3.11 - Noise

3.11.1 - Introduction

This section describes existing conditions related to noise and vibration in the project area as well as the regulatory framework. This section also evaluates the possible impacts related to noise and vibration that could result from implementation of the project. For purposes of this analysis, noise impacts will be compared to the thresholds of Contra Costa County and the City of Walnut Creek, as these jurisdictions contain receptors that could be potentially affected by project construction and operation. Information included in this section is based on the Contra Costa County General Plan, as well as the City of Walnut Creek General Plan, the project-specific traffic analysis report included in Appendix I, and project-specific noise modeling results (noise modeling data is provided in Appendix H). No public comments were received during the Environmental Impact Report (EIR) scoping period related to noise.

3.11.2 - Environmental Setting

Characteristics of Noise

Noise is generally defined as unwanted or objectionable sound. Sound becomes unwanted when it interferes with normal activities, when it causes actual physical harm or when it has adverse effects on health. The effects of noise on people can include general annoyance, interference with speech communication, sleep disturbance, and in the extreme, hearing impairment. Noise effects can be caused by pitch or loudness. *Pitch* is the number of complete vibrations or cycles per second of a wave that result in the range of tone from high to low; higher-pitched sounds are louder to humans than lower-pitched sounds. *Loudness* is the intensity or amplitude of sound.

Sound is produced by the vibration of sound pressure waves in the air. Sound pressure levels are used to measure the intensity of sound and are described in terms of decibels. The decibel (dB) is a logarithmic unit, which expresses the ratio of the sound pressure level being measured to a standard reference level. The 0 point on the dB scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Changes of 3 dB or less are only perceptible in laboratory environments. Audible increases in noise levels generally refer to a change of 3 dB or more, as this level has been found to be barely perceptible to the human ear in outdoor environments. Only audible changes in existing ambient or background noise levels are considered potentially significant.

The human ear is not equally sensitive to all frequencies within the audible sound spectrum, so sound pressure level measurements can be weighted to better represent frequency-based sensitivity of average healthy human hearing. One such specific "filtering" of sound is called "A-weighting." A-weighted decibels (dBA) approximate the subjective response of the human ear to a broad frequency noise source by discriminating against very low and very high frequencies of the audible spectrum. They are adjusted to reflect only those frequencies that are audible to the human ear. Because decibels are logarithmic units, they cannot be added or subtracted by ordinary arithmetic means. For example, if one noise source produces a noise level of 70 dB, the addition of another noise source with the same noise level would not produce 140 dB; rather, they would combine to produce a noise level of 73 dB.

As noise spreads from a source, it loses energy so that the farther away the noise receiver is from the noise source, the lower the perceived noise level. Noise levels diminish or attenuate as distance from the source increases based on an inverse square rule, depending on how the noise source is physically configured. Noise levels from a single-point source, such as a single piece of construction equipment at ground level, attenuate at a rate of 6 dB for each doubling of distance (between the single-point source of noise and the noise-sensitive receptor of concern). Heavily traveled roads with few gaps in traffic behave as continuous line sources and attenuate roughly at a rate of 3 dB per doubling of distance.

Table 3.11-1 shows some representative noise sources and their corresponding noise levels in dBA.

Table 3.11-1: Typical A-Weighted Noise Levels

Indoor Noise Source	Noise Level (dBA)	Outdoor Noise Sources
(Threshold of Hearing in Laboratory)	0	—
Library	30	Quiet Rural Nighttime
Refrigerator Humming	40	Quiet Suburban Nighttime
Quiet Office	50	Quiet Urban Daytime
Normal Conversation at 3 feet	60	Normal Conversation at 3 feet
Vacuum Cleaner at 10 feet	70	Gas Lawn Mower at 100 feet
Hair Dryer at 1 foot	80	Freight Train at 50 feet
Food Blender at 3 feet	90	Heavy-duty Truck at 50 feet
Inside Subway Train (New York)	100	Jet Takeoff at 2,000 feet
Smoke Detector Alarm at 3 feet	110	Unmuffled Motorcycle
Rock Band near stage	120	Chainsaw at 3 feet
—	130	Military Jet Takeoff at 50 feet
—	140	(Threshold of Pain)
Source: Compiled by FirstCarbon Solutions (FCS) 2018.		

Noise Descriptors

There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. Equivalent continuous sound level (L_{eq}) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the L_{eq} and community noise equivalent level (CNEL) or the day-night average level (L_{dn}) based on dBA. CNEL is the time-varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and a 10 dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale but without the adjustment for events occurring during the evening hours. CNEL and L_{dn} are within 1 dBA of each other and are normally exchangeable. The noise adjustments are added to the noise events occurring during the more sensitive hours.

Other noise rating scales of importance when assessing the annoyance factor include the maximum noise level (L_{max}), which is the highest exponential time-averaged sound level that occurs during a stated time period. The noise environments discussed in this analysis are specified in terms of maximum levels denoted by L_{max} for short-term noise impacts. L_{max} reflects peak operating conditions and addresses the annoying aspects of intermittent noise.

Noise Propagation

From the noise source to the receiver, noise changes both in level and frequency spectrum. The most obvious is the decrease in noise as the distance from the source increases. The manner in which noise reduces with distance depends on whether the source is a point or line source, as well as ground absorption, atmospheric conditions (wind, temperature gradients, and humidity) and refraction, and shielding by natural and manmade features. Sound from point sources, such as an air conditioning condenser, a piece of construction equipment, or an idling truck, radiates uniformly outward as it travels away from the source in a spherical pattern.

The attenuation or sound drop-off rate is dependent on the conditions of the land between the noise source and receiver. To account for this ground-effect attenuation (absorption), two types of site conditions are commonly used in noise models: soft-site and hard-site conditions. Soft-site conditions account for the sound propagation loss over natural surfaces such as normal earth and ground vegetation. For point sources, a drop-off rate of 7.5 dBA per each doubling of the distance (dBA/DD) is typically observed over soft ground with landscaping, as compared with a 6 dBA/DD drop-off rate over hard ground such as asphalt, concrete, stone and very hard packed earth. For line sources, such as traffic noise on a roadway, a 4.5 dBA/DD is typically observed for soft-site conditions compared to the 3 dBA/DD drop-off rate for hard-site conditions. Table 3.11-2 briefly defines these measurement descriptors and other sound terminology used in this section.

Table 3.11-2: Sound Terminology

Term	Definition
Sound	A vibratory disturbance created by a vibrating object which, when transmitted by pressure waves through a medium such as air, can be detected by a receiving mechanism such as the human ear or a microphone.
Noise	Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
Ambient Noise	The composite of noise from all sources near and far in a given environment.
Decibel (dB)	A unitless measure of sound on a logarithmic scale, which represents the squared ratio of sound-pressure amplitude to a reference sound pressure. The reference pressure is 20 micropascals, representing the threshold of human hearing (0 dB).

Table 3.11-2 (cont.): Sound Terminology

Term	Definition
A-Weighted Decibel (dBA)	An overall frequency-weighted sound level that approximates the frequency response of the human ear.
Equivalent Noise Level (L_{eq})	The average sound energy occurring over a specified time period. In effect, L_{eq} is the steady-state sound level that in a stated period would contain the same acoustical energy as the time-varying sound that actually occurs during the same period.
Maximum and Minimum Noise Levels (L_{max} and L_{min})	The maximum or minimum instantaneous sound level measured during a measurement period.
Day-Night Level (DNL or L_{dn})	The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring between 10:00 p.m. and 7:00 a.m. (nighttime).
Community Noise Equivalent Level (CNEL)	The energy average of the A-weighted sound levels occurring during a 24-hour period, with 5 dB added to the A-weighted sound levels occurring between 7:00 p.m. and 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring between 10:00 p.m. and 7:00 a.m.
Source: Data compiled by FCS 2018	

Traffic Noise

The level of traffic noise depends on the three primary factors: (1) the volume of the traffic, (2) the speed of the traffic, and (3) the number of trucks in the flow of traffic. Generally, the loudness of traffic noise is increased by heavier traffic volumes, higher speeds, and greater number of trucks. Vehicle noise is a combination of the noise produced by the engine, exhaust, and tires. Because of the logarithmic nature of noise levels, a doubling of the traffic volume (assuming that the speed and truck mix do not change) results in a noise level increase of 3 dBA. Based on the Federal Highway Administration (FHWA) community noise assessment criteria, this change is "barely perceptible." For reference, a doubling of perceived noise levels would require an increase of approximately 10 dBA. The truck mix on a given roadway also has an effect on community noise levels. As the number of heavy trucks increases and becomes a larger percentage of the vehicle mix, adjacent noise levels increase.

Stationary Noise

A stationary noise producer is any entity in a fixed location that emits noise. Examples of stationary noise sources include machinery, engines, energy production, and other mechanical or powered equipment and activities such as loading and unloading or public assembly that may occur at commercial, industrial, manufacturing, or institutional facilities. Furthermore, while noise generated by the use of motor vehicles over public roads is preempted from local regulation, although the use of these vehicles is considered a stationary noise source when operated on private property such as at a construction site, a truck terminal, or warehousing facility. The emitted noise from the producer can be mitigated to acceptable levels either at the source or on the adjacent property through the use of proper planning, setbacks, block walls, acoustic-rated windows, dense landscaping, or by changing the location of the noise producer.

