3.12 - Noise

3.12.1 - Introduction

This section describes the existing noise setting and potential effects from project implementation on the site and its surrounding area. Descriptions and analysis in this section are based on information contained in the Noise Analysis, prepared in July 2011 by Bollard Acoustical Consultants, Inc. (BAC). The noise report is included in this EIR as Appendix E.

3.12.2 - Environmental Setting

Noise Fundamentals

Noise is defined as unwanted sound. Sound becomes unwanted when it interferes with normal activities, when it causes actual physical harm, or when it has adverse effects on health. Sound is produced by the vibration of sound pressure waves in the air. Sound pressure levels are used to measure the intensity of sound and are described in terms of decibels. The decibel (dB) is a logarithmic unit that expresses the ratio of the sound pressure level being measured to a standard reference level. A-weighted decibels (dBA) approximate the subjective response of the human ear to a broad frequency noise source by discriminating between very low and very high frequencies of the audible spectrum. They are adjusted to reflect only those frequencies that are audible to the human ear. The scale value of zero is the threshold of human hearing.

Noise Descriptors

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}), which corresponds to a steady-state, A-weighted sound level containing the same total energy as a time-varying signal over a given time period (usually 1-hour). The L_{eq} is the foundation of the composite noise descriptor, L_{dn}, and shows very good correlation with community response to noise.

The Day-Night Average Level (L_{dn}) is based on the average noise level over a 24-hour day, with a +10 decibel weighting applied to noise occurring during nighttime hours (10 p.m. to 7 a.m.). The nighttime penalty is based on the assumption that people react to nighttime noise exposures as though they are twice as loud as daytime exposures. Because the L_{dn} represents a 24-hour average, it tends it tends to disguise short-term variations in the noise environment.

Noise has often been cited as being a health problem, not in terms of actual physiological damages such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise arise from interference with human activities such as sleep, speech, recreation, and tasks demanding concentration or coordination. When community noise interferes with human activities or contributes to stress, public annoyance with the noise source increases, and the acceptability of the environment for people decreases. This result is the basis for land use planning policies preventing exposures to excessive community noise levels.

In addition to the A-weighted noise level, other factors should be considered in establishing criteria for noise sensitive land uses. For example, sounds with noticeable tonal content such as whistles, horns, droning or high-pitched sounds may be more annoying than the A-weighted sound level alone suggests. Many noise standards apply a penalty or correction of 5 dBA to such sounds. The effects of unusual tonal content are generally more of a concern at nighttime when residents may notice the sound in contrast to low levels of ambient/background noise.

Because many rural residential areas experience very low noise levels, residents may express concern about the loss of "peace and quiet" due to the introduction of a sound that was not previously audible. In very quiet environments, the introduction of virtually any change in local activities will cause an increase in noise levels. A change in noise level and the loss of peace and quiet is the inevitable result of land use or activity changes in such areas. Audibility of a new noise source and/or increases in noise levels within recognized acceptable limits are not usually considered significant noise impacts, but these concerns should be addressed and considered in the planning and environmental review processes.

Noise Mitigation Fundamentals

Any noise problem may be considered as being composed of three basic elements: the noise source, a transmission path, and a receiver. The appropriate acoustical treatment for a given project should consider the nature of the noise source and the sensitivity of the receiver. The problem should be defined in terms of appropriate criteria (L_{dn}, L_{eq}, or L_{max}), the location of the sensitive receiver (inside or outside), and when the problem occurs (daytime or nighttime). Noise control techniques should then be selected to provide an acceptable noise environment for the receiving property while remaining consistent with local aesthetic standards and practical structural and economic limits. Fundamental noise control techniques include the following:

Use of Setbacks

Noise exposure may be reduced by increasing the distance between the noise sources and receiving use. Setback areas can take the form of open space, frontage roads, recreational areas, storage yards, etc. The available noise attenuation from this technique is limited by the characteristics of the noise source, but is generally about 4 to 6 dB per doubling of distance from the source.

Use of Barriers

Shielding by barriers can be obtained by placing walls, berms, or other structures, such as buildings, between the noise source and the receiver. The effectiveness of a barrier depends upon blocking line of sight between the source and receiver, and is improved with increasing the distance the sound must travel to pass over the barrier as compared to a straight line from source to receiver. The difference between the distance over a barrier and a straight line between source and receiver is called the "path length difference" and is the basis for calculating barrier noise reduction.

Barrier effectiveness depends upon the relative heights of the source, barrier, and receiver. In general, barriers are most effective when placed close to either the receiver or the source. An intermediate barrier location yields a smaller path-length-difference for a given increase in barrier height than does a location closer to either source or receiver.

For maximum effectiveness, barriers must be continuous and relatively airtight along their length and height. To ensure that sound transmission through the barrier is insignificant, barrier mass should be about 4 pounds per square foot, although a lesser mass may be acceptable if the barrier material provides sufficient transmission loss. Satisfaction of the above criteria requires substantial and well-fitted barrier materials, placed to intercept line of sight to all significant noise sources. Earth, in the form of berms or the face of a depressed area, is also an effective barrier material.

The attenuation provided by a barrier depends upon the frequency content of the source. Generally, higher frequencies are attenuated (reduced) more readily than lower frequencies. This results because a given barrier height is relatively large compared to the shorter wavelengths of high frequency sounds, while relatively small compared to the longer wavelengths of the frequency sounds. The effective center frequency for traffic noise is usually considered to be 550 hertz (Hz). Railroad engines, cars, and horns emit noise with differing frequency content, so the effectiveness of a barrier will vary for each of these sources. Frequency analyses are necessary to properly calculate barrier effectiveness for noise from sources other than highway traffic.

There are practical limits to the noise reduction provided by barriers. For highway traffic noise, a 5- to 10-dB noise reduction may often be reasonably attained. A 15-dB noise reduction is sometimes possible, but a 20-dB noise reduction is extremely difficult to achieve. Barriers usually are provided in the form of walls, berms, or berm/wall combinations. The use of an earth berm in lieu of a solid wall may provide up to 3 dB additional attenuation over that attained by a solid wall alone, due to the absorption provided by the earth. Berm/wall combinations offer slightly better acoustical performance than solid walls and are often preferred for aesthetic reasons.

Site Design

Buildings can be placed on a project site to shield other structures or areas, to remove them from noise-impacted areas, and to prevent an increase in noise level caused by reflections. The use of one building to shield another can significantly reduce overall project noise control costs, particularly if the shielding structure is insensitive to noise. As an example, carports or garages can be used to form or complement a barrier shielding adjacent dwellings or an outdoor activity area. Similarly, one residential unit can be placed to shield another so that noise reduction measures are needed for only the building closest to the noise source. Placement of outdoor activity areas within the shielded portion of a building complex, such as a central courtyard, can be an effective method of providing a quiet retreat in an otherwise noisy environment. Patios or balconies should be placed on the side of a building opposite the noise source, and “wing walls” can be added to buildings or patios to help shield sensitive uses.

