3.12 NOISE AND VIBRATION

This section includes a description of ambient noise conditions, a summary of applicable regulations related to noise and vibration, and an analysis of the potential impacts resulting from the implementation of the proposed SOIA. Mitigation measures are recommended, as necessary, to reduce potentially significant noise and vibration impacts.

3.12.1 ENVIRONMENTAL SETTING

ACOUSTIC FUNDAMENTALS

Noise is generally defined as sound that is loud, disagreeable, unexpected, or unwanted. Sound, as described in more detail below, is mechanical energy transmitted in the form of a wave because of a disturbance or vibration, and as any pressure variation in air that the human ear can detect.

Sound Properties

A sound wave is introduced into a medium (air) by a vibrating object. The vibrating object (e.g., vocal cords, the string and sound board of a guitar, the diaphragm of a radio speaker) is the source of the disturbance that moves through the medium. Regardless of the type of source that creates the sound wave, the particles of the medium through which the sound moves are vibrating in a back-and-forth motion at a given frequency (pitch).[1] A commonly used unit for frequency is cycles per second, called hertz (Hz).[2]

A wave is an energy transport phenomenon that transports energy along a medium. The amount of energy carried by a wave is related to the amplitude (loudness) of the wave. A high-energy wave is characterized by high amplitude; a low-energy wave is characterized by low amplitude. The amplitude of a wave refers to the maximum amount of displacement of a particle from its rest position. The energy transported by a wave is directly proportional to the square of the amplitude of the wave. This means that a doubling of the amplitude of a wave is indicative of a quadrupling of the energy transported by the wave.

1 The frequency of a wave refers to how often the particles vibrate when a wave passes through the medium. The frequency of a wave is measured as the number of complete back-and-forth vibrations of a particle per unit of time. If a particle of air undergoes 1,000 longitudinal vibrations in 2 seconds, then the frequency of the wave would be 500 vibrations per second.

2 Each particle vibrates as a result of the motion of its nearest neighbor. For example, the first particle of the medium begins vibrating at 500 Hz and sets the second particle of the medium into motion at the same frequency (500 Hz). The second particle begins vibrating at 500 Hz and sets the third particle into motion at 500 Hz. The process continues throughout the medium; hence each particle vibrates at the same frequency, which is the frequency of the original source. A guitar string vibrating at 500 Hz will set the air particles in the room vibrating at the same frequency (500 Hz), which carries a sound signal to the ear of a listener that is detected as a 500-Hz sound wave. The back-and-forth vibration motion of the particles of the medium would not be the only observable phenomenon occurring at a given frequency. Because a sound wave is a pressure wave, a detector could be used to detect oscillations in pressure from high to low and back to high pressure. As the compression (high-pressure) and rarefaction (low-pressure) disturbances move through the medium, they would reach the detector at a given frequency. For example, a compression would reach the detector 500 times per second if the frequency of the wave were 500 Hz. Similarly, a rarefaction would reach the detector 500 times per second if the frequency of the wave were 500 Hz. Thus, the frequency of a sound wave refers not only to the number of back-and-forth vibrations of the particles per unit of time, but also to the number of compression or rarefaction disturbances that pass a given point per unit of time. A detector could be used to detect the frequency of these pressure oscillations over a given period of time. The period of the sound wave can be found by measuring the time between successive high-pressure points (corresponding to the compressions) or the time between successive low-pressure points (corresponding to the rarefactions). The frequency is simply the reciprocal of the period; thus, an inverse relationship exists so that as frequency increases, the period decreases, and vice versa.

Sound and the Human Ear

Because of the ability of the human ear to detect a wide range of sound-pressure fluctuations, sound-pressure levels are expressed in logarithmic units called decibels (dB) to avoid a very large and awkward range in numbers. The sound-pressure level in decibels is calculated by taking the log of the ratio between the actual sound pressure and the reference sound pressure squared. The reference sound pressure is considered the absolute hearing threshold (Caltrans 2013). Use of this logarithmic scale reveals that the total sound from two individual sources, each measured at 65 A-weighted decibels (dBA), is 68 dBA, not 130 dBA; that is, doubling the source strength increases the sound pressure by 3 dBA.

Because the human ear is not equally sensitive to all sound frequencies, a specific frequency-dependent rating scale was devised to relate noise to human sensitivity. A dBA scale performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear. The basis for compensation is the faintest sound audible to the average ear at the frequency of maximum sensitivity. This dBA scale has been chosen by most authorities to regulate environmental noise. Typical indoor and outdoor noise levels are presented in Exhibit 3.12-1.

With respect to how humans perceive and react to changes in noise levels, a 1-dBA increase is imperceptible, a 3-dBA increase is barely perceptible, a 6-dBA increase is clearly noticeable, and a 10-dBA increase is subjectively perceived as approximately twice as loud (Egan 1988), as presented in Table 3.12-1.[3]

Table 3.12-1. Subjective Reaction to Changes in Noise Levels of Similar Sources

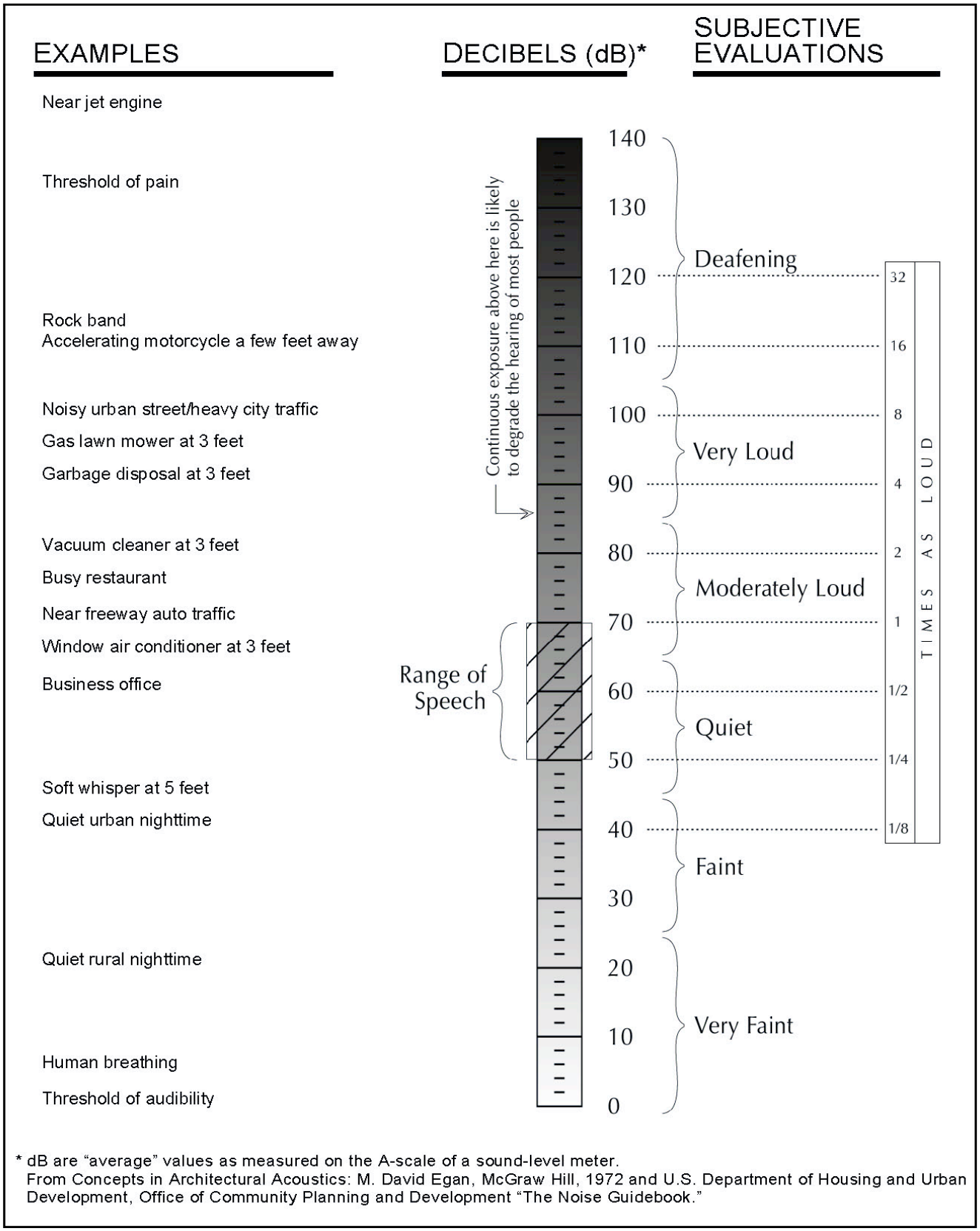
Change in Level, dBA	Subjective Reaction	Factor Change in Acoustical Energy
1	Imperceptible (except for tones)	1.3
3	Just barely perceptible	2.0
6	Clearly noticeable	4.0
10	About twice (or half) as loud	10.0

Note: dBA = A-weighted decibels
Source: Egan 1988

Sound Propagation and Attenuation

As sound (noise) propagates from the source to the receptor, the attenuation, or manner of noise reduction in relation to distance, is dependent on surface characteristics, atmospheric conditions, and the presence of physical barriers. The inverse-square law describes the attenuation caused by the pattern in which sound travels from the source to the receptor. Sound travels uniformly outward from a point source in a spherical pattern with an attenuation rate of 6 dBA per doubling of distance (dBA/DD). However, from a line source (e.g., a road), sound travels uniformly outward in a cylindrical pattern with an attenuation rate of 3 dBA/DD. The characteristics of the surface between the source and the receptor may result in additional sound absorption and/or reflection.

3 Table 3.12-1 was developed on the basis of the reactions of test subjects to changes in the levels of steady-state pure tones or broadband noise and to changes in levels of a given noise source. It is probably most applicable to noise levels in the range of 50–70 dBA, as this is the usual range of voice and interior noise levels.



Source: Data compiled by AECOM 2010

Exhibit 3.12-1 **Typical Noise Levels**

Atmospheric conditions such as wind speed, temperature, and humidity may affect noise levels. The presence of a barrier between the source and the receptor may also attenuate noise levels. The actual amount of attenuation depends on the size of the barrier and the frequency of the noise. A noise barrier may be any natural or human-made feature such as a hill, tree, building, wall, or berm (Caltrans 2013).

All buildings provide some exterior-to-interior noise reduction. A building constructed with a wood frame and a stucco or wood sheathing exterior typically provides an approximate exterior-to-interior noise reduction of 25 dBA with its windows closed; by contrast, a building constructed of a steel or concrete frame, a curtain wall or masonry exterior wall, and fixed plate glass windows of one-quarter-inch thickness typically provides an exterior-to-interior noise reduction of 30–40 dBA when its windows are closed (Paul S. Veneklasen & Associates 1973, cited in Caltrans 2002).

Noise Descriptors

The selection of a proper noise descriptor for a specific source depends on the spatial and temporal distribution, duration, and fluctuation of the noise. The noise descriptors most often encountered when dealing with traffic, community, and environmental noise are defined below (Caltrans 2013).

- **L_{max} (Maximum Noise Level):** The maximum instantaneous noise level during a specific period of time. The L_{max} may also be referred to as the "peak (noise) level."
- **L_{min} (Minimum Noise Level):** The minimum instantaneous noise level during a specific period of time.
- **L_{eq} (Equivalent Noise Level):** The energy mean (average) noise level. The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value is calculated, which is then converted back to dBA to determine the L_{eq}. In noise environments that are determined by major noise events, such as aircraft overflights, the L_{eq} value is heavily influenced by the magnitude and number of single events that produce the high noise levels.
- **L_{dn} (Day-Night Noise Level):** The 24-hour L_{eq} with a 10-dBA "penalty" for noise events that occur during the noise-sensitive hours between 10:00 p.m. and 7:00 a.m. In other words, 10 dBA is "added" to noise events that occur in the nighttime hours, and this generates a higher reported noise level when determining compliance with noise standards. The L_{dn} attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.
- **CNEL (Community Noise Equivalent Level):** Similar to the L_{dn} described above, but with an additional 5-dBA "penalty" added to noise events that occur during the noise-sensitive hours between 7:00 p.m. and 10:00 p.m., which are typically reserved for relaxation, conversation, reading, and television. When the same 24-hour noise data are used, the reported CNEL is typically approximately 0.5 dBA higher than the L_{dn}.
- **SENL (Single-Event [Impulsive] Noise Level):** A receiver's cumulative noise exposure from a single impulsive noise event, which is defined as an acoustical event of short duration and involves a change in sound pressure above some reference value. SENLs typically represent the noise events used to calculate the L_{eq}, L_{dn}, and CNEL.

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 descriptors such as L_{dn} and CNEL, as defined above, and correlates well with community response to noise.

Negative Effects of Noise on Humans

Negative effects of noise exposure include physical damage to the human auditory system, interference, and disease. Exposure to noise may result in physical damage to the auditory system, which may lead to gradual or traumatic hearing loss. Gradual hearing loss is caused by sustained exposure to moderately high noise levels over a period of time; traumatic hearing loss is caused by sudden exposure to extremely high noise levels over a short period. Gradual and traumatic hearing loss both may result in permanent hearing damage. In addition, noise may interfere with or interrupt sleep, relaxation, recreation, and communication. Although most interference may be classified as annoying, the inability to hear a warning signal may be considered dangerous. Noise may also be a contributor to diseases associated with stress, such as hypertension, anxiety, and heart disease. The degree to which noise contributes to such diseases depends on the frequency, bandwidth, and level of the noise, and the exposure time (Caltrans 2013).

Fundamental Noise Control Options

Any noise problem is generally 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 the time that 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 accessibility, safety, and aesthetic standards, as well as practical structural and economic limits. Fundamental noise control options are described below.

Setbacks

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

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 on blocking the line of sight between the source and receiver; effectiveness is improved when the sound must travel a longer distance to pass over the barrier than if it were traveling in 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.[4] Earth, in the form of berms or the face of a depressed area, is also an effective barrier material.

There are practical limits to the noise reduction provided by barriers. For vehicle traffic or railroad noise, a noise reduction of 5–10 dBA may often be reasonably attained. A 15-dBA noise reduction is sometimes possible, but a 20-dBA 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 dBA additional attenuation over that attained by a solid wall alone, because of the absorption provided by the earth. Berm/wall combinations offer slightly better acoustical performance than solid walls alone, and they are sometimes preferred for aesthetic reasons.

Site Design

Buildings can be placed on a project site to shield other structures or areas from areas affected by noise, and to prevent an increase in noise level caused by reflections. The use of one building to shield another can significantly reduce a project's overall noise control costs, particularly if the shielding structure is insensitive to noise.

Site design should guard against 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 dBA. 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 located carefully. 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 Façades

When interior noise levels are of concern in a noisy environment, noise reduction may be obtained through acoustical design of building façades. Standard construction practices provide a noise reduction of 10–15 dBA for building façades with open windows and a noise reduction of approximately 25 dBA when windows are closed. Thus, an exterior-to-interior noise reduction of 25 dBA can be obtained by requiring that building design include adequate ventilation systems, which allows windows on a noise-affected façade to remain closed under any weather condition.

Where greater noise reduction is required, acoustical treatment of the building façade is necessary. Reducing relative window area is the most effective control technique, followed by providing acoustical glazing (thicker glass or increased air space between panes) in frames with low air infiltration rates, using fixed (nonmovable) acoustical glazing, or eliminating 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 using double or staggered stud walls, or mounting interior walls on resilient channels. Noise control for exterior doorways is provided by reducing door area, 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.

4 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 the line of sight to all significant noise sources.

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-dBA attenuation of traffic noise (Caltrans 2009). 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 a receiver, increasing ground absorption of sound and thus increasing the attenuation of sound with distance. Planting trees and shrubs also offers aesthetic and psychological value, and it may reduce adverse public reaction to a noise source by removing the source from view, even though noise levels will be largely unaffected. However, trees planted on the top of a noise-control berm can slightly degrade the acoustical performance of the barrier. This effect can occur when high-frequency sounds are diffracted (bent) by foliage and directed downward over a barrier.

The effects of vegetation on 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.

Vibration

Vibration is the periodic oscillation of a medium or object. The rumbling sound caused by the vibration of room surfaces is called structureborne noise. Sources of groundborne vibrations include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) or human-made causes (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, such as operating factory machinery, or transient, such as explosions. As is the case with airborne sound, groundborne vibrations may be described by amplitude and frequency.

Vibration amplitudes are usually expressed in peak particle velocity (PPV) or root mean square (RMS), as in RMS vibration velocity. PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is often used in monitoring of blasting vibration because it is related to the stresses that are experienced by buildings (FTA 2006). PPV and RMS are normally described in inches per second (in/sec).

