3.11 NOISE AND VIBRATION

This section includes a summary of applicable regulations related to noise and vibration, a description of ambient-noise conditions, and an analysis of potential short-term construction and long-term operational-source noise impacts associated with the Elk Grove Housing Element and Safety Element Update (Project).

A comment letter received in response to the notice of preparation (NOP) requested that the noise and vibration analysis assume windows and doors to be open instead of closed. The methodology used to conduct traffic noise modeling for the Project is intended to analyze exterior noise levels at the outdoor activity area of the land use. This methodology is based on the City's traffic noise standards provided in Table 8-3, "Maximum Allowable Noise Exposure, Transportation Noise Sources," in the Services Health, and Safety element of the City's General Plan. The traffic noise modeling does not analyze interior noise levels from traffic and, therefore, does not make assumptions about whether doors and windows are opened or closed.

3.11.1 Regulatory Setting

FEDERAL

U.S. Environmental Protection Agency Office of Noise Abatement and Control

The U.S. Environmental Protection Agency (EPA) Office of Noise Abatement and Control was originally established to coordinate Federal noise control activities. In 1981, EPA administrators determined that subjective issues such as noise would be better addressed at more local levels of government. Consequently, in 1982 responsibilities for regulating noise control policies were transferred to state and local governments. However, documents and research completed by the EPA Office of Noise Abatement and Control continue to provide value in the analysis of noise effects.

Federal Transit Administration

To address the human response to ground vibration, the Federal Transit Administration (FTA) has set forth guidelines for maximum-acceptable vibration criteria for different types of land uses. These guidelines are presented in Table 3.11-1.

Table 3.11-1 Ground-Borne Vibration (GBV) Impact Criteria for General Assessment

Land Use Category	GVB Impact Levels (VdB re 1 micro-inch/second)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations.	65 [4]	65 [4]	65 [4]
Category 2: Residences and buildings where people normally sleep.	72	75	80
Category 3: Institutional land uses with primarily daytime uses.	75	78	83

Notes: VdB = vibration decibels referenced to 1 µ inch/second and based on the root mean square (RMS) velocity amplitude.

[1] "Frequent Events" is defined as more than 70 vibration events of the same source per day.

[2] "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day.

[3] "Infrequent Events" is defined as fewer than 30 vibration events of the same source per day.

[4] This criterion is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research would require detailed evaluation to define acceptable vibration levels.

Source: FTA 2018.

STATE

California Building Code Sound Transmission Standards

Noise within habitable units that is attributable to external sources is regulated by the California Building Standards codified in the California Code of Regulations, Title 24, Part 2, Section 1207. These standards are enforceable at the time of construction or during occupancy and apply to habitable units with common interior walls, partitions, and ceilings or those adjacent to public areas, such as halls, corridors, stairways, and service areas. Under these standards, the interior noise levels attributable to exterior sources shall not exceed 45 decibels (dB) in any habitable room. The noise metrics used to measure these levels can be day-night average sound level (L_{dn}) or Community Noise Equivalent Level (CNEL), consistent with the local general plan. An acoustical analysis documenting compliance with the interior sound level standards shall be prepared for structures containing habitable rooms. Under PRC Section 25402.1(g), all cities and counties in the State are required to enforce the adopted California Building Code, including these standards for noise in interior environments.

California General Plan Guidelines

The State of California General Plan Guidelines 2017, published by the California Governor's Office of Planning and Research (OPR) (2017), provides guidance for the compatibility of projects within areas of specific noise exposure. Acceptable and unacceptable community noise exposure limits for various land use categories have been determined to help guide new land use decisions in California communities. In many local jurisdictions, these guidelines are used to derive local noise standards and guidance. Citing EPA materials and the State Sound Transmissions Control Standards, the State's general plan guidelines recommend interior and exterior CNEL of 45 and 60 decibels (dB) for residential units, respectively (OPR 2017:378).

California Department of Transportation

In 2013, Caltrans published the Transportation and Construction Vibration Manual (Caltrans 2020). The manual provides general guidance on vibration issues associated with construction and operation of projects in relation to human perception and structural damage. Table 3.11-2 presents recommendations for levels of vibration that could result in damage to structures exposed to continuous vibration.

Table 3.11-2 Caltrans Recommendations Regarding Levels of Vibration Exposure

PPV (in/sec)	Effect on Buildings
0.4-0.6	Architectural damage and possible minor structural damage
0.2	Risk of architectural damage to normal dwelling houses
0.1	Virtually no risk of architectural damage to normal buildings
0.08	Recommended upper limit of vibration to which ruins and ancient monuments should be subjected
0.006-0.019	Vibration unlikely to cause damage of any type

Notes: PPV= Peak Particle Velocity; in/sec = inches per second

Source: Caltrans 2020.

LOCAL

City of Elk Grove General Plan

Chapter 8 of the *City of Elk Grove General Plan* (City of Elk Grove 2019) includes noise policies that are applicable to the Project:

- **Policy N-1-1:** New development of the uses listed in Table 8-3 [presented as Table 3.11-3 of this SEIR] shall conform with the noise levels contained in the 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.

- **Policy N-1-2:** Where noise mitigation measures are required to achieve the standards of Tables 8-3 and 8-4 [presented as Tables 3.11-3 and 3.11-4, respectively, in this SEIR], the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered a means of achieving the noise standards only after all other practical design-related noise mitigation measures, including the use of distance from noise sources, have been integrated into the project.
- **Policy N-1-4:** Protect noise-sensitive land uses, identified in Table 8-3 [presented as Table 3.11-3 in this SEIR], from noise impacts.
- **Policy N-1-8:** For development projects that are subject to discretionary review, the City may require applicants to assess potential construction noise impacts on nearby sensitive uses and to minimize impacts on those uses.

Table 3.11-3 Maximum Allowable Noise Exposure, Transportation Noise Sources

Land Use	Outdoor Activity Areas[1,2] L_{dn}	Interior Spaces	
		L_{dn}	L_{eq}[3]
Residential	60[4,g]	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 as roadways)	60[d,7]	40[6]	-
Transient Lodging	60[5,7]	45	-
Hospitals, Nursing Homes	60[4,7]	45	-
Theaters, Auditoriums, Music Halls	-	-	35
Churches, Meeting Halls	60[4,7]	-	40
Office Buildings	-	-	45
Schools, Libraries, Museums	-	-	45

[1] Where the location of outdoor activity areas is unknown, the exterior noise level standards shall be applied to the property line of the receiving land use. Where it is not practical to mitigate exterior noise levels at patios or balconies of apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area.

[2] Transportation projects subject to California Department of Transportation review or approval shall comply with the Federal Highway Administration noise standards for evaluation and abatement of noise impacts.

[3] As determined for a typical worst-case hour during periods of use.

[4] Where it is not possible to reduce noise in outdoor activity areas to 60 dB L_{dn} or less using a practical application of the best available noise reduction measures, an exterior noise level of up to 65 dB L_{dn} may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

5 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.

[6] The intent of this noise standard is to provide increased protection against sleep disturbance for residences located near railroad tracks.

