4.3 Noise and Vibration

This section describes the concepts and terminology of noise, defines the existing noise levels at noise-sensitive locations nearest to the Project Site, and describes the regulatory settings associated with the Project. This section also identifies the applicable significance thresholds for noise impacts, assesses potential impacts of the Project and alternatives, recommends measures to mitigate significant adverse impacts, and discusses cumulative projects.

4.3.1 Environmental Setting

Noise is often defined as unwanted sound, which is perceived subjectively by individuals. Noise levels at various locations of an area fluctuate and change character during different periods of the day. Exposure to severe noise levels over prolonged periods can cause physiological changes, including ear damage. The acceptability of more common noise levels and types of noise varies among neighborhoods, individuals, and time of day. The following sections describe the concepts and terminology of noise and vibration and document existing noise levels at noise sensitive locations nearest to the Project Site.

4.3.1.1 Noise Effects

Noise levels are reduced the farther away a receptor is from the source because of several effects, including geometry, atmosphere, ground, and barrier.

Geometric Effects

Geometric effect refers to the spreading of sound energy as a result of the expansion of the wavefronts. Geometric spreading is independent of frequency and has a major effect in almost all sound propagation situations. There are two common kinds of geometric spreading: spherical and cylindrical spreading. In the case of spherical spreading from a point source, which is due to a noise source radiating sound equally in all directions, the sound level is reduced by 6 decibels (dB) for each doubling of distance from the source. A busy highway would be a cylindrical source with equal sound power output per unit length of highway. A cylindrical source will produce cylindrical spreading, resulting in a sound-level reduction of 3 dB per doubling of distance.

Atmospheric Effects

Atmospheric effects are due to air absorption and wind and temperature gradients. Air absorption is primarily due to the "molecular relaxation effect" between air molecules, where air molecules are excited and then relaxed by the passing sound pressure wave. High frequencies are absorbed more than low frequencies. The amount of absorption depends on the temperature and humidity of the atmosphere.

Precipitation (rain, snow, or fog) has an insignificant effect on sound levels although the precipitation will obviously affect the humidity and may also affect wind and temperature gradients. Atmospheric absorption is only an issue at higher frequencies and is a strong function of humidity and temperature. For example, at 68 degrees Fahrenheit (°F) and 70% humidity, air absorption of sound at frequencies of 16,000 hertz (Hz) occurs at approximately 8 dB per 100 feet. However, at 0% humidity, the rate drops to approximately 1 dB per 100 feet.

Under normal circumstances, atmospheric absorption can be neglected except where long distances or high frequencies are involved (greater than 4,000 Hz). At less than 2,000 Hz, the rate of sound level drop, due to air absorption, is less than 0.25 dB per 100 feet (at 68°F and 70% humidity).

The speed that sound propagates in a gas depends on the temperature of the gas. Higher temperatures produce higher speeds of sound. Since the temperature of the atmosphere is not uniform, there are local variations in the sound speed. For example, under normal conditions the atmosphere is cooler at higher altitudes. This results in sound waves being 'bent' upwards. This will result in the formation of a shadow zone, which is a region in which sound does not penetrate. In reality, some sound will enter this zone due to scattering. Scattering occurs when sound waves are propagating through the atmosphere and meet a region of inhomogeneity (a local variation in sound speed or air density) and some of their energy is re-directed into many other directions. In environmental noise situations, scattering is caused by air turbulence, rough surfaces, and obstacles, such as trees. The scattering of sound by rain, snow, or fog at ordinary frequencies is insignificant.

Under conditions of a temperature inversion (temperature increasing with increasing height), the sound waves will be refracted downwards, and therefore may be heard over larger distances. This frequently occurs in winter and at sundown.

When a wind is blowing there will be a wind gradient because the layer of air next to the ground is stationary. A wind gradient results in sound waves propagating upwind being 'bent' upwards and those propagating downwind being 'bent' downwards. This effect can cause noise levels downwind to be higher than those upwind.

Temperature and wind gradients can result in measured sound levels being very different to those predicted from geometrical spreading and atmospheric absorption considerations alone. These differences may be as great as 20 dB. These effects are particularly important where sound is propagating over distances greater than 500 feet. Temperature inversions and winds can also result in the effectiveness of a barrier being dramatically reduced.

Ground and Barrier Effects

If sound is propagating over ground, attenuation will occur due to acoustic energy losses on reflection. These losses will depend on the surface. Smooth, hard surfaces will produce little absorption, whereas thick grass may result in sound levels being reduced by up to about 10 db per 300 feet at 2000 Hz. High frequencies are generally attenuated more than low frequencies.

Reflection from the ground can result in another mechanism by which sound levels are reduced. When the source and receiver are both close to the ground, the sound wave reflected from the ground may interfere destructively with the direct wave. This effect, called the ground effect, is normally noticed over distances of several yards and more, and in the frequency range of 200 to 600 Hz.

Research on propagation through trees yields conflicting results. Dense shrubbery can produce effective noise attenuation. A band of trees several hundred feet deep is required to achieve significant attenuation.

Significant attenuation can be achieved with solid barriers. A barrier should be at least high enough to obscure the ‘line of sight’ between the noise source and receiver. A barrier is most effective for high frequencies since low frequencies are diffracted around the edge of a barrier more easily. The maximum performance of a barrier is limited to about 40 dB, due to scattering by the atmosphere. A barrier is most effective when placed either very close to the source or the receiver.

