

4.8 NOISE

INTRODUCTION

This section evaluates noise and vibration levels associated with implementation of the proposed project. The noise and vibration analysis in this section assesses: existing noise and vibration conditions at the project site and its vicinity, as well as short-term construction and long-term operational noise and vibration levels associated with the proposed project. Mitigation measures for significant impacts are recommended when appropriate to reduce noise and vibration levels.

EXISTING SETTING

Noise Characteristics and Effects

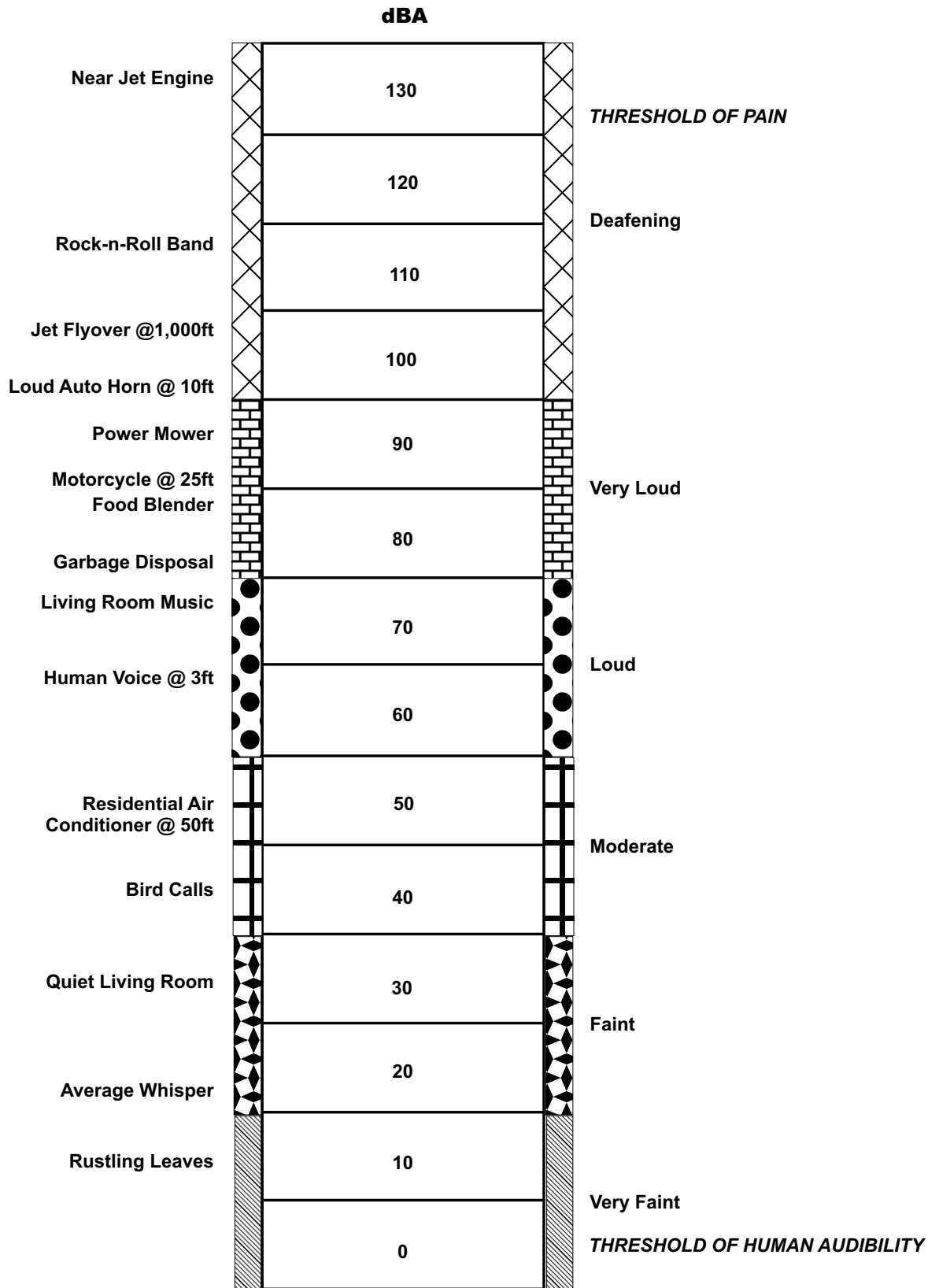
Characteristics of Sound. Sound is technically described in terms of the loudness (amplitude) and frequency (pitch) of the sound. The standard unit of measurement for sound is the decibel (dB). The human ear is not equally sensitive to sound at all frequencies. The “A-weighted scale,” abbreviated dBA, reflects the normal hearing sensitivity range of the human ear. On this scale, the range of human hearing extends from approximately 3 to 140 dBA. **Figure 4.8-1** provides examples of A-weighted noise levels from common sounds.

Noise Definitions. This noise analysis discusses sound levels in terms of Community Noise Equivalent Level (CNEL) and Equivalent Noise Level (L_{eq}).

Community Noise Equivalent Level. CNEL is an average sound level during a 24-hour period. CNEL is a noise measurement scale, which accounts for noise source, distance, single event duration, single event occurrence, frequency, and time of day. Human reaction to sound between 7:00 p.m. and 10:00 p.m. is as if the sound were actually 5 dBA higher than if it occurred from 7:00 a.m. to 7:00 p.m. From 10:00 p.m. to 7:00 a.m., humans perceive sound as if it were 10 dBA higher due to the lower background level. Hence, the CNEL is obtained by adding an additional 5 dBA to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and 10 dBA to sound levels in the night from 10:00 p.m. to 7:00 a.m. Because CNEL accounts for human sensitivity to sound, the CNEL 24-hour figure is always a higher number than the actual 24-hour average.

Equivalent Noise Level. L_{eq} is the average noise level on an energy basis for any specific time period. The L_{eq} for one hour is the energy average noise level during the hour. The average noise level is based on the energy content (acoustic energy) of the sound. L_{eq} can be thought of as the level of a continuous noise which has the same energy content as the fluctuating noise level. The equivalent noise level is expressed in units of dBA.

Effects of Noise. Noise is generally defined as unwanted sound. The degree to which noise can impact the human environment range from levels that interfere with speech and sleep (annoyance and nuisance) to levels that cause adverse health effects (hearing loss and psychological effects). Human response to noise is subjective and can vary greatly from person to person. Factors that influence individual response include the intensity, frequency, and pattern of noise, the amount of background noise present before the intruding noise, and the nature of work or human activity that is exposed to the noise source.



SOURCE: TAHA, 2011.

Audible Noise Changes. Studies have shown that the smallest perceptible change in sound level for a person with normal hearing sensitivity is approximately 3 dBA. A change of at least 5 dBA would be noticeable and would likely evoke a community reaction. A 10-dBA increase is subjectively heard as a doubling in loudness and would cause a community response.

