

Environmental Noise Analysis

Elverta Park Residential Development

Sacramento County, California

BAC Job # 2014-117

Prepared For:

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Introduction

The proposed Elverta Park residential project consists of the development of single-family residential uses on the south side of Elverta Road west of the intersection of Watt Avenue and Elverta Road in Sacramento County, California. The project site is bordered to the north by Elverta Road, to the west and south by a number of single-family residential uses on large rural type lots, and to the east by several commercial uses including a public storage facility and Walmart. Future traffic on Elverta Road, activities at the Walmart store and aircraft activity at McClellan Air Force Base are considered to be potentially significant noise sources which could affect this development. As a result, the acoustical consulting firm of Bollard Acoustical Consultants, Inc. (BAC) was retained by the project applicant to prepare this analysis of potential noise impacts and to provide mitigation measures where appropriate. Figure 1 shows the project area.

Noise Fundamentals and Terminology

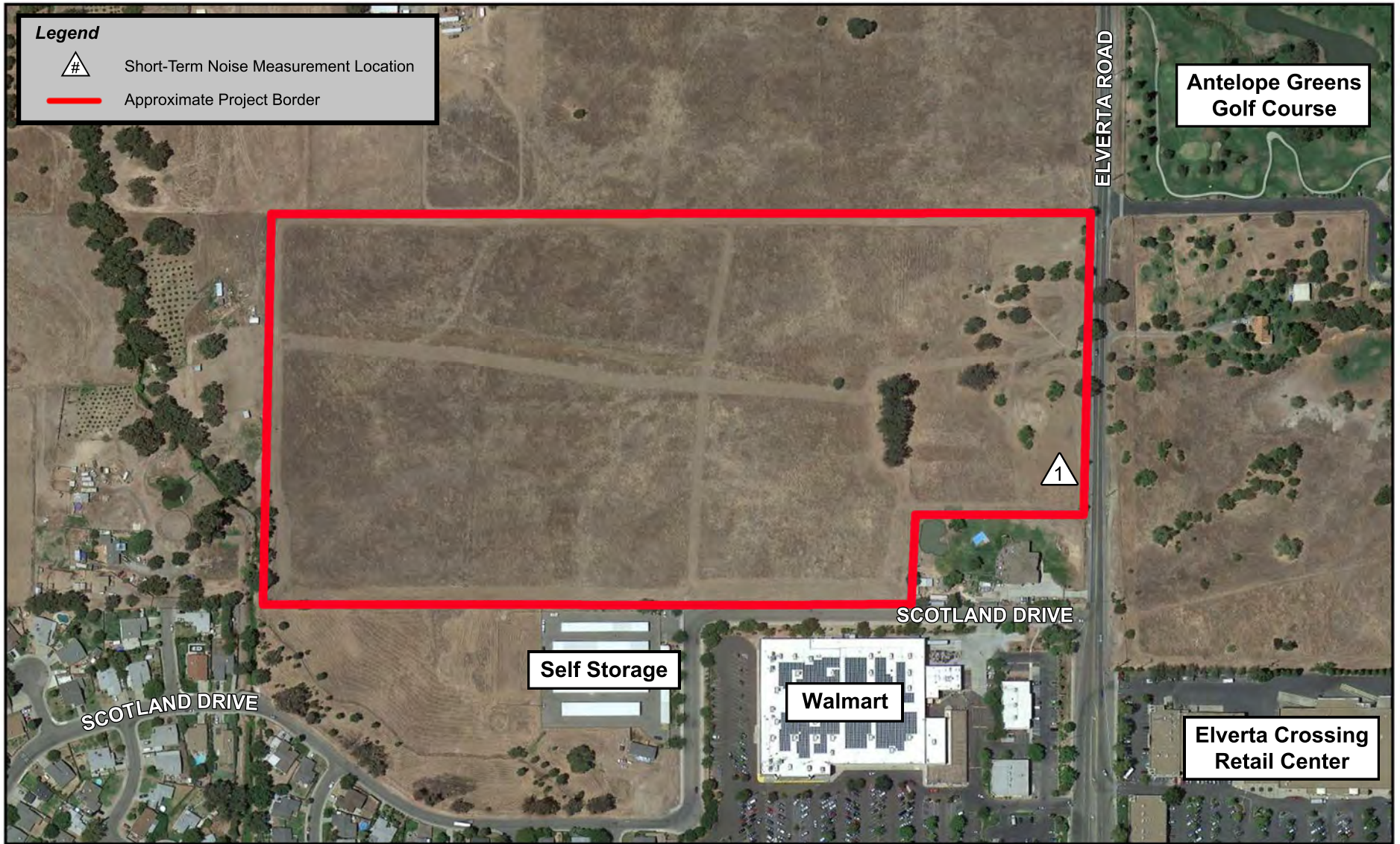
Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard, and thus are called sound. Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in levels (dB) correspond closely to human perception of relative loudness. Appendix A contains definitions of Acoustical Terminology. Table 1 shows common noise levels associated with various sources.