Barriers not built for acoustical purposes are often found in sound propagation situations. The most common of these are hills and buildings. In urban situations, buildings can be effective barriers. It is possible for buildings to produce a different acoustical effect. In a street, multiple reflections from parallel building facades can result in considerable reverberation and consequently reduced attenuation. The propagation of sound is very complex and influenced by a large number of factors. This report only examines the attenuation of sound due to geometry, barriers specifically placed by the Project or mitigation measures, and barriers such as the terrain, as well as air absorption for the linear decibel scale analysis.

Tonal Effects

Noise in which a single frequency stands out is said to contain a ‘pure tone.’ Sources that produce pure tones are often described as being ‘tonal’ and tend to be more noticeable – and potentially annoying – to humans than sources that do not contain pure tones. In assessing the subjective impact of tonal noise, it is common practice to take this increased annoyance into account by adding a 5-dBA penalty to the measured noise level. Section 4.3.1.2, Noise Terminology, describes the dBA rating scale.

Effects on Wildlife

Wildlife response to sound is dependent not only on the magnitude but also the characteristic of the sound, or the sound frequency distribution and whether the sound is natural or human made (noise). Wildlife is affected by a broader range of sound frequencies than humans. Therefore, a linear decibel scale (non-A weighted) analysis is preferred for wildlife impact analysis. Noise is known to affect an animal’s physiology and behavior, and chronic noise-induced stress can be deleterious to an animal’s energy budget, reproductive success, and long-term survival (Radle 2001).

4.3.1.2 Noise Terminology

Sound is technically described in terms of amplitude (loudness) and frequency (pitch). The standard unit of sound amplitude measurement is the decibel (dB). The decibel scale is a logarithmic scale that describes the physical intensity of the pressure vibrations that make up any sound. The pitch of the sound is related to the frequency of the pressure vibration. Because the human ear is not equally sensitive to a given sound level at all frequencies, a special frequency-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (dBA) provides this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear.

A typical noise environment consists of a base of steady background noise that is the sum of many distant and indistinguishable noise sources. Superimposed on this background noise are the sounds from individual local sources. These sounds can vary from an occasional aircraft flyover to virtually continuous noise from traffic on a nearby roadway. Table 4.3-1 lists representative noise levels for specific activities.

Table 4.3-1 Representative Environmental Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	—110—	Rock Band
Jet Fly-over at 100 feet	—105—	
	—100—	
Gas Lawnmower at 3 feet	—95—	
	—90—	
	—85—	Food Blender at 3 feet
Diesel Truck going 50 mph at 50 feet	—80—	Garbage Disposal at 3 feet
Noisy Urban Area during Daytime	—75—	
Gas Lawnmower at 100 feet	—70—	Vacuum Cleaner at 10 feet
Commercial Area	—65—	Normal Speech at 3 feet
Heavy Traffic at 300 feet	—60—	
	—55—	Large Business Office
Quiet Urban Area during Daytime	—50—	Dishwasher in Next Room
	—45—	
Quiet Urban Area during Nighttime	—40—	Theater, Large Conference Room (background)
Quiet Suburban Area during Nighttime	—35—	
	—30—	Library
Quiet Rural Area during Nighttime	—25—	Bedroom at Night, Concert Hall (background)
	—20—	
	—15—	Broadcast/Recording Studio
	—10—	
	—5—	
Lowest Threshold of Human Hearing	—0—	Lowest Threshold of Human Hearing

Source: FTA 2006

Several rating scales have been developed to analyze the adverse effect of community noise on people. Because environmental noise fluctuates over time, these scales consider that the effect of noise upon people largely depends upon the total acoustical energy content of the noise, as well as the time of day when the noise occurs. The rating scales of Equivalent Continuous Sound Level (Leq), minimum instantaneous noise level (Lmin), and the maximum instantaneous noise level (Lmax) are measures of ambient noise, while the Day-Night Average Level (Ldn) and

Community Noise Equivalent Level (CNEL) are measures of community noise (or noise levels with penalties for noise in the evening or nighttime). Leq is the average A-weighted sound level measured over a given time interval. Leq can be measured over any time period, but is typically measured for 1-minute, 15-minute, 1-hour, and 24-hour periods. CNEL is another A-weighted average sound level measured over a 24-hour time period. However, this noise scale is adjusted to account for some individuals' increased sensitivity to noise levels during the evening and nighttime hours. Leq, Lmin, and Lmax, as well as Ldn and CNEL are all applicable to this analysis and defined as follows:

- Leq, the equivalent energy noise level in dBA, is the average acoustic energy content of noise for a stated period of time. Thus, the Leq of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.
- Ldn, the Day-Night Average Level, is a 24-hour average Leq with a 10 dBA 'weighting' or penalty added to noise the hours of 10:00 p.m. 7:00 a.m. to account for noise sensitivity during the nighttime. The logarithmic effect of these additions is that a 60 dBA 24-hour Leq would result in a measurement of 66.4 dBA Ldn.
- CNEL, the Community Noise Equivalent Level, is a 24-hour average Leq with a 5 dBA "weighting" during the hours of 7:00 p.m. to 10:00 p.m. and a 10 dBA "weighting" added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for noise sensitivity in the evening and nighttime, respectively. The logarithmic effect of these additions is that a 60 dBA-24 hour Leq would result in a measurement of 66.7 dBA CNEL.
- Lmin is the minimum instantaneous noise level experienced during a given period of time, in dBA.
- Lmax is the maximum instantaneous noise level experienced during a given period of time, in dBA.