Noise levels decrease as the distance from the noise source to the receiver increases. Noise generated by a stationary noise source, or “point source,” will decrease by approximately 6 dBA over hard surfaces (e.g., reflective surfaces such as parking lots or smooth bodies of water) and 7.5 dBA over soft surfaces (e.g., absorptive surfaces such as soft dirt, grass, or scattered bushes and trees) for each doubling of the distance. For example, if a noise source produces a noise level of 89 dBA at a reference distance of 50 feet, then the noise level would be 83 dBA at a distance of 100 feet from the noise source, 77 dBA at a distance of 200 feet, and so on. Noise generated by a mobile source will decrease by approximately 3 dBA over hard surfaces and 4.8 dBA over soft surfaces for each doubling of the distance.

Generally, noise is most audible when traveling by direct line-of-sight.¹ Barriers, such as walls, berms, or buildings, that break the line-of-sight between the source and the receiver greatly reduce noise levels from the source since sound can only reach the receiver by bending over the top of the barrier. Sound barriers can reduce sound levels by up to 20 dBA. However, if a barrier is not high or long enough to break the line-of-sight from the source to the receiver, its effectiveness is greatly reduced.

REGULATORY FRAMEWORK

Redlands Municipal Code. The City of Redlands has established policies and regulations concerning the generation and control of noise that could adversely affect its citizens and noise sensitive land uses. Chapter 8.06 – Community Noise Control of the Redlands Municipal Code (RMC) includes exterior noise standards for residential, commercial and industrial land uses within the City of Redlands. **Table 4.8-1** shows the noise standards for the City of Redlands.

TABLE 4.8-1: CITY OF REDLANDS EXTERIOR AND INTERIOR NOISE LIMITS		
Receiving Land Use Category	Time Interval	Noise Level Limit (dBA CNEL)
Exterior Noise Limits		
Single-family residential districts	10:00 p.m. to 7:00 a.m. (nighttime)	50
	7:00 a.m. to 10:00 p.m. (daytime)	60
Multi-family residential districts; public space; institutional	10:00 p.m. to 7:00 a.m. (nighttime)	50
	7:00 a.m. to 10:00 p.m. (daytime)	60
Commercial	10:00 p.m. to 7:00 a.m. (nighttime)	60
	7:00 a.m. to 10:00 p.m. (daytime)	65
Industrial	Anytime	75
Interior Noise Limits		
Single-family residential districts	Anytime	45
Multi-family residential districts; public space; institutional	Anytime	45
Commercial	Anytime	50
Industrial	Anytime	60
SOURCE: Redlands Municipal Code, Title 8 (Health and Safety), Chapter 8.06 (Community Noise Control, Sections (8.06.070 and 8.06.080).		

¹Line-of-sight is an unobstructed visual path between the noise source and the noise receptor.

Section 8.06.070 indicates, “[n]o person shall operate, or cause to be operated, any source of sound at any location within the city or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person which causes the noise level when measured on any other property to exceed:

1. The noise standard for that land use specified in **Table 4.8-1** of this section for a cumulative period of more than thirty (30) minutes in any hour; or
2. The noise standard specified in **Table 4.8-1** of this section plus five (5) dB for a cumulative period of more than fifteen (15) minutes in any hour; or
3. The noise standard specified in **Table 4.8-1** of this section plus ten (10) dB for a cumulative period of more than five (5) minutes in any hour; or
4. The noise standard specified in **Table 4.8-1** of this section plus fifteen (15) dB for a cumulative period of more than one minute in any hour; or
5. The noise standard specified in **Table 4.8-1** of this section plus twenty (20) dB or the maximum measured ambient level, for any period of time.”

Subsection C of Section 8.06.070 states, “If the measured ambient level exceeds the allowable noise exposure standard within any of the first four (4) noise limit categories above, the allowable noise exposure standard shall be adjusted in five (5) dB increments in each category as appropriate to encompass or reflect said ambient noise level. In the event the ambient noise level exceeds the fifth noise limit category, the maximum allowable noise level under this category shall be increased to reflect the maximum ambient noise level.”

Regarding construction, Section 8.06.090, Subsection F includes the following prohibited disturbance: “Construction and/or Demolition: Operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration or demolition work between weekday hours of 6:00 p.m. and 7:00 a.m., including Saturdays, or at any time on Sundays or holidays, such that the sound therefrom creates a noise disturbance across a residential or commercial real property line, except for emergency work by public service utilities, the city, or another governmental entity. All mobile or stationary internal combustion engine powered equipment or machinery shall be equipped with exhaust and air intake silencers in proper working order, or suitable to meet the standards set forth herein.”

Section 8.06.080 establishes interior noise standards by land use category. Those standards are shown in **Table 4.8-1**. Single- and multi-family residential districts have an interior noise limit of 45 dBA, commercial uses have an interior noise limit of 50 dBA, and industrial uses have an interior noise limit of 60 dBA.

Noise Element of the General Plan. The City of Redlands Noise Element provides a comprehensive program to achieve and maintain land use compatibility with environmental noise levels. It identifies noise sources and noise sensitive land uses, and defines areas of noise impact for the purpose of developing programs to ensure that Redlands residents will be protected from excessive noise intrusion. Within the Noise Element is the Noise Land Use Compatibility Matrix similar to California Department of Health Services, which describes the noise levels compatible with a land uses, modified to City of Redlands standards found in **Table 4.8-1**. As shown in the table, the City has indicated that exterior noise levels at residential land uses should not exceed 60 dBA CNEL. Exterior land uses include private yards of single family as measured at the property line, multi-family private patios or balconies, mobile home parks, hospital patios, park picnic areas, school playgrounds, and hotel and recreational areas.

The Noise Element also includes general policies to control noise in the City. Policies relevant to the proposed project include:

- 9.0a Protect public health and welfare by eliminating existing noise problems where feasible and by preventing significant degradation of the future acoustic environment.
- 9.0b Incorporate noise considerations into land use planning decisions.
- 9.0e Use the criteria specified in **Table 4.8-4**, below, to assess the compatibility of proposed land uses with the projected noise environment, and apply the noise standards in **Table 4.8-1**, which prescribe interior and exterior noise standards in relation to specific land uses. Do not approve projects that would not comply with the standards in **Table 4.8-1**.
- 9.0f Require a noise impact evaluation based on noise measurements . . . as part of the project review process. Should measurements indicate that unacceptable noise levels will be created or experienced, require mitigation measures based on a detailed technical study prepared by a qualified acoustical engineer (i.e., a Registered Professional Engineer in the State of California with a minimum of three years experience in acoustics).
- 9.0h Minimize potential transportation noise through proper design of street circulation, coordination of routing, and other traffic control measures.
- 9.0i Require construction of barriers to mitigate sound emissions where necessary or where feasible, and encourage use of walls and berms to protect residential or other noise sensitive land uses that are adjacent to major roads, commercial, or industrial areas.
- 9.0s Require mitigation to ensure that indoor noise levels for residential living spaces not exceed 45 dB CNEL due to the combined effect of all exterior noise sources.
- 9.0t Require proposed commercial projects near existing residential land use to demonstrate compliance with the Community Noise Ordinance prior to approval of the project.
- 9.0u Require all new residential projects or replacement dwellings to be constructed near existing sources of non-transportation noise (including but not limited to commercial facilities or public parks with sports activities) to demonstrate via an acoustical study conducted by a Registered Engineer that the indoor noise levels will be consistent with the limits contained in the Community Noise Ordinance.
- 9.0v Consider the following impacts as possibly "significant":
 - An increase in exposure of four or more dB if the resulting noise level would exceed that described as clearly compatible for the affected land use, as established in **Table 4.8-4**, below, and **Table 4.8-1**, above; or
 - Any increase of six dB or more, due to the potential for adverse community response.