[7] In cases where the existing ambient noise level exceeds 60 dB, the maximum allowable project-related permanent increase in ambient noise levels shall be 3 dB L_{dn}.

Source: City of Elk Grove 2019:8-57

- **Policy N-1-9:** For projects involving the use of major vibration-generating equipment (e.g., pile drivers, vibratory rollers) that could generate groundborne vibration levels in excess of 0.2 in/sec ppv, the City may require a project-specific vibration impact assessment to analyze potential groundborne vibrational impacts and may require measures to reduce ground vibration levels.
- **Policy N-2-1:** Noise created by new proposed non-transportation noise sources shall be mitigated so as not to exceed the noise level standards of Table 8-4 [presented as Table 3.11-4 in this SEIR], as measured immediately within the property line of lands designated for noise-sensitive uses.
- **Policy N-2-2:** The following criteria shall be used as CEQA significance thresholds for transportation and stationary noise sources:

- Where existing ambient 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 shall be considered significant; and
- Where existing ambient 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 shall be considered significant; and
- Where existing ambient 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 shall be considered significant. Public roadway improvements to alleviate traffic congestion and safety hazards shall utilize FHWA [Federal Highway Administration] noise standards to allow a reasonable dollar threshold per dwelling to be used in the evaluation and abatement of impacts.
- The standards outlined in Table 8-4 [presented as Table 3.11-4 in this EIR] shall not apply to public projects to alleviate traffic congestion and safety hazards.

► **Policy N-2-4:** Where sound walls or noise barriers are constructed, strongly encourage and consider requiring a combination of berms and walls to reduce the apparent height of the wall and produce a more aesthetically appealing streetscape.

Table 3.11-4 Noise Level Performance Standards for New Projects Affected by or Including Non-Transportation Noise Sources*

Performance Standards for Stationary Sources	Noise Level Descriptor	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Performance Standards for Typical Stationary Noise Sources[1]	Hourly L_{eq}, dB	55[3,4]	45[3,4]
Performance Standards for Stationary Noise Sources Which Are Tonal, Impulsive, Repetitive, or Consist Primarily of Speech or Music[2]	Hourly L_{eq}, dB	50[3,4]	40[3,4]

* Applies to noise-sensitive land uses only.

[1] These standards 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, and blowers.

[2] These standards apply to noises which are tonal in nature, impulsive, repetitive, or which consist primarily of speech or music (e.g., humming sounds, outdoor speaker systems). Typical noise sources in this category include pile drivers, drive-through speaker boxes, punch presses, steam valves, and transformer stations. HVAC/pool equipment are exempt from these standards.

[3] These noise levels do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwelling). HVAC/pool equipment are exempt from these standards.

[4] The City may impose noise level standards which are more or less restrictive based upon determination of existing low or high ambient noise levels.

Source: City of Elk Grove 2019:8-58

City of Elk Grove Municipal Code

Chapter 6.32 of the Elk Grove Municipal Code addresses noise generation in the City. Section 6.32.080 of the Elk Grove Municipal Code contains exterior noise standards for sensitive receptors, outlined in Table 6.32-1 (presented as Table 3.11-5 in this SEIR). The metric of these standards is L_{eq} because they are identical to the noise level performance standards included in the General Plan presented in Table 3.11-4.

Table 3.11-5 Exterior Noise Standards for Sensitive Receptors[1]

	7:00 am to 10:00 pm	10:00 pm to 7:00 am
Stationary noise sources, generally	55 dB	45 dB
Stationary noise sources which are tonal, impulsive, repetitive, or consist primarily of speech or music	50 dB	40 dB

Source: Section 6.32.080 of the Elk Grove Municipal Code

[1] Sensitive receptors are defined as receiving premises used for residential purposes and for nonresidential purposes that are sensitive to noise, including, but not limited to, residential dwellings, schools, hospitals, hotels, and community care facilities.

In the case that the measured ambient noise level exceeds the noise levels identified in Table 6.32-1 (presented as Table 3.11-5 in this SEIR), a maximum increase of 5-dBA is allowed where the ambient noise level is above that shown in the table but less than 60 dB. Where the ambient noise level is between sixty (60) dB and sixty-five (65) dB, inclusive, a maximum increase of three (3) dB above the ambient noise level is allowed. Finally, where the ambient noise level is greater than sixty-five (65) dB, a maximum increase of one and one-half (1.5) dB above the ambient noise level is allowed.

Section 6.32.100 of the Elk Grove Municipal Code provides the several exemptions to all noise regulations specified within Chapter 6.32.100 of the Code. Relevant to the Project, the exemption includes:

- 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 in close proximity to residential uses. Noise associated with these activities not located in close proximity to 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 7:00 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;
- noise sources associated with the authorized collection of solid waste (e.g., refuse and garbage); and
- noise sources associated with the minor maintenance and operation of residential real property, including but not limited to pool equipment and heating and air conditioning units. Additionally, yard maintenance equipment and other power tools may be allowed provided the activities take place between the hours of 7:00 a.m. and 10:00 p.m.

City of Elk Grove Construction Specifications Manual

The Elk Grove Construction Specifications Manual (City of Elk Grove 2020) includes the following standards that are applicable to the Project and noise:

- Section 7-8.01: Allowable Times and Hours of Work. Unless otherwise noted in the Special Provisions or approved by the City, no work shall be done between the hours of 6 p.m. and 7 a.m., or on Saturdays, Sundays, or legal holidays. Unless otherwise noted in the Special Provisions or approved by the City, no lane of traffic shall be closed to the public during the peak hours of 7:00 a.m. to 8:30 a.m. and 3:00 p.m. to 6:00 p.m., except as necessary for the proper care and protection of work already performed or in case of an emergency repair as defined below. Exceptions are allowed only with the City's written permission.
- Section 7-8.02: Off-Period Work. A written request to work between 6 p.m. and 7 a.m. or on Saturdays, Sundays, or legal holidays, or to close a lane of traffic during peak hours must be submitted at least two (2) Working Days in advance of the intended work. The City will evaluate the Contractor's request to determine if there is a benefit to the City, a nuisance or a hazard to the public, the project, or the area surrounding the site, and if the Contractor should pay any City overtime costs related to the off-period work. The City may place conditions on any approval of off-period work based on this analysis.
- Section 10-6: Noise Control. The Contractor shall comply with all local noise control and noise level rules, regulations, and ordinances that apply to the Work. The Special Provisions may contain specific or additional requirements. Internal combustion engines used for any purpose on the Work must be equipped with a muffler recommended by the manufacturer.

3.11.2 Environmental Setting

ACOUSTIC FUNDAMENTALS

Prior to discussing the noise setting for the Project, background information about sound, noise, vibration, and common noise descriptors is needed to provide context and a better understanding of the technical terms referenced throughout this section.

Sound, Noise, and Acoustics

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

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

Sound Pressure Levels and Decibels

The amplitude of pressure waves generated by a sound source determines the loudness of that source. A logarithmic scale is used to describe sound pressure level (SPL) in terms of decibels (dB). Because decibels are logarithmic units, SPLs cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3-dB increase. In other words, when two identical sources are each producing sound of the same loudness at the same time, the resulting sound level at a given distance would be 3 dB higher than if only one of the sound sources was producing sound under the same conditions. For example, if one idling truck generates an SPL of 70 dB, two trucks idling simultaneously would not produce 140 dB; rather, they would combine to produce 73 dB. Under the decibel scale, three sources of equal loudness together produce a sound level approximately 5 dB louder than one source.

