Environmental Noise Assessment

White Rock Springs Ranch Residential Development

Folsom, California

BAC Job # 2015-170

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October 19, 2015

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Introduction

The proposed White Rock Springs Ranch Development (project) is located within the Folsom South of U.S. Highway 50 Specific Plan. The project proposes to construct single-family homes at a site located at the northeast quadrant of the intersection of Placerville Road (Road "B") and White Rock Road. The project area and site plan are shown in Figures 1 and 2, respectively.

Traffic on Placerville Road and White Rock Road is considered to be a potentially significant noise source which may affect the design of the project. As a result, Bollard Acoustical Consultants, Inc. (BAC) was retained by the project applicant to prepare this acoustical analysis. Specifically, this analysis was prepared to determine whether traffic noise from White Rock Road, Road "A", Road "B", or Empire Ranch Road would cause noise levels at the project site to exceed acceptable limits as described in the Noise Element of the City of Folsom General Plan. In addition, this analysis was prepared to evaluate compliance with the Folsom South of U.S. Highway 50 Specific Plan EIR Noise Mitigation Measures.

Noise Fundamentals and Terminology

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

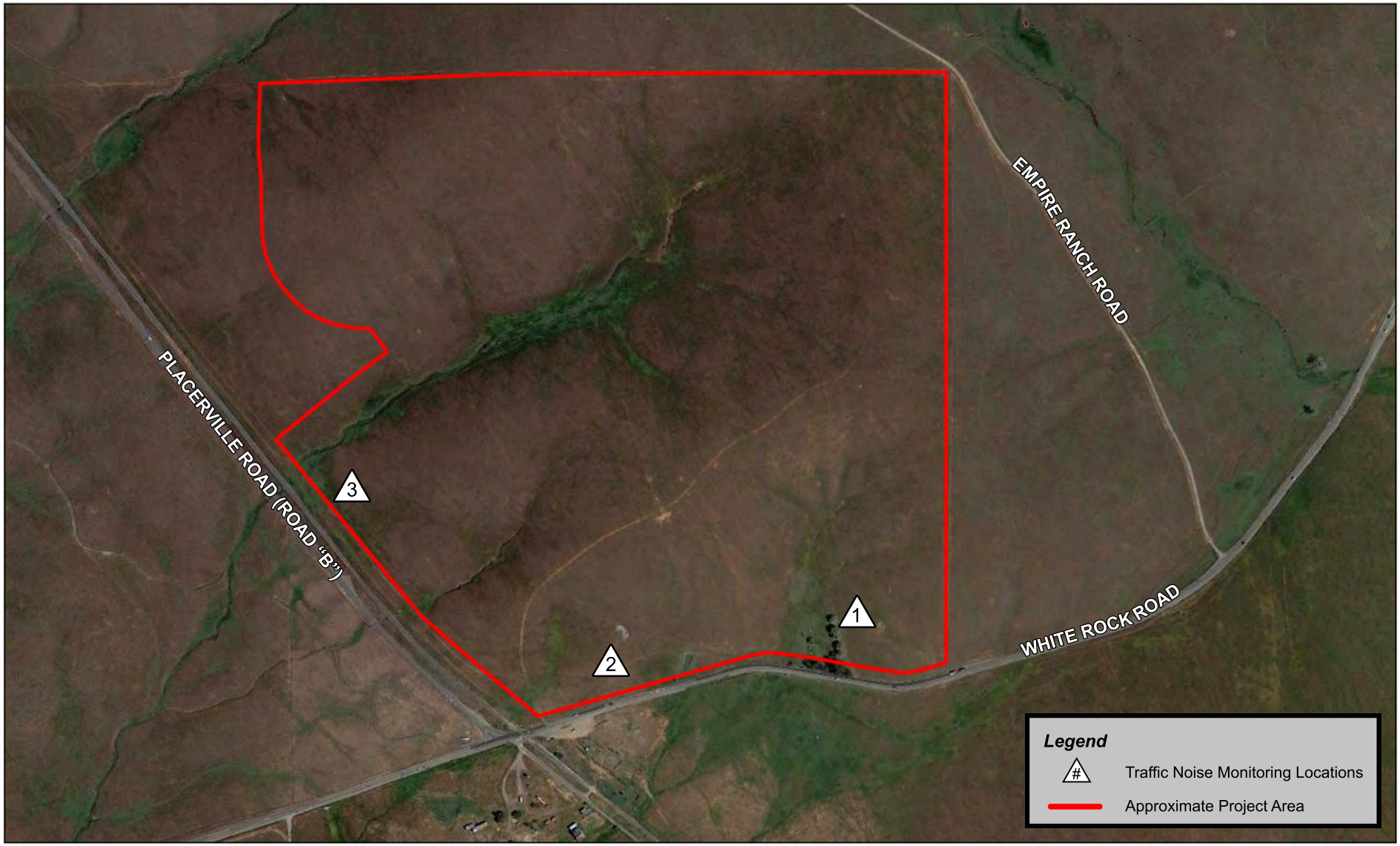
The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighing the frequency response of a sound level meter by means of the standardized A-weighing 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