Human and structural response to different vibration levels is influenced by a number of factors, including ground type, distance between source and receptor, duration, and the number of perceived vibration events. Table 3.12-2, which was developed by the California Department of Transportation (Caltrans), shows the vibration levels which would normally be required to result in damage to structures. The vibration levels are presented in terms of peak particle velocity in inches per second.

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. It takes some time for the human body to respond to vibration signals. In a sense, the human body responds to average vibration amplitude. The RMS of a signal is the average of the squared amplitude of the signal, typically calculated over a period of 1 second. Like airborne sound, the RMS velocity is often expressed in decibel notation, as vibration decibels (VdB), which serves to compress the range of numbers required to describe vibration (FTA 2006). This is based on a reference value of 1 microinch per second (μin/sec).

The background vibration-velocity level in residential areas is usually approximately 50 VdB. Groundborne vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level

of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels (FTA 2006).

Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the groundborne vibration is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration-velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings. Construction activities can generate groundborne vibrations, which can pose a risk to nearby structures. Constant or transient vibrations can weaken structures, crack facades, and disturb occupants (FTA 2006).

Table 3.12-2. Effects of Various Vibration Levels on People and Buildings

Peak Particle Velocity			
inches/second	mm/second	Human Reaction	Effect on Buildings
0.006–0.019	0.15–0.30	Threshold of perception; possibility of intrusion	Vibrations unlikely to cause damage of any type
0.08	2.0	Vibrations readily perceptible	Recommended upper level of which ruins and ancient monuments should be subjected
0.10	2.5	Level at which continuous vibrations begin to annoy people	Virtually no risk of architectural damage to normal buildings
0.20	5.0	Vibrations annoying to people in buildings	Threshold at which there is a risk of architectural damage to normal dwelling – houses with plastered walls and ceilings
0.4–0.6	10–15	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges	Vibrations at a greater level than normally expected from traffic, but would cause architectural damage and possibly minor structural damage

Notes:
PPV=peak particle velocity
In/sec=inches per second
mm/sec= millimeters per second
Source: Caltrans 2013

Construction vibrations can be transient, random, or continuous. Transient construction vibrations are generated by blasting, impact pile driving, and wrecking balls. Continuous vibrations result from vibratory pile drivers, large pumps, horizontal directional drilling, and compressors. Random vibration can result from jackhammers, pavement breakers, and heavy construction equipment. Table 3.12-3 describes the general human response to different levels of groundborne vibration-velocity levels.

Table 3.12-3. Human Response to Groundborne Vibration Levels	
Vibration Velocity (Vibration Decibels)	**Human Response**
65	Approximate threshold of perception for many humans.
75	Approximate dividing line between barely perceptible and distinctly perceptible.
85	Vibration acceptable only if there is a small number of events per day.
Source: FTA 2006	

EXISTING NOISE ENVIRONMENT

Community Noise Survey

A community noise survey was conducted on March 2nd through March 3rd, 2016, to document the existing noise environment various locations within the proposed SOIA Area. The dominant noise source identified during the ambient noise survey was traffic from the State Route 99 (SR 99) along the eastern boundary and Kammerer Road along the northern boundary of the SOIA Area.[5]

Community noise survey locations are shown in Exhibit 3.12-2. The L_{eq}, L_{max}, L_{50}, and L_{90} values were taken at each long-term ambient noise measurement location presented in Table 3.12-4. During the survey, average daytime ambient noise levels ranged from 44.4 dB to 63.5 dB L_{eq}, with maximum noise levels that ranged from 62.7 dB to 75.9 dB L_{max}.

Table 3.12-4. Summary of Measured 24-hour Long Term Ambient Noise Levels

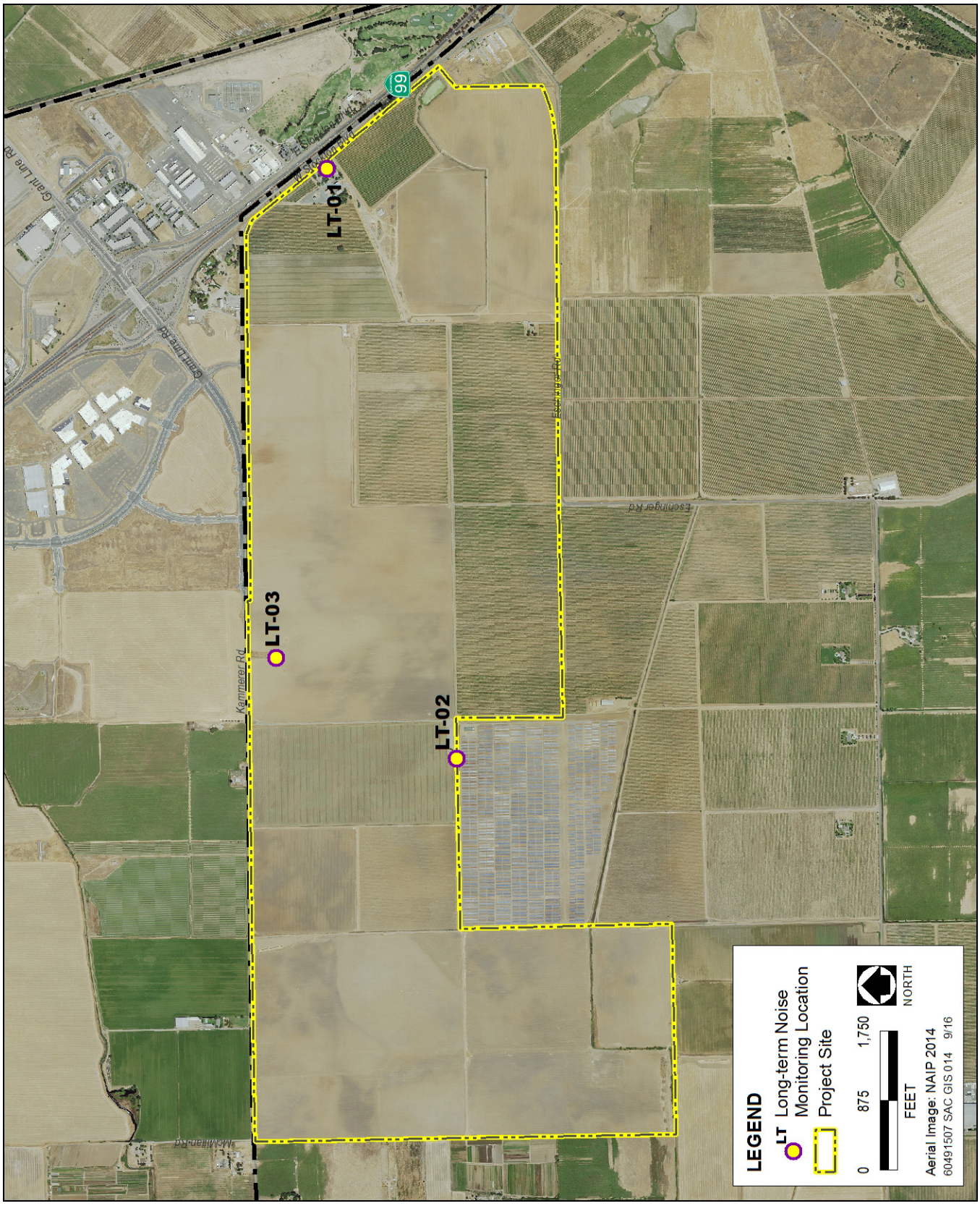
				Average Measured Hourly Noise Levels, dBA							
				Daytime (7 a.m.–10 p.m.)				Nighttime (10 p.m.–7 a.m.)			
Site	Location	Date	L_{dn}	L_{eq}	L_{max}	L_{50}	L_{90}	L_{eq}	L_{max}	L_{50}	L_{90}
LT-1	10686 W Stockton Blvd Elk Grove, CA 95757	3/2/16 – 9/3/16	68.1	63.5	75.9	62.4	58.8	61.3	74.8	58.5	51.8
LT-2	Southern Boundary by northeast of Solar Panels	3/2/16 – 9/3/16	46.8	44.4	62.7	38.2	35.8	39.1	49.4	36.1	32.8
LT-3	Northern Boundary along Kammerer Road by Power Tower	3/2/16 – 9/3/16	56.3	51.2	66.2	47.0	41.6	49.6	62.7	44.3	38.1

Notes: dB = A-weighted decibels; L_{dn} = day-night average noise level; L_{eq} = the equivalent hourly average noise level; L_{max} = maximum noise level; L_{50} = the noise level exceeded 50% of a specific period of time; L_{90} = the noise level exceeded 90% of a specific period of time.

Monitoring locations correspond to those depicted in Exhibit 3.12-2.

Source: Data collected by AECOM 2016

5 Measurements of noise levels were taken in accordance with ANSI standards. Continuous 24-hour, long-term monitoring of noise levels was conducted at three locations in the City using Larson Davis Laboratories (LDL) Model 820 sound-level meters. The sound-level meters were calibrated before and after use with an LDL Model CAL200 acoustical calibrator to ensure that the measurements would be accurate. The equipment used meets all pertinent specifications of the ANSI for Type 1 sound-level meters (ANSI S1.4-1983[R2006]).



Source: AECOM 2016

Exhibit 3.12-2 **Noise Monitoring Locations Map**

Existing Noise Sources

The primary noise source in the SOIA Area was vehicle traffic and miscellaneous sources within rural residential communities (e.g., people talking, dogs barking, and operation of landscaping equipment).

Roadways

Existing vehicle traffic noise levels in the SOIA Area were modeled using the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA-RD-77-108) and traffic data was used from the previous SOIA request that included the proposed SOIA Area and surrounding lands (Fehr & Peers 2011).[6]

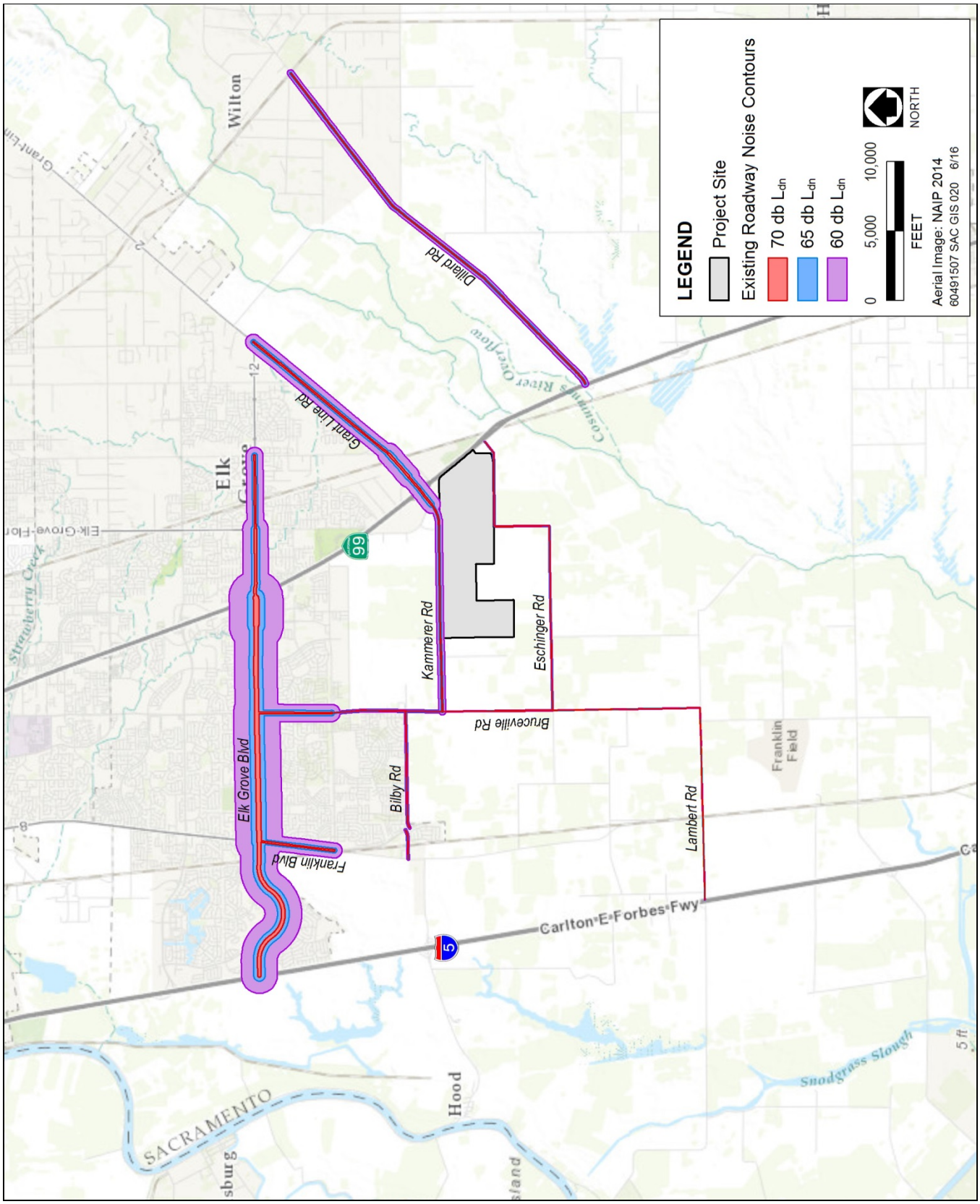
Table 3.12-5 summarizes the modeled traffic noise levels, provides noise levels at 100 feet from the centerline of roadways that could be affected by potential future development in the SOIA Area, and lists distances from the roadway centerlines to the 60 dB, 65 dB, and 70 dB L_{dn} traffic noise contours. Exhibit 3.12-3a and Exhibit 3.12-3b show the traffic noise contours for roadways within the vicinity of the SOIA Area. These traffic noise modeling results are based on existing average daily traffic (ADT) volumes. As shown in Table 3.12-5, the location of the 60 dB L_{dn} contour ranges from 25 to 1,671 feet from the centerline of the modeled surface street roadways. The extent to which noise sensitive uses in the area are affected by existing traffic noise depends on their respective proximity to the roadways and their individual sensitivity to noise.

Sensitive Receptors

Noise-sensitive land uses are generally considered to include those uses where quiet is an essential element of their intended purpose. This typically would include residences, schools, hospitals, nursing homes, retirement residences, places of worship, libraries, and sometimes parks, historic sites, cemeteries, and other places where low interior noise levels are essential.

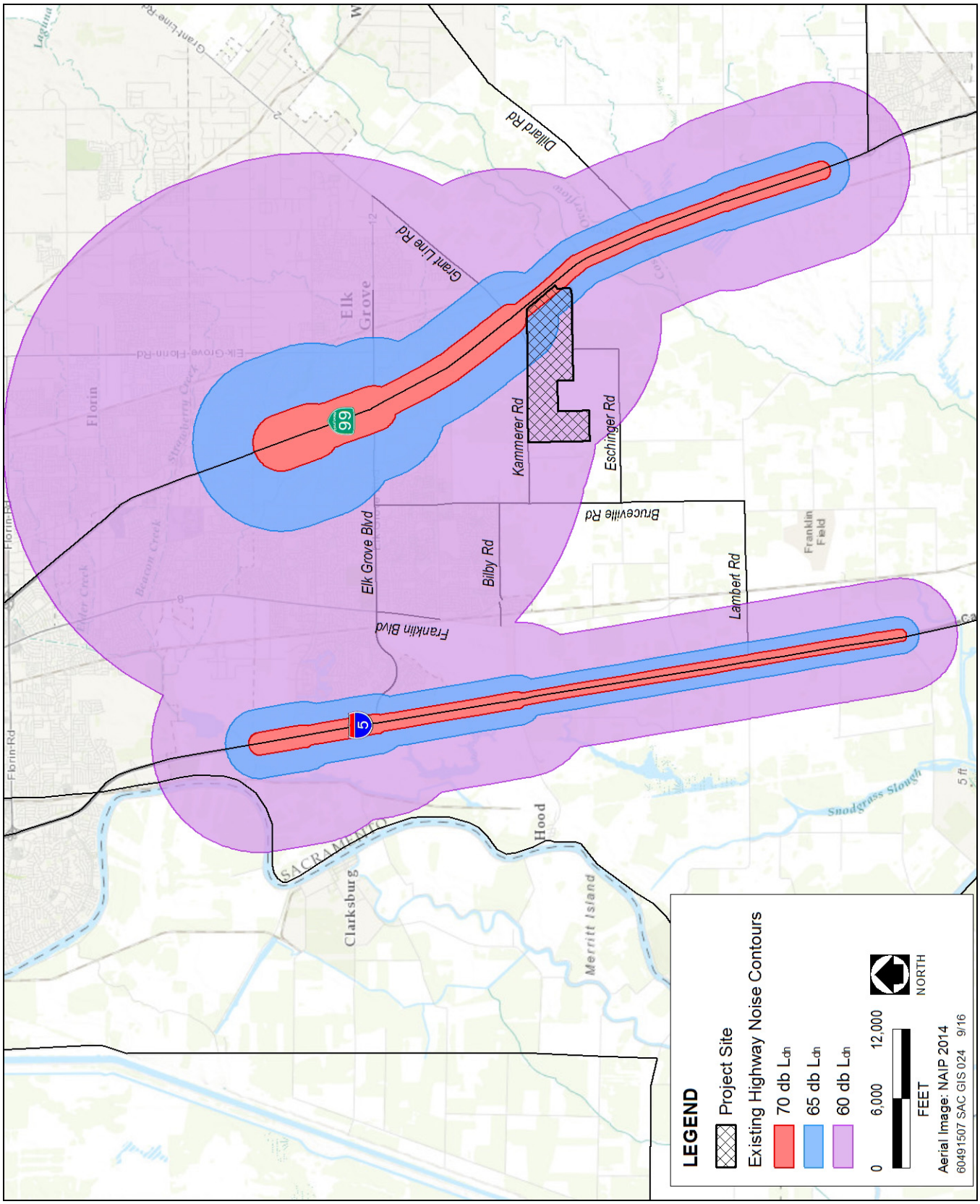
There are some homes in the vicinity of the SOIA Area, but for the most part, surrounding uses are not noise sensitive.