Noise environments and consequences of human activities are usually well represented by average noise levels during the day or night, or over a 24-hour period, as represented by the Ldn or the CNEL. Environmental noise levels are generally considered low when the CNEL is less than 60 dBA, moderate in the 60 to 70 dBA range, and high greater than 70 dBA. Examples of low daytime noise levels are isolated, natural settings that can provide noise levels as low as 20 dBA and quiet, suburban, residential streets that can provide noise levels around 40 dBA. Noise levels above 45 dBA at night can disrupt sleep. Examples of moderate-level noise environments are urban residential or semi-commercial areas (typically 55 to 60 dBA) and commercial locations (typically 60 dBA). People may consider louder environments adverse, but most will accept the higher noise levels associated with more noisy urban residential or residential-commercial areas (60 to 75 dBA) or dense urban or industrial areas (65 to 80 dBA).

When evaluating changes in 24-hour community noise levels, a difference of 3 dBA is a barely perceptible increase to most people (Caltrans 1998). A 5-dBA increase is readily noticeable, while a difference of 10 dBA would be perceived as a doubling of loudness. New development within a community could potentially lead to activities that increase the 24-hour community noise levels.

Noise levels from a particular source decline as distance to the receptor increases (see the Geometric Effects section). Other factors, such as the weather, wind, and reflecting or shielding factors, also help intensify or reduce the noise level at any given location. A commonly used rule of thumb for roadway noise (a linear noise source) is that for every doubling of distance from the source, the noise level is reduced by about 3 dBA at acoustically 'hard' locations (i.e., the area between the noise source and the receptor is nearly complete asphalt, concrete, hard-packed soil, or other solid materials) and 4.5 dBA at acoustically 'soft' locations (i.e., the area between the source and receptor is unpacked earth or has vegetation, including grass).

Noise from stationary or point sources is reduced by about 6 to 7.5 dBA for every doubling of distance at acoustically hard and soft locations, respectively. Noise levels may also be reduced by intervening structures; generally, a single row of buildings between the receptor and the noise source reduces the noise level by about 5 dBA, while a solid wall or berm reduces noise levels by 5 to 10 dBA.

4.3.1.3 Vibration

Vibration is acoustic energy transmitted as pressure waves through a solid medium, such as soil or concrete. Like noise, the rate at which pressure changes occur is the frequency of the vibration, measured in Hz. Vibration may be the form of a single pulse of acoustical energy, a series of pulses, or a continuous oscillating motion.

Ground-Borne Vibration

The way that vibration is transmitted through the ground depends on the soil type, the presence of rock formations or man-made features and the topography between the vibration source and the receptor location. These factors vary considerably from site to site and make accurate predictions of vibration levels at receptors distant from the source extremely difficult (often impossible) in practice.

As a general rule, vibration waves tend to dissipate and reduce in magnitude with distance from the source. Also, the high frequency vibrations are generally attenuated rapidly as they travel through the ground, so that the vibration received at locations distant from the source tends to be dominated by low-frequency vibration. The frequencies of ground-borne vibration most perceptible to humans are in the range from less than 1 Hz up to 100 Hz.

When a ground-borne vibration arrives at a building, there is usually an initial ground-to-foundation coupling loss. However, once the vibration energy is in the building structure it can be amplified by the resonance of the walls and floors. Occupants can perceive vibration as motion of the building elements (particularly floors) and also rattling of lightweight components, such as windows, shutters, or items on shelves. Vibrating building surfaces can also radiate noise, which is typically heard as a low-frequency rumbling known as ground-borne noise. At very high levels, low-frequency vibration can cause damage to buildings.

Soil and subsurface conditions are known to have a strong influence on the levels of ground-borne vibration. Among the most important factors are the stiffness and internal damping of the soil and the depth to bedrock. Experience with ground-borne vibration is that vibration propagation is more efficient in stiff clay soils, and shallow rock seems to concentrate the vibration energy close to the surface and can result in ground-borne vibration problems at large distances from the track. Factors such as layering of the soil and depth to water table can have significant effects on the propagation of ground-borne vibration (FTA 2006).

Vibration Measurement

Vibration may be defined in terms of the displacement, velocity, or acceleration of the particles in the medium material. In environmental assessments, where human response is the primary concern, velocity is commonly used as the descriptor of vibration level, expressed in millimeters per second (mm/s). The amplitude of vibration can be expressed in terms of the wave peaks or as an average, called the root mean square (rms). The rms level is generally used to assess the effect of vibration on humans. Vibration levels for typical sources of ground-borne vibration are shown in Table 4.3-2 below.

Vibration can produce several types of wave motion in solids including, compression, shear, and torsion, so the direction in which vibration is measured is significant and should generally be stated as vertical or horizontal. Human perception also depends to some extent on the direction of the vibration energy relative to the axes of the body. In whole-body vibration analysis, the direction parallel to the spine is usually denoted as the z-axis, while the axes perpendicular and parallel to the shoulders are denoted as the x- and y-axes respectively.