A-Weighted Decibels

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

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

The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments of the relative loudness or annoyance of a sound, their judgment correlates well with the A-scale sound levels of those sounds. Thus, noise levels are typically reported in terms of A-weighted decibels. All sound levels discussed in this section are expressed in A-weighted decibels. Table 3.11-6 describes typical A-weighted noise levels for various noise sources.

Table 3.11-6 Typical A-Weighted Noise Levels

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

Source: Caltrans 2013: Table 2-5

Human Response to Changes in Noise Levels

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

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear can discern 1-dB changes in sound levels when exposed to steady, single-frequency ("pure-tone") signals in the mid-frequency (1,000–8,000 Hz) range. In general, the healthy human ear is most sensitive to sounds between 1,000 and 5,000 Hz and perceives both higher and lower frequency sounds of the same magnitude with less intensity (Caltrans 2013:2-18). In typical noisy environments, changes in noise of 1–2 dB are generally not perceptible. However, it is widely accepted that people can begin to detect sound level increases of 3 dB in typical noisy environments. Further, a 5-dB increase is generally perceived as a distinctly noticeable increase, and a 10-dB increase is generally perceived as a doubling of loudness (Caltrans 2013:2-10). Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) that would result in a 3-dB increase in sound would generally be perceived as barely detectable.

Vibration

Vibration is the periodic oscillation of a medium or object with respect to a given reference point. Sources of vibration include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) and those introduced by human activity (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, (e.g., operating factory machinery) or transient in nature (e.g., explosions). Vibration levels can be depicted in terms of amplitude and frequency, relative to displacement, velocity, or acceleration.

Vibration amplitudes are commonly expressed in peak particle velocity (PPV) or root-mean-square (RMS) vibration velocity. PPV and RMS vibration velocity are normally described in inches per second (in/sec) or in millimeters per second. PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is typically used in the monitoring of transient and impact vibration and has been found to correlate well to the stresses experienced by buildings [Federal Transit Agency (FTA) 2006:7-5, Caltrans 2013:6].

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 1-second period. As with 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 2018:7-4; Caltrans 2020:7). This is based on a reference value of 1 micro inch per second.

The typical background vibration-velocity level in residential areas is approximately 50 VdB. Ground 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 2018:7-8; Caltrans 2020:27).

Typical outdoor sources of perceptible ground vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the ground 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 to fragile buildings. Construction activities can generate sufficient ground vibrations to pose a risk to nearby structures. Constant or transient vibrations can weaken structures, crack facades, and disturb occupants (FTA 2018:7-5).

Vibrations generated by construction activity can be transient, random, or continuous. Transient construction vibrations are generated by blasting, impact pile driving, and wrecking balls. Continuous vibrations are generated by vibratory pile drivers, large pumps, and compressors. Random vibration can result from jackhammers, pavement breakers, and heavy construction equipment.

Table 3.11-7 summarizes the general human response to different ground vibration-velocity levels.

Table 3.11-7 Human Response to Different Levels of Ground Noise and Vibration

Vibration-Velocity Level	Human Reaction
65 VdB	Approximate threshold of perception.
75 VdB	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85 VdB	Vibration acceptable only if there are an infrequent number of events per day.

Notes: VdB = vibration decibels referenced to 1 µ inch/second and based on the root mean square (RMS) velocity amplitude.

Source: FTA 2018:7-8

Sound Propagation

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

Geometric Spreading

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

Ground Absorption

The propagation path of noise from a source to a receiver is usually very close to the ground. Noise attenuation from ground absorption and reflective-wave canceling provides additional attenuation associated with geometric spreading. Traditionally, this additional attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 feet. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, such as a parking lot or body of water), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receiver, such as soft dirt, grass, or scattered bushes and trees), additional ground-attenuation value of 1.5 dB per doubling of distance is normally assumed. When added to the attenuate rate associated with cylindrical spreading, the additional ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance. This would hold true for point sources, resulting in an overall drop-off rate of up to 7.5 dB per doubling of distance.

Atmospheric Effects

Receivers located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels, as wind can carry sound. Sound levels can be increased over large distances (e.g., more than 500 feet) from the source because of atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also affect sound attenuation.

Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receiver attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. A barrier that breaks the line of sight between a source and a receiver will typically result in at least 5 dB of noise reduction (Caltrans 2013:2-41; FTA 2018:5-6, 6-25). Barriers higher than the line of sight provide increased noise reduction (FTA 2018:2-12). Vegetation between the source and receiver is rarely effective in reducing noise because it does not create a solid barrier unless there are multiple rows of vegetation (FTA 2018:2-11).

EXISTING NOISE ENVIRONMENT

Existing Noise- and Vibration-Sensitive Land Uses

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential uses are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels, and because these land uses are places of rest and sleep for City residents. Additionally, the City of Elk Grove defines sensitive receptors as "receiving premises used for residential purposes and for nonresidential purposes that are sensitive to noise, including, but not limited to, residential dwellings, schools, hospitals, hotels, and community care facilities as those uses are defined in [Elk Grove Municipal Code] Title 23 (Zoning)." Additional land uses such as parks, historic sites, cemeteries, and recreation areas are also considered sensitive to increases in exterior noise levels. Schools, churches, hotels, libraries, and other places where low interior noise levels are essential are also considered noise-sensitive land uses. The City includes many of these types of noise-sensitive land uses including residential, hotel/motel, parks and recreational facilities, religious institutions, and schools. These land uses are given priority in assessing and addressing noise exposure given the noise-sensitive nature of the land uses and activities occurring in these locations.

Existing Noise Sources

The noise environment in the Planning Area is defined primarily by vehicular traffic on State Route (SR) 99, Interstate 5 (I-5), and local roadways. To a lesser extent, railroad traffic, occasional aircraft overflights, nearby agricultural activities, and landscape maintenance activities at residential and commercial uses also contribute on an intermittent basis to ambient noise levels. Industrial uses in the City are located primarily in the south-central and northwest portions of the City and are collocated adjacent to the two existing rail lines which run north–south through the City.

Roadway Noise Sources

Noise levels along roadways are affected by several traffic characteristics, including average daily traffic (ADT) volumes, the vehicle mix, roadway conditions, vehicle speed, and the gradient of the roadway. The major east–west roadways in the City are Laguna Boulevard, Elk Grove Boulevard, and Calvine Road. The major north–south roadways are Grant Line Road, Bond Road, Elk Grove Florin Road, Bruceville Road, and Franklin Boulevard. SR 99 runs north–south through the City, running adjacent to predominantly mixed-use, commercial, and office land uses. In general, these roadways abut commercial or residential land uses with some sound-reducing measures (e.g., sound walls, setbacks from roadways) incorporated into site design. I-5 runs north–south along the western border of the City's boundaries. Currently, residential, commercial, and residential land uses are located adjacent to I-5, although a significant buffer distance (approximately 160 feet) exists between City boundaries and the nearest travel lane on I-5.