6 The FHWA model is based on CALVENO reference noise factors for automobiles, medium trucks, and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receptor, and ground attenuation factors.



Source: AECOM 2016

Exhibit 3.12-3a **Existing Roadway Noise Contours**



Source: AECOM 2016

Exhibit 3.12-3b **Existing Highway Noise Contours**

Table 3.12-5. Summary of Modeled Levels of Existing Traffic Noise

Roadway	Segment From	Segment To	L_{dn} (dB) 100 Feet	Distance (feet) from Roadway Centerline to L_{dn} Contour 70 dB	65 dB	60 dB
Elk Grove Boulevard	Interstate 5 (I-5)	Harbour Point Drive	69.8	128	406	1,284
Elk Grove Boulevard	Harbour Point Drive	Franklin Boulevard	70.0	132	419	1,324
Elk Grove Boulevard	Franklin Boulevard	Bruceville Road	71.0	167	529	1,671
Elk Grove Boulevard	Bruceville Road	Laguna Springs Drive	70.6	153	484	1,530
Elk Grove Boulevard	Laguna Springs Drive	SR-99	71.6	194	613	1,937
Elk Grove Boulevard	SR-99	E. Stockton Boulevard	68.5	95	300	948
Elk Grove Boulevard	E Stockton Boulevard	Elk Grove Florin Road	68.4	91	289	912
Elk Grove Boulevard	Elk Grove Florin Road	Waterman Road	66.5	60	190	600
Grant Line Road	Promenade Parkway	E Stockton Boulevard	66.8	64	201	635
Grant Line Road	E Stockton Boulevard	Waterman Road	67.7	79	249	786
Grant Line Road	Waterman Road	Elk Grove Boulevard	66.3	57	179	565
Bilby Road	Franklin Boulevard	Bruceville Road	57.9	9	29	92
Kammerer Road	Bruceville Road	Promenade Parkway	62.8	25	80	253
Eschinger Road	Bruceville Road	State Route 99 (SR 99)	55.8	5	16	50
Dillard Road	SR 99	Wilton Road	62.5	24	74	235
Lambert Road	I-5	Bruceville Road	52.2	2	8	25
Franklin Boulevard	Elk Grove Boulevard	Whitelock Parkway	67.4	55	172	545
Bruceville Road	Elk Grove Boulevard	Whitelock Parkway	67.9	62	196	620
Bruceville Road	Whitelock Parkway	Kammerer Road	60.1	10	32	102
Bruceville Road	Kammerer Road	Eschinger Road	56.1	4	13	41
Bruceville Road	Eschinger Road	Lambert Road	54.6	3	9	29
Interstate 5	Twin Cities Road	Hood Franklin Road	76.5	448	1,417	4,480
Interstate 5	Hood Franklin Road	Elk Grove Boulevard	77.3	538	1,700	5,376
Interstate 5	Elk Grove Boulevard	Laguna Boulevard	78.3	681	2,153	6,809
Interstate 5	Laguna Boulevard	North of Laguna Boulevard	79.1	815	2,578	8,153
State Route 99	Mingo Road	Arno Road	78.4	690	2,182	6,899
State Route 99	Arno Road	Dillard Road	78.0	627	1,983	6,272
State Route 99	Dillard Road	Eschinger Road	78.0	636	2,012	6,361
State Route 99	Eschinger Road	Grant Line Road	78.0	636	2,012	6,361
State Route 99	Grant Line Road	Elk Grove Boulevard	79.7	938	2,967	9,383
State Route 99	Elk Grove Boulevard	Laguna Boulevard/ Bond Road	81.8	1,530	4,837	15,296
State Route 99	Laguna Boulevard/ Bond Road	North of Laguna Boulevard/ Bond Road	82.9	1,954	6,178	19,537

Notes: dB = A-weighted decibels; L_{dn} = day-night average noise level.
Source: Data modeled by AECOM in 2016

3.12.2 REGULATORY FRAMEWORK

Various private and public agencies have established noise guidelines and standards to protect citizens from potential hearing damage and other adverse physiological and social effects associated with noise and vibration.

FEDERAL PLANS, POLICIES, REGULATIONS, AND LAWS

Although not directly applicable to the proposed SOIA, the research that supported the development of federal community noise standards is broadly applicable in understanding human response to different noise levels and is summarized below for the reader's edification.

U.S. Environmental Protection Agency Noise Control Act

The Federal Noise Control Act of 1972 (Public Law 92-574) established a requirement that all federal agencies administer their programs to promote an environment free of noise that would jeopardize public health or welfare.[7] Although the EPA was given a major role in disseminating information to the public and coordinating federal agencies, each federal agency retains authority to adopt noise regulations pertaining to agency programs.[8]

In 1974, in response to the requirements of the federal Noise Control Act, the EPA identified indoor and outdoor noise level limits to protect public health and welfare (communication disruption, sleep disturbance, and hearing damage). Outdoor and indoor noise exposure limits of 55 dB L_{dn} and 45 dB L_{dn}, respectively, are identified as desirable to protect against speech interference and sleep disturbance for residential, educational, and healthcare areas. The sound-level criterion identified to protect against hearing damage in commercial and industrial areas is 70 dB 24-hour L_{eq} (both outdoors and indoors).

The U.S. Environmental Protection Agency's (EPA's) Office of Noise Abatement and Control was established to coordinate federal noise control activities. In 1981, EPA administrators determined that subjective issues such as noise would be better addressed at lower levels of government. Consequently, in 1982 responsibilities for regulating noise control policies were transferred to state and local governments.

U.S. Department of Housing and Urban Development Noise Abatement and Control

The U.S. Department of Housing and Urban Development (HUD) has established guidelines for evaluating noise impacts on residential projects seeking financial support under various grant programs (HUD 2013), as summarized below:

- **Acceptable $\leq$ 65 dB.** Sites are generally considered acceptable for residential use if they are exposed to outdoor noise level of 65 dB L_{dn} or less.
- **Normally Unacceptable 65-75 dB.** Sites are considered "normally unacceptable" if they are exposed to outdoor noise levels of 65-75 dB L_{dn}.
- **Unacceptable > 75 dB.** Sites are considered "unacceptable" if they are exposed to outdoor noise levels above 75 dB L_{dn}.

The HUD goal for the interior noise levels in residences is 45 dB L_{dn} or less.

7 The U.S. Environmental Protection Agency (EPA) was given the responsibility for providing information to the public regarding identifiable effects of noise on public health and welfare, publishing information on the levels of environmental noise that will protect the public health and welfare with an adequate margin of safety, coordinating federal research and activities related to noise control, and establishing federal noise emission standards for selected products distributed in interstate commerce. The Noise Control Act also directed that all federal agencies comply with applicable federal, State, interstate, and local noise control regulations.

8 The EPA can, however, require other federal agencies to justify their noise regulations in terms of the Noise Control Act policy requirements.

Federal Aviation Administration Airport Noise Compatibility Planning

14 CFR Part 150, "Airport Noise Compatibility Planning" prescribes the procedures, standards, and methodology to be applied to airport noise compatibility planning activities. Noise levels below 65 dB L_{dn} are normally considered to be acceptable for noise-sensitive land uses.

Federal Highway Administration Procedures for Abatement of Highway Traffic Noise and Construction Noise Regulations

FHWA regulations (23 CFR 772) specify procedures for evaluating noise impacts associated with federally funded highway projects and determining whether these impacts are sufficient to justify funding noise abatement. The FHWA noise abatement criteria are based on worst hourly L_{eq} sound levels, not 24-hour average values (e.g., L_{dn} or CNEL). The worst-hour L_{eq} criteria for residential, educational, and healthcare facilities are 67 dB outdoors and 52 dB indoors. The worst-hour L_{eq} criterion for commercial and industrial areas is 72 dB (outdoors).

Federal Transit Administration Transit Noise and Vibration Impact Assessment

Federal Transit Administration (FTA) procedures for the evaluation of noise from transit projects are specified in the document entitled, "Transit Noise and Vibration Impact Assessment" (FTA, 2006). The FTA Noise Impact Criteria address the following categories:

- **Category 1:** Buildings or parks, where quiet is an essential element of their purpose.
- **Category 2:** Residences and buildings where people normally sleep. This includes residences, hospitals, and hotels where nighttime sensitivity is assumed to be of utmost importance.
- **Category 3:** Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, churches, and active parks.

The L_{dn} noise level descriptor is used to characterize noise exposure for residential areas (Category 2). For other noise sensitive land uses, such as outdoor amphitheaters and school buildings (Categories 1 and 3), the maximum hourly L_{eq} during the facility's operating period is used. Noise impacts are identified based on absolute predicted noise levels and increases in noise associated with the subject project.

Federal Railroad Administration

The Federal Railroad Administration (FRA) noise standards are the same as those specified by the FTA.

U.S. Department of Transportation and U.S. EPA Vibration Guidelines

To address the human response to groundborne vibration, the FTA of the U.S. Department of Transportation has set forth guidelines for maximum-acceptable-vibration criteria for different types of land uses. These include 65 VdB referenced to 1 μin/sec and based on RMS velocity amplitude for land uses where low ambient vibration is essential for interior operations (e.g., hospitals, high-tech manufacturing, laboratory facilities); 80 VdB for residential uses and buildings where people normally sleep; and 83 VdB for institutional land uses with primarily daytime operations (e.g., schools, churches, clinics, offices) (FTA 2006).

Standards have also been established to address the potential for groundborne vibration to cause structural damage to buildings. These standards were developed by the Committee of Hearing, Bio Acoustics, and Bio Mechanics

(CHABA) at the request of the U.S. Environmental Protection Agency (FTA 2006). For fragile structures, CHABA recommends a maximum limit of 0.25 in/sec PPV (FTA 2006).

STATE PLANS, POLICIES, REGULATIONS, AND LAWS

In 1971, the State required cities and counties to include noise elements in their general plans (Government Code Section 65302 et seq.). The State of California General Plan Guidelines (Office of Planning and Research 2003) identify guidelines for the noise elements of local general plans, including a sound level/land-use compatibility chart. The noise element guidelines identify the "normally acceptable" range of noise exposure for low-density residential uses as less than 60 dB L_{dn}, and the "conditionally acceptable" range as 55-70 dB L_{dn}. The "normally acceptable" range for high-density residential uses is identified as below 65 dB L_{dn}, and the "conditionally acceptable" range is identified as 60-70 dB L_{dn}. For educational and medical facilities, levels below 70 dB L_{dn} are considered "normally acceptable," and levels of 60-70 dB L_{dn} are considered "conditionally acceptable." For office and commercial land uses, levels below 70 dB L_{dn} are considered "normally acceptable," and levels of 67.5–77.5 dB L_{dn} are considered "conditionally acceptable." Overlapping noise level ranges are intended to indicate that local conditions (existing sound levels and community attitudes toward dominant sound sources) should be considered in evaluating land use compatibility at specific locations. The State's guidance for land use / noise compatibility is summarized in Table 3.12-6.

Table 3.12-6. Land Use Noise Compatibility Guidelines

Land Use Category	Community Noise Exposure (CNEL/L_{dn}, dBA)			
	Normally Acceptable[1]	Conditionally Acceptable[2]	Normally Unacceptable[3]	Clearly Unacceptable[4]
Residential-Low Density Single Family, Duplex, Mobile Home	<60	55–70	70–75	75+
Residential-Multiple Family	<65	60–70	70–75	75+
Transient Lodging, Motel, Hotel	<65	60–70	70–80	80+
School, Library, Church, Hospital, Nursing Home	<70	60–70	70–80	80+
Auditorium, Concert Hall, Amphitheater		<70	65+	
Sports Arenas, Outdoor Spectator Sports		<75	70+	
Playground, Neighborhood Park	<70		67.5–75	72.5+
Golf Courses, Stable, Water Recreation, Cemetery	<75		70–80	80+
Office Building, Business Commercial and Professional	<70	67.5–77.5	75+	
Industrial, Manufacturing, Utilities, Agriculture	<75	70–80	75+	

Notes: CNEL = Community Noise Equivalent Level; dBA = A-weighted decibels; L_{dn} = day-night average noise level.
[1] Specified land use is satisfactory, based on the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
[2] New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features are included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.
[3] 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 needed noise insulation features included in the design. Outdoor areas must be shielded.
[4] New construction or development should generally not be undertaken.
Source: OPR 2003:244-254

In 1984, State noise element provisions were revised to "recognize" guidelines prepared by the Office of Noise Control of the California Department of Health Services and to analyze and quantify, "to the extent practicable, as determined by the legislative body," noise from the following sources: highways and freeways; primary arterials and major local streets; passenger and freight on-line railroad operations and ground rapid transit systems;

commercial, general aviation, heliport, helistop and military airport operations, aircraft overflights, jet engine test stands, and other ground facilities and maintenance functions related to airport operation; local industrial plants, including, but not limited to, railroad classification yards; and other ground stationary noise sources identified by local agencies as contributing to the community noise environment. As noted in the draft update to the General Plan Guidelines, the Office of Planning and Research notes that the Department of Health Services Office of Noise Control no longer exists, and the guidelines have been incorporated into the General Plan Guidelines for Noise Elements (OPR 2015).

Also a part of the draft General Plan Guidelines is a discussion regarding the balance between environmental noise and other planning objectives, including recognition that developed infill locations may experience higher levels of noise but are often desirable places to live and work for the very reason that they are active. Moreover, there are design strategies that can reduce adverse exposure to noise even in areas with relatively higher ambient noise levels (OPR 2015).

California Department of Transportation

For the protection of fragile, historic, and residential structures, Caltrans recommends for highway construction analysis a threshold of 0.2 in/sec PPV for normal residential buildings and 0.08 in/sec PPV for old or historically significant structures (Caltrans 2013). These standards are more stringent than the recommended guidelines established by the Federal Transit Authority (FTA), presented above.

REGIONAL AND LOCAL PLANS, POLICIES, REGULATIONS, AND ORDINANCES

City of Elk Grove General Plan

The City of Elk Grove General Plan Noise Element contains policies and actions to protect citizens from exposure to excessive noise. The Noise Element establishes standards for various land use categories with respect to transportation and non-transportation noise sources. According to the Noise Element, transportation noise sources are defined as traffic on public roadways, railroad line operations and aircraft in flight. Non-transportation noise sources may include industrial operations; outdoor recreation facilities; heating, ventilating, and air conditioning (HVAC) units; loading docks; and others. The standards provide the basis for decisions on determining noise mitigation requirements.

Noise-related policies and actions are highlighted below.

- **NO-1:** New development of the uses listed in Table NO-C (Table 3.12-7 of this document) 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.

- **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 (Table 3.12-9 of this document) or the performance standards of Table NO-A (Table 3.12-7 of this document), an acoustical analysis shall be required as part of the environmental review process so that noise mitigation may be included in the project design.

- **NO-3:** Noise created by new proposed nontransportation noise sources shall be mitigated so as not to exceed the noise level standards of Table NO-A (Table 3.12-7 of this document) as measured immediately within the property line of lands designated for noise-sensitive uses.