Table 4.3-2 Typical Levels of Ground-Borne Vibration

Source	Typical Velocity at 50 feet (inches/second, rms)[a]	Human or Building Response
Blasting from construction projects	0.10	Minor cosmetic damage to fragile buildings
Bulldozers and other heavy tracked construction equipment.	0.06	Workplace annoyance; difficulty with vibration-sensitive tasks.
Commuter rail, upper range	0.02	
Rapid transit rail, upper range	0.010	Distinctly Perceptible Residential annoyance for infrequent events
Commuter rail, typical range	0.008	
Bus or truck over bump	0.004	Barely perceptible. Residential annoyance for frequent events
Rapid transit rail, typical range	0.003	
Bus or truck typical	0.002	Threshold of perception
Background vibration	0.0004	None

a. rms = root mean square

Source: FTA 2006

Large vehicles can also increase ground vibration along streets that they travel. Vibration would be a function of the vehicle speeds and the condition of the pavement. CalTrans indicates that “vehicles traveling on a smooth roadway are rarely, if ever, the source of perceptible ground vibration” and that “vibration from vehicle operations is almost always the result of pavement discontinuities, the solution is to smooth the pavement to eliminate the discontinuities (CalTrans

2004)." Trucks traveling on area roadways could cause vibrations at nearby residences if roadways are not maintained.

4.3.1.4 Sensitive Receptors

Some land uses are more sensitive to noise than others, due to the amount of noise exposure and the types of activities typically involved. Residential areas, schools, libraries, religious institutions, hospitals, nursing homes, parks, some wildlife areas, and quiet outdoor recreation areas are generally more sensitive to noise than are commercial and industrial land uses. Figure 4.3-1 shows sensitive receptors near the Project Site. Receptors near the Project Site include:

- Pismo Dunes State Vehicular Recreation Area;
- Oso Flaco Lake and Dunes;
- Fire Station No. 22 to the north on State Route 1 (Willow Road);
- Residences along Monadella Street and areas to the north and south of State Route 1 (Willow Road);
- Commercial uses north and south of State Route 1 (Willow Road);
- Agricultural uses to the east and south along State Route 1 (Cabrillo Highway);
- Golf course and residences to the east along State Route 1 (Cabrillo Highway); and
- Residences along routes to and from U.S. Highways 101 and 166.

In addition, areas along the pipeline route that runs from the Santa Maria Refinery to the Rodeo Refinery in the Bay Area are exposed to elevated noise levels due to the location of pumping stations along the pipeline route (see Section 2.0, Project Description). Sensitive receptors near the Santa Margarita Pump Station would include residences located to the northwest of the pump station along Linden Avenue, Poplar Avenue, Chestnut Avenue, and Walnut Avenue.

Figure 4.3-1 Sensitive Receptors and Noise Monitoring Locations Near the Project Site

Note: Noise monitoring location 5 is in Santa Margarita (not shown in this aerial photo), at the corner of Linden Avenue and El Camino Real, location 6 is in front of the Summit Pump Station (also not on this map). Monitoring was also conducted in front of the Santa Margarita Pump Station.

4.3.1.5 Existing Noise Sources

Existing operations at the Project Site constitute one noise source. Other noise sources near the Project Site and nearby vicinity contributing to the noise environment include traffic on adjacent roads, railroad operations, and commercial and industrial operations at neighboring facilities. The following sections discuss each of these noise sources.

Traffic Noise

The predominant sources of traffic noise at the Project Site are vehicles on State Route 1 (Willow Road). Noise levels from traffic are estimated in the San Luis Obispo County General Plan Noise Element for 2010 traffic levels, which are estimates generated at the time of the Noise Element adoption in 1992 (San Luis Obispo 1992). The Noise Element estimates that CNEL (or Ldn) noise levels along State Route 1 near the Proposed Project site exceed 65 dBA due to roadway noise. Table 4.3-3 shows centerline distances to specific noise levels.

Table 4.3-3 Roadway Noise Levels: Noise Element and Calculated Current

Roadway	Segment	Noise at 100 feet, CNEL	Distance to Noise Contour, feet		
			60 CNEL	65 CNEL	70 CNEL
FHWA Model Calculated Values: Current Traffic Levels (2008)					
State Route 1	At Santa Maria Refinery entrance	65.3	342	108	34
Noise Element Values (2010)					
State Route 1	Santa Barbara County to Valley Road	-	136	63	29
State Route 1	Valley Road to Halcyon Road	-	223	104	48
Railroad	Grade Crossing	-	525	244	113

Notes: Distances are in feet from roadway centerline. Local streets based on San Luis Obispo County Public Works Traffic Counts December 2008. Time of day distribution based on Noise Element Technical Reference Document.

Existing traffic-generated noise levels were also modeled using a version of the Federal Highway Administration Traffic Noise Model and current traffic data provided by the County of San Luis Obispo and CalTrans (FHWA 1998). This analysis was conducted in order to demonstrate the noise levels associated with current traffic levels (the Noise Element addresses estimated traffic levels for 2010). The analysis indicates that properties along State Route 1 near the Refinery are exposed to a traffic-generated CNEL of 65 dBA (at 100 feet from the road centerline) and noise levels of 60 dBA are experienced as far as 136 to 342 feet from the roadway.

Railroad Noise

The railroad is approximately 200 feet to the west of the Proposed Project Site. Noise levels due to railroad activity are estimated in the San Luis Obispo County General Plan Noise Element. These estimates are based on ten freight and four passenger trains per day. Distances to the 60 dB contour value range up to 525 feet from a grade crossing (see Table 4.3-3).