Another option in site design is the placement of relatively insensitive land uses, such as commercial or storage areas, between the noise source and a more sensitive portion of the project. Examples include development of a commercial strip along a busy arterial to block noise affecting a residential area or providing recreational vehicle storage or travel trailer parking along the noise-impacted edge of a mobile home park. If existing topography or development adjacent to the project site provides some shielding, as in the case of an existing berm, knoll, or building, sensitive structures or activity areas may be placed behind those features to reduce noise control costs.

Site design should also avoid creating reflecting surfaces that may increase on-site noise levels. For example, two buildings placed at an angle facing a noise source may cause noise levels within that angle to increase by up to 3 dB. The open end of U-shaped buildings should point away from noise sources for the same reason. Landscaping walls or noise barriers located within a development may inadvertently reflect noise back to a noise-sensitive area unless carefully located. Avoidance of these problems while attaining an aesthetic site design requires close coordination between local agencies, the project engineer and architect, and the noise consultant.

Building Design

When structures have been located to provide maximum noise reduction by barriers or site design, noise reduction measures may still be required to achieve an acceptable interior noise environment. The cost of such measures may be reduced by placement of interior dwelling unit features. For example, bedrooms, living rooms, family rooms, and other noise-sensitive portions of a dwelling can be located on the side of the unit farthest from the noise source.

Bathrooms, closets, stairwells, and food preparation areas are relatively insensitive to exterior noise sources and can be placed on the noisy side of a unit. When such techniques are employed, noise reduction requirements for the building facade can be significantly reduced, although the architect must take care to isolate the noise-impacted areas by the use of partitions or doors.

In some cases, external building facades can influence reflected noise levels affecting adjacent buildings. This is primarily a problem where high-rise buildings are proposed, and the effect is most evident in urban areas, where an “urban canyon” may be created. Bell-shaped or irregular building facades and attention to the orientation of the building can reduce this effect.

Noise Reduction by Building Facades

When interior noise levels are of concern in a noisy environment, noise reduction may be obtained through acoustical design of building facades. Standard residential construction practices provide 10- to 15-dB noise reduction for building facades with open windows, and approximately 25-dB noise reduction when windows are closed. Thus, a 25-dB exterior-to-interior noise reduction can be obtained by the requirement that building design include adequate ventilation systems, allowing windows on a noise-impacted facade to remain closed under any weather condition.

Where greater noise reduction is required, acoustical treatment of the building facade is necessary. Reduction of relative window area is the most effective control technique, followed by providing acoustical glazing (thicker glass or increased air space between panes) in low air infiltration rate frames, use of fixed (non-movable) acoustical glazing, or the elimination of windows. Noise transmitted through walls can be reduced by increasing wall mass (using stucco or brick in lieu of wood siding), isolating wall members by the use of double- or staggered-stud walls, or mounting interior walls on resilient channels. Noise control for exterior doorways is provided by reducing door area, by using solid-core doors, and by acoustically sealing door perimeters with suitable gaskets. Roof treatments may include the use of plywood sheathing under roofing materials.

Whichever noise control techniques are employed, it is essential that attention be given to installation of weather stripping and caulking of joints. Openings for attic or subfloor ventilation may also require acoustical treatment; tight-fitting fireplace dampers and glass doors may be needed in aircraft noise-impacted areas.

Design of acoustical treatment for building facades should be based upon analysis of the level and frequency content of the noise source. The transmission loss of each building component should be defined, and the composite noise reduction for the complete facade calculated, accounting for absorption in the receiving room. A one-third octave band analysis is a definitive method of calculating the A-weighted noise reduction of a facade.

A common measure of transmission loss is the Sound Transmission Class (STC). STC ratings are not directly comparable to A-weighted noise reduction and must be corrected for the spectral content of the noise source. Requirements for transmission loss analyses are outlined by Title 24 of the California Code of Regulations.

Use of Vegetation

Trees and other vegetation are often thought to provide significant noise attenuation. However, approximately 100 feet of dense foliage (so that no visual path extends through the foliage) is required to achieve a 5-dB attenuation of traffic noise. Thus, the use of vegetation as a noise barrier should not be considered a practical method of noise control unless large tracts of dense foliage are part of the existing landscape.

Vegetation can be used to acoustically “soften” intervening ground between a noise source and receiver, increasing ground absorption of sound and thus increasing the attenuation of sound with distance. Planting of trees and shrubs is also of aesthetic and psychological value, and may reduce adverse public reaction to a noise source by removing the source from view, even though noise levels will be largely unaffected. It should be noted, however, that trees planted on the top of a noise control berm can actually degrade the acoustical performance of the barrier slightly. This effect can occur when high-frequency sounds are diffracted (bent) by foliage and directed downward over a barrier.

