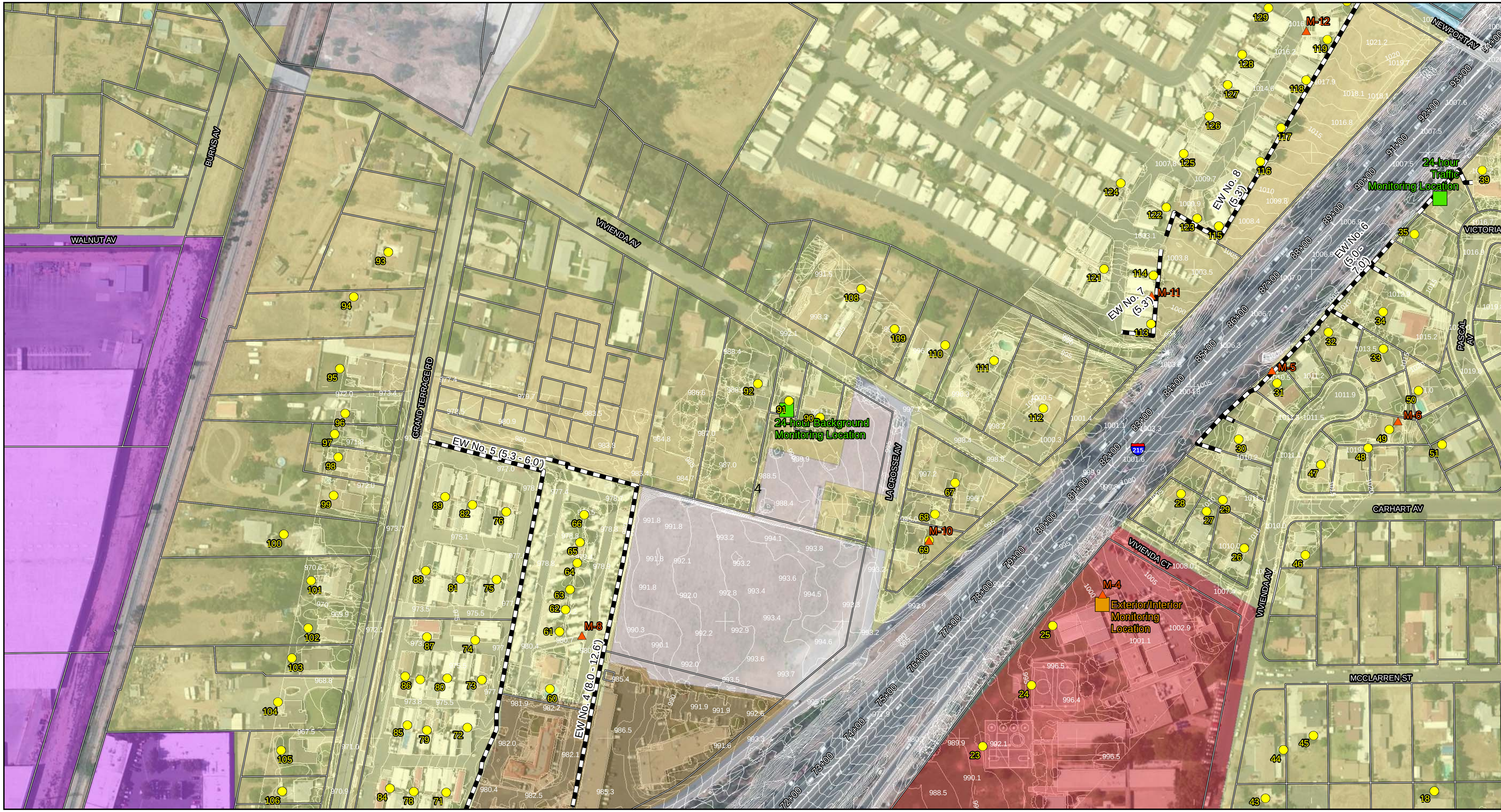

LEGEND

- Existing Sound Barriers
- Monitoring Locations
- Modeled Receiver Locations
- 24-hour Noise Monitoring Location
- Exterior/Interior Noise Monitoring Location

Land Use

- Commercial
- Industrial
- Institutional
- Residential
- Utility
- Vacant

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SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

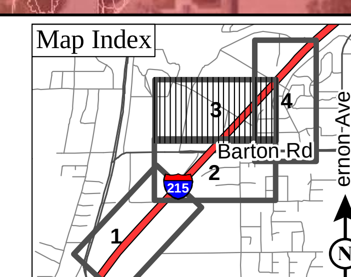

FIGURE 2
Sheet 3 of 4

I-215/Barton Road Interchange Improvement Project

Monitoring and Receiver Locations

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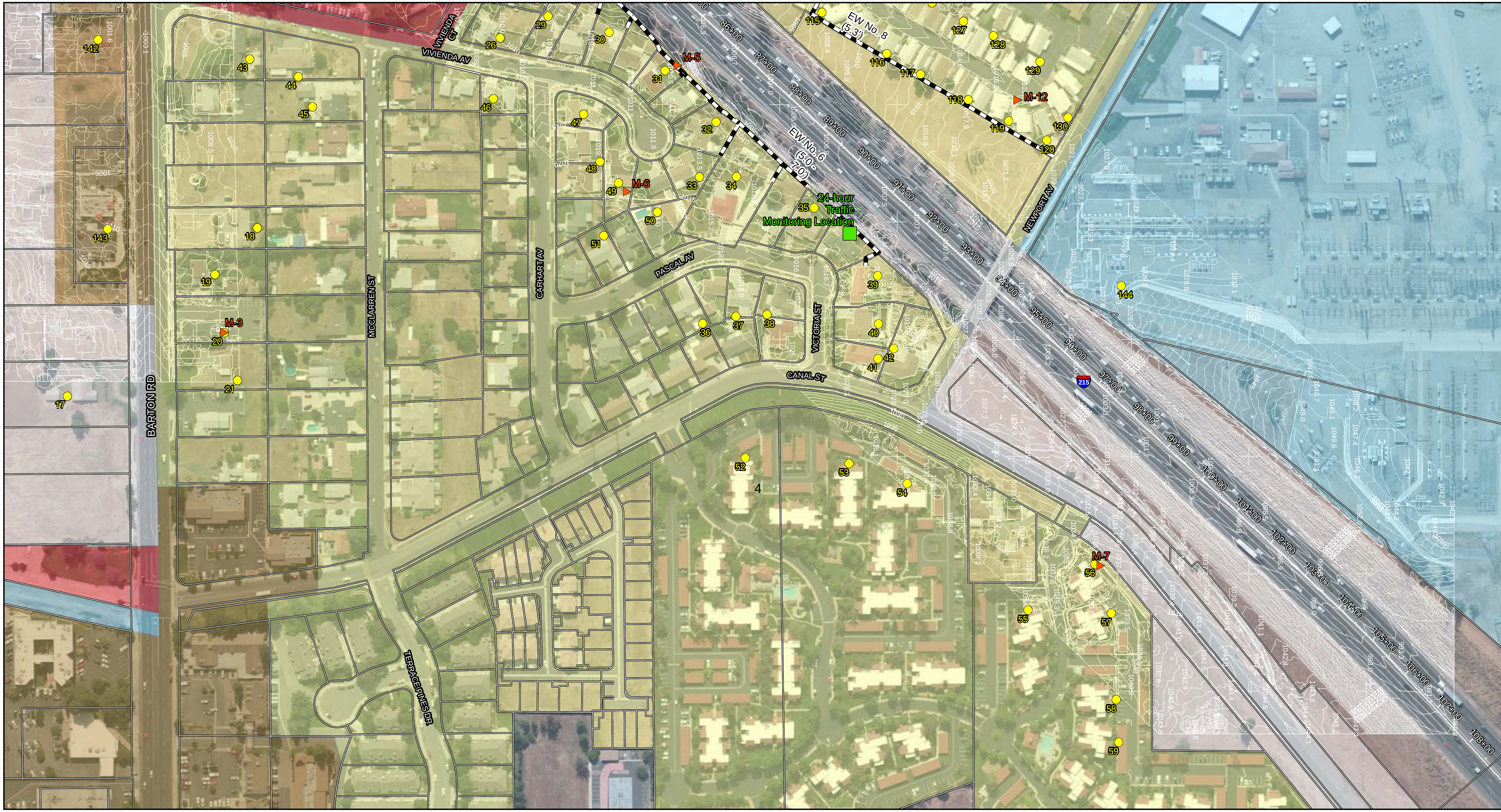

LEGEND

Existing Sound Barriers

Monitoring Locations

Modeled Receiver Locations

24-hour Noise Monitoring Location

Exterior/Interior Noise Monitoring Location

Land Use

Commercial

Industrial

Institutional

Residential

Utility

Vacant

0 100 200
FEET

SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

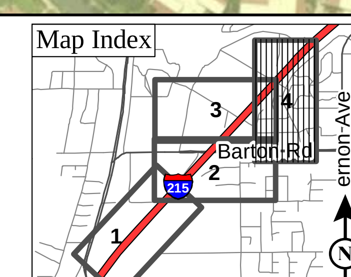

FIGURE 2

Sheet 4 of 4

I-215/Barton Road Interchange Improvement Project

Monitoring and Receiver Locations

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Model 824 Type 1 (Serial No. 1612) and 820 Type 1 (Serial No. 4973) sound level meters.

The following measurement procedures were utilized:

- Calibrate sound level meter.
- Set up sound level meter at a height of 5 ft.
- Commence noise monitoring.
- Collect site-specific data such as date, time, direction of traffic, vehicle speed, and the location of the sound level meter relative to any existing feature.
- Count passing vehicles for a period of 15 minutes during noise level measurement. Vehicles are split into three categories: automobiles, medium trucks, and heavy trucks.
- Stop measurement after 15 minutes.
- Calibrate sound level meter.
- Proceed to next monitoring site and repeat.

The traffic counts were expanded to hourly volumes (multiplied by four to normalize the results to hourly values) and entered into Traffic Noise Model (TNM) 2.5 for each monitoring site. The monitoring results were used to calibrate the model outputs.

5.3. Traffic Noise Level Prediction Methods

Traffic noise levels were predicted using the FHWA TNM 2.5. TNM 2.5 is a computer model based on two FHWA reports: FHWA-PD-96-009 and FHWA-PD-96-010 (FHWA 1998a, 1998b). Key inputs to the traffic noise model were the locations of roadways, shielding features (e.g., topography and buildings), sound barriers, ground type, and receptors. For receivers, barriers, and building rows located beyond the topographic map, the elevations were obtained using Global Positioning System (GPS) surveys, or they were determined to be generally similar to the closest area that has topographic map coverage because the area is generally flat, as observed during the field inspection. A detailed description of how the elevation was estimated for each receiver, barrier, and building row located beyond the topographic map is provided in Appendix A. Three-dimensional representations of these inputs were developed using computer-aided design (CAD) drawings, aerials, and topographic contours provided by AECOM. It should be noted that the CAD datum is currently in NAD83, CCS83 Zone (0405) – EPOCH 1984 VERT DATUM-NGVD29. This datum is approximately 2.3 ft different than the datum used by Caltrans, which is NAD83, CCS83 Zone (0405) – EPOCH 2007.00 VERT DATUM-NAVD88.

Traffic counts, measured vehicle speeds, and ambient noise levels were used to calibrate the TNM 2.5 under existing roadway conditions. The existing traffic noise levels were calculated using the traffic volumes and actual travel speeds obtained during the short-term noise measurements. The noise levels were then adjusted to the peak traffic noise hour using the 24-hour noise level measurement to determine the existing worst-case traffic noise levels. Future traffic noise levels at all 144 receiver locations were modeled using the worst-case traffic operations (prior to speed degradation) or the future (2040) peak-hour traffic volumes obtained from the Traffic Operations Analysis (December 2011), whichever is lower. The worst-case traffic condition is assumed to be LOS D/E, which corresponds to 1,950 vehicles per lane per hour (vplph) on the highway mainline, 1,500 vplph on HOV lanes, 1,200 vplph on highway ramps and Barton Road, and 1,000 vplph on local roadways such as Grand Terrace Road, Vivienda Avenue, and La Crosse Avenue. Traffic noise is generally loudest when vehicles on a given roadway travel at free-flowing traffic conditions. Accordingly, these worst-case traffic volume assumptions are based on the maximum number of vehicles that can typically travel in a given lane while still resulting in free-flowing traffic conditions. A summary of traffic data inputs for existing and future conditions are presented in Appendix A.

TNM 2.5 is sensitive to the volume of trucks on the roadway because trucks contribute disproportionally to traffic noise. Vehicle distributions on all roadways within the project area were based on traffic counts collected during ambient noise level measurement. Vehicle distributions on I-215 were not obtained from *Annual Average Daily Trucks on the California State Highway System* (Caltrans 2009) because vehicle distributions obtained from traffic counts collected during ambient noise level measurement contained higher truck percentages, which represents a worse scenario than Caltrans statistics. Table 3 shows the vehicle distribution and vehicle speeds for each vehicle category and roadway within the project area used to calculate existing and future traffic noise levels.

5.4. Methods for Identifying Traffic Noise Impact and Consideration of Abatement

Traffic noise impacts are considered to occur at receptor locations where predicted design-year noise levels are at least 12 dBA greater than existing noise levels, or where predicted design year noise levels approach or exceed the NAC for the applicable activity category. Where traffic noise impacts are identified, noise

Table 3. Vehicle Distribution and Vehicle Speed

Roadway	Vehicle (%)			Vehicle Speed (mph)		
	Automobiles	Medium Trucks	Heavy Trucks	Automobiles	Medium Trucks	Heavy Trucks
I-215 Mainline	92	4	4	65	65	55
I-215 HOV	94	6	N/A[1]	65	65	N/A[1]
I-215 On-ramp at Barton Road	91	6	3	65	65	55
I-215 Off-ramp at Barton Road	91	6	3	45	45	40
Grand Terrace Road	95	5	0	30	30	25
Vivienda Avenue	100	0	0	30	30	25
Commerce Way	92	6	2	35	35	30
Michigan Avenue	92	6	2	35	35	30
Barton Road	94	4	2	40	40	35
La Crosse Avenue	94	6	0	30	30	25

Source: LSA Associates, Inc., September 2013.
[1] N/A = Not Applicable. Heavy trucks are not allowed on HOV Lanes.
HOV = high-occupancy vehicle mph = miles per hour
I-215 = Interstate 215

abatement must be considered for reasonableness and feasibility as required by 23 CFR 772 and the Protocol.

According to the Protocol, abatement measures are considered acoustically feasible if a minimum noise reduction of 5 dBA at impacted receptor locations is predicted with implementation of the abatement measure. In addition, barriers should be designed to intercept the line of sight from the exhaust stack of a truck to the first tier of receptors as required by the Highway Design Manual, Chapter 1100 (Caltrans 2012). Other factors that affect feasibility include topography, access requirements for driveways and ramps, presence of local cross streets, utility conflicts, other noise sources in the area, and safety considerations. The overall reasonableness of noise abatement is determined by considering factors such as the construction cost of the barrier, noise reduction design goal (a noise level reduction of 7 dBA or more at one or more benefited receptors), and the viewpoints of benefited receptors (including property owners and residents of the benefited receptors).

The Protocol defines the procedure for assessing the reasonableness of sound barriers from a cost perspective. A cost-per-residence allowance is calculated for each benefited residence (i.e., residences that receive at least 5 dBA of noise reduction from a sound barrier). The 2011 allowance is $55,000 per benefited residence. Total allowances are calculated by multiplying the cost per residence by the number of benefited residences.

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Chapter 6. Existing Noise Environment

6.1. Existing Land Uses

As previously mentioned, developed and undeveloped land uses in the project vicinity were identified through land use maps, aerial photography, and site inspection. Within each land use category, sensitive receivers were identified. Existing land uses in the project area include single-family and multifamily residences; two mobile home parks (Grand Terrace Mobile Home Park and Grand Royale Mobile Estates); an RV park (Terrace Village RV Park); a fast-food restaurant (Demetri's Restaurant) with an outdoor eating area; a school (Grand Terrace Elementary School); a utility facility; office, commercial, and light industrial uses; and vacant land. Existing land uses in the project area are described below and in further detail.

- **East of I-215, South of Barton Road:** Land uses in this area include single-family residences; a fast-food restaurant with an outdoor eating area; vacant land; commercial and light industrial uses. These land uses are located up to 20 ft higher in elevation than I-215. Residential land uses were evaluated under Activity Category B, which has an exterior NAC of 67 dBA L_{eq}. The outdoor eating area associated with the fast-food restaurant was evaluated under the Activity Category E (72), which has an exterior NAC of 72 dBA L_{eq}. Vacant land, commercial, and light industrial uses were evaluated under Activity Categories F and G land uses. Although Activity Category F has no impact criteria, traffic noise levels were provided in this noise study for reporting purposes.
- **East of I-215, Between Barton Road and Newport Avenue:** Land uses in this area include single-family residences and the Grand Terrace Elementary School. These land uses are located up to 20 ft higher in elevation than I-215. Residences and the school playground were evaluated under Activity Categories B and C, which has an exterior NAC of 67 dBA L_{eq}. The interior of the school classroom building was evaluated under Activity Category D, which has an interior NAC of 52 dBA L_{eq}.
- **East of I-215, North of Newport Avenue:** Land uses in this area include single- and multifamily residences that are located between 20 and 50 ft higher in elevation than I-215. These land uses were evaluated under Activity Category B, which has an exterior NAC of 67 dBA L_{eq}.

- **West of I-215, South of Barton Road:** Land uses in this area include commercial and light industrial uses that are located approximately up to 15 ft higher in elevation than I-215. Commercial and light industrial uses were evaluated under Activity Category F land uses. Although Activity Category F has no impact criteria, traffic noise levels were provided in this study for reporting purposes.
- **West of I-215, Between Barton Road and Newport Avenue:** Land uses in this area include single-family residences, two mobile home parks, an RV park, commercial uses, and vacant land. The majority of the land uses are located approximately 15 ft higher in elevation than I-215. A small portion of the area is located approximately 10 ft lower in elevation than I-215. Single-family residences, mobile homes, and an RV park were evaluated under Activity Category B, which has an exterior NAC of 67 dBA L_{eq}. Commercial uses were evaluated under Activity Category F land uses. Although Activity Category F has no impact criteria, traffic noise levels were provided in this study for reporting purposes. Vacant land in this area would be acquired as part of the proposed project.
- **West of I-215, North of Newport Avenue:** Land uses in this area include utilities that are located between 20 and 50 ft higher in elevation than I-215. The utility facility was evaluated under Activity Category F land use. Although Activity Category F has no impact criteria, traffic noise levels were provided in this study for reporting purposes.

6.2. Noise Measurement Results

The existing noise environment in the project area is based on short-term and 24-hour traffic noise level measurements. Also, interior and exterior noise level measurements were conducted at the school classroom building to evaluate potential interior noise impacts.

6.2.1. Short-Term Monitoring

The primary source of noise in the project area is traffic on I-215 and Barton Road. Short-term (15-minute) noise measurements were conducted to document existing noise levels at 12 representative sensitive receiver locations within the project area. Short-term (15-minute) noise level measurements were conducted using Larson Davis Models 824 and 820 Type 1 sound level meters. Table 4 contains the results of the short-term noise level measurements.

Table 4. Short-Term Ambient Noise Monitoring Results

Monitor No.	Date	Start Time	Duration	dBA L_{eq}
M-1	11/6/2008	2:20 p.m.	15 minutes	64.2
M-2	2/2/2010	11:32 a.m.	15 minutes	51.6
M-3	1/21/09	10:09 a.m.	15 minutes	54.8
M-4	1/21/09	9:05 a.m.	15 minutes	71.2
M-5	11/6/2008	10:42 a.m.	15 minutes	75.3
M-6	11/6/2008	10:42 a.m.	15 minutes	51.6
M-7	11/6/2008	9:54 a.m.	15 minutes	54.9
M-8	11/6/2008	1:08 p.m.	15 minutes	54.2
M-9	2/2/2010	12:08 p.m.	15 minutes	53.2
M-10	11/6/2008	11:24 a.m.	15 minutes	68.9
M-11	11/6/2008	11:24 a.m.	15 minutes	60.6
M-12	11/20/2008	12:19 p.m.	15 minutes	51.7

Source: LSA Associates, Inc., September 2013.
dBA L_{eq} = equivalent continuous sound level measured in A-weighted decibels

Table 5 describes the physical locations of the noise monitoring. These short-term noise measurements were used to calibrate the noise model and to predict the noise levels at all 144 modeled sensitive receivers in the project area. The short-term monitoring locations are shown in Figure 2. The noise monitoring results, concurrent traffic counts, and measured vehicle speeds for each monitoring site are included in Appendix A. Table 6 shows the meteorological conditions during the short-term noise measurements.

6.2.2. Noise Model Calibration

A total of 12 separate model runs were conducted using the traffic counts and measured vehicle speeds collected during the ambient noise monitoring. The results of these model runs were compared to the measured ambient noise levels to ensure the accuracy of TNM 2.5. Correction factors known as K-factors were applied to each of the modeled receiver locations so that the monitored and modeled noise levels were the same. Table 7 shows the measured ambient noise level, the modeled noise levels using traffic counts and measured vehicle speeds during noise monitoring, and the K-factor at each of the 12 monitored locations. The model input and output data for the calibration model runs are included in Appendix B.

Table 5. Physical Location of Noise Level Measurements

Monitor No.	Location Description	Noise Sources	Comments
M-1	21875 De Berry Street; located between I-215 and the house; on the southeast corner of I-215 and Barton Road.	Traffic on I-215.	There is no existing wall or property wall. There is open space between I-215 and residence.
M-2	12175 Michigan Avenue; on north edge of yard; no noise shielding only chain link fence.	Light traffic on Michigan Avenue; trucks coming from both ways turn across the street onto Commerce Way; can't hear freeway noise from this location.	There is no existing wall or property wall.
M-3	22270 Barton Road; in the backyard; located on the northeastern corner of I-215 and Barton Road.	Traffic on Barton Road and faint aircraft noise.	Driveway access from Barton Road onto property.
M-4	12066 Vivienda Avenue; Grand Terrace Elementary School; between classroom 30 and 25; located on the northeast corner of I-215 and Barton Road; approximately 100 ft from I-215.	Traffic on I-215 and one car moving in the parking lot.	There is no existing wall or property wall.
M-5	11948 Vivienda Court; in the backyard; located on the east side of I-215 between Barton Road and Newport Avenue.	Traffic on I-215 and dog barking next door.	Residence is located approximately 4 ft higher in elevation than I-215. Sound meter is between property line and I-215.
M-6	11947 Vivienda Court; in the backyard; located on the east side of I-215 between Barton Road and Newport Avenue.	Faint traffic from I-215 and faint aircraft noise.	Second row residence, 4 ft high existing property wall around backyard. Backyard area is shielded by residence structure.
M-7	11750 Mount Vernon Avenue; The Highlands Apartments; located next to the patio at Apartment No. FF1206 at the northeast corner of I-215 and Newport Avenue.	Traffic on I-215 and very light traffic on Canal Street, some faint aircraft noise, and faint train noise.	There is no existing wall or property wall.
M-8	21900 Barton Road; Terrace Village RV Park; located at Unit No. 48 on the northwest corner of I-215 and Barton Road.	Traffic on I-215, some leaf blower noise, aircraft noise, faint dog barking, door creaking when it blows open and closed, and noise from raking leaves.	Existing 12.6 ft high property wall between I-215 and the RV Park. A 15 ft high building located on the east side of the RV Park.
M-9	21842 Grand Terrace Road; not in backyard; 12 ft behind orange tree.	Traffic on Barton Road.	There is no existing wall or property wall.
M-10	11981 La Crosse Avenue, in the backyard; located on the west side of I-215 between Barton Road and Newport Avenue.	Traffic on I-215, I-215 off-ramp to Barton Road, and some faint aircraft noise.	There is no existing wall or property wall.
M-11	22111 Newport Avenue Unit No. 181; Grand Royal Estates; located on the southwest corner of I-215 and Newport Avenue.	Traffic on I-215.	Existing 5.3 ft high wall along the property line between the residences and I-215.
M-12	2211 Newport Avenue Unit No. 41; Grand Royal Estates; located at the end of the driveway on the southwest corner of I-215 and Newport Avenue.	Traffic on I-215, quiet car driving by neighbors, birds chirping, and faint aircraft noise.	Existing 5.3 ft high wall along the property line between the residence and I-215. Took measurement from the driveway due to no accessibility.

Source: LSA Associates, Inc., September 2013.
ft = feet
I-215 = Interstate 215
RV = recreational vehicle

Table 6. Meteorological Conditions During Noise Monitoring

Date	Temperature (°F)	Average Wind Speed (mph)
11/6/2008	78.3–85.2	0.7–6.0
11/20/2008	77.0–85.3	0.0–2.1
1/21/2009	66.2–67.5	0.6–1.8
2/2/2010	68.9-69.0	0.8-1.0

Source: LSA Associates, Inc., September 2013.
°F = degrees Fahrenheit
mph = miles per hour

Table 7. Model Calibration

Monitor No.	Measured Noise Level (dBA L_{eq})	Modeled Noise Level (dBA L_{eq})	K-Factor (dBA)
M-1	64.2	66.9	-2.7
M-2	51.6	57.3	-5.7
M-3	54.8	53.7	1.1
M-4	71.2	75.2	-4.0
M-5	75.3	78.5	-3.2
M-6	51.6	59.1	-7.5
M-7	54.9	59.4	-4.5
M-8	54.2	54.5	-0.3
M-9	53.2	60.6	-7.4
M-10	68.9	73.9	-5.0
M-11	60.6	68.7	-8.1
M-12	51.7	60.1	-8.4

Source: LSA Associates, Inc., September 2013.
dBA = A-weighted decibels
L_{eq} = equivalent continuous sound level

As shown in Table 7, monitoring locations M-2, M-4, M-5, M-6, M-7, and M-9 through M-12 have K-factors greater than 3 dBA. Based on the TeNS in Section N-5460, K-factors between 3 and 4 can be calibrated unless the validity of the noise measurement conducted is in serious doubt. Also, differences of 5 dBA or greater should be approached with caution by retaking measurements and looking for obvious causes for the difference such as meteorology, pavement conditions, obstructions, reflections, etc. Monitoring locations M-2, M-4, M-5, and M-9 were rechecked; noise level measurements and field surveys of existing features and the TNM 2.5 modeled input data were also reexamined and determined to be accurate. Therefore, K-factors shown in Table 7 were used to calibrate the noise model. Additional site surveys of the existing terrain and ambient noise level measurements were conducted for monitoring locations M-6, M-11, and M-12 to verify the K-factor.

The original noise level measurement results for monitoring locations M-6 and M-11 (November 6, 2008) and the new noise level measurement results for monitoring location M-12 (November 20, 2008) were selected for calibration because they yielded the lowest K-factor value. The complexity of the terrain, distance from I-215 to the receiver, and different roadway pavement types observed in the field are possible reasons as to why these nine monitoring locations have a K-factor greater than 3 dBA.

6.2.3. Long-term 24-Hour Monitoring (Traffic Noise Levels)

Long-term traffic noise level measurement was conducted to document the peak traffic noise hour. Long-term ambient noise monitoring was conducted using a Larson Davis Model 824 Type 1 sound level meter (Serial Number 1612) at one location. The long-term noise level measurement was performed at 11902 Pascal Avenue, Grand Terrace, California, from 3:00 p.m. on Tuesday, February 2, 2010, to 2:00 p.m. on Wednesday, February 3, 2010. The long-term noise monitoring location is shown on Figure 2.

Table 8 shows that traffic noise peaks during the 7:00 a.m. to 9:00 a.m. hours. To determine existing peak traffic noise levels in the project area, the difference between the hour in which the short-term ambient noise measurements were conducted and the peak traffic noise hour was added to the monitored noise levels. For example, monitoring location M-1 was conducted during the 2:00 p.m. hour. Table 8 shows that the noise level during this hour is generally 1 dB lower than the level during the peak traffic noise hour. Therefore, 1 dBA is added to the existing levels for receivers that represent monitoring location M-1 to determine the existing peak noise level. For receiver locations where ambient noise monitoring was not conducted, existing noise levels were calculated using TNM 2.5 with traffic volumes counted during the noise monitoring.

6.2.4. Long-term 24- Hour Monitoring (Background Noise Levels)

Other sources of noise within the project area include railroad noise. A 24-hour community background noise level measurement was conducted using a Larson Davis Model 820 Type 1 sound level meter (Serial No. 1584) to capture nonvehicular traffic noise sources, such as train noise from UPRR, located within the project area. The 24-hour community background noise level measurement was performed at 21995 Vivienda Avenue, Grand Terrace, California, from 4:00 p.m. on Tuesday, February 2, 2010, to 4:00 p.m. on Wednesday, February 3, 2010. The location of the 24-hour community background noise level measurement is shown on Figure 2.

Table 8. Long-Term 24-hour Traffic Noise Levels Measurement Results at 11902 Pascal Avenue, Grand Terrace, California

Hour	Time	Date	Noise Level (dBA L_{eq})
1	3:00 PM	2/2/10	67
2	4:00 PM	2/2/10	67
3	5:00 PM	2/2/10	67
4	6:00 PM	2/2/10	66
5	7:00 PM	2/2/10	66
6	8:00 PM	2/2/10	66
7	9:00 PM	2/2/10	66
8	10:00 PM	2/2/10	65
9	11:00 PM	2/2/10	64
10	12:00 AM	2/3/10	63
11	1:00 AM	2/3/10	61
12	2:00 AM	2/3/10	60
13	3:00 AM	2/3/10	61
14	4:00 AM	2/3/10	61
15	5:00 AM	2/3/10	64
16	6:00 AM	2/3/10	66
17	7:00 AM	2/3/10	**68**[1]
18	8:00 AM	2/3/10	**68**
19	9:00 AM	2/3/10	**68**
20	10:00 AM	2/3/10	67
21	11:00 AM	2/3/10	67
22	12:00 PM	2/3/10	67
23	1:00 PM	2/3/10	67
24	2:00 PM	2/3/10	67

Source: LSA Associates, Inc., September 2013.
[1] Bold numbers represent peak traffic noise hour.
dBA L_{eq} = equivalent continuous sound level measured in A-weighted decibels

Table 9 shows the results of the 24-hour background noise level measurement. Table 9 shows that the ambient noise level peaks at 58 dBA during the 8:00 p.m.–9:00 p.m. and 12:00 p.m.–1:00 p.m. hours. The existing rail operation contributes to the ambient noise environment at nearby residences and would continue into the future.

6.2.5. Interior/Exterior Noise Level Measurements

Interior and exterior noise level measurements were conducted at Grand Terrace Elementary School to determine the existing exterior-to-interior noise level reduction. The classroom building closest to I-215 was evaluated to ensure that the interior noise standard of 52 dBA L_{eq} NAC is preserved. Table 10 shows the results of the exterior and interior noise level measurements and the existing exterior-to-interior noise level reduction.