- **NO-3- Action 1:** Limit construction activity to the hours of 7 a.m. to 7 p.m. whenever such activity is adjacent to residential uses.

- **NO-3- Action 2:** Consider limiting the hours of operation for loading docks, trash compactors, and other noise-producing uses in commercial areas which are adjacent to residential uses.

- **NO-3- Action 3:** The City shall require that stationary construction equipment and construction staging areas be set back from existing noise-sensitive land uses.

► **NO-4:** Where proposed non-residential land uses are likely to produce noise levels exceeding the performance standards of Table NO-A (Table 3.12-7 of this document) 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 3.12-8 of this document).

► **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 3.12-9 of this document) 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.

► **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 may be exposed to increased noise levels due to roadway improvement projects as a result of increased roadway capacity, increases in travel speeds, etc. It may not be practical to reduce increased traffic noise levels consistent with those contained in Table NO-C (Table 3.12-9 of this document). Therefore, the following criteria shall be used as a test of significance for roadway improvement projects which are not directly tied to a development project:

- 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.

► **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.

- **NO-7-Action 1:** Consider adopting a citywide noise reduction program to reduce traffic and other noise levels citywide.

- **NO-9:** Where noise mitigation measures are required to achieve the standards of Tables NO-A (Table 3.12-7 of this document) and NO-C (Table 3.12-9 of this document), 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.

- **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.

The types of uses that may typically produce the noise sources addressed below in the Impact Analysis 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 3.12-7. Noise Level Performance Standards for New Projects Affected by or Including Non-Transportation Noise Sources [Table NO-A of the Noise Element]

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 L_{eq}, 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 L_{eq}, dB	50	40
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 which are more or less restrictive than those specified above based upon determination of existing low or high ambient noise levels.		

Table 3.12-8. (Table NO-B of the Noise Element) 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 L_{dn} 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 which 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 which could be used to evaluate the effectiveness of the proposed mitigation measures.

Table 3.12-9. Maximum Allowable Noise Exposure, Transportation Noise Sources [Table NO-C of Noise Element]

Land Use	Outdoor Activity Areas[1]	Interior Spaces	
	L_{dn}/CNEL, dB	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.

City of Elk Grove Municipal Code

The City of Elk Grove has adopted a noise ordinance with performance standards and quantitative vibration guidelines. The Noise Control Ordinance is contained in Title 6 Health and Sanitation and vibration guidelines are contained in Title 23 Zoning Code of the City's Municipal Code. The Municipal Code contains performance standards for the purpose of preventing unnecessary, excessive and annoying sound levels from all sources and includes noise standards for non-transportation sources and railroad sources.

6.32.080 Exterior noise standards

A. The following noise standards, unless otherwise specifically indicated in this chapter, shall apply to all properties within a designated noise area.

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

B. It is unlawful for any person at any location within the City to create any noise which causes the noise levels on an affected property, when measured in the designated noise area, to exceed for the duration of time set forth following the specified exterior noise standards in any one (1) hour by:

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

C. Each of the noise limits specified in subsection (B) of this section shall be reduced by five (5) dBA for impulsive or simple tone noises, or for noises consisting of speech or music.

D. Boundary between Different Noise Areas. If the measurement location is on a boundary between two (2) different designated noise areas, the lower noise level limit applicable to the two (2) areas shall apply.

E. If the ambient noise level exceeds that permitted by any of the first four (4) noise-limit categories specified in subsection (B) of this section, the allowable noise limit shall be increased in five (5) dBA increments in each category to encompass the ambient noise level. If the ambient noise level exceeds the fifth (5th) noise level category, the maximum ambient noise level shall be the noise limit for that category.

6.32.090 Interior noise standards

A. 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 pm 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.

B. If the ambient noise level exceeds that permitted by any of the noise level categories specified in subsection (A) of this section, the allowable noise limit shall be increased in five (5) dBA increments in each category to encompass the ambient noise level.

6.32.1 00 Exemptions

The following activities shall be exempted from the provisions of this chapter:

A. School bands, school athletic and school entertainment events;

B. Outdoor gatherings, public dances, shows and sporting and entertainment events, provided said events are conducted pursuant to a license or permit by the City;

C. Activities conducted on parks, public playgrounds and school grounds, provided such parks, playgrounds and school grounds are owned and operated by a public entity or private school;

D. Any mechanical device, apparatus or equipment related to or connected with emergency activities or emergency work; the exemption does not include permanently installed emergency generators;

E. Noise sources associated with construction, repair, remodeling, demolition, paving or grading of any real property, provided said activities only occur between the hours of 7:00 a.m. and 7:00 p.m. when located adjacent to residential uses. Noise associated with these activities not located adjacent residential uses may occur between the hours of 6:00 a.m. and 8:00 p.m. However, when an unforeseen or unavoidable condition occurs during a construction project and the nature of the project necessitates that work in process be continued until a specific phase is completed, the contractor or owner shall be allowed to continue work after 8:00 p.m. and to operate machinery and equipment necessary until completion of the specific work in progress can be brought to conclusion under conditions which will not jeopardize inspection acceptance or create undue financial hardships for the contractor or owner;

F. Noise sources associated with agricultural operations, provided such operations do not take place between the hours of 8:00 p.m. and 6:00 a.m.;

G. All mechanical devices, apparatus or equipment which are utilized for the protection or salvage of agricultural crops during periods of adverse weather conditions or when the use of mobile noise sources is necessary for pest control;

H. Any activity, to the extent provisions of Chapter 65 of Title 42 of the United States Code, and Articles 3 and 3.5 of Chapter 4 of Division 9 of the Public Utilities Code of the State of California preempt local control of noise regulations and land use regulations related to noise control of airports and their surrounding geographical areas, any noise source associated with the construction, development, manufacture, maintenance, testing or operation of any aircraft engine, or of any weapons system or subsystems which are owned, operated or under the jurisdiction of the United States, or any other activity to the extent regulation thereof has been preempted by State or Federal law or regulation;

I. Any noise sources associated with the maintenance and operation of aircraft or airports which are owned or operated by the United States;

J. Railroad Activities. The operation of locomotives, rail cars, and facilities by a railroad that is regulated by the State Public Utilities Commission;

K. State or Federal Preexempted Activities. Any activity, to the extent the regulation of it has been preempted by State or Federal law;

L. Public Health and Safety Activities. All transportation, flood control, and utility company maintenance and construction operation at any time on public rights-of-way, and those situations that may occur on private property deemed necessary to serve the best interest of the public and to protect the public's health and well-being, including debris and limb removal, removal of damaged poles and vehicles, removal of downed wires, repairing traffic signals, repair of water hydrants and mains, gas lines, oil lines, and sewers, restoring electrical service, street sweeping, unplugging sewers, vacuuming catch basins, etc. The regular testing of motorized equipment and pumps shall not be exempt;

M. Solid Waste Collection. Noise sources associated with the authorized collection of solid waste (e.g., refuse and garbage);

N. Maintenance of Residential Real Property. Noise sources associated with the minor maintenance of residential real property, provided the activities take place between the hours of 7:00a.m. and 10:00 p.m.

6.32.110 Machinery, equipment, fans and air conditioning

It is unlawful for any person to operate any mechanical equipment, pump, fan, air conditioning apparatus, stationary pumps, stationary cooling towers, stationary compressors, similar mechanical devices, or any combination thereof in any manner so as to create any noise which would cause the maximum noise level to exceed a maximum limit of fifty-five (55) dBA at any point at least one (1' 0") foot inside the property line of the affected residential property and three (3' 0") feet to five (5' 0") feet above ground level.

6.32.140 Prohibited activities

The following acts shall be a violation of this chapter:

A. Construction Noise. Operating or causing the operation of tools or equipment on private property used in alteration, construction, demolition, drilling or repair work daily between the hours of 7:00 p.m. and 7:00 a.m. when located adjacent to residential uses, or between the hours of 8:00 p.m. and 6:00 a.m. when not located adjacent to residential uses, so that the sound creates a noise disturbance across a residential property line, except for emergency work of public service utilities. However, when an unforeseen or unavoidable condition occurs during a construction project and the nature of the project necessitates that work in process be continued until a specific phase is completed, the contractor or owner shall be allowed to continue work after 8:00 p.m. and to operate machinery and equipment necessary until completion of the specific work in progress can be brought to conclusion under conditions which will not jeopardize inspection acceptance or create undue financial hardships for the contractor or owner.

B. Loading and Unloading Activities. Loading, unloading, opening, closing or other handling of boxes, crates, containers, building materials, garbage cans, or similar objects on private property between the hours of 10:00 p.m. and 7:00 a.m. in a manner to cause a noise disturbance.

C. Sweepers and Associated Equipment. Operating or allowing the operation of sweepers or associated sweeping equipment (e.g., blowers) on private property between the hours of 10:00 p.m. and 7:00 a.m. in, or adjacent to, a residential zoning district.

D. Places of Public Entertainment. Operating or allowing to be operated any loudspeaker, musical instrument, or other source of sound in any place of public entertainment that exceeds ninety-five (95) dBA at any point normally occupied by a customer.

E. Stationary Nonemergency Signaling Devices. Sounding or allowing the sounding of an electronically amplified signal from a stationary bell, chime, siren, whistle, or similar devices intended for nonemergency purposes, from a private property for more than ten (10) consecutive seconds in any hourly period.

F. Public Nuisance Noise. Public nuisance noise is noise that is generally not associated with a particular land use but creates a nuisance situation by reason of its being disturbing, excessive, or offensive. Examples would include excessively loud noise from alarms, animals and fowl in nonagricultural districts, horns, musical instruments, stereos, music players, televisions, vehicle or motorboat repairs and testing, and similar noise.

23.60.060 Vibration

Uses that generate vibrations that may be considered a public nuisance or hazard on any adjacent property shall be cushioned or isolated to prevent generation of vibrations. Uses shall be operated in compliance with the following provisions:

1. Uses shall not generate ground vibration that is perceptible without instruments by the average person at any point along or beyond the property line of the parcel containing the activities;

2. Uses, activities, and processes shall not generate vibrations that cause discomfort or annoyance to reasonable persons of normal sensitivity or which endangers the comfort, repose, health or peace of residents whose property abuts the property line of the parcel;

3. Uses shall not generate ground vibration that interferes with the operations of equipment and facilities of adjoining parcels; and

4. Vibrations from temporary construction/demolition and vehicles that leave the subject parcel (e.g., trucks, trains, and aircraft) are exempt from the provisions of this Section.

County of Sacramento General Plan

The County of Sacramento General Plan Noise Element contains policies related to land use and noise compatibility. If the SOIA is approved, if annexation is proposed and approved in the future, and if development is proposed and approved in the future, this would occur under the jurisdiction of Elk Grove.

However, the SOIA Area is currently in unincorporated Sacramento County, and there would continue to be property in the unincorporated adjacent to the SOIA Area, even if there is development in the future. Therefore, County policies are presented for context.

Policies:

NO-1. The noise level standards for noise-sensitive areas of new uses affected by traffic or railroad noise sources in Sacramento County are shown by Table 3.12-10. Where the noise level standards of Table 3.12-10 are predicted to be exceeded at new uses proposed within Sacramento County which are affected by traffic or railroad noise, appropriate noise mitigation measures shall be included in the project design to reduce projected noise levels to a state of compliance with the Table 3.12-10 standards.

NO-5. The interior and exterior noise level standards for noise-sensitive areas of new uses affected by existing non-transportation noise sources in Sacramento County are shown by Table 3.12-11. Where the noise level standards of Table 3.12-11 are predicted to be exceeded at a proposed noise-sensitive area due to existing non-transportation noise sources, appropriate noise mitigation measures shall be included in the project design to reduce projected noise levels to a state of compliance with the Table 3.12-11 standards within sensitive areas.

NO-6. Where a project would consist of or include non-transportation noise sources, the noise generation of those sources shall be mitigated so as not exceed the interior and exterior noise level standards of Table 3.12-11 at existing noise-sensitive areas in the project vicinity.

NO-7. The "last use there" shall be responsible for noise mitigation. However, if a noise-generating use is proposed adjacent to lands zoned for uses which may have sensitivity to noise, then the noise generating use shall be responsible for mitigating its noise generation to a state of compliance with the Table 2 standards at the property line of the generating use in anticipation of the future neighboring development.

NO-8. Noise associated with construction activities shall adhere to the County Code requirements. Specifically, Section 6.68.090(e) addresses construction noise within the County.

NO-9. For capacity enhancing roadway or rail projects, or the construction of new roadways or railways, a noise analysis shall be prepared in accordance with the Table 3.12-13 requirements. If pre-project traffic noise levels already exceed the noise standards of Table 1 and the increase is significant as defined below, noise mitigation measures should be considered to reduce traffic and/or rail noise levels to a state of compliance with the Table 3.12-10 standards. A significant increase is defined as follows:

Pre-Project Noise Environment (Ldn)	Significant Increase
Less than 60 dB	5+ dB
60 - 65 dB	3+ dB
Greater than 65 dB	1.5+ dB

NO-10. For interim capacity enhancing roadway or rail projects, or the construction of new interim roadways or railways, it may not be practical or feasible to provide mitigation if the ultimate roadway or railway design would render the interim improvements ineffective or

obsolete. An example would be a noise barrier constructed for an interim project which would need to be removed to accommodate the ultimate project. The following factors should be considered in determining whether or not noise mitigation will be implemented for interim projects, but in general, noise mitigation for interim projects would not be provided:

a. The severity of the impact
b. The cost and effectiveness of the mitigation.
c. The number of properties which would benefit from the mitigation.
d. The foreseeable duration between interim and ultimate improvements.
e. Aesthetic, safety and engineering considerations.

NO-11. If noise-reducing pavement is to be utilized in conjunction with a roadway improvement project, of if such paving existing adjacent to a proposed new noise-sensitive land use, the acoustical benefits of such pavement shall be included in the noise analysis prepared for the project.

NO-12. All noise analyses prepared to determine compliance with the noise level standards contained within this Noise Element shall be prepared in accordance with Table 3.12-13.

NO-13. Where noise mitigation measures are required to satisfy the noise level standards of this Noise Element, emphasis shall be placed on the use of setbacks and site design to the extent feasible, prior to consideration of the use of noise barriers.

NO-14. Noise analyses prepared for multi-family residential projects, town homes, mixed-use, condominiums, or other residential projects where floor ceiling assemblies or party-walls shall be common to different owners/occupants, shall be consistent with the State of California Noise Insulation standards.

NO-15. The County shall have the flexibility to consider the application of 5 dB less restrictive exterior noise standards than those prescribed in Tables 3.12-10 and 3.12-11 in cases where it is impractical or infeasible to reduce exterior noise levels within infill projects to a state of compliance with the Tables 3.12-10 and 3.12-11 standards. In such cases, the rational for such consideration shall be clearly presented and disclosure statements and noise easements should be included as conditions of project approval. The interior noise level standards of Tables 3.12-10 and 3.12-11 would still apply.

NO-16. The following sources of noise shall be exempt from the provisions of this Noise Element:

a. Emergency warning devices and equipment operated in conjunction with emergency situations, such as sirens and generators which are activated during power outages. The routine testing of such warning devices and equipment shall also be exempt provided such testing occurs during daytime hours.
b. Activities at schools, parks or playgrounds, provided such activities occur during daytime hours.
c. Activities associated with events for which a permit has been obtained from the County.

Table 3.12-10. Noise Standards for New Uses Affected by Traffic and Railroad Noise
Sacramento County Noise Element [Table 1 of the Sacramento County General Plan]

New Land Use	Sensitive[1] Outdoor Area–L_{dn}	Sensitive[2] Interior Area–L_{dn}	Notes
All Residential	65	45	5
Transient Lodging	65	45	3,5
Hospitals & Nursing Homes	65	45	3, 4, 5
Theaters & Auditoriums	---	35	3
Churches, Meeting Halls Schools, Libraries, etc.	65 65	40 40	3 3
Office Buildings	65	45	3
Commercial Buildings	---	50	3
Playgrounds, Parks, etc.	70	---	
Industry	65	50	3

Notes:
1 Sensitive areas are defined in acoustic terminology section.
2 Interior noise level standards are applied within noise-sensitive areas of the various land uses, with windows and doors in the closed positions.
3 Where there are no sensitive exterior spaces proposed for these uses, only the interior noise level standard shall apply.
4 Hospitals are often noise-generating uses. The exterior noise level standards for hospitals are applicable only at clearly identified areas designated for outdoor relaxation by either hospital staff or patients.
5 If this use is affected by railroad noise, a maximum (L_{max}) noise level standard of 70 dB shall be applied to all sleeping rooms to reduce the potential for sleep disturbance during nighttime train passages.
Source: County of Sacramento General Plan Noise Element 2011. Table1.