Project Area and Traffic Noise Monitoring Locations

White Rock Springs Ranch Residential Development - Folsom, California



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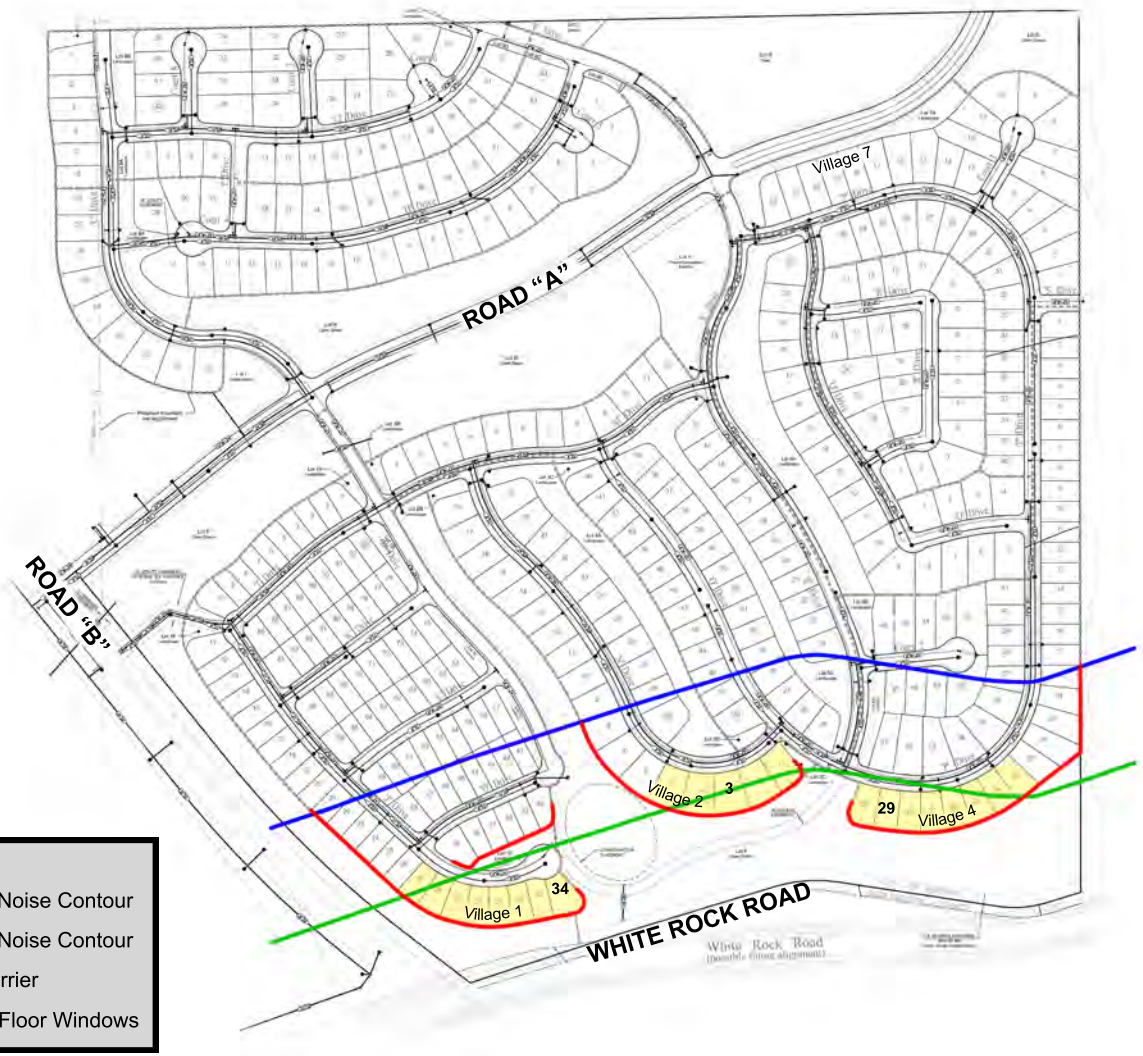
Scale (feet)

0 350 700

Figure 2

Proposed Project Site Plan and Recommended Noise Barrier Locations
White Rock Springs Ranch Residential Development - Folsom, California



Legend

- White Rock Road 60 dB Noise Contour
- White Rock Road 65 dB Noise Contour
- Recommended Noise Barrier
- Required Upgraded 2nd-Floor Windows

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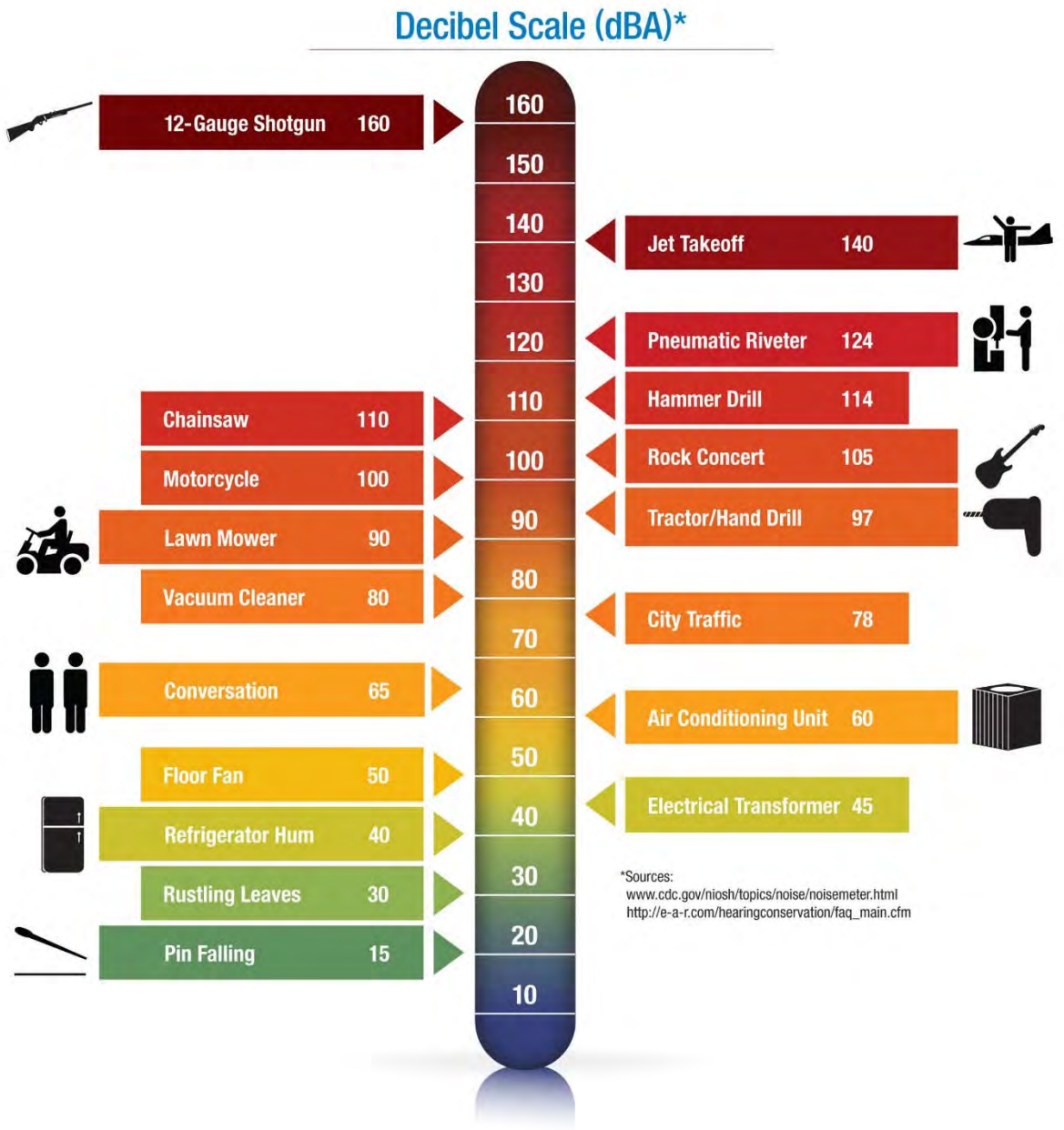
Scale (feet)
0 300 600