Table 9. 24-Hour Community Background Noise Level Measurement Results at 21995 Vivienda Avenue, Grand Terrace, California

Hour	Time	Date	Noise Level (dBA L_{eq})
1	4:00 PM	2/2/10	52
2	5:00 PM	2/2/10	54
3	6:00 PM	2/2/10	55
4	7:00 PM	2/2/10	56
5	8:00 PM	2/2/10	**58**[1]
6	9:00 PM	2/2/10	57
7	10:00 PM	2/2/10	55
8	11:00 PM	2/2/10	55
9	12:00 AM	2/3/10	55
10	1:00 AM	2/3/10	55
11	2:00 AM	2/3/10	55
12	3:00 AM	2/3/10	56
13	4:00 AM	2/3/10	56
14	5:00 AM	2/3/10	56
15	6:00 AM	2/3/10	57
16	7:00 AM	2/3/10	57
17	8:00 AM	2/3/10	55
18	9:00 AM	2/3/10	54
19	10:00 AM	2/3/10	52
20	11:00 AM	2/3/10	54
21	12:00 PM	2/3/10	**58**
22	1:00 PM	2/3/10	54
23	2:00 PM	2/3/10	55
24	3:00 PM	2/3/10	54

Source: LSA Associates, Inc., September 2013.
[1] Bold numbers represent highest background noise levels.
dBA L_{eq} = equivalent continuous sound level measured in A-weighted decibels

Table 10. Exterior/Interior Noise Monitoring Results

Receiver	Exterior (dBA L_{eq})	Interior (dBA L_{eq})	Exterior to Interior Noise Level Reduction	Land Use Description
EI-1	64.9	42.7	22.2	12066 Vivienda Avenue; Grand Terrace Elementary School; classroom building closest to the I-215.

Source: LSA Associates, Inc., September 2013.
dBA L_{eq} = equivalent continuous sound level measured in A-weighted decibels
I-215 = Interstate 215

6.3. Existing Noise Levels

Traffic volume counts and vehicle speeds measured during the ambient noise monitoring were coded into TNM 2.5 with existing roadway conditions to calibrate the modeling result. The model input and output data for the calibration model runs are included in Appendix B. As discussed in Section 5.3, the noise levels were then adjusted to the peak traffic noise hour using the 24-hour noise level measurement to determine the existing worst-case traffic noise level, as discussed in Section 3.3.1.2 of the TeNS. For example: The calculated noise level after calibration for Receiver R-135 is 72 dBA L_{eq}. The noise level measurement closest to this receiver is noise monitoring location M-1. Noise monitoring location M-1 was conducted at 2:20 p.m. Table 8 shows the 2:00 p.m. hour is 1 dBA lower than the peak traffic noise hour during the 7:00 a.m. to 9:00 a.m. hour. Therefore, 1 dBA was added to the calculated noise level of 72 dBA L_{eq} to adjust the noise level to the worst-case condition. The results of the existing traffic noise modeling are shown in Table B-1. Currently, of the 144 modeled receiver locations, 20 receivers approach or exceed the 67 dBA L_{eq} NAC. Figure 2 shows the locations of the modeled receivers.

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Chapter 7. Future Noise Environment, Impacts, and Considered Abatement

7.1. Future Noise Environment and Impacts

The noise study was conducted to determine the future traffic noise impacts at sensitive receivers along I-215 from south of Barton Road to north of Newport Avenue. Potential long-term noise impacts associated with project operations are solely from traffic noise. Traffic noise was evaluated for the worst-case traffic condition. Using coordinates obtained from the topographic maps, 144 receiver locations associated with existing residences; a school; two mobile home parks; an RV park; a fast-food restaurant with an outdoor eating area; a utility facility; and office, commercial, and light industrial uses were evaluated in the model.

Future traffic noise levels under Modified Alternative 7 at all 144 receiver locations were determined with existing walls using the worst-case traffic operations (prior to speed degradation) or the future (2040) peak-hour traffic volumes obtained from the Traffic Operations Analysis (December 2011), as described in Section 5.3. Table B-1 in Appendix B summarizes the traffic noise modeling results for existing, future No Build, and Modified Alternative 7 conditions. Traffic noise levels shown in Table B-1 also reflect the 24-hour community background noise levels for all scenarios. A community background noise level of 58 dBA L_{eq} was applied to traffic noise levels for Receivers R-60 through R-130 under all scenarios because they are located near existing rail operations and in the vicinity of the community background noise level measurement. Traffic noise levels under the Modified Alternative 7 were compared to existing conditions and to the future No Build conditions. The comparison to existing conditions is included in the analysis to identify traffic noise impacts under 23 CFR 772. The comparison to the future No Build condition indicates the direct effect of the project.

As stated in the TeNS, modeling results are rounded to the nearest decibel before comparisons are made. In some cases, this can result in relative changes that may not appear intuitive. An example would be a comparison between sound levels of 64.4 and 64.5 dBA. The difference between these two values is 0.1 dB. However, after rounding, the difference is reported as 1 dB.

Traffic noise impacts occur when either of the following takes place: (1) if the traffic noise level at a sensitive receiver location is predicted to "approach or exceed" its NAC, or (2) if the predicted traffic noise level is 12 dBA or more over its corresponding modeled existing noise level at the sensitive receiver locations analyzed. When traffic noise impacts occur, noise abatement measures must be considered. Of the 144 modeled receivers, 23 receivers would approach or exceed the 67 dBA L_{eq} NAC under Modified Alternative 7. No receivers would experience a substantial increase of 12 dBA or more over their corresponding modeled existing noise levels.

The following receiver locations would be or would continue to be exposed to noise levels that approach or exceed the NAC under Activity Categories B, C, D, and E for Modified Alternative 7.

- **Receiver R-1:** This receiver location represents an existing residence along De Berry Street on the east side of I-215, south of Barton Road. Currently there are no existing walls that shield this residence. One sound barrier (SB Nos. 22a and 22b) was modeled along the edge of shoulder to shield this residence. SB Nos. 22a and 22b are two barriers that are evaluated as one barrier because they overlap with one another.
- **Receiver R-19:** This receiver location represents a single-family residence along Barton Road and east of Vivienda Avenue. Currently there are no existing walls that shield this residence. As there is driveway access onto the property from Barton Road, it is not feasible to abate traffic noise with sound barriers.
- **Receivers R-23 through R-25, R-27 through R-32, and R-35:** These receiver locations represent existing residences and the playground associated with Grand Terrace Elementary School along Vivienda Avenue, Vivienda Court, and Pascal Avenue on the east side of I-215 between Barton Road and Newport Avenue. A 5- to 7-ft high existing wall (EW No. 6) along the residential property line currently shields these residences. Currently, there are no existing walls that shield the school playground from I-215. One sound barrier (SB Nos. 23a and 23b) along the State right-of-way (ROW) was modeled to shield these residences and the school playground. SB Nos. 23a and 23b are two barriers that are evaluated as one barrier because they overlap with one another.
- **Receivers R-60, R-70, R-77, and R-83:** These receiver locations represent an existing swimming pool at the RV park and existing mobile homes along Grand Terrace Road on the west side of I-215 between Barton Road and Vivienda Avenue. An existing 5.3 to 6 ft high wall (EW No. 5) along the residential

property line currently shields the mobile homes. One sound barrier (SB No. 24) along the State ROW was modeled to shield these areas.

- **Receivers R-67, R-68, R-111, R-112, R-115, and R-116:** These receiver locations represent existing single-family residences and mobile homes on the west side of I-215 between Barton Road and Newport Avenue. Two existing 5.3 ft high walls (EW Nos. 7 and 8) along the residential property line currently shield the mobile homes. Two sound barriers were modeled at two different locations to shield the mobile homes. One sound barrier (SB No. 25) was modeled along the edge of shoulder and the other sound barrier (SB No. 26) was modeled along the residential property line to shield only Receivers R-115 and R-116. Sound barrier effectiveness at the two different locations was evaluated.
- **Receiver R-143:** This receiver location represents a fast-food restaurant with an outdoor eating area located on the east side of I-215, south of Barton Road. Currently there are no existing walls that shield the outdoor eating area. As there is driveway access onto the property from Barton Road, it is not feasible to abate traffic noise with sound barriers.

7.1.1. Interior Noise Impacts

An interior noise analysis was conducted at Grand Terrace Elementary School to evaluate classroom buildings under Activity Category D (52) and to meet the requirements of Section 216 of the California Streets and Highways Code. Figure 2 shows the location of the interior noise evaluation. As shown in Table 10, the calculated existing exterior-to-interior noise level attenuation for the school classroom building is 22.2 dBA. Table 11 shows that the predicted traffic noise levels would be 73.3 dBA L_{eq} under Modified Alternative 7. As shown in Table 11, based on the measured existing exterior-to-interior noise level attenuation (Table 10), the predicted future classroom interior noise level would be 51.1 dBA L_{eq} under Modified Alternative 7. Interior noise levels would approach or exceed the 52 dBA L_{eq} NAC under the Modified Alternative 7. SB Nos. 23a and 23b were analyzed to shield classroom buildings closest to I-215.

Table 11. Predicted Future Interior Noise Levels (dBA)

Receiver	Exterior to Interior Reduction[1]	Modified Alternative 7	
		Exterior	Interior
EI-1	22.2	73.3	51.1

Source: LSA Associates, Inc., September 2013.

[1] The exterior to interior reduction was calculated based on the exterior and interior noise level measurements shown in Table 10.

dBA = A-weighted decibels

7.2. Preliminary Noise Abatement Analysis

7.2.1. Sound Barrier Modeling

In accordance with 23 CFR 772, noise abatement is considered where noise impacts are predicted in areas of frequent human use that would benefit from a lowered noise level. Potential noise abatement measures identified in the Protocol include the following:

- Avoiding the impact by using design alternatives, such as altering the horizontal and vertical alignment of the proposed project;
- Constructing sound barriers;
- Acquiring property to serve as a buffer zone;
- Using traffic management measures to regulate types of vehicles and speeds; and
- Acoustically insulating public-use or nonprofit institutional structures.

All of these abatement options have been considered. However, because of the configuration and location of the project, abatement in the form of a sound barrier is the only abatement that is considered to be feasible.

A total of five noise barriers for Modified Alternative 7 were evaluated for feasibility based on achievable noise reduction. For each noise barrier found to be acoustically feasible, a reasonable cost allowance was calculated. Table B-1 in Appendix C shows the barrier modeling results for Modified Alternative 7. For any noise barrier to be considered reasonable from a cost perspective, the estimated cost of the noise barrier should be equal to or less than the total cost allowance calculated for the barrier. The cost calculations of the noise barrier should include all items appropriate and necessary for construction of the barrier such as traffic control, drainage modification, and retaining walls. Construction cost estimates are not provided in this NSR, but are presented in the Noise Abatement Decision Report (NADR). The NADR is a design responsibility and is prepared to compile information from the NSR, other relevant environmental studies, and design considerations into a single, comprehensive document before public review of the project. The NADR is prepared by the project engineer after completion of the NSR and prior to publication of the draft environmental document. The NADR includes noise abatement construction cost estimates that have been prepared and signed by the project engineer based on site-specific conditions. Construction cost estimates are compared to reasonableness allowances in the NADR to identify which wall configurations are reasonable from a cost perspective.

The design of noise barriers presented in this report is preliminary and has been conducted at a level appropriate for environmental review and not for final design of the project. Preliminary information on the physical location, length, and height of the noise barriers is provided in this report. If pertinent parameters change substantially during the final project design, preliminary noise barrier designs may be modified or eliminated from the final project. A final decision on construction of the noise abatement will be made upon completion of the project design.

The following is a discussion of noise abatement considered for Modified Alternative 7 where traffic noise impacts are predicted.

7.2.2. SB Nos. 22a and 22b

A 2,149 ft long barrier along the edge of shoulder on the east side of I-215 south of Barton Road was analyzed to shield Receiver R-1 because traffic noise levels under Modified Alternative 7 conditions would approach or exceed the 67 dBA L_{eq} NAC under Activity Category B. Traffic modeling results in Table B-1 in Appendix C indicate that traffic noise levels would be 67 dBA L_{eq}, and the increase in noise levels would be 2 dB. SB Nos. 22a and 22b were evaluated from 6 to 16 ft at 2 ft increments. SB Nos. 22a and 22b are shown on Figure 3. Table 12 lists the barrier reductions, the number of benefited residences, the reasonable allowances per benefited residence, and the total reasonable allowance for each barrier height.

Table 12. Summary of Reasonableness for SB Nos. 22a and 22b[1]

Barrier I.D.: SB No. 22a and 22b						
Modified Alternative 7 with Barrier	**6 Ft Barrier**	**8 Ft Barrier**	**10 Ft Barrier**	**12 Ft Barrier**	**14 Ft Barrier**	**16 Ft Barrier**
Highest Noise Barrier Reduction (dB)	1	2	3	4	5	7
Number of Benefited Residences	0	0	0	0	3	3
Reasonable Allowance Per Benefited Residence[2]	N/A	N/A	N/A	N/A	$55,000	$55,000
Total Reasonable Allowance	N/A	N/A	N/A	N/A	$165,000	$165,000

Source: LSA Associates, Inc., September 2013.

[1] An NADR will be prepared to identify the noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

[2] The cost consideration in the reasonableness determination of noise abatement is based on a 2011 allowance per benefited unit/receptor of $55,000 (Caltrans 2011).

Caltrans = California Department of Transportation
dB = decibels
ft = foot/feet
N/A = Not Applicable
NADR = Noise Abatement Decision Report
SB = Sound Barrier

7.2.3. SB Nos. 23a and 23b

A 2,160 ft long barrier within the State ROW on the east side of I-215 between Barton Road and Newport Avenue was analyzed to shield Receivers R-23 through R-25, R-27 through R-32, R-35, and the exterior/interior receiver because traffic noise levels under Modified Alternative 7 conditions would approach or exceed the 67 dBA L_{eq} NAC under Activity Category B. These barriers are currently being constructed as part of the I-215 Bi-County HOV Lane Gap Closure Project (EA No. 0M940) and would not be constructed as part of the I-215/Barton Interchange Improvement Project. However, these barriers were evaluated independently from the I-215 Bi-County HOV Lane Gap Closure Project in order to be consistent with the previous NSR completed for Alternatives 3 and 6. Traffic modeling results in Table B-1 in Appendix C indicate that traffic noise levels would range from 68 to 75 dBA L_{eq} and the increase in noise would range from 1 to 8 dB. SB Nos. 23a and 23b were evaluated from 6 to 14 ft at 2 ft increments. A noise barrier height of 16 ft was not evaluated because the wall would be located within 15 ft of the nearest travel lane. SB Nos. 23a and 23b are shown on Figure 3. Table 13 lists the barrier reductions, the number of benefited residences, the reasonable allowances per benefited residence, and the total reasonable allowance for each barrier height. Sound barrier surveys have already been completed for SB Nos. 23a and 23b as part of the I-215 Bi-County HOV Lane Gap Closure project (EA No. 0M940).

Table 13. Summary of Reasonableness for SB Nos. 23a and 23b[1]

Barrier I.D.: SB No. 23a and 23b						
Modified Alternative 7 with Barrier	**6 Ft Barrier**	**8 Ft Barrier**	**10 Ft Barrier**	**12 Ft Barrier**	**14 Ft Barrier**	**16 Ft Barrier**
Highest Noise Barrier Reduction (dB)	4	7	9	11	12	NP[3]
Number of Benefited Residences	N/A	7	18	23	27	NP
Reasonable Allowance Per Benefited Residence[2]	N/A	$55,000	$55,000	$55,000	$55,000	NP
Total Reasonable Allowance	N/A	$385,000	$990,000	$1,265,000	$1,485,000	NP

Source: LSA Associates, Inc., September 2013.

[1] An NADR will be prepared to identify the noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

[2] The cost consideration in the reasonableness determination of noise abatement is based on a 2011 allowance per benefited unit/receptor of $55,000 (Caltrans 2011).

[3] NP = Not Permitted. The maximum height of this barrier is 14 ft because it is located within 15 ft of the nearest travel lane.

Caltrans = California Department of Transportation
dB = decibels
ft = foot/feet
N/A = Not Applicable
NADR = Noise Abatement Decision Report
SB = Sound Barrier

7.2.4. SB No. 24

A 890 ft long barrier along the State ROW on the northwestern corner of I-215 and Barton Road was analyzed to shield Receivers R-60, R-70, R-77, and R-83 because traffic noise levels under Modified Alternative 7 conditions would approach or exceed the 67 dBA L_{eq} NAC under Activity Category B. Traffic modeling results in Table B-1 in Appendix C indicate that traffic noise levels would range from 66 to 68 dBA L_{eq} and the increase in noise would range from 1 to 8 dB. SB No. 24 was evaluated from 6 to 16 ft at 2 ft increments. SB No. 24 is shown on Figure 3. Table 14 lists the barrier reductions, the number of benefited residences, the reasonable allowances per benefited residence, and the total reasonable allowance for each barrier height.

Table 14. Summary of Reasonableness for SB No. 24[1]

Barrier I.D.: SB No. 24						
Modified Alternative 7 with Barrier	**6 Ft Barrier**	**8 Ft Barrier**	**10 Ft Barrier**	**12 Ft Barrier**	**14 Ft Barrier**	**16 Ft Barrier**
Highest Noise Barrier Reduction (dB)	4	5	6	6	7	7
Number of Benefited Residences	0	1	1	5	5	5
Reasonable Allowance Per Benefited Residence[2]	N/A	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	$55,000	$55,000	$275,000	$275,000	275,000

Source: LSA Associates, Inc., September 2013.

[1] An NADR will be prepared to identify the noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

[2] The cost consideration in the reasonableness determination of noise abatement is based on a 2011 allowance per benefited unit/receptor of $55,000 (Caltrans 2011).

Caltrans = California Department of Transportation
dB = decibels
ft = foot/feet
N/A = Not Applicable
NADR = Noise Abatement Decision Report
SB = Sound Barrier

7.2.5. SB No. 25

A 1,488 ft long barrier along the State ROW on the west side of I-215 between Barton Road and Newport Avenue was analyzed to shield Receivers R-67, R-68, R-111, R-112, R-115, and R-116 because traffic noise levels under the modified Alternative 7 conditions would approach or exceed the 67 dBA L_{eq} NAC under Activity Category B. This barrier is currently being constructed as part of the I-215 Bi-County HOV Lane Gap Closure Project (EA No. 0M940) and would not be constructed as part of the I-215/Barton Interchange Improvement Project. However, these barriers were evaluated independently from the I-215 Bi-County HOV Lane Gap Closure Project in order to be consistent with the previous NSR completed for Alternatives 3 and 6. A portion of SB No. 25 along the edge of shoulder on the west side of I-215 was analyzed to shield only Receivers R-115 and R-116. A shorter sound barrier length of 500 ft from Station (STA) 85+00 to STA 90+00 was used to compare with SB No. 26 to evaluate the effectiveness of the two sound barrier locations. Traffic modeling results in Table B-1 in Appendix C indicate that traffic noise levels would range from 66 to 71 dBA L_{eq} and the increase in noise would range from 0 to 2 dB. SB No. 25 was evaluated from 6 to 14 ft at 2 ft increments. A noise barrier height of 16 ft was not evaluated because the wall would be located within 15 ft of the nearest travel lane. SB No. 25 is shown on Figure 3. Table 15 lists the barrier reductions, the number of benefited residences, the reasonable allowances per benefited residence, and the total reasonable allowance for each barrier height. Sound barrier surveys have already been completed for SB No. 25 as part of the I-215 Bi-County HOV Lane Gap Closure project (EA No. 0M940).

Approximately 235 ft (STA 77+00 to STA 79+35) of the southern portion of this barrier would have to be reconstructed as part of the I-215 Barton Road Interchange Improvement Project to accommodate the new I-215 southbound off-ramp. This portion of the barrier would be constructed along the new State ROW line.

Table 15. Summary of Reasonableness for SB No. 25[1]

Barrier I.D.: SB No. 25						
Modified Alternative 7 with Barrier	**6 Ft Barrier**	**8 Ft Barrier**	**10 Ft Barrier**	**12 Ft Barrier**	**14 Ft Barrier**	**16 Ft Barrier**
Highest Noise Barrier Reduction (dB)	6	7	8	8	9	NP[3]
Number of Benefited Residences	2	3	3	5	13	NP
Reasonable Allowance Per Benefited Residence[2]	$55,000	$55,000	$55,000	$55,000	$55,000	NP
Total Reasonable Allowance	$110,000	$165,000	$165,000	$275,000	$715,000	NP

Source: LSA Associates, Inc., September 2013.
1 An NADR will be prepared to identify the noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.
2 The cost consideration in the reasonableness determination of noise abatement is based on a 2011 allowance per benefited unit/receptor of $55,000 (Caltrans 2011).
3 NP = Not Permitted. The maximum height of this barrier is 14 ft because it is located within 15 ft of the nearest travel lane.
Caltrans = California Department of Transportation
dB = decibels
ft = foot/feet
NADR = Noise Abatement Decision Report
SB = Sound Barrier

7.2.6. SB No. 26

A 353 ft long barrier along the residential property line on the west side of I-215 between Vivienda Avenue and Newport Avenue was analyzed to shield Receivers R-115 and R-116 because traffic noise levels under the modified Alternative 7 conditions would approach or exceed the 67 dBA L_{eq} NAC under Activity Category

B. Traffic modeling results in Table B-2 in Appendix C indicate that traffic noise levels would range from 66 to 67 dBA L_{eq} and the increase in noise would range from 0 to 1 dB. SB No. 26 was evaluated from 6 to 16 ft at 2 ft increments. SB No. 26 is shown on Figure 3. Table 16 lists the barrier reductions, the number of benefited residences, the reasonable allowances per benefited residence, and the total reasonable allowance for each barrier height.

Table 16. Summary of Reasonableness for SB No. 26[1]

Barrier I.D.: SB No. 26						
Modified Alternative 7 with Barrier	**6 Ft Barrier**	**8 Ft Barrier**	**10 Ft Barrier**	**12 Ft Barrier**	**14 Ft Barrier**	**16 Ft Barrier**
Highest Noise Barrier Reduction (dB)	3	5	7	7	8	8
Number of Benefited Residences	0	4	5	5	5	5
Reasonable Allowance Per Benefited Residence[2]	N/A	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	$220,000	$275,000	$275,000	$275,000	$275,000

Source: LSA Associates, Inc., September 2013.
1 An NADR will be prepared to identify the noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.
2 The cost consideration in the reasonableness determination of noise abatement is based on a 2011 allowance per benefited unit/receptor of $55,000 (Caltrans 2011).
Caltrans = California Department of Transportation
dB = decibels
ft = foot/feet
N/A = Not Applicable
NADR = Noise Abatement Decision Report
SB = Sound Barrier

7.2.7. Parallel Barriers

Parallel barrier effects occur when sound barriers are located on both sides of the roadway, reflecting traffic noise back and forth across the roadway multiple times, and build up a reverberant sound field between them. This reverberation increases noise levels at nearby receivers on both sides of the roadway, compared to what would exist without the barrier on the opposite side. Parallel barrier configurations that have a roadway width to sound barrier height ratio of 15:1 or less (width/height) would degrade the performance of sound barriers. Parallel barriers within the project area are located along I-215 north of Barton Road. The minimum parallel barrier ratio along the I-215 north of Barton Road would be 11:1. Therefore, to avoid this effect, Caltrans standard practice would require sound barriers along I-215 north of Barton Road to be provided with an acoustically absorptive surface with a Noise Reduction Coefficient (NRC) of 0.80 or greater.

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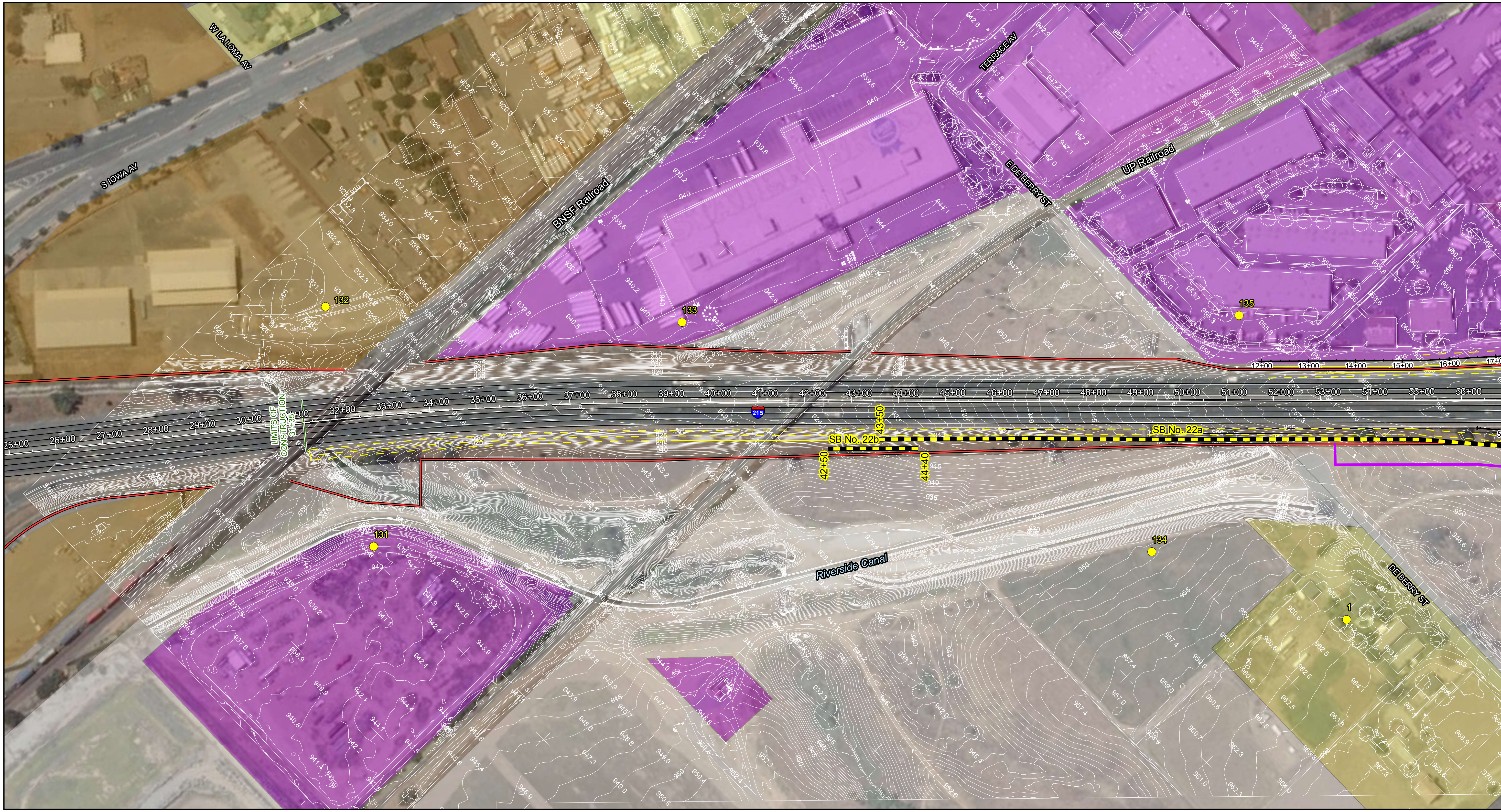

LEGEND

- Modified Alternative 7 Layout
- Existing State Right of Way
- Proposed Right of Way
- Temporary Construction Easement
- Mixed Flow and HOV Lanes
- Modeled Sound Barrier
- I-215 Bi-County HOV Lane Gap Closure Project Sound Barrier
- Modeled Receiver Locations
- Potential Full Acquisition

Land Use

- Commercial
- Industrial
- Institutional
- Residential
- Utility
- Vacant

0 100 200
FEET

Note: Receivers R-36 to R-42, R-52 to R-59, R-118 to R-120, R-128 to R-130, and R-144 are not shown because they are located beyond the limits of construction under Modified Alternative 7.

SOURCE: NAIP (6/2010); County of San Bernardino (5/09); AECOM (3/2013)

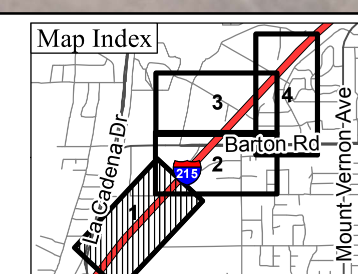

FIGURE 3
Sheet 1 of 4

I-215/Barton Road Interchange Improvement Project

Modified Alternative 7
Modeled Sound Barriers and Receiver Locations

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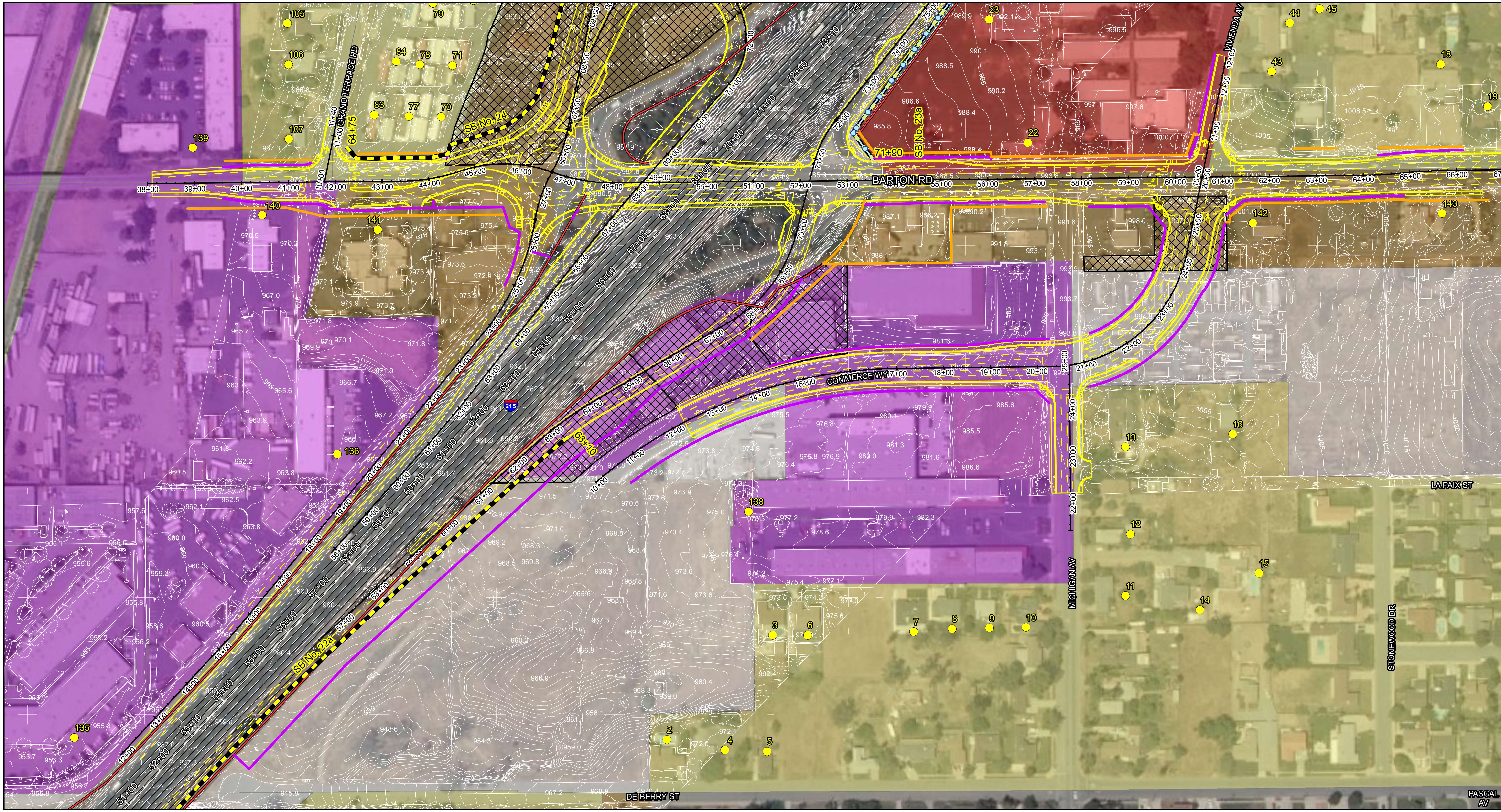

LEGEND

- Modified Alternative 7 Layout
- Existing State Right of Way
- Proposed Right of Way
- Temporary Construction Easement
- Mixed Flow and HOV Lanes
- Modeled Sound Barrier
- I-215 Bi-County HOV Lane Gap Closure Project Sound Barrier
- Modeled Receiver Locations
- Potential Full Acquisition

Land Use

- Commercial
- Industrial
- Institutional
- Residential
- Utility
- Vacant

0 100 200
FEET

Note: Receivers R-36 to R-42, R-52 to R-59, R-118 to R-120, R-128 to R-130, and R-144 are not shown because they are located beyond the limits of construction under Modified Alternative 7.