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

Community noise is commonly described in terms of the “ambient” noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}) over a given time period (usually one hour). The L_{eq} is the foundation of the Day-Night Average Level noise descriptor, L_{dn} , and shows very good correlation with community response to noise.

Figure 1

Elverta Park Residential Development - Sacramento County, California Project Area and Noise Measurement Locations



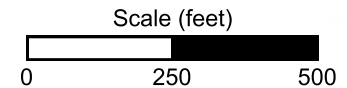
Legend



Short-Term Noise Measurement Location



Approximate Project Border



The Day-Night Average Level (L_{dn}) is based upon the average noise level over a 24-hour day, with a +10 decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment. L_{dn} -based noise standards are commonly used to assess noise impacts associated with traffic, railroad and aircraft noise sources.

Table 1
Typical A-Weighted Sound Levels of Common Noise Sources

Loudness Ratio	dBA	Description
128	130	Threshold of pain
64	120	Jet aircraft take-off at 100 feet
32	110	Riveting machine at operators position
16	100	Shotgun at 200 feet
8	90	Bulldozer at 50 feet
4	80	Diesel locomotive at 300 feet
2	70	Commercial jet aircraft interior during flight
1	60	Normal conversation speech at 5-10 feet
1/2	50	Open office background level
1/4	40	Background level within a residence
1/8	30	Soft whisper at 2 feet
1/16	20	Interior of recording studio

Criteria for Acceptable Noise Exposure

Sacramento County General Plan

The Sacramento County General Plan Noise Element applies an exterior noise level standard of 65 dB L_{dn} at outdoor activity areas of residential land uses exposed to transportation noise sources (i.e., traffic). The intent of this standard is to provide an acceptable exterior noise environment for outdoor activities. For single-family residential uses, such as the proposed project, this limit is normally applied at primary outdoor activity areas. Sacramento County also utilizes an interior noise level standard of 45 dB L_{dn} or less within noise-sensitive project dwellings. The intent of this interior noise limit is to provide a suitable environment for indoor communication and sleep.

The County also establishes acceptable hourly noise level performance criteria for new residential projects which are affected by non-transportation noise sources, such as those attributed to loading dock operations or automotive repair centers. The non-transportation noise level performance criteria are provided in Table 2.

Table 2
Noise Level Performance Standards¹
For Residential Areas Affected By Non-Transportation Noise Sources

Noise Level Descriptor	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Hourly L ₅₀	55 dB	50 dB
Maximum level	75 dB	70 dB

Notes:

1. The Table 1 standards shall be reduced by 5 dB for sounds consisting primarily of speech or music, and for recurring impulsive sounds. If the existing ambient noise level exceeds the standards of Table 1, then the noise level standards shall be increased at 5 dB increments to encompass the ambient.

Source: Sacramento County General Plan (2011)

Evaluation of Future Elverta Road Traffic Noise Levels

Traffic Noise Prediction Methodology:

The Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA-RD-77-108) with the Calveno vehicle noise emission curves was used to predict traffic noise levels at the project site. The FHWA Model is the traffic noise prediction model preferred by the Federal Highway Administration and the State of California Department of Transportation (Caltrans) for use in traffic noise assessment.

Traffic Noise Prediction Model Calibration:

The FHWA Model provides reasonably accurate traffic noise predictions under “ideal” roadway conditions. Ideal conditions are generally considered to be long straight roadway segments with uniform vehicle speeds, a flat roadway surface, good pavement conditions, a statistically large volume of traffic, and an unimpeded view of the roadway from the receiver location. Such conditions appeared to be in effect at this project site. Nonetheless, BAC conducted a calibration of the FHWA Model through site-specific traffic noise level measurements and concurrent traffic counts.