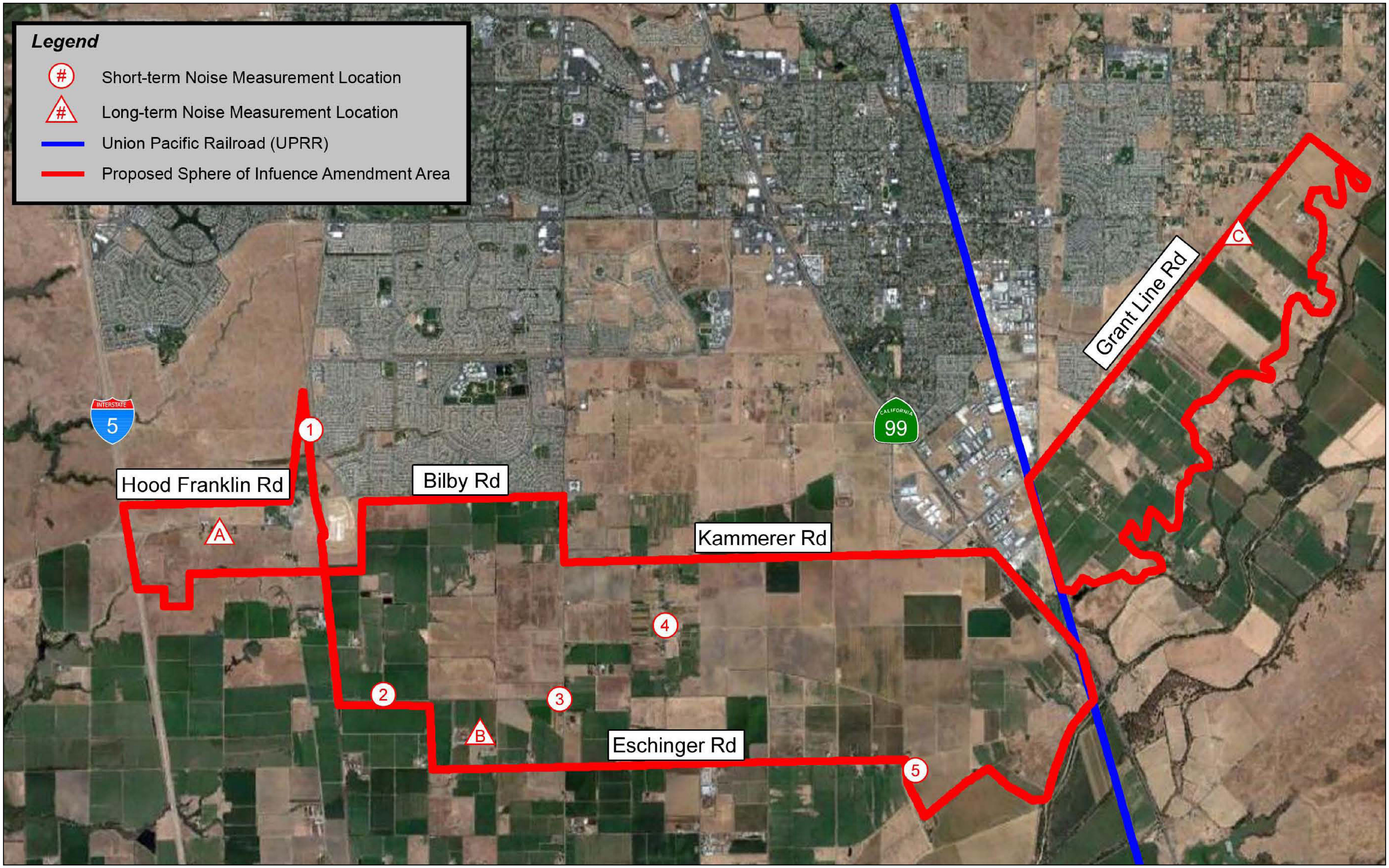
In summary, the effects of vegetation upon noise transmission are minor and are primarily limited to increased absorption of high frequency sounds and to reducing adverse public reaction to the noise by providing aesthetic benefits.

Existing Noise Levels

The major noise sources in the Elk Grove Sphere of Influence Amendment (SOIA) Area include traffic on Interstate 5 (I-5) and State Route 99 (SR-99), local traffic on major arterials, and railroad operations on the Union Pacific Railroad (UPRR) and Burlington Northern Santa Fe (BNSF) railroad tracks. The project area primarily contains such agricultural uses as fallow/row crops/nursery, orchards, vineyard, and dairy and livestock operations. Few structures exist within the project site, and these are limited to barns, rural housing, storage sheds, and related structures. A small area surrounding the intersections of Hood Franklin Road/County Road J8 and Bilby Road/County Road J8 is developed with relatively suburban uses. This area is identified as the Old Town Franklin community. The existing land uses in this community can be described as a mix of rural housing, light industrial, commercial, and public facilities. Franklin Cemetery is located at the intersection of Franklin Boulevard and Hood Franklin Road.

Community Noise Survey

To quantify existing noise levels in the quieter parts of the SOIA Area, a community noise survey was performed at eight locations. These survey locations were chosen to provide adequate representation of the entire project area. Three of the eight locations were monitored over a continuous 24-hour period, while the other five locations were each monitored for two short-term periods during daytime and nighttime hours. The community noise survey noise measurement locations are illustrated in Exhibit 3.12-1. The results of the community noise survey are provided in Table 3.12-1. The complete results of the continuous noise surveys are provided in tabular and graphical formats in Appendix E.



Source: Bollard Acoustical Consultants

Michael Brandman Associates

NORTH

Exhibit 3.12-1
Noise Measurement Locations

Table 3.12-1: Community Noise Measurement Survey Results

Site	Location	Time Period	L_{eq}	L_{max}	L_{dn}	Noise Sources
1	Franklin Ranch Pet Hospital & Hotel (Back Parking Lot)	Daytime	45	58	50	Distant/Local Traffic, A/C Overflights, Natural
		Afternoon	43	51		
		Nighttime	43	53		
2	Ranch Gate on Core Road	Daytime	54	79	57	Natural Sources. Traffic on Core Road, A/C
		Afternoon	49	72		
		Nighttime	50	71		
3	Sacramento Municipal Utility District Gas Pipeline Valve Site (#8)	Daytime	53	71	54	Traffic on Bruceville Road, A/C, Natural Noises
		Afternoon	53	75		
		Nighttime	45	63		
4	10760 & 10759 Rau Road	Daytime	52	72	56	Local Traffic, Natural Sounds, Community, A/C
		Afternoon	53	71		
		Nighttime	49	73		
5	Corner Near Greenbelt Carriers Site	Daytime	48	61	51	Local Traffic, AG
		Afternoon	53	71		
		Nighttime	35	46		
A	3460 Hood-Franklin Road	Daytime	53	67	59	—
		Nighttime	53	64		
B	6225 Eschinger Road	Daytime	51	71	52	—
		Nighttime	44	64		
C	9675 Grant Line Road (Backyard)	Daytime	53	68	57	—
		Nighttime	51	67		

Notes:
L_{dn} values for short-term measurement sites (Sites 1–5) were estimated based on average measured values. Two measurement sessions were completed during daytime hours for these sites to better assess daytime noise exposure—one in the morning and one in the afternoon.
L_{dn} for long-term measurement sites (Sites A–C) were calculated based on measured hourly L_{eq} data.
Source: Bollard Acoustical Consultants, Inc. 2011

Roadway Noise

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 within the Elk Grove SOIA Area. The FHWA-RD-77-108 Model is considered acceptable for the development of general traffic noise predictions.

A diversity of local roadways and facilities exist within or adjacent to the SOIA Area. The major roads serving the area include Bilby Road, Kammerer Road, Hood-Franklin Road, Grant Line Road, Eschinger Road, and Bruceville Road. Hood-Franklin Road, Kammerer Road, and Grant Line Road provide direct access to I-5 and SR-99. No new roads or road improvements are proposed as part of this application. The SOIA Area currently requires minimal circulation and roadway services, as the area remains primarily agricultural. Since no specific land use plan has been defined, existing uses are expected to remain unchanged. Existing service providers are expected to continue the current service level. Addition of the SOIA Area would cause no additional, immediate demand for circulation service and roadway infrastructure. However, as discussed below, future urbanization activities within the SOIA Area could result in increased traffic noise along roadways used by project-generated traffic

The FHWA Model was used with existing traffic data to develop L_{dn} contours for these roadways as well as other smaller roadways in the City. The FHWA Model input data for the studied roadways is provided in Appendix E. The predicted L_{dn} at a reference distance of 100 feet and the distances from the centerlines of the major roadways to the 60-, 65-, and 70-dB L_{dn} contours are summarized in Table 3.12-2.