The effects of stationary noise depend on factors such as characteristics of the equipment and operations, distance and pathway between the generator and receptor, and weather. Stationary noise sources may be regulated at the point of manufacture (e.g., equipment or engines), with limitations on the hours of operation, or with provision of intervening structures, barriers or topography.

Construction activities are a common source of stationary noise. Construction-period noise levels are higher than background ambient noise levels but eventually cease once construction is complete. Construction is performed in discrete steps, each of which has its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated on each construction site and, therefore, would change the noise levels as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction related noise ranges to be categorized by work phase. Table 3.11-3 shows typical noise levels of construction equipment as measured at a distance of 50 feet from the operating equipment.

Table 3.11-3: Typical Construction Equipment Maximum Noise Levels, L_{max}

Type of Equipment	Impact Device? (Yes/No)	Specification Maximum Sound Levels for Analysis (dBA at 50 feet)
Impact Pile Driver	Yes	95
Auger Drill Rig	No	85
Vibratory Pile Driver	No	95
Jackhammers	Yes	85
Pneumatic Tools	No	85
Pumps	No	77
Scrapers	No	85
Cranes	No	85
Portable Generators	No	82
Rollers	No	85
Dozers	No	85
Tractors	No	84
Front-End Loaders	No	80
Backhoe	No	80
Excavators	No	85
Graders	No	85
Air Compressors	No	80

Table 3.11-3 (cont.): Typical Construction Equipment Maximum Noise Levels, L_{max}

Type of Equipment	Impact Device? (Yes/No)	Specification Maximum Sound Levels for Analysis (dBA at 50 feet)
Dump Truck	No	84
Concrete Mixer Truck	No	85
Pickup Truck	No	55
Source: FHWA 2006. Highway Construction Noise Handbook, August.		

Noise from Multiple Sources

Because sound pressure levels in decibels are based on a logarithmic scale, they cannot be added or subtracted in the usual arithmetical way. Therefore, sound pressure levels in decibels are logarithmically added on an energy summation basis. In other words, adding a new noise source to an existing noise source, both producing noise at the same level, will not double the noise level. Instead, if the difference between two noise sources is 10 dBA or more, the louder noise source will dominate and the resultant noise level will be equal to the noise level of the louder source. In general, if the difference between two noise sources is 0–1 dBA, the resultant noise level will be 3 dBA higher than the louder noise source, or both sources if they are equal. If the difference between two noise sources is 2–3 dBA, the resultant noise level will be 2 dBA above the louder noise source. If the difference between two noise sources is 4–10 dBA, the resultant noise level will be 1 dBA higher than the louder noise source.

Characteristics of Vibration

Groundborne vibration consists of rapidly fluctuating motion through a solid medium, specifically the ground, that has an average motion of zero and in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. The effects of groundborne vibration typically only causes a nuisance to people, but in extreme cases, excessive groundborne vibration has the potential to cause structural damage to buildings. Although groundborne vibration can be felt outdoors, it is typically only an annoyance to people indoors where the associated effects of the shaking of a building can be notable. Groundborne noise is an effect of groundborne vibration and only exists indoors, since it is produced from noise radiated from the motion of the walls and floors of a room, and may also consist of the rattling of windows or dishes on shelves.

Several different methods are used to quantify vibration amplitude such as the maximum instantaneous peak in the vibrations velocity, which is known as the peak particle velocity (PPV) or the root mean square (RMS) amplitude of the vibration velocity. Because of the typically small amplitudes of vibrations, vibration velocity is often expressed in decibels—denoted as LV—and is based on the reference quantity of 1 micro inch per second. To distinguish these vibration levels referenced in decibels from noise levels referenced in decibels, the unit is written as "VdB."

Although groundborne vibration can be felt outdoors, it is typically only an annoyance to people indoors where the associated effects of the shaking of a building can be notable. When assessing annoyance from groundborne vibration, vibration is typically expressed as root mean square (RMS) velocity in units of decibels of 1 micro-inch per second, with the unit written in VdB. Typically, developed areas are continuously affected by vibration velocities of 50 VdB or lower. Human perception to vibration starts at levels as low as 67 VdB. Annoyance due to vibration in residential settings starts at approximately 70 VdB.

Off-site sources that may produce perceptible vibrations are usually caused by construction equipment, steel-wheeled trains, and traffic on rough roads, while smooth roads rarely produce perceptible groundborne noise or vibration. Construction activities, such as blasting, pile driving and operating heavy earthmoving equipment, are common sources of groundborne vibration. Construction vibration impacts on building structures are generally assessed in terms of PPV. Typical vibration source levels from construction equipment are shown in Table 3.11-4.[1]

Table 3.11-4: Vibration Levels of Construction Equipment

Construction Equipment	PPV at 25 Feet (inches/second)	RMS Velocity in Decibels (VdB) at 25 Feet
Water Trucks	0.001	57
Scraper	0.002	58
Bulldozer—small	0.003	58
Jackhammer	0.035	79
Concrete Mixer	0.046	81
Concrete Pump	0.046	81
Paver	0.046	81
Pickup Truck	0.046	81
Auger Drill Rig	0.051	82
Backhoe	0.051	82
Crane (Mobile)	0.051	82
Excavator	0.051	82
Grader	0.051	82
Loader	0.051	82
Loaded Trucks	0.076	86
Bulldozer—Large	0.089	87
Caisson drilling	0.089	87
Vibratory Roller (small)	0.101	88
Compactor	0.138	90
Clam shovel drop	0.202	94
Vibratory Roller (large)	0.210	94
Pile Driver (impact-typical)	0.644	104

[1] Federal Highway Administration (FHWA). 2006. Highway Construction Noise Handbook. August.

Table 3.11-4 (cont.): Vibration Levels of Construction Equipment

Construction Equipment	PPV at 25 Feet (inches/second)	RMS Velocity in Decibels (VdB) at 25 Feet
Pile Driver (impact-upper range)	1.518	112
Source: Compilation of scientific and academic literature, generated by the Federal Transit Administration (FTA) and FHWA.		

The propagation of groundborne vibration is not as simple to model as airborne noise. This is because noise in the air travels through a relatively uniform medium, while groundborne vibrations travel through the earth, which may contain significant geological differences. Factors that influence groundborne vibration include:

- **Vibration source:** Type of activity or equipment, such as impact or mobile, and depth of vibration source;
- **Vibration path:** Soil type, rock layers, soil layering, depth to water table, and frost depth; and
- **Vibration receiver:** Foundation type, building construction, and acoustical absorption.

Among these factors that influence groundborne vibration, there are significant differences in the vibration characteristics when the source is underground compared to at the ground surface. In addition, soil conditions are known to have a strong influence on the levels of groundborne vibration. Among the most important factors are the stiffness and internal damping of the soil and the depth to bedrock. Vibration propagation is more efficient in stiff clay soils than in loose sandy soils, and shallow rock seems to concentrate the vibration energy close to the surface, and can result in groundborne vibration problems at large distance from the source. Factors such as layering of the soil and depth to the water table can have significant effects on the propagation of groundborne vibration. Soft, loose, sandy soils tend to attenuate more vibration energy than hard, rocky materials. Vibration propagation through groundwater is more efficient than through sandy soils. There are three main types of vibration propagation: surface, compression, and shear waves. Surface waves, or Rayleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wave front, similar to ripples produced by throwing a rock into a pool of water. P-waves, or compression waves, are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal (i.e., in a "push-pull" fashion). P-waves are analogous to airborne sound waves. S-waves, or shear waves, are also body waves that carry energy along an expanding spherical wave front. However, unlike P-waves, the particle motion is transverse, or side-to-side and perpendicular to the direction of propagation.

As vibration waves propagate from a source, the vibration energy decreases in a logarithmic nature and the vibration levels typically decrease by 6 VdB per doubling of the distance from the vibration source. As stated above, this drop-off rate can vary greatly depending on the soil type, but it has been shown to be effective enough for screening purposes, in order to identify potential vibration impacts that may need to be studied through actual field tests. The vibration level (calculated below as "PPV") at a distance from a point source can generally be calculated using the vibration reference equation:

$$PPV = PPV_{ref} * (25/D)^n \text{ (in/sec)}$$

Where:

PPV_{ref} = reference measurement at 25 feet from vibration source
D = distance from equipment to the receptor
n = vibration attenuation rate through ground

According to Chapter 12 of the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (2006), an "n" value of 1.5 is recommended to calculate vibration propagation through typical soil conditions.[2]

Existing Noise Levels

Ambient Noise

The existing noise environment in the vicinity of the project site was documented through a noise monitoring effort performed at the project site. Noise monitoring locations are shown in Exhibit 3.11-1, and the noise measurement data sheets are contained in Appendix H. A total of three short-term noise measurements (15 minutes each) were taken on Tuesday, January 22, 2019 starting at 2:10 p.m. and ending at 3:15 p.m., during the midday peak noise hour. One long-term ambient noise measurement (48 hours) was also conducted on the project site, starting at 4:00 p.m. on Tuesday, January 22, 2019 and ending at 4:00 p.m. on Thursday, January 24, 2019. These measurements provide a baseline of existing noise conditions.