Commercial, Industrial, Residential, and Recreational Noise

The area near the Project Site includes some light industrial/commercial uses, as well as residential and recreational uses that could generate noise. Figure 4.3-1 depicts many of these, which include the following:

- Recreational vehicular uses to the west at the Pismo Dunes State Vehicular Recreation Area;
- County Fire Department activities to the north at Fire Station No. 22;
- Residential activities to the north along Monadella Street;
- Light industrial and commercial uses along State Route 1 (Willow Road);
- Light industrial uses, such as a junk yard, recreational vehicle storage and repair, and auto sales, to the northeast on Alley Oop Way and Gasoline Alley Place;
- Agricultural activities to the east and southwest; and
- Recreational and golf activities to the east at Monarch Dunes Golf Club along State Route 1 (Cabrillo Highway).

All of these locations potentially produce noise on an intermittent basis due to activities.

Agricultural Noise

The San Luis Obispo County General Plan Noise Element discusses noise associated with agricultural operations. Noise levels from agricultural sources that could be in the project vicinity include diesel engines (74 to 85 dBA) and tractors (72 to 75 dBA at 150 feet).

4.3.1.6 Noise Measurements

Noise measurements were obtained as part of this EIR analysis on June 21, 2011, in the vicinity of the Project Site, along transportation routes, and at selected pump stations. The measurements were taken at six locations during the day, evening, and nighttime to allow for a calculation of CNEL and at the pump stations to obtain a nighttime minimum level. Noise was also measured at the fenceline in front of the Santa Margarita Pump Station to determine the noise contribution of the pumps to nearby residential areas. The results of these measurements and their locations are shown in Table 4.3-4 and Figure 4.3-1.

Table 4.3-4 Existing Ambient Noise Levels Near the Project Site

No.	Location	Daytime Leq (dBA)	Evening Leq (dBA)	Nighttime Leq (dBA)	CNEL (dBA)	Noise Sources
1	Oso Flaco Lake Parking lot	43.6	40.1	48.9	54.9	Visitors, wind, surf, automobiles, birds, frogs (at night) tractors
2	Willow Road and Guadalupe Road	65.8	65	60.9	68.9	Traffic noise on Willow and Highway 1
3	Winterhaven Way	59.2	51.5	42.0	57.3	Traffic noise on Highway 1, dogs, fire station alarms, occasional alarms from the Refinery
4	Monadella Street	49.3	45	43.6	51.5	Traffic noise from Highway 1, birds, wind in trees
5	Linden Ave and El Camino Real (near Santa Margarita Pump Station)	56.0	-	41.7	-	Traffic on El Camino Real, Traffic on Highway 101, crickets, frogs (at night), pump station engines
6	In front of Summit Pump Station	48.7	-	-	-	Traffic from Highway 101 and Los Berros Road. No pumps audible.

Note: Location 5 daytime Leq is taken near the corner of Linden Ave and El Camino Real. Source: In-field measurements taken June 21, 2011 by MRS with a Quest 1900 noise meter.

The noise baseline in the area is generally dominated by traffic noise, which produces a CNEL close to 69 dBA for areas close to roadways (along State Route 1). Residential areas close to the SMF experience noise levels ranging from approximately 52 to 69 dBA CNEL. The SMF contributed very little to area noise levels.

Background noise measurements were also taken at night in residential areas near the Santa Margarita Pump Station to determine the noise contribution of the pumping engines. Noise monitoring was also performed at the fenceline of the Santa Margarita Pump Station to determine the noise levels at the edge of the property.

Pump Station Noise

The pump stations associated with the Proposed Project contribute to the noise levels in the areas near the pump stations. Generally, the pump stations that operate with electric-drive pumps do not produce noise levels that are an issue at any areas near the pump stations. The Cuesta Pump Station uses electric-drive pumps. (see Section 2.0, Project Description). The pumps at Shandon are engine-driven, but they are remotely located. Summit Pump Station does not have any pumps.

The pumps at the Santa Margarita Pump Station are engine-driven and produce noise in the surrounding area during the day and at night. Nighttime noise measurements taken at the Santa Margarita Pump Station fenceline, during periods of zero traffic along El Camino Real, indicate a noise level of 70.6 dBA at 50 feet equivalent and measured 59.7 dBA at the pump station fenceline.

This noise would create a noise level of 40.9 dBA at the closest residential property line. Although this level would be audible, it would not contribute significantly to the existing noise levels and would not cause an exceedance of the code. The baseline noise level in the residential area at night is 41.7 dBA. The pumps increase noise levels by 2.6 dBA during nighttime hours, which would be audible but would not be considered a significant noise impact.

However, the current 59.7-dBA noise level at the fenceline exceeds the County Noise Element 50-dBA standard of allowable daytime noise. Implementation of mitigation measure N-1 will reduce this impact to less than significant.

4.3.2 Regulatory Setting

4.3.2.1 State Regulations

California Health and Safety Code, Division 28, Noise Control Act

The California Noise Control Act states that excessive noise is a serious hazard to public health and welfare and that it is the policy of the State to provide an environment for all Californians that is free from noise that jeopardizes their health or welfare.