A Larson-Davis Laboratories (LDL) Model 820 precision integrating sound level meter was used to complete the noise level measurement survey. The meter was calibrated before use with an LDL Model CA200 acoustical calibrator to ensure the accuracy off the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4).

The FHWA Model calibration process was performed at one location on the project site on the afternoon of June 4th, 2014. The traffic noise measurement location is shown on Figure 1. The detailed results of this procedure are provided in Appendix B. The FHWA Model was found to reasonably predict traffic noise levels at the measurement site. As a result, no calibration adjustment was applied to the FHWA Model for the prediction of future traffic noise levels at the project site.

Predicted Future Traffic Noise Levels at the Project Site:

The FHWA Model was used with future traffic data to predict future traffic noise levels at the proposed noise outdoor activity areas of the Elverta Park Residential Development which are located adjacent to Elverta Road. Future traffic noise levels were predicted at representative rear yard areas of this development. Average daily traffic volumes for future conditions (2025) were obtained from the Sacramento Area Council of Governments (SACOG). The FHWA Model inputs and predicted future traffic noise levels at the project site are shown in Appendix C. The predicted future traffic noise levels and contours are summarized below in Table 3. Future Elverta Road unmitigated traffic noise contours are illustrated on Figure 2.

Table 3
Predicted Future Traffic Noise Levels and Contour Distances¹
Elverta Park Residential Development – Sacramento County, California

Description	Distance From Roadway Centerline (feet)	L _{dn} (dB)	Distance to L _{dn} Noise Contour (feet) ^{3,4}		
			70 dB	65 dB	60 dB
Outdoor Activity Area & Building Façade of Residences Proposed Adjacent to Elverta Road	90	69	82	177	381

Notes:

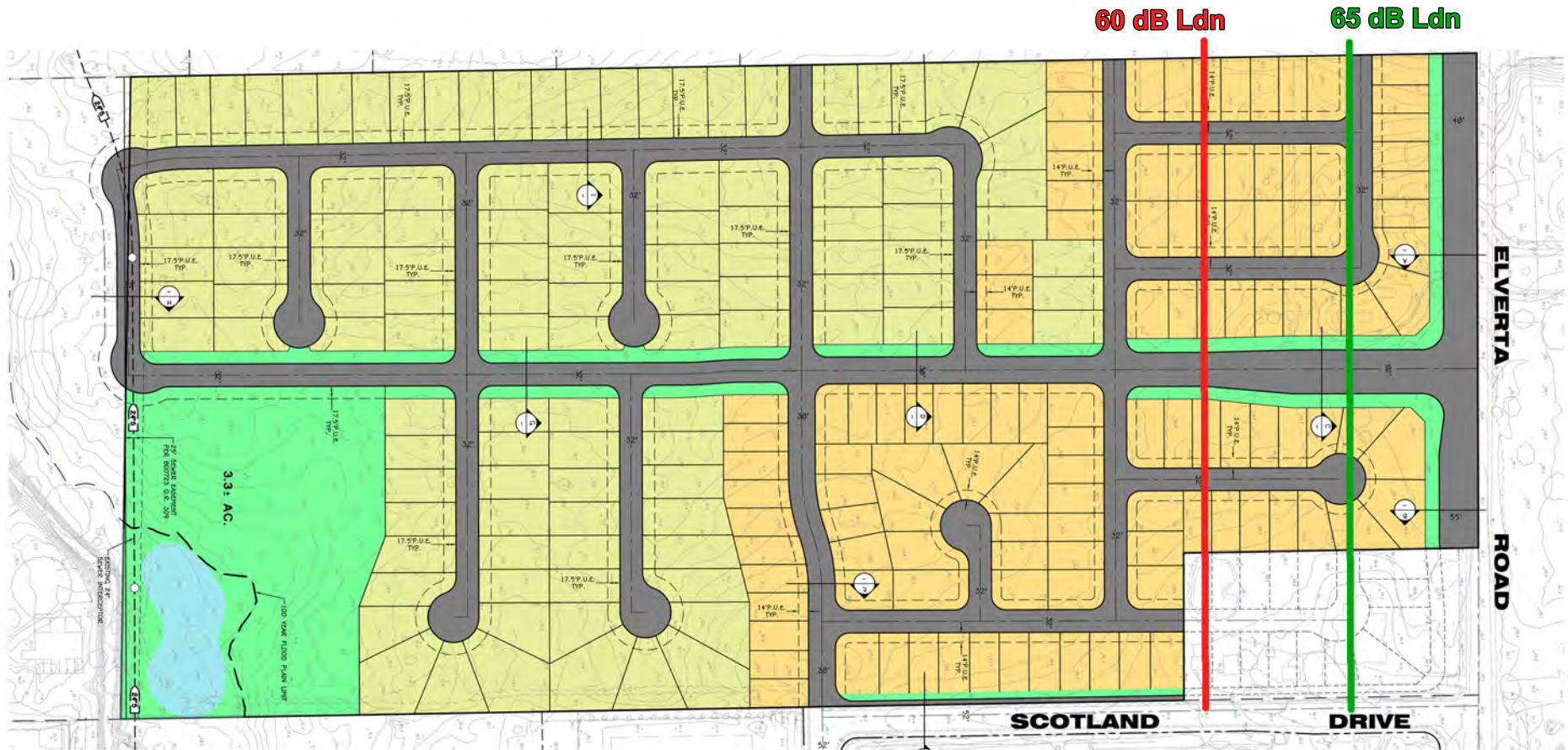
1. A complete listing of FHWA Model inputs and results are provided in Appendix C.
2. Lot locations are illustrated on Figure 1.
3. Future Elverta Road unmitigated traffic noise contours are illustrated on Figure 2.
4. Distance to future traffic noise contours are measured from the centerline of Elverta Road.