Short-term Noise Measurements

The short-term noise measurement results are summarized in Table 3.11-5. The noise measurements determined that daytime ambient noise levels range from 56.9 dBA to 61.2 dBA L_{eq} in the vicinity of the project site. The noise measurements indicate that noise within the vicinity of the project site is generally characterized by construction activities (taking place at the apartment building across Del Hombre Lane), vehicle traffic on nearby roadways, and the Bay Area Rapid Transit (BART) light rail train.

Table 3.11-5: Existing Ambient Noise Levels in the Vicinity of the Project Site

Site Location	Location Description	L_{eq} (dBA)	Primary Noise Sources
ST-1	Northeast corner of project site	57.1	Construction noise, vehicular traffic along Roble Road into apartment buildings, BART light rail train
ST-2	Southeast corner of project site	56.9	Construction noise, leaf blower, vehicular traffic on Treat Boulevard and Honey Trail, BART light rail train
ST-3	Southwest corner of project site	61.2	Construction on apartment buildings across Del Hombre Lane, BART light rail train, vehicular traffic on Treat Boulevard, bicyclists, and pedestrians
Source: FCS 2018.			

[2] Federal Transit Administration (FTA). 2006. Transit Noise and Vibration Impact Assessment. May.

Long-term Noise Measurement

The long-term noise measurement, shown as LT-1 on Exhibit 3.11-1, was conducted on the northwestern corner of the project site, approximately 75 feet southeast of the raised BART rail line. The resulting measurement determined that ambient noise levels at this location averaged 70 dBA CNEL. As was observed by the technician at the time of the noise measurement, the dominant noise sources in the project vicinity are construction on apartment buildings across Del Hombre Lane and Jones Road, vehicular traffic on Treat Boulevard and Roble Road, and BART light rail trains.

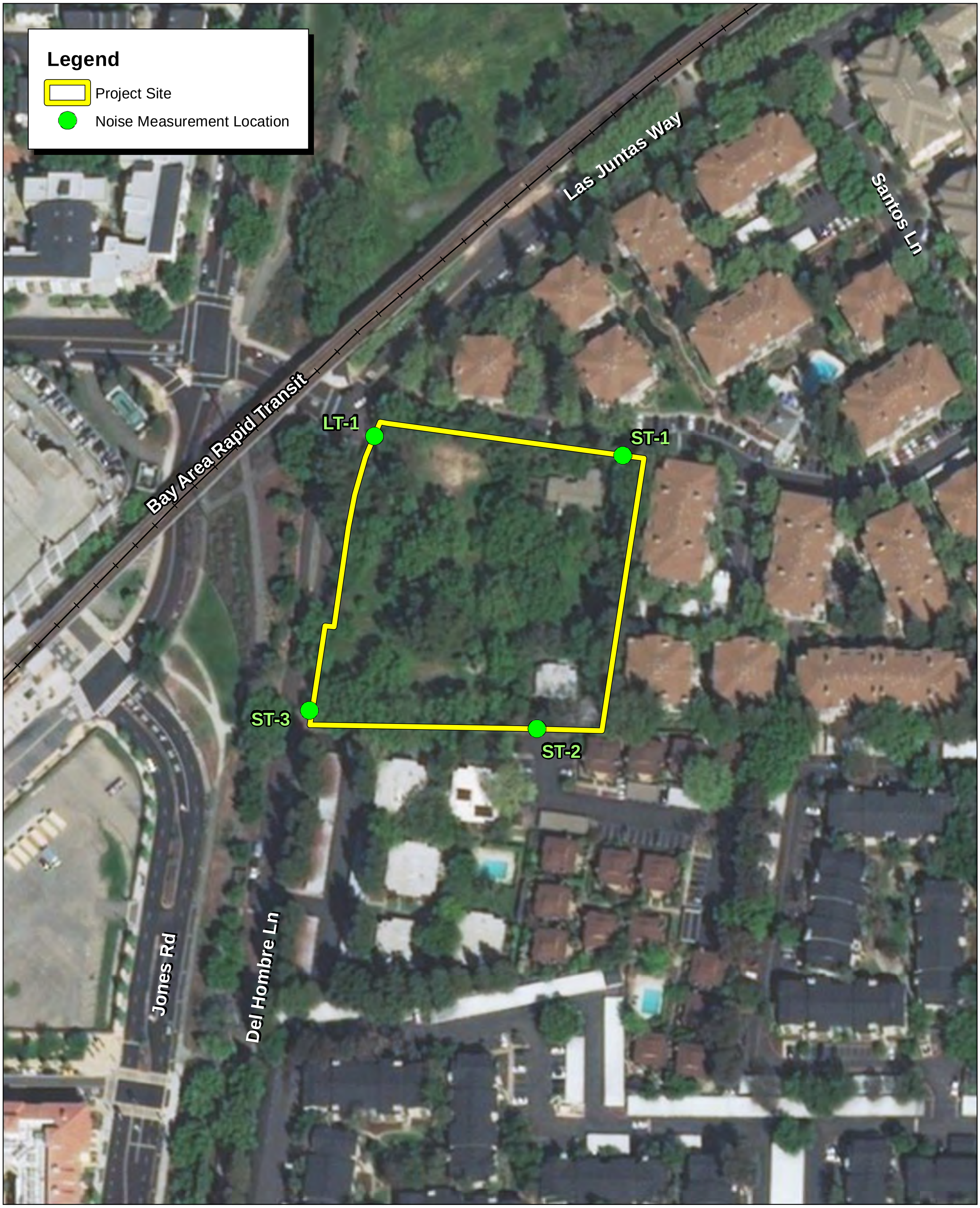
Traffic Noise

In addition to the ambient noise measurements, existing traffic noise on local roadways in the areas surrounding the project site was calculated to quantify existing traffic noise levels, based on the existing traffic volumes included in Appendix I. Existing traffic noise levels along selected roadway segments in the project vicinity were modeled using the FHWA Traffic Noise Prediction Model (FHWA-RD-77-108). Site-specific information is entered, such as roadway traffic volumes, roadway active width, source-to-receiver distances, travel speed, noise source and receiver heights, and the percentages of automobiles, medium trucks, and heavy trucks that the traffic is made up of throughout the day, amongst other variables. The modeled average daily traffic (ADT) volumes were obtained by multiplying the AM peak-hour intersection traffic volumes from the project-specific traffic study by a factor of 8 (Fehr & Peers 2018). The model inputs and outputs, including the 60 dBA, 65 dBA, and 70 dBA L_{dn} traffic noise contour distances, are provided in Appendix H. A summary of the modeling results is shown in Table 3.11-6. The modeling results show that existing traffic noise levels on roadway segments adjacent to the project site range up to 58.0 dBA CNEL as measured at 50 feet from the centerline of the outermost travel lane. Interstate 680 (I-680) is located over 1,700 feet to the west of the project site. At this distance and with the shielding provided by intervening structures, noise from I-680 is not a major contributor to the ambient noise environment on the project site and is therefore not analyzed further.

Table 3.11-6: Existing Traffic Noise Levels in the Vicinity of the Project Site

Roadway Segment	ADT	Centerline to 70 L_{dn}(feet)	Centerline to 65 L_{dn}(feet)	Centerline to 60 L_{dn}(feet)	L_{dn} (dBA) 50 feet from Centerline of Outermost Lane
Las Juntas Way—Iron Horse Lane to Coggins Drive	4,000	< 50	< 50	< 50	56.3
Las Juntas Way—Coggins Drive to Del Hombre Lane	3,600	< 50	< 50	< 50	55.9
Las Juntas Way—Roble Road to Santos Lane	3,100	< 50	< 50	< 50	55.2
Del Hombre Lane—Honey Trail to Roble Road	**200**	**< 50**	**< 50**	**< 50**	**43.3**
Coggins Drive—Las Juntas Way to Jones Road	**5,900**	**< 50**	**< 50**	**< 50**	**58.0**
Jones Road—Coggins Drive to Harvey Drive	7,100	< 50	< 50	< 50	57.3

Note:
ADT = Average Daily Traffic
Modeling results do not take into account mitigating features such as topography, vegetative screening, fencing, building design, or structure screening. Rather it assumes a worst case of having a direct line of site on flat terrain.
Bold values indicated roadway segments that are adjacent to the project site.
Source: FCS 2018.



Source: ESRI Aerial Imagery.

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150 75 0 150 Feet

Exhibit 3.11-1
Noise Measurement Location Map

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Existing Stationary Noise Levels

Commercial and residential land uses in the vicinity of the project site generate noise from typical parking lot activities, rooftop mechanical ventilation systems, and landscaping and maintenance equipment activities. These activities are point sources of noise that affect the existing noise environment. Parking lot activities, such as small delivery vehicle loading/unloading and engines starting or doors shutting, typically generate approximately 60 dBA to 70 dBA L_{max} at 50 feet. The existing ambient noise measurements results described above, with documented noise levels ranging from 61 dBA to 67 dBA L_{eq}, are representative of the daytime noise levels experienced from these types of activities in the vicinity of the project site.

Noise-Sensitive Land Uses

Noise-sensitive land uses generally consist of those uses where exposure to noise would result in adverse effects, as well as uses for which quiet is an essential element of their intended purpose. Residential dwellings are of primary concern, because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Other typical noise-sensitive land uses include hospitals, convalescent facilities, hotels, religious institutions, libraries, and other uses where low noise levels are essential.

