San Luis Low Point Improvement Project Environmental Impact Statement / Environmental Impact Report

Appendix E1: Noise and Vibration Supporting Information

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Appendix E1
Noise and Vibration Supporting Information

This appendix supports the Noise and Vibration analysis and contains area of analysis figures and presents a framework for understanding noise and vibration levels. In addition, this appendix provides a detailed description, summarized in the Noise and Vibration Affected Environment, of existing noise and vibration levels and sensitive receptors with the potential to be affected by the action alternatives.

E1.1 Noise and Vibration Terminology

E1.1.1 Noise

Noise can be generally defined as unwanted sound. Sound, traveling in the form of waves from a source, is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level (referred to as sound level) is the most common descriptor used to characterize the loudness of an ambient sound level. It is measured in decibels (dB), with zero dB corresponding roughly to the threshold of human hearing and 120 to 140 dB corresponding to the threshold of pain.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather a broad band of frequencies varying in levels of magnitude (sound power). The sound pressure level, therefore, constitutes the additive force exerted by a sound corresponding to the frequency/sound power level spectrum. The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. Consequently, when assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies and greater sensitivity to mid-range frequencies. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted dB (dBA). Frequency A-weighting follows an international standard methodology of frequency de-emphasis and is typically applied to community noise measurements. Some representative noise sources and their corresponding A-weighted noise levels are shown in Table E1-1.

TableE1-1. Typical Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110	Rock band
Jet flyover at 1,000 feet		
	100	
Gas lawnmower at 3 feet		
	90	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80	Garbage disposal at 3 feet
Noise urban area, daytime		
Gas lawnmower, 100 feet	70	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60	
		Large business office
Quiet urban daytime	50	Dishwasher in next room
Quiet urban nighttime	40	Theater, large conference room (background)
Quite suburban nighttime		
	30	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20	
		Broadcast/recording studio
	10	
	0	

Source: California Department of Transportation (Caltrans) 2013a.
Key:
dBA = A-weighted decibel scale
mph = miles per hour

A key concept in evaluating potential noise impacts is the perceived effect of incremental increase in existing noise levels. Table E1-2 presents the effect of increasing noise levels. For example, the table shows that an increase of 3 dBA is barely perceptible, an increase of 5 dBA is noticeable, and that a 10 dBA increase would be perceived by someone to be a doubling of noise.

Table E1-2. Decibel Changes, Loudness, and Energy Loss

Sound Level Change (dBA)	Relative Loudness/ Impact	Acoustical Energy Gain (%)
0	Reference	0
+3	Barely Perceptible Change	50
+5	Noticeable Change	67
+10	Twice as Loud	90
+20	Four Times as Loud	99

Source: Federal Highway Administration (FHWA) 2011.
Key:
dBA = A-weighted decibel scale

Noise analyses and regulations use the following terms:

- **L_{eq}: Equivalent energy level** - A-weighted sound level corresponding to a steady-state sound level that contains the same total energy as a varying signal over a given sample period. This is typically computed over 1-, 8-, and 24-hour sample periods.

- **L_{dn}: Day-night average level** - the energy average sound level for a 24-hour day determined after the addition of a 10 dBA penalty to all noise events occurring at night between 10 p.m. and 7 a.m. This is a useful measure for community noise impact because people in their homes are much more sensitive to noise at night when they are relaxing or sleeping than they are in the daytime.

- **L_{max}: Maximum noise level** - representing the highest sound level measured for a given period.

- **L_{min}: Minimum noise level** - representing the lowest sound level measured for a given period.

- **L_x: Statistical noise descriptor** – the noise level exceeded X% of a specified time period. For example, L_{10} indicates the noise level that is exceeded 10% of the time during a given period.

- **CNEL: Community Noise Equivalent Level** - a 24-hour average L_{eq} that includes the addition of five dBA to sound levels from 7 p.m. to 10 p.m. and an addition of 10 dBA to sound levels from 10 p.m. to 7 a.m. The CNEL is commonly used in California instead of the L_{dn}.

Noise effects on humans can range from annoyance to physical discomfort and harm. Sleeping patterns, speech communication, mental acuity, and heart and breathing rates can all be disturbed by noise. Perception of the noise is affected by its pitch, loudness, and character.

Sound levels from isolated point sources of noise typically decrease by about 6 dBA for every doubling of distance from the noise source. When the noise source is a continuous line, such as vehicle traffic on a highway, sound levels decrease by about 3 dBA for every doubling of distance. Noise levels can also be affected by several factors other than the distance from the noise source. Topographic features and structural barriers that absorb, reflect, or scatter sound waves can affect the reduction of noise levels. Atmospheric conditions (wind speed and direction, humidity levels, and temperatures) and the presence of dense vegetation can also affect the degree to which sound is attenuated over distance.

E1.1.2 Vibration

Vibration refers to groundborne noise and perceptible motion. The most common impacts from groundborne vibration include annoyance, movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, disruption of vibration-sensitive operations or activities, and triggering of landslides. Vibrations caused by construction can be interpreted as energy transmitted in waves through the soil mass. These energy waves generally dissipate with distance from the vibration source, due to spreading of the energy and frictional losses. Thus, groundborne vibrations from most construction activities very rarely reach the levels that can damage structures but can achieve the perceptible ranges in buildings very close to construction sites (Federal Transit Authority [FTA] 2006).

In extreme cases, vibration can cause damage to buildings or equipment. In most circumstances, common ground-induced vibrations related to roadway traffic and construction activities pose no threat to buildings or structures, with the occasional exception of blasting and sheet pile-driving during construction. In order to assess the potential for structural damage associated with vibration, the vibratory ground motion in the vicinity of the affected structure is measured in terms of peak particle velocity (PPV) in the vertical and horizontal directions, typically in units of inches per second (in/sec). The PPV is defined as the maximum instantaneous peak of the vibration signal. California Department of Transportation (Caltrans) estimates that frequent generation of vibration at levels exceeding 0.3 in/sec can damage older residential structures and cause annoyance to humans (Caltrans 2013b).

Annoyance from vibration often occurs when the vibration exceeds the threshold of perception. A vibration level that causes annoyance would be well below the damage threshold for normal buildings. Generally, groundborne vibration does not provoke adverse human reaction to those who are outdoors as the effects associated with the shaking of building are absent.

Construction activities can either result in continuous or single-impact (transient) vibration impacts. Typical equipment or activities that could result in continuous vibration impacts include excavation equipment, traffic, vibratory pile drivers, and vibratory compaction equipment; examples of transient vibration sources include blasting and drop balls. Some construction activities, like jackhammers or impact pile drivers, can continually generate single transient events at a high frequency; however, for evaluation purposes, these equipment would be regarded as having frequent or continuous vibration impacts.