Source: Bollard Acoustical Consultants, Inc. (2014)

The Table 3 data indicate that future traffic noise levels are predicted to exceed the 65 dB L_{dn} exterior noise level standard applied by Sacramento County to the outdoor activity areas of new residential developments. Specifically, future traffic noise levels in the backyard areas of the lots located nearest to Elverta Road are predicted to be approximately 69 dB L_{dn}, not including shielding provided by proposed 6-foot high masonry barrier. Therefore, additional analysis of this shielding is required to ensure compliance with the County's exterior noise level standard.

At the nearest proposed residential building facades, the Table 3 data indicate that the predicted future traffic noise exposure would be approximately 69 dB L_{dn}. This information is used in a subsequent section of this report to assess compliance with the County's interior noise level standards.

Figure 2
 Elverta Park Residential Development - Sacramento County, California
 Proposed Project Site Plan and Unmitigated Future Noise Contours

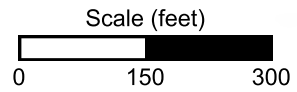


Legend

- Unmitigated Future 60 dB Ldn Contour
- Unmitigated Future 65 dB Ldn Contour



Existing Walmart



Traffic Noise Mitigation Measures

Exterior Areas:

Noise mitigation measures for outdoor activity areas of residential developments can take several forms, including setbacks, lot orientation and noise barriers. For this project, a 9 dB decrease in traffic noise levels is required to achieve compliance with the County's 65 dB L_{dn} exterior noise level standard at the nearest outdoor activity areas to Elverta Road. The project applicant has proposed to construct a 6-foot high masonry barrier at the rear of the lots nearest to Elverta Road.

An analysis of noise barrier effectiveness was conducted for this project and is summarized below in Table 4 for representative lots nearest to Elverta Road. The detailed results of the noise barrier effectiveness is provided as Appendix D.

Table 4
Barrier Analysis Results¹
Elverta Park Residential Development – Sacramento County, California

Barrier Height (feet) ²	Predicted Future Traffic Noise Level at Outdoor Activity Area, L_{dn} (dB)
No barrier	69
6	64
7	62
8	61
9	59
10	58