Vibration Characteristics and Effects

Characteristics of Vibration. Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. Vibration can be a serious concern, causing buildings to shake and rumbling sounds to be heard. In contrast to noise, vibration is not a common environmental problem. It is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. Some common sources of vibration

are trains, buses on rough roads, and construction activities, such as blasting, pile driving, and heavy earth-moving equipment.

Vibration Definitions. There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe vibration impacts to buildings and is usually measured in inches per second. The root mean square (RMS) amplitude is most frequently used to describe the effect of vibration on the human body. The RMS amplitude is defined as the average of the squared amplitude of the signal. Decibel notation (Vdb) is commonly used to measure RMS. The decibel notation acts to compress the range of numbers required to describe vibration.²

Effects of Vibration. High levels of vibration may cause physical personal injury or damage to buildings. However, ground-borne vibration levels rarely affect human health. Instead, most people consider ground-borne vibration to be an annoyance that can affect concentration or disturb sleep. In addition, high levels of ground-borne vibration can damage fragile buildings or interfere with equipment that is highly sensitive to ground-borne vibration (e.g., electron microscopes). To counter the effects of ground-borne vibration, the Federal Transit Administration (FTA) has published guidance relative to vibration impacts. According to the FTA, engineered concrete and masonry buildings can be exposed to ground-borne vibration levels of 0.3 inches per second without experiencing structural damage. Buildings extremely susceptible to vibration damage can be exposed to ground-borne vibration levels of 0.12 inches per second without experiencing structural damage.³

Applicable Regulations. There are no adopted City standards for ground-borne vibration. According to the Federal Transit Administration (FTA), standard buildings can be exposed to ground-borne vibration levels of 0.3 inches per second without experiencing structural damage.⁴

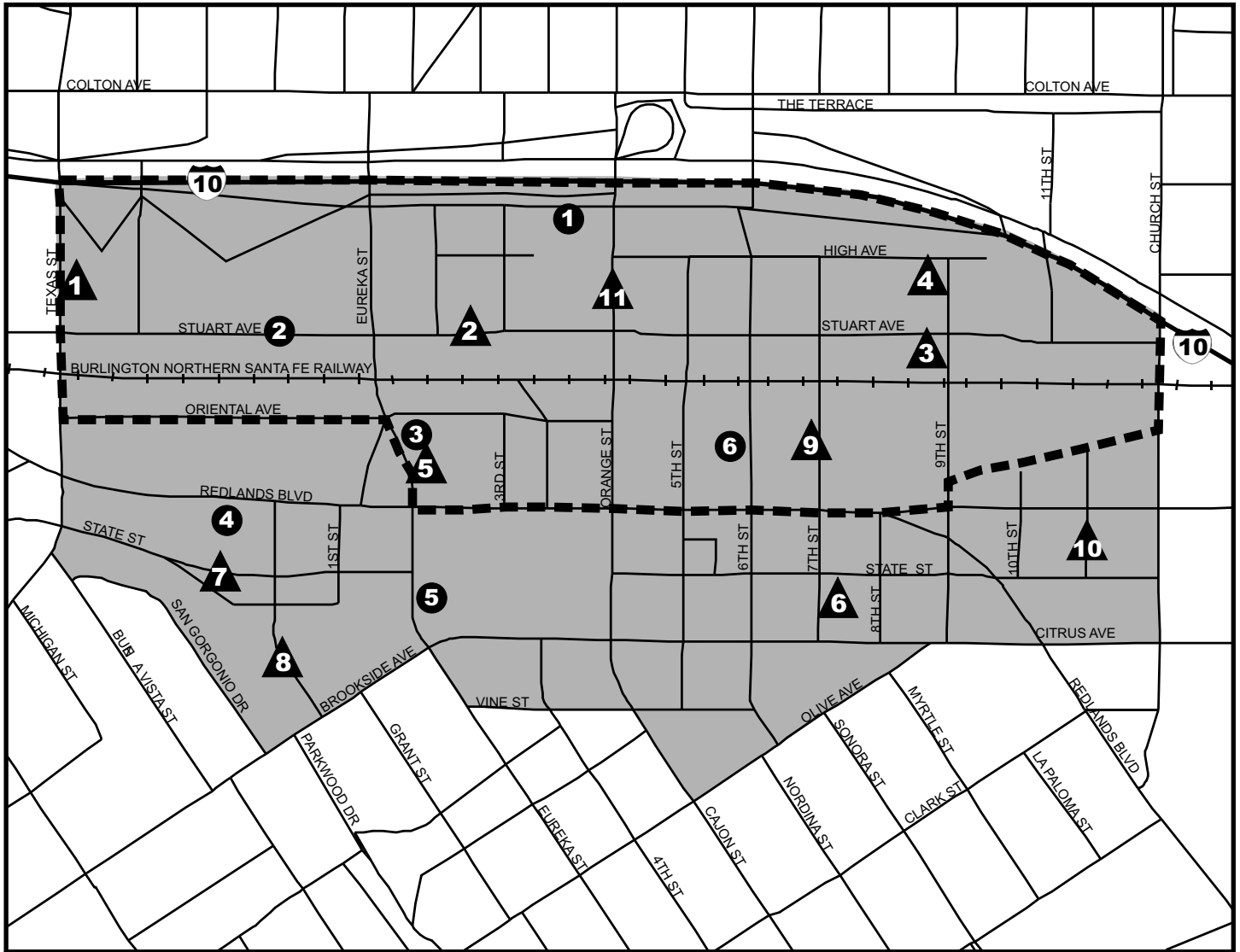
Existing Noise and Vibration Levels

Monitored Ambient Noise Levels. The existing noise environment is characterized by vehicular traffic and noises typical to an urban area (e.g., sirens, horns, helicopters, etc.). A series of 15-minute sound measurements were taken using a SoundPro DL Sound Level Meter between 7:00 a.m. and 2:00 p.m. on May 26, 2010 to determine existing ambient daytime and nighttime noise levels in the project vicinity. Noise monitoring locations are shown in **Figure 4.8-2**. As shown in **Table 4.8-2**, existing ambient sound levels ranged from 58.8 to 65.0 dBA L_{eq} during the AM peak hour period (7:00 to 9:00 a.m.). Off-peak ambient sound levels ranged from 51.8 to 60.2 dBA L_{eq} .