Land uses adjacent to I-5 also include some sound-reducing measures to address traffic noise exposure for nearby noise-sensitive land uses.

Noise levels associated with existing vehicle traffic on major roadways within the City are included in the City's General Plan EIR which was certified in January 2019 (City of Elk Grove 2018) and serve as the existing traffic noise levels in this analysis. Because traffic volumes and subsequent traffic noise levels in the City are affected primarily by the addition of new development projects in the City, difference in traffic noise levels between 2018 and the date of publication of this SEIR are not considered to have increased substantially. Therefore, the General Plan EIR baseline for traffic noise levels still serves as an appropriate baseline for this analysis.

Table 3.11-8 depicts predicted existing average-daily traffic noise levels (dBA CNEL/Ldn) at 50 feet from the near travel-lane centerline for major roadway segments adjacent to the candidate housing sites identified as part of the Project. The extent to which nearby land uses are affected by existing traffic noise depends on multiple factors, including their respective proximity to the roadways, shielding provided by intervening terrain and structures, and their individual sensitivity to noise.

Table 3.11-8 Existing Traffic Noise Levels

Roadway	From	To	dBA L_{dn} at 50 Feet from Near-Travel-Lane Centerline1
			Existing
Bond Rd	SR 99	E Stockton Blvd	70.6
	E Stockton Blvd	Elk Crest Dr	72.0
	Waterman Rd	Bradshaw Rd	70.4
Bradshaw Rd	Calvine Rd	Sheldon Rd	67.4
Bruceville Rd	Big Horn Blvd	Laguna Blvd	69.2
Calvine Rd	Power Inn Rd	Elk Grove Florin Rd	71.7
	Elk Grove Florin Rd	Waterman Rd	70.6
	Waterman Rd	Bradshaw Rd	69.2
Elk Grove Blvd	I-5	Harbour Point Dr	68.9
	Harbour Point Dr	Four Winds Dr	70.3
	Franklin Blvd	Bruceville Rd	72.0
Elk Grove Blvd	Elk Grove Florin Rd	Waterman Rd	63.8
Laguna Blvd	SR 99	Franklin Blvd	70.8
	Big Horn Blvd	Laguna Springs Dr	71.2
	Laguna Springs Dr	SR 99	71.1
Power Inn Rd	Calvine Rd	Sheldon Rd	65.8
Sheldon Rd	SR 99	E. Stockton Blvd	70.8
	E. Stockton Blvd	Power Inn Rd	71.0
Waterman Rd	Sheldon Rd	Bond Rd	66.2
	Bond Rd	Elk Grove Blvd	70.7
	Elk Grove Blvd	Grant Line Rd	66.9
Whitelock Pkwy	Big Horn Blvd	Lotz Pkwy	62.3

Source: City of Elk Grove 2018

Rail Noise

Two active rail lines are present in the City – one in the central potion and one in the western portion. The central line runs north–south and enters the City at State Route 99. This rail line is adjacent to residential and industrial land uses in the City and currently has an average of 32 daily pass-through train trips. The line is operated by Union Pacific Railroad (UPRR) and bisects some of the City's major arterials, including Grant Line Road, Elk Grove Boulevard, Bond Road, Elk Grove-Florin Road, Sheldon Road, and Calvine Road. This rail line also serves Amtrak passenger trains with an average of four daily passenger train trips; this service has since been converted to thruway bus service due to reduced demand caused by the COVID-19 pandemic. Except for Grant Line Road, these crossings occur at grade.

The UPRR line in the western portion of the Planning Area runs north–south and bisects Franklin Boulevard, Elk Grove Boulevard, and Laguna Boulevard. This line is located adjacent to residential and industrial land uses in the City. The crossings at Elk Grove Boulevard and Laguna Boulevard are grade-separated.

The City has established a series of quiet zones for many of the at-grade crossings to limit noise exposure to residents from train warning horns. These quiet zones include the at-grade crossings which intersect with Calvine Road, Sheldon Road, Elk Grove-Florin Road, Bond Road, Elk Grove Boulevard, Franklin Boulevard, and Bilby Road. While railroads are directed to not sound warning horns at these crossings, warning horns would still be used in emergency situations per Federal Railroad Administration regulations and UPRR operating rules. Where the rail lines are adjacent to residential uses, sound walls have been erected to reduce noise exposure levels.

Aircraft Noise

There is one public airport and two private airports within 3 miles of the Planning Area. They are Franklin Field, which is public, and Sky Way Estates Airport and Borges-Clarksburg Airport, which are private. Sacramento Executive Airport, a public use airport, is approximately 6 miles north-northwest of the City, and Sacramento International Airport, a high-traffic airport, is approximately 20 miles north-northwest. Franklin Field, Sacramento Executive, Sacramento International airport noise contours do not extend into the City of Elk Grove (SACOG 1992, SACOG 1999). The Borges-Clarksburg Airport had about 3,000 general aviation operations in 2001, with 18 aircraft based in the field (SkyVector 2020). Operation data was not located for Sky Way Estates Airport, but only 8 aircraft are based in the field (Airnav 2020). The low number of operations and number of aircraft based at these two fields, and their distance from the City of Elk Grove, indicates that noise generation within the City from these airports is minimal.

Construction Noise Sources

Construction activities are a regular and ongoing source of noise throughout the City. The noise levels generated by construction activities are generally isolated to the vicinity of a construction site and occur during daytime hours in accordance with City regulations. Construction activities also occur for relatively short-term periods of a few weeks to several months; upon completion of construction activity, noise exposure ceases. Table 3.11-9 illustrates noise levels for common construction equipment and activities at 50 feet. According to the EPA, construction noise levels are highest for pile-driving activities and can reach as high as 107 dBA.

Table 3.11-9 Noise Ranges of Typical Construction Equipment

Construction Equipment	Noise Levels at dBA Leq at 50 feet
Front Loader	72–86
Truck	82–95
Crane (movable)	75–88
Crane (derrick)	86–89
Vibrator	68–82
Saw	72–82
Pneumatic Impact Equipment	83–88
Pile Driving (peaks)	95–107
Jackhammer	81–98

Construction Equipment	Noise Levels at dBA Leq at 50 feet
Pump	68–72
Generator	71–83
Compressor	75–87
Concrete Mixer	75–88
Concrete Pump	81–85
Backhoe	73–95
Tractor	77–98
Scraper/Grader	80–93
Paver	85–88

Source: EPA 1971

Industrial Noise Sources

The largest concentrations of industrial land in the City are in the north-central, northwest, and south-central sections. Current industrial uses in the City include heavy industrial and light industrial/warehouse. Generally, heavy industrial uses are located away from noise-sensitive uses and near other noise-generating land uses such as major roadways and/or railroad lines. Primary noise sources associated with industrial uses include motors, agitators, forklifts, air compressors, and heavy- and medium-duty trucks with specific equipment use largely based on the type of industrial operation or use occurring at specific locations.