Project Site Vicinity

Noise-sensitive land uses in the vicinity of the project site include multi-family residential buildings located across the raised BART rail line to the northwest of the project site, as well as directly to the north, northeast, east, and south of the project site.

Project Site

The noise-sensitive land uses at the project site include the two existing residences within the project site boundaries.

3.11.3 - Regulatory Framework

Federal

Noise Control Act

The adverse impact of noise was officially recognized by the federal government in the Noise Control Act of 1972, which serves three purposes:

- Promulgating noise emission standards for interstate commerce
- Assisting State and local abatement efforts
- Promoting noise education and research

The Federal Office of Noise Abatement and Control (ONAC) was initially tasked with implementing the Noise Control Act. However, the ONAC has since been eliminated, leaving the development of federal noise policies and programs to other federal agencies and interagency committees.

Among the agencies now regulating noise are the Occupational Safety and Health Administration (OSHA), which limits noise exposure of workers to 90 dB L_{eq} or less for 8 continuous hours or 105 dB L_{eq} or less for 1 continuous hour; the United States Department of Transportation (DOT), which assumed a significant role in noise control through its various operating agencies; and the Federal Aviation Administration (FAA), which regulates noise of aircraft and airports. Surface transportation system noise is regulated by a host of agencies, including the FTA. Transit noise is regulated by the federal Urban Mass Transit Administration, while freeways that are part of the interstate highway system are regulated by the FHWA. Finally, the federal government actively advocates that local jurisdictions use their land use regulatory authority to arrange new development in such a way that "noise sensitive" uses are either prohibited from being sited adjacent to a highway, or alternatively, that developments are planned and constructed in such a manner that minimize potential noise impacts.

Since the federal government has preempted the setting of standards for noise levels that can be emitted by transportation sources, local jurisdictions are limited to regulating the noise generated by the transportation system through nuisance abatement ordinances and land use planning.

Federal Transit Administration

The project is not subject to the regulation requirements of the FTA; however, the FTA's vibration impact criteria are accepted industry-wide as the best vibration impact guidelines when a local governing agency does not have vibration standards of its own.

The FTA has established industry accepted standards for vibration impact criteria and impact assessment. These guidelines are published in its Transit Noise and Vibration Impact Assessment document (FTA 2006). The FTA guidelines include thresholds for construction vibration impacts for various structural categories as shown in Table 3.11-7.

Table 3.11-7: Federal Transit Administration Construction Vibration Impact Criteria

Building Category	PPV (in/sec)	Approximate VdB
I. Reinforced-Concrete, Steel or Timber (no plaster)	0.5	102
II. Engineered Concrete and Masonry (no plaster)	0.3	98
III. Non Engineer Timber and Masonry Buildings	0.2	94
IV. Buildings Extremely Susceptible to Vibration Damage	0.12	90
Source: FTA 2006. Transit Noise and Vibration Impact Assessment.		

State

California General Plan Guidelines

Established in 1973, the California Department of Health Services Office of Noise Control was instrumental in developing regularity tools to control and abate noise for use by local agencies. One significant model is the "Land Use Compatibility for Community Noise Environments Matrix," which allows the local jurisdiction to delineate compatibility of sensitive uses with various incremental levels of noise.[3]

[3] California Department of Health, Office of Noise Control, "Land Use Compatibility for Community Noise Environments Matrix," 1976.

Government Code Section 65302 mandates that the legislative body of each county and city in California adopt a noise element as part of its comprehensive general plan. The local noise element must recognize the land use compatibility guidelines published by the State Department of Health Services. The guidelines rank noise/land use compatibility in terms of normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable. The project is also subject to review under the State of California Environmental Quality Act (CEQA). Appendix G of the CEQA Guidelines provides impact thresholds for potential noise and vibration impacts.

California Building Standards Code

The State of California has established noise insulation standards for new hotels, motels, apartment houses, and dwellings (other than single-family detached housing). These requirements are provided in the 2016 California Building Standards Code (CBC) (California Code of Regulations [CCR], Title 24).[4] As provided in the CBC, the noise insulation standards set forth an interior standard of 45 dBA CNEL as measured from within the structure's interior. When such structures are located within a 65-dBA CNEL (or greater) exterior noise contour associated with a traffic noise along a roadway, an acoustical analysis is required to ensure that interior levels do not exceed the 45-dBA CNEL threshold. Title 24 standards are typically enforced by local jurisdictions through the building permit application process.

Local

The project site is located in a pocket of unincorporated Contra Costa County land. The project site is located approximately 100 feet from the nearest limits of the City of Walnut Creek, located north of the project site across the BART rail line, with the closest residential receptor in Walnut Creek located approximately 530 feet north of the project site. The project site is located over 2,300 feet from the limits of the City of Concord (northeast of the site), and over 1,000 feet from the limits of the City of Pleasant Hill (northwest of the site). Therefore, the goals and policies related to noise from both the Contra Costa County General Plan and the City of Walnut Creek General Plan as well as the applicable noise regulations from both the Contra Costa County Ordinance Code and Walnut Creek Municipal Code are presented below.

Contra Costa County General Plan

Noise Element

The Noise Element of the Contra Costa County General Plan[5] establishes the following noise policies that may be applicable to the project. As listed below, exterior noise levels up to 65 dBA L_{dn} are considered *normally acceptable* for new multi-family residential land use developments, *conditionally acceptable* from 65 dBA to 75 dBA L_{dn}, and *unacceptable* above 75 dBA L_{dn}.

- **Policy 11-1:** New projects shall be required to meet acceptable exterior noise level standards as established in the Noise and Land Use Compatibility Guidelines contained in Figure 11-6 [of the Noise Element]. These guidelines, along with the future noise levels shown in the future

[4] California Building Standards Commission. 2017. California Building Standards Code (CCR Title 24), January 1.
[5] Contra Costa County. 2005. Contra Costa County General Plan, Noise Element. January 18.

noise contours maps, should be used by the county as a guide for evaluating the compatibility of “noise sensitive” projects in potentially noisy areas.

- For multi-family residential uses, Figure 11-6 identifies a noise level of 65 dBA L_{dn} as normally acceptable, and a noise level of 70 dBA L_{dn} as conditionally acceptable

- **Policy 11-2:** The standard for outdoor noise levels in residential areas is an L_{dn} of 60 dB. However, an L_{dn} of 60 dB or less may not be achievable in all residential areas due to economic or aesthetic constraints. One example is small balconies associated with multi-family housing. In this case, second and third story balconies may be difficult to control to the goal. A common outdoor use area that meets the goal can be provided as an alternative.
- **Policy 11-3:** If the primary noise source is train passbys, then the standard for outdoor noise levels in residential areas is an L_{dn} of 70 dB. A higher L_{dn} is allowable since the L_{dn} is controlled by a relatively few number of train passbys that are disruptive outdoors only for short periods. Even though the L_{dn} may be high, during the majority of the time the noise level will be acceptable.
- **Policy 11-4:** Title 24, Part 2, of the California Code of Regulations requires that new multiple family housing projects, hotels, and motels exposed to a L_{dn} of 60 dB or greater have a detailed acoustical analysis describing how the project will provide an interior L_{dn} of 45 dB or less. The County also shall require new single-family housing projects to provide for an interior L_{dn} of 45 dB or less.
- **Policy 11-5:** In developing residential areas exposed to an L_{dn} in excess of 65 dB due to single events such as train operation, indoor noise levels due to these single events shall not exceed a maximum A-weighted noise level of 50 dB in bedrooms and 55 dB in other habitable rooms. Single event indoor residential noise levels from airport related causes will be 45 dB CNEL.
- **Policy 11-8:** Construction activities shall be concentrated during the hours of the day that are not noise-sensitive for adjacent land uses and should be commissioned to occur during normal work hours of the day to provide relative quiet during the more sensitive evening and early morning periods.

According to the County’s land use compatibility standards contained in Figure 11-6 of the Noise Element, ambient noise environments are considered *normally acceptable* for new multi-family residential land use development with noise levels ranging up to 60 dBA CNEL/L_{dn}. Environments with noise levels from 55 dBA to70 dBA CNEL/L_{dn} are considered *conditionally acceptable* for new multi-family land use development; and such development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features are included in the design. Environments with noise levels from 70 dBA to 75 dBA CNEL/L_{dn} are considered *normally unacceptable* for new multi-family land use development, and *clearly unacceptable* for levels above 75 dBA CNEL/L_{dn}.

City of Walnut Creek General Plan

Safety and Noise Element

The Safety and Noise Element of the Walnut Creek General Plan[6] establishes land use compatibility standards for noise. The land use compatibility standards for noise provide the basis for making

[6] City of Walnut Creek. 2006. Walnut Creek General Plan, Safety and Noise Element. April 4.

decisions on location of land uses in relation to noise sources and for determining noise mitigation requirements. According to the City of Walnut Creek's Land Use/Noise Compatibility standards, exterior noise levels up to 65 dBA L_{dn} are considered *normally acceptable* for new multi-family residential land use developments, *conditionally acceptable* from 65 dBA to 75 dBA L_{dn}, and *unacceptable* above 75 dBA L_{dn}.

The City of Walnut Creek has adopted the following General Plan Safety and Noise Element goals, policies, and actions to reduce potential noise hazards.