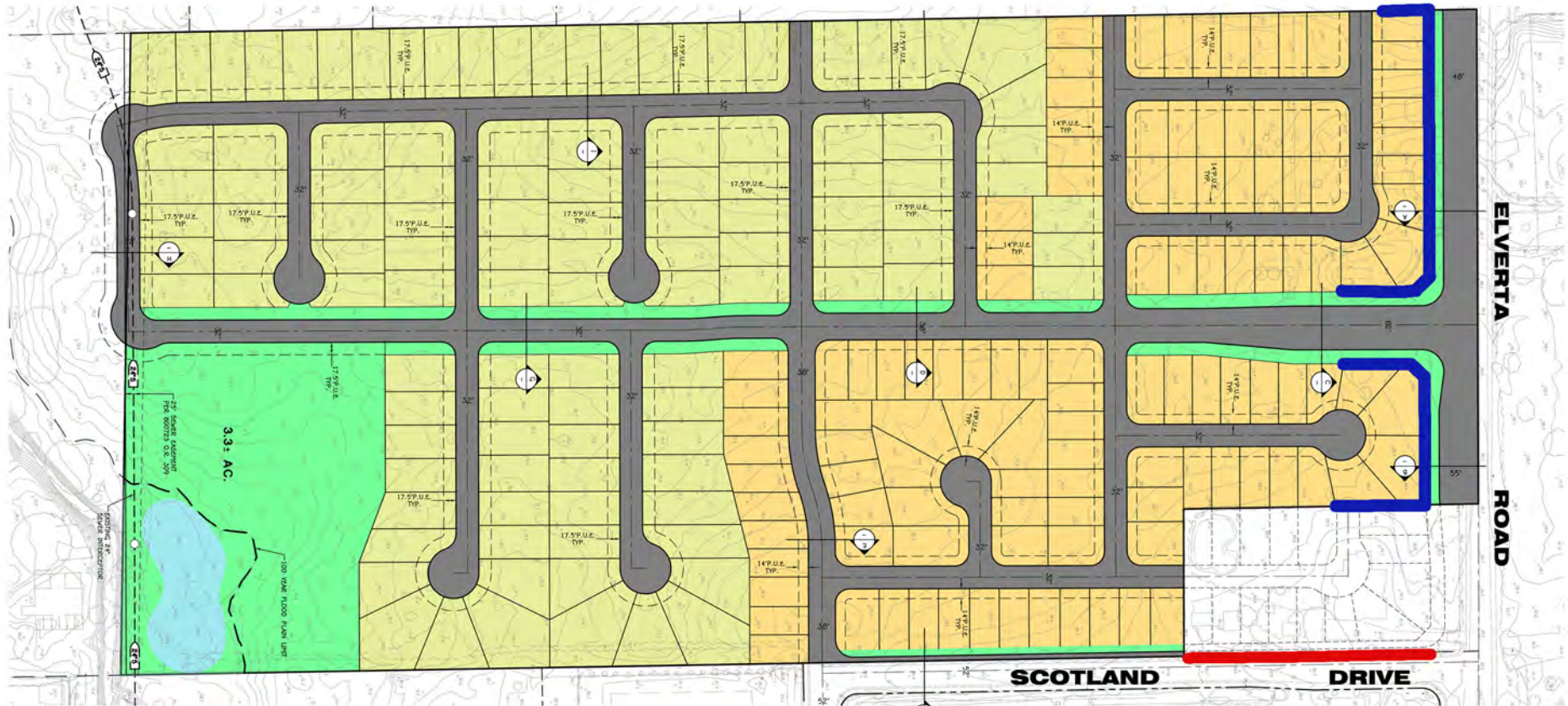
Notes:

1. A complete listing of Noise Barrier Effectiveness inputs and results are provided in Appendix D.
2. Barrier heights are relative to the building pad elevations.

Source: Bollard Acoustical Consultants, Inc. (2014)

As seen in Table 4, the results of the noise barrier analysis indicate that the proposed 6-foot tall noise barrier would be adequate to reduce future Elverta Road traffic noise levels to 66 dB L_{dn} or less at the proposed backyard areas. The location of the recommended barriers are shown on Figure 3.

Figure 3
 Elverta Park Residential Development - Sacramento County, California
 Existing & Recommended Noise Barrier Locations



Existing Walmart

Legend

- Existing 8-Foot Noise Barrier Location
- Recommended Noise Barrier Location



Interior Areas:

The worst-case exposure of any residence in the Elverta Park Residential Development to future traffic noise would occur at the residences nearest to Elverta Road. As indicated in Table 3, the predicted future L_{dn} at the first-floor facades of these residences would be approximately 69 dB, not including shielding provided by the proposed noise barrier. Due to reduced ground absorption of sound at elevated locations, traffic noise levels are expected to be approximately 2 dB higher at second floor facades (71 dB L_{dn}). Given a future worst-case exterior noise level of 71 dB L_{dn} , a building facade noise reduction of 26 dB would be required to achieve an interior noise level of 45 dB L_{dn} .

Standard residential construction (wood siding, STC-27 windows, door weather-stripping, exterior wall insulation, composition plywood roof), results in an exterior to interior noise reduction of at least 25 dB with windows closed and approximately 15 dB with windows open. Therefore, standard construction would be acceptable for shielded first-floor facades, but would fail to provide the required noise reduction at elevated (unshielded) second-floor facades.