Agricultural Activities

Noise levels associated with agricultural activities can vary substantially depending on the type of activities being conducted and equipment used. Due to the seasonal nature of agricultural activities, there are often extended periods of time when no noise is generated on properties that are actively being farmed, followed by short-term periods of more intensive equipment use and associated noise levels. However, such noise levels are typically distributed over a large area and prolonged noise levels at individual nearby receptors would not be anticipated for most activities. In addition, given that agricultural activities typically occur during the daytime hours, noise generated by nearby agricultural activities are often largely masked by vehicle traffic noise along nearby roadways (i.e., Kammerer Road, Bruceville Road, Promenade Parkway, and SR 99).

Ambient Noise Levels

As part of the evaluation of Elk Grove's General Plan Update, long- and short-term noise measurements were taken in 2015 to characterize noise conditions across the Planning Area. The General Plan Update Draft EIR, released in July 2018, explained that the 2015 measurements were adequate at the time because noise sources that would substantially alter ambient noise levels in the Planning Area would be associated primarily with traffic volumes on roadways throughout the City, but that these generally do not drastically change from year to year. Furthermore, these measurements are used to provide a representative idea of the variation in noise levels across the planning area for the purposes of this analysis. As a result, those noise measurements are still relevant for this analysis. A summary of measurement data is provided in Table 3.11-10. The long-term noise measurement locations were identified as unique noise generators in the Planning Area due to a high volume of traffic, large number of truck trips, or commercial activities occurring in the vicinity. The eight long-term monitoring locations included residential, commercial, and industrial portions of the Planning Area. Short-term noise measurements were taken at 20 locations that generally represent residential areas in the Planning Area where ambient noise levels were anticipated to be lower than those along major transportation corridors and commercial areas (City of Elk Grove 2018).

Table 3.11-10 Summary of Ambient Noise Measurement Data

Noise Measurement	Range of Noise Levels (dBA)
Long-term Ambient Noise, 24-hour L_{dq}	61–78
Short-term Ambient Noise (L_{eq})	50–71

Note: L_{eq} represents an average of the sound energy occurring over a specified period. In effect, L_{eq} is the steady-state sound level containing the same acoustical energy as the time-varying sound level that occurs during the same period (Caltrans 2013:2-48). For instance, the 1-hour equivalent sound level, also referred to as the hourly L_{eq}, is the energy average of sound levels occurring during a 1-hour period and is the basis for noise abatement criteria used by California Department of Transportation (Caltrans) and Federal Transit Administration (FTA) (Caltrans 2013:2-47; FTA 2018:2-19).

Source: City of Elk Grove 2018

3.11.3 Environmental Impacts and Mitigation Measures

METHODOLOGY

This impact analysis is based primarily on review of the analysis presented in the General Plan EIR.

Construction Noise and Vibration

To assess potential short-term construction-related noise and vibration impacts, typical Project-generated construction source noise and vibration levels were determined based on methodologies, reference emission levels, and usage factors from FTA's *Guide on Transit Noise and Vibration Impact Assessment* methodology (FTA 2018) and FHWA's *Roadway Construction Noise Model User's Guide* (FHWA 2006). Reference levels for noise and vibration emissions for specific equipment or activity types are well documented and the usage thereof common practice in the field of acoustics.

Operational Noise and Vibration

Non-Transportation Noise

With respect to non-transportation noise sources (e.g., stationary) associated with project implementation, the assessment of long-term (operational-related) impacts was based on reconnaissance data, reference noise emission levels, and measured noise levels for activities and equipment associated with project operation (e.g., building mechanical equipment), and standard attenuation rates and modeling techniques.

Transportation Noise

Traffic noise levels were calculated using the FHWA roadway noise prediction model (FHWA-RD-77-108) based on California vehicle reference noise emission factors. The Project includes a list of both existing and candidate housing sites in the project area. For future development, all of the candidate housing sites would require either changes in the sites zoning designation to higher density residential uses or changes to residential uses from other zoning designations. It is assumed that these zoning changes and subsequent development of the housing sites would result in additional vehicles trips on adjacent roadways, compared to their existing zoning designations as part of the City's General Plan. These changes would result in changes to traffic noise levels on affected roadway segments which may affect nearby sensitive receptors. Increases in traffic noise levels attributable to the Project were analyzed using roadway traffic data included in the City's General Plan EIR as well as roadway traffic data analyzed as part of the transportation analysis for the Project. New vehicle trips generated by the Project were added to traffic volumes modeled as part of General Plan EIR to analyze the roadway traffic noise level increases on affected roadways that would be associated with the Project. Projected traffic noise level increases were then compared to the City's transportation noise standards (see Section 3.11.1) to identify whether any standards were exceeded and any new or substantially more severe impacts would result from the Project.

Additional input data included day/night percentages of autos, medium and heavy trucks, vehicle speeds, ground attenuation factors, and roadway widths. For this analysis, the mix of vehicles on the roadway was adjusted based on

information from the traffic analysis conducted for this project. For roadway segments included in this analysis, distances to the nearest receptor adjacent to roadways were measured and used in FHWA roadway noise prediction model to calculate traffic noise level at the site of the receptor. Note that the traffic noise modeling does not account for any natural or human- made shielding (e.g., the presence of trees or solid backyard fences or walls) and, consequently, estimates worst-case noise exposure levels.

THRESHOLDS OF SIGNIFICANCE

As a project undertaken by the City of Elk Grove, City noise standards are reasonable and appropriate thresholds for determination of significance. Therefore, a noise impact is considered significant if implementation of the Housing Element and Safety Element Update would result in any of the following:

- construction-generated noise levels at residential receptors exceeding 50 dB L_{eq} or 65 dB L_{max} (the City's nighttime standards for fixed noise sources as shown in Table 3.11-5) during non-exempt nighttime hours from 7:00 p.m. to 7:00 a.m., Monday through Saturday, as defined in the City's Code of Ordinances;
- long-term, traffic-generated noise levels exceeding the outdoor and interior noise standards for transportation noise sources as specified in Table 3.11-3 or an increase in ambient-noise levels of more than the allowable noise increment at nearby existing noise-sensitive land uses as specified in Policy N-2-2 in the City's General Plan;
- long-term noise levels generated by stationary or area sources that exceed City standards for fixed noise sources, shown in Table 3.11-5, at existing noise-sensitive land uses;
- construction-generated or operational vibration levels exceeding Caltrans's recommended standards with respect to the prevention of structural building damage (shown in Table 3.11-2) or human response (shown in Table 3.11-3) at nearby vibration-sensitive land uses;
- for a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels; 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

As described above, Franklin Field, Sacramento Executive, Sacramento International airport noise contours do not extend into the City of Elk Grove, and noise generation from Sky Way Estates Airport and Borges-Clarksburg Airport within the City of Elk Grove is minimal. As a result, noise impacts due to proximity to public and private airports and airstrips is not discussed further.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Impact 3.11-1: Construction Activities Could Result in a Substantial Temporary Increase in Noise Levels at Nearby Noise-Sensitive Land Uses

The General Plan EIR determined that the potential noise generation from construction activities could result in a substantial temporary increase in noise levels, but that this impact would be reduced through adherence to the Municipal Code and General Plan Policy N-1-7, and that in some cases the City could require a site-specific assessment and mitigation to reduce construction noise. The General Plan EIR concluded this impact would be less than significant. Construction activities associated with implementation of the Housing Element and Safety Element Updates would be required to comply with these same standards as well as General Plan Policy N-1-8 and would not result in new or substantially more several impacts related to construction noise. Project impacts would be **less than significant**.