- **Goal 8:** Provide compatible noise environments for new development, redevelopment, and condominium conversions.
- **Policy 8.1:** Apply the noise and land use compatibility table and standards to all residential, commercial, and mixed-use proposals, including condominium conversions.
- **Policy 8.2:** Address the issue of residences affected by intermittent urban noise from sources such as heating, ventilating, and air conditioning equipment and by outdoor maintenance activities, such as parking lot sweeping and early morning garbage collection.
- **Action 8.2.2:** For new multifamily residential projects and for the residential component of mixed-use development, use a standard of 65 L_{dn} in outdoor areas, excluding balconies.
- **Action 8.2.3:** Strive for a maximum interior noise levels at 45 L_{dn} in all new residential units.
- **Action 8.2.4:** For new downtown mixed-use development or for new residential development affected by noise from BART or helicopters, ensure that maximum noise levels do not exceed 50 L_{dn} in bedrooms and 55 L_{dn} in other rooms.

Contra Costa County Ordinance Code—Noise Ordinance

It should be noted that the Contra Costa County Ordinance Code does not contain any noise ordinance codes or performance standards that are applicable to the project.

City of Walnut Creek Municipal Code Noise Ordinance[7]

The City of Walnut Creek Noise Ordinance is codified in Chapter 6, Article 2 of the City's Municipal Code. Section 4-6.203f prohibits construction activities other than between the hours of 7:00 a.m. and 6:00 p.m. on non-holiday weekdays, or those precise hours of operation enumerated in individual building and grading permits.

3.11.4 - Impacts and Mitigation Measures

Significance Criteria

According to 2019 CEQA Guidelines updated Appendix G, to determine whether impacts related to noise and vibration are significant environmental effects, the following questions are analyzed and evaluated.

[7] City of Walnut Creek. 2018. Walnut Creek Municipal Code Noise Ordinance. Website: https://www.codepublishing.com/CA/WalnutCreek/#!/WalnutCreek04/WalnutCreek0406.html Accessed December 20, 2018.

Would the project:

a) Generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

b) Cause a significant environmental impact due to a conflict with a land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?[8]

c) Generate excessive groundborne vibration or groundborne noise levels?

d) For a project located within the vicinity of a private airstrip or 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?

Approach to Analysis

Noise Measurement Methodology

The existing ambient noise levels at the project site were documented through a noise monitoring effort conducted at the project site on January 22, 2019, by noise technicians. The field survey noted that noise in the project vicinity is generally characterized by vehicle traffic on the local roadways as well as transit along the BART railway.

The noise measurements were taken using Larson-Davis Model LxT2 Type 2 precision sound level meters programmed in "slow" mode to record noise levels in "A" weighted form. The sound level meter was calibrated using a Larson-Davis calibrator, Model CAL 150. The accuracy of the calibrator is maintained through a program established through the manufacturer and is traceable to the National Bureau of Standards. All noise level measurement equipment meets American National Standards Institute specifications for sound level meters (S1.4 1983 identified in Chapter 19.68.020.AA).

Traffic Noise Modeling Methodology

The level of traffic noise depends on the three primary factors: (1) the volume of the traffic, (2) the speed of the traffic, and (3) the number of trucks in the flow of traffic. Generally, the loudness of traffic noise is increased by heavier traffic volumes, higher speeds, and greater number of trucks. Vehicle noise is a combination of the noise produced by the engine, exhaust, and tires. Because of the logarithmic nature of traffic noise levels, a doubling of the traffic volume (assuming that the speed and truck mix do not change) results in a noise level increase of 3 dBA. Based on the FHWA community noise assessment criteria, this change is "barely perceptible"; for reference a doubling of perceived noise levels would require an increase of approximately 10 dBA. The truck mix on a given roadway also has an effect on community noise levels. As the number of heavy trucks increases and becomes a larger percentage of the vehicle mix, adjacent noise levels increase.

[8] This significance criteria question is from the Land Use and Planning section of the CEQA Guidelines Appendix G checklist questions. However, since the question addresses impacts related to conflicts with land use plans, which would include project-related conflicts related to noise land use compatibility standards of the General Plan Noise Element, it is also included here.

The FHWA highway traffic noise prediction model (FHWA RD-77-108) was used to evaluate traffic-related noise conditions in the vicinity of the project site. Model input data includes without- and with-project average daily traffic volumes on adjacent roadway segments, day/night percentages of autos, medium and heavy trucks, vehicle speeds, ground attenuation factors, and roadway widths. The roadway speeds are based on the posted speed limits observed during site visits. Traffic modeling was performed using the data obtained from the project-specific traffic study conducted by Fehr & Peers.[9] This traffic study provides data for existing (year 2018), near-term, and cumulative (year 2040) traffic conditions. The resultant noise levels were weighed and summed over a 24-hour period to determine the CNEL values.

The roadway traffic noise model assumptions and outputs are provided in Appendix H.

The project site lies within Contra Costa County, but the project site is located approximately 100 feet from the nearest boundary of the City of Walnut Creek. Therefore, for purposes of this analysis, noise impacts are compared to the thresholds of Contra Costa County and the City of Walnut Creek, as these jurisdictions contain receptors that could be potentially affected by project construction and operation. For purposes of this analysis, the most restrictive of the noise policies and performance standards of Contra Costa County and the City of Walnut Creek are applied to the analysis for this project.

Vibration Methodology

Contra Costa County does not have adopted criteria for construction groundborne vibration impacts. Therefore, the FTA's vibration impact criteria is utilized to evaluate potential vibration impacts resulting from construction activities. The FTA has established industry accepted standards for vibration impact criteria and impact assessment. These guidelines are published in its Transit Noise and Vibration Impact Assessment document,[10] and are summarized in Table 3.11-7 in the regulatory discussion above.

Specific Thresholds of Significance

For purposes of this analysis, the following thresholds are used to evaluate the significance of noise and vibration resulting from implementation of the project.

- A significant impact would occur if the project would generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
  - For temporary construction noise, a significant impact would occur if construction activities would result in a substantial temporary increase in ambient noise levels outside of the County's standard permissible hours for construction (7:30 a.m. to 5:00 p.m., except no construction on weekends or state and federal holidays) that would result in annoyance or sleep disturbance of nearby sensitive receptors.
  - For project-related traffic noise, a significant impact would occur if the project would cause the L_{dn} to increase by 5 dBA or more even if the L_{dn} would remain below normally acceptable

9 Fehr & Peers. 2019. Transportation Impact Assessment Del Hombre Apartments. January.
10 Federal Transit Administration (FTA). 2006. Transit Noise and Vibration Impact Assessment. May.

levels for a receiving land use (as defined in the land use compatibility standards); or by 3 dBA or more, thereby causing the L_{dn} in the project vicinity to exceed normally acceptable levels and result in noise levels that would be considered conditionally acceptable for a receiving land use; or by 1.5 dBA or more where the L_{dn} currently exceeds conditionally acceptable levels. A doubling of traffic volume generally results in a three dBA increase in noise.

  - For project-related stationary noise sources, Contra Costa County and the City of Walnut Creek established a maximum exterior noise performance threshold for receiving residential land uses of 65 dBA L_{dn}. Contra Costa County and the City of Walnut Creek also established a maximum interior noise threshold of 45 dBA L_{dn}; however, if ambient noise levels exceed 65 dBA L_{dn} due to train noise, the maximum interior noise threshold would be 50 dBA L_{dn} in bedrooms and 55 dBA L_{dn} in other habitable rooms. For purposes of this analysis, an increase of more than 3 dBA above the applicable noise performance thresholds would be considered a significant impact.

- A significant impact would occur if the project would conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect. For new multi-family residential land use developments, ambient noise levels up to 65 dBA L_{dn} are considered "normally acceptable." A maximum interior noise threshold of 45 dBA L_{dn} has also been established for residential development; however, if ambient noise levels exceed 65 dBA L_{dn} due to train noise, the maximum interior noise threshold would be 50 dBA L_{dn} in bedrooms and 55 dBA L_{dn} in other habitable rooms.

- A significant impact would occur if the project would generate groundborne vibration or groundborne noise levels in excess of applicable standards. Contra Costa County and the City of Walnut Creek have not adopted criteria for construction or operational groundborne vibration impacts. Therefore, for purposes of this analysis, the FTA's construction vibration impact criteria are utilized. The FTA threshold of 0.2 in/sec PPV is the potential damage criteria threshold for buildings of non-engineer timber and masonry construction. For operational impacts, a significant impact will occur if project on-going activities would produce groundborne vibrations that are perceptible without instruments by a reasonable person at the property lines of the site.

- For a project located within the vicinity of a private airstrip or 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, a significant impact would occur if the project would expose people residing or working in the project area to excessive noise levels.

Impact Evaluation

Substantial Noise Increase in Excess of Standards

Impact NOI-1: **The project would generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.**

As discussed below, operational noise would not result in a significant impact. For construction noise, restricting construction activities to normal business hours, as provided by Mitigation Measure (MM) NOI-1, would reduce potential impacts related to site preparation, grading, and construction to less than significant.