E1.1.2.1 Area of Analysis

The area of analysis for noise includes the following study areas where construction would occur:

- San Luis Reservoir (in Merced County)
- Santa Teresa Water Treatment Plant (in Santa Clara County)
- Pacheco Reservoir (in Santa Clara County)

Figure E1-1 illustrates the area of analysis.

E1.2 Existing Conditions

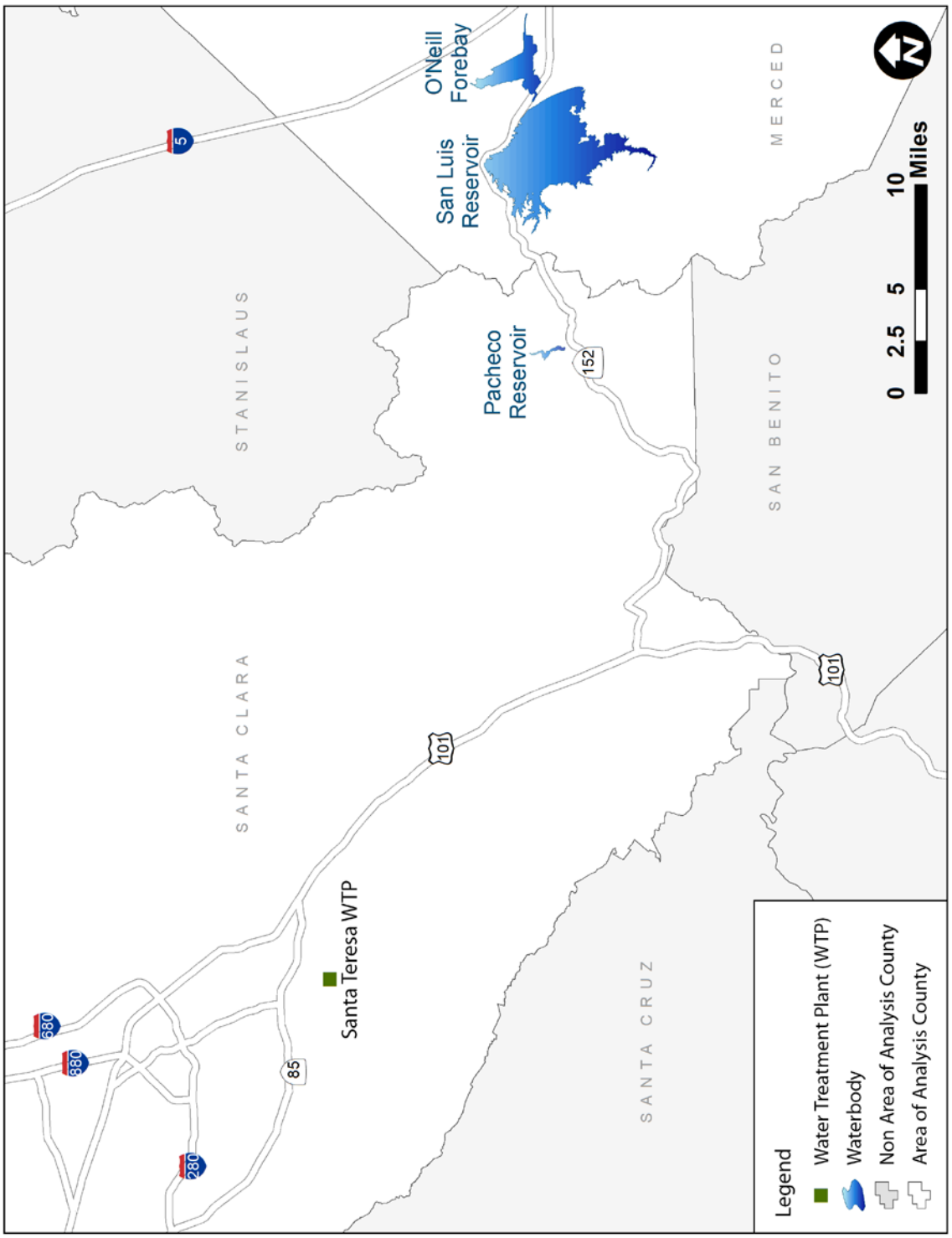
Noise sources currently existing in the area of analysis are of three general types: agricultural noise, general stationary noise, and general mobile noise. No major sources of vibration are known to exist in the area of the San Luis Reservoir.

Farm operations produce noise from a variety of sources. These include heavy equipment for plowing and harvesting, dairy equipment, crop-spraying aircraft, wind turbines for frost protection, on-site processing equipment, and irrigation water pumps. In addition to affecting the farmers and farm laborers, agricultural noise also affects those living in or near agricultural areas.

General stationary noises (i.e., those emanating from fixed locations) are associated with a variety of land uses. Stationary sources include air conditioning units, power tools, motors, generators, appliances, and manufacturing and industrial facilities. Noise-sensitive receptors may have stationary noise sources at their locations.

General mobile noise sources include vehicles, aircraft, and trains. Mobile noise is usually temporary and variable, but can be intense and annoying because of its abruptness and intensity. In urban areas, these mobile sources contribute to the ambient noise.

The counties in the area of analysis vary from rural to urban environments, and include farming, industrial, residential, and commercial noise sources. The sections below describe the prevailing noise conditions (and vibration conditions, if unusual) and noise-and vibration-sensitive receptors in the area of analysis. On the whole, no major long-term sources of vibration are known to exist in the area of analysis.



FigureE1-1. Noise and Vibration Area of Analysis

E1.2.1 Merced County

As summarized in the Noise and Vibration Affected Environment, in specific areas of Merced County, transportation noise is the dominant noise source. These sources include railroads, vehicular traffic, and airports (Merced County has five general aviation airports). Other areas of the county are dominated by agricultural land uses, and are relatively quiet. Freight and passenger trains pass through Merced County frequently, and constitute a primary source of noise. The county's rail traffic includes both high- and low-speed lines.

Specific noise sources throughout Merced County include sand and gravel excavation; a biomass electrical generating plant; trucking companies; chicken farms; fruit, nut, and vegetable processing and packaging plants; dog kennels; auto wreckers; winery processing facilities; dairies; recreational boating; and an auto racetrack.

The noise source closest to the proposed alternatives in the vicinity of the San Luis Reservoir is the O'Neill Forebay Recreational Boating area. Motor boats are the main source of noise at O'Neill Forebay.

The *2030 Merced County General Plan Draft Program Environmental Impact Report (EIR)* (2012) includes predicted traffic noise levels and traffic noise level increases expected with buildout associated with the General Plan. The FHWA Highway Traffic Noise Prediction Model was used in the General Plan to predict hourly L_{eq} values for free-flowing traffic conditions. To predict L_{dn} values, the input volume was adjusted to account for the day/night distribution of traffic. Table E1-9 summarizes these findings for 2010 and estimated 2030 traffic noise levels along roadways near San Luis Reservoir in Merced County. 2015 traffic volume data from Caltrans (2016) shows annual average daily traffic (AADT) volumes on State Route (SR) 152 that are similar to those listed in Table E1-3. This indicates that traffic noise levels on SR 152 near San Luis Reservoir have not changed appreciably from the data in Table E1-9.