The proposed Project also includes updates to the Safety Element to incorporate emergency access route information and could result in emergency access improvements. These updates would not result in noise because they either result in administrative changes or have uncertain physical impacts because it is currently not known where additional emergency access improvements would ultimately be constructed. No specific changes in the built environment are proposed as part of the Safety Element amendments.

Construction noise associated with future residential land uses and associated infrastructure development under the Housing Element update would be temporary in nature and would vary depending on the characteristics of the construction activities being performed. The proposed Project includes existing and candidate housing sites that would have construction activity as future residential projects are approved over the life of the Housing Element Update. Development of these sites would also require construction of associated infrastructure, such as roadways and water distribution pipelines, with the majority of development concentrated in the south-central and north-central portions of the City. Under the proposed Project, the primary sources of temporary or periodic noise would be construction activity and maintenance work. Noise generated during construction of buildings and related structures is typically associated with the operation of off-road equipment, including excavation and demolition equipment. Considering this, construction is a continuous source of temporary noise and would continue to be a major noise source in the City. These noise impacts from construction activities were identified in Impact 5.10.1 of the General Plan EIR.

Where housing sites would remain zoned for similar density as in the General Plan, these impacts would be similar to impacts as identified in the General Plan EIR in character, extent, and intensity. However, the Housing Element Update includes proposed rezoning at several housing sites that would either increase allowable density or change the type of base zoning district. For example, the update involves rezoning sites that are RD-4 and RD-5 to RD-25, increasing the density allowed on the site. As an example of the change in use, the update involves rezoning sites that are SC or LC to RD-30. An increase in density may prolong and increase noise generated during construction because constructing a multi-unit residential building can take longer than solitary single-family homes. More construction activities may also occur at one time given the larger size of buildings. Rezoning sites from non-residential use to high-density residential use is likely to result in impacts that are similar to those contemplated in the General Plan EIR. For example, a multifamily building could be similar to a business and professional office park in size, so the duration and kind of construction and the noise generated might also be similar.

The time that construction would occur, however, would be similar to that contemplated in the General Plan EIR. The majority of construction activities would occur during daytime hours, when sensitive receptors are less sensitive to increased noise levels. Noise levels associated with construction activities occurring during the more noise-sensitive evening and nighttime hours (i.e., 7 p.m. to 7 a.m.) are of increased concern, though are unlikely to occur for residential construction. While some construction activities must be continuous (e.g., well drilling or concrete pouring) until completed, residential development typically does not need to be because it is typically on a smaller scale than would require a multiday effort (see, for example Stockton 2015, where a building required 18 hours to pour the foundation for a high-rise building). However, nighttime construction may be required and may occur in limited situations for some residential construction if there are scheduling issues with tasks that must be done continuously until completed. Construction activities performed during these evening hours could result in increased annoyance and potential sleep disruption for occupants of nearby residential dwellings because exterior ambient noise levels typically decrease during the nighttime hours as community activities (e.g., commercial activities, vehicle traffic) decrease. See Table 3.11-8 for a list of typical uncontrolled noise levels generated by commonly used construction equipment.

For the General Plan EIR, construction noise modeling was done for the loudest typical phase of construction (site preparation) using a conservative scenario for construction noise disturbance. That scenario modeled an excavator, dozer, dump truck, front end loader, and grader. Results of the modeling showed that typical construction site noise levels could be as high as 93 L_{eq} dBA at 25 feet and 81 L_{eq} dBA at 100 feet. Construction activity that would include an impact pile driver could reach 97 L_{eq} dBA at 25 feet and 85 L_{eq} dBA at 100 feet.

The City's Municipal Code and Elk Grove Construction Specifications Manual include standards for noise-related activities, including exemptions for intermittent noise sources including construction activities. Municipal Code

Chapter 6.32.100 contained in Title 6, Health and Sanitation, exempts construction noise from the standards set forth in the municipal code for non-transportation noise between the hours of 6:00 a.m. and 8:00 p.m., but construction activities may only occur between the hours of 7:00 a.m. and 7:00 p.m. when located in proximity to residential uses. There is also an exemption for unforeseen or unavoidable conditions during construction when the nature of the project necessitates that work continue until completion of a specific phase subject to approval by the City. This would reduce the potential for construction noise to occur at the more-sensitive times of day. General Plan Policy N-1-8 would further protect current and future sensitive land uses from noise impacts related to future development in the City. Under Policy N-1-8, for development projects that are subject to discretionary review, the City may require applicants to assess potential construction noise impacts on nearby sensitive uses and to minimize impacts on those uses.

In summary, future construction activity is anticipated with adoption of the Project, but the activity would be temporary, intermittent, and vary in size and characteristics depending on the type of development. Existing receptors and sensitive land uses may be adversely affected by anticipated noise levels from new construction. Construction-related noise generated during the day (7:00 a.m. through 7:00 p.m. in proximity to residential uses and 6:00 a.m. through 8:00 p.m. in other instances) is generally exempt from meeting noise standards, and unforeseen circumstances necessitating work past 7:00 p.m. is also generally exempt, as provided under the Municipal Code and General Plan Policy N-1-7. However, in certain cases, the City could require a site-specific assessment and require mitigation to reduce construction noise levels on nearby sensitive uses. There is no new significant effect and the impact is not substantially more severe than the impact identified in the General Plan EIR because, similar to what was identified in the General Plan EIR, the construction noise would occur during the day—when sensitive receptors are least sensitive—and would occur consistent with what is allowed in the Municipal Code and General Plan. This impact would be **less than significant**.

Mitigation Measures

No additional mitigation is required beyond compliance with General Plan Policy N-1-8 and Municipal Code Section 6.32.100 and the Elk Grove Construction Specifications Manual.

Impact 3.12-2: Traffic Noise

General Plan EIR Impact 5.10.2 identified that implementation of the General Plan would result in a significant and unavoidable increase in transportation noise, including traffic noise levels along many existing roadways in the City. Further, Impact 5.10.2 notes that the General Plan includes a set of policies that are intended to ensure that new specific proposed development would comply with noise standards and would not adversely impact sensitive land uses from traffic noise. The policies include Policy N-1-1, Policy N-1-2, Policy N-1-4, Policy N-1-5, and Policy N-2-3. Activities resulting from implementation of the Housing Element and Safety Element Update would also be subject to the set of General Plan policies listed above and would not result in a new or substantially more severe impact. Project impacts would be **less than significant**.

The list of candidate housing sites included in the Housing Element Update could be developed in the future and would result in additional vehicle trips to roadways in the City. New vehicle trips associated with these candidate housing sites would result in additional traffic noise level increases beyond those that were modeled and analyzed in the City's current General Plan EIR (City of Elk Grove 2018). These increased traffic volumes could expose existing and future sensitive receptors and noise sensitive land uses to increased traffic noise. Residential developments, schools, libraries, hospitals, convalescent homes, and places of worship are the most noise-sensitive land uses.