Construction

For purposes of this analysis, a significant impact would occur if construction activities would result in a substantial temporary increase in ambient noise levels outside of the permissible hours for construction (7:30 a.m. to 5:00 p.m., except no construction on weekends or state and federal holidays) that would result in annoyance or sleep disturbance of nearby sensitive receptors. Noise impacts from construction activities associated with the project would be a function of the noise generated by construction traffic, construction equipment, equipment location, sensitivity of nearby land uses, and the timing and duration of the construction activities. A discussion of the potential impacts associated with each of these types of activities is provided below.

Construction Traffic Noise

One type of noise impact that could occur during project construction would result from the increase in traffic flow on local streets, associated with the transport of workers, equipment, and materials to and from the project site. The transport of workers and construction equipment and materials to the project site would incrementally increase noise levels on access roads leading to the site. Because project construction workers and construction equipment would use existing routes, noise from passing trucks would be similar to existing vehicle-generated noise on these local roadways. In addition, these trips would not result in a doubling of daily traffic volumes on any of the local roadways in the project vicinity and would thus not result in a perceptible change in existing traffic noise levels. For this reason, intermittent noise from construction trips would be minor when averaged over a longer time-period and would not be expected to result in a perceptible increase in hourly- or daily-average traffic noise levels in the project vicinity. Therefore, construction-related noise impacts associated with the transportation of workers and equipment to the project site would be less than significant.

Construction Equipment Noise

Construction is performed in discrete steps, each of which entails its own mix of equipment, and consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated on-site. Thus, the noise levels vary as construction progresses. Despite the variety in the types and sizes of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction noise ranges to be categorized by work phase.

Table 3.11-3 lists the maximum noise levels recommended for noise impact assessments for typical construction equipment based on a distance of 50 feet between the equipment and a noise receptor.

The site preparation phase, which includes excavation and grading activities, tend to generate the highest noise levels, because the noisiest construction equipment is earthmoving equipment. Earthmoving equipment includes excavating machinery and compacting equipment, such as bulldozers, draglines, backhoes, front loaders, roller compactors, scrapers, and graders. Typical operating cycles for these types of construction equipment may involve 1 or 2 minutes of full power operation followed by 3 or 4 minutes at lower power settings. Operating cycles for these types of construction equipment may involve 1 or 2 minutes of full power operation followed by 3 or 4 minutes at lower power settings.

Construction of the project is expected to require the use of scrapers, bulldozers, water trucks, haul trucks, and pickup trucks. The foundation would involve spread footings, so impact equipment such as pile drivers is not expected to be used during construction of the project. Based on the information provide in Table 3.11-3, the maximum noise level generated by each scraper is assumed to be 85 dBA L_{max} at 50 feet from this equipment. Each bulldozer would generate 85 dBA L_{max} at 50 feet. The maximum noise level generated by graders is approximately 85 dBA L_{max} at 50 feet. Each doubling of sound sources with equal strength increases the noise level by 3 dBA. Assuming that each piece of construction equipment operates at some distance from the other equipment, a reasonable worst-case combined noise level during this phase of construction would be 90 dBA L_{max} at a distance of 50 feet from the acoustic center of a construction area. This would result in a reasonable worst-case hourly average of 86 dBA L_{eq}. The acoustic center reference is used, because construction equipment must operate at some distance from one another on a project site, and the combined noise level as measured at a point equidistant from the sources would (acoustic center) be the worst-case maximum noise level. The effect on sensitive receptors is evaluated below.

The nearest off-site noise-sensitive receptor to the project site is the multi-family residence located southeast of the project building, which would be located approximately 90 feet from the acoustic center of construction activity where multiple pieces of heavy machinery would operate. Again, the acoustic center refers to a point equidistant from multiple pieces of equipment operating simultaneously which would produce the worst-case maximum noise level. At this distance, construction noise levels at the exterior facade of this nearest residential home would be expected to range up to approximately 85 dBA L_{max}, with a worst-case hourly average of approximately 81 dBA L_{eq}, intermittently, when multiple pieces of heavy construction equipment operate simultaneously at the nearest construction footprint. These noise levels would be intermittent and would be reduce as equipment moves over the project site further from adjacent sensitive receptors. Therefore, restricting construction activities to daytime hours only would ensure that construction noise would not result in a substantial exceedance of the construction noise standards established by Contra Costa County General Plan Policy 11-8.

MM NOI-1 requires adherence to the permissible construction hours and also requires implementation of best management noise reduction techniques and practices that would ensure that construction noise levels would not result in a substantial temporary increase in ambient noise levels that would result in annoyance or sleep disturbance of nearby sensitive receptors. Therefore, with implementation of MM NOI-1, temporary construction noise impacts would be reduced to less than significant.

Operation

The project will result in an increase in traffic on local roadway segments in the project vicinity. In addition, implementation of the project would introduce new stationary noise sources to the ambient noise environment in the project vicinity, including new mechanical ventilation equipment. The potential for a substantial increase in ambient noise levels resulting from these noise sources is analyzed below.

Traffic Noise

Neither the County nor the City of Walnut Creek define "substantial increase," therefore, for purpose of this analysis, a substantial increase is based on the following criteria. As noted in the characteristics of noise discussion, audible increases in noise levels generally refer to a change of 3 dBA or more, as this level has been found to be barely perceptible to the human ear in outdoor environments. A change of 5 dBA is considered the minimum readily perceptible change to the human ear in outdoor environments. Therefore, for purposes of this analysis, a significant impact would occur if the project would cause the L_{dn} to increase by any of the following:

- 5 dBA or more even if the L_{dn} would remain below normally acceptable levels for a receiving land use.
- 3 dBA or more, thereby causing the L_{dn} in the project vicinity to exceed normally acceptable levels and result in noise levels that would be considered conditionally acceptable for a receiving land use.
- 1.5 dBA or more where the L_{dn} currently exceeds conditionally acceptable levels.

The highest traffic noise level increase with implementation of the project would occur along Del Hombre Lane between Honey Trail and Roble Road under existing plus project conditions. Along this roadway segment, the project would result in traffic noise levels ranging up to approximately 52 dBA L_{dn} as measured at 50 feet from the centerline of the nearest travel lane, representing an increase of 8.8 dBA over existing conditions for this roadway segment. However, as documented by the long-term ambient noise measurement conducted adjacent to this roadway segment, ambient noise levels at this location averaged 70 dBA L_{dn}. This represents the combined noise levels from traffic on all local roadways, as well as noise from BART rail activity and other stationary noise sources in the project vicinity. Therefore, the traffic noise levels that would result from implementation of the project along Del Hombre Lane between Honey Trail and Roble Road would actually not result in any perceptible increase in the ambient noise levels adjacent to this roadway segment.

No other modeled roadway segment would experience an increase of greater than 1 dBA under any of the plus project traffic scenarios. Therefore, project-related traffic noise level would result in less than significant increases in traffic noise levels along modeled roadway segments in the project vicinity. This would be a less than significant impact, and no mitigation would be required.

Stationary Noise

A significant impact would occur if operational noise levels generated by stationary noise sources at the project site would result in a substantial permanent increase in ambient noise levels in excess of any of the noise performance thresholds established in Contra Costa County and the City of Walnut Creek General Plans. Contra Costa County and the City of Walnut Creek both establish a maximum exterior noise performance threshold for receiving residential land uses of 65 dBA L_{dn}. Contra Costa County and the City of Walnut Creek also establish a maximum interior noise threshold of 45 dBA L_{dn}; however, if ambient noise levels exceed 65 dBA L_{dn} due to train noise, the maximum interior noise threshold would be 50 dBA L_{dn} in bedrooms and 55 dBA L_{dn} in other habitable rooms.

As noted in the characteristics of noise discussion, audible increases in noise levels generally refer to a change of 3 dBA or more, as this level has been found to be barely perceptible to the human ear in outdoor environments. A change of 5 dBA is considered the minimum readily perceptible change to the human ear in outdoor environments. Therefore, for purposes of this analysis, an increase of more than 3 dBA above the applicable noise performance thresholds would be considered a substantial permanent increase in ambient noise levels.

Implementation of the project would introduce new stationary noise sources to the ambient noise environment in the project vicinity, including new mechanical ventilation equipment. The project would include installation of new rooftop mechanical ventilation equipment. Proposed parking areas would be enclosed in parking structures, and associated noise would not propagate to nearby sensitive receptors; thus the following analysis is limited to stationary noise associated with proposed mechanical equipment.

Noise levels from typical mechanical ventilation equipment range up to approximately 60 dBA L_{eq} as measured at a distance of 25 feet. The building's proposed rooftop mechanical ventilation units could be located as close as 50 feet from the nearest noise-sensitive receptor, which is the multi-family residential home located southeast of the proposed building. At this distance, noise levels generated by this equipment would attenuate to below 54 dBA L_{eq} at this closest residential receptor. These noise levels would not exceed Contra Costa County's or the City of Walnut Creek's maximum exterior noise threshold for receiving residential land uses of 65 dBA L_{dn}. They would therefore also not exceed the maximum interior noise threshold of 45 dBA L_{dn} as measured inside the nearest residential receptor. Therefore, operational noise levels generated by the proposed mechanical ventilation equipment would not result in a substantial permanent increase in ambient noise levels in excess of any of the noise performance thresholds, and would represent a less than significant impact.

Overall

Implementation of the project would introduce new stationary noise sources to the ambient noise environment in the project vicinity, including new rooftop mechanical ventilation equipment. Noise levels generated by this equipment would attenuate to below 54 dBA L_{eq} at the closest residential receptor. These noise levels would not exceed established standards as measured at the nearest receptor. Therefore, this impact would be less than significant.