Table E1-3. Traffic Noise Level Data, Merced County

SR 152 Segment	Existing (2010) AADT	Existing (2010) L_{dn} @ 100 Feet (dB)	2030 No Project L_{dn} @ 100 Feet (dB)	Change from Existing (dB)	2030 Buildout L_{dn} @ 100 Feet (dB)	Change from Existing (dB)
Santa Clara County Line to SR 33	23,800	74	78	5	78	5
SR 33 to Interstate 5	23,000	74	79	5	79	5
Interstate 5 to Ortigalita Rd. (West Los Banos)	21,600	72	77	5	77	5
Ortigalita Rd. to SR 165	26,500	73	74	1	74	1
SR 165 to Ward Rd. (East Los Banos)	32,000	74	74	0	74	0
Ward Rd. to SR 33 (Dos Palos)	17,500	72	75	3	75	3
SR 33 to SR 59	15,300	72	73	2	73	2
SR 59 to Madera County Line	15,400	71	73	2	73	2

Source: Merced County 2012.
Key:
AADT = annual average daily traffic
dB = decibel
L_{dn} = day-night average noise level
SR = state route

Merced County performed a community noise survey in 2006 for the General Plan *Background Report* (2013) in order to quantify existing noise levels in the quieter parts of the county. The survey included a monitoring location in the unincorporated town of Santa Nella, approximately two miles northeast of the reservoir. Based on the noise measurement results summarized in Table E1-4, an L_{dn} of 56 dBA was estimated for this location. Noise sources included traffic noise from the interstate and natural sounds.

Table E1-4. Merced County Noise Survey Data for the Town of Santa Nella

Time Period	L_{eq} (dB)	L_{max} (dB)
Morning	45.9	52.6
Afternoon	51.9	61.8
Nighttime	49.6	57.2

Source: Merced County 2013.
Key:
dB = decibel
L_{eq} = equivalent (average) noise level
L_{max} = maximum noise levels

E1.2.2 San Luis Reservoir

Noise monitoring conducted for the project consisted of continuous 24-hour noise readings at the San Luis Creek Use Area and campground on O'Neill Forebay. Additionally, spot-check noise readings were taken at several recreational locations at San Luis Reservoir. Table E1-5 lists the 24-hour noise readings taken at the San Luis Creek campground. The quietest noise levels were measured during the early afternoon during periods of calm winds; these measured 36 to 38 dBA 1-hour L_{eq} at the San Luis Creek Use Area. The noise levels increased at night from wind rustling the leaves in surrounding trees. Nighttime noise levels increased to 42 dBA 1-hour L_{eq} around the San Luis Creek Use Area.

Table E1-5. 24-Hour Baseline Noise Monitoring Results in Proposed Project Area (at San Luis Creek Campground)

Date	Time	1-hour L_{eq} (dBA)
9/11/2003	13:00	46
	14:00	38
	15:00	38
	16:00	37
	17:00	36
	18:00	36
	19:00	38
	20:00	37
	21:00	40
	22:00	40
	23:00	38
9/12/2003	0:00	38
	1:00	38
	2:00	37
	3:00	42
	4:00	39
	5:00	40
	6:00	41
	7:00	39
	8:00	44
	9:00	41
	10:00	40
	11:00	40

Source: Santa Clara Valley Water District 2003.
Key:
dBA = A-weighted decibel scale
L_{eq} = equivalent energy level

Table E1-6 summarizes the findings from noise monitoring completed at recreational sites around San Luis Reservoir and O'Neill Forebay. Measured daytime noise levels at campgrounds and picnic areas were low, ranging from 39 to 43 dBA L_{eq} (5-minute, 10-minute, and 15-minute durations), with most of the observed noise generated by cars traveling on nearby park roads. Power boats on the reservoir are an additional noise source.

Table E1-6. Baseline Noise Monitoring Results

Location	Date	Start Time	Duration (minutes)	L_{eq} (dBA)	Dominant Noise Sources
Medeiros Picnic Area	9/11/2003	3:35 p.m.	10	43	Cars on local park road
Basalt Area Campground #5	9/11/2003	2:55 p.m.	10	42	Cars on campground road
Dinosaur Point Picnic Area	9/12/2003	10:14 a.m.	10	40	Very quiet
Visitor Center	9/11/2003	9:46 a.m.	15	48	Traffic on SR 152, cars in parking lot
San Luis Creek Area Boat Launch	9/11/2003	11:07 a.m.	10	42	Cars in parking lot, airplanes
Pacheco State Park (at gate to Dinosaur Point)	9/12/2003	10:45 a.m.	5	39	Very quiet; some wind noise

Source: Santa Clara Valley Water District 2003.
Key:
dBA = A-weighted decibel scale
L_{eq} = equivalent energy level
SR = scenic route

The *San Luis Reservoir Resource State Recreation Area Final Resource Management Plan/General Plan and Final Environmental Impact Statement/Environmental Impact Report* (United States Department of the Interior, Bureau of Reclamation [Reclamation] and CDPR 2013) identifies noise-sensitive land uses around the reservoir. The Basalt Use Area and the Dinosaur Point Use Area would be closed during construction and are not included as noise-sensitive receptors in this analysis. Additionally, the Operations and Maintenance facilities for the Department of Water Resources (DWR) and the Gianelli Pumping Plant were not included as noise-sensitive receptors because they are onsite workers and are covered by Occupational Safety and Health Administration (OSHA) noise regulations to protect workers from excessive noise exposure. The receptors analyzed include:

- Romero Visitor Center (located along SR 152 west of the Gonzaga Road entrance).
- San Luis Wildlife Area (managed by the Department of Fish and Wildlife, located at the western edge of the Reservoir, north of Pacheco State Park), this area is designated for hiking, bird watching, and hunting. There are no developed facilities in this area.