Table 3.12-11 Non-Transportation Noise Standards
Sacramento County Noise Element Median (L50) / Maximum (Lmax)[1] [Table 2 of the Sacramento County General Plan]

Receiving Land Use	Outdoor Area[2]		Interior[3]	
	Daytime	Nighttime	Day & Night	Notes
All Residential	55 / 75	50 / 70	35 / 55	
Transient Lodging	55 / 75	---	35 / 55	4
Hospitals & Nursing Homes	55 / 75	---	35 / 55	5, 6
Theaters & Auditoriums	---	---	30 / 50	6
Churches, Meeting Halls, Schools, Libraries, etc.	55 / 75	---	35 / 60	6
Office Buildings	60 / 75	---	45 / 65	6
Commercial Buildings	---	---	45 / 65	6
Playgrounds, Parks, etc.	65 / 75	---	---	6
Industry	60 / 80	---	50 / 70	6

Notes:
1 The Table 2 standards shall be reduced by 5 dB for sounds consisting primarily of speech or music, and for recurring impulsive sounds. If the existing ambient noise level exceeds the standards of Table 3.10-11, then the noise level standards shall be increased at 5 dB increments to encompass the ambient.
2 Sensitive areas are defined acoustic terminology section.
3 Interior noise level standards are applied within noise-sensitive areas of the various land uses, with windows and doors in the closed positions.
4 Outdoor activity areas of transient lodging facilities are not commonly used during nighttime hours.
5 Hospitals are often noise-generating uses. The exterior noise level standards for hospitals are applicable only at clearly identified areas designated for outdoor relaxation by either hospital staff or patients.
6 The outdoor activity areas of these uses (if any), are not typically utilized during nighttime hours.
7 Where median (L_{50}) noise level data is not available for a particular noise source, average (L_{eq}) values may be substituted for the standards of this table provided the noise source in question operates for at least 30 minutes of an hour. If the source in question operates less than 30 minutes per hour, then the maximum noise level standards shown would apply.
Source: County of Sacramento General Plan Noise Element 2011. Table 2.

Table 3.12-12 Requirements for Acoustical Analyses Prepared in Sacramento County [Table 3 of the Sacramento County General Plan]
An acoustical analysis prepared pursuant to the Noise Element shall:
A. Be the responsibility of the applicant.
B. Be prepared by qualified persons 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.
D. Estimate projected future (20 year) noise levels in terms of the Standards of Tables 1 and 2, 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.
F. Estimate interior and exterior noise exposure after the prescribed mitigation measures have been implemented.

Caretaker residences are a compatible use within all CNEL ranges, provided that they are ancillary to the primary use of a property, intended for the purpose of property protection or maintenance, and subject to the condition that all residential units be designed to limit intruding noise such that interior levels do not exceed 45 CNEL, with windows closed, in any habitable room.

Sacramento County Noise Control Ordinance

The Sacramento County Noise Control Ordinance contains performance standards for the purpose of preventing unnecessary, excessive and offensive noise levels at sensitive receptors within the county. Table 3.12-13 includes excerpts from the Noise Control Ordinance.

Table 3.12-13. Excerpts from the County of Sacramento Noise Control Ordinance

Noise Area	County Zoning Districts	Time Period	Exterior Noise Standard
1	RE-1, RD-1, RE-2, RD-2, RE-3, RD-3, RD-4, R-1-A, RD-5, R-2, RD-10, R-2A, RD-20, R-3, R-D-30, RD-40, RM-1, RM-2, A-1-B, AR-1, A-2, AR-2, A-5, AR-5	7 a.m.–10 p.m.	55 dB
		10 p.m.–7 a.m.	50 dB

a Noise standards, unless otherwise specifically indicated in this chapter, shall apply to all properties within a designated noise area.

b It is unlawful for any person at any location within the County to create any noise which causes the noise levels on an affected property, when measured in the designated noise area, to exceed for the duration of time set forth following, the specified exterior noise standards in any one hour by:

Cumulative Duration of the Intrusive Sound	Allowance Decibels (dB)
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

c. Each of the noise limits specified in subdivision (b) of this section shall be reduced by five dB for impulsive or simple tone noises, or for noises consisting of speech or music.

d. If the ambient noise level exceeds that permitted by any of the first four noise-limit categories specified in subdivision (b), the allowable noise limit shall be increased in five dB increments in each category to encompass the ambient noise level. If the ambient noise level exceeds the fifth noise level category, the maximum ambient noise level shall be the noise limit for that category.

Notes: dB = A-weighted decibels

Source: County of Sacramento Code, Noise Control 1976

Exemptions

Section 6.68.090 of the County of Sacramento Code establishes conditions that are considered exempt from the associated provisions, as described below:

a. School bands, school athletic and school entertainment events;

b. Outdoor gatherings, public dances, shows and sporting and entertainment events, provided said events are conducted pursuant to a license or permit by the County;

c. Activities conducted on parks, public playgrounds and school grounds, provided such parks, playgrounds and school grounds are owned and operated by a public entity or private school;

d. Any mechanical device, apparatus or equipment related to or connected with emergency activities or emergency work;

e. Noise sources associated with construction, repair, remodeling, demolition, paving or grading of any real property, provided said activities do not take place between the hours of eight p.m. and six a.m. on weekdays and Friday commencing at eight p.m. through and including seven a.m. on Saturday; Saturdays commencing at eight p.m. through and including seven a.m. on the next following Sunday and on each Sunday after the hour of eight p.m. Provided, however, when an unforeseen or unavoidable condition occurs during a construction project and the nature of the project necessitates that work in process be continued until a specific phase is completed, the contractor or owner shall be allowed to continue work after eight p.m. and to operate machinery and equipment necessary until completion of the specific work in progress can be brought to conclusion under conditions which will not jeopardize inspection acceptance or create undue financial hardships for the contractor or owner;

f. Noise sources associated with agricultural operations, provided such operations do not take place between the hours of eight p.m. and six a.m.;

g. All mechanical devices, apparatus or equipment which are utilized for the protection or salvage of agricultural crops during periods of adverse weather conditions or when the use of mobile noise sources is necessary for pest control;

h. Noise sources associated with maintenance of residential area property, provided said activities take place between the hours of six a.m. and eight p.m. on any day except Saturday or Sunday, or between the hours of seven a.m. and eight p.m. on Saturday or Sunday;

i. Any activity, to the extent provisions of Chapter 65 of Title 42 of the United States Code, and Articles 3 and 3.5 of Chapter 4 of Division 9 of the Public Utilities Code of the State of California preempt local control of noise regulations and land use regulations related to noise control of airports and their surrounding geographical areas, any noise source associated with the construction, development, manufacture, maintenance, testing or operation of any aircraft engine, or of any weapons system or subsystems which are owned, operated or under the jurisdiction of the United States, or any other activity to the extent regulation thereof has been preempted by state or Federal law or regulation;

j. Any noise sources associated with the maintenance and operation of aircraft or airports which are owned or operated by the United States.

3.12.3 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

METHODOLOGY

Data included in Chapter 2 of this EIR, "Project Description," and obtained during on-site noise monitoring were used to determine potential locations of sensitive receptors and potential noise- and vibration-generating land uses in the SOIA Area. Noise-sensitive land uses and major noise sources near the SOIA Area were identified based on existing documentation (e.g., equipment noise levels and attenuation rates) and site reconnaissance data.

The project does not propose development, any change in land use, or any change in land use designation or zoning. Any future City of Elk Grove development would first require an annexation request to Sacramento LAFCo. Annexation may occur in multiple phases or under a single application depending on the timing and nature of future project applications. The City would use the amended SOI boundary in discussions with future applicants, Sacramento County, affected service providers, landowners, residents, and stakeholders. In order to facilitate environmental analysis for this SOIA request, the applicant has developed a conceptual land use scenario, which is detailed in Chapter 2 of this EIR, "Project Description."

To assess the impacts of potential short-term construction noise on future sensitive receptors, the sensitive receptors and their relative exposure to the impacts were identified. The construction noise could be generated if there were development within the SOIA Area or off-site improvement areas was predicted by using the Federal Transit Noise and Vibration Impact Assessment methodology (FTA 2006: 12-1 – 12-15). The emission noise levels referenced and the usage factors were based on the Federal Highway Administration Roadway Construction Noise Model. The noise levels of the specific construction equipment that would be used and the resulting noise levels where sensitive receptors are located were calculated.

Traffic noise modeling was conducted based on average daily traffic volumes obtained from the analysis of a previous SOIA request that included this proposed SOIA Area, as well as other areas. This is discussed in more detail in Section 3.14, "Transportation." The FHWA Highway Traffic Noise Prediction Model (FHWA RD 77-108) was used to calculate traffic noise levels along affected roadways, based on the trip distribution estimates as discussed in Section 3.14, "Transportation." The project's contribution to the existing traffic noise levels along area roadways was determined by comparing the predicted noise levels at a reference distance of 100 feet from the roadway centerline for the baseline and cumulative conditions with and without project-generated traffic.

Potential noise impacts from long-term (operation-related) stationary sources were assessed based on existing documentation (e.g., equipment noise levels) and site reconnaissance data. This analysis also included an evaluation of noise-generating uses that could affect noise-sensitive receptors near the SOIA Area.

To assess the land use compatibility of the proposed project with on-site noise levels, predicted traffic noise contours were used to determine if development of possible future land uses in the SOIA Area would exceed the applicable noise criteria.

Groundborne vibration impacts were qualitatively assessed based on existing documentation (e.g., vibration levels produced by specific construction equipment operations) and the distance of sensitive receptors from the given source.

This EIR considers the impacts associated with possible future development within the SOIA Area, including the development of both noise-sensitive and noise-generating land uses. Noise impacts were identified for new noise-sensitive developments located within areas affected by substantial existing or future noise sources (e.g., aircraft, automobile or truck traffic, railroad lines, industrial uses). Noise impacts were also identified for noise-producing projects proposed near existing or proposed noise-sensitive areas. Finally, noise impacts were evaluated by comparing traffic noise generation associated with future development relative to existing conditions.

THRESHOLDS OF SIGNIFICANCE

Based on Appendix G of the State CEQA Guidelines, a noise impact is considered significant if implementation of the proposed project under consideration would result in any of the following:

- 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;
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;
- For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public-use airport, would the project expose people residing or working in the project area to excessive noise levels; or
- For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels.

ISSUES NOT DISCUSSED FURTHER

- **Excessive Noise from an Airport**—Future development would not expose people to excessive noise levels from an airport or private airstrip. Because the SOIA Area would not be located in an area exposed to excessive aircraft-generated noise levels (e.g., not within the 60 dB L_{dn}/CNEL contour of any airport), there would be no impact related to aircraft noise, and therefore this issue is not discussed further in this EIR.

IMPACT ANALYSIS

IMPACT 3.12-1 Temporary, short-term exposure of sensitive receptors to construction noise. *Short-term construction source noise levels could exceed the applicable City standards at nearby noise-sensitive receptors. In addition, if construction activities were to occur during more noise-sensitive hours, construction source noise levels could also result in annoyance and/or sleep disruption to occupants of existing and proposed noise-sensitive land uses and create a substantial temporary increase in ambient noise levels. This impact is considered* ***significant****.*

The project does not propose development or land use change. If the SOIA is approved, and if any future annexation request are approved, future development could occur on the project site which would include construction. Residences and businesses located adjacent to areas of construction activity could be exposed to

future construction noise from on-site construction activity or from off-site construction activity associated with infrastructure improvements. These off-site infrastructure improvements could be for existing roadway improvements, utilities, or water connection, and are not known at this time. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise sensitive land uses, or when construction durations last over extended periods of time.

Major noise generating construction activities could include site grading and excavation, installation of infrastructure, building erection, paving, and landscaping. The highest construction noise levels are typically generated during grading and excavation and lower noise levels typically occur during building construction. The duration of construction period would differ depends on the scale and extent of possible future proposed developments.

To assess noise levels associated with the various equipment types and operations, construction equipment can be considered to operate in two modes, mobile and stationary. Mobile equipment sources move around a construction site performing tasks in a recurring manner (e.g., loaders, graders, dozers). Stationary equipment operates in a given location for an extended period of time to perform continuous or periodic operations. Thus, determining the location of stationary sources during specific phases, or the effective acoustical center of operations for mobile equipment during various phases of the construction process is necessary. Operational characteristics of heavy construction equipment are additionally typified by short periods of full-power operation followed by extended periods of operation at lower power, idling, or powered-off conditions.

Without feasible noise control, large pieces of earth-moving equipment, such as graders, excavators, and dozers, generate maximum noise levels of 85 dBA to 90 dBA at a distance of 50 feet (refer to Table 3.12-14) (EPA 1971: 11). Typical hourly average construction-generated noise levels are about 80 dBA to 85 dBA, measured at a distance of 50 feet from the site during busy construction periods. It is possible that pile-driving could occur if the SOIA Area is subject to development in the future. This type of construction activity could produce very high noise levels of approximately 105 dB at 50 feet.

Noise from localized point sources (such as construction sites) typically decreases by 6 dB to 7.5 dB with each doubling of distance from source to receptor. The existing intervening ground type at the SOIA Area is currently soft and attenuates noise due to absorption; therefore, an attenuation rate of 7.5 dB per doubling of distance was assumed and accounted for in construction operation noise level predictions.

With respect to future on-site and existing off-site noise-sensitive receptors, the City of Elk Grove and the County of Sacramento exempt daytime construction noise from applicable standards, as described above in Section 3.12.2. However, if construction activities occur during the more noise-sensitive evening and nighttime hours, due to the potential necessity of continuous activity for specific components to maintain structural integrity, project-generated noise levels could exceed daytime and nighttime noise standards of 55 dB L_{eq} and 55 dB L_{eq} at, respectively, possible future on-site sensitive receptors. Currently, there are no on-site noise-sensitive receptors; however, it is projected that as the project develops, new noise-sensitive receptors could be located near construction source noise activity centers.

Table 3.12-14. Typical Construction Equipment Noise Levels	
Equipment Item	Typical Maximum Noise Level (dB) at 50 Feet
Earthmoving	
Backhoes	80
Bulldozers	85
Front Loaders	80
Graders	85
Paver	85
Roller	85
Scrapers	85
Tractors	84
Slurry Trencher	82
Dump Truck	84
Pickup Truck	55
Materials Handling	
Concrete Mixer Truck	85
Concrete Pump Truck	82
Crane	85
Man Lift	85
Stationary Equipment	
Compressors	80
Generator	82
Pumps	77
Impact Equipment	
Compactor	80
Jack Hammers	85
Impact Pile Drivers (Peak Level)	95
Pneumatic Tools	85
Rock Drills	85
Other Equipment	
Concrete Saws	90
Vibrating Hopper	85
Welding Machine / Torch	73

Notes: dB = A-weighted decibels
Noise levels are for equipment fitted with properly maintained and operational noise control devices, per manufacturer specifications.
Source: Bolt, Beranek and Newman Inc. 1981, FTA 2006:12-6

It is possible, if there is development in the SOIA Area in the future, construction could expose sensitive receptors to construction noise. Construction of on-site elements could expose future on-site and existing off-site sensitive receptors to equipment noise levels that exceed the applicable noise standards and/or result in a substantial increase in ambient noise levels. This is a **significant** impact.

Mitigation Measures

Mitigation Measure 3.12-1: Implement Noise-Reducing Construction Practices, Prepare and Implement a Noise Control Plan, and Monitor and Record Construction Noise near Sensitive Receptors.

At the time of submittal of any application to annex territory within the SOIA Area, the City of Elk Grove shall impose a condition on all discretionary projects to reduce impacts associated with noise generated during project-related on-site construction activities and future off-site infrastructure improvements.

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 7 p.m. Monday through Friday, and between 8 a.m. and 6 p.m. on Saturdays and Sundays.

- Noisy 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 off-site instead of on-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 250 feet 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 and necessary to reduce construction noise levels consistent with applicable policies, 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 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, as feasible, to shield sensitive receptors from construction noise.