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

Figure 3
Typical A-Weighted Sound Levels of Common Noise Sources



Criteria for Acceptable Noise Exposure

The City of Folsom General Plan Noise Element establishes an exterior noise level standard of 60 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, these limits are normally applied at backyard areas.

The City of Folsom 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.

Folsom South of U.S. Highway 50 Specific Plan Noise Mitigation Measures

The noise mitigation measures shown below have been incorporated into the Folsom South of U.S. Highway 50 Specific Plan in order to mitigate identified environmental impacts. The noise-related Mitigation Measures which are applicable to the development of single-family residential land uses within the White Rock Springs Ranch development are reproduced below. Following each mitigation measure is a brief discussion as to the applicability of the mitigation measure to the White Rock Springs Ranch Residential Development.

MM 3A.11-1 Implement Noise-Reducing Construction Practices, Prepare and Implement a Noise Control Plan, and Monitor and Record Construction Noise near Sensitive Receptors.

To reduce impacts associated with noise generated during project-related construction activities, the project applicant(s) and their primary contractors for engineering design and construction of all project phases shall ensure that the following requirements are implemented at each work site in any year of project construction to avoid and minimize construction noise effects on sensitive receptors. The project applicant(s) and primary construction contractor(s) shall employ noise-reducing construction practices. Measures that shall be used to limit noise shall include the measures listed below:

- Noise-generating construction operations shall be limited to the hours between 7 a.m. and 6 p.m. Monday through Friday, and between 8 a.m. and 5 p.m. on Saturdays and Sundays.

- All construction equipment and equipment staging areas shall be located as far as possible from nearby noise-sensitive land uses.

- All construction equipment shall be properly maintained and equipped with noise-reduction intake and exhaust mufflers and engine shrouds, in accordance with manufacturers' recommendations. Equipment engine shrouds shall be closed during equipment operation.

- All motorized construction equipment shall be shut down when not in use to prevent idling.

- Individual operations and techniques shall be replaced with quieter procedures (e.g., using welding instead of riveting, mixing concrete on-site instead of off-site).

- Noise-reducing enclosures shall be used around stationary noise-generating equipment (e.g., compressors and generators) as planned phases are built out and future noise sensitive receptors are located within close proximity to future construction activities.

- Written notification of construction activities shall be provided to all noise-sensitive receptors located within 850 feet of construction activities. Notification shall include anticipated dates and hours during which construction activities are anticipated to occur and contact information, including a daytime telephone number, for the project representative to be contacted in the event that noise levels are deemed excessive. Recommendations to assist noise-sensitive land uses in reducing interior noise levels (e.g., closing windows and doors) shall also be included in the notification.

- To the extent feasible, acoustic barriers (e.g., lead curtains, sound barriers) shall be constructed to reduce construction-generated noise levels at affected noise-sensitive land uses. The barriers shall be designed to obstruct the line of sight between the noise-sensitive land use and on-site construction equipment. When installed properly, acoustic barriers can reduce construction noise levels by approximately 8–10 dB (EPA 1971).

- When future noise sensitive uses are within close proximity to prolonged construction noise, noise-attenuating buffers such as structures, truck trailers, or soil piles shall be located between noise sources and future residences to shield sensitive receptors from construction noise.

- The primary contractor shall prepare and implement a construction noise management plan. This plan shall identify specific measures to ensure compliance with the noise control measures specified above. The noise control plan shall be submitted to the City of Folsom before any noise-generating construction activity begins. Construction shall not commence until the construction noise management plan is approved by the City of Folsom. Mitigation for the two off-site roadway connections into El Dorado County must be coordinated by the project applicant(s) of the applicable project phase with El Dorado County, since the roadway extensions are outside of the City of Folsom's jurisdictional boundaries.

Mitigation Measure 3A.11-1 will be implemented during project construction.

MM 3A.11-3 Implement Measures to Prevent Exposure of Sensitive Receptors to Groundborne Noise or Vibration from Project Generated Construction Activities.

- To the extent feasible, blasting activities shall not be conducted within 275 feet of existing or future sensitive receptors.

- To the extent feasible, bulldozing activities shall not be conducted within 50 feet of existing or future sensitive receptors.

- All blasting shall be performed by a blast contractor and blasting personnel licensed to operate in the State of California.

- A blasting plan, including estimates of vibration levels at the residence closest to the blast, shall be submitted to the enforcement agency for review and approval prior to the commencement of the first blast.

- Each blast shall be monitored and documented for groundborne noise and vibration levels at the nearest sensitive land use and associated recorded submitted to the enforcement agency.

Mitigation Measure 3A.11-3 will be implemented during project construction.

MM 3A.11-4 Implement Measures to Prevent Exposure of Sensitive Receptors to Increases in Noise from Project-Generated Operational Traffic on Off-site and On-Site Roadways.