SOURCE: NAIP (6/2010); County of San Bernardino (5/09); AECOM (3/2013)

Map Index

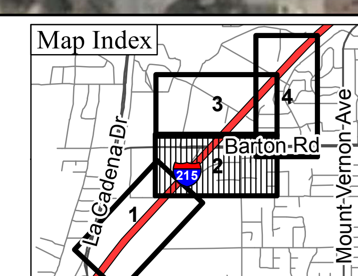

FIGURE 3
Sheet 2 of 4

I-215/Barton Road Interchange Improvement Project

Modified Alternative 7
Modeled Sound Barriers and Receiver Locations

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LEGEND

- Modified Alternative 7 Layout
- Existing State Right of Way
- Proposed Right of Way
- Temporary Construction Easement
- Mixed Flow and HOV Lanes
- Modeled Sound Barrier
- I-215 Bi-County HOV Lane Gap Closure Project Sound Barrier
- Modeled Receiver Locations
- Potential Full Acquisition

Land Use

- Commercial
- Industrial
- Institutional
- Residential
- Utility
- Vacant

0 100 200
FEET

Note: Receivers R-36 to R-42, R-52 to R-59, R-118 to R-120, R-128 to R-130, and R-144 are not shown because they are located beyond the limits of construction under Modified Alternative 7.

SOURCE: NAIP (6/2010); County of San Bernardino (5/09); AECOM (3/2013)

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Map Index

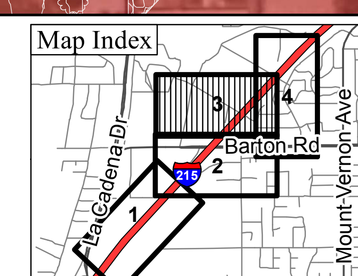

FIGURE 3
Sheet 3 of 4

I-215/Barton Road Interchange Improvement Project

Modified Alternative 7
Modeled Sound Barriers and Receiver Locations

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LEGEND

- Modified Alternative 7 Layout
- Existing State Right of Way
- Proposed Right of Way
- Temporary Construction Easement
- Mixed Flow and HOV Lanes
- Modeled Sound Barrier
- I-215 Bi-County HOV Lane Gap Closure Project Sound Barrier
- Modeled Receiver Locations
- Potential Full Acquisition

Land Use

- Commercial
- Industrial
- Institutional
- Residential
- Utility
- Vacant

0 100 200
FEET

Note: Receivers R-36 to R-42, R-52 to R-59, R-118 to R-120, R-128 to R-130, and R-144 are not shown because they are located beyond the limits of construction under Modified Alternative 7.

SOURCE: NAIP (6/2010); County of San Bernardino (5/09); AECOM (3/2013)

Map Index

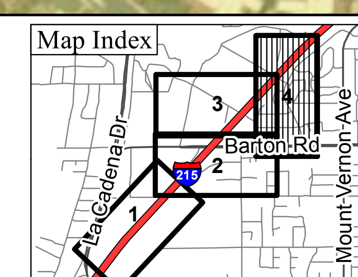

FIGURE 3
Sheet 4 of 4

I-215/Barton Road Interchange Improvement Project

Modified Alternative 7
Modeled Sound Barriers and Receiver Locations

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Chapter 8. Construction Noise

Two types of short-term noise impacts would occur during project construction. The first type would be from construction crew commutes and the transport of construction equipment and materials to the project site and would incrementally raise noise levels on access roads leading to the site. The pieces of heavy equipment for grading and construction activities will be moved on site, will remain for the duration of each construction phase, and will not add to the daily traffic volume in the project vicinity. A high single-event noise exposure potential at a maximum level of 87 dBA L_{max} from trucks passing at 50 ft will exist. However, the projected construction traffic will be minimal when compared to existing traffic volumes on I-215 and other affected streets, and its associated long-term noise level change will not be perceptible. Therefore, short-term construction-related worker commutes and equipment transport noise impacts would be less than substantial.

The second type of short-term noise impact is related to noise generated during roadway construction. Construction is performed in discrete steps, 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 and the noise levels within the project area 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. Table 17 lists typical construction equipment noise levels (L_{max}) recommended for noise impact assessments, based on a distance of 50 ft between the equipment and a noise receiver.

Typical noise levels at 50 ft from an active construction area range up to 91 dBA L_{max} during the noisiest construction phases. The site preparation phase, which includes grading and paving, tends to generate the highest noise levels because the noisiest construction equipment is earthmoving equipment. Earthmoving equipment includes excavating machinery such as backfillers, bulldozers, and front loaders. Earthmoving and compacting equipment includes compactors, scrapers, and graders. 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 of the proposed project is expected to require the use of earthmovers, bulldozers, water trucks, and pickup trucks. Noise associated with the use of

Table 17. Typical Construction Equipment Noise Levels

Type of Equipment	Range of Maximum Sound Levels (dBA L_{max} at 50 ft)	Suggested Maximum Sound Levels for Analysis (dBA L_{max} at 50 ft)
Pile drivers	81–96	93
Rock drills	83–99	96
Jackhammers	75–85	82
Pneumatic tools	78–88	85
Pumps	74–84	80
Scrapers	83–91	87
Haul trucks	83–94	88
Cranes	79–86	82
Portable generators	71–87	80
Rollers	75–82	80
Dozers	77–90	85
Tractors	77–82	80
Front-end loaders	77–90	86
Hydraulic backhoe	81–90	86
Hydraulic excavators	81–90	86
Graders	79–89	86
Air compressors	76–89	86
Trucks	81–87	86

Source: *Noise Control for Buildings and Manufacturing Plants* (Bolt, Beranek & Newman, 1987).
dBA = A-weighted decibels
ft = feet
L_{max} = maximum sound level

construction equipment is estimated between 79 and 89 dBA L_{max} at a distance of 50 ft from the active construction area for the grading phase. As seen in Table 17, the maximum noise level generated by each earthmover is assumed to be approximately 86 dBA L_{max} at 50 ft from the earthmover in operation. Each bulldozer would generate approximately 85 dBA L_{max} at 50 ft. The maximum noise level generated by water trucks and pickup trucks is approximately 86 dBA L_{max} at 50 ft from these vehicles. Each doubling of the sound source with equal strength increases the noise level by 3 dBA. Each piece of construction equipment operates as an individual point source. The worst-case composite noise level at the nearest residence during this phase of construction would be 91 dBA L_{max} (at a distance of 50 ft from an active construction area).

In addition to standard construction equipment, the proposed project may require the use of pile drivers. As shown in Table 17, pile driving generates noise levels of approximately 93 dBA L_{max} at 50 ft. If pile driving is conducted concurrently with site preparation, the construction site could potentially generate noise levels of 95 dBA L_{max} at a distance of 50 ft.

The closest sensitive receiver locations are located 50 ft from the project construction areas. Therefore, these receiver locations may be subject to short-term noise reaching 95 dBA L_{max} generated by construction activities within the project area. Compliance with the construction hours specified in the City of Colton's Bid and Contract template and the City of Grand Terrace Municipal Code, for work within each respective city, and Caltrans Standard Standard Specifications for work within State ROW will be required to minimize construction noise impacts on sensitive land uses adjacent to the project site. Construction noise is regulated by Caltrans Standard Special Provisions in Section 14-8.02. Noise control shall conform to the provisions in Section 14-8.02. The noise level from the Contractor's operations, between the hours of 9:00 p.m. and 6:00 a.m., shall not exceed 86 dBA at a distance of 50 ft. In addition, the Contractor shall equip all internal combustion engines with the manufacturer-recommended muffler and shall not operate any internal combustion engine on the job site without the appropriate muffler.

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Chapter 9. References

AECOM. Barton Road Interchange Improvement Project: Roundabout Analyses. January 2013.

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

California Department of Transportation, Standard Special Provisions, Section S5-310, 2009.

———. Standard Specifications, Section 14-8.02, June 2009.

———. *Annual Average Daily Trucks on the California State Highway System*, 2009.

———. *Highway Design Manual*. January 2007.

———. Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects, May 2011.

———. Technical Noise Supplement, November 2009.

Federal Highway Administration, Traffic Noise Model (TNM) Version 2.5, April 2004.

Harris, Cyril, Handbook of Acoustical Measurements and Noise Control, Third Edition, 1991.

Iteris Inc., Traffic Operations Analysis, Interstate 215/Barton Road Interchange Improvement Project, December 2011.

Southern California Association of Governments. 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy Growth Forecast. http://rtpscs.scag.ca.gov/Documents/2012/final/SR/2012fRTP_GrowthForecast.pdf

United States Department of Transportation, Federal Highway Administration Procedures for Abatement of Highway Traffic Noise, CFR 23 Part 772, as amended July 8, 1982.

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Appendix A. Traffic Counts and Traffic Data

This appendix contains tables presenting the traffic counts with measured vehicle speeds during ambient noise level measurements and traffic data for existing conditions, future No Build, and Modified Alternative 7 conditions.

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TRAFFIC COUNTS AND MEASURED VEHICLE SPEEDS FOR EXISTING CONDITIONS (MODEL CALIBRATION) AND MODELED FUTURE TRAFFIC VOLUMES (FUTURE NO BUILD AND MODIFIED ALTERNATIVE 7)

Traffic Counts for Model Calibration (Short-Term Noise Level Measurements)

	Traffic Counts (15 min)			Distribution			Traffic Volume (Hourly)			Lanes 1 & 2			Lane 3			Measured Average Speed		
	Auto	Medium	Heavy	Auto	Medium	Heavy	Auto	Medium	Heavy	Auto	Med	Heavy	Auto	Med	Heavy	Auto	Medium	Heavy
M-1																		
I-215 NB	1185	36	44	0.94	0.03	0.03	4740	144	176	3160	96	117	1580	48	59	60	47	53
I-215 SB	1108	30	44	0.94	0.03	0.04	4432	120	176	2955	80	117	1477	40	59	60	47	53
M-2																		
I-215 NB	980	38	35	0.93	0.04	0.03	3920	152	140	2613	101	93	1307	51	47	67	61	60
I-215 SB	956	26	47	0.93	0.03	0.05	3824	104	188	2549	69	125	1275	35	63	67	61	60
Barton NB Off Ramp	78	8	5	0.86	0.09	0.05	312	32	20							45	45	40
Michigan Avenue NB	60	5	1	0.91	0.08	0.02	240	20	4							35	35	30
Michigan Avenue SB	50	2	1	0.94	0.04	0.02	200	8	4							35	35	30
M-3																		
I-215 NB	1022	71	40	0.90	0.06	0.04	4088	284	160	2725	189	107	1363	95	53	61	51	52
I-215 SB	878	27	36	0.93	0.03	0.04	3512	108	144	2341	72	96	1171	36	48	61	51	52
Barton NB On Ramp	56	6	3	0.86	0.09	0.05	224	24	12							61	51	52
Barton EB	105	6	1	0.94	0.05	0.01	420	24	4							40	40	35
Barton WB	99	3	3	0.94	0.03	0.03	396	12	12							40	40	35
M-4																		
I-215 NB	1263	52	39	0.93	0.04	0.03	5052	208	156	3368	139	104	1684	69	52	64	52	56
I-215 SB	891	44	59	0.90	0.04	0.06	3564	176	236	2376	117	157	1188	59	79	64	52	56
Barton NB On Ramp	73	8	2	0.88	0.10	0.02	292	32	8							64	52	56
M-5																		
I-215 NB	918	39	40	0.92	0.04	0.04	3672	156	160	2448	104	107	1224	52	53	67	52	52
I-215 SB	915	59	46	0.90	0.06	0.05	3660	236	184	2440	157	123	1220	79	61	67	52	52
Barton NB On Ramp	52	3	5	0.87	0.05	0.08	208	12	20							67	52	52
Barton SB Off Ramp	76	9	2	0.87	0.10	0.02	304	36	8							45	45	40
M-6																		
I-215 NB	918	39	40	0.92	0.04	0.04	3672	156	160	2448	104	107	1224	52	53	66	64	61
I-215 SB	915	59	46	0.90	0.06	0.05	3660	236	184	2440	157	123	1220	79	61	66	63	61
Barton NB On Ramp	52	3	5	0.87	0.05	0.08	208	12	20							66	63	61
Barton SB Off Ramp	76	9	2	0.87	0.10	0.02	304	36	8							55	51	48
M-7																		
I-215 NB	947	74	61	0.88	0.07	0.06	3788	296	244	2525	197	163	1263	99	81	65	55	49
I-215 SB	983	39	56	0.91	0.04	0.05	3932	156	224	2621	104	149	1311	52	75	65	55	49
Barton NB On Ramp	70	3	0	0.96	0.04	0.00	280	12	0							65	55	0
Barton SB Off Ramp	74	3	3	0.93	0.04	0.04	296	12	12							45	45	40
M-8																		
I-215 NB	1067	41	30	0.94	0.04	0.03	4268	164	120	2845	109	80	1423	55	40	60	47	53
I-215 SB	1034	48	33	0.93	0.04	0.03	4136	192	132	2757	128	88	1379	64	44	60	47	53
Barton NB On Ramp	83	2	2	0.95	0.02	0.02	332	8	8							60	47	53
Barton SB Off Ramp	90	5	2	0.93	0.05	0.02	360	20	8							45	45	40
Barton EB	73	3	1	0.95	0.04	0.01	292	12	4							40	40	35
Barton WB	73	3	1	0.95	0.04	0.01	292	12	4							40	40	35

Traffic Counts for Model Calibration (Short-Term Noise Level Measurements)

	Traffic Counts (15 min)			Distribution			Traffic Volume (Hourly)			Lanes 1 & 2			Lane 3			Measured Average Speed		
	Auto	Medium	Heavy	Auto	Medium	Heavy	Auto	Medium	Heavy	Auto	Med	Heavy	Auto	Med	Heavy	Auto	Medium	Heavy
M-9																		
I-215 NB	1008	27	64	0.92	0.02	0.06	4032	108	256	2688	72	171	1344	36	85	71	58	58
I-215 SB	1019	51	34	0.92	0.05	0.03	4076	204	136	2717	136	91	1359	68	45	71	58	58
Barton EB	127	7	5	0.91	0.05	0.04	508	28	20							40	40	35
Barton WB	99	2	4	0.94	0.02	0.04	396	8	16							40	40	35
Grand Terrace NB	10	1	0	0.91	0.09	0.00	40	4	0							30	30	0
Grand Terrace SB	5	0	0	1.00	0.00	0.00	20	0	0							30	0	0
Barton SB Off Ramp	88	7	4	0.89	0.07	0.04	352	28	16							45	45	40
M-10																		
I-215 NB	1042	48	40	0.92	0.04	0.04	4168	192	160	2779	128	107	1389	64	53	64	53	54
I-215 SB	1005	25	45	0.93	0.02	0.04	4020	100	180	2680	67	120	1340	33	60	64	53	54
Barton NB On Ramp	70	4	2	0.92	0.05	0.03	280	16	8							64	53	54
Barton SB Off Ramp	88	7	0	0.93	0.07	0.00	352	28	0							45	45	0
M-11																		
I-215 NB	1042	48	40	0.92	0.04	0.04	4168	192	160	2779	128	107	1389	64	53	64	53	54
I-215 SB	1005	25	45	0.93	0.02	0.04	4020	100	180	2680	67	120	1340	33	60	64	53	54
Barton NB On Ramp	70	4	2	0.92	0.05	0.03	280	16	8							64	53	54
Barton SB Off Ramp	88	7	0	0.93	0.07	0.00	352	28	0							45	45	0
M-12																		
I-215 NB	1056	33	40	0.94	0.03	0.04	4224	132	160	2816	88	107	1408	44	53	69	58	52
I-215 SB	1133	49	49	0.92	0.04	0.04	4532	196	196	3021	131	131	1511	65	65	69	58	52
Barton NB On Ramp	75	2	0	0.97	0.03	0.00	300	8	0							69	58	0
Barton SB Off Ramp	91	2	1	0.97	0.02	0.01	364	8	4							45	45	40
Newport Avenue EB	13	0	0	1.00	0.00	0.00	52	0	0							30	0	0
Newport Avenue WB	8	0	0	1.00	0.00	0.00	32	0	0							30	0	0

Future No Build Traffic Volumes

Future No Build	AM Peak	PM Peak	Worst-Case	Volume	No of Lanes	Vehicle Distribution			Modeled Traffic Volume			Vehicle Speeds		
						Auto	Med	Heavy	Auto	Med	Heavy	Auto	Med	Heavy
I-215 NB Lanes 1 & 2	5509	6329	3900	3900	2	0.92	0.04	0.04	2392	104	104	65	65	55
I-215 SB Lanes 1 & 2	5479	5519	3900	3900	2	0.92	0.04	0.04	2392	104	104	65	65	55
I-215 NB Lane 3	2754	3165	1950	1950	1	0.92	0.04	0.04	1794	78	78	65	65	55
I-215 SB Lane 3	2740	2759	1950	1950	1	0.92	0.04	0.04	1794	78	78	65	65	55
I-215 NB HOV	1430	1605	1500	1500	1	0.94	0.06	0.00	1410	90	0	65	65	0
I-215 SB HOV	1524	1551	1500	1500	1	0.94	0.06	0.00	1410	90	0	65	65	0
Barton NB Off ramp	706	935	1200	935	1	0.91	0.06	0.03	851	56	28	45	45	40
Barton NB On ramp	1095	922	1200	1095	1	0.91	0.06	0.03	996	66	33	65	65	55
Barton SB On ramp	1026	873	1200	1026	1	0.91	0.06	0.03	934	62	31	65	65	55
Barton SB Off ramp	710	889	1200	889	1	0.91	0.06	0.03	809	53	27	45	45	40
La Crosse (northern)	328	366	1000	366	1	1.00	0.00	0.00	366	0	0	30	0	0
Grand Terrace NB	253	78	1000	253	1	0.95	0.05	0.00	240	13	0	30	30	0
Grand Terrace SB	214	41	1000	214	1	0.95	0.05	0.00	203	11	0	30	30	0
Vivienda NB	220	68	1000	220	1	1.00	0.00	0.00	220	0	0	30	0	0
Vivienda SB	186	36	1000	186	1	1.00	0.00	0.00	186	0	0	30	0	0
La Crosse NB	24	71	1000	71	1	0.94	0.06	0.00	67	4	0	30	30	0
La Crosse SB	46	16	1000	46	1	0.94	0.06	0.00	43	3	0	30	30	0
Michigan NB	1079	880	1000	1000	1	0.92	0.06	0.02	920	60	20	35	35	30
Michigan SB	653	875	1000	875	1	0.92	0.06	0.02	805	53	18	35	35	30
Barton WB (La Cadena to SB Ramps)	769	992	1200	992	2	0.94	0.04	0.02	932	40	20	40	40	35
Barton WB (SB Ramps to NB Ramps)	1509	1402	1200	1200	2	0.94	0.04	0.02	1128	48	24	40	40	35
Barton WB (NB Ramp to Michigan)	2246	2023	1200	1200	2	0.94	0.04	0.02	1128	48	24	40	40	35
Barton WB (East of Michigan)	1490	1762	1200	1200	2	0.94	0.04	0.02	1128	48	24	40	40	35
Barton EB (La Cadena to SB Ramps)	868	1407	1200	1200	2	0.94	0.04	0.02	1128	48	24	40	40	35
Barton EB (SB Ramps to NB Ramps)	1136	1779	1200	1200	2	0.94	0.04	0.02	1128	48	24	40	40	35
Barton EB (NB Ramps and Michigan)	1483	2413	1200	1200	2	0.94	0.04	0.02	1128	48	24	40	40	35
Barton EB (East of Michigan)	1141	2146	1200	1200	2	0.94	0.04	0.02	1128	48	24	40	40	35

Modified Alternative 7 Traffic Volumes

Alternative 7 Modified	AM Peak	PM Peak	Worst-Case	Volume	No of Lanes	Vehicle Distribution			Modeled Traffic Volume			Vehicle Speeds		
						Auto	Med	Heavy	Auto	Med	Heavy	Auto	Med	Heavy
I-215 NB Lanes 1 & 2	5509	6329	3900	3900	2	0.92	0.04	0.04	2392	104	104	65	65	55
I-215 SB Lanes 1 & 2	5479	5519	3900	3900	2	0.92	0.04	0.04	2392	104	104	65	65	55
I-215 NB Lane 3	2754	3165	1950	1950	1	0.92	0.04	0.04	1794	78	78	65	65	55
I-215 SB Lane 3	2740	2759	1950	1950	1	0.92	0.04	0.04	1794	78	78	65	65	55
I-215 NB HOV	1430	1605	1500	1500	1	0.94	0.06	0.00	1410	90	0	65	65	0
I-215 SB HOV	1524	1551	1500	1500	1	0.94	0.06	0.00	1410	90	0	65	65	0
Barton NB Off ramp	706	935	1200	935	1	0.91	0.06	0.03	851	56	28	45	45	40
Barton NB On ramp	1095	922	1200	1095	1	0.91	0.06	0.03	996	66	33	65	65	55
Barton SB On ramp	1026	873	1200	1026	1	0.91	0.06	0.03	934	62	31	65	65	55
Barton SB Off ramp	688	883	1200	883	1	0.91	0.06	0.03	804	53	26	45	45	40
Grand Terrace NB	257	84	1000	257	1	0.95	0.05	0.00	244	13	0	30	30	0
Grand Terrace SB	214	41	1000	214	1	0.95	0.05	0.00	203	11	0	30	30	0
La Crosse NB	52	192	1000	192	1	0.94	0.06	0.00	180	12	0	30	30	0
La Crosse SB	61	70	1000	70	1	0.94	0.06	0.00	66	4	0	30	30	0
Vivienda NB	261	166	1000	261	1	1.00	0.00	0.00	261	0	0	30	0	0
Vivienda SB	186	36	1000	186	1	1.00	0.00	0.00	186	0	0	30	0	0
Commerce NB	1083	905	1000	1000	1	0.92	0.06	0.02	920	60	20	35	35	30
Commerce SB	686	882	1000	882	1	0.92	0.06	0.02	811	53	18	35	35	30
Michigan NB	1079	880	1000	1000	1	0.92	0.06	0.02	920	60	20	35	35	30
Michigan SB	653	876	1000	876	1	0.92	0.06	0.02	806	53	18	35	35	30
Barton WB (La Cadena to Grand Terrace)	818	1038	2400	1038	2	0.94	0.04	0.02	976	42	21	40	40	35
Barton WB (Grand Terrace to SB Ramps)	897	1136	2400	1136	2	0.94	0.04	0.02	1068	45	23	40	40	35
Barton WB (SB Ramps to NB Ramps)	1498	1391	2400	1498	2	0.94	0.04	0.02	1408	60	30	40	40	35
Barton WB (NB Ramps to Michigan/Vivienda)	2235	2012	2400	2235	2	0.94	0.04	0.02	2101	89	45	40	40	35
Barton WB (East of Michigan/Vivienda)	1445	1751	2400	1751	2	0.94	0.04	0.02	1646	70	35	40	40	35
Barton EB (La Cadena to Grand Terrace)	858	1212	2400	1212	2	0.94	0.04	0.02	1139	48	24	40	40	35
Barton EB (Grand Terrace to La Crosse/SB Ramps)	873	1514	2400	1514	2	0.94	0.04	0.02	1423	61	30	40	40	35
Barton EB (SB Ramps to NB Ramps)	1136	1779	2400	1779	2	0.94	0.04	0.02	1672	71	36	40	40	35
Barton EB (NB Ramps to Michigan/Vivienda)	1483	2413	2400	2400	2	0.94	0.04	0.02	2256	96	48	40	40	35
Barton EB (East of Michigan/Vivienda)	1015	2045	2400	2045	2	0.94	0.04	0.02	1922	82	41	40	40	35

Appendix B. Predicted Future Noise Levels and Noise Barrier Analysis

This appendix contains tables that summarize the traffic noise modeling results for existing, future No Build, and Modified Alternative 7 conditions. This table also compares the predicted noise reductions by barrier height for each noise barrier analyzed.

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Table B-1. Predicted Future Noise and Noise Barrier Analysis along the State ROW or ES for Modified Alternative 7

Receptor No.	SB No.	Location	Land Use	No. of Dwelling Units / Receptors	Adjusted Existing Noise Level, dBA L_{eq}(h)	2040 Noise Level: Without Project	2040 Noise Level: With Project	2040 Noise Level: With Project Minus No Project Conditions	2040 Noise Level: With Project Minus Existing Conditions	Activity Category (NAC)	Impact Type	6 ft L_{eq}(h)	6 ft I.L.[1]	6 ft NBR	8 ft L_{eq}(h)	8 ft I.L.	8 ft NBR	10 ft L_{eq}(h)	10 ft I.L.	10 ft NBR	12 ft L_{eq}(h)	12 ft I.L.	12 ft NBR	14 ft L_{eq}(h)	14 ft I.L.	14 ft NBR	16 ft L_{eq}(h)	16 ft I.L.	16 ft NBR
						Future Worst-Hour Noise Levels, dBA L_{eq}(h) — Noise Prediction With Barrier, Barrier Insertion Loss (I.L.), and Number of Benefited Receptors (NBR)																							
R-1	22a & 22b	De Berry Street	Residential	3	65	**66**[2]	**67**	1	2	B(67)	None	**66**	1	0	65	2	0	64	3	0	63	4	0	62[3]	5	3	60	7	3
R-2		De Berry Street	Residential	1	53	55	57	2	4	B(67)	None	--[4]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-3		Rene Lane	Residential	1	51	53	56	3	5	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-4		De Berry Street	Residential	1	51	54	56	2	5	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-5		De Berry Street	Residential	1	51	53	55	2	4	B(67)	A/E[5]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-6		Rene Lane	Residential	1	50	53	56	3	6	B(67)	A/E	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-7		Rene Lane	Residential	1	49	53	55	2	6	B(67)	A/E	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-8		Rene Lane	Residential	1	50	54	55	1	5	B(67)	A/E	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-9		Rene Lane	Residential	1	52	57	56	-1	4	B(67)	A/E	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-10		Rene Lane	Residential	2	56	62	60	-2	4	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-11		Michigan Street	Residential	1	55	60	59	-1	4	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-12		Michigan Street	Residential	1	54	59	59	0	5	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-13		Michigan Street	Residential	1	55	60	61	1	6	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-14		Michigan Street	Residential	1	49	54	53	-1	4	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-15		Michigan Street	Residential	1	47	51	53	2	6	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-16		Michigan Street	Residential	1	49	53	56	3	7	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-17		Barton Road	Residential	3	59	62	64	2	5	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-18		Barton Road	Residential	1	58	61	62	1	4	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-19		Barton Road	Residential	2	61	64	**66**	2	5	B(67)	None	NF[6]	NF	0	NF	NF	0	NF	NF	0	NF	NF	0	NF	NF	0	NF	NF	0
R-20		Barton Road	Residential	2	56	59	60	1	4	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-21		Barton Road	Residential	2	58	61	63	2	5	B(67)	A/E	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-22		Barton Road	School	1[1]	57	65	65	0	8	C(67)	None	--[7]	--[7]	0	64	1	0	64	1	0	64	1	0	63	2	0	NP[8]	NP	0
R-23		Vivienda Avenue	School	3[1]	**68**	**69**	**72**	3	4	C(67)	A/E	**70**	2	0	**68**	4	0	**66**	6	3	65	7	3	63	9	3	NP	NP	0
R-24		Vivienda Avenue	School	3[1]	**70**	**71**	**72**	1	2	C(67)	A/E	**71**	1	0	**69**	3	0	**67**	5	3	65	7	3	63	9	3	NP	NP	0
R-25		Vivienda Avenue	School	3[1]	**73**	**74**	**75**	1	2	C(67)	None	**74**	1	0	**72**	3	0	**69**	6	3	**66**	9	3	64	11	3	NP	NP	0
R-26		Vivienda Avenue	Residential	1	61	63	63	0	2	B(67)	None	62	1	0	61	2	0	61	2	0	60	3	0	59	4	0	NP	NP	0
R-27	23a & 23b	Vivienda Court	Residential	1	**70**	**71**	**71**	0	1	B(67)	None	**68**	3	0	**66**	5	1	65	6	1	63	8	1	62	9	1	NP	NP	0
R-28		Vivienda Court	Residential	1	**74**	**75**	**75**	0	1	B(67)	None	**71**	4	0	**68**	7	1	**66**	9	1	64	11	1	63	12	1	NP	NP	0
R-29		Vivienda Avenue	Residential	2	**69**	**70**	**70**	0	1	B(67)	None	**67**	3	0	**66**	4	0	65	5	2	63	7	2	61	9	2	NP	NP	0
R-30		Vivienda Avenue	Residential	2	**68**	**69**	**69**	0	1	B(67)	None	**67**	2	0	**66**	3	0	65	4	0	64	5	2	63	6	2	NP	NP	0
R-31		Vivienda Avenue	Residential	2	**67**	**68**	**68**	0	1	B(67)	None	**67**	1	0	65	3	0	64	4	0	62	6	2	62	6	2	NP	NP	0
R-32		Vivienda Avenue	Residential	1	**69**	**70**	**70**	0	1	B(67)	None	--[7]	--[7]	0	**67**	3	0	**66**	4	0	65	5	1	63	7	1	NP	NP	0
R-33		Vivienda Avenue	Residential	1	62	63	64	1	2	B(67)	None	--[7]	--[7]	0	62	2	0	62	2	0	61	3	1	59	5	1	NP	NP	0
R-34		Pascal Avenue	Residential	2	64	65	65	0	1	B(67)	A/E	--[7]	--[7]	0	63	2	0	62	3	0	61	4	0	60	5	2	NP	NP	0
R-35		Pascal Avenue	Residential	2	**74**	**75**	**75**	0	1	B(67)	A/E	--[7]	--[7]	0	**69**	6	2	**67**	8	2	65	10	2	64	11	2	NP	NP	0
R-36	23a & 23b	Pascal Avenue	Residential	3	53	54	--[9]	--	--	B(67)	None	--[7]	--[7]	0	52	1	0	52	1	0	51	2	0	50	3	0	NP	NP	0
R-37		Pascal Avenue	Residential	2	55	55	--[9]	--	--	B(67)	None	--[7]	--[7]	0	53	2	0	53	2	0	52	3	0	51	4	0	NP	NP	0
R-38		Victoria Street	Residential	2	56	56	--[9]	--	--	B(67)	None	--[7]	--[7]	0	55	1	0	55	1	0	54	2	0	53	3	0	NP	NP	0
R-39		Victoria Street	Residential	1	**73**	**73**	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-40		Victoria Street	Residential	1	**69**	**69**	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table B-1. Predicted Future Noise and Noise Barrier Analysis along the State ROW or ES for Modified Alternative 7