²*Ibid.*

³Federal Railway Administration, *High Speed Ground Transportation Noise and Vibration Impact Assessment*, October 2005.

⁴*Ibid.*



LEGEND:

-  Proposed Specific Plan Area
-  Peak Hour Noise Monitoring Locations
-  Off-Peak Hour Noise Monitoring Locations

SOURCE: TAHA, 2011.

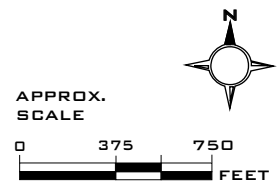


TABLE 4.8-2: EXISTING NOISE LEVELS		
Key to Figure 4.8-2	Noise Monitoring Location	Sound Level (dBA, L_{eq})
Peak Hour Period (7:30 to 9:30 a.m.)		
1	South side of Pearl Avenue between 3 rd and Orange Streets	65.0
2	North side of Stuart Avenue between Lawton and Eureka Streets	58.8
3	East side of Eureka Street between Oriental Avenue and Redlands Boulevard	62.1
4	South side of Redlands Boulevard between Texas and Kendall Streets	64.7
5	East side of Orange Street between Citrus Avenue and Vine Street	62.3
6	East side of 6 th Street between Stuart Avenue and Redlands Boulevard	59.3
Off-Peak Period		
1	East side of Texas Street between Stuart and Pearl Avenues	
2	North side of Stuart Avenue between Eureka and Orange Streets	54.1
3	South side of Stuart Avenue between 9 th and 7 th Streets	54.4
4	Southwest corner of 9 th Street and High Avenue	57.2
5	West side of Orange Street between Citrus Avenue and Vine Street	60.2
6	South side of State Street between 7 th and 8 th Streets	56.7
7	South side of State Street between Kendall and Texas Streets	51.8
8	East side of Kendall Street between Citrus and Brookside Avenues	52.0
9	East side of 7 th Street between Stuart Avenue and Redlands Boulevard	58.0
10	East side of 11 th Street between Central Avenue and State Street	52.5
11	East side of Orange Street between Pearl and Stuart Avenues	57.4
SOURCE: TAHA, 2010.		

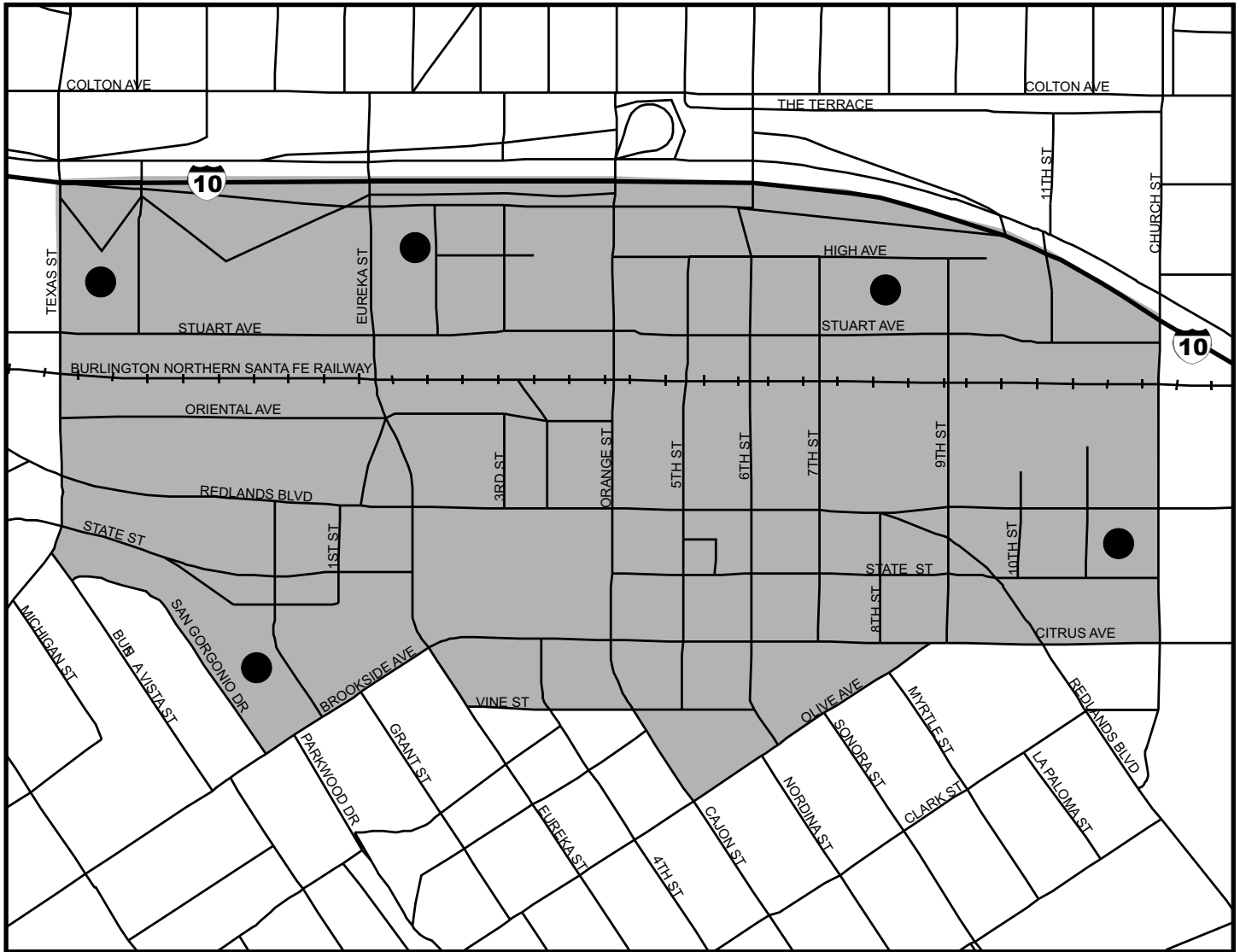
Modeled Vehicular Noise Levels. Vehicular traffic is the predominant noise source in the project vicinity. The CNEL was calculated for various roadway segments near the project site using existing traffic volumes provided by the project traffic consultant and the Federal Highway Administration (FHWA) RD-77-108 noise calculation formulas. As shown in **Table 4.8-3**, existing mobile source noise levels range from 60.2 to 66.7 dBA CNEL.