To meet applicable noise standards as set forth in the appropriate General Plan or Code (e.g., City of Folsom, County of Sacramento, and County of El Dorado) and to reduce increases in traffic-generated noise levels at noise-sensitive uses, the project applicant(s) of all project phases shall implement the following:

- Obtain the services of a consultant (such as a licensed engineer or licensed architect) to develop noise-attenuation measures for the proposed construction of on-site noise-sensitive land uses (i.e., residential dwellings and school classrooms) that will produce a minimum composite Sound Transmission Class (STC) rating for buildings of 30 or greater, individually computed for the walls and the floor/ceiling construction of buildings, for the proposed construction of on-site noise-sensitive land uses (i.e., residential dwellings and school classrooms).

- Prior to submittal of tentative subdivision maps and improvement plans, the project applicant(s) shall conduct a site-specific acoustical analysis to determine predicted roadway noise impacts attributable to the project, taking into account site-specific conditions (e.g., site design, location of structures, building characteristics). The

acoustical analysis shall evaluate stationary- and mobile-source noise attributable to the proposed use or uses and impacts on nearby noise-sensitive land uses, in accordance with adopted City noise standards. Feasible measures shall be identified to reduce project-related noise impacts. These measures may include, but are not limited to, the following:

- limiting noise-generating operational activities associated with proposed commercial land uses, including truck deliveries;
- constructing exterior sound walls;
- constructing barrier walls and/or berms with vegetation;
- using "quiet pavement" (e.g., rubberized asphalt) construction methods on local roadways; and,
- using increased noise-attenuation measures in building construction (e.g., dual-pane, sound-rated windows; exterior wall insulation).

Pursuant to this mitigation measure, this report includes an analysis of traffic noise impacts at proposed single-family residential lots within the White Rock Springs Ranch development resulting from traffic on Placerville Road (Road "B") and White Rock Road. As determined by this analysis, which is presented later in this report, future traffic noise levels generated by traffic on White Rock Road is predicted to exceed the City of Folsom exterior noise standard at the nearest proposed residential lots to this roadway. As a result, this analysis prescribes specific noise control measures as required to achieve satisfaction with the City's exterior and interior noise level standards applicable to new residential developments.

MM 3A.11-5 Implement Measures to Reduce Noise from Project-Generated Stationary Sources.

The project applicant(s) for any particular discretionary development project shall implement the following measures to reduce the effect of noise levels generated by on-site stationary noise sources that would be located within 600 feet of any noise-sensitive receptor:

- Routine testing and preventive maintenance of emergency electrical generators shall be conducted during the less sensitive daytime hours (i.e., 7:00 a.m. to 6:00 p.m.). All electrical generators shall be equipped with noise control (e.g., muffler) devices in accordance with manufacturers' specifications.

- External mechanical equipment associated with buildings shall incorporate features designed to reduce noise emissions below the stationary noise source criteria. These features may include, but are not limited to, locating generators within equipment rooms or enclosures that incorporate noise-reduction features, such as acoustical louvers, and exhaust and intake silencers. Equipment enclosures shall be oriented so that major openings (i.e., intake louvers, exhaust) are directed away from nearby noise-sensitive receptors.

- Parking lots shall be located and designed so that noise emissions do not exceed the stationary noise source criteria established in this analysis (i.e., 50 dB for 30 minutes in every hour during the daytime [7 a.m. to 10 p.m.] and less than 45 dB for 30 minutes of every hour during the night time [10 p.m. to 7 a.m.]). Reduction of parking lot noise can be achieved by locating parking lots as far away as feasible from noise sensitive land uses, or using buildings and topographic features to provide acoustic shielding for noise-sensitive land uses.

- Loading docks shall be located and designed so that noise emissions do not exceed the stationary noise source criteria established in this analysis (i.e., 50 dB for 30 minutes in every hour during the daytime [7 a.m. to 10 p.m.] and less than 45 dB for 30 minutes of every hour during the night time [10 p.m. to 7 a.m.]). Reduction of loading dock noise can be achieved by locating loading docks as far away as possible from noise sensitive land uses, constructing noise barriers between loading docks and noise-sensitive land uses, or using buildings and topographic features to provide acoustic shielding for noise-sensitive land uses.

Evaluation of Future Traffic Noise Levels at Proposed Single-Family Residences within the Development

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.

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 are not present at this project site due to topographic shielding partially obscuring the roadway from view. As a result, Bollard Acoustical Consultants, Inc. conducted a calibration of the FHWA Model through site-specific traffic noise level measurements and concurrent traffic counts.

The calibration process was performed at three locations on the project site on July 10, 2015, with noise measurements conducted simultaneously at heights of 5 and 15 feet to calibrate the model at first and second-floor elevations. The traffic noise measurement locations are shown in Figure 1. The detailed results of this procedure are provided in Appendices B. As a result of this procedure, no calibration offset was made to the prediction of ground floor traffic noise levels and a calibration offset of +3 dB was applied to predicted second-floor noise levels.

Predicted Future Exterior Traffic Noise Levels

The FHWA Model was used with future traffic data contained in the Folsom South of Highway 50 Specific Plan EIR to predict future traffic noise levels at the proposed residential backyards and building facades located closest to White Rock Road, Road "A", Road "B" (Placerville Road), and Empire Ranch Road. The predicted worst-case future traffic noise levels at the lots proposed nearest to these roadways are summarized in Table 1. Detailed listings of the FHWA Model inputs and predicted future traffic noise levels at the project site are provided in Appendices C.

Table 1
Predicted Future Traffic Noise Levels
White Rock Springs Ranch Residential Development – City of Folsom, California

Lot Description	Distance From Roadway Centerline (feet)	L_{dn} (dB)	Distance to Noise Contour (feet)	
			70 dB L_{dn}	65 dB L_{dn}
Lot 34[a] nearest to White Rock Road	105	71	132	284
Lot 3[b] nearest to White Rock Road	235	66	132	284
Lot 29[c] nearest to White Rock Road	185	68	132	284
Lots 16 - 22 nearest to Road "A"	70	59	14	29
Lots 14 - 22 nearest to Road "B"	220	57	32	68
Lot 8 nearest to Empire Ranch Road	235	60	54	117

Notes:
[1] A complete listing of FHWA Model inputs and results are provided in Appendices C.
[a] Village 1; see Figure 2.
[b] Village 2; see Figure 2.
[c] Village 4; see Figure 2.