Table 3.12-2: Existing Traffic Noise Levels and Contour Distances

#	Roadway	Segment Description	L_{dn} @ 100 feet	Distance to L_{dn} Contours (ft)		
				70 dB	65 dB	60 dB
1	Lambert Boulevard	Bruceville Road (West) to Bruceville Road (East)	55	10	22	48
2	Franklin Boulevard	Core Road to Hood Franklin	57	14	30	65
3	Hood Franklin	I-5 to Franklin Boulevard	63	34	72	156
4	Bilby Road	Franklin Boulevard to Willard Parkway	62	31	67	145
5	Dillard Road	State Route 99 to Riley Road	62	31	66	143
6	Grant Line Road	Wilton Road to Calvine Road	68	71	152	328
7	Grant Line Road	Elk Grove Boulevard to Wilton Road	67	66	142	306
8	Grant Line Road	Bradshaw Road to Elk Grove Boulevard	65	50	107	230
9	Grant Line Road	State Route 99 to Bradshaw Road	68	70	151	326
10	Waterman Road	Grant Line Road to Elk Grove Boulevard	63	35	75	162
11	Elk Grove Boulevard	Elk Grove Florin Road to Bradshaw Road	66	55	118	253

Table 3.12-2 (cont.): Existing Traffic Noise Levels and Contour Distances

#	Roadway	Segment Description	L_{dn} @ 100 feet	Distance to L_{dn} Contours (ft)		
				70 dB	65 dB	60 dB
12	Elk Grove Boulevard	State Route 99 to Elk Grove Florin Road	70	107	230	495
13	Elk Grove Boulevard	Laguna Springs Drive to State Route 99	70	94	202	435
14	Elk Grove Florin	East Stockton Boulevard to Elk Grove Boulevard	61	25	54	117
15	Elk Grove Boulevard	I-5 to Franklin Boulevard	68	79	170	366
16	Elk Grove Boulevard	Franklin Boulevard to Bruceville Road	69	91	196	421
17	Bradshaw Road	Grant Line Road to Bond Road	63	33	72	155
18	Interstate 5	Laguna Boulevard to Meadowview Road	81	527	1136	2448
19	Interstate 5	Elk Grove Boulevard to Laguna Boulevard	79	415	895	1927
20	Interstate 5	Hood Franklin Road to Elk Grove Boulevard	78	359	773	1665
21	Interstate 5	Twin Cities Road to Hood Franklin Road	78	330	711	1531
22	State Route 99	Arno Road to Dillard Road	77	308	663	1429
23	State Route 99	Dillard Road to Grant Line Road	77	292	630	1357
24	State Route 99	Grant Line Road to Elk Grove Boulevard	78	329	710	1529
25	Kammerer Road	Bruceville Road to Hood Franklin Road	56	12	27	57
26	Bruceville Road	Lambert Road to Point Pleasant Road	57	15	31	68
27	Bruceville Road	Eshinger Road to Kammerer Road	59	18	39	84
28	Bruceville Road	Poppy Ridge Road to Whitelock Parkway	61	26	57	122
29	Bruceville Road	Whitelock Parkway to Terrazzo Drive	70	94	202	434
Source: Bollard Acoustical Consulting, Inc. 2011						

Airport Noise

Sunset Skyranch Airport, also known as Elk Grove Airport, was located near the intersection of Grant Line Road and Bradshaw Road, just outside the city limits of Elk Grove. The airport was privately owned and operated but is now closed. As a result, the SOIA Area is no longer influenced by noise from this airport.

Franklin Field is located on Bruceville Road approximately 2.6 miles south of the SOIA Area. Franklin Field is a visual flight rated (VFR) airport having two perpendicular runways: a north–south runway (18-36) that is 3,295 feet long and 60 feet wide, and an east–west runway (9-27) which is 31,000 feet long and 60 wide. A 650-foot by 250-foot run-up apron and a tie-down apron (430 feet by 120 feet) exist. A wind cone and segmented circle are maintained to assist pilots. There are 42 tie-down spaces, 23 for transient aircraft. There are also four T-hangars. No fixed-base operator exists. The sole use of Franklin Field is by general aviation aircraft, both single- and multi-engine types, for training and touch-and-go activity. Crop dusters also use the facility during the planting and spraying season. The noise contours for Franklin Field are reproduced in Appendix E.

Railroad Noise

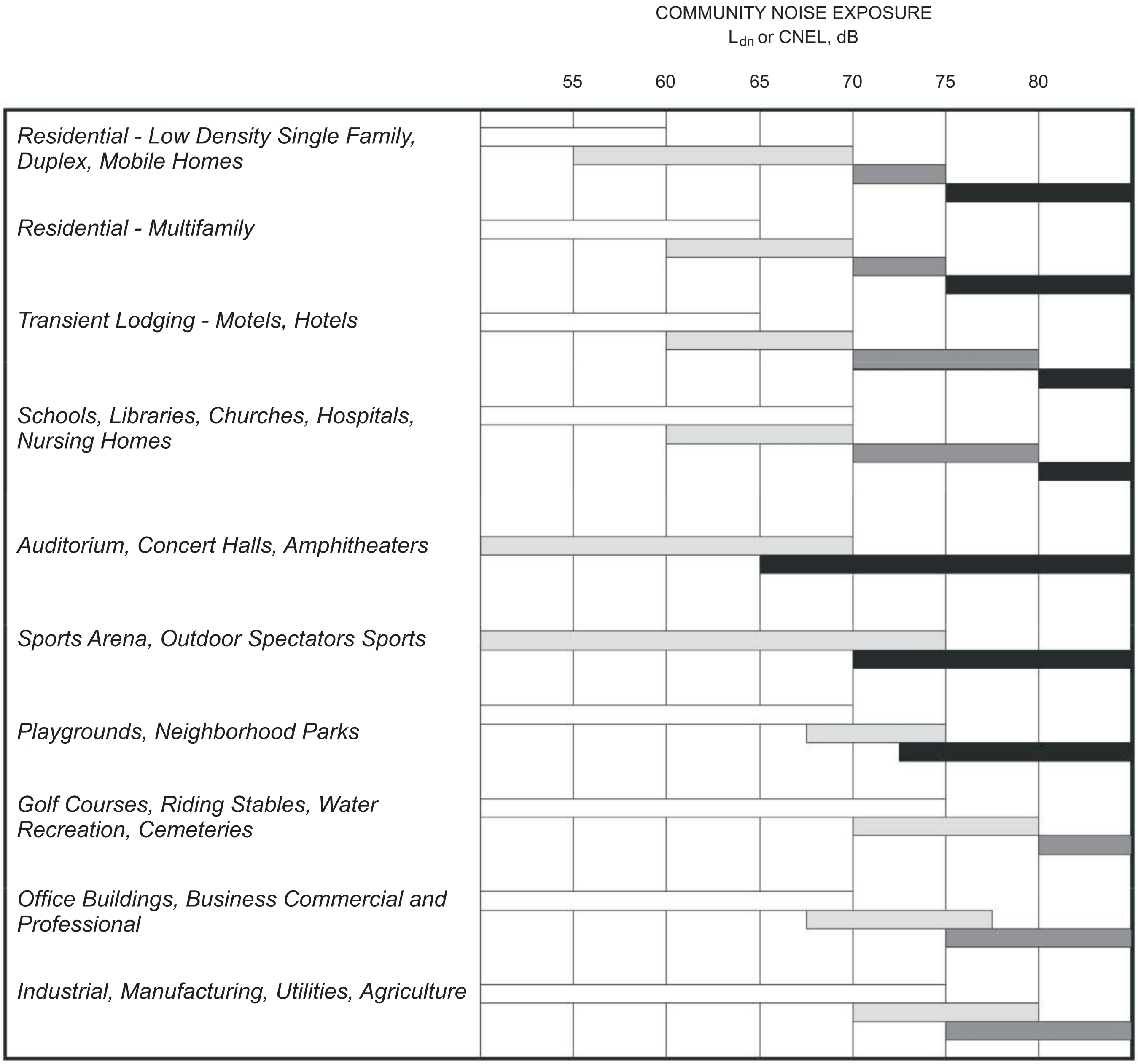
There are two sets of railroad tracks operated within the SOIA Area. The Union Pacific Railroad (UPRR) tracks run from north to south near Franklin Boulevard near the western boundary of the SOIA Area. The Burlington Northern and Santa Fe Railroad (BNSF) tracks run from north to south through the SOIA Area near SR-99.