Significance after Mitigation

With implementation of Mitigation Measure 3.12-1, construction would be limited to daytime hours, for which associated noise levels are considered exempt from the provisions of applicable standards established by the City of Elk Grove and the County of Sacramento. On-site and off-site impacts from temporary, short-term exposure of sensitive receptors to increased equipment noise from project would be reduced. However, given the uncertainty of future potential development of the SOIA Area and possibility of off-site infrastructure improvements that may be required to serve currently unknown developments within the SOIA Area, it is not now possible to determine the effectiveness of mitigation with certainty. With enforcement of the above mitigation measure and existing noise regulations, future development in the SOIA Area and off-site improvements would be designed to minimize potential impacts. For example, when installed properly, acoustic barriers can reduce construction noise levels by approximately 8–10 dB (EPA 1971). This mitigation measure would reduce potential impacts. However, it is not possible to demonstrate that this would avoid significant construction noise impacts in every case. There is no additional feasible mitigation. The impact is considered **significant and unavoidable.**

IMPACT 3.12-2 Temporary, short-term exposure of sensitive receptors to increased traffic noise levels from project construction. *Future development would result in temporary increases in on- and off-site roadway traffic noise associated with project construction. Construction-generated traffic could expose sensitive receptors to noise levels along on- and off-site roadways that would not exceed the applicable noise standards and/or result in a substantial increase in ambient noise levels. This impact would be* ***less than significant****.*

Future development would result in an increase of traffic volumes due to the addition of construction-generated traffic associated with on-site future development and off-site infrastructure improvements. Construction-generated traffic on the local roadway network was analyzed based on a maximum construction-related traffic volume of 500 vehicles daily and assuming nine hours of construction period per day (between the hours of 9 a.m. and 6 p.m.), the project would result in 56 construction vehicles per hour. As such, all materials would be transported the local roadway network, thus increasing traffic volumes along affected roadway segments.

To examine the effect of project-generated traffic increases, traffic noise levels associated with the proposed project were calculated for roadway segments in the vicinity of the SOIA Area using the FHWA Highway Noise Prediction Model (FHWA-RD-77-108). Traffic noise levels were modeled under existing conditions, with and without construction traffic. Vehicle speeds and truck volumes on local area roadways were determined based on field observations and vehicle counts conducted. Additional input data included day/night percentages of autos, medium and heavy trucks, vehicle speeds, ground attenuation factors, and roadway widths. Project construction related traffic increases accounted for a 0 to 2 dBA increase in short-term traffic noise levels. Construction-related traffic noise would result in an estimated 2-dBA increase over existing traffic noise levels along Eschinger Road from Bruceville Road to SR 99 and Lambert Road from I-5 to Bruceville Road.

Thus, implementation of proposed SOIA would not result in a substantial temporary or periodic increase in ambient noise levels in the vicinity of the SOIA Area associated with construction traffic. As a result, this impact would be **less than significant**.

Mitigation Measures

No mitigation measures are required.

IMPACT 3.12-3 **Temporary, short-term exposure of sensitive receptors to potential groundborne noise and vibration from project construction.** *Future development could expose sensitive receptors to groundborne noise and vibration levels that exceed applicable standards that could cause human disturbance or damage structures. Construction of future projects could cause a temporary, short-term disruptive vibration if construction activities were to occur near sensitive receptors. This impact is considered* ***significant****.*

Construction activities associated with future development have the potential to result in varying degrees of temporary groundborne vibration, depending on the specific construction equipment used, the location of construction activities relative to sensitive receptors, the operations/activities involved, and the construction material of buildings housing affected vibration-sensitive uses. Vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increases in distance. The type and density of soil can also affect the transmission of energy. Table 3.12-15 provides vibration levels for typical construction equipment.

Table 3.12-15. Typical Vibration Levels for Construction Equipment

Equipment		PPV at 25 Feet (in/sec)	Approximate L_v at 25 Feet
Pile Driver (Impact)	Upper Range	1.518	112
	Typical	0.644	104
Pile Driver (Sonic)	Upper Range	0.734	105
	Typical	0.170	93
Large Bulldozer		0.089	87
Caisson Drilling		0.089	87
Truck		0.076	86
Jackhammer		0.035	79
Small Bulldozer		0.003	58

Notes: in/sec = inches per second; Lv = the velocity level in decibels referenced to 1 microinch per second and based on the root mean square velocity amplitude; PPV = peak particle velocity
[1] For normal residential buildings and for buildings more susceptible to structural damage, respectively.
Sources: Caltrans 2004: 26, FTA 2006: 12-12

Construction vibration would occur during construction of the proposed project during equipment operation on the SOIA Area and during the transport of construction equipment and materials to and from the site. New development should minimize vibration impacts to adjacent uses during construction based on Caltrans vibration standards. A vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction. A vibration level of 80 VdB will be used to evaluate human response to groundborne vibration levels.

The required construction equipment is not known at this time, but could possibly include pile drivers, loaded trucks, and bulldozers. According to the FTA, vibration levels associated with the use of such equipment would be approximately 0.089 in/sec PPV and 87 VdB (referenced to 1 μin/sec and based on the root mean square velocity amplitude) at 25 feet, as shown in Table 3.12-15. Using FTA's recommended procedure for applying a propagation adjustment to these reference levels, predicted vibration levels of typical construction activities would not exceed 0.2 in/sec PPV (Caltrans's recommended standard with respect to the prevention of structural damage for normal buildings) and 80 VdB (FTA's maximum-acceptable vibration standard with respect to human

annoyance for residential uses) within 60 feet of vibration-sensitive receptors. If construction activities include the use of a pile driver, vibration levels would not exceed 0.2 in/sec PPV within 100 feet and 80VdB within 200 feet of a vibration sensitive receptor.

Depending on the nature of future projects, existing vibration-sensitive receptors could be located within 60 feet of proposed typical construction sites and within 300 feet of pile driving sites. Typical construction equipment, loaded trucks, jackhammers, bulldozers, generates vibration levels that decrease quickly over distance where pile driving activities generate significantly more vibration energy and requires more distance for it to decrease the vibration levels. Temporary, short-term vibration levels from project construction sources could exceed FTA's maximum-acceptable vibration standard of 80 VdB with respect to human response for residential uses (i.e., annoyance) at vibration-sensitive land uses. If construction activities were to occur during more noise-sensitive hours, vibration from construction sources could annoy and/or disrupt the sleep of occupants of existing and proposed residences and expose persons to excessive groundborne vibration or groundborne noise levels.

Therefore, vibration levels anticipated over temporary periods of time as a result of proposed project construction could expose sensitive receptors to levels that exceed applicable standards. Thus, project construction of on-site and unknown off-site elements could expose future on-site and existing off-site sensitive receptors to construction vibration levels that exceed the applicable standards and/or cause human disturbance. Thus, this would be considered **significant**.

Mitigation Measures

Mitigation Measure 3.12-3: Implement Measures to Reduce Groundborne Noise and Vibration Levels at Sensitive Receptors during Pile Driving Activities.

At the time of submittal of any application to annex territory within the SOIA Area, the City of Elk Grove shall impose a condition on all discretionary projects to reduce groundborne noise and vibration levels at sensitive receptors during pile driving activities, such as the following:

- A disturbance coordinator shall be designated and this person's contact information shall be posted in a location near the project site that it is clearly visible to the nearby receivers most likely to be disturbed. The director would manage complaints and concerns resulting from activities that cause vibrations. The severity of the vibration concern should be assessed by the disturbance coordinator, and if necessary, evaluated by a professional with construction vibration expertise.

- The pre-existing condition of all buildings within a 500-foot radius within the immediate vicinity of proposed pile driving activities shall be recorded in the form of a preconstruction survey. The preconstruction survey shall determine conditions that exist before construction begins for use in evaluating damage caused by construction activities. Fixtures and finishes within a 500-foot radius of construction activities susceptible to damage shall be documented (photographically and in writing) before construction. All damage will be repaired to its pre-existing condition.

- Vibration monitoring shall be conducted before and during pile driving operations occurring within 500 feet of the sensitive receptors. Every attempt shall be made to limit construction generated vibration levels in accordance with Caltrans recommendations during pile driving and impact activities in the vicinity of the historic structures.

- Pile driving required within a 500-foot radius of sensitive receptors should use alternative installation methods, where possible (e.g., pile cushioning, jetting, predrilling, cast-in-place systems, resonance-free vibratory pile drivers). This would reduce the number and amplitude of impacts required to seat the pile.

Significance after Mitigation

Implementation of Mitigation Measure 3.12-3, would substantially limit the effects of groundborne vibration on sensitive receptors. Pile driving construction would be conducted at least 500 feet from vibration sensitive receptors, or use alternative methods when within 500 feet from a vibration sensitive receptor. Therefore, project-generated groundborne noise and vibration levels would be reduced.

However, given the uncertainty of future potential development of the SOIA Area and possibility of off-site infrastructure improvements that may be required to serve currently unknown developments within the SOIA Area, LAFCo finds that it is not now possible to determine the effectiveness of mitigation with certainty. With enforcement of the above mitigation measure, future development in the SOIA Area and off-site improvements would be designed to minimize potential impacts. LAFCo would condition future annexation on compliance with Mitigation Measure 3.12-3. However, it is not possible to determine at this time whether this mitigation would avoid all potentially significant impacts. There is no additional feasible mitigation. The impact is considered **significant and unavoidable.**

IMPACT 3.12-4 Long-term traffic noise levels at existing noise-sensitive receivers. *Future development would result in an increase in vehicle trips. The increased traffic volumes would result in a noticeable (3 dB or greater) increase in traffic noise along roadways in and within the vicinity of the proposed SOIA Area. Therefore, this impact is considered* ***significant****.*

Possible future development within the SOIA Area could result in an increase in traffic volumes on the local roadway network and, consequently, an increase in noise levels from traffic sources along affected segments. To assess the impact of project-generated traffic increases, traffic noise levels associated with the proposed SOIA were calculated for roadway segments in the project study area using the FHWA Highway Noise Prediction Model (FHWA-RD-77-108). Traffic noise levels were modeled under existing and future conditions, with and without project implementation. Average daily traffic (ADT) volumes and the distribution thereof were obtained a previous proposed SOIA traffic study. Vehicle speeds and truck volumes on local area roadways were determined based on field observations. Additional input data included day/night percentages of autos, medium and heavy trucks, vehicle speeds, ground attenuation factors, and roadway widths. Refer to Appendix D of this EIR for complete modeling inputs and results.

The project's contribution to the existing and future traffic noise levels along area roadways was determined by comparing the predicted noise levels with and without project-generated traffic. Tables 3.12-16 and 3.12-17 summarize the modeled traffic noise levels at 100 feet from the centerline of affected roadway segments in the vicinity of the SOIA Area. Modeled increases that would be considered substantial, an increase of 3 dBA, in comparison to existing no project conditions are indicated in bold. Modeled roadway noise levels assume no natural or artificial shielding between the roadway and the receptor.

As shown in Tables 3.12-16 and 3.12-17, the modeling conducted shows that future development, in addition to existing conditions, would result in traffic noise level increases ranging from 0 dBA to + 14 dBA L_{dn}, compared

to noise levels without the project.[9] Specifically, traffic generated under existing and future conditions by the proposed project would contribute a substantial increase in future traffic noise conditions along four project area roadways: Kammerer Road between Bruceville Road and Promenade Parkway, Eschinger Road between Bruceville Road and SR 99, Lambert Road between I-5 and Bruceville Road, and Bruceville Road between Whitelock Parkway and Lambert Road. Therefore, long-term noise levels from project-generated traffic sources would result in a substantial permanent increase in ambient noise levels (an increase of 3 dBA or greater) under existing and future conditions. As a result, this impact is considered **significant**.

Table 3.12-16. Predicted Traffic Noise Levels, Existing Plus Project Conditions

Roadway	Segment Location	L_{dn} at 100 Feet, dB			
		No Project	Plus Project	Net Change	Significant Impact?
Elk Grove Boulevard	From I-5 to Harbour Point Drive	71	72	1	No
Elk Grove Boulevard	From Harbour Point Drive to Franklin Boulevard	71	72	1	No
Elk Grove Boulevard	From Franklin Boulevard to Bruceville Road	72	73	1	No
Elk Grove Boulevard	From Bruceville Road to Laguna Springs Drive	72	73	1	No
Elk Grove Boulevard	From Laguna Springs Drive to SR-99	73	74	1	No
Elk Grove Boulevard	From SR-99 to East Stockton Boulevard	70	71	1	No
Elk Grove Boulevard	From East Stockton Boulevard to Elk Grove Florin Road	70	71	1	No
Elk Grove Boulevard	From Elk Grove Florin Road to Waterman Road	68	69	1	No
Grant Line Road	From Promenade Parkway to East Stockton Boulevard	68	70	2	No
Grant Line Road	From East Stockton Boulevard to Waterman Road	69	71	2	No
Grant Line Road	From Waterman Road to Elk Grove Boulevard	68	70	2	No
Bilby Road	From Franklin Boulevard to Bruceville Road	60	63	**3**	**Yes**
Kammerer Road	From Bruceville Road to Promenade Parkway	64	69	**5**	**Yes**
Eschinger Road	From Bruceville Road to SR 99	57	71	**14**	**Yes**
Dillard Road	From SR 99 to Wilton Road	64	65	1	No
Lambert Road	From I-5 to Bruceville Road	54	61	**7**	**Yes**
Franklin Boulevard	From Elk Grove Boulevard to Whitelock Parkway	67	69	2	No
Bruceville Road	From Elk Grove Boulevard to Whitelock Parkway	68	69	1	No
Bruceville Road	From Whitelock Parkway to Kammerer Road	60	68	**8**	**Yes**
Bruceville Road	From Kammerer Road to Eschinger Road	56	67	**11**	**Yes**
Bruceville Road	From Eschinger Road to Lambert Road	55	60	**5**	**Yes**

Notes: dB = A-weighted decibels; L_{dn} = day-night average noise level

* Traffic noise levels are predicted at a standard distance of 100 feet from the roadway centerline and do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.

Source: AECOM 2016

9 Project-related traffic noise increase under future plus project conditions would slightly vary from those under existing plus project conditions, because adjustment in traffic rerouting to Southeast Connector was taken into account under cumulative plus project.

Table 3.12-17. Predicted Traffic Noise Levels, Future Plus Project (2020) Conditions					
Roadway	Segment Location	L_{dn} at 100 Feet, dB			
		No Project	Plus Project	Net Change	Significant Impact?
Elk Grove Boulevard	From I-5 to Harbour Point Drive	71	71	0	No
Elk Grove Boulevard	From Harbour Point Drive to Franklin Boulevard	71	71	0	No
Elk Grove Boulevard	From Franklin Boulevard to Bruceville Road	73	73	0	No
Elk Grove Boulevard	From Bruceville Road to Laguna Springs Drive	73	74	1	No
Elk Grove Boulevard	From Laguna Springs Drive to SR-99	74	75	1	No
Elk Grove Boulevard	From SR-99 to East Stockton Boulevard	71	71	0	No
Elk Grove Boulevard	From East Stockton Boulevard to Elk Grove Florin Road	70	71	1	No
Elk Grove Boulevard	From Elk Grove Florin Road to Waterman Road	71	71	0	No
Grant Line Road	From Promenade Parkway to East Stockton Boulevard	70	71	1	No
Grant Line Road	From East Stockton Boulevard to Waterman Road	71	72	1	No
Grant Line Road	From Waterman Road to Elk Grove Boulevard	70	71	1	No
Bilby Road	From Franklin Boulevard to Bruceville Road	62	64	2	No*
Kammerer Road	From Bruceville Road to Promenade Parkway	70	72	2	No*
Eschinger Road	From Bruceville Road to SR 99	57	71	**14**	**Yes**
Dillard Road	From SR 99 to Wilton Road	64	65	1	No
Lambert Road	From I-5 to Bruceville Road	54	61	**7**	**Yes**
Franklin Boulevard	From Elk Grove Boulevard to Whitelock Parkway	66	68	2	No
Bruceville Road	From Elk Grove Boulevard to Whitelock Parkway	68	68	0	No
Bruceville Road	From Whitelock Parkway to Kammerer Road	60	67	**7**	**Yes**
Bruceville Road	From Kammerer Road to Eschinger Road	56	67	**11**	**Yes**
Bruceville Road	From Eschinger Road to Lambert Road	55	60	**5**	**Yes**

Notes: dB = A-weighted decibels; L_{dn} = day-night average noise level. Traffic noise levels are predicted at a standard distance of 100 feet from the roadway centerline and do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.

* Project-related traffic noise increase under cumulative plus project conditions would slightly vary from those under existing plus project conditions, because adjustment in traffic rerouting to Southeast Connector was taken into account under cumulative plus project.