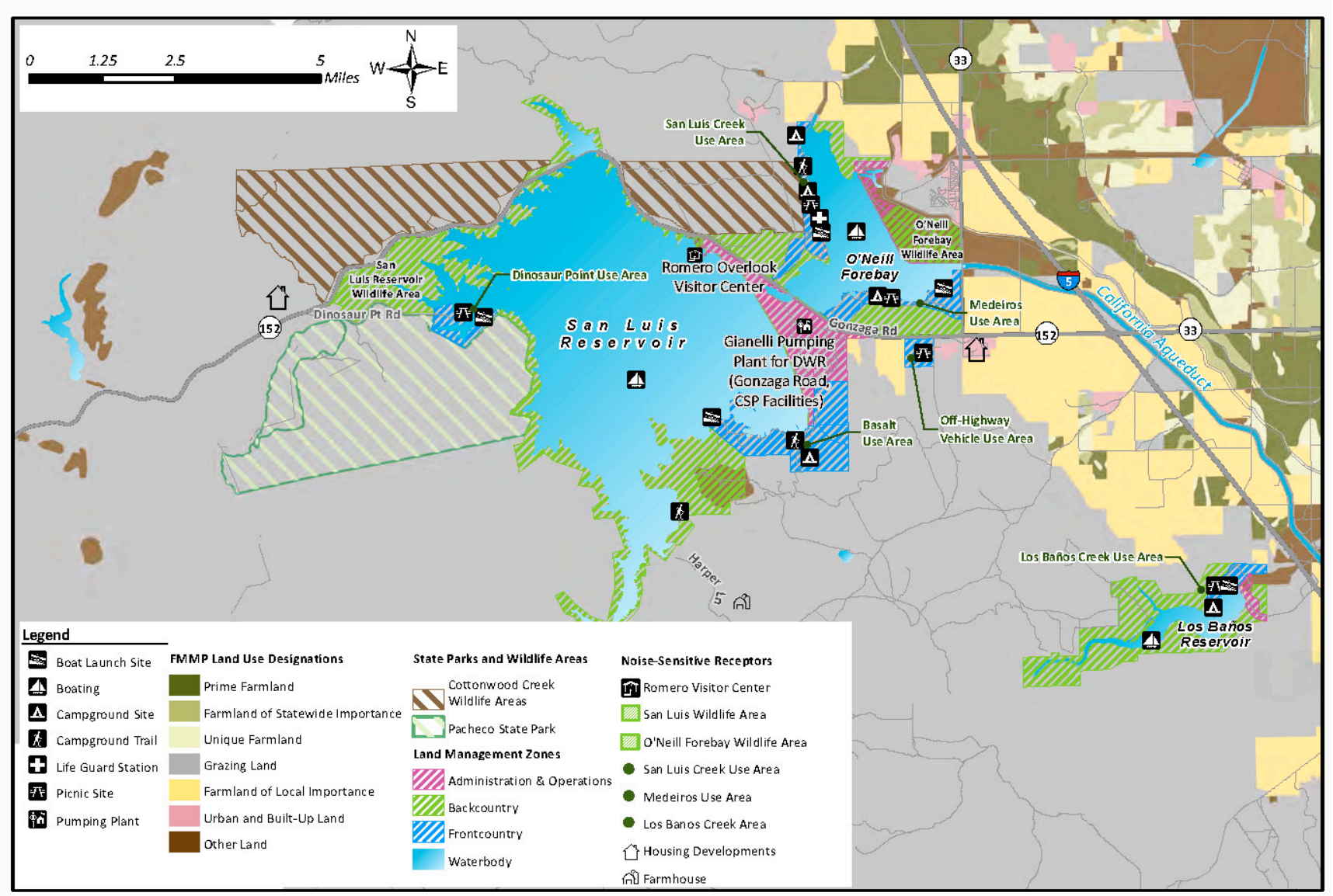
- O'Neill Forebay Wildlife Area (located northeast of the O'Neill Forebay), this area is used for hunting and passive recreation.

- San Luis Creek Use Area (located on the north side of SR 152, west of O'Neill Forebay), this area is the most developed within the project area and contains group and recreational vehicle camping, a swimming beach, boat launch site, and picnic areas.

- Medeiros Use Area (located on the south side of the O'Neill Forebay and north of SR 152) this area is predominantly used for windsurfing and camping.

- Los Banos Creek Use Area (located southeast of the San Luis Reservoir approximately one and a half miles west of Interstate 5), this area contains flood management facilities, hiking trails, camping, and picnic areas, among other recreational uses.

Land uses surrounding San Luis Reservoir consist mainly of publicly owned parkland and wildlife areas maintained and managed by the State of California. Several campgrounds and day-use picnic areas present along the shores of the reservoir and forebay are relatively close to areas where construction activities would take place under some project alternatives. The residences nearest potential construction sites at San Luis Reservoir include a cluster of homes on Dinosaur Point Road between SR 152 and Whiskey Flat Trail, and a farmhouse located approximately one mile southeast of the reservoir along Harper Lane. Northeast of O'Neill Forebay, housing tracts face SR 33, which would be a travel route for workers and haul trucks. Figure E1-2 depicts these noise-sensitive land uses around San Luis Reservoir.



Source: Reclamation and CDPR 2013.