Level of Significance Before Mitigation

Potentially Significant (construction noise only)

Mitigation Measures

MM NOI-1 Implement Noise-reduction Measures During Construction

To reduce potential construction noise impacts, the following multi-part mitigation measure shall be implemented for the project:

- The construction contractor shall ensure that all equipment driven by internal combustion engines shall be equipped with mufflers, which are in good condition and appropriate for the equipment.
- The construction contractor shall ensure that unnecessary idling of internal combustion engines (i.e., idling in excess of 5 minutes) is prohibited.
- The construction contractor shall utilize “quiet” models of air compressors and other stationary noise sources where technology exists.
- At all times during project grading and construction, the construction contractor shall ensure that stationary noise-generating equipment shall be located as far as practicable from sensitive receptors and placed so that emitted noise is directed away from adjacent residences.
- The construction contractor shall ensure that the construction staging areas shall be located to create the greatest feasible distance between the staging area and noise-sensitive receptors nearest the project site.
- Restrict noise-generating construction activities (including construction-related traffic, excluding interior work within the building once the building envelope is complete) at the project site and in areas adjacent to the project site to the hours of 7:30 a.m. to 5:00 p.m., Monday through Friday, unless otherwise approved by CDD, with no construction allowed on weekends, federal and State holidays.

Level of Significance After Mitigation

Less Than Significant with Mitigation

Noise Levels That Would Conflict with Any Land Use Plan, Policy, or Regulation

Impact NOI-2: The project could cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect.

Construction

Impacts related to noise land use compatibility consistency are limited to operational impacts. No respective construction impacts would occur.

Operation

A significant impact would occur if the project would result in a conflict with Contra Costa County or the City of Walnut Creek applicable adopted land use compatibility standards. The applicable standards are summarized as follows:

- 65 dBA L_{dn} for the proposed multi-family residential land use development; or

- conditionally acceptable land use compatibility threshold of 70 dBA L_{dn} for the proposed multi-family residential land use development.

Contra Costa County and the City of Walnut Creek also establish a maximum interior noise threshold of 45 dBA L_{dn}; however, for new downtown mixed-use development or for new residential development affected by noise from BART or helicopters, the project must ensure that maximum noise levels do not exceed 50 L_{dn} in bedrooms and 55 L_{dn} in other rooms.

The FHWA highway traffic noise prediction model (FHWA RD-77-108) was used to evaluate existing and future project-related traffic noise conditions along modeled roadway segments in the vicinity of the project site. The projected future traffic noise levels on roadways adjacent to the site were analyzed to determine compliance with the applicable noise and land use compatibility standards. Traffic modeling was performed using the data obtained from the project-specific traffic impact study conducted by Fehr & Peers[11] (Appendix I). This traffic impact study provides data for existing (year 2019) and cumulative conditions (year 2040). The resultant noise levels were weighed and summed over a 24-hour period to determine the L_{dn} values. The traffic noise modeling input and output files—including the 60 dBA, 65 dBA, and 70 dBA CNEL noise contour distances—are included in Appendix H. The following tables show a summary of the traffic noise levels for existing (year 2019), near term, and cumulative (year 2040) traffic conditions, with and without the project, as measured at 50 feet from the centerline of the outermost travel lane.

Table 3.11-8 shows a summary of the traffic noise levels for existing (year 2019) scenarios with and without project conditions as measured at 50 feet from the centerline of the outermost travel lane.

Table 3.11-8: Project Traffic Noise Modeling Results Summary

Roadway Segment	L_{dn} (dBA) 50 feet from Centerline of Outermost Lane		
	Existing without Project	Existing with Project	Increase over Existing without Project (dBA)
Las Juntas Way—Iron Horse Lane to Coggins Drive	56.3	56.8	0.5
Las Juntas Way—Coggins Drive to Del Hombre Lane	55.9	56.9	1.0
Las Juntas Way—Roble Road to Santos Lane	55.2	55.6	0.4
Del Hombre Lane—Honey Trail to Roble Road	43.3	52.1	8.8
Coggins Drive—Las Juntas Way to Jones Road	58.0	58.4	0.4
Jones Road—Coggins Drive to Harvey Drive	57.3	57.6	0.3

Note:
Modeling results do not take into account mitigating features such as topography, vegetative screening, fencing, building design, or structure screening. Rather it assumes a worst case of having a direct line of site on flat terrain.
Source: FCS 2019.

[11] Fehr & Peers. 2019. Transportation Impact Assessment Del Hombre Apartments. January.

Table 3.11-9 shows a summary of the traffic noise levels for opening year (2022) traffic conditions with and without project conditions as measured at 50 feet from the centerline of the outermost travel lane.

Table 3.11-9: Opening Year Traffic Noise Modeling Results Summary

Roadway Segment	L_{dn} (dBA) 50 feet from Centerline of Outermost Lane		
	Opening Year without Project	Opening Year with Project	Increase over Opening Year without Project (dBA)
Las Juntas Way—Iron Horse Lane to Coggins Drive	57.1	57.6	0.5
Las Juntas Way—Coggins Drive to Del Hombre Lane	57.0	57.9	0.9
Las Juntas Way—Roble Road to Santos Lane	56.8	57.1	0.3
Del Hombre Lane—Honey Trail to Roble Road	48.1	53.1	5.0
Coggins Drive—Las Juntas Way to Jones Road	58.6	58.9	0.3
Jones Road—Coggins Drive to Harvey Drive	57.8	58.1	0.3

Note:
Modeling results do not take into account mitigating features such as topography, vegetative screening, fencing, building design, or structure screening. Rather it assumes a worst case of having a direct line of site on flat terrain.
Source: FCS 2019.

Table 3.11-10 shows a summary of the traffic noise levels for cumulative (year 2040) conditions with and without project conditions as measured at 50 feet from the centerline of the outermost travel lane.

Table 3.11-10: Cumulative Traffic Noise Modeling Results Summary

Roadway Segment	L_{dn} (dBA) 50 feet from Centerline of Outermost Lane		
	Cumulative without Project	Cumulative with Project	Increase over without Project (dBA)
Las Juntas Way—Iron Horse Lane to Coggins Drive	57.5	57.9	0.4
Las Juntas Way—Coggins Drive to Del Hombre Lane	57.4	58.2	0.8
Las Juntas Way—Roble Road to Santos Lane	57.0	57.4	0.4
Del Hombre Lane—Honey Trail to Roble Road	48.1	53.1	5.0
Coggins Drive—Las Juntas Way to Jones Road	59.0	59.2	0.2
Jones Road—Coggins Drive to Harvey Drive	58.1	58.4	0.3

Note:
Modeling results do not take into account mitigating features such as topography, vegetative screening, fencing, building design, or structure screening. Rather it assumes a worst case of having a direct line of site on flat terrain.
Source: FCS 2019.

The highest traffic noise levels that would be experienced at the project would occur on Del Hombre Lane between Honey Trail and Roble Road under cumulative plus project conditions. These traffic noise levels would range up to approximately 59.2 dBA L_{dn} as measured at 50 feet from the centerline of the nearest travel lane. The nearest proposed façade would be located approximately 35 feet from the centerline of the roadway. At this distance, traffic noise levels would range up to approximately 63 dBA L_{dn}. These traffic noise levels do not exceed the "normally acceptable" standard of 65 dBA L_{dn} for new multi-family residential land use developments and would be considered less than significant.

However, the existing ambient noise environment includes other major noise sources, including noise from BART rail line activity. The ambient noise environment on the project site was documented through the ambient noise monitoring effort described in the existing conditions discussion. A long-term (24-hour) noise measurement was conducted on the northwestern corner of the project site, approximately 75 feet southeast of the raised BART rail line. As was observed by the technician at the time of the noise measurement, the dominant noise sources in the project vicinity include vehicular traffic on Treat Boulevard and Roble Road, and BART rail activity. The resulting measurement showed that ambient noise levels at this location averaged 70 dBA L_{dn}. These ambient noise levels exceed the "normally acceptable" land use compatibility range, but are within the "conditionally acceptable" land use compatibility range of below 75 dBA L_{dn} for new multi-family residential land use development. Therefore, according to County Policy 11-5, if ambient noise levels exceed 65 dBA L_{dn} due to train noise, design measures must be included in the project to maintain the maximum interior noise threshold of 50 dBA L_{dn} in bedrooms and 55 dBA L_{dn} in other habitable rooms.

Based on the United States Environmental Protection Agency (EPA) Protective Noise Levels,[12] a combination of walls, doors, and windows provided in accordance with State building code requirements for the proposed residential development would result in a 25 dBA in exterior-to-interior noise reduction with windows closed and a 15 dBA or more with windows open. With windows open, interior noise levels of the nearest proposed units to the BART rail line would not meet the interior noise standard of 50 dBA L_{dn} (i.e., 70 dBA–15 dBA = 55 dBA). This impact is potentially significant. Therefore, MM NOI-2 shall be implemented, which requires that the project shall include a code compliant mechanical ventilation system that would permit windows to remain closed for prolonged periods. The inclusion of the proposed air conditioning system would allow windows to remain closed and would be sufficient to reduce traffic and BART noise levels to meet the interior noise level standard of 50 dBA L_{dn} (i.e., 70 dBA–25 dBA = 45 dBA). This mitigation measure would ensure that potentially impacted interior residential units would meet the interior noise level requirement of 45 dBA L_{dn}. Therefore, with implementation of MM NOI-2, future projected traffic and BART noise impacts would be reduced to less than significant.