As part of the City of Elk Grove General Plan Noise Element preparation, continuous noise monitoring of railroad activity was conducted on both the UPRR and BNSF tracks. The results were compared to similar data more recently collected in the area. Although daily train usage of these tracks varies, based upon the noise monitoring results it was determined that approximately twenty trains per day are operated along each set of tracks. The Sound Exposure Level (SEL) of individual trains was recorded along with the duration and maximum noise level during the monitoring program. The aggregate of the data collected indicates that at a distance of 100 feet, the average train operating on these tracks will produce an SEL of approximately 105 dB when using the warning horn and approximately 100 dB without using the horn. Trains are generally required to sound warning horns within 800 feet of at-grade crossings.

To determine the L_{dn} value associated with railroad operations, the following formula was used:

$$L_{dn} = SEL + 10\log N_{eq} - 49.4 \text{ dB, where:}$$

SEL is the mean measured SEL of the train events (105 with horn and 100 without), N_{eq} is the sum of the day plus 10 times the number of nighttime (10 p.m. to 7 a.m.) train events, and 49.4 is 10 times the logarithm of the number of seconds per day.



LEGEND:

NORMALLY ACCEPTABLE
Specified land use is satisfactory, based upon the assumption that any building involved are of normal conventional construction without any special noise insulation requirements.

NORMALLY UNACCEPTABLE
New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needs noise insulation features included in the design.

CONDITIONALLY ACCEPTABLE
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.

CLEARLY UNACCEPTABLE
New construction or development should generally not be undertaken.

Source: California Department of Health. Guidelines for the Preparation and Content of Noise Elements of the General Plan. November, 1990.

Source: California Department of Health, 1990.

Michael Brandman Associates

Exhibit 3.12-2
Land Use Matrix

Based upon this information, the Ldn at a distance of 100 feet due to activity on these tracks is approximately 75 dB and 70 dB with and without use of the horn, respectively. Using this information, the distances to railroad noise level contours were calculated and are presented in Table 3.12-3.

Table 3.12-3: Estimated Distances to Railroad Noise Contours (feet)

UPRR & BNSF Tracks	60 dB L_{dn}	65 dB L_{dn}	70 dB L_{dn}
Without Horn	464	215	100
With Horn	1000	464	215
Source: Bollard Acoustical Consulting, Inc. 2011.			

3.12.3 - Regulatory Framework

State

Noise Standards

Established in 1973, the California Department of Health Services Office of Noise Control was instrumental in developing regularity tools to control and abate noise for use by local agencies. One significant model is the “Land Use Compatibility for Community Noise Environments Matrix,” which allows the local jurisdiction to clearly delineate compatibility of sensitive uses with various incremental levels of noise, which is shown above in Table 3.12-3.

Title 24, Chapter 1, Article 4 of the California Administrative Code (California Noise Insulation Standards) requires noise insulation in new hotels, motels, apartment houses, and dwellings (other than single-family detached housing) that provides an annual average noise level of no more than 45 dBA CNEL. When such structures are located within a 60-dBA CNEL (or greater) noise contour, an acoustical analysis is required to ensure that interior levels do not exceed the 45-dBA CNEL annual threshold. In addition, Title 21, Chapter 6, Article 1 of the California Administrative Code requires that all habitable rooms, hospitals, convalescent homes, and places of worship shall have an interior CNEL of 45 dB or less due to aircraft noise.

Government Code Section 65302 mandates that the legislative body of each county and city in California adopt a noise element as part of its comprehensive general plan. The local noise element must recognize the land use compatibility guidelines published by the California Department of Health Services. The guidelines rank noise land use compatibility in terms of normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable.

Single-Event Noise Descriptors

Noise is rarely regulated by SEL descriptors. As previously discussed, the SEL descriptor represents the acoustic energy of a single event normalized to a 1-second event duration, while L_{dn} and CNEL represent the weighted average of the intensity of noise over a 24-hour period, with adjustments for nighttime noise sensitivity.

However, the courts have indirectly recognized SEL limits for unique circumstances such as sleep disturbance from aircraft overflights (e.g., *Berkeley Keep Jets Over the Bay Com. v. Bd. of Port Comrs. of Oakland,* 91 Cal. App. 4^{th} 1344 [2001]). In the Berkeley decision, the court held that impacts to sleep disturbance should be analyzed using the SEL descriptor, in addition to analyzing the L_{dn} or CNEL noise impacts. The ruling did not recommend a specific SEL noise threshold for sleep disturbance. A threshold for sleep disturbance is not absolute, since a high degree of variability exists from one person to another. As a result, no government agencies have suggested what frequencies of awakenings are acceptable. For these reasons, the Federal Interagency Committee on Noise and the California Airport and Land Use Planning Handbook continue to use L_{dn} or CNEL as the primary tool for land use compatibility planning and do not establish SEL standards. Since the L_{dn} and CNEL represent the cumulative exposure to all single events—that is, the exposure of all SELs taken together, weighed to add penalties for nighttime occurrences and averaged over a 24-hour period—the L_{dn} and CNEL-based standards already account for the individual impacts associated with SELs.