Receptor No.	SB No.	Location	Land Use	No. of Dwelling Units / Receptors	Adjusted Existing Noise Level, dBA $L_{eq}(h)$	Future Worst-Hour Noise Levels, dBA $L_{eq}(h)$																							
						2040 Noise Level				Activity Category (NAC)	Impact Type	Noise Prediction With Barrier, Barrier Insertion Loss (I.L.), and Number of Benefited Receptors (NBR)																	
												6 ft			8 ft			10 ft			12 ft			14 ft			16 ft		
						Without Project	With Project	With Project Minus No Project Conditions	With Project Minus Existing Conditions			$L_{eq}(h)$	I.L.[1]	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR
R-41		Canal Street	Residential	1	**66**	**66**	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-42		Newport Avenue	Residential	1	**68**	**69**	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-43		Barton Road	Residential	1	56	62	63	1	7	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-44		Vivienda Avenue	Residential	1	56	60	62	2	6	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-45		McClarren Street	Residential	3	55	59	60	1	5	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-46	23a & 23b	Carhart Avenue	Residential	1	57	59	59	0	2	B(67)	None	57	2	0	56	3	0	56	3	0	55	4	0	54	5	1	NP	NP	0
R-47		Carhart Avenue	Residential	1	53	54	54	0	1	B(67)	None	53	1	0	53	1	0	53	1	0	52	2	0	51	3	0	NP	NP	0
R-48		Carhart Avenue	Residential	2	57	58	58	0	1	B(67)	None	57	1	0	57	1	0	56	2	0	55	3	0	54	4	0	NP	NP	0
R-49		Vivienda Avenue	Residential	2	52	53	53	0	1	B(67)	None	52	1	0	52	1	0	52	1	0	51	2	0	50	3	0	NP	NP	0
R-50		Pascal Avenue	Residential	2	57	58	58	0	1	B(67)	None	57	1	0	57	1	0	56	2	0	55	3	0	54	4	0	NP	NP	0
R-51		Pascal Avenue	Residential	3	55	56	56	0	1	B(67)	None	54	2	0	54	2	0	54	2	0	53	3	0	52	4	0	NP	NP	0
R-52		Canal Street	Apartment	6	50	51	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-53		Canal Street	Apartment	8	55	56	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-54		Canal Street	Apartment	6	57	58	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-55		Canal Street	Apartment	8	52	54	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-56		Canal Street	Apartment	8	55	57	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-57		Canal Street	Apartment	8	54	55	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-58		Canal Street	Apartment	8	54	55	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-59		Canal Street	Residential	8	54	55	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-60	24	Grand Terrace Road	RV Park	1	60	61	**68**	7	8	B(67)	None	64	4	0	63	5	1	62	6	0	62	6	1	61	7	1	61	7	1
R-61		Grand Terrace Road	RV Park	9	60	60	64	4	4	B(67)	None	62	2	0	62	2	0	61	3	0	61	3	0	61	3	0	61	3	0
R-62		Grand Terrace Road	RV Park	8	60	60	63	3	3	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-63		Grand Terrace Road	RV Park	8	60	60	62	2	2	B(67)	None	--[7]	--[7]	--	--[7]	--[7]	--	--[7]	--[7]	--	--[7]	--[7]	--	--	--	--	--	--	--
R-64		Grand Terrace Road	RV Park	8	59	60	62	2	3	B(67)	None	--[7]	--[7]	--	--[7]	--[7]	--	--[7]	--[7]	--	--[7]	--[7]	--	--	--	--	--	--	--
R-65		Grand Terrace Road	RV Park	8	59	60	61	1	2	B(67)	None	--[7]	--[7]	--	--[7]	--[7]	--	--[7]	--[7]	--	--[7]	--[7]	--	--	--	--	--	--	--
R-66		Grand Terrace Road	RV Park	9	59	60	61	1	2	B(67)	None	--[7]	--[7]	--	--[7]	--[7]	--	--[7]	--[7]	--	--[7]	--[7]	--	--	--	--	--	--	--
R-67	25	Vivienda Avenue	Residential	1	**69**	**70**	**70**	0	1	B(67)	None	65	5	1	64	6	1	63	7	1	62	8	1	62	8	1	NP	NP	0
R-68		La Crosse Avenue	Residential	1	**69**	**70**	**70**	0	1	B(67)	None	64	6	1	63	7	1	62	8	1	61	9	1	61	9	1	NP	NP	0
R-69		La Crosse Avenue	Residential	1	**70**	**71**	--[10]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-70	24	Grand Terrace Road	Mobile Home	4	62	63	**66**	3	4	B(67)	None	--[7]	--[7]	--	64	2	0	63	3	0	62	4	0	62	4	0	62	4	0
R-71		Grand Terrace Road	Mobile Home	3	60	61	64	3	4	B(67)	None	--[7]	--[7]	--	62	2	0	61	3	0	61	3	0	61	3	0	61	3	0
R-72		Grand Terrace Road	Mobile Home	2	60	61	63	2	3	B(67)	None	--[7]	--[7]	--	61	2	0	61	2	0	61	2	0	61	2	0	60	3	0
R-73		Grand Terrace Road	Mobile Home	4	59	60	61	1	2	B(67)	None	--[7]	--[7]	--	60	1	0	60	1	0	60	1	0	60	1	0	60	1	0
R-74		Grand Terrace Road	Mobile Home	2	60	60	61	1	1	B(67)	None	--[7]	--[7]	--	60	1	0	60	1	0	60	1	0	60	1	0	60	1	0
R-75		Grand Terrace Road	Mobile Home	4	59	59	60	1	1	B(67)	None	--[7]	--[7]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-76		Grand Terrace Road	Mobile Home	4	59	60	60	0	1	B(67)	None	--[7]	--[7]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-77	24	Grand Terrace Road	Mobile Home	4	63	64	**67**	3	4	B(67)	None	--[7]	--[7]	--	63	4	0	63	4	0	62	5	0	62	5	4	62	5	4
R-78		Grand Terrace Road	Mobile Home	4	60	61	65	4	5	B(67)	None	--[7]	--[7]	--	62	3	0	62	3	0	61	4	0	61	4	0	61	4	0
R-79		Grand Terrace Road	Mobile Home	3	60	60	62	2	2	B(67)	None	--[7]	--[7]	--	61	1	0	61	1	0	61	1	0	60	2	0	60	2	0
R-80		Grand Terrace Road	Mobile Home	4	60	60	61	1	1	B(67)	None	--[7]	--[7]	--	60	1	0	60	1	0	60	1	0	60	1	0	60	1	0

Table B-1. Predicted Future Noise and Noise Barrier Analysis along the State ROW or ES for Modified Alternative 7

Receptor No.	SB No.	Location	Land Use	No. of Dwelling Units / Receptors	Adjusted Existing Noise Level, dBA L_{eq}(h)	Future Worst-Hour Noise Levels, dBA L_{eq}(h)																							
						2040 Noise Level				Activity Category (NAC)	Impact Type	Noise Prediction With Barrier, Barrier Insertion Loss (I.L.), and Number of Benefited Receptors (NBR)																	
												6 ft			8 ft			10 ft			12 ft			14 ft			16 ft		
						Without Project	With Project	With Project Minus No Project Conditions	With Project Minus Existing Conditions			L_{eq}(h)	I.L.[1]	NBR	L_{eq}(h)	I.L.	NBR	L_{eq}(h)	I.L.	NBR	L_{eq}(h)	I.L.	NBR	L_{eq}(h)	I.L.	NBR	L_{eq}(h)	I.L.	NBR
R-81		Grand Terrace Road	Mobile Home	3	59	60	61	1	2	B(67)	None	--[7]	--[7]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-82		Grand Terrace Road	Mobile Home	3	59	60	60	0	1	B(67)	None	--[7]	--[7]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-83		Grand Terrace Road	Mobile Home	2	63	**66**	**67**	1	4	B(67)	None	--[7]	--[7]	--	64	3	0	63	4	0	63	4	0	63	4	0	63	4	0
R-84		Grand Terrace Road	Mobile Home	3	60	63	63	0	3	B(67)	None	--[7]	--[7]	--	62	1	0	62	1	0	62	1	0	62	1	0	62	1	0
R-85	24	Grand Terrace Road	Mobile Home	3	61	61	62	1	1	B(67)	None	--[7]	--[7]	--	61	1	0	61	1	0	61	1	0	61	1	0	61	1	0
R-86		Grand Terrace Road	Mobile Home	4	60	62	62	0	2	B(67)	None	--[7]	--[7]	--	62	0	0	62	0	0	62	0	0	62	0	0	62	0	0
R-87		Grand Terrace Road	Mobile Home	1	60	61	61	0	1	B(67)	None	--[7]	--[7]	--	61	0	0	61	0	0	61	0	0	61	0	0	61	0	0
R-88		Grand Terrace Road	Mobile Home	3	59	61	62	1	3	B(67)	None	--[7]	--[7]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-89		Grand Terrace Road	Mobile Home	1	59	61	61	0	2	B(67)	None	--[7]	--[7]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-90		Vivienda Avenue	Residential	1	61	62	62	0	1	B(67)	None	61	1	0	61	1	0	61	1	0	60	2	0	60	2	0	NP	NP	0
R-91	25	Vivienda Avenue	Residential	1	60	61	61	0	1	B(67)	None	60	1	0	60	1	0	60	1	0	60	1	0	60	1	0	NP	NP	0
R-92		Vivienda Avenue	Residential	1	60	60	60	0	0	B(67)	None	60	0	0	60	0	0	60	0	0	60	0	0	60	0	0	NP	NP	0
R-93		Grand Terrace Road	Residential	1	58	58	58	0	0	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-94		Grand Terrace Road	Residential	1	58	58	58	0	0	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-95		Grand Terrace Road	Residential	1	58	58	58	0	0	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-96		Grand Terrace Road	Residential	1	58	58	58	0	0	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-97		Grand Terrace Road	Residential	1	58	58	58	0	0	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-98		Grand Terrace Road	Residential	1	58	58	58	0	0	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-99		Grand Terrace Road	Residential	2	58	58	58	0	0	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-100		Grand Terrace Road	Residential	2	58	59	59	0	1	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-101		Grand Terrace Road	Residential	1	59	59	59	0	0	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-102		Grand Terrace Road	Residential	1	59	59	59	0	0	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-103		Grand Terrace Road	Residential	1	59	59	59	0	0	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-104		Grand Terrace Road	Residential	1	59	59	59	0	0	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-105		Grand Terrace Road	Residential	1	59	59	59	0	0	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-106		Grand Terrace Road	Residential	1	59	60	60	0	1	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-107		Grand Terrace Road	Residential	1	62	63	63	0	1	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-108		Vivienda Avenue	Residential	1	60	61	61	0	1	B(67)	None	60	1	0	60	1	0	60	1	0	60	1	0	60	1	1	NP	NP	0
R-109		Vivienda Avenue	Residential	1	62	63	63	0	1	B(67)	None	61	2	0	61	2	0	61	2	0	60	3	0	60	3	1	NP	NP	0
R-110		Vivienda Avenue	Residential	2	63	64	63	-1	0	B(67)	None	62	1	0	61	2	0	61	2	0	61	2	0	60	3	2	NP	NP	0
R-111		Vivienda Avenue	Residential	1	65	**66**	**66**	0	1	B(67)	None	64	2	0	63	3	0	62	4	0	62	4	0	61	5	1	NP	NP	0
R-112	25	Vivienda Avenue	Residential	1	**70**	**71**	**71**	0	1	B(67)	None	**67**	4	0	66	5	1	65	6	1	63	8	1	63	8	1	NP	NP	0
R-113		Newport Avenue	Mobile Home	2	63	64	65	1	2	B(67)	None	65	0	0	64	1	0	63	2	0	62	3	0	61	4	2	NP	NP	0
R-114		Newport Avenue	Mobile Home	2	62	63	63	0	1	B(67)	None	62	1	0	62	1	0	61	2	0	60	3	0	60	3	2	NP	NP	0
R-115		Newport Avenue	Mobile Home	2	**66**	**66**	**67**	1	1	B(67)	None	**66**	1	0	65	2	0	64	3	0	63	4	0	62	5	2	NP	NP	0
R-116		Newport Avenue	Mobile Home	2	**66**	**66**	**66**	0	0	B(67)	None	63	3	0	63	3	0	62	4	0	61	5	2	60	6	2	NP	NP	0
R-117		Newport Avenue	Mobile Home	2	63	63	63	0	0	B(67)	None	62	1	0	62	1	0	61	2	0	60	3	0	60	3	0	NP	NP	0
R-118		Newport Avenue	Mobile Home	2	60	60	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-119		Newport Avenue	Mobile Home	2	60	60	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-120		Newport Avenue	Mobile Home	1	59	59	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table B-1. Predicted Future Noise and Noise Barrier Analysis along the State ROW or ES for Modified Alternative 7

Receptor No.	SB No.	Location	Land Use	No. of Dwelling Units / Receptors	Adjusted Existing Noise Level, dBA $L_{eq}(h)$	Future Worst-Hour Noise Levels, dBA $L_{eq}(h)$																							
						2040 Noise Level				Activity Category (NAC)	Impact Type	Noise Prediction With Barrier, Barrier Insertion Loss (I.L.), and Number of Benefited Receptors (NBR)																	
												6 ft			8 ft			10 ft			12 ft			14 ft			16 ft		
						Without Project	With Project	With Project Minus No Project Conditions	With Project Minus Existing Conditions			$L_{eq}(h)$	I.L.[1]	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR
R-121	25	Newport Avenue	Mobile Home	5	64	64	65	1	1	B(67)	None	64	1	0	63	2	0	62	3	0	61	4	0	<u>60</u>	<u>5</u>	5	NP	NP	0
R-122		Newport Avenue	Mobile Home	2	63	64	64	0	1	B(67)	None	63	1	0	63	1	0	62	2	0	61	3	0	61	3	0	NP	NP	0
R-123		Newport Avenue	Mobile Home	1	64	65	65	0	1	B(67)	None	65	0	0	64	1	0	63	2	0	62	3	0	61	4	0	NP	NP	0
R-124		Newport Avenue	Mobile Home	2	61	62	62	0	1	B(67)	None	62	0	0	61	1	0	61	1	0	60	2	0	60	2	0	NP	NP	0
R-125		Newport Avenue	Mobile Home	4	60	60	60	0	0	B(67)	None	60	0	0	60	0	0	59	1	0	59	1	0	59	1	0	NP	NP	0
R-126		Newport Avenue	Mobile Home	3	60	60	60	0	0	B(67)	None	59	1	0	59	1	0	59	1	0	59	1	0	59	1	0	NP	NP	0
R-127		Newport Avenue	Mobile Home	4	59	59	59	0	0	B(67)	None	59	0	0	59	0	0	59	0	0	59	0	0	59	0	0	NP	NP	0
R-128		Newport Avenue	Mobile Home	3	59	59	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-129		Newport Avenue	Mobile Home	4	59	59	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-130		Newport Avenue	Mobile Home	3	59	59	--[9]	--	--	B(67)	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-131		Taylor Street	Light Industrial	1	68	70	71	1	3	F	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-132		S. Iowa Avenue	Commercial	1	70	71	72	1	2	F	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-133		De Berry Street	Light Industrial	1	73	74	75	1	2	F	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-134		De Berry Street	Vacant Land	1	69	70	70	0	1	G	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-135		De Berry Street	Light Industrial	1	72	74	74	0	2	F	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-136		La Crosse Avenue	Light Industrial	1	72	73	73	0	1	F	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-137		Commerce Way	Light Industrial	1	63	64	--[10]	--	--	F	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-138		Michigan Avenue	Light Industrial	1	53	55	60	5	7	F	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-139		Barton Road	Light Industrial	1	58	60	60	0	2	F	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-140		Barton Road	Light Industrial	1	61	62	64	2	3	F	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-141		Barton Road	Commercial	1	61	62	65	3	4	F	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-142		Barton Road	Commercial	1	66	70	73	3	7	F	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
R-143		Barton Road	Restaurant	1	66	70	**72**	2	6	E(72)	None	NF	NF	0	NF	NF	0	NF	NF	0	NF	NF	0	NF	NF	0	NF	NF	0
R-144		Newport Avenue	Utilities	1	60	60	--[9]	--	--	F	None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EI	23a & 23b	De Berry Street	Residential	3	--	--	73/**51**[10]	--	--	--	None	70/48	3	0	<u>67/45</u>	<u>6</u>	3	<u>66/44</u>	<u>7</u>	3	<u>63/41</u>	<u>10</u>	3	<u>62/40</u>	<u>11</u>	3	NP	NP	3

Source: LSA Associates, Inc., September 2013.

1. I.L.: Insertion Loss.
2. Numbers in **bold** represent noise levels that approach or exceed the NAC.
3. Underlined noise levels have been attenuated by at least 5 dBA (i.e., feasible barrier height).
4. Either no barrier was analyzed at this location because the modeled receiver would not approach or exceed the NAC or this receiver would be acquired under this alternative.
5. A/E = Approach or exceed the NAC.
6. NF = Not Feasible.
7. Shaded area represents the existing wall height.
8. NP = Not Permitted. Noise barriers within 15 ft of the nearest travel lane are not permitted to exceed 14 ft in height.
9. Noise levels for this receiver are not shown because it is located beyond the limits of construction under Modified Alternative 7.
10. This receiver would be acquired under Modified Alternative 7.

dBA $L_{eq}(h)$ = equivalent continuous sound level per hour measured in A-weighted decibels
EI = Exterior to Interior measurement
ft = foot/feet
NAC = Noise Abatement Criteria
SB = Sound Barrier

Table B-2. Predicted Future Noise and Noise Barrier Analysis along the PL for Modified Alternative 7

Receptor No.	SB No.	Location	Land Use	No. of Dwelling Units / Receptors	Adjusted Existing Noise Level, dBA $L_{eq}(h)$	Future Worst-Hour Noise Levels, dBA $L_{eq}(h)$																							
						2040 Noise Level				Activity Category (NAC)	Impact Type	Noise Prediction With Barrier, Barrier Insertion Loss (I.L.), and Number of Benefited Receptors (NBR)																	
												6 ft			8 ft			10 ft			12 ft			14 ft			16 ft		
						Without Project	With Project	With Project Minus No Project Conditions	With Project Minus Existing Conditions			$L_{eq}(h)$	I.L.[1]	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR
R-115	26	Newport Avenue	Mobile Home	2	**66**[2]	**66**	**67**	1	1	B(67)	None	64	3	0	62[3]	5	2	60	7	2	60	7	2	59	8	2	59	8	2
R-116		Newport Avenue	Mobile Home	2	**66**	**66**	**66**	0	0	B(67)	None	64	2	0	61	5	2	60	6	2	60	6	2	59	7	2	59	7	2
R-123		Newport Avenue	Mobile Home	1	64	65	65	0	1	B(67)	None	64	1	0	61	4	0	60	5	2	60	5	2	59	6	2	59	6	2

Source: LSA Associates, Inc., September 2013.

1 I.L.: Insertion Loss.

2 Numbers in **bold** represent noise levels that approach or exceed the NAC.

3 Underlined noise levels have been attenuated by at least 5 dBA (i.e., feasible barrier height).

dBA L_{eq} = equivalent continuous sound level measured in A-weighted decibels

ft = feet

NAC = Noise Abatement Criteria

PL = property line

SB = Sound Barrier

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Appendix C. Supplemental Data

This appendix contains the noise monitoring results, and sound level calibration certifications. Other supplemental data include the justifications of receiver and building row elevations located outside of the topographic map coverage and the description of each TNM 2.5 file

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SHORT-TERM NOISE LEVEL MEASUREMENTS

Sheet _____ of _____

NOISE MEASUREMENT SURVEY

Site Number: M-1 Date: 11-6-2008 Time: From 2:20 To 2:35 PM

Site Location: 21875 DeBerry Street, FRONT SEATING AREA

Noise Sources: TRAFFIC ON I-215

Measurement Results (dBA)

Leq 64.2
Lmax 70.1
Lmin 60.1
Lpeak 88.8
L2 67.1
L8 66.0
L25 64.8
L50 63.8
SEL 93.8

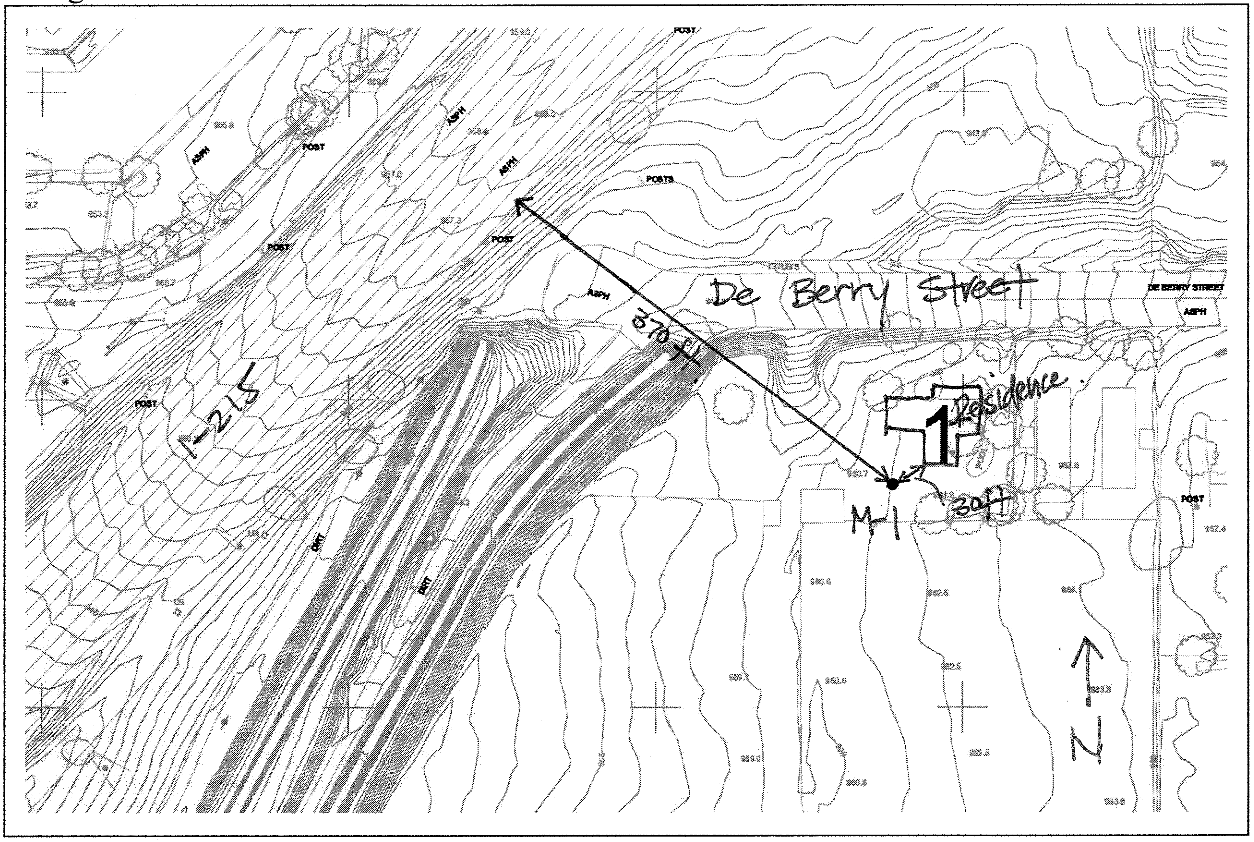
Comments: Vacant area B/w I-215 and house
NO EXISTING BARRIER

Equipment: LARSON DAVIS 824 MODEL Sound METER

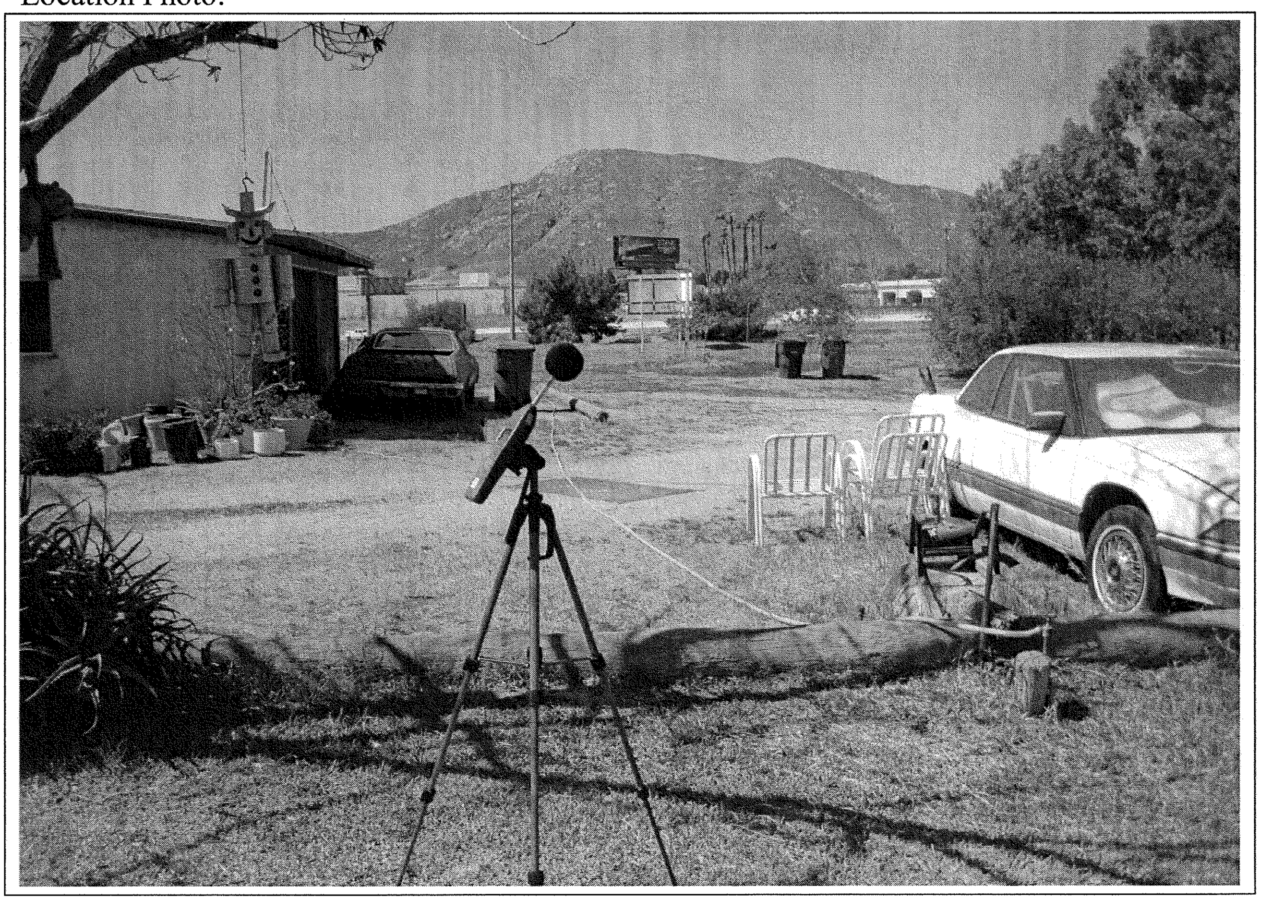
Atmospheric Conditions: to the SE
Wind Velocity: Ave. 6.0 / MAX 11.3 (MPH); Temperature: 79.8 (F)
Relative Humidity: 13.6 (%)

Test Personnel: TEAK KIM

Diagram:



Location Photo:



Sheet _____ of _____

NOISE MEASUREMENT SURVEY

Site Number: 2 Date: 2/2/10 Time: From 11:32 To 11:47

Site Location: 12175 Michigan Ave on North edge of yard, no noise shielding - only chain link fence. House is abandoned.