Thus, traffic noise levels adjacent to the project site would not exceed noise levels that Contra Costa County and the City of Walnut Creek consider acceptable for new residential land uses. As such, traffic noise would result in a less than significant impact for the proposed multi-family residential development.

[12] United States Environmental Protection Agency (EPA) 550/9-79-100, November 1978.

Therefore, the impact related to noise land use compatibility standards consistency would be less than significant.

Level of Significance Before Mitigation

Potentially Significant (operational noise only)

Mitigation Measures

MM NOI-2 Install Mechanical Ventilation System

To reduce potential traffic and BART noise impacts, prior to issuance of building permits, the applicant shall submit evidence to the satisfaction of the Department of Conservation and Development to demonstrate that the project includes a code compliant mechanical ventilation system that would permit windows to remain closed for prolonged periods.

Level of Significance After Mitigation

Less Than Significant

Groundborne Vibration/Noise Levels

Impact NOI-3: The project would not result in generation of excessive groundborne vibration or groundborne noise levels.

Construction

Contra Costa County and the City of Walnut Creek have not adopted criteria for construction groundborne vibration impacts. Therefore, for purposes of this analysis, the FTA's vibration impact criteria are utilized. The FTA has established industry accepted standards for vibration impact criteria and impact assessment. These guidelines are published in the agency's Transit Noise and Vibration Impact Assessment document.[13] Therefore, for purposes of this analysis, a significant impact would occur if the project would generate groundborne vibration or groundborne noise levels in excess of the FTA impact assessment criteria for construction (0.2 in/sec PPV for non-engineer timber and masonry buildings).

Groundborne noise is generated when vibrating building components radiate sound, or noise generated by groundborne vibration. In general, if groundborne vibration levels are do not exceed levels considered to be perceptible, then groundborne noise levels would not be perceptible in most interior environments. Therefore, this analysis focuses on determining exceedances of groundborne vibration levels.

Construction activity can result in varying degrees of ground vibration, depending on the equipment used on the site. Operation of construction equipment causes vibrations that spread through the ground and diminish in strength with distance. Buildings in the vicinity of a construction site respond to these vibrations with varying results ranging from no perceptible effects at the low levels,

[13] Federal Transit Administration (FTA). 2006. Transit Noise and Vibration Impact Assessment. May.

to slight damage at the highest levels. As shown in the Setting section above, Table 3.11-4 provides approximate vibration levels for various construction activities.

Impact equipment, such as pile drivers, are not expected to be used during construction of the project. Therefore, of the variety of equipment used during construction of this component of the project, the small vibratory rollers that would be used in the site preparation phase of construction would produce the greatest groundborne vibration levels. Small vibratory rollers produce groundborne vibration levels ranging up to 0.101 in/sec PPV at 25 feet from the operating equipment.

The nearest off-site receptor to where the heaviest construction equipment would operate are the multi-family residential homes, approximately 40 feet southeast of the nearest construction footprint for the project. As measured at the nearest receptor, operation of a small vibratory roller could result in groundborne vibration levels up to 0.050 in/sec PPV. This is well below the FTA's damage threshold criteria of 0.2 PPV for non-engineer timber and masonry buildings. Therefore, construction-related groundborne vibration impacts to off-site receptors would be less than significant.

Operation

Contra Costa County and the City of Walnut Creek have not adopted criteria for operational groundborne vibration impacts. Therefore, for purposes of this analysis, a significant impact would occur if project on-going activities would produce groundborne vibrations that are perceptible without instruments by a reasonable person at the property lines of a site. Implementation of the project would not include any permanent sources of vibration that would expose persons in the project vicinity to groundborne vibration levels that could be perceptible without instruments at any existing sensitive land use in the vicinity of the project site. Therefore, operational groundborne vibration impacts would be less than significant.

Level of Significance

Less Than Significant

Excessive Noise Levels from Airport Activity

Impact NOI-4:	**The project would not expose people residing or working in the project area to excessive noise levels for a project located within the vicinity of a private airstrip or 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.**

Construction

Noise impacts related to a project being located proximate to a private airstrips, public airport, or public use airport are limited to operational impacts. No respective construction impacts would occur.

Operation

A significant impact would occur if the project would expose people residing or working in the project area to excessive noise levels for a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport.

The project site is not located within the vicinity of a private airstrip. Additionally, there is not a private airstrip located within a 5-mile radius of the project. The closest public airport is the Buchanan Field Airport located 3.5 miles north of the project site. The project site is also not located within a 55 dBA CNEL airport noise contours of any public or public use airport. As such, operation of the project would not expose people residing or working at the project site to excessive noise levels associated with public airport or public use airport noise. Therefore, no impact related to exposure of persons residing or working at the project site to excessive noise levels associated with airport activity would occur.

Level of Significance

No Impact

3.11.5 - Cumulative Impacts

Construction Noise

The geographic scope of the cumulative noise analysis is the project vicinity, including surrounding sensitive receptors. Noise impacts tend to be localized; therefore, the area near the project area (approximately 0.25 mile) would be the area most affected by proposed plan activities. Nearby projects surrounding this site that are currently or soon to be under construction include Las Juntas (estimated completion Fall 2019) and Avalon Block C (estimated completion Summer 2019). The project's current estimated construction schedule is for site preparation work to begin in Summer 2020. Therefore, the project's loudest phase of construction activity (the site preparation phase) would not overlap with any other current or planned development project located within 0.25 mile of the project site. Therefore, the project would result in a less than significant cumulative impact related to construction noise.

Operational Traffic Noise

The significance threshold for a cumulative traffic noise impact would be traffic noise levels that would cause the L_{dn} to increase by 1.5 dBA or more where the L_{dn} currently exceeds conditionally acceptable levels.

None of the modeled roadway segments in the project vicinity would have traffic noise levels that would exceed conditionally acceptable noise levels for any adjacent land uses. In addition, the highest traffic noise level increase under cumulative plus project conditions would occur along Del Hombre Lane between Honey Trail and Roble Road. Along this roadway segment, the project would result in an increase of 5 dBA over conditions that would exist without the project; however, the resulting traffic noise levels along this segment would range up to approximately 53 dBA L_{dn} as measured at 50 feet from the centerline of the nearest travel lane. These cumulative plus project traffic noise levels would not result in any increase in the documented existing ambient noise levels adjacent to this roadway segment. Therefore, project-related traffic noise level would result in less than significant increases in traffic noise levels along modeled roadway segments in the project vicinity. This would be a less than significant impact, and no mitigation would be required.

Given the above information, the project, in conjunction with other existing, planned, and probable future projects, would result in a less than significant cumulative impact related to noise.

Operational Stationary Noise

Implementation of the project would introduce new stationary noise sources to the ambient noise environment in the project vicinity, including new rooftop mechanical ventilation equipment. However, noise levels generated by this equipment would attenuate to below 54 dBA L_{eq} at the closest residential receptor. These noise levels would not exceed existing background ambient noise levels. Therefore, implementation of the project would not result in a cumulatively considerable contribution to existing ambient noise conditions in the project vicinity. This impact would be less than significant.

Noise Land Use Compatibility Consistency

Combined cumulative year traffic and BART activity noise levels at the project site would result in noise levels that Contra Costa County and the City of Walnut Creek consider to be conditionally acceptable for new multi-family residential land uses (with projected noise levels of up to 70 dBA L_{dn} at the nearest proposed façade). This impact is potentially significant. However, as discussed under Impact NOI-2, MM NOI-2 shall be implemented, which requires the project to include a code compliant mechanical ventilation system that would permit windows to remain closed for prolonged periods. This measure would ensure that potentially impacted interior residential units would meet the interior noise level requirement of 45 dBA L_{dn}. Therefore, implementation of MM NOI-2 would ensure that the project would not result in a cumulatively considerable contribution to consistency with noise land use compatibility standards. Therefore, with implementation of MM NOI-2, the project would result in a less than significant cumulative impact related to land use compatibility consistency.

Construction Vibration

The only cumulatively considerable contribution to vibration conditions in the project vicinity would result from introduction of new permanent sources of groundborne vibration in the project site vicinity. The only major sources of groundborne vibration in the project vicinity is railroad activity along the light rail line. Implementation of the project would not introduce any new permanent sources of groundborne vibration to the project vicinity and would not increase railroad activity. Therefore, implementation of the project would not result in a cumulatively considerable contribution to vibration conditions in the project vicinity. This impact would be less than significant.

Operational Vibration

Implementation of the project would not include any permanent sources of vibration that would expose persons in the project vicinity to groundborne vibration levels that could be perceptible without instruments at any existing sensitive land use in the vicinity of the project site. Therefore, implementation of the project would not result in a cumulatively considerable contribution to vibration conditions in the project vicinity. This impact would be less than significant.

Level of Cumulative Significance Before Mitigation

Potentially Significant (operation noise only)

Mitigation Measures

Implement MM NOI-2

Level of Cumulative Significance After Mitigation

Less Than Significant

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