Vibration Standards

Title 14 of the California Administrative Code Section 15000 requires that all state and local agencies implement the California Environmental Quality Act (CEQA) Guidelines, which requires the analysis of exposure of persons to excessive groundborne vibration. However, no statute has been adopted by the state that quantifies the level at which excessive groundborne vibration occurs.

The California Department of Transportation (Caltrans) issued the Transportation- and Construction-Induced Vibration Guidance Manual in 2004. The manual provides practical guidance to Caltrans engineers, planners, and consultants who must address vibration issues associated with the construction, operation, and maintenance of Caltrans projects. However, this manual is also used as a reference point by many lead agencies and CEQA practitioners throughout California, as it provides numeric thresholds for vibration impacts. Thresholds are established for continuous (construction-related) and transient (transportation-related) sources of vibration, which found that the human response becomes distinctly perceptible at 0.25 inch per second PPV for transient sources and 0.04 inch per second PPV for continuous sources.

Local

City of Elk Grove

Approval by LAFCo of this SOIA does not authorize any change in land use or governance. However, the proposed project would adjust the City of Elk Grove's SOI and allow the City the opportunity to file an annexation request with LAFCo to annex lands within the SOIA Area. The City of Elk Grove General Plan establishes goals and policies to guide both present and future development within the City's jurisdiction. The General Plan establishes the following policies associated with noise that are relevant to the proposed project:

- **Policy NO-1:** New development of the uses listed in Table NO-C (Table 3.12-4) shall conform with the noise levels contained in that Table. All indoor and outdoor areas shall be located, constructed, and/or shielded from noise sources in order to achieve compliance with the City's noise standards.

Table 3.12-4: Maximum Allowable Noise Exposure Transportation Noise Sources

Land Use	Outdoor Activity Areas[1] L_{dn}/CNEL, dB	Interior Spaces	
		L_{dn}/CNEL, dB	L_{eq}, dB[2]
Residential	60[3]	45	—
Residential subject to noise from railroad tracks, aircraft overflights, or similar noise sources which produce clearly identifiable, discrete noise events (the passing of a single train, as opposed to relatively steady noise sources such as roadways)	60[3]	40[5]	—
Transient Lodging	60[4]	45	—
Hospitals, Nursing Homes	60[3]	45	—
Theaters, Auditoriums, Music Halls	—	—	35
Churches, Meeting Halls	60[3]	—	40
Office Buildings	—	—	45
Schools, Libraries, Museums	—	—	45
Playgrounds, Neighborhood Parks	70	—	—

1. Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use.
   Where it is not practical to mitigate exterior noise levels at patio or balconies of apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area.
2. As determined for a typical worst-case hour during periods of use.
3. Where it is not possible to reduce noise in outdoor activity areas to 60 dB L_{dn}/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 65 dB L_{dn}/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.
4. In the case of hotel/motel facilities or other transient lodging, outdoor activity areas such as pool areas may not be included in the project design. In these cases, only the interior noise level criterion will apply.
5. The intent of this noise standard is to provide increased protection against sleep disturbance for residences located near railroad tracks.

- **Policy NO-2**: Where noise-sensitive land uses are proposed in areas exposed to existing or projected exterior noise levels exceeding the levels specified in Table NO-C or the performance standards of Table NO-A (Table 3.12-5), an acoustical analysis shall be required as part of the environmental review process so that noise mitigation may be included in the project design.

The types of uses which may typically produce the noise sources addressed below include, but are not limited to: industrial facilities including pump stations, trucking operations, tire shops, auto maintenance shops, metal fabricating shops, shopping centers, drive-up windows, car washes, loading docks, public works projects, batch plants, bottling and canning plants, recycling centers, electric generating stations, race tracks, landfills, sand and gravel operations, and athletic fields.

Table 3.12-5: Noise Level Performance Standards for New Projects Affected by or Including Non-Transportation Noise Sources

Part 1: Performance Standards for Typical Stationary Noise Sources		
Noise Level Descriptor	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Hourly Leq, dB	55	45
The standards above will apply generally to noise sources that are not tonal, impulsive, or repetitive in nature. Typical noise sources in this category would include HVAC systems, cooling towers, fans, blowers, etc.		
Part 2: Performance Standards for Stationary Noise Sources Which Are Tonal, Impulsive, Repetitive, or Consist Primarily of Speech or Music		
Noise Level Descriptor	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Hourly Leq, dB	50	40
Notes: The standards in Part 2 apply to noises which are tonal in nature, impulsive or repetitive, or which consist primarily of speech or music (e.g., humming sounds, outdoor speaker systems, etc.). Typical noise sources in this category include pile drivers, drive-through speaker boxes, punch presses, steam valves, and transformer stations. These noise level standards in Parts 1 and 2 above do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings). The City may impose noise level standards that are more or less restrictive than those specified above based upon determination of existing low or high ambient noise levels.		

- **Policy NO-3:** Noise created by new proposed non-transportation noise sources shall be mitigated so as not to exceed the noise level standards of Table NO-A (Table 3.12-5) as measured immediately within the property line of lands designated for noise-sensitive uses.
- **Policy NO-4:** Where proposed non-residential land uses are likely to produce noise levels exceeding the performance standards of Table NO-A (Table 3.12-5) at existing or planned noise-sensitive uses, an acoustical analysis shall be required as part of the environmental review process so that noise mitigation may be included in the project design. The requirements for the content of an acoustical analysis are shown in Table NO-B (Table 3.12-6).

Table 3.12-6: Requirements for Acoustical Analysis

All acoustical analysis prepared pursuant to this Noise Element shall: A. Be the financial responsibility of the applicant. B. Be prepared by a qualified person experienced in the fields of environmental noise assessment and architectural acoustics. C. Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions and the predominant noise sources. D. Estimate existing and projected cumulative (20 years) noise levels in terms of Ldn or CNEL and/or the standards of Table NO-A, and compare those levels to the adopted policies of the Noise Element. E. Recommend appropriate mitigation to achieve compliance with the adopted policies and standards of the Noise Element, giving preference to proper site planning and design over mitigation measures that require the construction of noise barriers or structural modifications to buildings which contain noise-sensitive land uses. F. In cases where a sound wall is proposed, the potential impacts associated with noise reflecting off the wall and toward other properties or sensitive uses shall be evaluated. G. Estimate noise exposure after the prescribed mitigation measures have been implemented. H. Describe a post-project assessment program that could be used to evaluate the effectiveness of the proposed mitigation measures.