Ambient Vibration Levels. There are no stationary sources of vibration located near the project site. Heavy-duty trucks and trains can generate ground-borne vibrations that vary depending on vehicle type, weight, and pavement conditions. Based on field observations, vibration levels from adjacent roadways are not typically perceptible at the project site.



Sensitive Receptors

Noise- and vibration-sensitive land uses are locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Residences, schools, hospitals, guest lodging, libraries, and some passive recreation areas would each be considered noise- and vibration-sensitive and may warrant unique measures for protection from intruding noise. The sensitive receptors listed below are also shown in **Figure 4.8-3** and **4.8-4**.

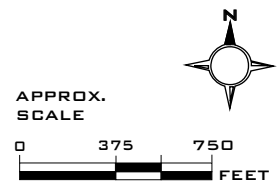
TABLE 4.8-3: EXISTING COMMUNITY NOISE EQUIVALENT LEVEL	
Roadway Segment	Estimated CNEL (dBA)
Redlands Boulevard between Texas Street and Eureka Street	62.3
Redlands Boulevard between Eureka Street and 3 rd Street	65.4
Redlands Boulevard between 3 rd Street and Orange Street	62.6
Redlands Boulevard between Orange Street and 6 th Street	65.4
Redlands Boulevard between 6 th Street and State Street	62.3
Pearl Avenue between Eastbound I-10 Off Ramp and Eureka Street	66.9
Pearl Avenue between Eureka Street and Orange Street	62.6
Pearl Avenue between Orange Street and 6 th Street	63.9
Pearl Avenue between 6 th Street and Eastbound I-10 On Ramp	62.3
Orange Street between Pearl Avenue and Stuart Avenue	66.7
Orange Street between Stuart Avenue and Oriental Avenue	65.5
Orange Street between Oriental Avenue and Redlands Boulevard	66.7
Orange Street between Redlands Boulevard and State Street	63.9
Orange Street between State Street and Citrus/Brookside Avenue	65.4
Orange Street between Citrus/Brookside Avenue and Olive Avenue	65.9
Westbound I-10 between Westbound I-10 Off Ramp and 6 th Street	60.2
Orange Street between Pearl Avenue and Colton Avenue	65.6
Orange Street between Olive Avenue and Clark Street	64.8
Redlands Boulevard between Texas Street and New York Street	62.0
Redlands Boulevard between Citrus/Brookside Avenue and Clark Street	65.7
SOURCE: TAHA, 2010.	

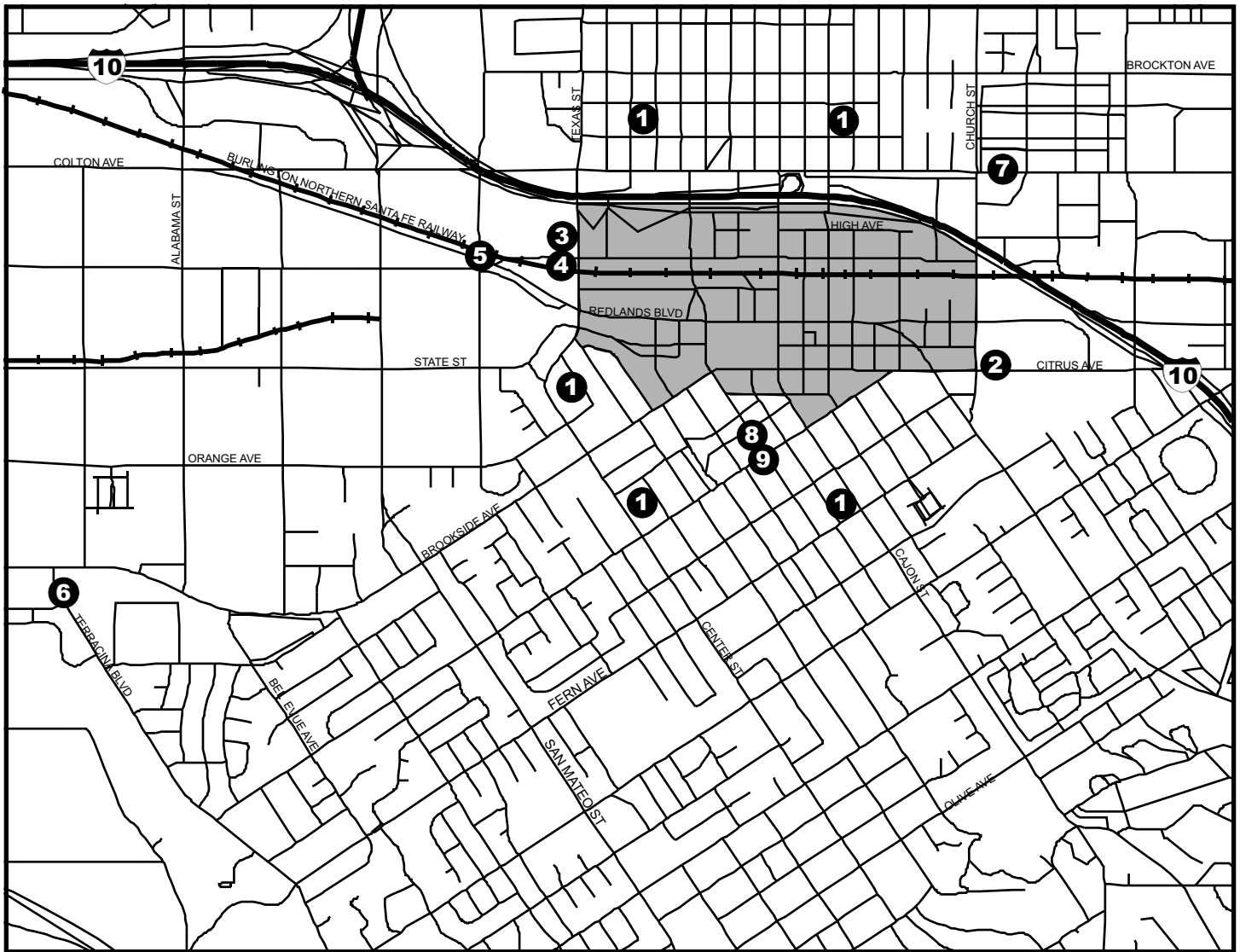


LEGEND:

-  Proposed Specific Plan Area
-  Sensitive Receptors - Single-family Residences

SOURCE: TAHA, 2011.





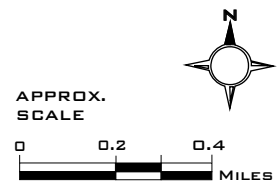
LEGEND:

 Proposed Specific Plan Area

 Off-Site Air Quality Sensitive Receptors

- 1. Residential Land Uses (Multiple locations north and south of the Proposed Specific Plan Area)
- 2. Redlands High School
- 3. Orangewood High School
- 4. Redlands Independent Study Education
- 5. Jeannie David Park
- 6. Redlands Community Hospital
- 7. Franklin Elementary School
- 8. A.K. Smiley Park
- 9. Sacred Heart Academy

SOURCE: TAHA, 2011.