Analysis

Outdoor Activity Areas (Backyards):

The Table 1 data indicates that future traffic noise levels are predicted to be greater than the 60 dB L_{dn} exterior noise level standard applied by City of Folsom to the outdoor activity areas of new residential developments. More specifically, future traffic noise levels in the backyard areas of the lots located adjacent to White Rock Road are predicted to range from 65 to 71 dB L_{dn}. Noise mitigation measures would be necessary for lots adjacent to White Rock Road to achieve compliance with the City's exterior noise level standards.

Bollard Acoustical Consultants, Inc. evaluated the effectiveness of noise barriers in reducing future White Rock Road traffic noise levels for this development. A listing of the noise barrier effectiveness algorithm inputs and results is shown in Appendices D. The results of the FHWA modeling exercise are summarized in Table 2.

Table 2
Predicted Future White Rock Road Traffic Noise Levels with Various Noise Barrier Heights
White Rock Springs Ranch Residential Development – City of Folsom, California

Village[1]	Nearest Lots[2]	Barrier Height (feet)	Resulting Noise Level (L_{dn})
Village 1	31 – 34	6	61
		7	60
		8	59
Village 2	2 - 4	6	61
		7	60
		8	59
Village 4	27 – 30	6	61
		7	60
		8	59

Notes:
[1] Village locations shown on Figure 2.
[2] Recommended barriers extend beyond the lots listed based upon the noise contours described in Appendices C.
Source: FHWA-RD-77-108 with inputs from the project site plans and Appendices C.

The Table 2 data indicates that barrier heights of 7 feet relative to backyard elevation would be required to reduce future White Rock Road traffic noise levels to approximately 60 dB L_{dn} or less, respectively, at the outdoor activity areas of proposed adjacent lots. Figure 2 shows the locations of the recommended noise barriers.

Interior Areas:

After construction of the required barriers along the adjacent lots of White Rock Road, the exterior noise environment at the residences proposed closest to those roadways is predicted to be approximately 60 dB L_{dn} or less at first-floor facades. To achieve compliance with the City's 45 dB L_{dn} interior noise level requirement within first-floor rooms, a building facade noise reduction of 15 dB would be required of the first-floor exterior wall construction.

Standard residential construction typically results in an exterior to interior noise reduction of about 25 dB with windows closed, and approximately 15 dB with windows open. Therefore, standard construction practices would be adequate for first-floor facades of all residences constructed within this development, provided mechanical equipment is included in the project construction to allow occupants to close doors and windows as desired for additional acoustical isolation.

Due to reduced ground absorption at elevated positions, traffic noise levels at second-floor facades are predicted to be approximately 3 dB higher than first-floor levels. In addition, second-floor facades would not be shielded by the recommended noise barriers. As a result, second floor exposure of the residences proposed adjacent to White Rock Road would range from 68 to 74 dB L_{dn}.

To ensure satisfaction with the City's 45 dB L_{dn} interior noise level standard, this analysis recommends that all second-floor bedroom windows of the lots located adjacent to White Rock Road from which the roadway is visible have a minimum STC rating of 32. The specific lots where upgraded window assemblies would be required are indicated on Figure 2.

Evaluation of Noise Generated During Aerojet Rocket Test Activities

As described in the Folsom South of U.S. Highway 50 Specific Plan DEIR/DEIS, Aerojet is located south of U.S. 50 between Mercantile Drive and Prairie City Road (an east-west distance of approximately 6 miles). Given the relatively brief duration of outdoor rocket testing activities occurring at Aerojet, noise generated by such activities would likely be subject to the City of Folsom 65 dB L_02 noise standard at the proposed residences in the White Rock Springs Ranch Residential Development. Page 3A.11.7 of the Folsom South of U.S. Highway 50 Specific Plan DEIR/DEIS reports that the distance to the 65 dB noise contour associated with the firing of smaller rocket engines extend to approximately 7,920 feet from the test stand. Because it is unclear which test stands are utilized by Aerojet for such rocket testing, it is not possible to determine the exact distance from the test location to the White Rock Springs Ranch project site. It is known that the distance from the eastern boundary of the Aerojet facility (Prairie City Road), to the western boundary of the White Rock Springs Ranch Residential Development (Placerville Road), is in excess of 10,000 feet. As a result, even if rocket testing were to occur immediately adjacent to Prairie City Road, the 65 dB noise contour resulting from that testing would still fall at least 7,000 feet west of the White Rock Springs Ranch Site. Therefore, noise generated by small rocket testing activities at the Aerojet Facility is not expected to exceed City of Folsom noise criteria at future residences constructed within the White Rock Springs Ranch development. Therefore, no noise mitigation measures would be warranted for this noise source.

Noise Generated During Project Construction

During the construction phases of the project, noise from construction activities would add to the noise environment in the immediate project vicinity. Activities involved in construction would generate maximum noise levels, as indicated in Table 3, ranging from 70 to 90 dB at a distance of 50 feet. This noise increase would be of short duration, and would likely occur primarily during daytime hours.

It should be noted that there are no existing residences or other noise-sensitive land uses in the immediate project vicinity, so construction noise impacts as offsite locations are predicted to be insignificant. As residences are constructed within the project development, noise from ongoing construction-related activities will be audible at completed residences, but is not expected to be significant provided construction activities are limited to daytime hours.

Table 3
Typical Construction Equipment Noise

Equipment Description	Maximum Noise Level at 50 feet, dBA
Auger drill rig	85
Backhoe	80
Bar bender	80
Boring jack power unit	80
Chain saw	85
Compactor (ground)	80
Compressor (air)	80
Concrete batch plant	83
Concrete mixer truck	85
Concrete pump truck	82
Concrete saw	90
Crane (mobile or stationary)	85
Dozer	85
Dump truck	84
Excavator	85
Flatbed truck	84
Front end loader	80
Generator (25 kilovoltamperes [kVA] or less)	70
Generator (more than 25 kVA)	82
Grader	85
Hydra break ram	90
Jackhammer	85
Mounted impact hammer (hoe ram)	90
Paver	85
Pickup truck	55
Pneumatic tools	85
Pumps	77
Rock drill	85
Scraper	85
Soil mix drill rig	80
Tractor	84
Vacuum street sweeper	80
Vibratory concrete mixer	80
Welder/Torch	73

Source: Federal Highway Administration 2006.