Figure E1-2. Noise-Sensitive Land Uses Near San Luis Reservoir

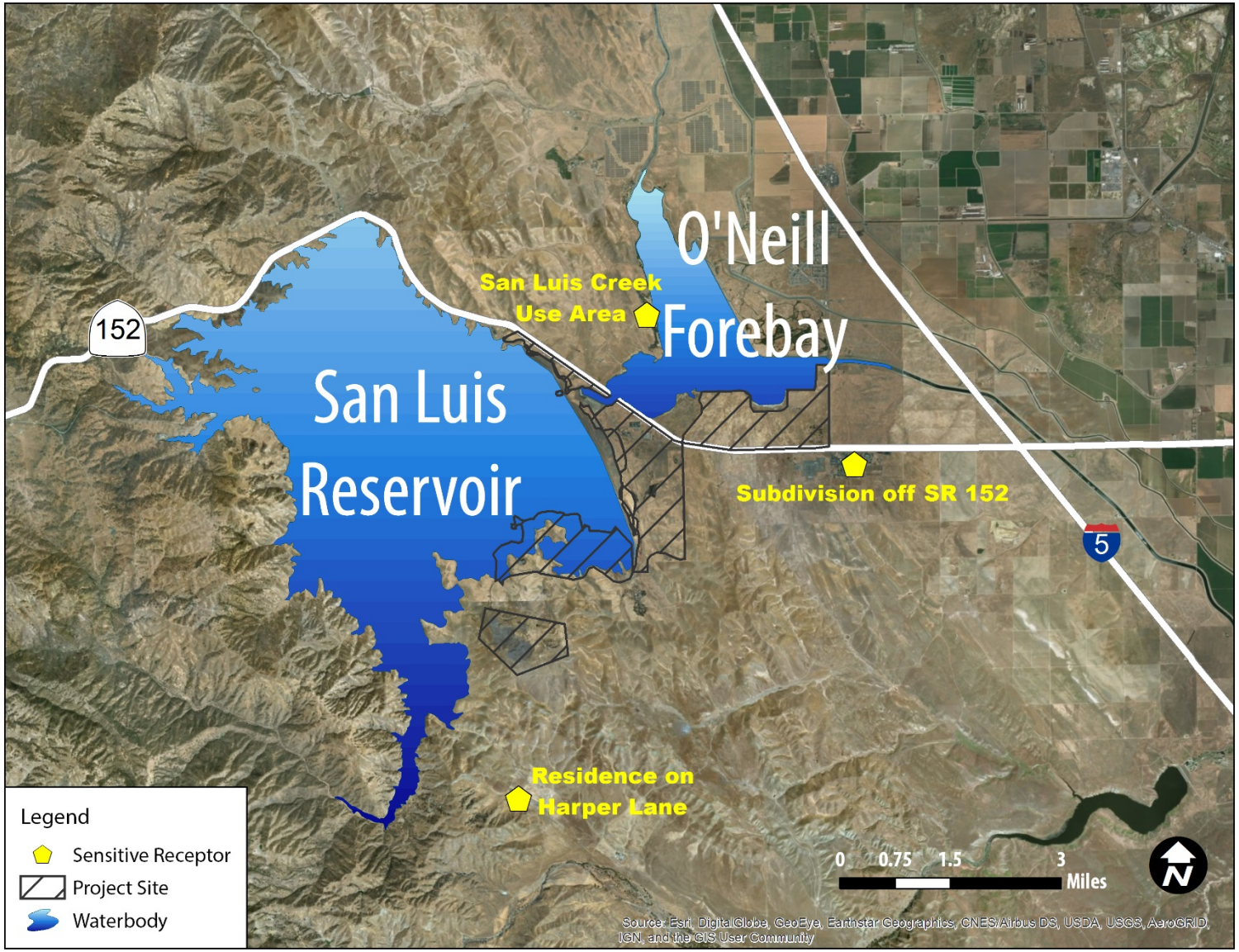


Figure E1-3. Noise Sensitive Receptors (Alternative 4)

E1.2.3 Santa Clara Valley Water District Service Area

Existing conditions are described for the Santa Teresa Water Treatment Plant (WTP), which is within the Santa Clara Valley Water District (SCVWD) Service Area.

The WTP is in developed to partly-developed areas of Santa Clara County in the City of San Jose. The noise sensitive land uses are residences, schools, churches and other noise-sensitive receivers near the WTP.

As summarized in the Noise and Vibration Affected Environment, at the SCVWD Santa Teresa WTP in San Jose, the estimated noise level is an L_{dn} of 55 dBA. This is based on noise monitoring data in the *Envision San Jose 2040 General Plan Comprehensive Update Environmental Noise Assessment* (Illingworth & Rodkin, Inc. 2010). At the closest monitored location to the water treatment plant, a L_{dn} of 56 dBA was measured 110 feet from the nearest lane of the Almaden Expressway. The Santa Teresa WTP is located in an open space area adjacent to a residential neighborhood. Figure E1-4 identifies the sensitive receptors closest to the Santa Teresa WTP.

E1.2.4 Pacheco Reservoir Region

As summarized in the Noise and Vibration Affected Environment, Pacheco Reservoir is in a largely undeveloped portion of Santa Clara County. The noise sensitive land uses are residences. At Pacheco Reservoir, the estimated noise level is an L_{dn} 40 dBA. This is based on the United States Environmental Protection agency (USEPA) *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (USEPA 1974). Pacheco Reservoir is located in an open space area adjacent to rural, grazing land use. The following are the sensitive receptors closest to Pacheco Reservoir:

- Residence on El Toro Road
- Residence on unnamed access road
- Residence off SR 152

Figure E1-5 identifies the sensitive receptors closest to the construction areas associated with the Pacheco Reservoir Expansion Alternative.