Source: Data modeled by AECOM 2016

Mitigation Measures

Reducing increases in traffic-generated noise levels at existing noise-sensitive uses adjacent to Kammerer Road between Bruceville Road and Promenade Parkway, Eschinger Road between Bruceville Road and SR 99, Lambert Road between I-5and Bruceville Road, and Bruceville Road between Whitelock Parkway and Kammerer, may not be feasible. The City of Elk Grove Policy NO-7 discourages the construction of soundwalls to reduce traffic noise levels in residential areas originally constructed without soundwalls. Elk Grove Policy NO-7-Action-1 would implement a city-wide noise reduction program to reduce traffic noise levels. This could be accomplished through distribution versus concentration of traffic and measures to reduce travel demand by incorporating density mixing of uses, pedestrian and bike infrastructure, and transit services. Reducing travel demand would reduce traffic volumes and therefore traffic noise levels.

Future development in the SOIA Area would be designed to minimize potential impacts. However, it is not possible to determine at this time whether this program would avoid all potentially significant impacts. Significant traffic noise impacts at existing and future noise-sensitive areas can be difficult to feasibly mitigate. Some areas may have side of the road with noise barriers that increase noise levels experienced on the other side of the roadway. New noise barriers may have limited effectiveness for traffic noise mitigation since openings are often

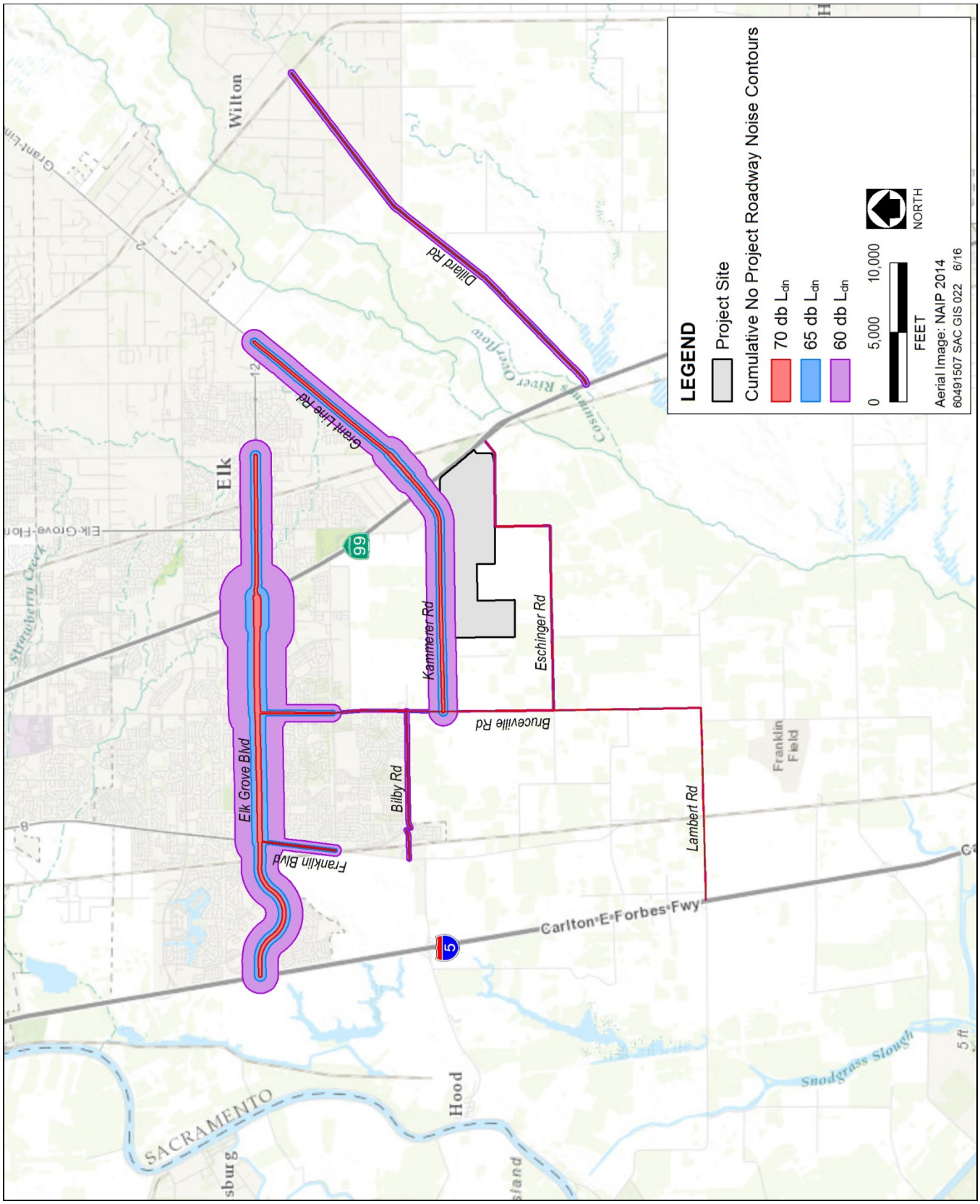
required for pedestrian, bicycle, vehicle, and emergency access and visual access for safety. Quiet pavement may be infeasible due to cost. It may not be feasible to reduce traffic noise impacts to a less-than-significant level at all existing and future noise-sensitive land uses along Kammerer Road between Bruceville Road and Promenade Parkway, Eschinger Road between Bruceville Road and SR 99, Lambert Road between I-5 and Bruceville Road, and Bruceville Road between Whitelock Parkway and Kammerer. There is no additional feasible mitigation. The impact is considered **significant and unavoidable.**

IMPACT 3.12-5 Land use compatibility of on-site sensitive receptors with future traffic noise levels. *Future development would result in future traffic noise that could expose proposed new land uses to levels that exceed the City's standards. This traffic noise could result in annoyance and/or sleep disruption to nearby noise-sensitive receptors. Therefore, this impact is considered* ***significant****.*

The FHWA Traffic Noise Prediction Model was used to estimate the land use compatibility of possible future on-site noise-sensitive receptors with noise levels from future vehicle traffic sources. Exhibits 3.12-4a through 3.12-4d illustrate the predicted distances to the 60 dBA, 65 dBA and 70 dBA L_{dn} traffic noise contours. These contour distances are used to identify areas within the SOIA Area that would be considered potentially subject to noise impacts from traffic. The roadway traffic noise levels shown represent conservative potential noise exposure to existing roadways, since the calculations do not assume natural or artificial shielding or reflection from existing or proposed structures or topography. Actual noise levels would vary from day to day, depending on factors such as local traffic volumes and speed, shielding from existing and proposed structures, variations in attenuation rates resulting from changes in surface parameters, and meteorological conditions. On-site project roadway network locations and volumes are not known at this time and cannot be described in this EIR.

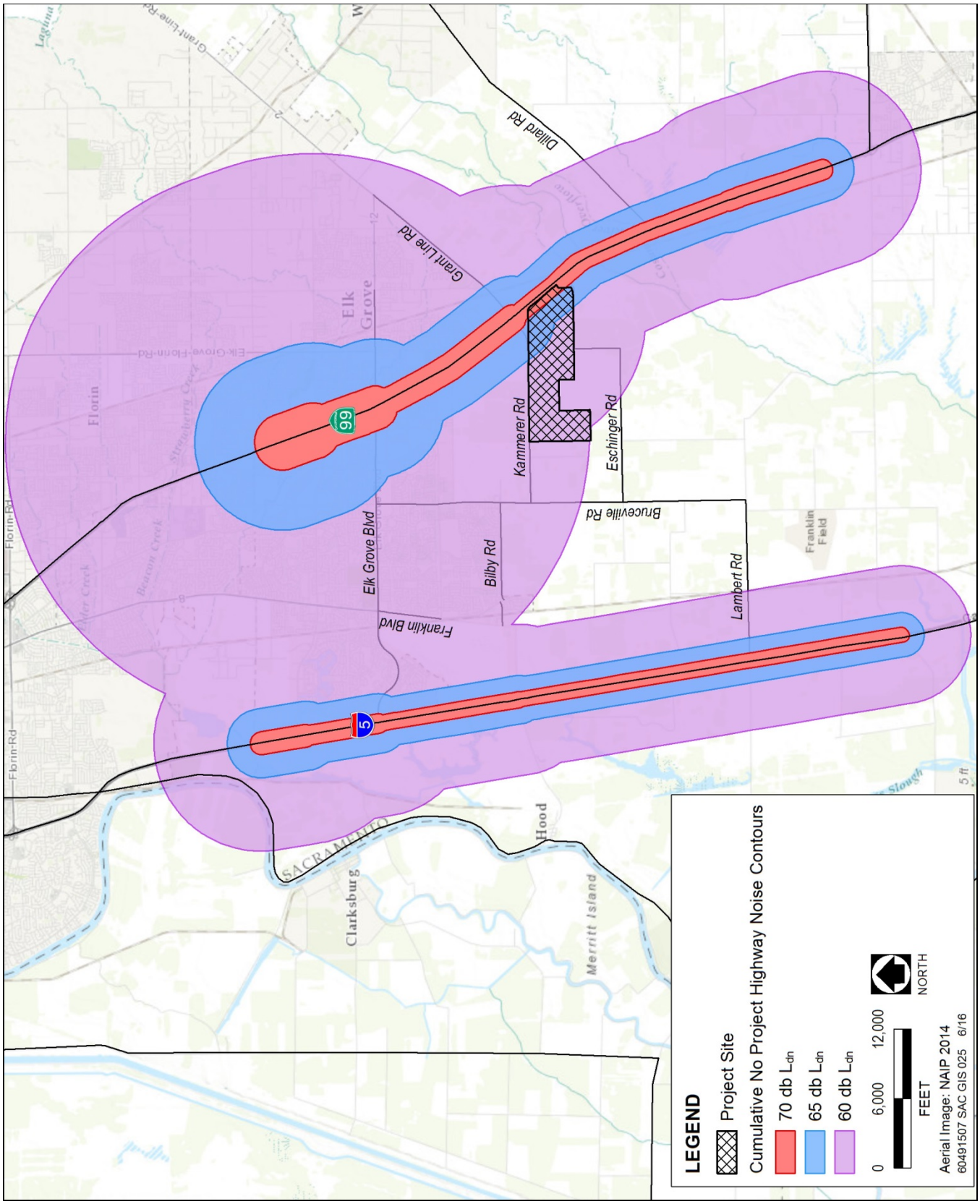
It is not possible to describe traffic noise impacts to any particular land use or development since the SOIA application does not include any requested land use change or development proposal. However, noise-sensitive receptors located within future 60 dB L_{dn} noise contours, could be exposed to noise levels exceeding the City of Elk Grove General Plan Noise Element standard of 60 dB L_{dn} for residential uses affected by transportation noise sources. It is possible that future development within the SOIA Area could occur in these locations. Therefore, impacts related to land use compatibility is considered **significant**.

Potential measures that can be implemented include (but are not limited to) setbacks, site design, construction of noise barrier combination of berms and walls between the roadway and noise-sensitive uses and installation of low-noise pavement, such as open-grade asphalt or rubberized asphalt. Emphasis will be placed on the use of setbacks, site design and the use of berm and soundwall combinations to the extent feasible as outlined in the City of Elk Grove Noise Policy NO-8 and NO-9, prior to consideration of the use of noise barriers.



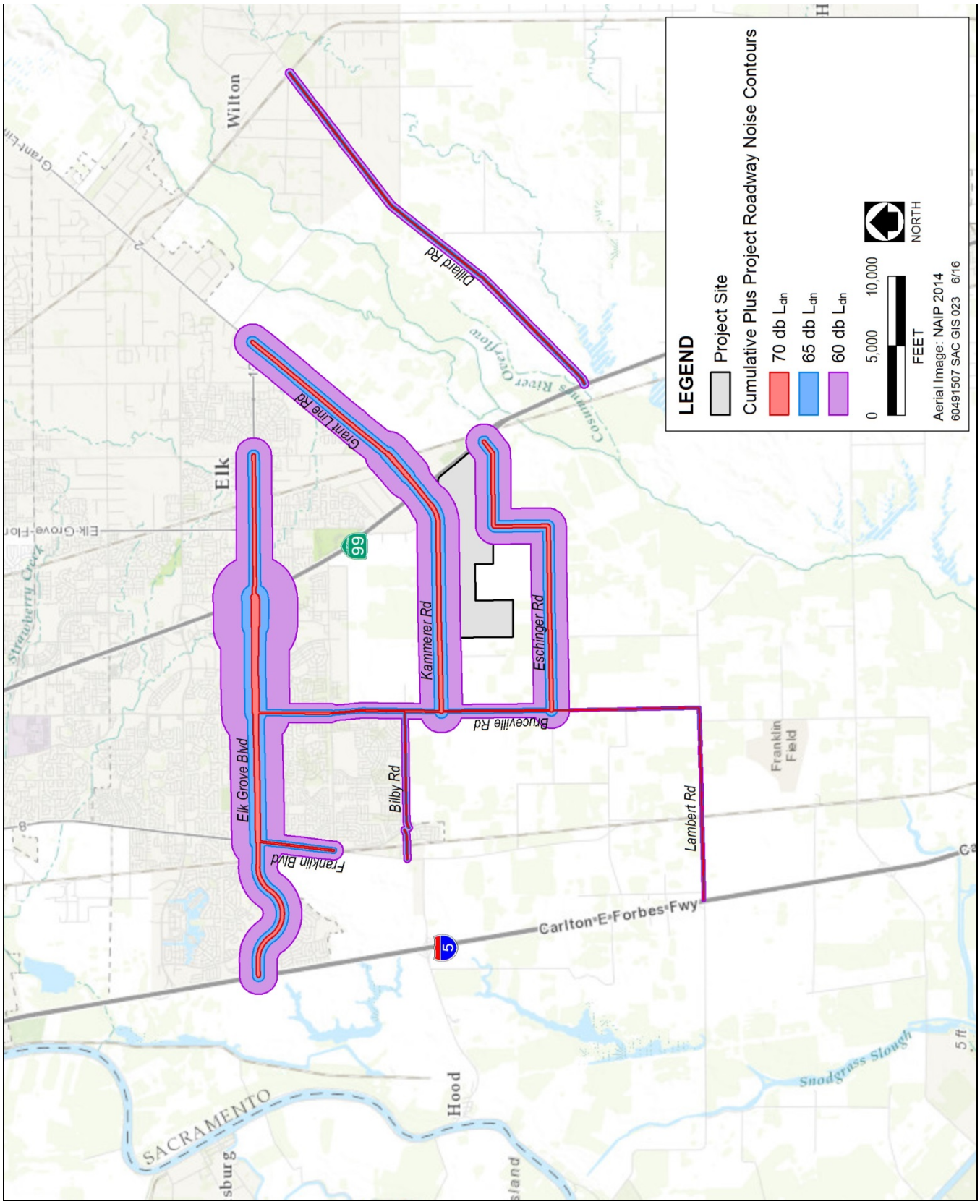
Source: AECOM 2016

Exhibit 3.12-4a **Cumulative No Project Roadway Noise Contours**



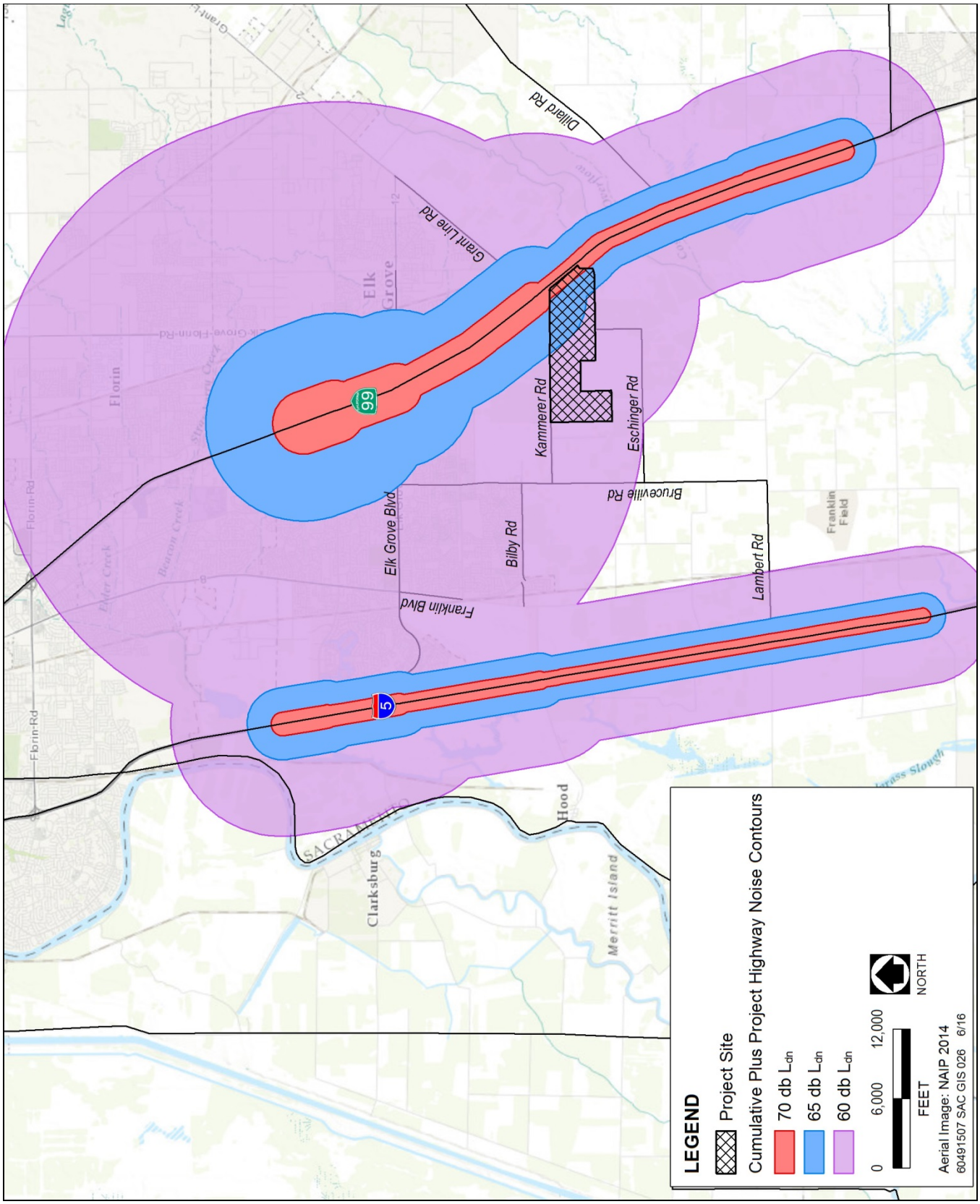
Source: AECOM 2016

Exhibit 3.12-4b **Cumulative No Project Highway Noise Contours**



Source: AECOM 2016

Exhibit 3.12-4c **Future Plus Project Roadway Noise Contours**



Source: AECOM 2016

Exhibit 3.12-4d **Future Plus Project Highway Noise Contours**

Mitigation Measures

Mitigation Measure 3.12-5: Implement Measures to Improve Land Use Compatibility to Reduce Exposure of On-Site Sensitive Receptors to Project-Generated Increases in Operational Traffic Noise Levels.