California Government Code Section 65302

Section 65302(f) of the California Government Code and the Guidelines for the Preparation and Content of the Noise Element of the General Plan, prepared by the California Department of Health Services and included in the 1990 State of California General Plan Guidelines published by the State Office of Planning and Research, provide requirements and guidance to local agencies in the preparation of their Noise Elements. The Guidelines require that major noise sources and areas containing noise-sensitive land uses be identified and quantified by preparing generalized noise exposure contours for current and projected conditions. Contours may be prepared in terms of either the CNEL or the Ldn, which are descriptors of total noise exposure at a given location for an annual average day. The CNEL and Ldn are generally considered to be equivalent descriptors of the community noise environment within plus or minus 1.0 dB.

4.3.2.2 County Local Ordinances and Policies

The applicable noise standards governing the project area are the criteria in the County's Noise Element of the General Plan, which covers noise exposure from major sources in the County including roadways, railways, airports, and stationary sources, and the criteria in the County's Municipal Code, covering stationary noise sources such as loading docks, parking lots, and ventilation equipment.

The San Luis Obispo County Noise Element of the General Plan provides a policy framework for addressing potential noise impacts in the planning process. The Noise Element is directed at minimizing future noise conflicts, whereas a noise ordinance focuses on resolving existing noise conflicts. The Noise Element includes maps showing the extent of noise exposure from the major noise sources in the County (roadways, railways, airports, and stationary sources), along with the goals, policies, and implementation program adopted by the County to reduce future noise impacts. The goals of the Noise Element, compiled under the mandate of Section 65302(f) of the California Government Code and guidelines prepared by the California Department of Health Services, are to ensure that all areas of the County are free from excessive noise and that appropriate maximum levels are adopted for residential, commercial, and industrial areas; to reduce new noise sources to the maximum extent possible; to reduce, to the maximum extent possible, the impact of noise within the county; and to ensure that land uses are compatible with the related noise characteristics of those uses.

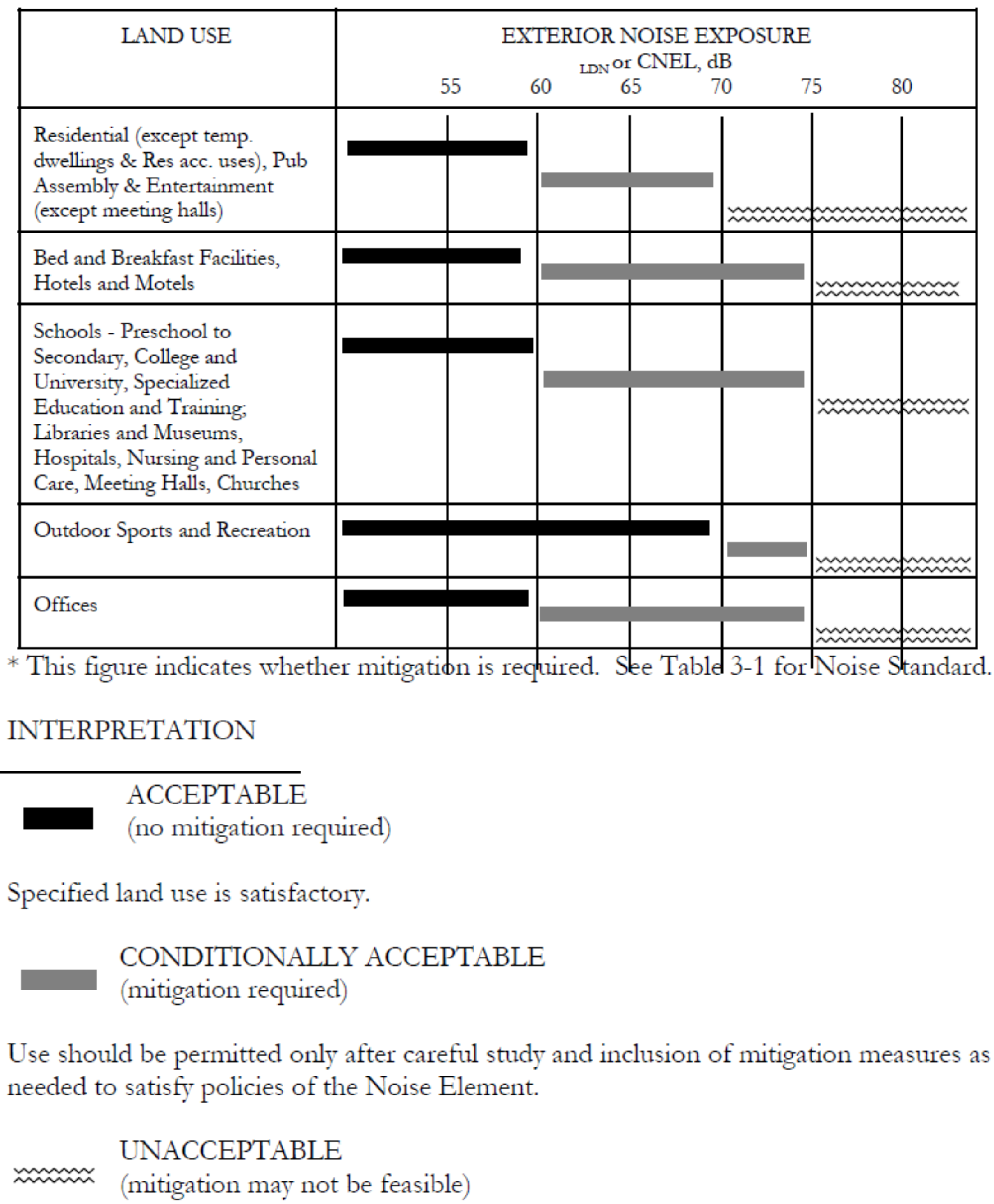
Among the most significant policies of the Noise Element are numerical noise standards that limit noise exposure within noise-sensitive land uses and performance standards for new commercial and industrial uses that might adversely impact noise-sensitive land uses. When the potential for adverse noise impacts is identified, mitigation is required to carry out the specific recommendations of an expert in acoustics or, under some circumstances, by implementing standard noise mitigation packages. When mitigation is required, highest priority is given to avoiding or reducing noise impacts through site planning and project design, and lowest priority given to structural mitigation measures such as construction of sound walls and acoustical treatment of buildings.