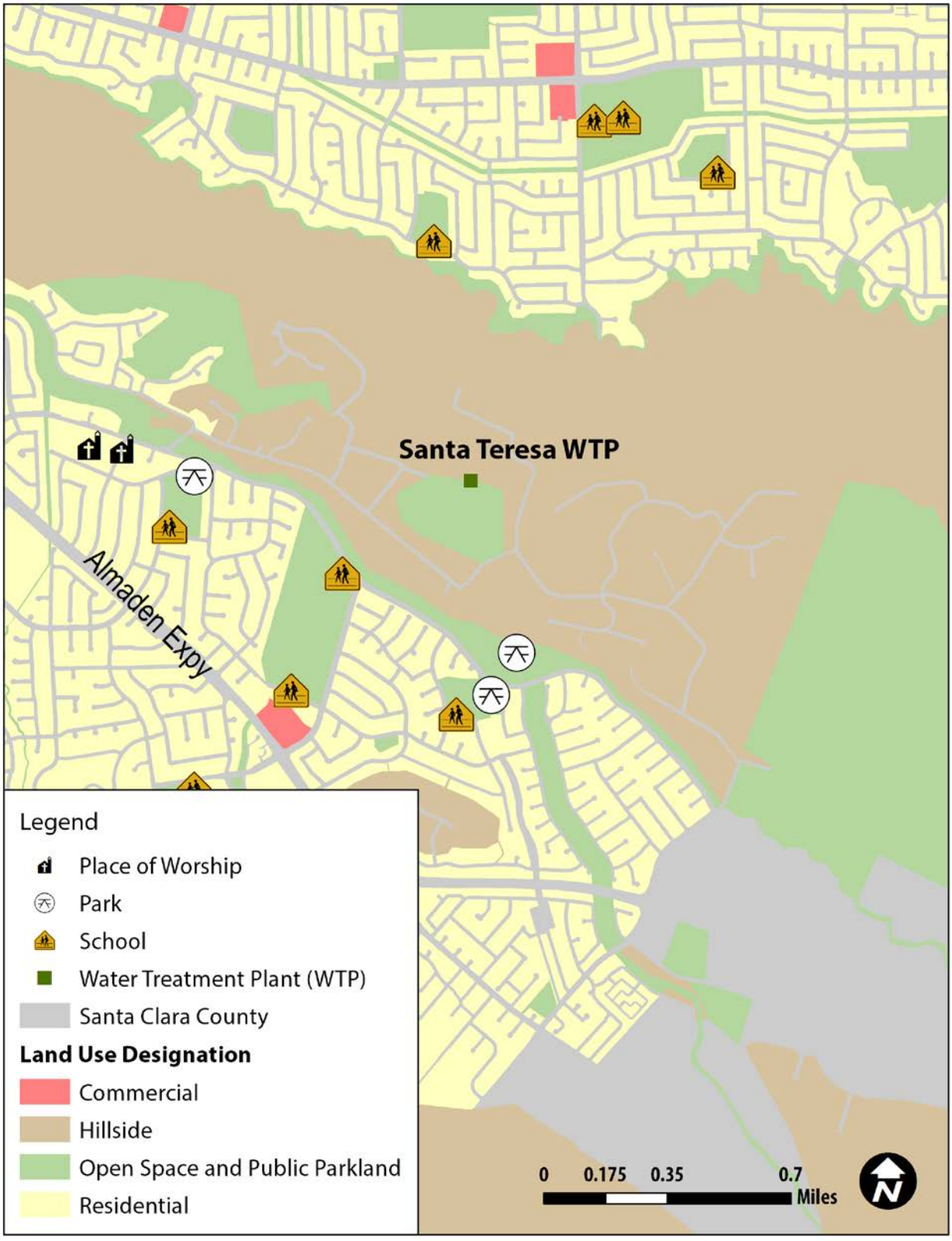


Figure E1-4. Noise-Sensitive Land Uses Near Santa Teresa WTP

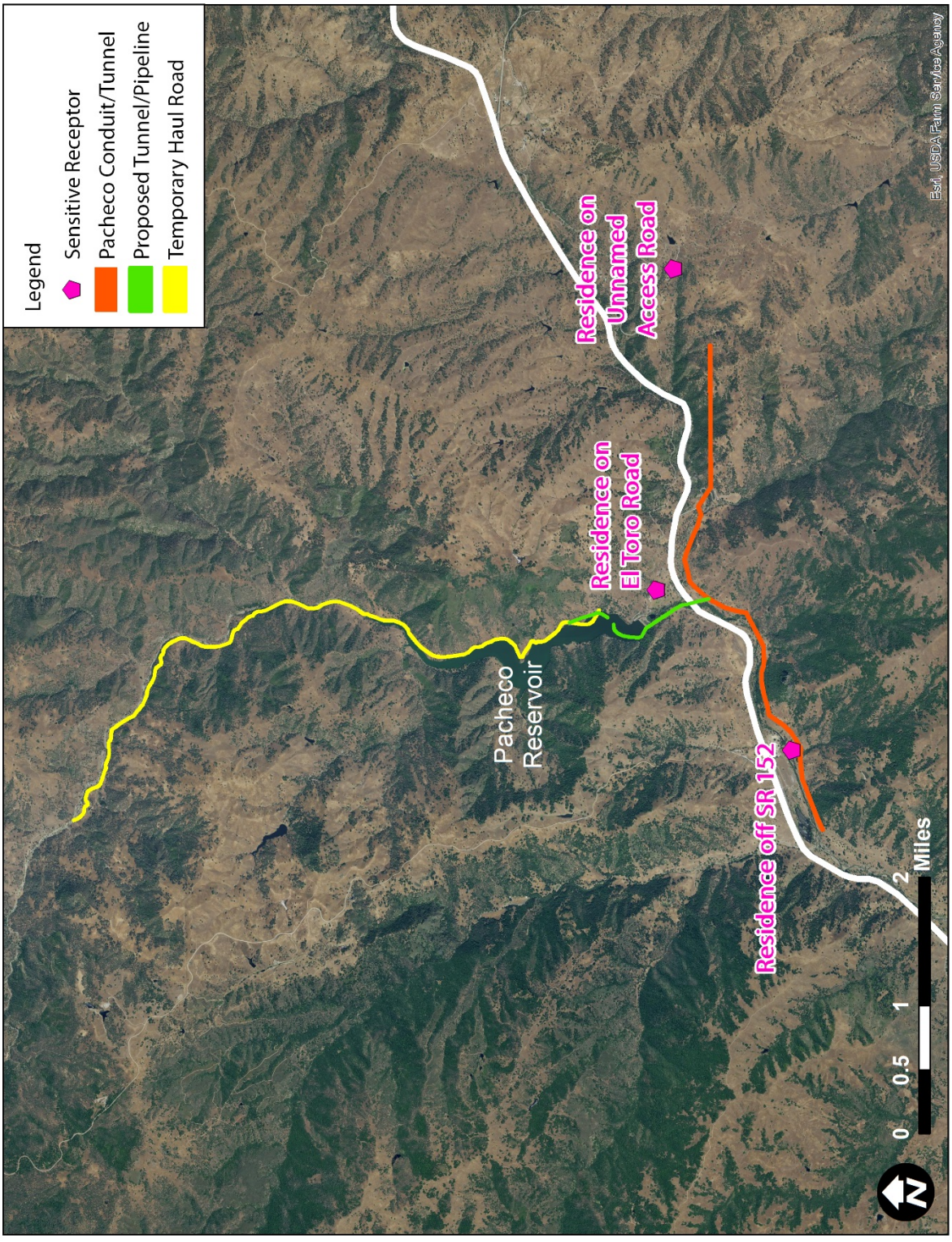


Figure E1-5. Noise Sensitive Receptors Near Pacheco Reservoir

E1.3 Assessment Methods

This section describes the approach and methods used to analyze the noise and vibration impacts related to construction and operation of the project alternatives. The focus of this analysis is on potential temporary construction and long-term impacts to local noise-sensitive receptor sites located near the proposed alternatives. Off-site vehicle trip assumptions are consistent with those used in Chapter 15, Traffic and Transportation, and construction and operational activities are consistent with those used in Chapter 10 Air Quality.

Activities with the potential for generating short-term, temporary increases in noise levels include construction activities and construction-related traffic. Long-term noise impacts could occur from operation of new facilities or new water treatment equipment. Activities that would have no, or negligible, noise impacts include the implementation of operational measures like facilitation and delivery of Central Valley Project (CVP) water using the South Bay Aqueduct.

The noise level at nearby sensitive receptors during the construction of each alternative was calculated by (1) attenuating the construction sound level for distance to the receptor and (2) logarithmically adding the attenuated construction noise source level to the ambient noise level. Construction noise was predicted using the equations and guiding principles from the FHWA Roadway Construction Noise Model (RCNM). The RCNM database provides maximum noise levels for various pieces of construction equipment at a reference distance of 50 feet. The types of construction equipment that could be used during the construction of each alternative, the percentage of time that the equipment would operate at full power (usage factor) during an hour and each piece's maximum noise level are presented in Table E1-7. The construction equipment is anticipated to operate only during weekdays and during daylight hours with the exception of Lower San Felipe Intake Alternative. For the Lower San Felipe Intake Alternative tunnel option, it was assumed that tunnel boring operations would continue 24 hours per day; therefore, 12 employees would work in the tunnel each day (assumes four workers per 8-hour shift).