Conclusions & Recommendations

A portion of the White Rock Springs Ranch Residential Development project site will be exposed to future White Rock Road traffic noise levels in excess of the City of Folsom 60 dB L_{dn} exterior noise level standard. The following specific noise mitigation measures are recommended to achieve compliance with the City's exterior and interior noise standards:

- A 7-foot solid noise barrier would be required to reduce future White Rock Road traffic noise levels to the City of Folsom exterior criteria of 60 dB L_{dn}. This barrier is specified relative to backyard/building pad elevation.

- Masonry is considered a suitable material for the traffic noise barriers. To preserve views, all or a portion of the recommended noise barriers could also be constructed of glass, provided the glass meets a minimum sound transmission class (STC) rating of 20. If glass is used as a barrier material, the height of the White Rock Road barrier required to achieve satisfaction with City noise standards would remain 7 feet relative to backyard elevation. Other materials may be acceptable but should be either approved by the City or reviewed by an acoustical consultant prior to use.

- 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.

- All second-floor bedroom windows of the lots located adjacent to White Rock Road from which the roadway is visible should have a minimum STC rating of 32. Figure 2 shows the specific lots where upgrades are recommended.

These conclusions are based on the White Rock Springs Ranch Residential Development traffic assumptions cited in Appendices C and on noise reduction data for standard residential dwellings. Deviations from the data in Appendices C or the project site plan shown in Figure 2, could cause future traffic noise levels to differ from those predicted in this analysis. In addition, Bollard Acoustical Consultants, Inc. 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 BAC's noise assessment for the proposed White Rock Springs Ranch Residential Development. Please contact BAC at (916) 663-0500 or paulb@bacnoise.com with any questions regarding this assessment.

Appendix A

Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
Ldn	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
Lmax	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.
RT_{60}	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.

Appendix B-1

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

Project Information:	Job Number:	2015-170
	Project Name:	White Rock Springs Ranch
	Roadway Tested:	White Rock Road
	Test Location:	Site 1
	Test Date:	July 10, 2015
Weather Conditions:	Temperature (Fahrenheit):	64
	Relative Humidity:	72%
	Wind Speed and Direction:	Calm
	Cloud Cover:	Cloudy
Sound Level Meter:	Sound Level Meter:	LDL Model 820 (BAC #1)
	Calibrator:	LDL Model CAL200
	Meter Calibrated:	Immediately before
	Meter Settings:	A-weighted, slow response
Microphone:	Microphone Location:	On project site
	Distance to Centerline (feet):	230
	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):	55
Test Parameters:	Test Time:	11:21 AM
	Test Duration (minutes):	15
	Observed Number Automobiles:	106
	Observed Number Medium Trucks:	5
	Observed Number Heavy Trucks:	6
	Observed Average Speed (mph):	60
Model Calibration:	Measured Average Level (L_{eq}):	58.6
	Level Predicted by FHWA Model:	58.8
	Difference:	***0.2 dB***

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Appendix B-2

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

Project Information:	Job Number:	2015-170
	Project Name:	White Rock Springs Ranch
	Roadway Tested:	White Rock Road
	Test Location:	Site 1
	Test Date:	July 10, 2015
Weather Conditions:	Temperature (Fahrenheit):	64
	Relative Humidity:	72%
	Wind Speed and Direction:	Calm
	Cloud Cover:	Cloudy
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):	230
	Microphone Height:	15 feet above ground
	Intervening Ground (Hard or Soft):	**Soft**
	Elevation Relative to Road (feet):	15
Roadway Condition:	Pavement Type	Asphalt
	Pavement Condition:	Good
	Number of Lanes:	2
	Posted Maximum Speed (mph):	55
Test Parameters:	Test Time:	11:21 AM
	Test Duration (minutes):	15
	Observed Number Automobiles:	106
	Observed Number Medium Trucks:	5
	Observed Number Heavy Trucks:	6
	Observed Average Speed (mph):	60
Model Calibration:	Measured Average Level (L_{eq}):	61.4
	Level Predicted by FHWA Model:	58.8
	Difference:	***-2.6 dB***

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Appendix B-3

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

Project Information:	Job Number:	2015-170
	Project Name:	White Rock Springs Ranch
	Roadway Tested:	White Rock Road
	Test Location:	Site 2
	Test Date:	July 10, 2015
Weather Conditions:	Temperature (Fahrenheit):	64
	Relative Humidity:	72%
	Wind Speed and Direction:	Calm
	Cloud Cover:	Cloudy
Sound Level Meter:	Sound Level Meter:	LDL Model 820 (BAC #1)
	Calibrator:	LDL Model CAL200
	Meter Calibrated:	Immediately before
	Meter Settings:	A-weighted, slow response
Microphone:	Microphone Location:	On project site
	Distance to Centerline (feet):	140
	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):	55
Test Parameters:	Test Time:	11:21 AM
	Test Duration (minutes):	15
	Observed Number Automobiles:	106
	Observed Number Medium Trucks:	5
	Observed Number Heavy Trucks:	6
	Observed Average Speed (mph):	55
Model Calibration:	Measured Average Level (L_{eq}):	58.6
	Level Predicted by FHWA Model:	61.2
	Difference:	***2.6 dB***

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Appendix B-4

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

Project Information:	Job Number:	2015-170
	Project Name:	White Rock Springs Ranch
	Roadway Tested:	White Rock Road
	Test Location:	Site 2
	Test Date:	July 10, 2015
Weather Conditions:	Temperature (Fahrenheit):	64
	Relative Humidity:	72%
	Wind Speed and Direction:	Calm
	Cloud Cover:	Cloudy
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):	140
	Microphone Height:	15 feet above ground
	Intervening Ground (Hard or Soft):	**Soft**
	Elevation Relative to Road (feet):	15
Roadway Condition:	Pavement Type	Asphalt
	Pavement Condition:	Good
	Number of Lanes:	2
	Posted Maximum Speed (mph):	55
Test Parameters:	Test Time:	11:21 AM
	Test Duration (minutes):	15
	Observed Number Automobiles:	106
	Observed Number Medium Trucks:	5
	Observed Number Heavy Trucks:	6
	Observed Average Speed (mph):	55
Model Calibration:	Measured Average Level (L_{eq}):	61.4
	Level Predicted by FHWA Model:	61.2
	Difference:	***-0.2 dB***