At the time of submittal of any application to annex territory within the SOIA Area, the City of Elk Grove shall impose a condition on all discretionary projects to reduce exposure of sensitive receptors to project-generated increases in operational traffic noise levels on area roadways, such as the following:

- Obtain the services of a qualified acoustical consultant 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 provide a minimum composite Sound Transmission Class (STC) rating for buildings to achieve an interior noise level of 45 dBA L_{dn} 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).

- When a project is adopted, and prior to the submittal of small-lot tentative subdivision maps and improvement plans, the project applicants 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 transportation 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. Measures may include, but are not limited to, the following:

    - site design may be taken into consideration to reduce noise levels within compliance of applicable noise standards. Where noise levels require mitigation, residential areas may be redesigned so that houses front the noise source. Fronting the residences to the noise source will achieve a 5 dBA to 8 dBA reduction in traffic noise levels due to shielding provided by the intervening residential building façade at the outdoor activity area;

    - increase minimum setback distances from the noise source. Increasing the setback distance would achieve a natural attenuation of traffic noise levels due to excess ground attenuation and additional noise propagation over distance;

    - use of increased noise-attenuation measures for second and third story facades in building construction (e.g., dual-pane, sound-rated windows; exterior wall insulation);

    - if no other feasible means exist, construct exterior sound walls. To be effective, noise barriers need to be continuous or solid, with no gaps between joints or at the base of the barrier, and must block the line of sight to windows of neighboring dwellings. Achieved noise reductions from barriers can vary, but typically range from approximately 5 to 10 dBA, depending on construction characteristics, height, and location.

- Where noise barrier heights are not feasible, the City may, at its discretion, require the project applicant to instead achieve the conditionally-acceptable noise level of 65-dBA CNEL at noise-sensitive locations, provided that interior noise levels are in compliance with the City's 45-dBA L_{dn}

interior noise level standard. As an alternative, site design may be taken into consideration to reduce noise levels within compliance of applicable noise standards. Where noise levels require sound walls in excess of a desirable height deemed by the City, residential areas may be redesigned so that houses front the noise source. For example, fronting the residences to the noise source would achieve a -5 dBA to -8 dBA reduction in traffic noise levels due to shielding provided by the intervening residential building façade at the outdoor activity area.

Significance after Mitigation

Implementation of Mitigation Measure 3.12-5 would reduce the significant interior and exterior noise level impacts at affected receptors. However, it is not now possible to determine the effectiveness of mitigation with certainty. With enforcement of the above mitigation measure, future development in the SOIA Area would be designed to minimize potential impacts. LAFCo would condition future annexation on compliance with Mitigation Measure 3.12-5. However, it is not possible to determine at this time whether this mitigation would avoid all potentially significant impacts. Significant traffic noise impacts at existing and future noise-sensitive areas can be difficult to feasibly mitigate. Some areas may have side of the road with noise barriers that increase noise levels experienced on the other side of the roadway. New noise barriers may have limited effectiveness for traffic noise mitigation since openings are often required for pedestrian, bicycle, vehicle, and emergency access and visual access for safety. Quiet pavement may be infeasible due to cost. It may not be feasible to reduce traffic noise impacts to a less-than-significant level at all noise-sensitive land uses. There is no additional feasible mitigation. The impact is considered **significant and unavoidable.**

IMPACT 3.12-6 Land use compatibility of on-site sensitive receptors to or generation of non-transportation noise levels in excess of local standards. *Future development of new noise-sensitive land uses would occur within areas that either are currently affected by noise from non-transportation noise sources, or will be in the future. These non-transportation noise sources could exceed the applicable noise standards (hourly L_{eq} dBA) and result in a substantial increase in ambient noise levels. Therefore, this impact is considered* ***significant****.*

It is possible future development within the SOIA Area could involve residential, commercial, office, and industrial; open space and recreation; and institutional and public facilities (e.g., electrical substations, and schools). Future development of noise-sensitive uses (e.g., residential dwellings, schools, hospitals, parks, hotels, places of worship, libraries) could occur in areas that either are currently exposed to or would be exposed to future noise from non-transportation noise sources that could exceed the 55 dB L_{eq} daytime and 45 dB L_{eq} nighttime. The long-term operation of these uses could result in non-transportation noise from, but not limited to, the following potential sources:

- landscape and building maintenance activities (e.g., hand tools, power tools, lawn and garden equipment);
- mechanical equipment (e.g., pumps, generators heating, ventilation, and cooling systems);
- garbage collection;
- parking lots;
- commercial, office, and industrial activities;
- other residential, school, and recreation activities and events; and
- agricultural activities.

Potential Sources of Stationary and Area Noise

Landscape and Building Maintenance Activities

Landscape maintenance activities include the use of leaf blowers, power tools, and gasoline-powered lawn mowers, could result in intermittent noise levels that range from approximately 88.3 dB at 6.5 feet, respectively. Based on an equipment noise level of 88.3 dB, the use of such equipment, assuming a noise attenuation rate of 6 dB per doubling of distance from the source, would result in exterior noise levels of approximately 70.1 dB at 50 feet. Although such activities would likely occur during the daytime hours, the exact hours and locations are unknown at this time. Such activities are intermittent and would occur during the daytime, which is a less noise-sensitive time of day. The use of such equipment is not so frequent that applicable daily noise standards or maximum single-event noise standards would be exceeded for noise-sensitive land uses.

Mechanical Equipment

The operation of mechanical equipment at residential, commercial, office, and industrial; and institutional and public facilities (e.g., electrical substations, wastewater treatment facility and filtered water treatment facility, and schools) is another non-transportation noise source. The operation of mechanical equipment (e.g., pumps, generators; heating, ventilation, and cooling systems) could result in intermittent noise levels of approximately 90 dB at 3 feet (EPA 1971). Based on this equipment noise level, the operation of such equipment, assuming a noise attenuation rate of 6 dB per doubling of distance from the source, may result in exterior noise levels of approximately 60 dB at 95 feet.

Although these types of equipment are typically shielded from direct exposure (e.g., housed on rooftops, in equipment rooms, or in exterior enclosures), the actual placement of such equipment on future land uses is not known at this time. It is possible that noise levels could exceed the applicable standards at existing and proposed noise-sensitive receptors and create a substantial permanent increase in ambient noise levels at existing noise-sensitive receptors if measures are not taken to reduce such noise exposure.

Garbage Collection Activities

Garbage collection activities (e.g., emptying large refuse dumpsters, possible multiple times per week, and the shaking of containers with a hydraulic lift), could result in instantaneous maximum noise levels of approximately 89 dB L_{max} at 50 feet. Such activities are anticipated to be very brief, intermittent, and would occur during daytime hours, which are considered to be less noise-sensitive times of day. Garbage collection activities are infrequent, and therefore would not be expected to exceed daily noise standards. Noises would typically emanate from public rights-of-way, which would normally be separated from outdoor gathering spaces associated with residential uses. Noise associated with garbage collection would not be expected to create single-event noise that would be substantially disruptive to daily activities or cause sleep disturbance.

Parking Lots

Parking lots and parking structures include noise sources such as vehicles entering/exiting the lot, alarms/radios, and doors slamming. Neither the size (i.e., capacity) or location of parking lots that could be constructed under the 2030 General Plan is known at this time. However, according to the FHWA, parking lots with a maximum hourly traffic volume of approximately 1,000 vehicles per hour either entering or exiting the lot could result in a peak hour and daily noise levels of approximately 56 dB L_{eq} and 63 dB L_{dn} at 50 feet.

Commercial, Office, and Industrial Activities

Commercial, office, and industrial noise sources include loading dock activities, air circulation systems, delivery areas, and the operation of trash compactors and air compressors. Such activities could result in intermittent noise levels of approximately 91 dB L_{max} at 50 feet (EPA 1971) and high single-event noise levels from backup alarms from delivery trucks during the more noise-sensitive hours of the day. Neither the exact hours of operation nor the location of such potential noise sources are known at this time. Thus, land use related noise levels could exceed the applicable standards at existing and proposed noise-sensitive receptors, especially if such activities were to occur during the more noise-sensitive hours (e.g., evening, nighttime, and early morning) and create a substantial increase in ambient noise levels at existing noise-sensitive receptors. In addition, if such activities were to occur during these more noise-sensitive hours, project-generated noise levels may result in annoyance and/or sleep disruption to occupants of the on-site (e.g., existing and proposed) noise-sensitive land uses.

Other Residential, School, and Recreation Activities and Events

Noise sources typical of residential, school, recreation, and event uses could include voices and amplified music/speaker systems. Such sources could result in noise levels of approximately 60–75 dB L_{eq} at 50 feet. Although such activities would likely occur primarily during the daytime hours, neither the hours of operation nor location of such sources are known at this time. It is possible that noise levels could exceed the applicable standards at existing and proposed noise-sensitive receptors, especially if such activities were to occur during the more noise-sensitive hours (e.g., evening, nighttime, and early morning) and create a substantial increase in ambient noise levels at existing noise-sensitive receptors. In addition, if such activities were to occur during these more noise-sensitive hours, project-generated noise levels may result in annoyance and/or sleep disruption to occupants of the existing and proposed noise-sensitive land uses.

Agricultural Activities

Agricultural activities adjacent to the proposed SOIA Area could involve the use of various types of heavy-duty equipment. Agricultural operations can occur during noise sensitive times of the day and involve substantial noise levels. The operation of heavy-duty equipment associated with agricultural activities typically results in noise levels of approximately 75 dB L_{eq} at 50 feet (EPA 1971). The closest distances between proposed noise-sensitive land uses and agricultural land uses would be approximately 50 to 200 feet in several locations. Based on the above noise levels and a typical noise-attenuation rate of 6 dB per doubling of distance, exterior noise levels at noise-sensitive receptors approximately 50 to 200 feet from agricultural activities could exceed 75 and 63 dB L_{eq}, respectively. It is important to note that the closest noise-sensitive receptors would not be exposed to this noise level for extended periods, given the mobile nature of agricultural activities (e.g., disking, plowing, harvesting). If, for instance, residential land uses were exposed to 75 dB L_{eq} for one entire hour during the daytime, and ambient noise levels were 50 dB L_{eq} during the rest of the daytime hours and 45 dB L_{eq} during the nighttime hours, the 24-hour noise level would be 62 dB L_{dn}.

Thus, this impact would be considered **significant**.

Mitigation Measures

Mitigation Measure 3.12-6: Implement Measures to Reduce Potential Exposure of Sensitive Receptors to Non-Transportation Source–Generated Noise.

At the time of submittal of any application to annex territory within the SOIA Area, the City of Elk Grove shall impose a condition on all discretionary projects to reduce potential exposure of sensitive receptors to non-transportation source-generated noise.

To reduce potential long-term exposure of sensitive receptors to noise generated by project-related non-transportation noise sources, the City shall evaluate individual facilities, subdivisions, and other project elements for compliance with the City Noise Ordinance and policies contained in the City's General Plan at the time that tentative subdivision maps and improvements plans are submitted. All project elements shall comply with City noise standards. The project applicants for all project phases shall implement the following measures to assure maximum reduction of project interior and exterior noise levels from operational activities.

- The proposed land uses shall be designed so that on-site mechanical equipment (e.g., HVAC units, compressors, and generators) and area-source operations (e.g., loading docks, parking lots, and recreational-use areas) are located as far as possible from or shielded from nearby noise-sensitive land uses.

- Residential air conditioning units shall be located a minimum of 10 feet from adjacent residential dwellings, including outdoor entertainment and relaxation areas, or shall be shielded to reduce operational noise levels at adjacent dwellings or designed to meet City noise standards. Shielding may include the use of fences or partial equipment enclosures. To provide effectiveness, fences or barriers shall be continuous or solid, with no gaps, and shall block the line of sight to windows of neighboring dwellings.

- To the extent feasible, residential land uses located within 2,500 feet of and within the direct line of sight of major noise-generating commercial uses (e.g., loading docks and equipment/vehicle storage repair facilities,) shall be shielded from the line of sight of these facilities by construction of a noise barrier. To provide effectiveness, noise barriers shall be continuous or solid, with no gaps, and shall block the line of sight to windows of neighboring dwellings.

- Dual-pane, noise-rated windows; mechanical air systems; exterior wall insulation; and other noise-reducing building materials shall be used.

- 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.

- Prior to issuance of occupancy permits, project applicants shall provide buyer-renter notification for any noise sensitive uses located within 200 feet on ongoing operations of agricultural equipment at adjacent agricultural land uses.

In addition, the City shall seek to reduce potential long-term exposure of sensitive receptors to noise generated by project-related non-transportation noise sources from public activities on school grounds, in neighborhood and community parks, and in open-space areas. Specifically, the City shall encourage the controlling agencies (i.e., schools and park and recreation districts) to implement measures to reduce project-generated interior and exterior noise levels to within acceptable levels, including but not limited to the following:

- On-site landscape maintenance equipment shall be equipped with properly operating exhaust mufflers and engine shrouds, in accordance with manufacturers' specifications.

- For maintenance areas located within 500 feet of noise-sensitive land uses, the operation of on-site landscape maintenance equipment shall be limited to the least noise-sensitive periods of the day, between the hours of 7 a.m. and 7 p.m.

- Outdoor use of amplified sound systems within 500 feet of noise-sensitive land uses shall be permitted only between 7 a.m. and 10 p.m. Sunday through Thursday, and between 7 a.m. and 11 p.m. on Friday and Saturday.

Significance after Mitigation

Compliance with the City Noise Ordinance and implementation of additional mitigation measures for the control of non-transportation source noise as identified above in Mitigation Measure 3.12-6 would reduce non-transportation source noise levels. Restricting noise generating activities to daytime hours as outlined in the City's Noise Control Ordinance and requiring stationary equipment to achieve property line noise limits would reduce the potential for noise impacts at sensitive receptors. Achievable noise reductions from fences or barriers can vary, but typically range from approximately 5 to 10 dBA, depending on construction characteristics, height, and location. However, it is not now possible to determine the effectiveness of mitigation with certainty. With enforcement of the above mitigation measure, future development in the SOIA Area would be designed to minimize potential impacts. LAFCo would condition future annexation on compliance with Mitigation Measure 3.12-6. However, it is not possible to determine at this time whether this mitigation would avoid all potentially significant impacts. There is no additional feasible mitigation. The impact is considered **significant and unavoidable.**