HUMMINGBIRD ENERGY STORAGE PROJECT NOISE AND VIBRATION ASSESSMENT

San José, California

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Prepared for:

Tyler Rogers
David J. Powers & Associates, Inc.
1736 Franklin Street, Suite 300
Oakland, CA 94612

Prepared by:

Carrie J. Janello
Michael S. Thill

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality
429 East Cotati Avenue
Cotati, CA 94931
(707) 794-0400

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INTRODUCTION

The project proposes an approximate 103,894-square-foot (sf) battery-based energy storage building and substation at 6321 San Ignacio Avenue in San José, California. As part of the proposed project, approximately 2.5 miles of transmission line running from the proposed substation to the Pacific Gas & Electric (PG&E) Metcalf substation would be installed. The transmission line would be underground along the east side of Monterey Road and would connect to the existing PG&E transmission line corridor that traverses Coyote Creek and connects to the Metcalf substation.

The proposed project would utilize an existing vacant industrial building to house lithium ion batteries, which would store excess energy generated by the electrical grid during the day. The batteries, inverters, and medium-voltage transformers would be installed within the existing building. The batteries would be assembled within racks and cabinets, which would be seismically anchored to the building foundation and constructed of non-flammable aluminum and steel. Once fully operational, the energy storage building would be able to store up to 75 mega-watt (MW)/300 mega-watt hour (MWh) of electricity generated within the South Bay-Moss Landing area. Metal-clad switchgear, a main power transformer, and additional electrical equipment would be installed within an approximate 15,000-sf fenced substation located in the parking area to the west of the energy storage building. All outside electrical equipment would be housed in the appropriate National Electrical Manufacturers Association (NEMA) rated enclosures and screened from view on all sides using screening methods and materials approved by the City. All outside electrical cabling would be installed underground. Figure 1 shows the energy storage building and adjacent substation at the proposed site.

FIGURE 1 Proposed Energy Storage Building and Substation



Source: Google Earth, 2019.

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into two sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise, summarizes applicable regulatory criteria, and discusses the existing noise environment at the project site and in the surrounding area; and 2) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents measures, where necessary, to mitigate the impacts of the project on sensitive receptors in the vicinity.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from

the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (L_{dn} or *DNL*) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA DNL. Typically, the highest steady traffic noise level during the daytime is about equal to the DNL and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA DNL with open windows and 65-70 dBA DNL if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed; those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The DNL as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA DNL. At a DNL of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the DNL increases to 70 dBA, the percentage of the population highly annoyed increases to about 25-30 percent of the population. There is, therefore, an increase of about 2

percent per dBA between a DNL of 60-70 dBA. Between a DNL of 70-80 dBA, each decibel increase increases by about 3 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the DNL is 60 dBA, approximately 30-35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous or frequent intermittent vibration levels produce. The guidelines in Table 3 represent syntheses of vibration criteria for human response and potential damage to buildings resulting from construction vibration.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to cause damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage. Most buildings are included within the categories ranging from “Historic and some old buildings” to “Modern industrial/commercial buildings”. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at lower levels than those shown, depending on the level of activity or the

sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

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

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Threshold at which there is a risk of damage to fragile buildings with no risk of damage to most buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential structures
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

Regulatory Background - Noise

The State of California and the City of San José have established regulatory criteria that are applicable in this assessment. The CEQA Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

State CEQA Guidelines. The CEQA guidelines are used in this analysis to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Generation of 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) Generation of excessive groundborne vibration or groundborne noise levels; or

(c) 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, if the project would expose people residing or working in the project area to excessive noise levels.

CEQA does not define what noise level increase would be considered substantial. Typically, an increase in the DNL noise level resulting from the project at noise sensitive land uses of 3 dBA or

greater would be considered a significant impact when projected noise levels would exceed those considered acceptable for the affected land use. An increase of 5 dBA DNL or greater would be considered a significant impact when projected noise levels would remain within those considered acceptable for the affected land use.

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies with the goal to, "Minimize the impact of noise on people through noise reduction and suppression techniques, and through appropriate land use policies," in the City of San José. The following policies are applicable to the proposed project:

EC-1.3 Mitigate noise generation of new nonresidential land uses to 55 dBA DNL at the property line when located adjacent to existing or planned noise-sensitive residential and public/quasi-public land uses.

EC-1.6 Regulate the effects of operational noise from existing and new industrial and commercial development on adjacent uses through noise standards in the City's Municipal Code.

EC-1.7 Require construction operations within San José to use best available noise suppression devices and techniques and limit construction hours near residential uses per the City's Municipal Code. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:

- Involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses.