Noise Sources: Light traffic on Michigan Ave. The trucks coming from both ways turn across the street onto Commerce Way. Can not hear freeway from this location

Measurement Results (dBA)

Leq 51.6
Lmax 61.7
Lmin 43.1
Lpeak 79.0
L2 57.1
L8 54.7
L25 52.2
L50 50.4
SEL 81.6

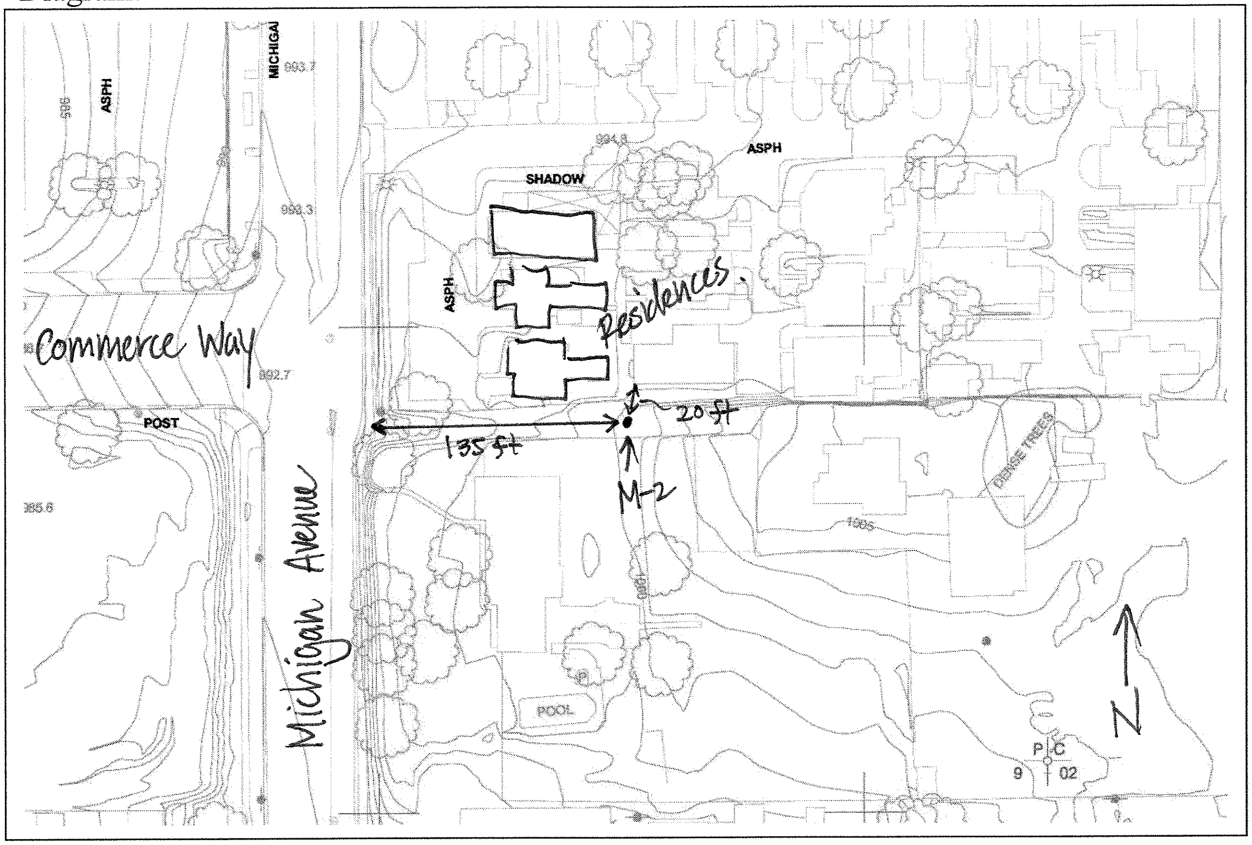
Comments:

Equipment: Larson Davis 824 Sound Level Meter

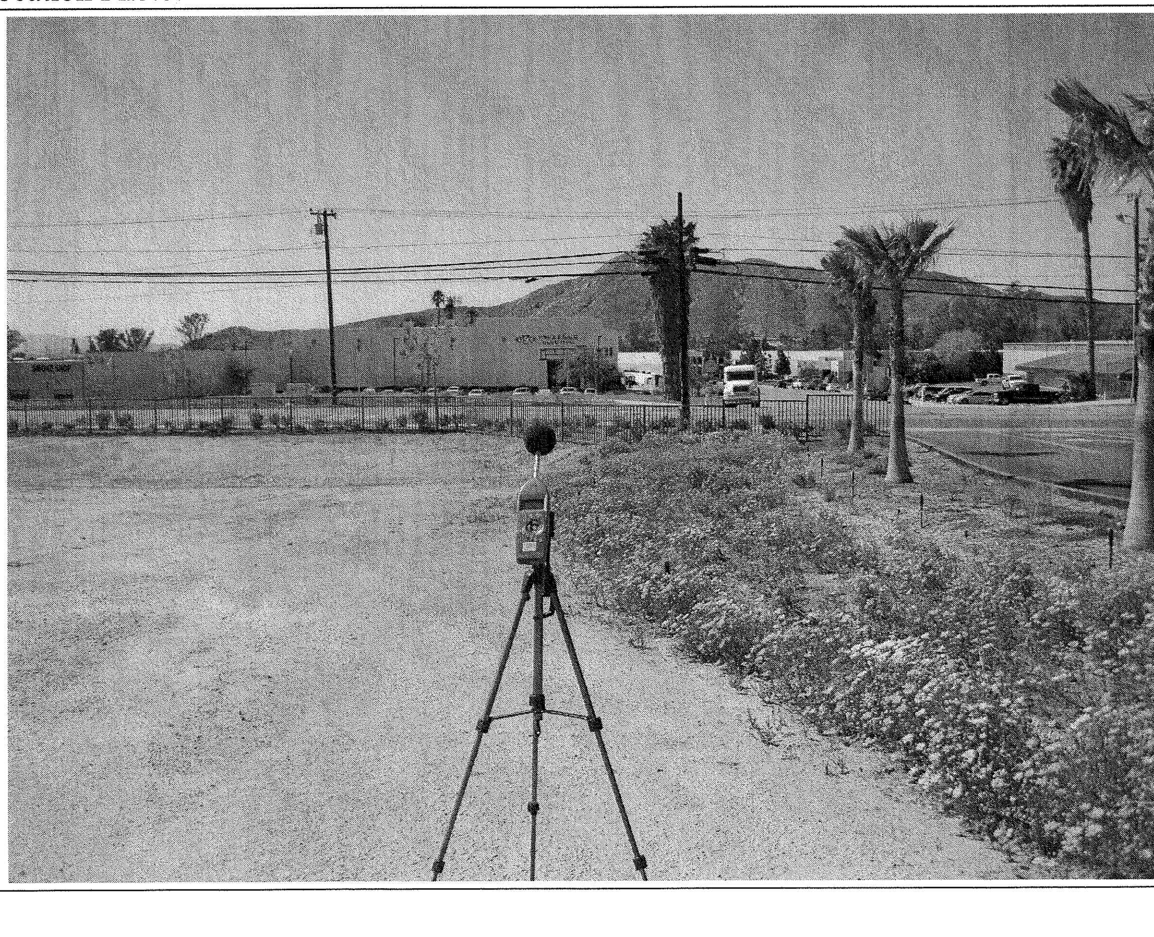
Atmospheric Conditions: Max/Avg
Wind Velocity: 1.7/0.8 (MPH); Temperature: 68.9° (F)
Relative Humidity: 40 (%)

Test Personnel: Corey Knips

Diagram:



Location Photo:



Sheet _____ of _____

NOISE MEASUREMENT SURVEY

Site Number: M-3 Date: 1-21-09 Time: From 10:09 To 10:24 am

Site Location: 22270 Barton Rd. Grand Terrace, CA
IN THE Backyard near the patio

Noise Sources: Barton Road Traffic
FAINT AIRCRAFT Noise

Measurement Results (dBA)

Leq 54.8
Lmax 65.4
Lmin 45.2
Lpeak 86.5
L2 60.7
L8 58.4
L25 55.8
L50 53.2
SEL

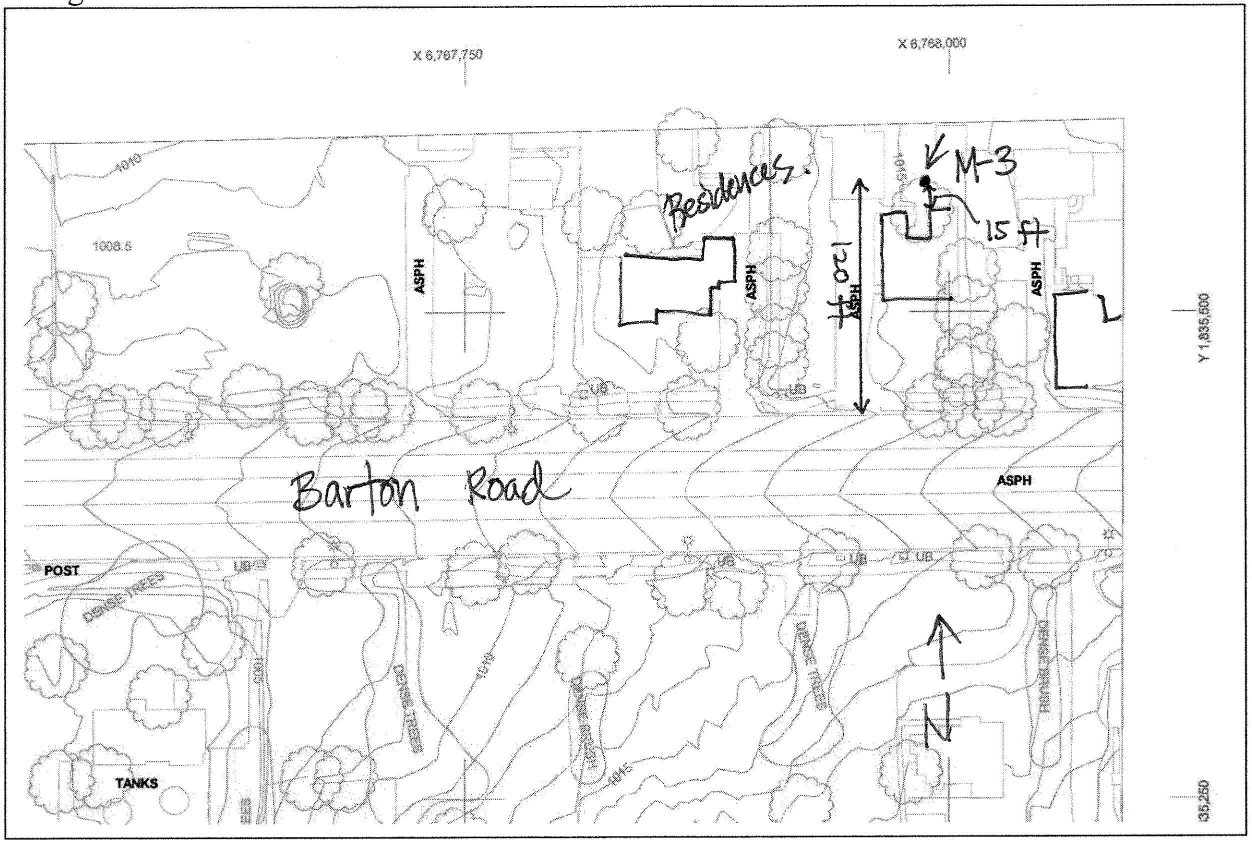
Comments: House was for sale with no current resident

Equipment: Larson Davis 820

Atmospheric Conditions: MAX. Avg.
Wind Velocity: 1.1 / 0.6 (MPH); Temperature: 67.5 (F)
Relative Humidity: 67.6 (%)

Test Personnel: Ryo Braco

Diagram:



Location Photo:

Sheet _____ of _____

NOISE MEASUREMENT SURVEY

Site Number: M-4 Date: 1/21/09 Time: From 9:05 To 9:30 a.m.

Site Location: 12066 Vivienda Avenue
END OF VIVIEND Avenue on Dirt between
Vivienda Avenue and School Parking lot.

Noise Sources: I-215 TRAFFIC
One car starting nearby in the parking lot.

Measurement Results (dBA)

Leq 71.2
Lmax 76.5
Lmin 63.9
Lpeak 94.9
L2 74.4
L8 73.2
L25 71.8
L50 70.9
SEL

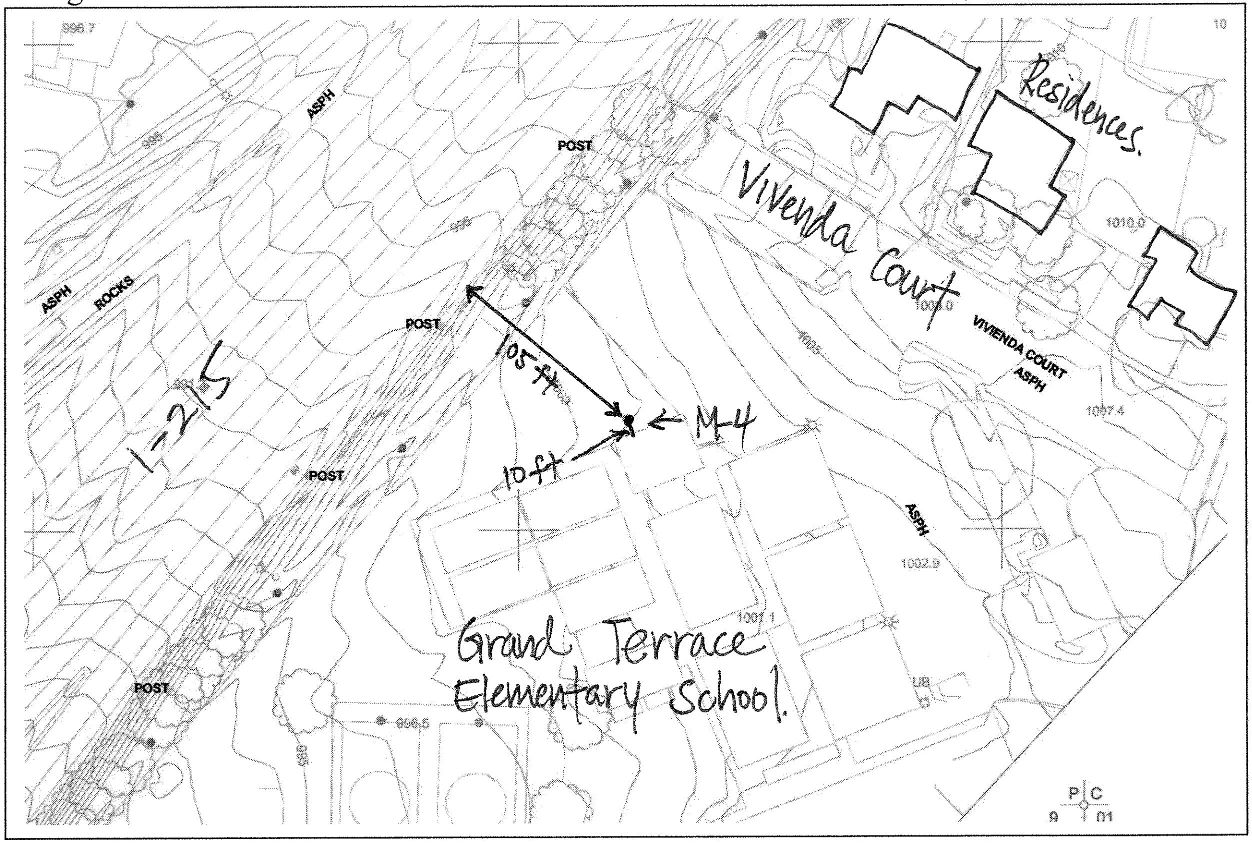
Comments: Free flowing traffic,

Equipment: Larson Davis 820

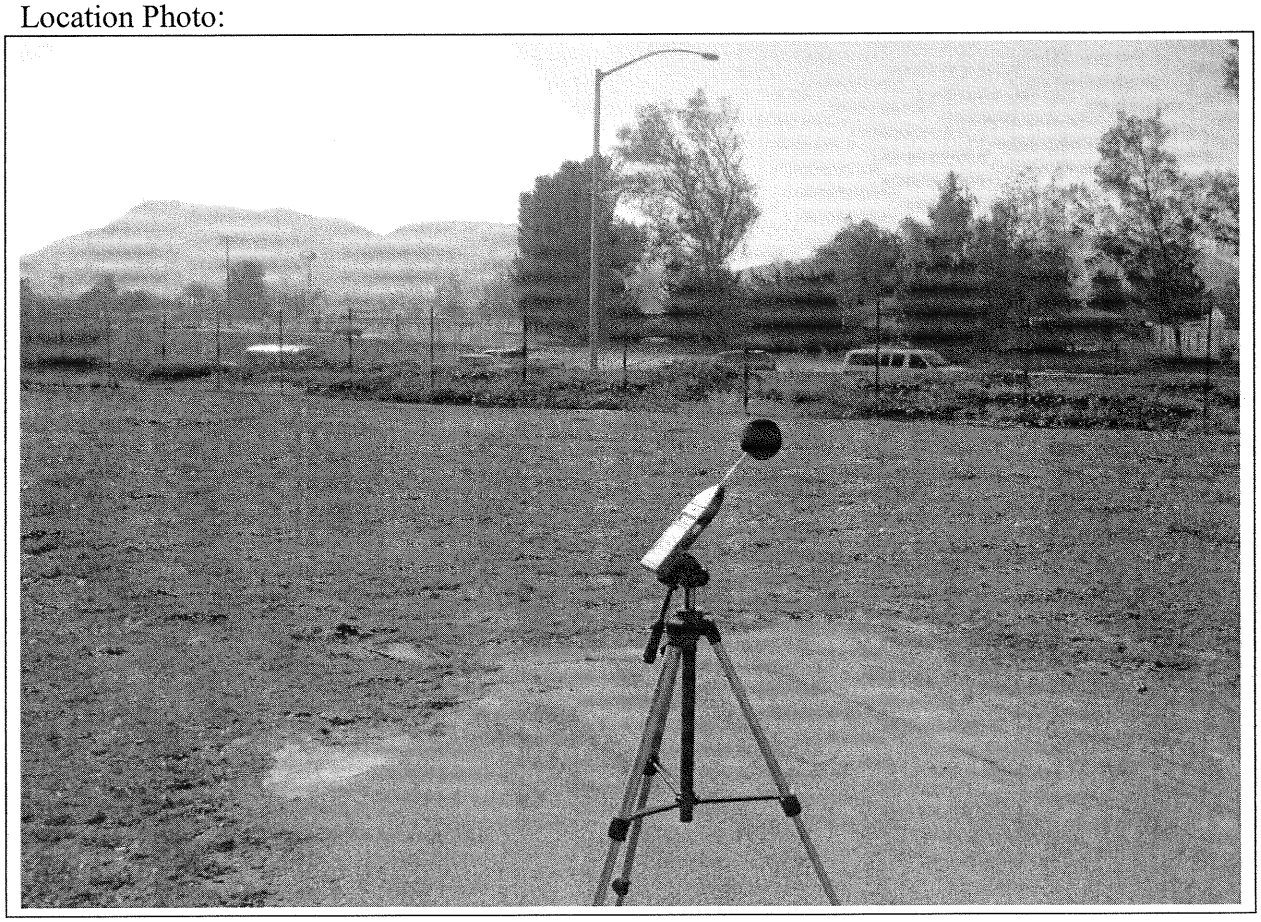
Atmospheric Conditions: MAX. AVG.
Wind Velocity: 3.2/1.8 (MPH); Temperature: 66.2 (F)
Relative Humidity: 50.3 (%)

Test Personnel: Ryo Braco

Diagram:



Location Photo:



Sheet _____ of _____

NOISE MEASUREMENT SURVEY

Site Number: M-5 **Date:** 11/6/08 **Time: From** 10:42 A.M **To** 10:57

Site Location: 11948 Vivienda Ct, between wall and I-215

Noise Sources: I-215 freeway traffic, noisy dogs next door

#2

Measurement Results (dBA)

Leq	75.3
Lmax	87.4
Lmin	64.6
Lpeak	107.8
L2	79.3
L8	77.5
L25	76.0
L50	74.6
SEL	104.9

Comments: Meter is between property wall and I-215, ground level where meter is located is approximately 4 feet above freeway. There are some tall trees diagonally to the right and left of meter, but it it clear between meter and the freeway

Equipment: Larson Davis 824 Noise Meter

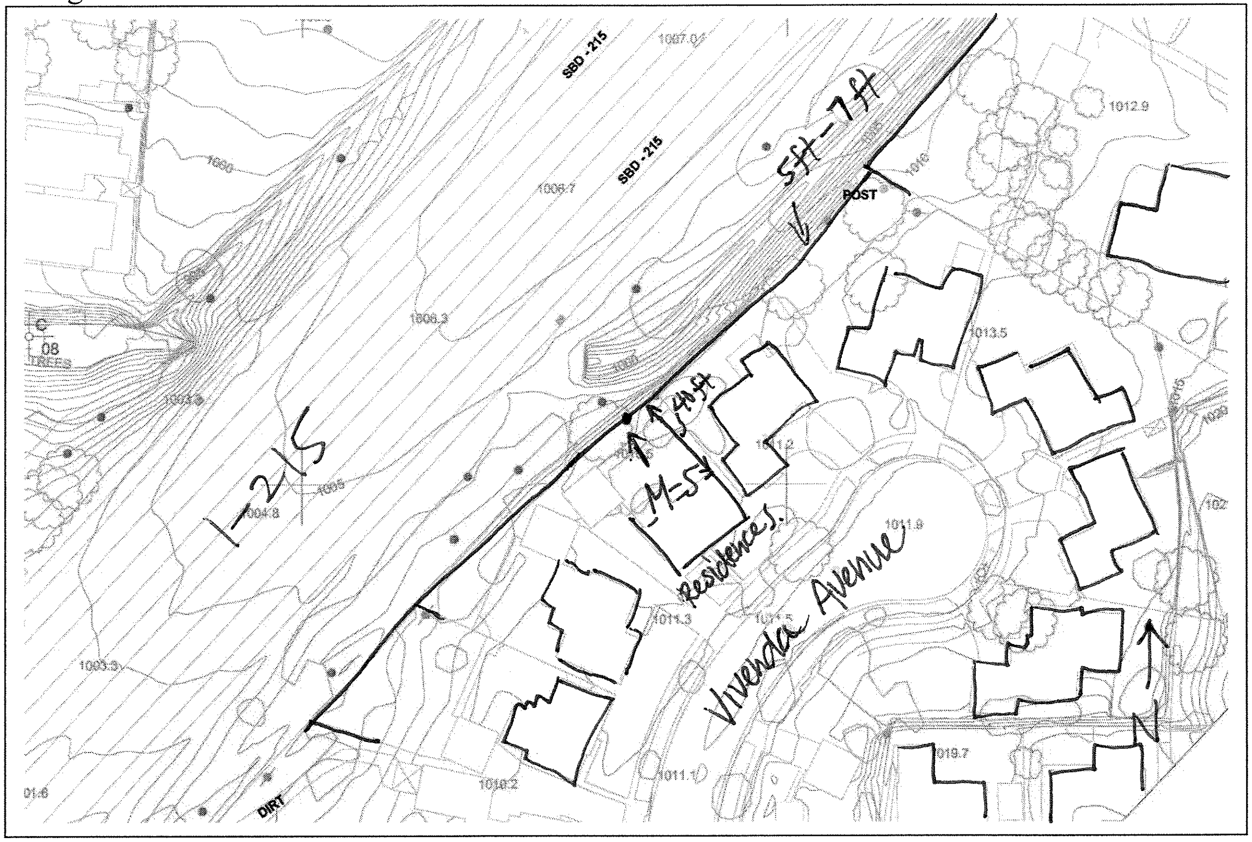
Atmospheric Conditions:

Wind Velocity: __________ **(MPH); Temperature:** __________ **(F)**

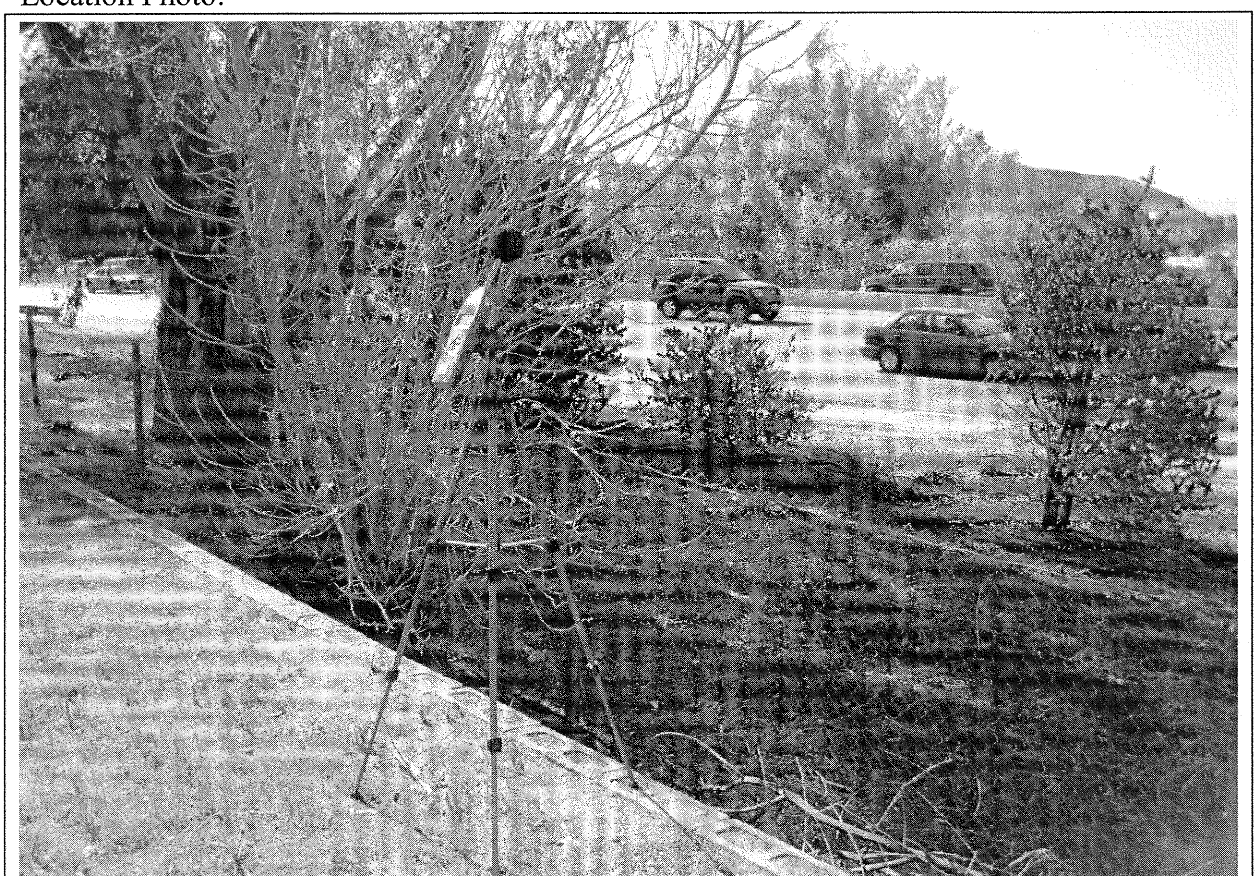
Relative Humidity: __________ **(%)**

Test Personnel: Corey Knips

Diagram:



Location Photo:



Sheet _____ of _____

NOISE MEASUREMENT SURVEY

Site Number: M-6 Date: 11-6-2008 Time: From 10:42 To 10:57 AM

Site Location: 11947 VIVIENDA CT, SECOND ROW HOUSE IN THE BACKYARD,

Noise Sources: TRAFFIC ON I-215 BUT QUIET - VERY FAINT NOISE FROM I-215

Measurement Results (dBA)

Leq 51.6
Lmax 59.4
Lmin 44.2
Lpeak 81.2
L2 57.3
L8 55.5
L25 52.5
L50 49.7
SEL

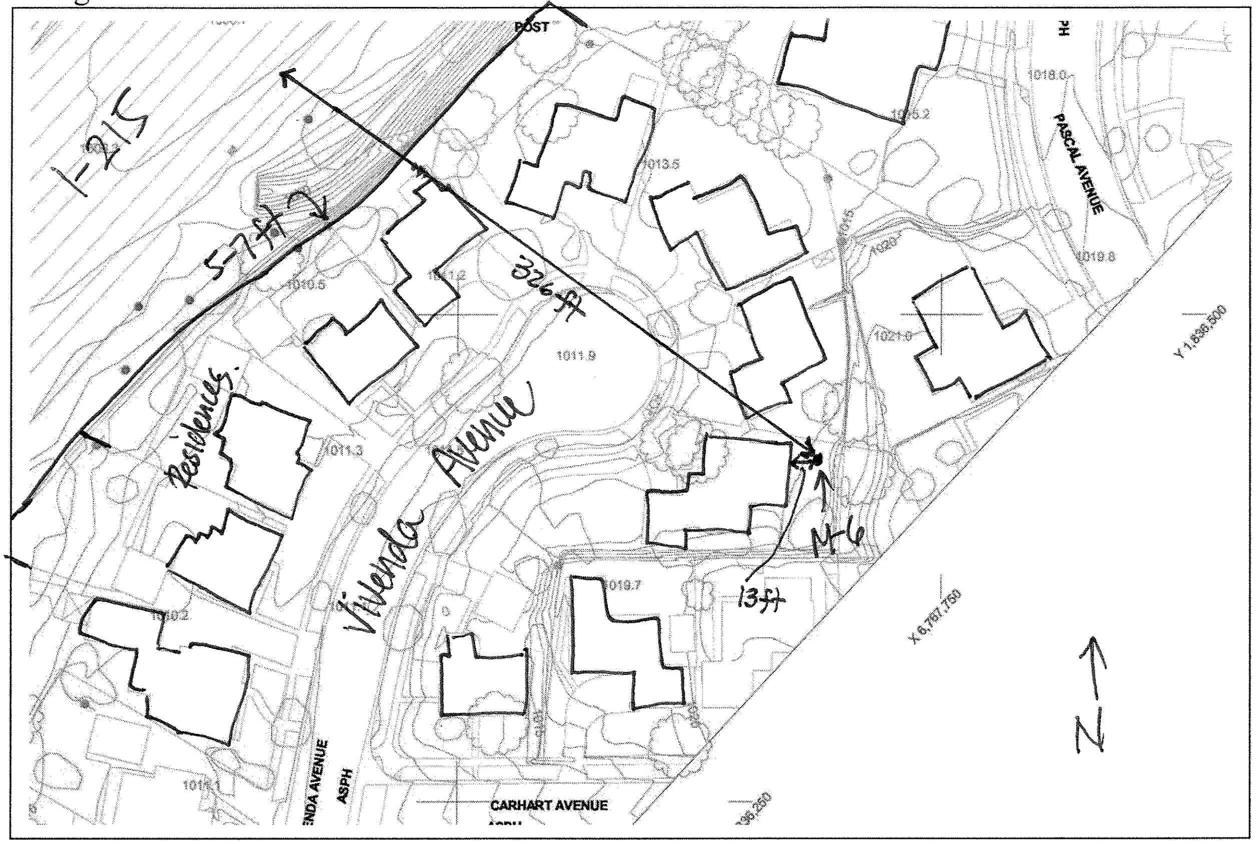
Comments: FAINT AIRCRAFT NOISE
4 FT PROPERTY WALL
BACKYARD AREA IS SHIELDED BY RESIDENTIAL STRUCTURE

Equipment: LARSON DAVIS 820 MODEL Sound METER

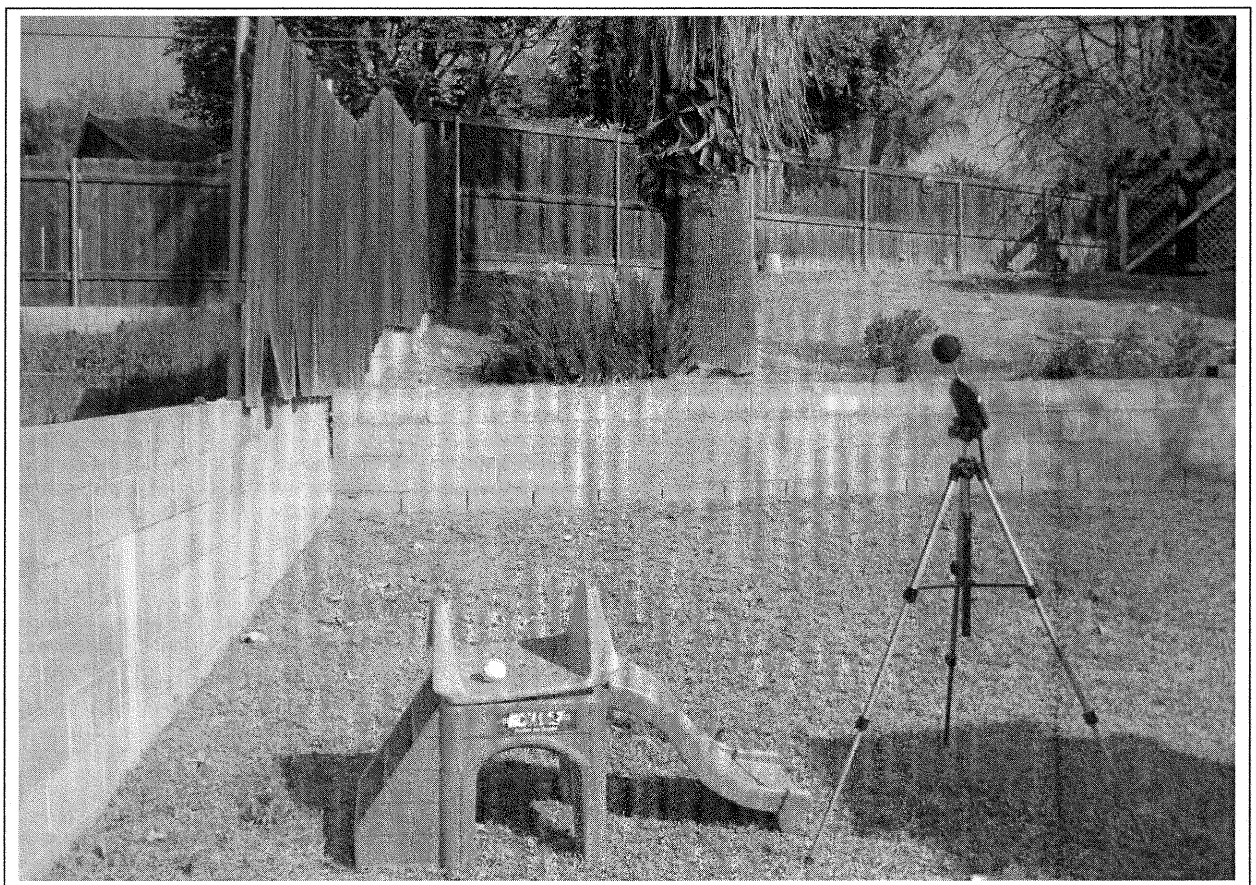
Atmospheric Conditions: Ave., Max.
Wind Velocity: 0.7/1.3 (MPH); Temperature: 80.1 (F)
Relative Humidity: 18.1 (%)

Test Personnel: TEAK KIM

Diagram:



Location Photo:



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NOISE MEASUREMENT SURVEY

Site Number: M-7 Date: 11-6-2008 Time: From 9:54 To 10:09 A.M

Site Location: 11750 Mt. Vernon Avenue (Apt# FF1206) IN THE PATIO

Noise Sources: TRAFFIC ON I-215
CANAL STREET – VERY LIGHT TRAFFIC Volume
– SLOW TRAFFIC SPEED