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Appendix B-5

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

Project Information:	Job Number:	2015-170
	Project Name:	White Rock Springs Ranch
	Roadway Tested:	Placerville Road
	Test Location:	Site 3
	Test Date:	July 10, 2015
Weather Conditions:	Temperature (Fahrenheit):	64
	Relative Humidity:	72%
	Wind Speed and Direction:	Calm
	Cloud Cover:	Cloudy
Sound Level Meter:	Sound Level Meter:	LDL Model 820 (BAC #7)
	Calibrator:	LDL Model CAL200
	Meter Calibrated:	Immediately before
	Meter Settings:	A-weighted, slow response
Microphone:	Microphone Location:	On project site
	Distance to Centerline (feet):	250
	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):	55
Test Parameters:	Test Time:	9:57 AM
	Test Duration (minutes):	15
	Observed Number Automobiles:	42
	Observed Number Medium Trucks:	0
	Observed Number Heavy Trucks:	0
	Observed Average Speed (mph):	55
Model Calibration:	Measured Average Level (L_{eq}):	52.1
	Level Predicted by FHWA Model:	50.5
	Difference:	***-1.6 dB***

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Appendix B-6

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

Project Information:	Job Number:	2015-170
	Project Name:	White Rock Springs Ranch
	Roadway Tested:	Placerville Road
	Test Location:	Site 3
	Test Date:	July 10, 2015
Weather Conditions:	Temperature (Fahrenheit):	64
	Relative Humidity:	72%
	Wind Speed and Direction:	Calm
	Cloud Cover:	Cloudy
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):	250
	Microphone Height:	15 feet above ground
	Intervening Ground (Hard or Soft):	**Soft**
	Elevation Relative to Road (feet):	15
Roadway Condition:	Pavement Type	Asphalt
	Pavement Condition:	Good
	Number of Lanes:	2
	Posted Maximum Speed (mph):	55
Test Parameters:	Test Time:	9:57 AM
	Test Duration (minutes):	15
	Observed Number Automobiles:	42
	Observed Number Medium Trucks:	0
	Observed Number Heavy Trucks:	0
	Observed Average Speed (mph):	55
Model Calibration:	Measured Average Level (L_{eq}):	51.1
	Level Predicted by FHWA Model:	50.5
	Difference:	***-0.6 dB***

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Appendix C-1

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

Project Information:

Job Number: 2015-170
Project Name: White Rock Springs Ranch
Roadway Name: White Rock Road

Traffic Data:

Year:	Cumulative
Average Daily Traffic Volume:	46,200
Percent Daytime Traffic:	83
Percent Nighttime Traffic:	17
Percent Medium Trucks (2 axle):	1.5
Percent Heavy Trucks (3+ axle):	1
Assumed Vehicle Speed (mph):	55
Intervening Ground Type (hard/soft):	**Soft**

Traffic Noise Levels:

				----------L_{dn}, dB----------			
Lots	**Description**	**Distance**	**Offset (dB)**	**Autos**	**Medium Trucks**	**Heavy Trucks**	**Total**
V1.34	Nearest backyard	105	0	71	60	62	71
V2.3	Nearest backyard	235	0	65	54	57	66
V4.29	Nearest backyard	185	0	67	56	58	68

Traffic Noise Contours (No Calibration Offset):

L_{dn} Contour, dB	Distance from Centerline, (ft)
75	61
70	132
65	284
60	612

Notes: Traffic data obtained from Folsom Specific Plan DEIR, with modeling condition, "Cumulative Plus Centralized Development." conservatively used as worst-case traffic scenario.

Appendix C-2

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

Project Information:

Job Number: 2015-170
Project Name: White Rock Springs Ranch
Roadway Name: Road "A"

Traffic Data:

Year:	Cumulative
Average Daily Traffic Volume:	4,700
Percent Daytime Traffic:	83
Percent Nighttime Traffic:	17
Percent Medium Trucks (2 axle):	1.5
Percent Heavy Trucks (3+ axle):	1
Assumed Vehicle Speed (mph):	35
Intervening Ground Type (hard/soft):	**Soft**

Traffic Noise Levels:

				----------L_{dn}, dB----------			
Lots	**Description**	**Distance**	**Offset (dB)**	**Autos**	**Medium Trucks**	**Heavy Trucks**	**Total**
V7.16 - 22	Nearest backyards	70	0	58	49	53	59

Traffic Noise Contours (No Calibration Offset):

L_{dn} Contour, dB	Distance from Centerline, (ft)
75	6
70	14
65	29
60	64

Notes: Traffic data obtained from Folsom Specific Plan DEIR, with modeling condition, "Cumulative Plus Proposed Project Additional Segments," conservatively used as worst-case traffic scenario.

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Appendix C-3

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

Project Information:

Job Number: 2015-170
Project Name: White Rock Springs Ranch
Roadway Name: Road "B"

Traffic Data:

Year:	Cumulative
Average Daily Traffic Volume:	12,000
Percent Daytime Traffic:	83
Percent Nighttime Traffic:	17
Percent Medium Trucks (2 axle):	1.5
Percent Heavy Trucks (3+ axle):	1
Assumed Vehicle Speed (mph):	40
Intervening Ground Type (hard/soft):	**Soft**

Traffic Noise Levels:

				----------L_{dn}, dB----------			
Lots	**Description**	**Distance**	**Offset (dB)**	**Autos**	**Medium Trucks**	**Heavy Trucks**	**Total**
V1.14 - 22	Nearest backyards	220	0	56	47	50	57

Traffic Noise Contours (No Calibration Offset):

L_{dn} Contour, dB	Distance from Centerline, (ft)
75	15
70	32
65	68
60	146

Notes: Traffic data obtained from Folsom Specific Plan DEIR, with modeling condition, "Cumulative Plus Resource Impact Minimization Additional Segments," conservatively used as worst-case traffic scenario.