The County has identified these noise-sensitive uses:

- Residential development, except temporary dwellings;
- Schools preschool to secondary; colleges and universities; specialized education and training;
- Health care services (hospitals);
- Nursing and personal care;
- Churches;
- Public assembly and entertainment;
- Libraries and museums;
- Hotels and motels;
- Bed and breakfast facilities;
- Outdoor sports and recreation; and
- Offices.

The Noise Element specifies the ranges of noise exposure from transportation noise sources which are considered to be acceptable, conditionally acceptable, or unacceptable for the development of different land uses. Figure 4.3-2 shows whether mitigation is needed for development of land uses near major transportation noise sources. In areas where the noise environment is acceptable, new development may be permitted without requiring noise mitigation. For areas where the noise environment is conditionally acceptable, new development would be allowed only after noise mitigation has been incorporated into the design of the project to reduce noise exposure. For areas where the noise environment is unacceptable, new development is usually not feasible.

Figure 4.3-2 Land Use Compatibility for New Development near Transportation Noise Sources



Source: SLOC 1992

For residential land uses, the Noise Element recommends an exterior noise standard of 60 dBA CNEL and an interior noise standard of 45 dBA CNEL. Table 4.3-5 lists the County's maximum exterior noise levels for stationary noise sources. Table 4.3-6 lists the County's maximum allowable noise exposure for noise from transportation noise sources.

Table 4.3-5 Noise Element Maximum Allowable Noise Exposure - Stationary Sources

Level	Daytime (7:00 a.m.–10:00 p.m.)	Nighttime (10:00 p.m.–7:00 a.m.)
Hourly Leq	50	45
Maximum Level, Lmax	70	65
Maximum Level – Impulsive Noise, Lmax	65	60

Notes: As determined at the property line of the receiving land use. When determining the effectiveness of noise mitigation measures, the standards may be applied on the receptor side of the noise barrier or other property line noise mitigation measures. Nighttime applies only where the receiving land use operates or is occupied during nighttime hours.

Source: SLOC 1992

Table 4.3-6 Noise Element Maximum Allowable Noise Exposure - Transportation Sources

Land Use	Outdoor Areas	Interior Spaces	
	Ldn/CNEL, dB	Ldn/CNEL, dB	Leq dB
Residential (except temporary dwellings and residential accessory uses)	60	45	--
Bed and Breakfast Facilities, Hotels, and Motels	60	45	--
Hospitals, Nursing and Personal Care	60	45	--
Public Assembly and Entertainment (except Meeting Halls)	--	--	35
Offices	60	--	45
Churches, Meeting Halls	--	--	45
Schools – Preschool to Secondary, College and University, Specialized Education and Training, Libraries and Museums	--	--	45
Outdoor Sports and Recreation	70	--	--

Source: SLOC 1992

Chapter 6, Section 40 of Title 23 (23.06.040) of the County Municipal Code establishes standards for acceptable exterior and interior noise levels and describes how noise shall be measured. These standards are intended to protect persons from excessive noise levels, which are detrimental to the public health, welfare, and safety. Excessive noise levels are also contrary to the public interest because they can interfere with sleep, communication, relaxation, and full enjoyment of one's property; contribute to hearing impairment and a wide range of adverse physiological stress conditions; and adversely affect the value of real property. The interior and exterior noise standards established in the County's Land Use Ordinance are consistent with the noise exposure standards in the County's General Plan Noise Element.

The County Code limits the hours of construction adjacent to residential or sensitive land uses between 7:00 a.m. and 9:00 p.m., Monday through Friday, and between 8:00 a.m. and 5:00 p.m. and Saturdays and Sundays.

4.3.3 Significance Criteria

Noise impacts are associated with operational activities. Operations noise impacts are also associated with traffic, both Project-generated that impacts existing receptors and existing traffic that could impact the proposed development, and stationary activities. Impacts are measured against the County Noise Element to determine significance.

4.3.3.1 Operations Traffic

Long-term off-site impacts from traffic noise are measured against multiple criteria. Both of these criteria must be met for a significant impact to be identified:

- Traffic noise levels would increase by more than 3 dB compared to existing conditions on a roadway segment adjacent to a noise-sensitive land use; and
- The resulting traffic noise level would exceed the County criteria level for the noise-sensitive land use. In this case, the criteria level is 60 dBA CNEL for residential, hotel, hospital, and office uses and 70 dBA CNEL for outdoor sports and recreation uses land uses (as per the County Code).

A noise level increase of 3 dBA or more is perceptible to the human ear and is often used as a threshold for a substantial increase.

Impacts associated with existing traffic that could impact the Proposed Project would be considered significant if:

- Existing traffic noise levels along the traffic routes would exceed the County Land Use Compatibility guidelines.