Measurement Results (dBA)

Leq 54.9
Lmax 68.8
Lmin 49.1
Lpeak 87.7
L2 61.7
L8 57.0
L25 54.5
L50 53.2
SEL

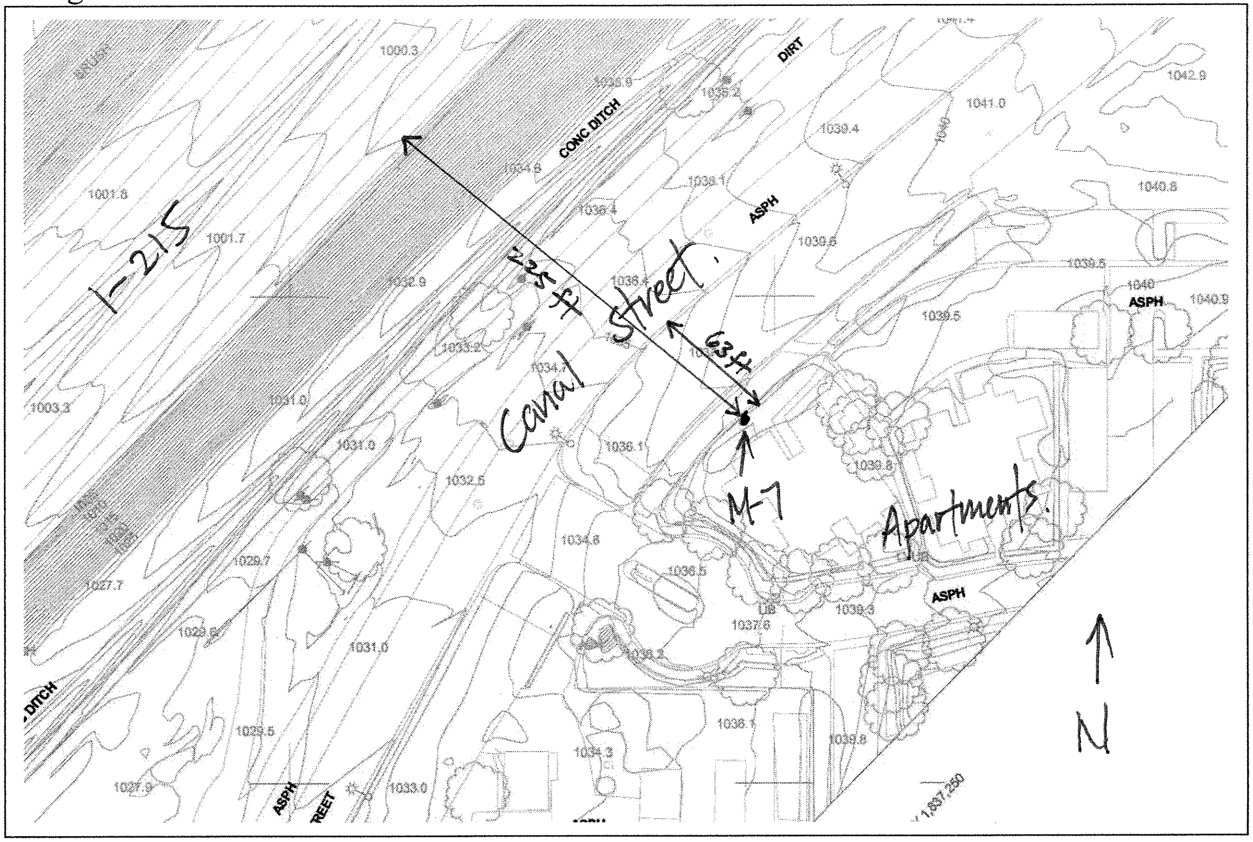
Comments: NO EXISTING WALL
FAINT AIRCRAFT NOISE
FAINT TRAIN NOISE

Equipment: LARSON DAVIS 820 MODE Sound METER

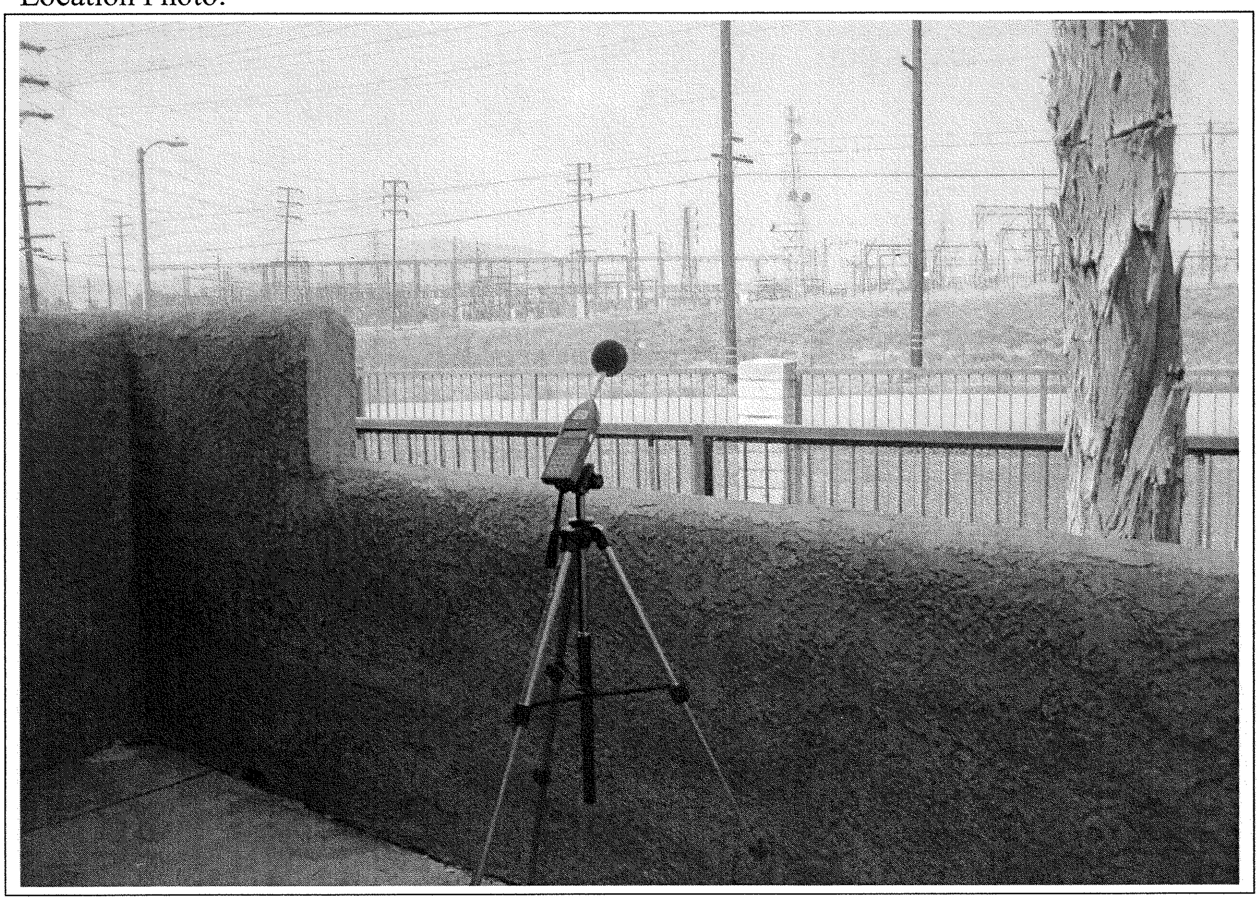
Atmospheric Conditions: MAX, AVG
Wind Velocity: 4.3/1.9 (MPH); Temperature: 78.3 (F)
Relative Humidity: 25 (%)

Test Personnel: TEAK KIM

Diagram:



Location Photo:



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NOISE MEASUREMENT SURVEY

Site Number: M-8 Date: 11/6/08 Time: From 1:08 To 1:23 pm.

Site Location: 21900 Barton Rd #48 Terrace Village R.V. Park #48 SE CORNER

Noise Sources: TRAFFIC ON I-215
Leaf blower - (filtered out the loudest of it)
aircraft noise, dog barking (faraway),
door creaking when it blows open and shuts at #48,
raking leaves

Measurement Results (dBA)

Leq 54.2
Lmax 69.4
Lmin 48.0
Lpeak 84.2
L2 61.4
L8 57.5
L25 53.9
L50 52.1
SEL 83.7

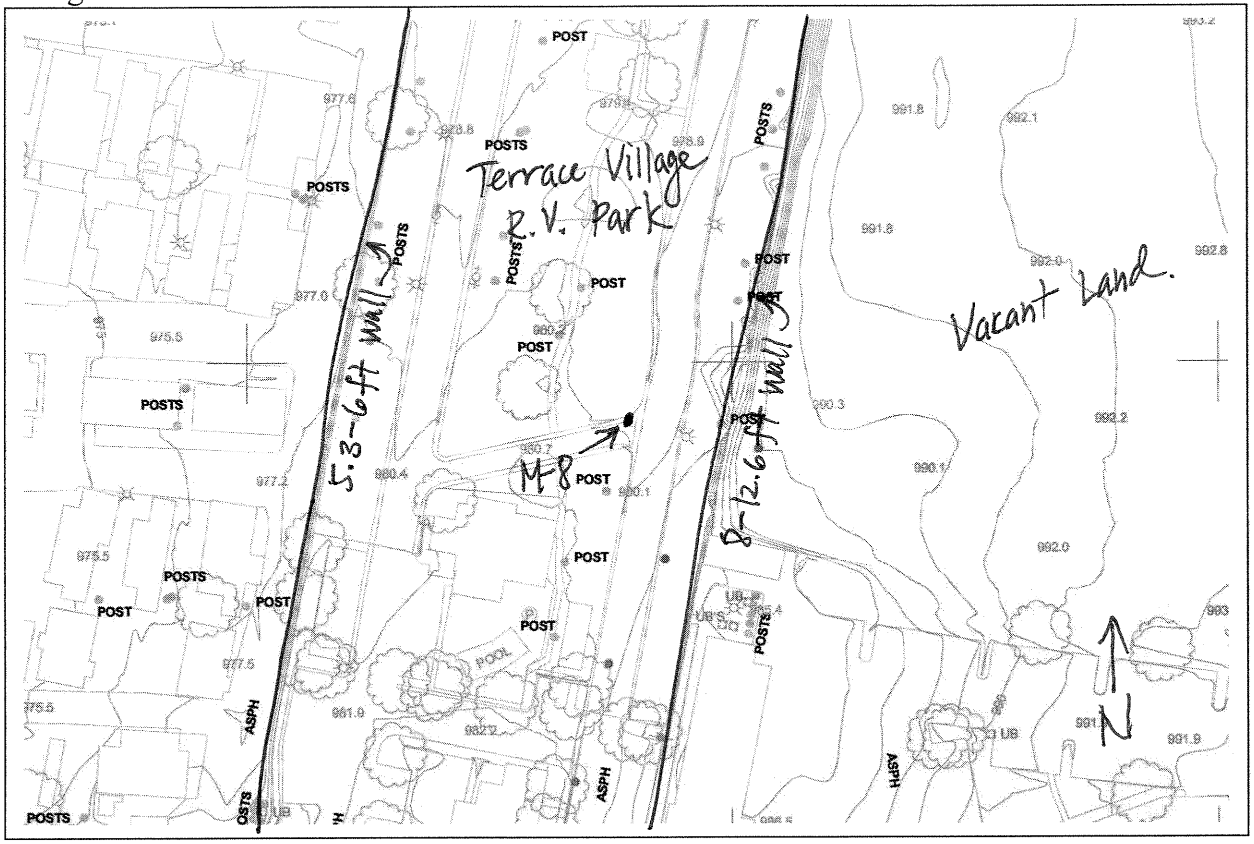
Comments: EXISTING 12.6 ft high ~~way~~ property wall between I-215 and the R.V. Park.
A 15.0 FT High building located on the EAST Side of the R.V. Park

Equipment: Larson DAVIS 824 NOISE METER

Atmospheric Conditions:
Wind Velocity: _________ (MPH); Temperature: _________ (F)
Relative Humidity: _________ (%)

Test Personnel: Corey Knips

Diagram:



Location Photo:

Sheet _____ of _____

NOISE MEASUREMENT SURVEY

Site Number: M-9 Date: 2/2/10 Time: From 12:08 To 12:23

Site Location: 21842 Grand Terrace Road Not in backyard. 12 feet behind orange tree

Noise Sources: Barton Road traffic, little dog barking a couple houses away (quiet and very brief), birds

Measurement Results (dBA)

Leq 53.2
Lmax 68.9
Lmin 40.7
Lpeak 85.6
L2 60.4
L8 56.4
L25 53.4
L50 50.4
SEL 82.7

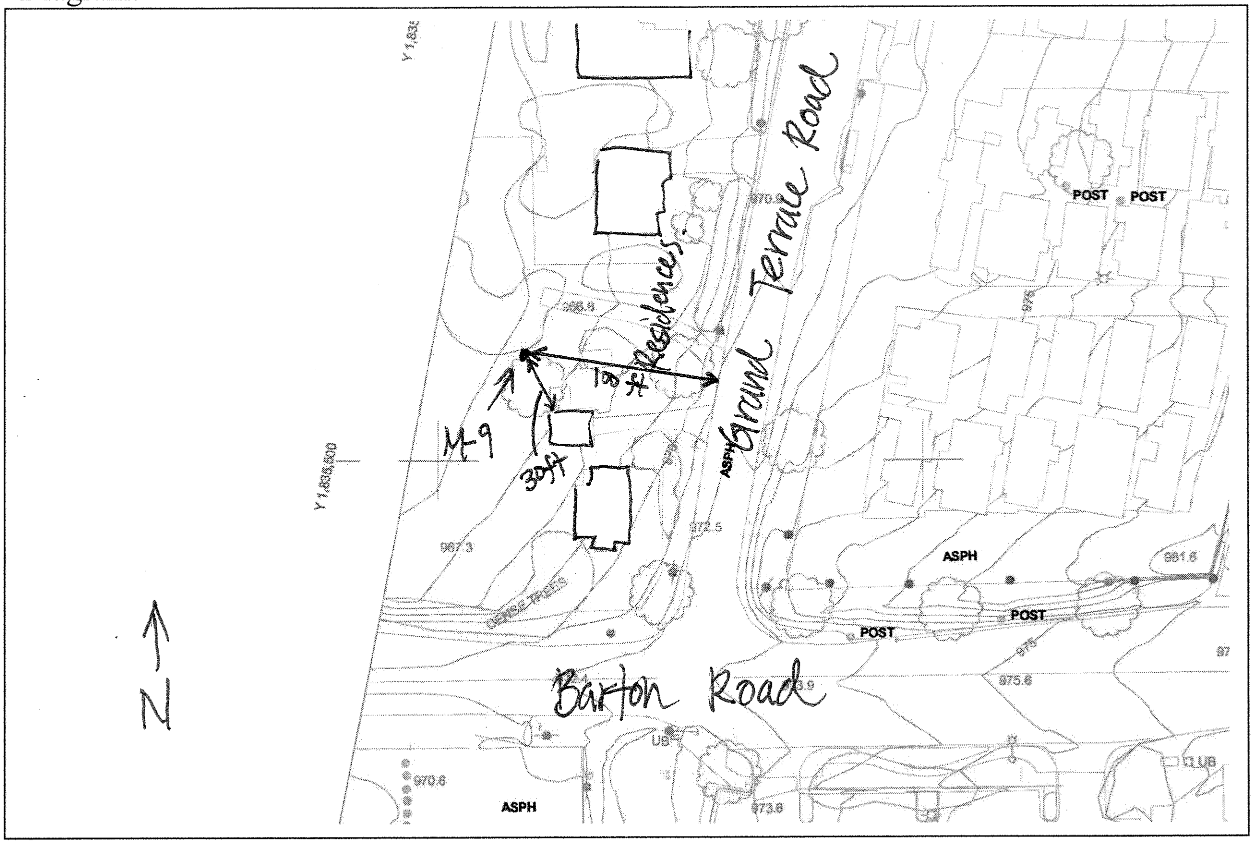
Comments: Dog in backyard kept barking until I set up the meter behind the tree. No houses around here have any walls only chainlink or barred fences

Equipment: Larson Davis 824 Sound Level Meter

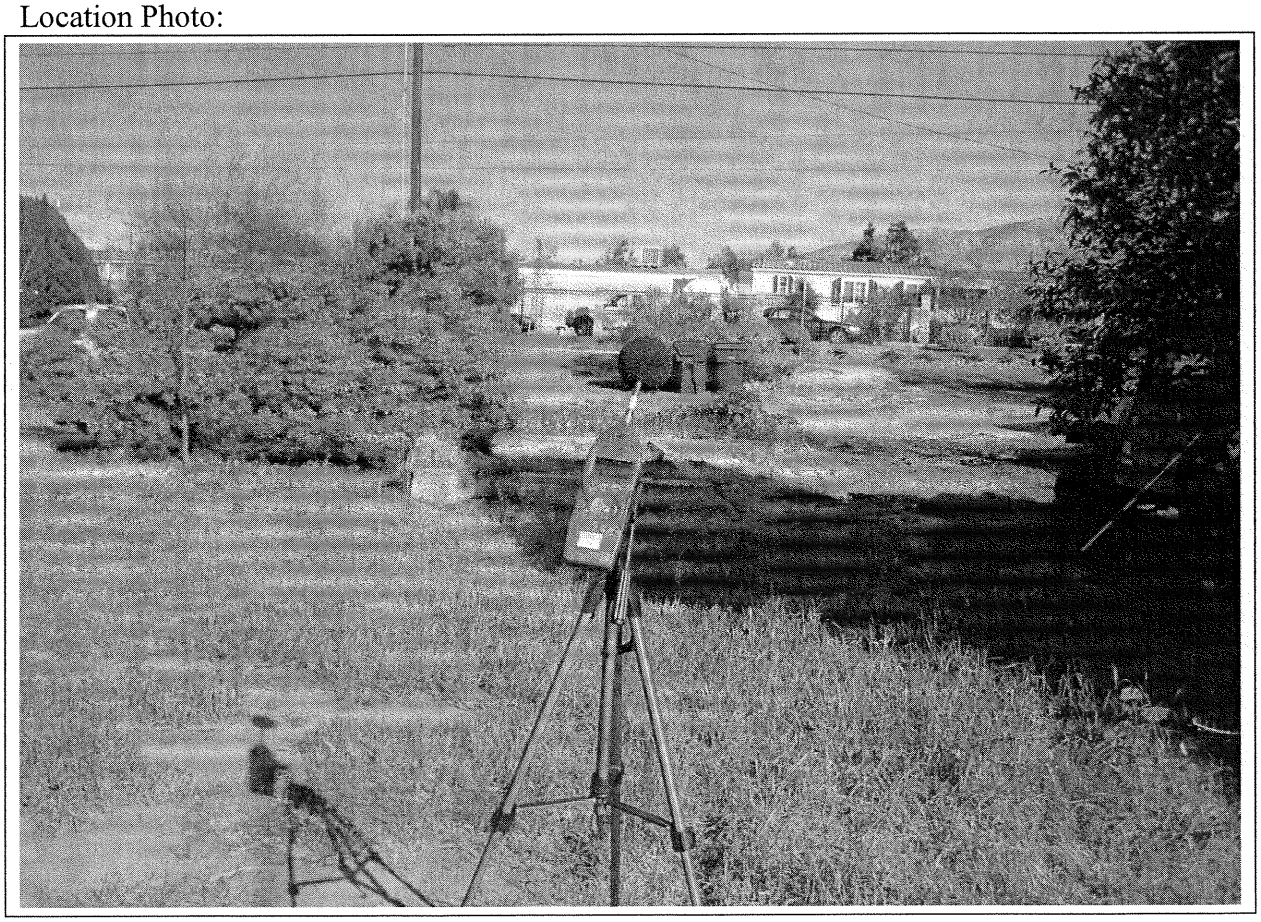
Atmospheric Conditions: Max/Avg
Wind Velocity: 2.6/1.0 (MPH); Temperature: 69.0° (F)
Relative Humidity: 39.0 (%)

Test Personnel: Corey Knips

Diagram:



Location Photo:



Sheet _____ of _____

NOISE MEASUREMENT SURVEY

Site Number: M-10 Date: 11-06-2008 Time: From 11:24 To 11:39 PM

Site Location: 11981 La Crosse Avenue, IN THE BACKYARD

Noise Sources: TRAFFIC ON I-215 OFF RAMP TO BARTON Road

Measurement Results (dBA)

Leq	68.9
Lmax	77.7
Lmin	61.0
Lpeak	91.9
L2	72.4
L8	71.3
L25	69.9
L50	68.4
SEL	

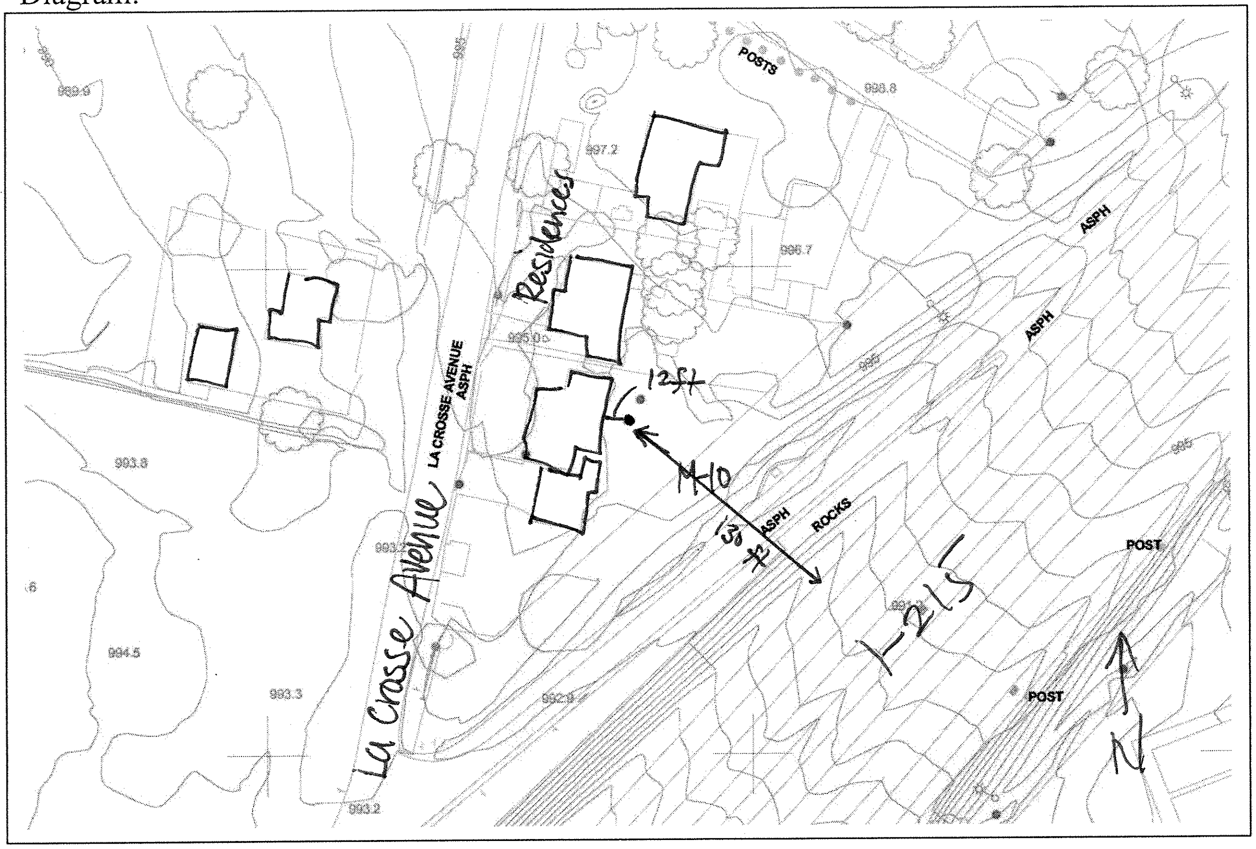
Comments: NO EXISTING WALL
NO PROPERTY WALL
FAINT AIRCRAFT NOISE

Equipment: LARSON DAVIS 820 MODEL SOUND METER

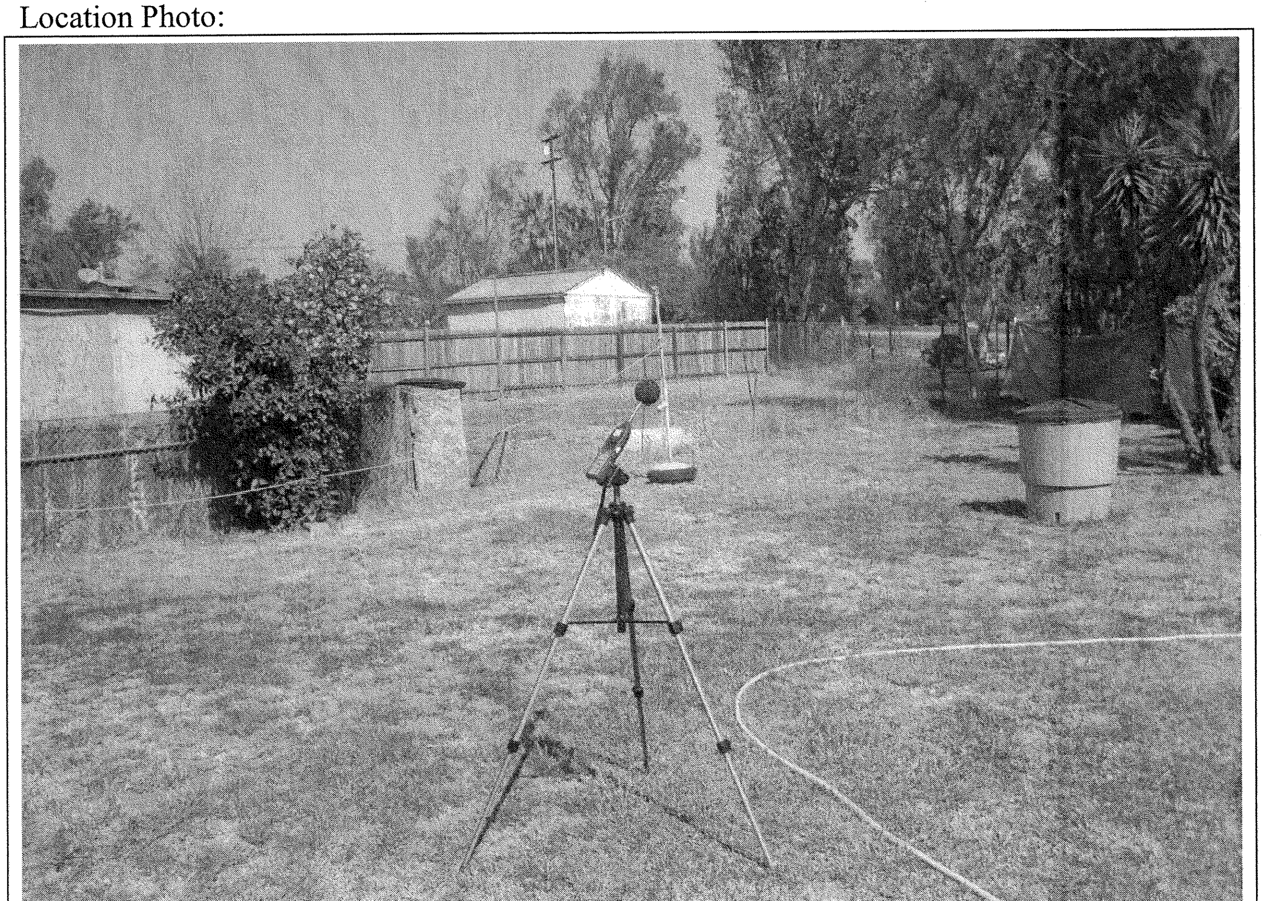
Atmospheric Conditions:
Wind Velocity: Ave. / MAX. 0.7 / 3.8 (MPH); Temperature: 84.2 (F)
Relative Humidity: 11.7 (%)

Test Personnel: TEAK KIM

Diagram:



Location Photo:



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NOISE MEASUREMENT SURVEY

Site Number: M-11 Date: 11/6/08 Time: From 11:24 To 11:39

Site Location: 22111 Newport Ave. #181 Grand Royal Estates
North side of backyard 10 ft west of wall, 9 ft north of home

Noise Sources: I-215 freeway traffic

#3

Measurement Results (dBA)

Leq	60.6
Lmax	69.8
Lmin	51.3
Lpeak	84.3
L2	65.1
L8	63.5
L25	61.4
L50	59.6
SEL	90.1