General Plan EIR Impact 5.10.2 identified that implementation of the General Plan would result in a significant increase in transportation noise, including traffic noise levels along many existing roadways in the City. As shown in Table 3.11-11, all of the roadways affected by new trips from implementation of the City's General Plan are expected to exceed the City's exterior noise standard for residential and other noise sensitive land uses (60 dBA Ldn). See Table 3.11-3 for the full list of noise standards by land use type. As discussed in General Plan EIR Impact 5.10.2, the General Plan includes a set of policies that are intended to ensure that new specific proposed development would comply with

noise standards and would not adversely impact sensitive land uses from traffic noise. These include Policy N-1-1, Policy N-1-2, Policy N-1-4, Policy N-1-5, and Policy N-2-3.

Table 3.11-11 Predicted Increases in Traffic Noise Levels

Roadway	From	To	L_{dn} at 50 Feet from Near-Travel-Lane Centerline[1] (dBA L_{dn})			Noise Level Increase (dBA)	Substantial Noise Level Increase?
			Existing Conditions (2018)	General Plan Buildout	General Plan Buildout w/ Housing Element		
Bilby Rd	Big Horn Blvd	Lotz Pkwy	NA	69.4	70.1	0.8	No
	Lotz Pkwy	Promenade Pkwy	NA	69.2	70.0	0.8	No
Bond Rd	SR 99	E Stockton Blvd	70.6	72.9	73.0	0.0	No
	E Stockton Blvd	Elk Crest Dr	72.0	72.1	72.2	0.1	No
	Waterman Rd	Bradshaw Rd	70.4	74.4	74.4	0.1	No
Bradshaw Rd	Calvine Rd	Sheldon Rd	67.4	72.8	72.9	0.1	No
Bruceville Rd	Big Horn Blvd	Laguna Blvd	69.2	72.3	72.4	0.1	No
Calvine Rd	Power Inn Rd	Elk Grove Florin Rd	71.7	71.0	71.0	0.1	No
	Elk Grove Florin Rd	Waterman Rd	70.6	74.5	74.5	0.0	No
	Waterman Rd	Bradshaw Rd	69.2	73.2	73.2	0.0	No
Elk Grove Blvd	I-5	Harbour Point Dr	68.9	73.0	73.1	0.0	No
	Harbour Point Dr	Four Winds Dr	70.3	71.5	71.6	0.1	No
	Franklin Blvd	Bruceville Rd	72.0	73.5	73.5	0.0	No
Elk Grove Blvd	Elk Grove Florin Rd	Waterman Rd	63.8	70.2	70.3	0.1	No
Laguna Blvd	SR 99	Franklin Blvd	70.8	71.6	71.8	0.2	No
	Big Horn Blvd	Laguna Springs Dr	71.2	72.9	73.0	0.0	No
	Laguna Springs Dr	SR 99	71.1	73.8	73.9	0.0	No
Power Inn Rd	Calvine Rd	Sheldon Rd	65.8	67.4	67.6	0.2	No
Sheldon Rd	SR 99	E. Stockton Blvd	70.8	73.1	73.3	0.2	No
Sheldon Rd	E. Stockton Blvd	Power Inn Rd	71.0	73.3	73.5	0.3	No
Waterman Rd	Sheldon Rd	Bond Rd	66.2	69.4	69.5	0.1	No
	Bond Rd	Elk Grove Blvd	70.7	73.8	73.9	0.1	No
	Elk Grove Blvd	Grant Line Rd	66.9	72.5	72.6	0.1	No
Whitelock Pkwy	Big Horn Blvd	Lotz Pkwy	62.3	67.0	67.2	0.2	No
	Lotz Pkwy	SR 99	NA	72.5	72.5	0.0	No

[1] Substantial increases defined as an increase of 5.0, or greater, where noise levels are less than the City's normally acceptable minimum noise level of 60 dBA L_{dn}; 3 dBA, or greater, where noise levels range from 60 to 65 dBA L_{dn}; and 1.5 dB, or greater, where the noise level exceeds 65 dBA L_{dn} without the proposed Project.

Source: Ascent Environmental 2020

Policy N-1-1 requires that indoor and outdoor areas in new development be located, constructed, and/or shielded from noise sources in order to achieve compliance with the City's noise standards. Policy N-1-2 encourages development projects to use site planning and project design measures before considering using sound barriers to achieve noise standards. Policy N-1-4 and Policy N-1-5 requires the City to protect noise sensitive land uses that are designated in the General Plan. Policy N-2-3 encourages new development to consider alternatives aside from sound

walls to reduce noise to acceptable levels in residential areas that were originally constructed without sound walls. However, the General Plan EIR found that while the General Plan policies listed above would serve to limit traffic noise exposure to sensitive receptors, these policies cannot ensure that noise levels would be reduced to levels within the City's noise standards for all locations of sensitive receptors. Therefore, this impact was determined significant and unavoidable.

Additional trips generated from housing sites as part of the Housing Element Update would result in additional increases in traffic noise levels not previously analyzed as part of the General Plan EIR. However, as shown in Table 3.11-11, the additional noise increases from the Project would not cause traffic noise levels on affected roadways to exceed any of the City's noise standards in Table 3.11-3. As noted in Section 3.11.2, traffic noise levels on relevant roadways previously exceeded the City's residential exterior noise standard (60 dBA L_{dn}) under existing conditions. As shown in Table 3.11-11, traffic noise level increases from the Project would range from 0.0 to 0.3 dBA CNEL and would be less than the allowable traffic noise increase of 1.5 dBA L_{dn} for roadway segments with noise levels above 65 dBA or +3 dBA increase for roadways between 60 and 65 dBA L_{dn} (see Policy N-2-2 in Section 3.11-1).

As a result, new vehicle trips generated by the Project would not result in a new or substantially more severe impact than was analyzed as part of the General Plan EIR. The Housing Element also includes housing sites located in areas that do not currently have roadways but that will be built out as part of future development in the City. As a result, traffic noise level increases cannot be determined for these locations at this time. Subsequent project applications would be required to submit noise analyses and associated noise attenuation features as part of building plans and/or site designs that may include building treatments to meet City interior noise standards, sound barriers, or other site improvements (e.g., building orientation to address line of sight associated with noise sources).

The proposed Project also includes updates to the Safety Element to incorporate emergency access route information and potential emergency access improvements. The updates would not result in changes to traffic volumes on roadways in the City and, therefore, would not result to changes in traffic noise levels that may affect sensitive receptors.

As shown in Table 3.11-11, the Project would increase traffic noise levels on affected roadways in the City. However, all affected roadway segments are above the City's traffic noise standard (60 dBA L_{dn}) under existing conditions and would be increased by implementation of the General Plan even without the Project. Traffic noise level increases as a result of the Project would not be above the City's allowable incremental noise increase threshold of 1.5 dBA (see Policy N-2-2 in Section 3.11-1) for roadway segments with noise levels above 65 dBA L_{dn} or +3 dBA increase for roadways between 60 and 65 dBA L_{dn}. As a result, the project would not result in a new or substantially more severe impact. This impact would **less than significant**.