On-Site Sensitive Receptors include the following:

- Single-family residences

Off-Site Sensitive Receptors include the following:

- Single- and multi-family residences located adjacent and south of the project site
- Redlands High School located 75 feet east of the project site
- Orangewood High School located 90 feet west of the project site
- RISE (Redlands Independent Study Education) located 90 feet west of the project site
- Lincoln Shrine (Park) located 210 feet south of the project site
- Davis Park located 490 feet west of the project site
- Franklin Elementary School located 780 feet northeast of the project site
- Smiley Park located 790 feet south of the project site
- Sacred Heart Academy (School) located 970 feet south of the project site

The above sensitive receptors represent the nearest sensitive receptors with the potential to be impacted by the proposed project. Additional sensitive receptors are located in the surrounding community and may be impacted by the proposed project.

THRESHOLDS OF SIGNIFICANCE

Noise

Construction. A significant impact would occur if:

- Construction activities would between the hours of 6:00 p.m. and 7:00 a.m. on Monday through Saturday, or at any time on Sunday or federal holidays.

Operational. Based on the Noise Element of the General Plan, a significant impact would occur if:

- Noise levels would increase by four or more dBA if the resulting noise level would exceed that described as clearly compatible for the affected land use, as established in **Table 4.8-4** and **Table 4.8-1**; or
- Any increase of six dBA or more, due to the potential for adverse community response.

Vibration

Construction. A significant impact would occur if:

- Construction activities would between the hours of 6:00 p.m. and 7:00 a.m. on Monday through Saturday, or at any time on Sunday or federal holidays.

Operational. A significant impact would occur if:

- If a device is operated that creates a vibration which is above the vibration perception threshold of an individual at or beyond the property boundary of the source if on private property or at one hundred fifty feet from the source if on a public space or public right of way; and/or
- Rail vibration levels exceed the FTA standard for residential exposure to frequent vibration of 72 VdB.

TABLE 4.8-4: NOISE/LAND USE COMPATIBILITY CHART							
Land Use Category	Community Noise Exposure - L_{dn} or CNEL (dBA)						
	60	65	70	75	80	85	>
RESIDENTIAL: Single Family, Duplex, Multiple Family							
RESIDENTIAL: Mobile Homes							
COMMERCIAL: Hotel, Motel, Transient Lodging							
COMMERCIAL: Commercial Retail, Bank, Restaurant, Movie Theater							
COMMERCIAL: Office Building, Research & Development, Professional Offices, City Office Building							
COMMERCIAL: Amphitheater, Concert Hall, Auditorium, Meeting Hall							
COMMERCIAL: Children's Amusement Park, Miniature Golf Course, Go-Cart Track, Equestrian Center, Sports Club							
COMMERCIAL: Automotive Service Station, Auto Dealership, Manufacturing, Warehousing, Wholesale, Utilities							
INSTITUTIONAL: Hospital, Church, Library, Schools Classroom							
OPEN SPACE: Parks							
OPEN SPACE: Golf Course, Cemeteries, Nature Centers, Wildlife Reserves, Wildlife Habitat							
AGRICULTURE: Agricultural Use							

	Normally Acceptable - Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction without any special noise insulation requirements.
	Conditionally Acceptable - New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply system or air conditionally will normally suffice.
	Normally Unacceptable - New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
	Clearly Unacceptable - New construction or development should generally not be undertaken.

SOURCE: City of Redlands, 1995 *General Plan*, August 1995, as amended December 12, 1997.

IMPACTS

Methodology

The noise analysis considers construction, operational, and vibration sources. Construction noise levels are based on information obtained from the United States Environmental Protection Agency. Vibration levels are based on data obtained from the FTA.⁵ Mobile source noise was modeled using the FHWA RD-77-108 noise calculation formulas.

⁵Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, May 2006.

Construction Impacts

Noise. Construction of the proposed project would result in temporary increases in ambient noise levels on an intermittent basis. Noise levels would fluctuate depending on the construction phase, equipment type and duration of use, distance between the noise source and receptor, and presence or absence of noise attenuation barriers.

Construction activities typically require the use of numerous pieces of noise-generating equipment. Typical noise levels from various types of equipment that may be used during construction are listed in **Table 4.8-5**. The table shows noise levels at distances of 50 and 100 feet from the construction noise source.

TABLE 4.8-5: MAXIMUM NOISE LEVELS OF COMMON CONSTRUCTION MACHINES		
Noise Source	Noise Level (dBA)	
	50 Feet /a/	100 Feet /a/
Front Loader	80	74
Trucks	89	83
Cranes (derrick)	88	82
Jackhammers	90	84
Generators	77	71
Back Hoe	84	78
Tractor	88	82
Scraper/Grader	87	81
Paver	87	81
Impact Pile Driving	101	95
Auger Drilling	77	71

/a/ Assumes a 6-dBA drop-off rate for noise generated by a "point source" and traveling over hard surfaces. Actual measured noise levels of the equipment listed in this table were taken at distances of ten and 30 feet from the noise source.
SOURCE: USEPA, *Noise from Construction Equipment and Operations, Building Equipment and Home Appliances*, PB 206717, 1971.

The proposed project encompasses a large area in the City of Redlands. Construction activity associated with the individual projects would increase ambient noise levels at both new sensitive receptors developed in the project site and existing sensitive receptors both inside and outside along the border of the project site. The increase in ambient noise levels would depend on the distance from the sensitive receptor to the noise source and the existing ambient noise level. **Table 4.8-6** shows construction noise levels based on various reference distances. The noise levels take into account the likelihood that more than one piece of construction equipment would be in operation at the same time and lists the typical overall noise levels that would be expected for each phase of construction.

Construction noise would result in a short-term increase in ambient noise levels at sensitive receptors. The City of Redlands acknowledges that construction activity generates noise, and regulates construction noise by limiting the hours of construction to between 7:00 a.m. and 6:00 p.m. Construction activity would comply with the City of Redlands Municipal Code, and would result in a less than significant impact. Nonetheless, this analysis recognizes that construction activity would occur in close proximity to sensitive receptors. Therefore, without mitigation, the proposed project would result in a significant impact related to construction noise.

TABLE 4.8-6: OUTDOOR CONSTRUCTION NOISE LEVELS			
Construction Phase	Noise Level At 50 Feet (dBA)	Noise Level At 100Feet (dBA)	Noise Level At 200 Feet (dBA)
Ground Clearing	84	78	72
Grading/Excavation	89	83	77
Foundations	78	72	66
Structural	85	79	73
Finishing	89	83	77
SOURCE: USEPA, <i>Noise from Construction Equipment and Operations, Building Equipment and Home Appliances</i> , PB 206717, 1971.			