- **Policy NO-5:** Noise created by the construction of new transportation noise sources (such as new roadways or new light rail service) shall be mitigated so as not to exceed the levels specified in Table NO-C (Table 3.12-4) at outdoor activity areas or interior spaces of existing noise sensitive land uses. Please see Policy NO-6 for discussion of improvements to existing roadways.
- **Policy NO-6:** It is anticipated that roadway improvement projects (such as widening of existing roadways) will be needed to accommodate build-out of the General Plan. Therefore, existing noise-sensitive uses
  - Where existing traffic noise levels are less than 60 dB L_{dn} at the outdoor activity areas of noise-sensitive uses, a +5 dB L_{dn} increase in noise levels due to roadway improvement projects will be considered significant; and
  - Where existing traffic noise levels range between 60 and 65 dB L_{dn} at the outdoor activity areas of noise-sensitive uses, a +3 dB L_{dn} increase in noise levels due to roadway improvement projects will be considered significant; and
  - Where existing traffic noise levels are greater than 65 dB L_{dn} at the outdoor activity areas of noise-sensitive uses, a +1.5 dB L_{dn} increase in noise levels due to roadway improvement projects will be considered significant.
- **Policy NO-7:** The City shall not require the installation of soundwalls in front yard areas to reduce noise to acceptable levels in residential areas which were originally constructed without soundwalls. The City shall emphasize other methods to reduce noise levels in these situations.
- **Policy NO-8:** Where noise mitigation measures are required to achieve the standards of Tables NO-A (Table 3.12-5) and NO-C (Table 3.12-4), the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered a means of achieving the noise standards only after all other practical design-related noise mitigation

measures—including the use of distance from noise sources—have been integrated into the project.

- **Policy NO-9:** Where soundwalls or noise barriers are constructed, the City shall strongly encourage and may require the use of a combination of berms and walls to reduce the apparent height of the wall and produce a more aesthetically appealing streetscape.

3.12.4 - Methodology

Michael Brandman Associates evaluated the proposed project's noise impacts through noise measurements and modeling of project noise impacts. Because this Recirculated Draft Environmental Impact Report considers the impacts associated with potential future urbanization within the SOIA Area, the following methodology was employed for the impact analysis. Noise impacts were identified for new noise-sensitive developments located within areas affected by substantial existing or future noise sources (aircraft, automobile or truck traffic, railroad lines, etc.). Noise impacts were also identified for noise-producing projects proposed near existing or proposed noise-sensitive areas. Finally, noise impacts were evaluated by comparing potential traffic noise generation associated with SOIA Area development relative to existing conditions. The analysis assumes that all new development would comply with City noise standards identified in the Regulatory Setting subsection. The analysis is described below.

Analysis of Future Traffic Noise Levels

The FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108), with CALVENO noise emission levels, was used to predict traffic noise levels within the SOIA Area. Table 3.12-7 shows the predicted Ldn values at a reference distance of 100 feet from the roadway centerlines. Table 3.12-7 also shows the existing traffic noise levels and the degree by which existing levels will increase upon General Plan buildout. The complete listing of FHWA model inputs and results are provided in Appendix E.

Table 3.12-7: Predicted Traffic Noise Level and Project-Related Traffic Noise Level Increases

Road	Segment	Ldn @ 100 Feet					
		Existing	Existing Plus Project	Chang e	Cumulati ve	Cumulativ e Plus Project	Chang e
Lambert Boulevard	Bruceville Road (West) to Bruceville Road (East)	55	62	7	55	63	8
Franklin Boulevard	Core Road to Hood Franklin	57	70	13	57	61	4
Hood Franklin Road	I-5 to Franklin Boulevard	63	66	3	66	70	4

Table 3.12-7 (cont.): Predicted Traffic Noise Level and Project-Related Traffic Noise Level Increases

Road	Segment	Ldn @ 100 Feet					
		Existing	Existing Plus Project	Change	Cumulative	Cumulative Plus Project	Change
Bilby Road	Franklin Boulevard to Willard Parkway	62	66	4	65	66	1
Dillard Road	State Route 99 to Riley Road	62	64	2	62	62	0
Grant Line Road	Wilton Road to Calvine Road	68	68	0	70	71	1
Grant Line Road	Elk Grove Boulevard to Wilton Road	67	69	2	70	71	1
Grant Line Road	Bradshaw Road to Elk Grove Boulevard	65	67	2	69	69	0
Grant Line Road	State Route 99 to Bradshaw Road	68	70	2	70	72	2
Waterman Road	Grant Line Road to Elk Grove Boulevard	63	66	3	65	68	3
Elk Grove Boulevard	Elk Grove Florin Road to Bradshaw Road	66	67	1	69	69	0
Elk Grove Boulevard	State Route 99 to Elk Grove Florin Road	70	71	1	71	72	1
Elk Grove Boulevard	Laguna Springs Drive to State Route 99	70	71	1	71	71	0
Elk Grove Florin Boulevard	East Stockton Boulevard to Elk Grove Boulevard	61	64	3	61	63	2
Elk Grove Boulevard	I-5 to Franklin Boulevard	68	69	1	68	68	0
Elk Grove Boulevard	Franklin Boulevard to Bruceville Road	69	70	1	70	70	0
Bradshaw Road	Grant Line Road to Bond Road	63	66	3	65	68	3

Table 3.12-7 (cont.): Predicted Traffic Noise Level and Project-Related Traffic Noise Level Increases

Road	Segment	Ldn @ 100 Feet					
		Existing	Existing Plus Project	Change	Cumulative	Cumulative Plus Project	Change
Interstate 5	Laguna Boulevard to Meadowview Road	81	81	0	81	82	1
Interstate 5	Elk Grove Boulevard to Laguna Boulevard	79	80	1	80	81	1
Interstate 5	Hood Franklin Road to Elk Grove Boulevard	78	79	1	79	80	1
Interstate 5	Twin Cities Road to Hood Franklin Road	78	78	0	79	79	0
State Route 99	Arno Road to Dillard Road	77	77	0	78	78	0
State Route 99	Dillard Road to Grant Line Road	77	77	0	78	78	0
State Route 99	Grant Line Road to Elk Grove Boulevard	78	79	1	79	79	0
Kammerer Road	Bruceville Road to Hood Franklin Road	56	66	10	62	68	6
Bruceville Road	Lambert Road to Point Pleasant Road	57	63	6	57	63	6
Bruceville Road	Eshinger Road to Kammerer Road	59	70	11	59	69	10
Bruceville Road	Poppy Ridge Road to Whitelock Parkway	61	69	8	61	68	7
Bruceville Road	Whitelock Parkway to Terrazzo Drive	70	70	0	70	71	1

Note:
Shaded cells represent significant, project-related traffic noise increases.
Source: Bollard Acoustical Consultants, Inc., 2011

The impacts related to noise from implementation of the 2003 Elk Grove General Plan were evaluated in the General Plan Environmental Impact Report (EIR). All mitigation measures identified for impacts in the Elk Grove General Plan EIR and adopted by the City continue to remain the responsibility of the City as part of implementation of the General Plan. Consequently, upon approval of any future annexation request for the SOIA Area, those General Plan policies and EIR mitigation measures are assumed to apply to development within the SOIA Area.