Table E1-7. Construction Equipment Types and Noise Levels

Equipment Type	Usage Factor	L_{max} at 50 Feet
All Other Equipment Greater than 5 hp	50%	85
Auger Drill Rig	20%	84
Compactor (ground)	20%	83
Concrete Mixer Truck	40%	79
Concrete Pump Truck	20%	81
Concrete Saw	20%	90
Crane	16%	81

Equipment Type	Usage Factor	L_{max} at 50 Feet
Dozer	40%	82
Drill Rig Truck	20%	79
Dump Truck	40%	76
Excavator	40%	81
Flat Bed Truck	40%	74
Front End Loader	40%	79
Generator	50%	81
Grader	40%	85
Roller	20%	80
Scraper	40%	84
Slurry Trenching Machine	50%	80

Source: FHWA 2006.
hp = horsepower
L_{max} = maximum noise level measured during a monitoring period

E1.4 Significance Criteria

The significance criteria described below were developed consistent with the CEQA Guidelines (applicable to this project) to determine the significance of potential impacts on noise that could result from implementation of the project. As summarized in the Noise and Vibration Impacts section, impacts on noise would be considered potentially significant if the project would result in:

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;
- 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, would the project expose people residing or working in the project area to excessive noise levels.

For the purpose of this analysis, noise levels in excess of standards established in the local general plan or noise ordinance vary for each alternative. For Alternatives 2 and 4, the Merced County Code (See Section C.3.8 in Appendix C) sets sound level limitations that no sound source should exceed the background sound level at the receiving property line by 10 dBA or more during the daytime hours (7 a.m. to 10 p.m.) and by 5 dBA or more during the nighttime hours (10 p.m. to 7 a.m.). However, the county's ordinance exempts construction activities during the daytime hours between 7 a.m. and 6 p.m. Therefore, for Alternatives 2 and 4, noise levels would be significant if they exceed the background sound level by 5 dBA or more during the nighttime hours.

For Alternative 3, Section 20.100.450 of the San Jose Municipal Code (See Section C.3.7 in Appendix C) limits hours of construction within 500 feet of a residential unit to Monday through Friday 7 a.m. to 7 p.m. In addition, the San Jose 2040 General Plan considers significant construction noise impacts to occur if a project located within 500 feet of a residential use or 200 feet of a commercial or office uses would involve substantial noise generating activities continuing for more than 12 months. Therefore, noise levels would be significant if construction took place within 500 feet of a residential unit outside of the designated hours and/or substantial noise generating activities continued for more than 12 months.

For Alternative 5, the Santa Clara County Ordinance (See Section C.3.14 in Appendix C) sets maximum permissible sound levels by receiving land use (See Table C-10). Additionally, the County has established maximum noise levels for construction activities (See Table C-11). Noise levels would be significant if they exceed the Santa Clara County maximum daytime noise level standard of 55 dBA from 7:00 a.m.- 10:00 p.m. or exceed the maximum nighttime noise level standard of 45 dBA from 10:00 p.m. – 7:00 a.m.

Project construction and operation that produce vibration levels that exceed 0.3 in/sec would be significant (Caltrans 2013b). Santa Clara County Code (Section B.11-194.2.7) prohibits operating any device that creates a vibrating effect that a) endangers or injures the safety or health of human beings or animals; or b) annoys or disturbs a person of normal sensitivities; or c) endangers or injures personal or real properties. These two criteria were utilized to evaluate the second bullet.

The significance criteria described above apply to the noise receptors that could be affected by the project. Changes in noise are determined relative to existing conditions and the No Action/No Project Alternative.

E1.5 Noise and Vibration Calculation Summary Tables

E1.5.1 Alternative 2- Lower San Felipe Intake

Table E1-8 summarizes the results of possible vibration effects from each construction phase for Alternative 2 (Tunnel Option). Detailed calculations are provided in Appendix E3.

Table E1-8. Summary of Vibration Effects from Lower San Felipe Intake Alternative (Tunnel Option)

Phase	Residence on Harper Lane (PPV, in/sec)	San Luis Creek Use Area (PPV, in/sec)	Subdivision off SR 152 (PPV, in/sec)
Mobilization	0.000060	0.000137	0.000091
Site Improvements	0.000060	0.000137	0.000091
Construct Vertical Shaft	0.000123	0.000279	0.000185
Set up TBM	0.000014	0.000031	0.000020
Tunneling and Spreading of Soils	0.000050	0.000113	0.000075
Cofferdam and TBM Out	0.000014	0.000031	0.000020
Connect to Existing Intake	0.000118	0.000267	0.000177
Fabricate Inlet	0.000118	0.000267	0.000177
Set Inlet and Flood Tunnel	0.000014	0.000031	0.000020
Construct Aeration Facility	0.000127	0.000287	0.000190
Fabricate and Set Air Tubing	0.000041	0.000092	0.000061
Final Work and Testing	0.000014	0.000031	0.000020
Demobilization	0.000050	0.000113	0.000075
Maximum	**0.000127**	**0.000287**	**0.000190**
Significant?	No	No	No

Key:
in/sec = inches per second
PPV = peak particle velocity
TBM = tunnel boring machine

Table E1-9 summarizes the daytime unmitigated L_{eq} that would occur at the nearest sensitive receptor from each construction area for Alternative 2 (Tunnel Option). Detailed calculations are provided in Appendix E2.

Table E1-9. Maximum 1-Hour Construction Phase L_{eq} (dBA) Increase Over No Action/No Project Alternative – Lower San Felipe Intake Alternative (Tunnel Option)

Construction Phase	Total from Residence on Harper Lane[1]	Increase from Residence on Harper Lane	Total from San Luis Creek Use Area[1]	Increase from San Luis Creek Use Area	Total from Residence off Dinosaur Point Road[1]	Increase from Residence off Dinosaur Point Road
Mobilization	40	0	41	1	40	0
Site Improvements	40	0	42	2	41	1
Construct Vertical Shaft	40	0	42	2	41	1
Set up TBM	40	0	41	1	40	0
Tunneling and Spreading of Soils	40	0	42	1	41	1
Cofferdam and TBM Out	40	0	41	1	40	0
Connect to Existing Intake	40	0	42	2	41	1
Fabricate Inlet	40	0	42	2	41	1

Construction Phase	Total from Residence on Harper Lane[1]	Increase from Residence on Harper Lane	Total from San Luis Creek Use Area[1]	Increase from San Luis Creek Use Area	Total from Residence off Dinosaur Point Road[1]	Increase from Residence off Dinosaur Point Road
Set Inlet and Flood Tunnel	40	0	41	1	40	0
Construct Aeration Facility	40	0	42	2	41	1
Fabricate and Set Air Tubing	40	0	41	1	40	0
Final Work and Testing	40	0	41	1	40	0
Demobilization	40	0	41	1	41	1
Maximum Construction Phase	**40**	**0**	**42**	**2**	**41**	**1**
Significant?	n/a	No	n/a	No	n/a	No

Note:

[1] Ambient (background) noise level during existing conditions equal to 40 dBA (see Table E-10 and Table E1-11 for baseline noise monitoring data).

Key:

dBA = A-weighted decibel scale

L_{eq} = equivalent energy level

TBM = tunnel boring machine

Table E1-10 summarizes the results of possible vibration effects from each construction phase for Alternative 2 (Pipeline Option). Detailed calculations are provided in Appendix E3.