Vibration. Table 4.8-7 shows construction vibration levels based on various reference distances. Construction vibration is a localized event and is typically only perceptible to a receptor that is in close proximity to the vibration source. Construction vibration would result in a short-term increase in vibration levels at sensitive receptors. The City of Redlands acknowledges that construction activity generates vibration, and regulates construction vibration by limiting the hours of construction to between 7:00 a.m. and 6:00 p.m. Construction vibration would comply with the City of Redlands Municipal Code, and would result in a less than significant impact. Nonetheless, this analysis recognizes that construction activity could occur in close proximity to sensitive receptors. Therefore, without mitigation, the proposed project would result in a significant impact related to construction vibration.

TABLE 4.8-7: VIBRATION VELOCITIES FOR CONSTRUCTION EQUIPMENT			
Equipment	PPV at 25 feet (Inches/Second) /a/	PPV at 50 feet (Inches/Second) /a/	PPV at 100 feet (Inches/Second) /a/
Pile Driver (Impact)	0.644	0.228	0.081
Pile Driver (Sonic)	0.170	0.060	0.021
Large Bulldozer	0.089	0.031	0.011
Caisson Drilling	0.089	0.031	0.011
Loaded Trucks	0.076	0.027	0.010
Jackhammer	0.035	0.012	0.004
Small Bulldozer	0.003	0.001	<0.001
/a/ Fragile buildings can be exposed to ground-borne vibration levels of 0.3 inches per second without experiencing structural damage.			
SOURCE: Federal Transit Administration, <i>Transit Noise and Vibration Impact Assessment</i> , May 2006.			

Operational Impacts

Mobile Noise. The proposed project would generate 31,374 net daily vehicle trips. To determine off-site noise impacts, traffic was modeled under future year (2025) “No Project” and “With Project” conditions utilizing FHWA RD-77-108 noise calculation formulas. Results of the analysis are summarized in Table 4.8-8. Future mobile source noise levels without the project would exceed the 60 dBA CNEL “clearly compatible” noise level for residential land uses as shown in Table 4.8-4. Therefore, a significant impact would result if the incremental noise level increases by 4 dBA or more as a result of the proposed project. The greatest project-related noise increase would be 3.2 dBA CNEL and would occur along Pearl Avenue between Eureka Street and Orange Street. The noise levels would not increase by more than 3 dBA at any other roadway segment. Therefore, the proposed project would result in less-than-significant impacts related to mobile source noise.

TABLE 4.8-8: 2025 COMMUNITY NOISE EQUIVALENT LEVEL - PROJECT			
Roadway Segment	Estimated dBA, CNEL /b/		
	No Project (2025)	Project (2025)	Project Impact
Redlands Boulevard between Texas Street and Eureka Street	63.4	64.3	0.9
Redlands Boulevard between Eureka Street and 3 rd Street	66.5	67.4	0.9
Redlands Boulevard between 3 rd Street and Orange Street	63.8	64.7	0.9
Redlands Boulevard between Orange Street and 6 th Street	66.6	67.1	0.5
Redlands Boulevard between 6 th Street and State Street	65.4	65.5	0.1
Pearl Avenue between Eastbound I-10 Off Ramp and Eureka Street	67.3	68.3	1.0
Pearl Avenue between Eureka Street and Orange Street	63.1	66.3	3.2
Pearl Avenue between Orange Street and 6 th Street	64.3	65.9	1.6
Pearl Avenue between 6 th Street and Eastbound I-10 On Ramp	62.8	64.2	1.4
Orange Street between Pearl Avenue and Stuart Avenue	67.2	68.1	0.9
Orange Street between Stuart Avenue and Oriental Avenue	66.1	66.5	0.4
Orange Street between Oriental Avenue and Redlands Boulevard	67.3	67.9	0.6
Orange Street between Redlands Boulevard and State Street	64.4	64.8	0.4
Orange Street between State Street and Citrus/Brookside Avenue	66.0	66.8	0.8
Orange Street between Citrus/Brookside Avenue and Olive Avenue	66.6	67.3	0.7
Westbound I-10 between Westbound I-10 Off Ramp and 6 th Street	61.4	63.1	1.7
Orange Street between Pearl Avenue and Colton Avenue	66.3	66.7	0.4
Orange Street between Olive Avenue and Clark Street	65.4	66.4	1.0
Redlands Boulevard between Texas Street and New York Street	63.1	63.8	0.7
Redlands Boulevard between Citrus/Brookside Avenue and Clark Street	66.3	66.3	<0.1

SOURCE: TAHA, 2010.

Stationary Noise. Individual projects are not anticipated to include unusual sources of stationary noise. Projects developed under the Downtown Redlands Specific Plan are expected to include standard urban development and associated mechanical equipment. It is assumed that the majority of stationary noise would be generated by heating, ventilation, and air conditioning (HVAC) systems. The precise location of HVAC systems is unknown at this time as specific projects have not been planned. Possible HVAC system locations include building basements, street level, and rooftops.

Mechanical equipment such as HVAC systems typically generate noise levels of approximately 60 dBA L_{eq} at 50 feet. This noise level would not exceed the exterior noise limits set for commercial and industrial uses within the City of Redlands, or the daytime limit for single- and multi-family residential districts. However, mechanical equipment that continues to function after 10:00 p.m. could exceed the 50-dBA noise limit for single- and multi-family residential districts. Therefore, without mitigation, the proposed project would result in a significant impact related to stationary noise.

Land Use Compatibility/Interior Noise Levels. The Redlands Passenger Rail, currently being planned by SANBAG, will be a new passenger train service running from Redlands to Downtown San Bernardino, utilizing the existing rail right-of-way. A rail station is planned in Downtown adjacent to the historic Santa Fe Depot between Orange Street and Eureka Street.

The rail line may encourage transit orientated development within the project site and may generate incompatible noise levels with new residential land uses. The rail line is in the planning and stage and has not been approved. The specific information needed to complete a detailed noise assessment (e.g.,

electric light rail or diesel-powered commuter rail, headways, etc.) was not available. It is acknowledged that train noise may not be compatible with residential land uses. Therefore, without mitigation, the proposed project would result in a significant impact related to residential exposure to train noise.

Vibration. The proposed project would not include significant stationary sources of ground-borne vibration, such as heavy equipment operations. Operational ground-borne vibration in the project vicinity would be generated by vehicular travel on the local roadways. However, similar to existing conditions, project-related traffic vibration levels would not be perceptible by sensitive receptors.

According to the FTA *Transit Noise and Vibration Impact Assessment* (May 2006), commuter rail typically generates a vibration level of 75 VdB at 50 feet. It is reasonable to assume that new residents would be at least 75 feet from the rail tracks. At this distance, the vibration level would be less than 70 VdB. The FTA guidance states that residences may be exposed to vibration levels up to 72 VdB when vibration events are frequent throughout the day. Train vibration levels at new residences would not exceed the FTA standards. Therefore, the proposed project would result in less-than-significant impacts related to vibration.