To achieve the required degree of noise reduction at the second floor facades located adjacent to Elverta Road, all second-floor bedroom windows of the lots adjacent to Elverta Road from which that roadway is visible should be upgraded to a minimum STC rating of 30. In addition, air conditioning should be provided for all residences within this development to allow the occupants to close doors and windows as desired for additional acoustical isolation.

Evaluation of Adjacent Walmart Noise Levels

The primary noise sources associated with the adjacent Walmart store include activities at the loading dock and automotive repair center. Loading dock activities include heavy truck movements in and out of the loading dock area, idling trucks, and the movement of cargo off of trucks. Noise generated from the automotive center includes the use of pneumatic tools and movement of vehicles in and out of the repair center.

BAC field observations conducted at the project site indicate that Walmart noise levels did not appear to be significant relative to background noise from Elverta Road. No mechanical equipment was identified along the west side of the Walmart store and the rooftop HVAC units were not audible from the project site. Furthermore, the Walmart store activities are substantially shielded from view of the project site by the Walmart building itself and by existing noise barriers located along the western boundary of the Walmart site and along the eastern border of the existing residence located near the northeast corner of the project site. As a result, additional noise mitigation for the Walmart store operations is not believed to be warranted for this project. Nonetheless, BAC recommends that disclosure statements be provided to all prospective residents of this development informing them of the potential for noise generation at the Walmart store, including possible nighttime truck deliveries.

Evaluation of Aircraft Noise from McClellan Air Force Base

The McClellan AFB Draft Final Reuse Plan Draft SEIR contains projected 2022 noise level contours for McClellan Air Force Base. The referenced McClellan AFB Draft Final Reuse Draft SEIR indicates that the proposed Elverta Park Residential Development Project Site is located well outside (approximately 1,400 feet) of the 2022 CNEL 60 dB noise level contour. Based on these noise contours, the project site is not predicted to be adversely impacted by aircraft noise. Figure 4 contains Exhibit 3.5-3 from the McClellan AFB Draft Final Reuse Draft SEIR and shows the 2022 CNEL 60 dB noise level contour along with the proximity of the Elverta Park Residential Development.

Although the project site is located well beyond the aircraft noise impact zone, BAC recommends that disclosure statements be provided to all prospective residents of this development informing them of the presence of aircraft noise generation at the project site, and informing them of the likelihood of periodic nighttime aircraft arrivals or departures.

Conclusions

A portion of the Elverta Park Residential Development project site will be exposed to future Elverta Road traffic noise levels in excess of Sacramento County's 65 dB L_{dn} exterior and 45 dB L_{dn} interior noise level standards for new residential developments. The following specific noise mitigation measures are recommended to achieve compliance with the County's noise standards:

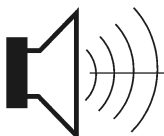
- A solid noise barrier measuring 6 feet in height, relative to the lot pad elevation, would be required to reduce future traffic noise levels to 65 dB L_{dn} or less in the backyards located adjacent to Elverta Road. Figure 3 shows the recommended noise barrier locations. Suitable materials for the traffic noise barriers include masonry and precast concrete panels. Other materials may be acceptable but should be reviewed by an acoustical consultant prior to use.
- All second-floor bedroom windows of residences constructed adjacent to Elverta Road, which have a view of the roadway, should have a minimum sound transmission class (STC) rating of 30. This measure is predicted to result in compliance with the County's 45 dB L_{dn} interior noise level standard.
- Mechanical ventilation (air conditioning) should be provided for all residences in this development to allow the occupants to close doors and windows as desired to achieve compliance with the applicable interior noise level criteria.
- BAC recommends that disclosure statements be provided to all prospective residents of this development informing them of the potential for noise generation at the Walmart store, including possible nighttime truck deliveries, as well as the potential for nighttime aircraft overflights associated with McClellan Airport.

These conclusions are based on the site plan shown in Figure 2, BAC observations, file data and assumptions, traffic volumes provided by SACOG and noise contours contained in the McClellan AFB Draft Final Reuse Plan Draft SEIR. Changes to the site plan or deviations from the assumptions cited herein could cause future noise levels to differ from those predicted in this analysis. BAC is not responsible for degradation in acoustic performance of the residential construction due to poor construction practices, failure to comply with applicable building code requirements, or for failure to adhere to the minimum building practices cited in this report.