Mitigation Measures

No additional mitigation is required beyond compliance with General Plan policies N-1-1, N-1-4, N-1-5, and N-2-3.

Impact 3.11-3: Future Development Could Expose Existing Noise-Sensitive Land Uses to New Non-Transportation Noise Sources that Could Exceed the City's Applicable Noise Standards

General Plan EIR Impact 5.10.3 determined that potential noise generation from future development could expose existing noise-sensitive land uses to new non-transportation noise sources that could exceed the City's applicable noise standards. Specific to residential land uses, the General Plan EIR identified lawn and garden equipment, voices, and amplified music as potential noise sources associated with residential land uses. The General Plan EIR identified Section 6.32.110 of the Municipal Code as containing hourly noise standards that apply to non-transportation noise sources. Implementation of the Housing Element Update and Safety Element Update would be required to comply with these standards and would not result in a new or substantially more severe noise impacts than was addressed in the General Plan EIR. Project impacts would be **less than significant**.

Implementation of the Housing Element Update would allow for the development of new residential land uses, predominantly located in the south-central and north-central portions of the City. Noise from proposed residential

land uses could increase ambient noise levels, due to typical activities associated with residential land uses, such as lawn and garden equipment, voices, and amplified music, and air conditioning units. These noise sources would be intermittent in nature and would vary considerably, depending on the specific characteristics of that residential area. Noise in residential areas also tends not to be of a level or frequency that would disturb sensitive receptors and would mostly occur during the daytime, when receptors are least sensitive. For example, lawn and garden equipment would be intermittently used during the daytime for the short period of time needed for yard maintenance. Voices would also be intermittent and not particularly loud. The noise impacts from development of residential land uses were identified in Impact 5.10.3 of the General Plan EIR. Additionally, General Plan Policy N-2-1 also indicates that noise created by new proposed non-transportation noise sources shall be mitigated so as not to exceed the noise level standards presented in Table 3.11-4. In summary, while the proposed Housing Element housing sites could result in future non-transportation or stationary noise increases, those increases would be limited due to the nature of noise sources and noise generation associated with residential development. Implementation General Plan Policy N-2-1 and compliance with Municipal Code Chapter 6.32 would also limit noise impacts.

The proposed Project also includes updates to the Safety Element to incorporate emergency access route information and the potential need for potential emergency access improvements. Thus, the Safety Element Update would not create any new stationary noise sources.

There is no new significant effect, and the impact is not more severe than the impact identified in the General Plan EIR. This impact would be **less than significant**.

Mitigation Measures

No additional mitigation is required beyond compliance with General Plan Policy N-2-1 and Municipal Code Section 6.32.110.

Impact 3.11-4: Result in Development Projects Involving that Could Expose Receptors to Excessive Groundborne Vibration

General Plan EIR Impact 5.10.4 determined that potential vibration generation from construction and operation could occur as a result of the project. Long-term vibration was mainly associated with transit system routes and maintenance activities, and vibration from increased traffic would not be perceptible. Short-term vibration associated with construction could be substantial for activities such as pile driving and vibratory rolling. Adherence to Policy N-1.9 was identified as having a mitigating effect on construction vibration. Implementation of the Housing Element Update and Safety Element Update would be required to comply with these standards and would not result in a new or substantially more severe vibration impacts. Project impacts would be **less than significant**.

Implementation of the Housing Element and Safety Element Update would result in future construction activities for housing sites and potential emergency access improvements, some of which could occur near existing residences and noise-sensitive land uses throughout the City. The vibration standards in Table 3.11-2 are used by the City as significance thresholds for analyzing vibration impacts. As stated in the table, a vibration of 0.2 in/sec ppv or less typically will not result in structural damage. This same threshold also represents the level at which vibration would be potentially annoying to people in buildings (Caltrans 2002b, 2004). For most construction projects, groundborne vibration levels would not pose a significant risk to nearby structures or occupants. Construction activities often associated with development projects that do not require the use of pile drivers but involve equipment such as a large dozer, loaded trucks, and a jackhammer would typically generate ground vibration levels of approximately 0.09 in/sec ppv, or less, at 25 feet (FTA 2006). However, the construction of some facilities may require the use of construction equipment that can cause vibrational impacts (i.e., pile drivers). In addition, road improvement projects (e.g., constructing roadways for residential development) often require the use of vibratory rollers, which, when operated close to existing structures, can result in increased levels of annoyance. Ground vibration levels associated with pile drivers can reach levels of approximately 1.52 in/sec ppv at 25 feet. Pile drivers can generate ground vibration levels of 0.2 in/sec ppv at distances up to approximately 200 feet (FTA 2006). Depending on the distance to nearby existing structures, the more vibration-intensive construction activities (e.g., pile driving, vibratory rollers)

could potentially exceed the criterion of 0.2 in/sec ppv at nearby structures. These vibration impacts were identified in General Plan EIR Impact 5.10.0.

As described in Elk Grove General Plan Policy N-1-9, for projects involving the use of major vibration-generating equipment (e.g., pile drivers, vibratory rollers) that could generate groundborne vibration levels in excess of 0.2 in/sec ppv, the City may require a project-specific vibration impact assessment to analyze potential groundborne vibrational impacts and may require measures to reduce ground vibration levels. Municipal Code Chapter 6.32.100 contained in Title 6, Health and Sanitation, exempts construction noise from the standards set forth in the municipal code for non-transportation noise between the hours of 6:00 a.m. and 8:00 p.m., but construction activities may only occur between the hours of 7:00 a.m. and 7:00 p.m. when located in proximity to residential uses; unforeseen circumstances necessitating work past 7:00 p.m. are also generally exempt. This would also reduce the potential for construction-related vibration to occur at the more-sensitive times of day. Subsequent projects would demonstrate compliance through including these requirements on building plans or improvement plans.

Long-term groundborne vibration is most commonly associated with land uses near transit system routes and maintenance activities. Groundborne vibration associated with buses or trucks are not commonly perceptible. Roadway vibration is correlated to the smoothness of the running surface for vehicles. If the roadway is smooth, vehicle groundborne vibration is typically not perceptible (FTA 2006, p. 7-5). While the proposed Project includes development that would result in traffic volume increases along major arterial and collector roads throughout the City, these increases in vibration would not be perceptible based on the aforementioned factors. Development of the residential land uses themselves would not result in the long-term generation of vibration because residential land uses generally do not have substantial sources of vibration.

In summary, construction activities in the Planning Area could generate groundborne vibration. In some cases, vibration levels may be high enough to affect structures or cause annoyance at sensitive receptors. As discussed above, the proposed Project would need to comply with policies to address the assessment and siting of development that may exceed the City's performance standard for noise-sensitive land uses. These policies would reduce construction vibration. Operational vibration would not be substantial due to the nature of transportation vibration and because residential uses do not generate substantial vibration. There is no new significant effect and the impact is not more severe than the impact identified in the General Plan EIR. This impact would be **less than significant**.

Mitigation Measures

No additional mitigation is required beyond compliance with General Plan Policy N-1-9 and Municipal Code Section 6.32.100.