3.12.5 - Thresholds of Significance

According to Appendix G, Environmental Checklist, of the CEQA Guidelines, noise impacts resulting from the implementation of the proposed project would be considered significant if the project would result in:

a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.

b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels. (Refer to Section 7.0, Effects Found Not to Be Significant.)

f) For a project within the vicinity of a private airstrip, expose people residing or working in the project area to excessive noise levels. (Refer to Section 7.0, Effects Found Not to Be Significant.)

Based on studies of test subjects' reactions to changes in environmental noise levels, the Federal Interagency Commission on Noise (FICON) developed the following recommendations for thresholds to be used in assessing the significance of project-related noise-level increases for transportation noise sources. Where background noise levels without the project would be less than 60 dB L_{dn}, a 5-dB or greater noise level increase due to the project is considered significant. Where background noise levels without the project would range from 60 to 65 dB L_{dn}, a 3-dB or greater noise level increase due to the project is considered significant. Finally, where background noise levels without the project would exceed 65 dB L_{dn}, a 1.5-dB or greater noise level increase due to the project is considered significant. This graduated scale is based on findings that people in quieter noise environments would tolerate larger increases in noise levels without adverse effects, whereas people already exposed to elevated noise levels exhibited adverse reactions to noise for smaller increases.

3.12.6 - Project Impacts and Mitigation Measures

This section discusses potential impacts associated with the development of the project and provides mitigation measures where appropriate.

On-site Roadway Noise

Impact NOI-1:	**Development within the SOIA Area may increase existing traffic noise levels at noise-sensitive land uses.**

Impact Analysis

Future urbanization within the SOIA Area may result in increased traffic noise along roadways used by project-generated traffic. As indicated in Table 3.12-7, the traffic noise increases associated with such development would range from 0 to 13 dB L_{dn} relative to existing conditions. As shown in Section 3.15, Transportation/Traffic, the project's indirect increases in traffic would exceed the project thresholds of significance on 13 roadway segments. As a result, this impact is considered significant. While repaving of the affected segments using open-graded asphalt, rubberized asphalt, or similar material could reduce traffic noise levels by 4 dB, thereby reducing this impact to a level of insignificance along some segments, this measure would not provide the required degree of noise reduction to fully mitigate this impact along all affected roadway segments. In addition, because of driveway access requirements and other physical constraints, the construction of solid noise barriers at the existing residences located along these impacted sections is similarly considered infeasible.

Although the proposed SOIA would amend the City's Sphere of Influence boundaries, property within the amended SOI Area would not be within the City's jurisdiction until future requests for annexation of property are approved by LAFCo. Upon approval of those future requests for annexation, the newly annexed property would be within the City's jurisdiction and subject to applicable City General Plan policies and regulations.

It is assumed that new development can be constructed such that noise from transportation sources could be reduced to within noise standards at sensitive uses; however, if new development increases traffic levels on roadways adjacent to existing residential uses, feasible measures may not be available to reduce traffic noise within standards. Compliance with City regulations typically includes methods such as construction of soundwalls or other design features to reduce noise, but the City does not typically require the installation of soundwalls in front yard areas to reduce noise to acceptable levels in residential areas that were originally constructed without soundwalls. In addition, in some cases, construction of soundwalls or other design features would not be feasible due to blocking site access or structural restrictions, which could result in traffic noise in some areas that exceed standards. Because the ability to reduce noise levels at all existing sensitive receptors is not known at this time, this is a potentially significant impact.

Level of Significance Before Mitigation

Potentially significant impact.

Mitigation Measures

No feasible mitigation measure is available.

Level of Significance After Mitigation

Significant and unavoidable impact.

Future Sensitive Receptors

Impact NOI-2: **The proposed project would not expose future sensitive receptors to elevated noise levels from both transportation and non-transportation noise sources.**

Impact Analysis

Although there are no specific proposals for noise-sensitive or noise-generating development within the SOIA Area, future development within the SOIA Area may result in the exposure of noise-sensitive land uses to noise levels in excess of the City of Elk Grove Noise Element standards. For example, development of residential uses within the railroad noise contour distances shown in Table 3.12-3 or adjacent to the major roadways identified in Table 3.12-7 would result in exceedance of the City's noise standards.

Noise mitigation measures required of future noise-sensitive or noise-generating land uses proposed within the SOIA Area would vary. General noise mitigation options are described in the Environmental Setting subsection. Detailed mitigation requirements will depend on several variables, including project design, sensitivity or noise-generating potential of the project, site grading, natural and man-made shielding, proximity to noise sources or sensitive receptors, and other factors. The City of Elk Grove Noise Element policies and implementation measures were specifically developed to anticipate such impacts and to require the preparation of noise studies in such cases so that appropriate noise mitigation is included with each project. The City's General Plan Noise Element Policies NO-1 through NO-9 require that a project's noise generation or exposure does not exceed the City's noise standards at sensitive receptors. Without compliance with these policies, impacts related to exposure future sensitive receptors to excessive noise levels may exceed noise thresholds. Any future development will be required to comply with City of Elk Grove Municipal Code Sections 6.32.090 and 6.32.090, which provides standards for exterior and interior noise levels, respectively, as follows (Table 3.12-8 and Table 3.12-9).

Table 3.12-8: Exterior and Interior Noise Levels

City Zoning Districts	Time Period	Exterior Noise Standard
Agricultural; Residential	7:00 a.m. – 10:00 p.m.	55 dBA
	10:00 p.m. – 7:00 a.m.	45 dBA

Table 3.12-9: Cumulative Duration of Sound

Cumulative Duration of the Intrusive Sound	Allowance Decibels
1. Cumulative period of 30 minutes per hour	0
2. Cumulative period of 15 minutes per hour	5
3. Cumulative period of 5 minutes per hour	10
4. Cumulative period of 1 minute per hour	15
5. Level not to be exceeded for any time per hour	20

In any apartment, condominium, townhouse, duplex, or multiple-dwelling unit, it is unlawful for any person to create any noise from inside his unit that causes the noise level when measured in a neighboring unit during the periods 10:00 p.m. to 7:00 a.m. to exceed:

1. Forty-five (45) dBA for a cumulative period of more than five (5) minutes in any hour;
2. Fifty (50) dBA for a cumulative period of more than one (1) minute in any hour;
3. Fifty-five (55) dBA for any period of time.

Because all future development must comply with these noise standards, this is a less than significant impact.

Level of Significance
Less than significant impact.

Mitigation Measures
No mitigation is required.

Level of Significance After Mitigation
Less than significant impact.