This concludes our environmental noise assessment for the proposed Elverta Park Residential Development in Sacramento County, California. Please contact BAC at (916) 663-0500 or paulb@bacnoise.com with any questions or requests for additional information.

Appendix A Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
L_{dn}	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
L_{max}	The highest root-mean-square (RMS) sound level measured over a given period of time.
Loudness	A subjective term for the sensation of the magnitude of sound.
Masking	The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.
Noise	Unwanted sound.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the Maximum level, which is the highest RMS level.
RT₆₀	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
SEL	A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.



B O L L A R D

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

Project Information: Job Number: 2014-117
Project Name: Elverta Park Residential Development
Roadway Tested: Elverta Road
Test Location: Site 1
Test Date: June 4, 2014

Weather Conditions: Temperature (Fahrenheit): 82
Relative Humidity: 25%
Wind Speed and Direction: W at 10 MPH
Cloud Cover: Clear

Sound Level Meter: Sound Level Meter: LDL Model 820 (BAC #8)
Calibrator: LDL Model CAL200
Meter Calibrated: Immediately before
Meter Settings: A-weighted, slow response

Microphone: Microphone Location: On project site
Distance to Centerline (feet): 75
Microphone Height: 5 feet above ground
Intervening Ground (Hard or Soft): **Soft**
Elevation Relative to Road (feet): 5

Roadway Condition: Pavement Type Asphalt
Pavement Condition: Good
Number of Lanes: 2
Posted Maximum Speed (mph): 45

Test Parameters: Test Time: 1:00 PM
Test Duration (minutes): 15
Observed Number Automobiles: 197
Observed Number Medium Trucks: 3
Observed Number Heavy Trucks: 1
Observed Average Speed (mph): 35

Model Calibration: Measured Average Level (L_{eq}): 59.8
Level Predicted by FHWA Model: 60.5
Difference: 0.7 dB

Conclusions:

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

Project Information:

Job Number: 2014-117
 Project Name: Elverta Park Residential Development
 Roadway Name: Elverta Road

Traffic Data:

Year: 2025
 Average Daily Traffic Volume: 34,900
 Percent Daytime Traffic: 85
 Percent Nighttime Traffic: 15
 Percent Medium Trucks (2 axle): 2
 Percent Heavy Trucks (3+ axle): 2
 Assumed Vehicle Speed (mph): 45
 Intervening Ground Type (hard/soft): **Soft**

Traffic Noise Levels:

		-----L _{dn} , dB-----					
Location:	Description	Distance	Offset (dB)	Autos	Medium Trucks	Heavy Trucks	Total
1	Lots nearest to Elverta Road	90	0	68	59	63	69

Traffic Noise Contours (No Calibration Offset):

L _{dn} Contour, dB	Distance from Centerline, (ft)
75	38
70	82
65	177
60	381

Notes:

**Appendix D
FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)
Noise Barrier Effectiveness Prediction Worksheet**

Project Information: Job Number: 2014-117
Project Name: Elverta Park Residential Development
Roadway Name: Elverta Road
Location(s): Lots nearest to Elverta Road

Noise Level Data: Year: 2025
Auto L_{dn}, dB: 68
Medium Truck L_{dn}, dB: 59
Heavy Truck L_{dn}, dB: 63

Site Geometry: Receiver Description: Lots nearest to Elverta Road
Centerline to Barrier Distance (C₁): 80
Barrier to Receiver Distance (C₂): 10
Automobile Elevation: 0
Medium Truck Elevation: 2
Heavy Truck Elevation: 8
Pad/Ground Elevation at Receiver: 0
Receiver Elevation¹: 5
Base of Barrier Elevation: 0
Starting Barrier Height 6

Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height ² (ft)	----- L _{dn} , dB -----				Barrier Breaks Line of Sight to...		
		Autos	Medium Trucks	Heavy Trucks	Total	Autos?	Medium Trucks?	Heavy Trucks?
6	6	61	53	58	64	Yes	Yes	Yes
7	7	60	52	57	62	Yes	Yes	Yes
8	8	58	50	56	61	Yes	Yes	Yes
9	9	57	49	54	59	Yes	Yes	Yes
10	10	56	48	53	58	Yes	Yes	Yes
11	11	55	47	52	57	Yes	Yes	Yes
12	12	54	46	51	56	Yes	Yes	Yes
13	13	53	45	50	55	Yes	Yes	Yes
14	14	53	44	49	55	Yes	Yes	Yes

Notes: 1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s)