MITIGATION MEASURES

The City of Redlands shall ensure the following measures are implemented as appropriate for individual development projects associated with the proposed project.

Construction

- N1** The City shall require construction contractors to equip construction equipment with mufflers and other suitable noise attenuation devices.
- N2** The City shall require construction contractors to use quieter equipment as opposed to noisier equipment (such as rubber-tired equipment rather than metal-tracked equipment).
- N3** The City shall require construction contractors to place noise-generating construction equipment and locate construction staging areas away from sensitive uses.
- N4** The City shall require construction contractors to notify all residential units located within 500 feet of any construction site of the construction schedule. All notices shall indicate the dates and duration of construction activities, as well as provide a telephone number where residents can inquire about the construction process and register complaints.
- N5** The City shall require construction contractors to establish a “noise disturbance coordinator” shall be established. The disturbance coordinator shall be responsible for responding to any local complaints about construction noise. The disturbance coordinator shall determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and shall be required to implement reasonable measures such that the complaint is resolved. All notices that are sent to residential units within 500 feet of the construction site and all signs posted at the construction site shall list the telephone number for the disturbance coordinator.
- N6** The City shall require construction contractors to utilize caisson drilling in place of pile driving, when feasible depending on geological samples. If pile driving is necessary, sonic pile driving shall be utilized instead of impact pile driving.

N7 The City shall require noise assessments for development constructed within the project site. The noise assessments shall identify additional noise control measures, including but not limited to, sound walls and curtains located between the noise source and sensitive receptors.

Operation

N8 The City shall require noise assessments for residential projects located within the project site. The noise assessment shall ensure that interior noise levels meet the City standards states in Section 8.06.080 of the Municipal Code.

N9 The City shall require mechanical equipment (e.g., heating, ventilation, and air conditioning systems) to be enclosed in equipment rooms such that noise is not audible at adjacent land uses and the noise levels comply with Section 8.06.100 of the City of Redlands Municipal Code.

N10 The City shall require residential land uses with direct line-of-site to the rail tracks to be developed with windows that have a sound transmission class rating of at least 30.

LEVEL OF IMPACT AFTER MITIGATION

Construction

Impacts related to construction noise and vibration were determined to be significant without mitigation. Implementation of Mitigation Measures **N1** through **N7** would reduce the impacts to less than significant.

Operation

Mitigation Measure **N8** would ensure that interior noise levels are acceptable for residential land uses. Mitigation Measure **N9** would reduce noise levels generated by stationary equipment at nearby residential uses. Mitigation Measure **N10** would reduce interior noise levels at residences located near the rail line. Implementation of these mitigation measures would reduce the impacts to less than significant.

CUMULATIVE IMPACTS

Construction

The project site is entirely located within the City of Redlands and does not border adjacent jurisdictions. It is likely that multiple projects would be simultaneously constructed within the project area. Construction noise would result in a short-term increase in ambient noise levels at sensitive receptors. This construction activity would comply with the City of Redlands Municipal Code. Construction activity not part of the Downtown Redlands Specific Plan and located in the general project area would also have to comply with the Municipal Code.

The City of Redlands acknowledges that construction activity generates noise, and regulates construction noise by limiting the hours of construction to between 7:00 a.m. and 6:00 p.m. Proposed project construction noise combined with related project construction noise would increase ambient noise levels. However, the proposed project would not contribute to a cumulatively considerable impact.

Operation

The Downtown Redlands Specific Plan project site encompasses a large area within the City of Redlands. The best way to determine cumulative noise impacts is to assess how the proposed project affects the surrounding community. A mobile noise analysis was completed for roadway segments outside of the

project site. As shown in **Table 4.8-9**, the greatest cumulative increase would be 3.7 dBA CNEL and would occur along Pearl Avenue between Eureka Street and Orange Street. Related projects and ambient growth would contribute 0.5 dBA to the incremental increase and the proposed project would contribute 3.2 dBA to the increase. The total increase of 3.7 dBA would not exceed the 4-dBA significance thresholds. Therefore, the proposed project would not contribute to a cumulatively considerable impact.

TABLE 4.8-9: 2025 CUMULATIVE COMMUNITY NOISE EQUIVALENT LEVEL - CUMULATIVE						
Roadway Segment	Estimated dBA, CNEL /b/					
	Existing (2010)	No Project (2025)	Project (2025)	No Project Cumulative Increase	Total Increment	Project Increment
Redlands Boulevard between Texas Street and Eureka Street	62.3	63.4	64.3	1.1	2.0	0.9
Redlands Boulevard between Eureka Street and 3 rd Street	65.4	66.5	67.4	1.1	2.0	0.9
Redlands Boulevard between 3 rd Street and Orange Street	62.6	63.8	64.7	1.2	2.1	0.9
Redlands Boulevard between Orange Street and 6 th Street	65.4	66.6	67.1	1.2	1.7	0.5
Redlands Boulevard between 6 th Street and State Street	62.3	65.4	65.5	3.1	3.2	0.1
Pearl Avenue between Eastbound I-10 Off Ramp and Eureka Street	66.9	67.3	68.3	0.4	1.4	1.0
Pearl Avenue between Eureka Street and Orange Street	62.6	63.1	66.3	0.5	3.7	3.2
Pearl Avenue between Orange Street and 6 th Street	63.9	64.3	65.9	0.4	2.0	1.6
Pearl Avenue between 6 th Street and Eastbound I-10 On Ramp	62.3	62.8	64.2	0.5	1.9	1.4
Orange Street between Pearl Avenue and Stuart Avenue	66.7	67.2	68.1	0.5	1.4	0.9
Orange Street between Stuart Avenue and Oriental Avenue	65.5	66.1	66.5	0.6	1.0	0.4
Orange Street between Oriental Avenue and Redlands Boulevard	66.7	67.3	67.9	0.6	1.2	0.6
Orange Street between Redlands Boulevard and State Street	63.9	64.4	64.8	0.5	0.9	0.4
Orange Street between State Street and Citrus/Brookside Avenue	65.4	66.0	66.8	0.6	1.4	0.8
Orange Street between Citrus/Brookside Avenue and Olive Avenue	65.9	66.6	67.3	0.7	1.4	0.7
Westbound I-10 between Westbound I-10 Off Ramp and 6 th Street	60.2	61.4	63.1	1.2	2.9	1.7
Orange Street between Pearl Avenue and Colton Avenue	65.6	66.3	66.7	0.7	1.1	0.4
Orange Street between Olive Avenue and Clark Street	64.8	65.4	66.4	0.6	1.6	1.0
Redlands Boulevard between Texas Street and New York Street	62.0	63.1	63.8	1.1	1.8	0.7
Redlands Boulevard between Citrus/Brookside Avenue and Clark Street	65.7	66.3	66.3	0.6	0.6	<0.1

SOURCE: TAHA, 2010.