Table E1-10. Summary of Vibration Effects from Lower San Felipe Intake Alternative (Pipeline Option)

Phase	Residence on Harper Lane (PPV, in/sec)	San Luis Creek Use Area (PPV, in/sec)	Subdivision off SR 152 (PPV, in/sec)
Mobilization	0.000033	0.000075	0.000050
Site Improvements	0.000074	0.000168	0.000111
Fabricate Inlet	0.000014	0.000031	0.000020
Build Cofferdam and Set Lower Inlet	0.000014	0.000031	0.000020
Lay Pipe	0.000041	0.000092	0.000061
Connect to Existing Intake	0.000014	0.000031	0.000020
Construct Aeration Facility	0.000063	0.000144	0.000095
Fabricate and Set Air Tubing	0.000014	0.000031	0.000020
Final Work and Testing	0.000014	0.000031	0.000020
Demobilization	0.000050	0.000113	0.000075
Maximum	**0.000074**	**0.000168**	**0.000111**
Significant?	No	No	No

Key: in/sec = inches per second; PPV = peak particle velocity

Table E1-11 summarizes the daytime unmitigated Leq that would occur at the nearest sensitive receptor from each construction area. Detailed calculations are provided in Appendix E2.

Table E1-11. Maximum 1-Hour Construction Phase L_{eq} (dBA) Increase Over No Action/No Project Alternative – Lower San Felipe Intake Alternative (Pipeline Option)

Construction Phase	Total from Residence on Harper Lane[1]	Increase from Residence on Harper Lane	Total from San Luis Creek Use Area[1]	Increase from San Luis Creek Use Area	Total from Residence off Dinosaur Point Road[1]	Increase from Residence off Dinosaur Point Road
Mobilization	40	0	41	1	40	1
Site Improvements	40	0	42	2	41	1
Fabricate Inlet	40	0	41	1	40	0
Build Cofferdam and Set Lower Inlet	40	0	41	1	40	0
Lay Pipe	40	0	41	1	40	0
Connect to Existing Intake	40	0	41	1	40	0
Construct Aeration Facility	40	0	42	2	41	1
Fab and Set Air Tubing	40	0	41	1	40	0
Final Work and Testing	40	0	41	1	40	0
Demobilization	40	0	41	1	40	0
Maximum Construction Phase	**40**	**0**	**42**	**2**	**41**	**1**
Significant?	n/a	No	n/a	No	n/a	No

Note: [1]Ambient (background) noise level during existing conditions equal to 40 dBA (see Table E1-10 and Table E1-11 for baseline noise monitoring data).

E1.5.2 Alternative 4- San Luis Reservoir Expansion

Table E1-12 summarizes the daytime and nighttime unmitigated Leq that would occur at the nearest sensitive receptor from each construction area for Alternative 4. Detailed calculations are provided in Appendix E2.

Table E1-12. Maximum 1-Hour Construction Phase L_{eq} (dBA) Increase Over No Action/No Project Alternative – San Luis Reservoir Expansion Alternative

Sensitive Receptor	Total Noise Level[1] (dBA)	Increased Noise Level (dBA)	Significant?
Daytime			
Residence on Harper Lane	40	0	No
San Luis Creek Use Area	49	9	No
Subdivision off SR 152	44	4	No

Sensitive Receptor	Total Noise Level[1] (dBA)	Increased Noise Level (dBA)	Significant?
Nighttime			
Residence on Harper Lane	33	3	No
San Luis Creek Use Area	48	18	Yes
Subdivision off SR 152	43	13	Yes

Note: [1] Ambient (background) noise level during existing conditions equal to 40 dBA during the day and 30 dBA at night.
Key: dBA = A-weighted decibel scale

E1.5.3 Alternative 5- Pacheco Reservoir Expansion

Table E1-13 summarizes the total daytime unmitigated L_{eq} that would occur at the nearest sensitive receptor from the construction area and whether these noise levels exceed Santa Clara County maximum noise limits.

Table E1-13. Maximum 1-Hour Construction Phase L_{eq} (dBA) and Exceedance of Maximum Noise Level Standards– Pacheco Reservoir Expansion Alternative

Sensitive Receptor	Total Noise Level[1] (dBA)	Exceed Maximum Daytime Noise Levels[2]?	Exceed Maximum Nighttime Noise Levels[3]?
Residence on El Toro Road	69	Yes	Yes
Residence on unnamed access road	44	No	No
Residence off SR 152	50	No	Yes

Note:[1] Ambient (background) noise level during existing conditions equal to 40 dBA during the day and 30 dBA at night.
[2] 55 dBA from 7:00 a.m.- 10:00 p.m.
[3] 45 dBA from 10:00 p.m.- 7:00 a.m.
Key: dBA = A-weighted decibel scale

Table E1-14 summarizes the peak day maximum PPV (in/sec) at sensitive receptors for the Pacheco Reservoir Expansion Alternative.

Table E1-14. Peak Day Maximum PPV at Sensitive Receptors

Sensitive Receptor	Maximum PPV (in/sec)	Significant?
Residence on El Toro Road	0.156440	No
Residence on unnamed access road	0.005428	No
Residence off SR 152	0.011805	No

Notes: Reference distance for blasting is 2,500 feet
Significance Threshold: 0.3 in/sec
Key: in/sec= inches per second; PPV= peak particle velocity

Table E1-15 summarizes the total daytime unmitigated L_{eq} that would occur at the nearest sensitive receptor from each construction/ staging area for Alternative 5. Table E1-16 summarizes operational noise levels at sensitive receptors. Detailed calculations are provided in Appendix E2.

Table E1-15. Maximum 1-Hour Construction Phase Leq (dBA) Increase Over No Action/No Project Alternative – Pacheco Reservoir Expansion Alternative

Sensitive Receptor	Total Noise Level[1] (dBA)	Increased Noise Level (dBA)	Significant?
Residence on El Toro Road	69	29	Yes
Residence on unnamed access road	44	4	No
Residence off SR 152	50	10	Yes

Note: [1] Ambient (background) noise level during existing conditions equal to 40 dBA during the day and 30 dBA at night.
Key: dBA = A-weighted decibel scale

Table E1-16. 1-Hour Operational Noise Level at Sensitive Receptors (dBA)- Pacheco Reservoir Expansion Alternative

Sensitive Receptor	Distance from Pumping Plant (ft)	Total Noise Level[1] (dBA)	Increased Noise Level (dBA)	Significant?
Residence on El Toro Road	2,130	54	14	Yes
Residence on unnamed access road	14,600	40	0	No
Residence off SR 152	9,120	41	1	No

Note: [1]Ambient (background) noise level during existing conditions equal to 40 dBA.
Key: dBA = A-weighted decibel scale

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