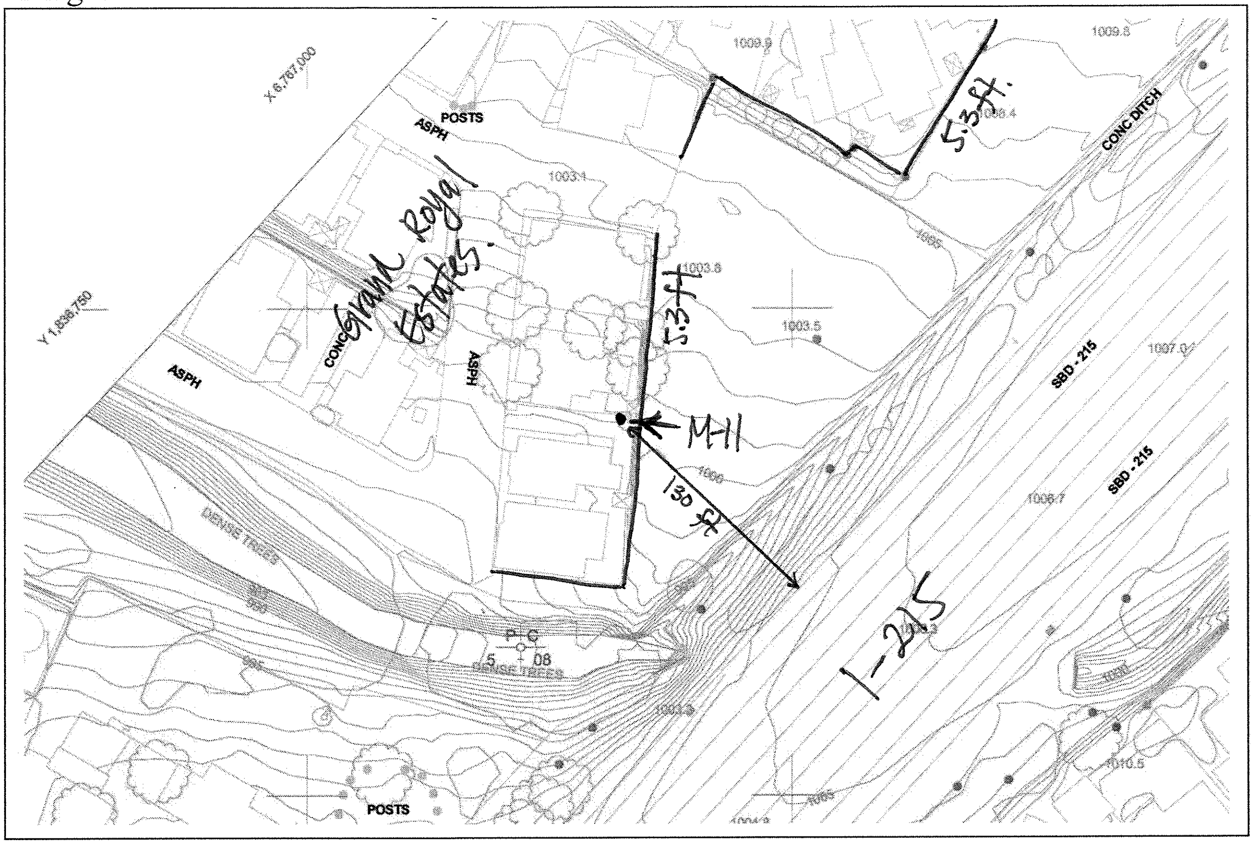
Comments: 5.3 FT EXISTING WALL

Equipment: Larson Davis 824 Noise Meter

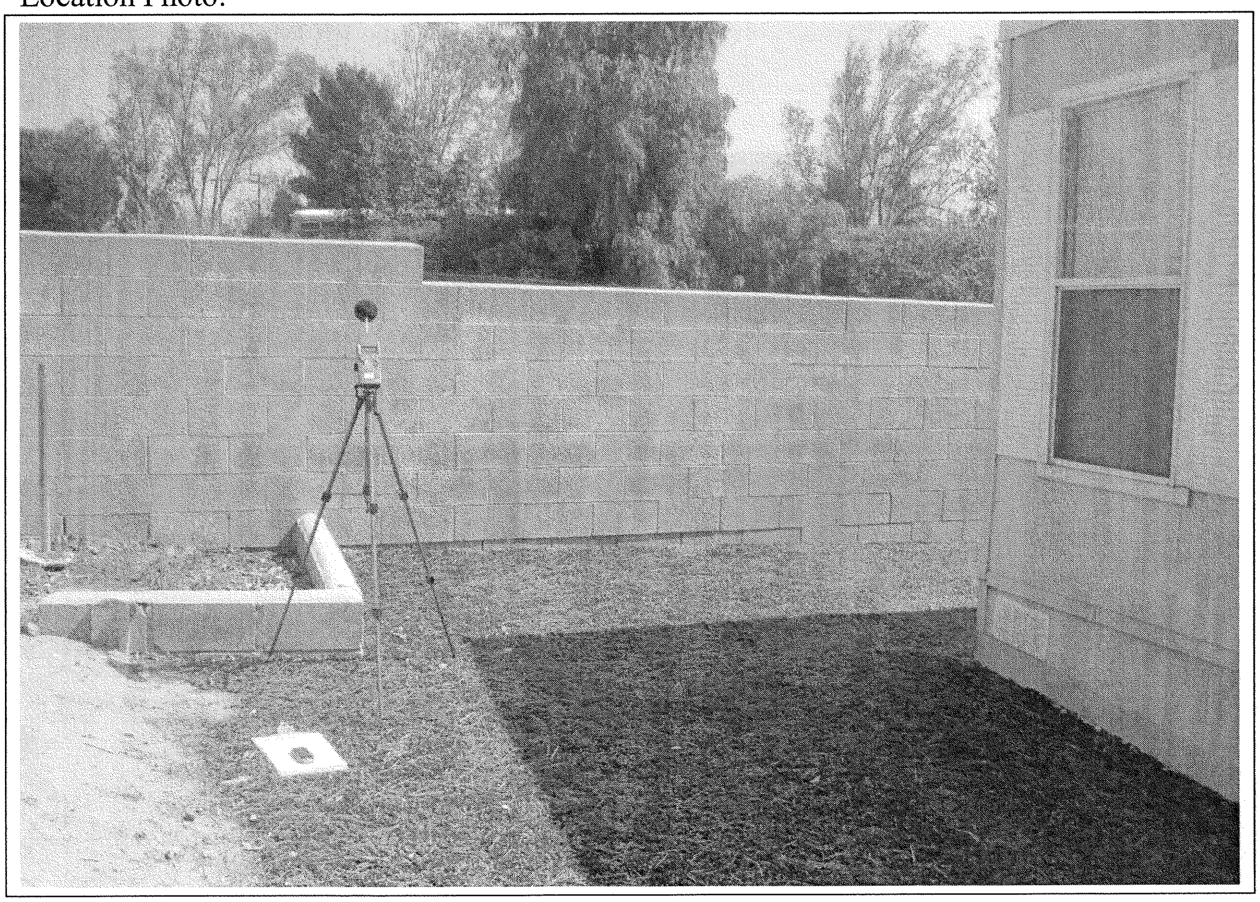
Atmospheric Conditions:
Wind Velocity: _________ (MPH); Temperature: _________ (F)
Relative Humidity: _________ (%)

Test Personnel: Corey Knips

Diagram:



Location Photo:



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NOISE MEASUREMENT SURVEY

Site Number: M-12 Date: 11-6-08 Time: From 9:54 am To 10:09 am

Site Location: 22111 Newport Avenue at Grand Royal Estates at the end of the driveway of #41

Noise Sources: Traffic on I-215 and Newport Avenue

Measurement Results (dBA)

Leq 48.9
Lmax 58.1
Lmin 44.9
Lpeak 82.0
L2 52.8
L8 50.9
L25 49.3
L50 48.2
SEL 78.5

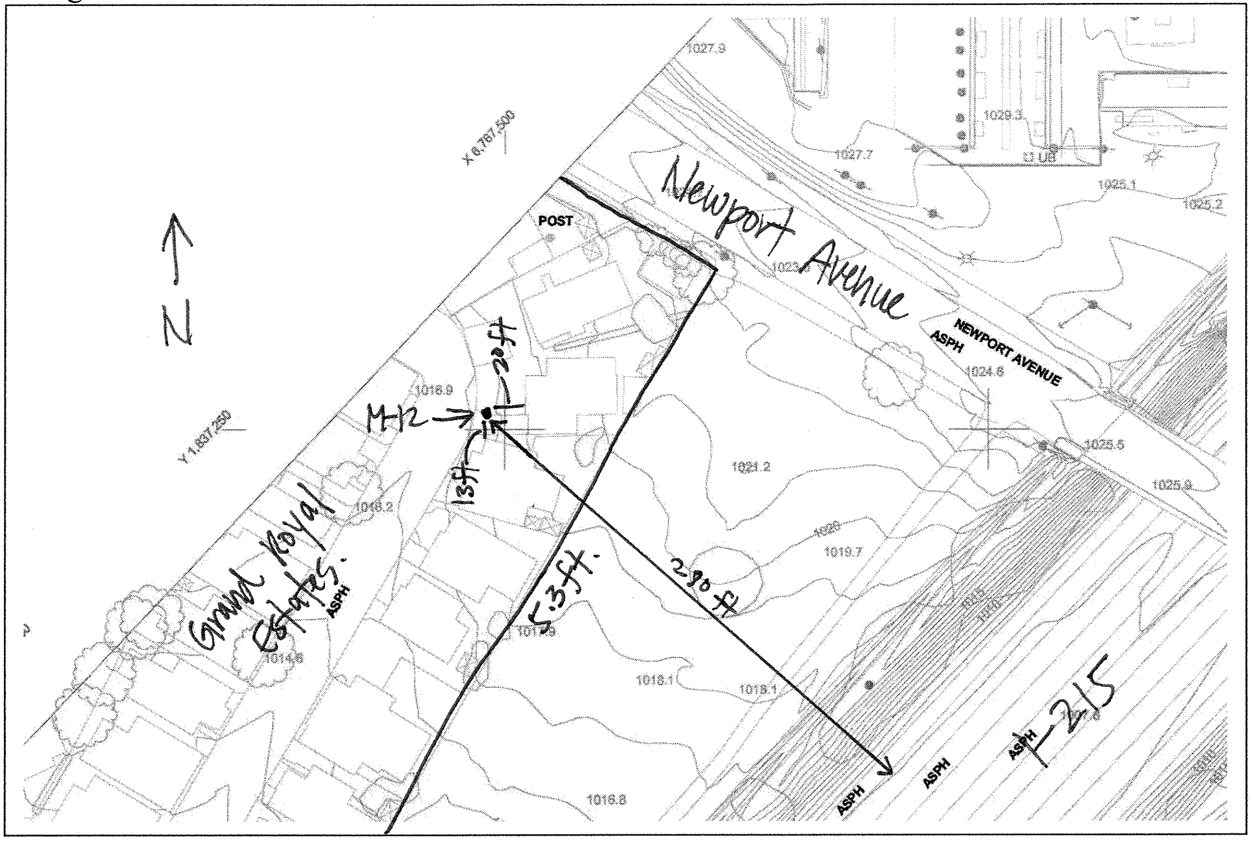
Comments: ________________________________

Equipment: Larson Davis model 824 Sound Level Meter.

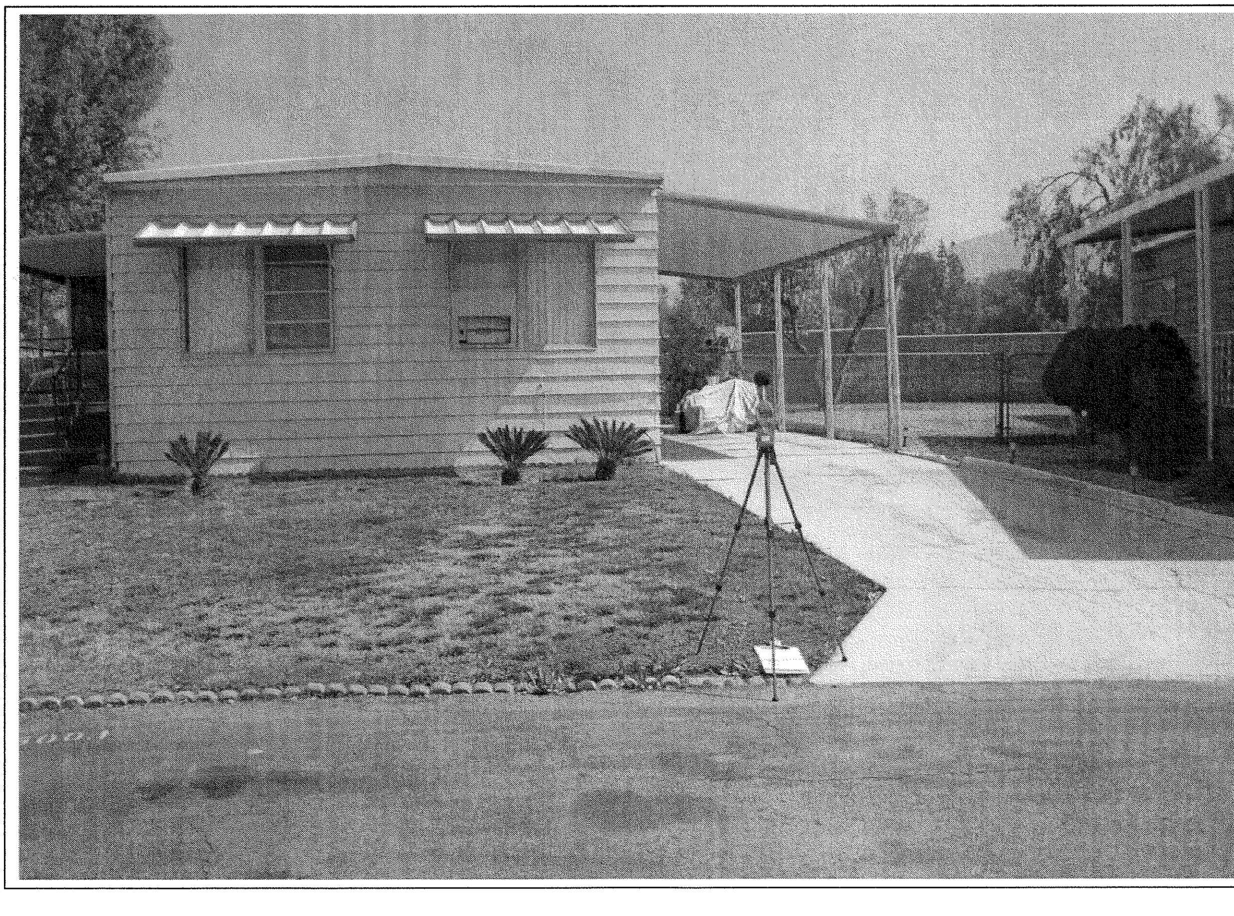
Atmospheric Conditions:
Wind Velocity: __________ (MPH); Temperature: __________ (F)
Relative Humidity: __________ (%)

Test Personnel: Corey Knips

Diagram:



Location Photo:



NOISE LEVEL MEASUREMENTS RETAKE

Sheet _____ of _____

NOISE MEASUREMENT SURVEY

Site Number: M-6 Date: 11-20-08 Time: From 11:27 am To 11:42 am

Site Location: 11947 Vivienda Court, in the middle of the backyard

Noise Sources: Some dogs barking (the neighbors and the property with noise meter had a small dog). Faint I-215 traffic. Birds chirping. Faint aircraft noise

Measurement Results (dBA)

Leq 50.6
Lmax 63.3
Lmin 45.6
Lpeak 82.5
L2 56.6
L8 52.5
L25 50.5
L50 49.5
SEL —

Comments: Elevated approx. 20 ft higher than I-215. There is an existing 4.5 ft wall (7 Blocks @ 8in between I-215 and noise meter). As well as a partial 6 ft high wooden fence starting where the backyard becomes elevated. The backyard has two levels. Noise level measurement was taken in the lowest section of the higher level (average elevation). Meter appears to be above I-215. Residence is slightly elevated above the freeway.

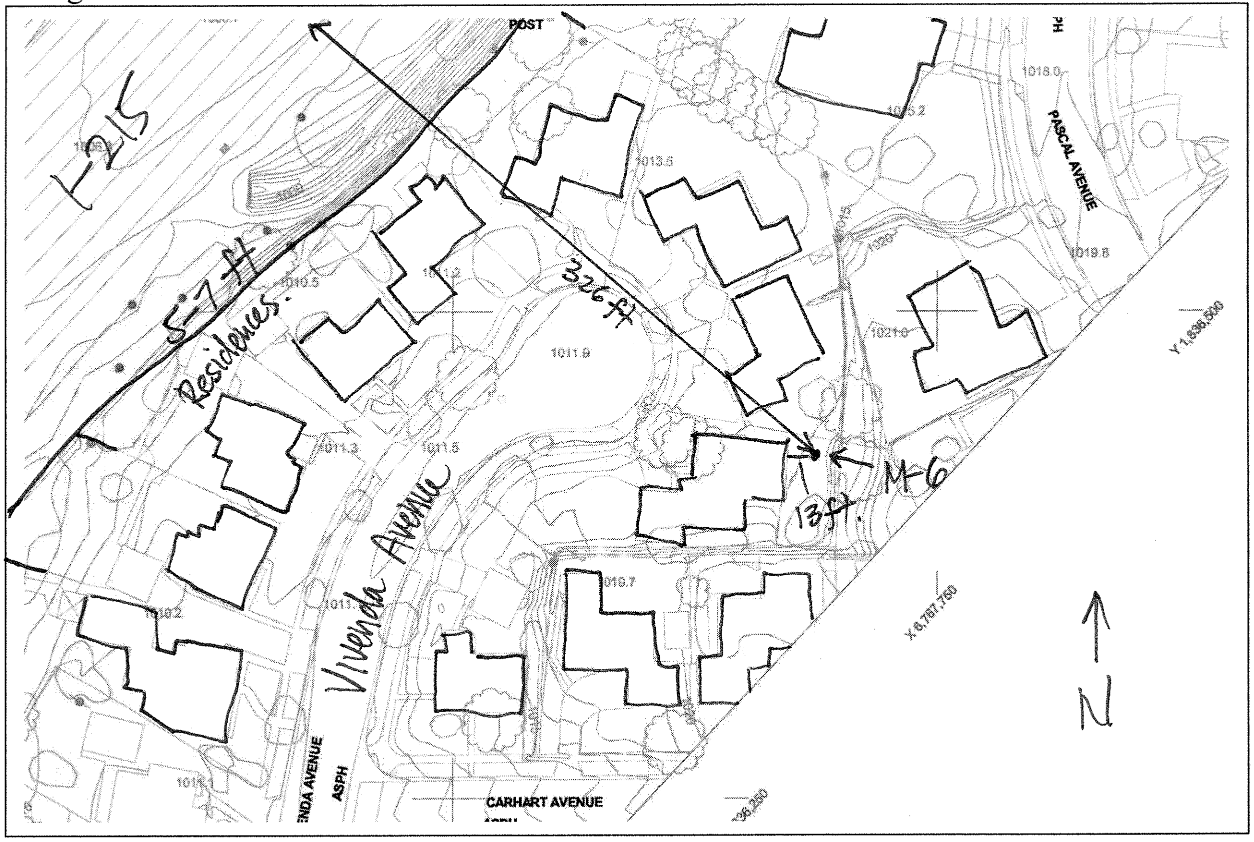
Equipment: Larson Davis model 820 Sound Level Meter

Atmospheric Conditions: Avg / Max
Wind Velocity: 0.0 / 1.7 (MPH); Temperature: 80.2 (F)
Relative Humidity: 28.5 (%)

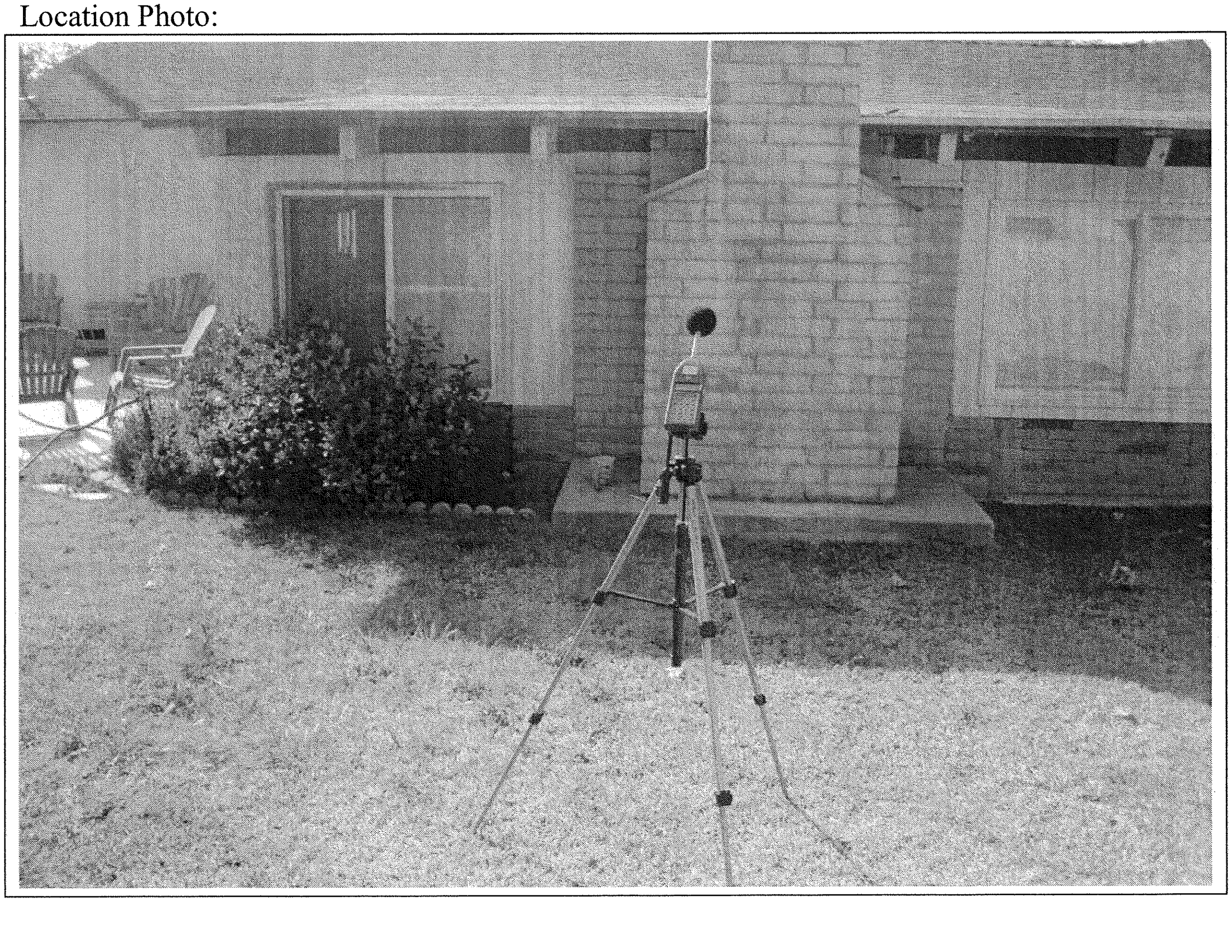
Test Personnel: Ryo Braco

Approx. 15 ft with a gradual down slope towards the freeway. Noise meter is approximately 20 ft above freeway but still has the top half of the house as a barrier.

Diagram:



Location Photo:



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NOISE MEASUREMENT SURVEY

Site Number: M-11 Date: 1-20-08 Time: From 12:52 pm To 1:07 pm

Site Location: 2211 Newport Avenue #181 on the northside of the backyard. along the property line of #180

Noise Sources: I-215 traffic, Helicopter flying over. Brief talking with resident was mostly filtered out

Measurement Results (dBA)

Leq 60.8
Lmax 74.6
Lmin 54.3
Lpeak 92.9
L2 66.5
L8 63.0
L25 60.9
L50 59.5
SEL —

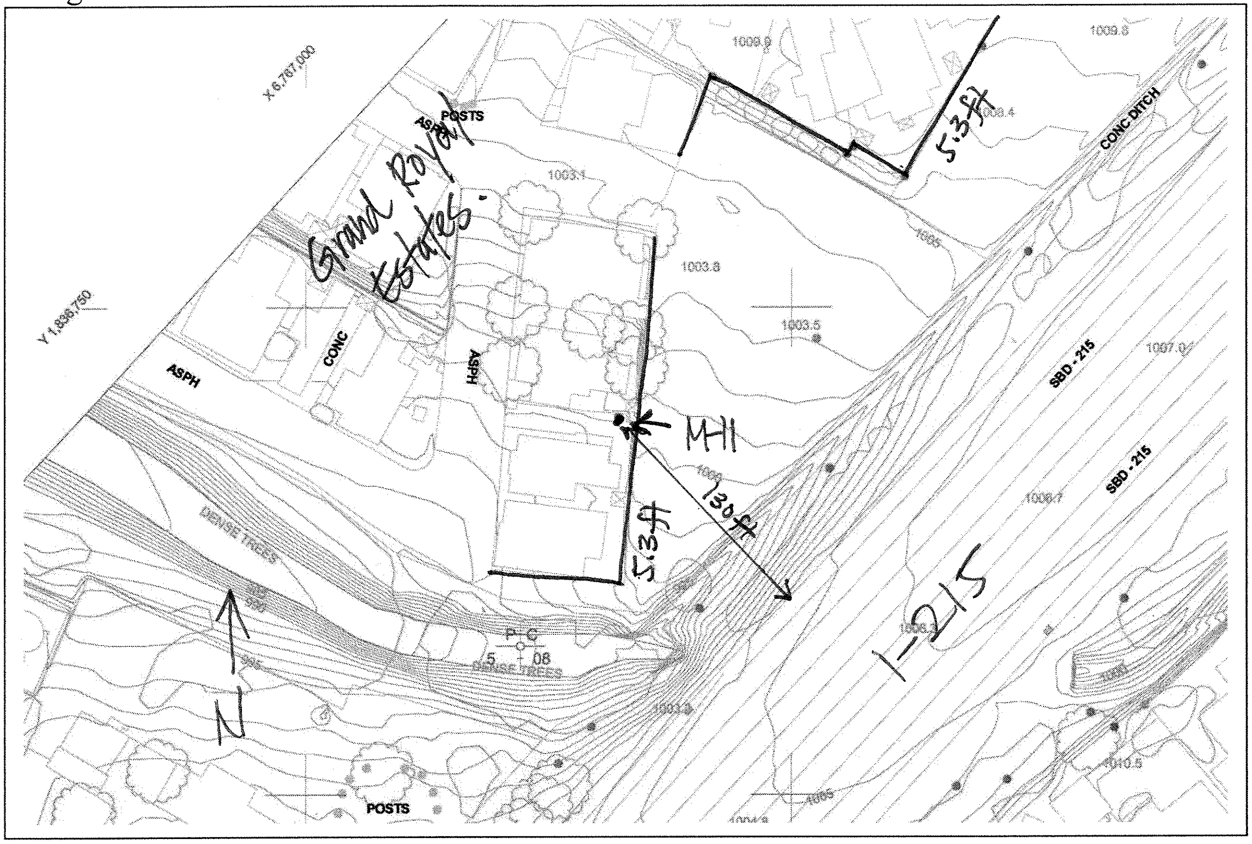
Comments: Noise meter is approx. 4 ft below the I-215. There is an existing 5.3 ft high wall along the property line between the house and I-215. Noise meter is below the freeway.

Equipment: Larson Davis model 820 Sound Level Meter.

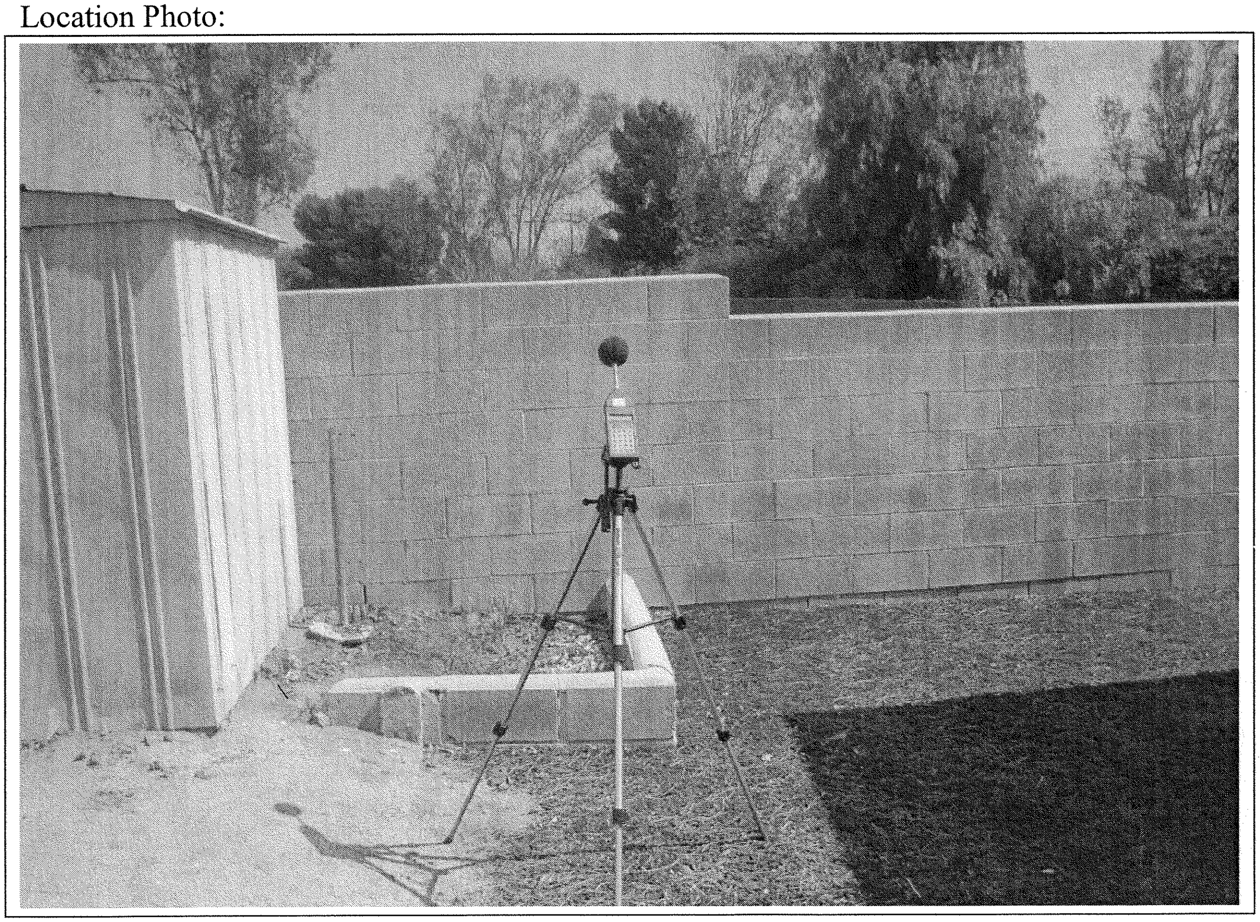
Atmospheric Conditions: AVG / Max
Wind Velocity: 0.0 / 0.9 (MPH); Temperature: 82.4 (F)
Relative Humidity: 18.4 (%)

Test Personnel: Ryo Braco.

Diagram:



Location Photo:



NOISE MEASUREMENT SURVEY

Site Number: M-12 Date: 11/20/08 Time: From 12:19pm To 12:24pm

Site Location: Grand Royal Estates 2211 Newport Avenue
House number 41, in the front street near the driveway

Noise Sources: I-215 traffic, quiet car driving by, neighbors
bird chirping faint aircraft noise

Measurement Results (dBA)

Leq 51.7
Lmax 61.5
Lmin 47.5
Lpeak 92.4
L2 57.9
L8 54
L25 51.7
L50 50.5
SEL

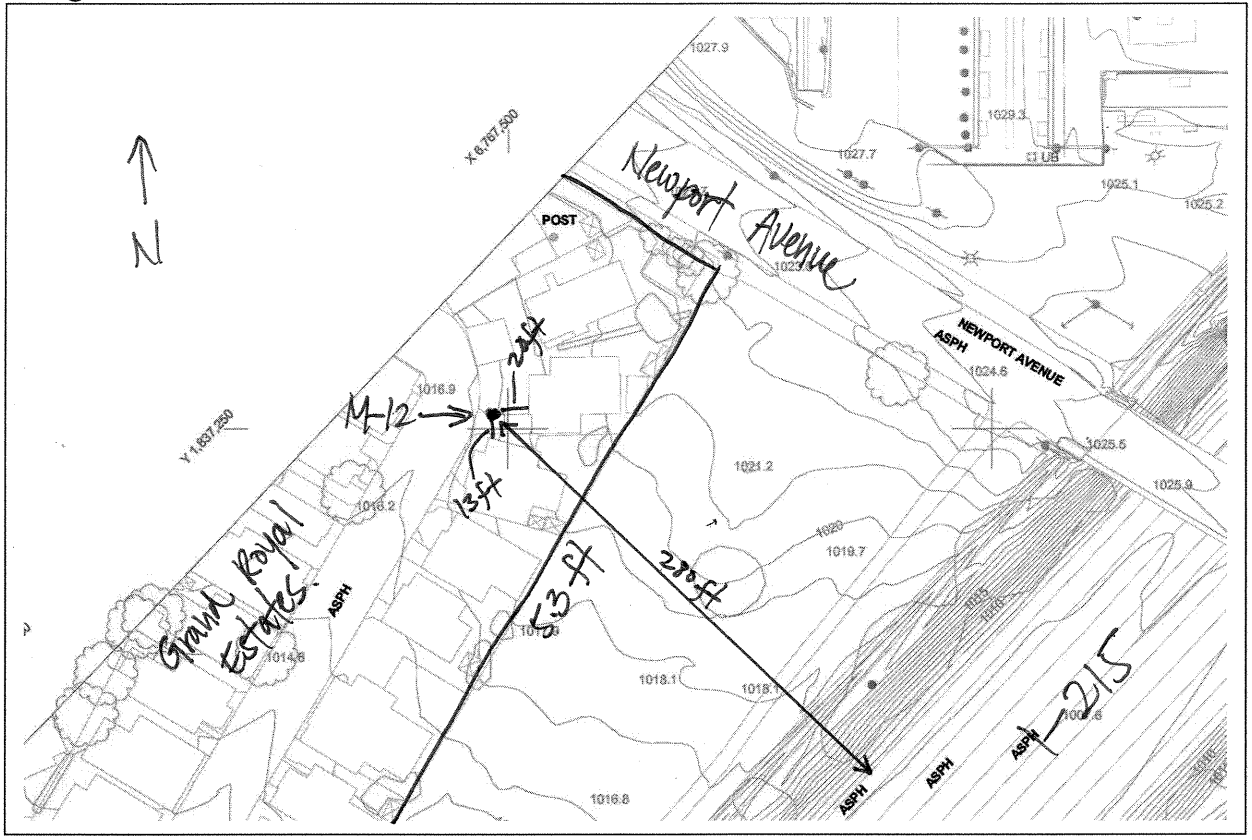
Comments: Office was closed so took measurement from the driveway and street. Existing sound wall 5.3 foot high 8 inch blocks, which is 75 feet east of sound meter. The wall reduces to 7 blocks at 8 inches 4.5 feet behind house 42. Noise meter is at a similar elevation as I-215.