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Appendix C-4

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

Project Information:

Job Number: 2015-170
Project Name: White Rock Springs Ranch
Roadway Name: Empire Ranch Road

Traffic Data:

Year:	Cumulative
Average Daily Traffic Volume:	27,000
Percent Daytime Traffic:	83
Percent Nighttime Traffic:	17
Percent Medium Trucks (2 axle):	1.5
Percent Heavy Trucks (3+ axle):	1
Assumed Vehicle Speed (mph):	40
Intervening Ground Type (hard/soft):	**Soft**

Traffic Noise Levels:

				----------L_{dn}, dB----------			
Lot	**Description**	**Distance**	**Offset (dB)**	**Autos**	**Medium Trucks**	**Heavy Trucks**	**Total**
V7.9	Nearest backyard	235	0	59	50	53	60

Traffic Noise Contours (No Calibration Offset):

L_{dn} Contour, dB	Distance from Centerline, (ft)
75	25
70	54
65	117
60	252

Notes: Traffic data obtained from Folsom Specific Plan DEIR, with modeling condition, "Cumulative Plus Resource Impact Minimization 1-29," conservatively used as worst-case traffic scenario.

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Appendix D-1

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

Project Information:

Job Number: 2015-170
Project Name: White Rock Springs Ranch
Roadway Name: White Rock Road
Location(s): Village 1, Lots 31 - 34

Noise Level Data:

Year: Cumulative
Auto L_{dn}, dB: 71
Medium Truck L_{dn}, dB: 60
Heavy Truck L_{dn}, dB: 62

Site Geometry:

Receiver Description: Nearest backyard
Centerline to Barrier Distance (C_1): 105
Barrier to Receiver Distance (C_2): 15
Automobile Elevation: 0
Medium Truck Elevation: 2
Heavy Truck Elevation: 8
Pad/Ground Elevation at Receiver: 36
Receiver Elevation[1]: 41
Base of Barrier Elevation: 36
Starting Barrier Height 6

Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height[2] (ft)	L_{dn}, dB Autos	L_{dn}, dB Medium Trucks	L_{dn}, dB Heavy Trucks	L_{dn}, dB Total	Barrier Breaks Line of Sight to… Autos?	Medium Trucks?	Heavy Trucks?
42	6	60	49	52	**61**	Yes	Yes	Yes
43	7	59	48	51	**60**	Yes	Yes	Yes
44	8	58	47	50	**59**	Yes	Yes	Yes
45	9	57	46	49	**58**	Yes	Yes	Yes
46	10	57	46	48	**57**	Yes	Yes	Yes
47	11	56	45	48	**57**	Yes	Yes	Yes
48	12	55	45	47	**56**	Yes	Yes	Yes
49	13	55	44	47	**56**	Yes	Yes	Yes
50	14	55	44	47	**56**	Yes	Yes	Yes

Notes: 1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s). 2. Noise barrier height specified relative to buillding pad elevation.

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Appendix D-2

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

Project Information:

Job Number: 2015-170
Project Name: White Rock Springs Ranch
Roadway Name: White Rock Road
Location(s): Village 2, Lots 2 - 4

Noise Level Data:

Year: Cumulative
Auto L_{dn}, dB: 71
Medium Truck L_{dn}, dB: 60
Heavy Truck L_{dn}, dB: 62

Site Geometry:

Receiver Description: Nearest backyard
Centerline to Barrier Distance (C_1): 220
Barrier to Receiver Distance (C_2): 15
Automobile Elevation: 0
Medium Truck Elevation: 2
Heavy Truck Elevation: 8
Pad/Ground Elevation at Receiver: 67
Receiver Elevation[1]: 72
Base of Barrier Elevation: 67
Starting Barrier Height 6

Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height[2] (ft)	L_{dn}, dB Autos	L_{dn}, dB Medium Trucks	L_{dn}, dB Heavy Trucks	L_{dn}, dB Total	Barrier Breaks Line of Sight to… Autos?	Medium Trucks?	Heavy Trucks?
73	6	60	49	52	**61**	Yes	Yes	Yes
74	7	60	49	51	**60**	Yes	Yes	Yes
75	8	59	48	50	**59**	Yes	Yes	Yes
76	9	58	47	49	**59**	Yes	Yes	Yes
77	10	57	46	49	**58**	Yes	Yes	Yes
78	11	56	45	48	**57**	Yes	Yes	Yes
79	12	56	45	47	**57**	Yes	Yes	Yes
80	13	55	44	47	**56**	Yes	Yes	Yes
81	14	55	44	47	**56**	Yes	Yes	Yes

Notes: 1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s). 2. Noise barrier height specified relative to buillding pad elevation.

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Appendix D-3

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

Project Information:

Job Number: 2015-170
Project Name: White Rock Springs Ranch
Roadway Name: White Rock Road
Location(s): Village 4, Lots 27 - 30

Noise Level Data:

Year: Cumulative
Auto L_{dn}, dB: 71
Medium Truck L_{dn}, dB: 60
Heavy Truck L_{dn}, dB: 62

Site Geometry:

Receiver Description: Nearest backyard
Centerline to Barrier Distance (C_1): 185
Barrier to Receiver Distance (C_2): 15
Automobile Elevation: 0
Medium Truck Elevation: 2
Heavy Truck Elevation: 8
Pad/Ground Elevation at Receiver: 65
Receiver Elevation[1]: 70
Base of Barrier Elevation: 65
Starting Barrier Height 6

Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height[2] (ft)	L_{dn}, dB: Autos	Medium Trucks	Heavy Trucks	Total	Barrier Breaks Line of Sight to… Autos?	Medium Trucks?	Heavy Trucks?
71	6	60	49	52	**61**	Yes	Yes	Yes
72	7	59	48	51	**60**	Yes	Yes	Yes
73	8	58	47	50	**59**	Yes	Yes	Yes
74	9	57	46	49	**58**	Yes	Yes	Yes
75	10	57	46	48	**58**	Yes	Yes	Yes
76	11	56	45	48	**57**	Yes	Yes	Yes
77	12	56	45	47	**57**	Yes	Yes	Yes
78	13	55	44	47	**56**	Yes	Yes	Yes
79	14	55	44	46	**56**	Yes	Yes	Yes

Notes: 1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s). 2. Noise barrier height specified relative to buillding pad elevation.

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