4.3.3.2 Operations Stationary Sources

The Proposed Project would be considered generating a significant impact if:

- The development would generate noise levels above those specified by the County Noise Element/Municipal Code.

4.3.4 Project Impacts and Mitigation Measures

Noise and vibration impacts would be generated both from Refinery operations and associated with increased traffic on area roadways. Impacts were determined by utilizing the Federal Highway Administration (FHWA) traffic noise model.

Impact #	Impact Description	Residual Impact
N.1	Operation increases at the Refinery could increase noise levels in the area.	Class II

Various operations and alarms at the Refinery generate noise in the community. The level of noise impacts on the community would not increase due to an increase in crude oil throughput at the Refinery. Alarm frequency would remain the same. Although equipment use, such as the crude heaters, would increase, noise levels would not increase at receptors near the Refinery.

The pump stations along the pipeline routes from the Santa Maria Pump Station to the Refinery and from the Refinery north to the Bay Area could increase their pumping frequency or pump-drive load or operate in a manner that would increase noise levels as more crude oil would need to be pumped (e.g., operating multiple pumps).

The Summit Pump Station, located midway between the Santa Maria Pump Station and the Refinery, is in close proximity to residences. However, as there are no pumps at this location, an increase in throughput would not generate additional noise levels at nearby residences.

The Santa Margarita Pump Station, located along the pipeline from the Refinery to the Bay Area, is also located in a rural area in close proximity to residences. Natural gas engines operate the pumps and make substantially more noise than electricity driven pumps. Noise monitoring at the Santa Margarita Pump Station indicated that noise levels during the nighttime would be audible to nearby residences, but would not produce a significant impact. However, noise levels at the Santa Margarita Pump Station property line currently exceed the County Noise Element limit of 50 dBA. Increasing operations of these pumps, which might or might not occur under the Proposed Project, would be considered a significant impact.

Mitigation Measures

N-1 *The Applicant shall provide for a noise monitoring study, under the supervision of the County staff, to determine the noise levels in the vicinity of the Santa Margarita Pump Station and the compliance with applicable codes and standards. If noise levels are a concern, the Applicant shall install, at the Santa Margarita Pump Station, a sound wall constructed of barrier pads between the noise sources and residences, as close to the pumping operations as feasible, to reduce noise levels at the closest receptor property line to the County significance threshold level 50 dBA. Additional barrier walls shall be installed as deemed necessary by in-field measurements. Installation of the sound wall shall be verified by County Planning and Building prior to the issuance of the updated permit/authorization to proceed.*

Residual Impacts

The noise reduction methods recommended in the mitigation measures are established industry practices that reduce noise levels in urban or rural situations. Noise levels at the property line would need to be reduced approximately 10 dBA, which is feasible with appropriately designed barriers and pads. With the implementation of sound walls and pads around the pumping engines at the Santa Margarita Pump Station, impacts would be reduced to *less than significant with mitigation* (Class II).

Impact #	Impact Description	Residual Impact
N.2	Traffic increases on area roadways near the Refinery could increase noise levels in the area.	Class III

Refinery operations generate traffic associated with coke and sulfur transportation out of the Refinery. Other traffic, such as traffic related to employees or deliveries, would not change with the Proposed Project. This increase in traffic levels could generate an increase in noise levels at nearby residences.

Noise was modeled using the FHWA Highway Noise Prediction Model, using 2008 traffic levels from the San Luis Obispo County Public Works Department and additional truck traffic added according to Section 2.0, Project Description. The Proposed Project would add less than four trucks per day to area traffic. Noise levels generated by this traffic scenario are estimated to increase by less than 0.1 dBA CNEL for a receptor 100 feet from the center of State Route 1. This would be a less than significant impact.

4.3.5 Other Issue Area Mitigation Measure Impacts

No mitigation measures are anticipated to produce additional noise impacts. Therefore, the mitigation measures would not result in additional significant impacts, and additional analysis or mitigation is not required. Additionally, the Santa Margarita Pump Station sound wall recommended in mitigation measure N-1 would not have a significant visual impact on surrounding properties and, therefore, would not require additional analysis or mitigation.

4.3.6 Cumulative Impacts

No other developments are currently proposed in the vicinity of the Proposed Project. All of the cumulative projects identified in Section 3.0, Cumulative Projects Description, are outside of the project area and would not impact the same area as the Proposed Project. As such, the there are no cumulative impacts associated with noise, other than the impacts identified for the Proposed Project.

4.3.7 Mitigation Summary/Monitoring Plan

Mitigation Measure	Requirements	Compliance Verification		
		Method	Timing	Responsible Party
N-1	The Applicant shall provide for a noise monitoring study, under the supervision of the County staff, to determine the noise levels in the vicinity of the Santa Margarita Pump Station and the compliance with applicable codes and standards. If noise levels are a concern, the Applicant shall install, at the Santa Margarita Pump Station, a sound wall constructed of barrier pads between the noise sources and residences, as close to the pumping operations as feasible, to reduce noise levels at the closest receptor property line to the County significance threshold level of 50 dBA. Additional barrier walls shall be installed as deemed necessary by in-field measurements. Installation of the sound wall shall be verified by County Planning and Building prior to the issuance of the updated permit/authorization to proceed.	Review of soundwall installation	Prior to issuance of permit	San Luis Obispo County Planning and Building Department