Equipment: Larson-Davis 820

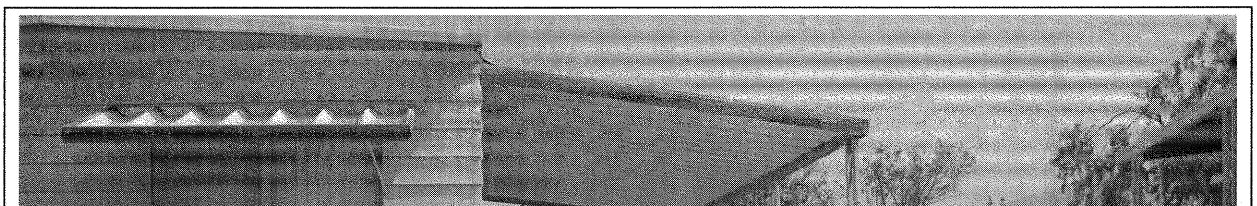
Atmospheric Conditions: AVG / MAX
Wind Velocity: 1.4 / 2.9 (MPH); Temperature: 85.3 (F)
Relative Humidity: 20.0 (%)

Test Personnel: Kyo Braco

Diagram:



Location Photo:



INTERIOR/EXTERIOR NOISE LEVEL MEASUREMENTS

NOISE MEASUREMENT SURVEY

Site Number: INTERIOR Date: 11/20/08 Time: From 10:03am To 10:18am

Site Location: 12066 Vivienda Avenue, Grand Terrace Elementary School Inside of classroom 30 in the middle of the room. Noise meter was approximately 100 feet from the I-215.

Noise Sources: None. Classroom door was cracked open slightly (less than 1 inch) to keep it from locking. Noticed some extremely faint air conditioner noise when picking up the noise meter along with the ticking of a clock 12 feet away.

Measurement Results (dBA)

Leq 42.7
Lmax 53.0
Lmin 34.1
Lpeak 71.4
L2 49.1
L8 46.2
L25 43.5
L50 41.1
SEL

Comments: No children were present. Measurement couldn't be taken in classroom 34 (closest to freeway) because children were having a music class. No music was audible inside or outside classroom 30. Noise meter is at a similar elevation as I-215.

Equipment: Larson-Davis 820

Atmospheric Conditions:
Wind Velocity: 0.0/0.0 (MPH); Temperature: 77.0 (F)
Relative Humidity: 48.2 (%)

Test Personnel: Ryo Braco

NOISE MEASUREMENT SURVEY

Site Number: EXTERIOR Date: 11/20/08 Time: From 10:03 am To 10:18 am

Site Location: 12066 Vivienda Avenue, Grand Terrace CA Elementary School
Between classroom 30 and 25, approximately 100 feet
Southeast of I-215.

Noise Sources: I-215 traffic

Measurement Results (dBA)

Leq 64.9
Lmax 71.3
Lmin 56.4
Lpeak 84.6
L2 69.1
L8 67.5
L25 65.7
L50 64.1
SEL 94.6

Comments: No sound walls between noise meter and I-215. Approximately 10 feet from classroom 30s building. No children present. An 8 foot chain link fence is along the property line which is ~75 feet southwest of noise meter. Noise meter is 10 feet from classroom 25s building. There is a large freeway sign between the freeway and noise meter but it appears to have very minimal impact.

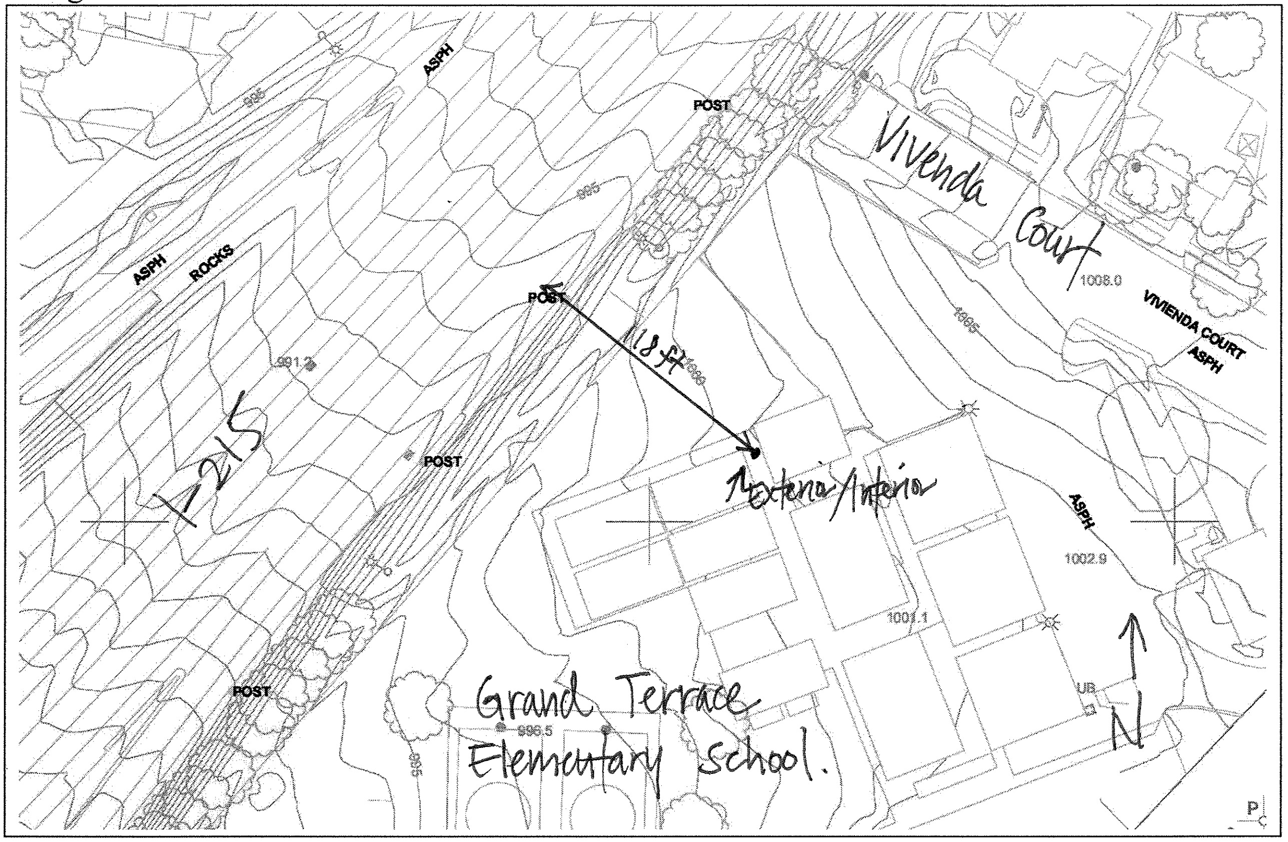
Equipment: Larson-Davis 824

Atmospheric Conditions:
Wind Velocity: Avg 0.7 / Max 2.5 (MPH); Temperature: 79.9 (F)
Relative Humidity: 32.1 (%)

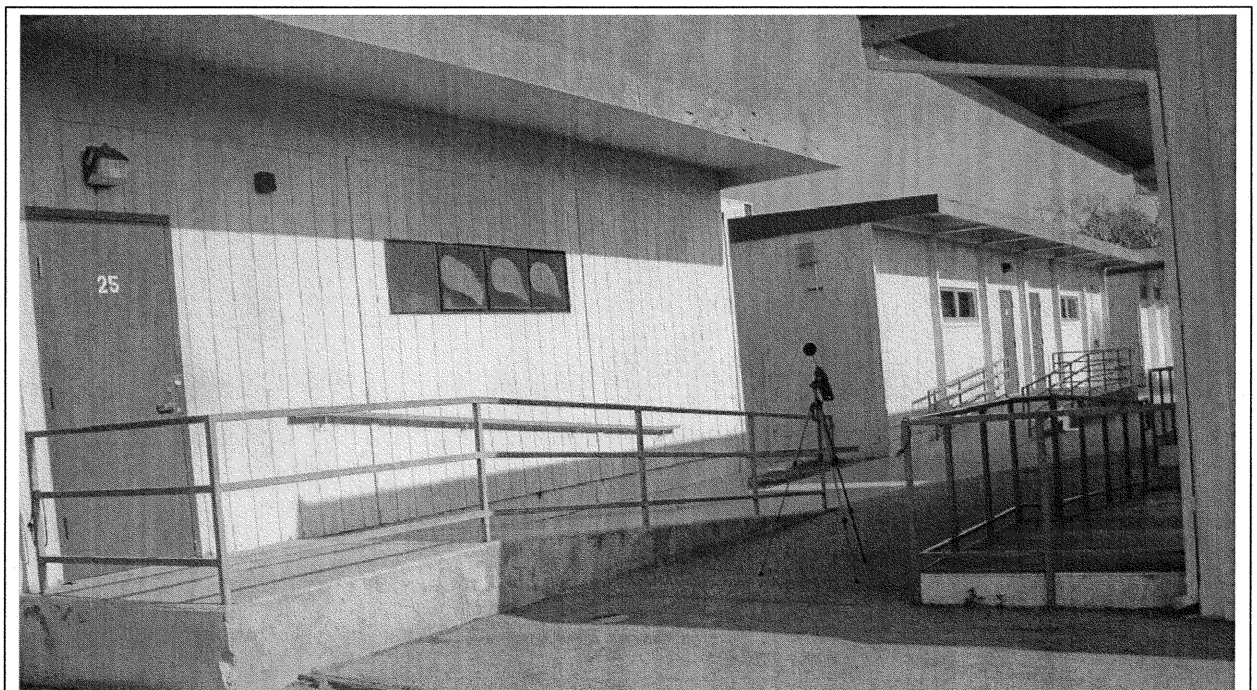
Test Personnel: Kyo Braco

School buildings 25 and 30 are approximately 11 feet high. All buildings are the same height. Noise meter is at a similar elevation as I-215.

Diagram:



Location Photo:



RECEIVER AND BUILDING BARRIER JUSTIFICATION

Receiver No.	Receiver Elevation Justification
R-4	An elevation of 973.0 ft was obtained using GPS for Receiver R-4.
R-5	An elevation of 973.0 ft was obtained using GPS for Receiver R-5.
R-7	An elevation of 980.0 ft was obtained using GPS for Receiver R-7.
R-8	An elevation of 982.0 ft was obtained using GPS for Receiver R-8.
R-9	An elevation of 986.0 ft was obtained using GPS for Receiver R-9.
R-10	An elevation of 992.0 ft was obtained using GPS for Receiver R-10.
R-11	An elevation of 996.0 ft was obtained using GPS for Receiver R-11.
R-12	An elevation of 995.0 ft was obtained using GPS for Receiver R-12.
R-14	An elevation of 998.0 ft was obtained using GPS for Receiver R-14.
R-15	An elevation of 973.0 ft was obtained using GPS for Receiver R-15.
R-17	The area without topographic coverage for Receiver R-17 was determined to be similar to the closest area with topographic map coverage. The closest area with topographic map coverage is 1023.0 ft. The elevation for Receiver R-17 was estimated to be 1023.0 ft.
R-18	An elevation of 1,010.0 ft was obtained using GPS for Receiver R-18.
R-36	An elevation of 1,021.0 ft was obtained using GPS for Receiver R-36.
R-43	An elevation of 1,010.0 ft was obtained using GPS for Receiver R-43.
R-44	An elevation of 1,012.0 ft was obtained using GPS for Receiver R-44.
R-45	An elevation of 1,012.0 ft was obtained using GPS for Receiver R-45.
R-51	An elevation of 1,025.0 ft was obtained using GPS for Receiver R-51.
R-52	An elevation of 1,030.0 ft was obtained using GPS for Receiver R-52.
R-53	An elevation of 1,039.0 ft was obtained using GPS for Receiver R-53.
R-55	The area without topographic coverage for Receiver R-55 was determined to be similar to building pad for the residential structure. The area representing the building pad from the topographic map coverage is 1044.0 ft. The elevation for Receiver R-55 was estimated to be 1044.0 ft.
R-58	An elevation of 1,042.0 ft was obtained using GPS for Receiver R-58.
R-59	An elevation of 1,042.0 ft was obtained using GPS for Receiver R-59.
R-93	An elevation of 975.0 ft was obtained using GPS for Receiver R-93.
R-94	An elevation of 975.0 ft was obtained using GPS for Receiver R-94.
R-95	An elevation of 973.0 ft was obtained using GPS for Receiver R-95.
R-100	An elevation of 971.0 ft was obtained using GPS for Receiver R-100.
R-110	An elevation of 973.0 ft was obtained using GPS for Receiver R-110.
R-128	An elevation of 1,016.0 ft was obtained using GPS for Receiver R-128.
R-129	An elevation of 1,017.0 ft was obtained using GPS for Receiver R-129.
R-139	The area without topographic coverage for Receiver R-139 was determined to be similar to the closest area with topographic map coverage. The closest area with topographic map coverage is 966.0 ft. The elevation for Receiver R-139 was estimated to be 966.0 ft.

Buidings	Building Elevation Justification
Building Barrier 7	Field observation indicated that this area is generally flat. The area without topographic coverage for Building Barrier 7 was determined to be similar to the closest area with topographic map coverage. The closest area with topographic map coverage is 1,022.0.
Building Barrier 10	An elevation of 1,010.0 ft was obtained using GPS for this area. The elevation for Building Barrier 20 is slightly lower and is estimated to be 1,009.0 ft.
Building Barrier 14	Field observation indicated that this area is generally flat. The area without topographic coverage for Building Barrier 14 was estimated to be 1,021.0 ft based on the closest area with topographic map coverage.
Building Barrier 15	Field observation indicated that this area is generally flat. The area without topographic coverage for Building Barrier 15 was estimated to be 1,024.0 ft based on the closest area with topographic map coverage.
Building Barrier 28	An elevation of 971.0 ft was obtained using GPS for this area. The elevation for Building Barrier 28 is 971.0 ft.
Building Barrier 33	Field observation indicated that this area is generally flat. The area without topographic coverage for Building Barrier 33 was estimated to be 974.0 ft based on the closest area with topographic map coverage.
Building Barrier 34	An elevation of 975.0 ft was obtained using GPS for this area. The elevation for Building Barrier 34 is 975.0 ft.
Building Barrier 35	An elevation of 975.0 ft was obtained using GPS for this area. The elevation for Building Barrier 33 is slightly higher in elevation and is estimated to be 977.0 ft.
Building Barrier 36	An elevation of 975.0 ft was obtained using GPS near this area. The elevation for Building Barrier 36 is higher in elevation and is estimated to be 978.0 ft.
Building Barrier 37	An elevation of 975.0 ft was obtained using GPS near this area. The elevation for Building Barrier 37 is higher in elevation and is estimated to be 979.0 ft.

SPOT ELEVATION CERTIFICATION

AECOM

AECOM
999 W. Town and Country Road
Orange, CA 92868
www.aecom.com

714 567 2501 tel
714 567 2441 fax

Memorandum

To	Joe Meraz	Page	1
CC	Lisa Williams		
Subject	Coordinate System and Datum for Spot Elevations		

From	Greg Hefter
Date	September 24, 2013

This memorandum is to confirm that the spot elevations that were supplied for the noise study report are based on the same datum and coordinate system as the rest of the survey information for the project. Point information supplied to the noise consultant was collected after the initial survey task was completed, but this memo is to verfy that the reference information for both the horizontal and vertical control was the same as was used for original topographic survey.

If you need additional clarifiaciton or have any questions please feel free to contact me at (714) 567-2784.

Thank you.

James L. Elliott

LICENSED LAND SURVEYOR
JAMES L. ELLIOTT
NO. 6334
STATE OF CALIFORNIA

CALIBRATION CERTIFICATE FOR LARSON DAVIS 824

Excalibur Engineering
9201 Irvine Blvd
Irvine, CA 92618
Phone : (949) 454-6603
Fax : (949) 454-6642

Certificate Of Calibration

Customer	LSA	**Dept.**	N/A
Report #	48475-1	**Bar Code #**	
Date Received	FRIDAY, FEBRUARY 27, 2009	**P.O. #**	CREDIT CARD
Manufacturer	LARSON DAVIS	**Serial #**	824A1612
Model #	824	**Asset #**	NAN
Description	SOUND LEVEL METER		

Date Calibrated 3/9/2009 **Calibration Due Date** 3/9/2010 **Calibration Interval** 12

Maintenance Procedure 4226

Temperature 20 ° C **Humidity** 40 % **Calibration Performed By** 28

Accuracy ANSI Type 1

Received In Tolerance

Remarks

Returned In Tolerance

Remarks Meets ANSI type 1 specifications under laboratory conditions.

ID #	Manufacturer	Model #	Description	Calibration Expires
878	BRUEL & KJAER	4226	SLM CALIBRATOR	1/28/2010
713	FLUKE	8920A	20 MHZ TRUE RMS VOLTMETER	7/11/2009

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.

Approved By

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Fax : (949) 454-6642

Certificate Of Calibration

Customer	LSA	**Dept.**	N/A
Report #	48475-2	**Bar Code #**	
Date Received	FRIDAY, FEBRUARY 27, 2009	**P.O. #**	CREDIT CARD
Manufacturer	LARSON DAVIS	**Serial #**	7977
Model #	2541	**Asset #**	NAN
Description	MICROPHONE		

Date Calibrated 3/9/2009 **Calibration Due Date** 3/9/2010 **Calibration Interval** 12

Maintenance Procedure 1371

Temperature 20 ° C **Humidity** 40 % **Calibration Performed By** 29

Accuracy ±1.2dB

Received In Tolerance

Remarks Sensitivity = -26.85dB re lv /PE

See attached frequency response chart.

Returned In Tolerance

Remarks

ID #	Manufacturer	Model #	Description	Calibration Expires
610	BRUEL & KJAER	4228	PISTONPHONE	1/30/2010
051	BRUEL & KJAER	2639	MICROPHONE PREAMPLIFIER	2/3/2010
043	BRUEL & KJAER	4190	1/2" CONDENSER MICROPHONE	6/10/2009
941	BRUEL & KJAER	1049	SINE & NOISE GENERATOR	12/5/2009
949	BRUEL & KJAER	2636	MEASURING AMPLIFIER	2/3/2010
305	AGILENT	8903B	AUDIO ANALYZER	5/30/2009
923	BRUEL & KJAER	2706	POWER AMPLIFIER	7/11/2009
713	FLUKE	8920A	20 MHZ TRUE RMS VOLTMETER	7/11/2009
654	BRUEL & KJAER	2307	LEVEL RECORDER	7/15/2009

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.

MAR 1 0 2009

Approved By

Excalibur Engineering is not liable for any damages, consequences or any remedy regarding this certification with the exception of the calibration within 30 days

Brüel & Kjær

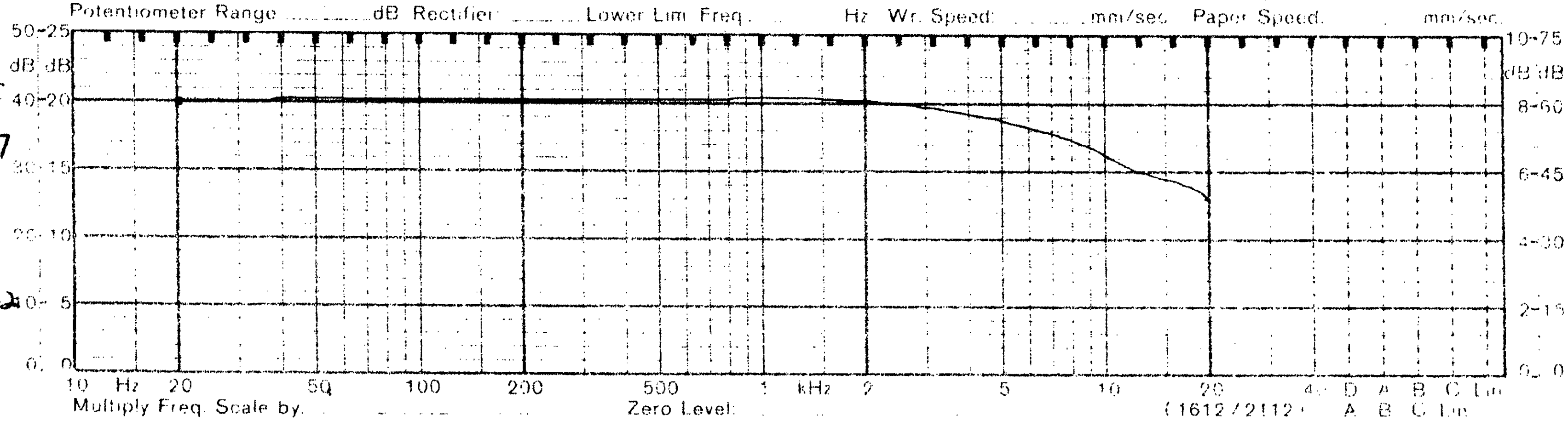
Measuring Object: Larson Davis 2541 S:N 7977

Sensitivity -26.85 re 1V/Pa

No. 48475-2

Date 3-9-09

Sign. #28. R.L



QP 0124

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Certificate Of Calibration

Customer	LSA	**Dept.**	N/A
Report #	48475-3	**Bar Code #**	
Date Received	FRIDAY, FEBRUARY 27, 2009	**P.O. #**	CREDIT CARD
Manufacturer	LARSON DAVIS	**Serial #**	3228
Model #	CAL200	**Asset #**	NAN
Description	PRECISION ACOUSTIC CALIBRATOR		

Date Calibrated 3/9/2009 **Calibration Due Date** 3/9/2010 **Calibration Interval** 12

Maintenance Procedure 1211

Temperature 20 ° C **Humidity** 40 % **Calibration Performed By** 28

Accuracy ± .2 dB

Received Out Of Tolerance

Remarks Spl out of tolerance

Returned In Tolerance

Remarks Adjsted SPL to less than 0.1 dB of nominal.

ID #	Manufacturer	Model #	Description	Calibration Expires
610	BRUEL & KJAER	4228	PISTONPHONE	1/30/2010
051	BRUEL & KJAER	2639	MICROPHONE PREAMPLIFIER	2/3/2010
043	BRUEL & KJAER	4190	1/2" CONDENSER MICROPHONE	6/10/2009
949	BRUEL & KJAER	2636	MEASURING AMPLIFIER	2/3/2010
305	AGILENT	8903B	AUDIO ANALYZER	5/30/2009
713	FLUKE	8920A	20 MHZ TRUE RMS VOLTMETER	7/11/2009

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.

Approved By

EXCALIBUR ENGINEERING
EQUIPMENT SPECIFICATION SHEET

Manufacturer: LARSON DAVIS **Model:** CAL200 **Procedure:** 1211
Work Order: 48475-3 **Serial:** 3228 **Asset:** NAN

RANGE/FUNCTION	APPLIED	AS FOUND	AS LEFT	TOLERANCE
S.P.L.	94.0 dB	94.55 dB	94.07 dB	±0.2 dB
	114.0 dB	114.61 dB	114.03 dB	±0.2 dB
FREQUENCY	1000 Hz	1000.2 Hz	1000.2 Hz	±1% IV
DISTORTION		.254%	.254%	<1%

*** Denotes out of tolerance condition.**

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Certificate Of Calibration

Customer	LSA	**Dept.**	N/A
Report #	48475-4	**Bar Code #**	
Date Received	FRIDAY, FEBRUARY 27, 2009	**P.O. #**	CREDIT CARD
Manufacturer	LARSON DAVIS	**Serial #**	2104
Model #	PRM902	**Asset #**	NAN
Description	MICROPHONE PRE AMP		

Date Calibrated 3/9/2009 **Calibration Due Date** 3/9/2010 **Calibration Interval** 12

Maintenance Procedure M.F.I.B

Temperature 20 ° C **Humidity** 40 % **Calibration Performed By** 28

Accuracy ± 0.10 dB (10 Hz-126 KHz)

Received In Tolerance

Remarks

Returned In Tolerance

Remarks

ID #	Manufacturer	Model #	Description	Calibration Expires
878	BRUEL & KJAER	4226	SLM CALIBRATOR	1/28/2010
941	BRUEL & KJAER	1049	SINE & NOISE GENERATOR	12/5/2009
713	FLUKE	8920A	20 MHZ TRUE RMS VOLTMETER	7/11/2009

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.

MAR 10 2009

Approved By

CALIBRATION CERTIFICATE FOR LARSON DAVIS 820

Excalibur Engineering
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Phone : (949) 454-6603
Fax : (949) 454-6642

Certificate Of Calibration

Customer	LSA	**Dept.**	N/A
Report #	48750-1	**Bar Code #**	
Date Received	THURSDAY, APRIL 23, 2009	**P.O. #**	CREDIT CARD
Manufacturer	LARSON DAVIS	**Serial #**	1584
Model #	820	**Asset #**	NAN
Description	SOUND LEVEL METER		

Date Calibrated 4/30/2009 **Calibration Due Date** 4/30/2010 **Calibration Interval** 12

Maintenance Procedure 4226

Temperature 21 ° C **Humidity** 34 % **Calibration Performed By** 28

Accuracy ANSI Type 1

Received In Tolerance

Remarks Meets ANSI Type 1 specifications undre laboratory conditions.

Returned In Tolerance

Remarks

ID #	Manufacturer	Model #	Description	Calibration Expires
878	BRUEL & KJAER	4226	SLM CALIBRATOR	1/28/2010
713	FLUKE	8920A	20 MHZ TRUE RMS VOLTMETER	4/16/2010

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.

4/30/2009

Approved By

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Certificate Of Calibration

Customer	LSA	**Dept.**	N/A
Report #	48750-2	**Bar Code #**	
Date Received	THURSDAY, APRIL 23, 2009	**P.O. #**	CREDIT CARD
Manufacturer	LARSON DAVIS	**Serial #**	4973
Model #	CAL200	**Asset #**	NAN
Description	PRECISION ACOUSTIC CALIBRATOR		

Calibration Information

Date Calibrated 4/30/2009 **Calibration Due Date** 4/30/2010 **Calibration Interval** 12

Maintenance Procedure 1211

Temperature 21 ° C **Humidity** 34 % **Calibration Performed By** 28

Accuracy ±0.5 dB

Condition Received

Received Out Of Tolerance

Remarks See attached data sheet for out of tolerance data.

Condition Returned

Returned In Tolerance

Remarks Adjusted SPL to less than 0.1dB of nominal

Standards Employed

ID #	Manufacturer	Model #	Description	Calibration Expires
610	BRUEL & KJAER	4228	PISTONPHONE	1/30/2010
051	BRUEL & KJAER	2639	MICROPHONE PREAMPLIFIER	2/3/2010
043	BRUEL & KJAER	4190	1/2" CONDENSER MICROPHONE	6/10/2009
949	BRUEL & KJAER	2636	MEASURING AMPLIFIER	2/3/2010
305	AGILENT	8903B	AUDIO ANALYZER	5/30/2009
713	FLUKE	8920A	20 MHZ TRUE RMS VOLTMETER	4/16/2010

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.

5/5/2009

Approved By

EXCALIBUR ENGINEERING
EQUIPMENT SPECIFICATION SHEET

Manufacturer: LARSON DAVIS
Work Order: 48750-2

Model: CAL200
Serial: 4973

Procedure: 1211
Asset: NAN

RANGE/FUNCTION	APPLIED	AS FOUND	AS LEFT	TOLERANCE
S.P.L	94.0dB	93.73dB*	93.91dB*	±0.2dB
	114.0dB	113.75dB*	113.90dB*	±0.2dB
FREQUENCY	1000 Hz	1000.2 Hz	1000.2 Hz	±1%IV
DISTORTION		.381%	.381%	<1%

* Denotes out of tolerance condition.

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Certificate Of Calibration

Customer	LSA	**Dept.**	N/A
Report #	48750-3	**Bar Code #**	
Date Received	THURSDAY, APRIL 23, 2009	**P.O. #**	CREDIT CARD
Manufacturer	PCB PIEZOTRONICS	**Serial #**	101355
Model #	377A60	**Asset #**	NAN
Description	MICROPHONE		

Date Calibrated 4/30/2009 **Calibration Due Date** 4/30/2010 **Calibration Interval** 12

Maintenance Procedure 1371

Temperature 21 ° C **Humidity** 32 % **Calibration Performed By** 28

Accuracy ± 2 dB

Received In Tolerance

Remarks Sensitivity = -26.211000.2 Hz

Returned In Tolerance

Remarks

ID #	Manufacturer	Model #	Description	Calibration Expires
051	BRUEL & KJAER	2639	MICROPHONE PREAMPLIFIER	2/3/2010
610	BRUEL & KJAER	4228	PISTONPHONE	1/30/2010
043	BRUEL & KJAER	4190	1/2" CONDENSER MICROPHONE	6/10/2009
654	BRUEL & KJAER	2307	LEVEL RECORDER	7/15/2009
941	BRUEL & KJAER	1049	SINE & NOISE GENERATOR	12/5/2009
949	BRUEL & KJAER	2636	MEASURING AMPLIFIER	2/3/2010
305	AGILENT	8903B	AUDIO ANALYZER	5/30/2009
655	BRUEL & KJAER	4142	MICRPHN CALIB APPARATUS	6/1/2010
713	FLUKE	8920A	20 MHZ TRUE RMS VOLTMETER	4/16/2010

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.

4/30/2009

Approved By

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Irvine, CA 92618
Phone : (949) 454-6603
Fax : (949) 454-6642

Certificate Of Calibration

Customer	LSA	**Dept.**	N/A
Report #	48750-4	**Bar Code #**	
Date Received	THURSDAY, APRIL 23, 2009	**P.O. #**	CREDIT CARD
Manufacturer	LARSON DAVIS	**Serial #**	2484
Model #	PRM828	**Asset #**	NAN
Description	PRE AMP		

Calibration Information

Date Calibrated 4/30/2009 **Calibration Due Date** 4/30/2010 **Calibration Interval** 12

Maintenance Procedure MFIB

Temperature 21 ° C **Humidity** 33 % **Calibration Performed By** 28

Accuracy ±.10dB (10 Hz -126 KHz)

Condition Received

Received In Tolerance

Remarks

Condition Returned

Returned In Tolerance

Remarks

Standards Employed

ID #	Manufacturer	Model #	Description	Calibration Expires
941	BRUEL & KJAER	1049	SINE & NOISE GENERATOR	12/5/2009
713	FLUKE	8920A	20 MHZ TRUE RMS VOLTMETER	4/16/2010

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.

[illegible] 5/5/2009

Approved By