EC-2.3 Require new development to minimize continuous vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, including ruins and ancient monuments or building that are documented to be structurally weakened, a continuous vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to a building. A continuous vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction. Equipment or activities typical of generating continuous vibration include but are not limited to: excavation equipment; static compaction equipment; vibratory pile drivers; pile-extraction equipment; and vibratory compaction equipment. Avoid use of impact pile drivers within 125 feet of any buildings, and within 300 feet of historical

buildings, or buildings in poor condition. On a project-specific basis, this distance of 300 feet may be reduced where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction. Transient vibration impacts may exceed a vibration limit of 0.08 in/sec PPV only when and where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction.

City of San José Municipal Code. The City's Municipal Code contains a Zoning Ordinance that limits noise levels at adjacent properties. Chapter 20.30.700 states that sound pressure levels generated by any use or combination of uses on a property shall not exceed 55 dBA at any property line shared with land zoned for residential use, except upon issuance and in compliance with a Conditional Use Permit.

Chapter 20.100.450 of the Municipal Code establishes allowable hours of construction within 500 feet of a residential unit between 7:00 am and 7:00 pm Monday through Friday unless permission is granted with a development permit or other planning approval. No construction activities are permitted on the weekends at sites within 500 feet of a residence.

Performance standards are provided in Chapter 20.50.300 of the City's Municipal Code. For noise, Table 20-135 includes maximum sound pressure level thresholds as measured at the receiving property lines.

Table 20-135
Noise Standards

	Maximum Noise Level in Decibels at Property Line
Industrial use adjacent to a property used or zoned for residential purposes	55
Industrial use adjacent to a property used or zoned for commercial purposes	60
Industrial use adjacent to a property used or zoned for industrial or use other than commercial or residential purposes	70

Existing Noise Environment

The project site is located at 6321 San Ignacio Avenue in San José, California. The existing vacant building is surrounded by other industrial and commercial buildings and is bounded to the north by State Route 85 (SR 85), which would be the dominant noise source in the project vicinity.

The nearest noise-sensitive receptors to 6321 San Ignacio Avenue would be the single-family residences to the north, opposite SR 85 and Monterey Road. These residences are over 700 feet from the proposed substation. However, the nearest residences along the project corridor would be located south of Bernal Road. Along the project corridor, residences are located on either side of

Monterey Road, from Bernal Road to just north of Metcalf Road. Monterey Road is a four-lane highway divided by a median along the project corridor. The ambient noise environment at these residences would be dominated by Monterey Road and the Union Pacific Railroad (UPRR) tracks that run parallel to Monterey Road. Based on previous measurements made along Monterey Road, daytime ambient noise levels typically ranged from 63 to 70 dBA L_{eq} at # feet from the centerline of Monterey Road. Nighttime ambient noise levels would be about 7 dBA lower than daytime noise levels, ranging from approximately 56 to 63 dBA L_{eq}.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- A significant noise impact would be identified if the project would generate a substantial temporary or permanent noise level increase over ambient noise levels at existing noise-sensitive receptors surrounding the project site and that would exceed applicable noise standards presented in the General Plan or Municipal Code at existing noise-sensitive receptors surrounding the project site.

    - Hourly average noise levels during construction that would exceed 60 dBA L_{eq} at residential land uses or exceed 70 dBA L_{eq} at commercial land uses and exceed the ambient noise environment by at least 5 dBA L_{eq} for a period of more than one year would constitute a significant temporary noise increase in the project vicinity.

    - A significant permanent noise level increase would occur if project-generated traffic would result in: a) a noise level increase of 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or b) a noise level increase of 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater.

    - A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan or Municipal Code.

- A significant impact would be identified if the construction of the project would generate excessive vibration levels surrounding receptors. Groundborne vibration levels exceeding 0.2 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

- A significant noise impact would be identified if the project would expose people residing or working in the project area to excessive noise levels.

Impact 1a: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. The incorporation of construction best management practices as project conditions of approval would result in a **less-than-significant** temporary noise impact.

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time.

Construction noise levels vary on a day-to-day basis, depending on the type and amount of equipment operating on-site and the specific task that is being completed on a particular day. Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. Table 4 summarizes the maximum instantaneous noise levels generated by typical construction equipment that generate either non-impact or impacts sounds at a distance of 50 feet from the noise source. The highest maximum noise levels generated by project construction would typically range from about 80 to 90 dBA L_{max} at a distance of 50 feet from the noise source. As shown in the table, impact pile driving generates noise levels up to 105 dBA L_{max}, and vibratory pile driving would generate noise levels up to 95 dBA L_{max}. Pile driving is not expected for the proposed project. Typical hourly average construction-generated noise levels for various types of projects are summarized in Table 5 at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.).

Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain can provide an additional 5 to 10 dBA noise reduction at distant receptors.

TABLE 4 Construction Equipment 50-Foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes:

[1] Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.

[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

[3] Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

TABLE 5 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	II	I	II	I	II	I	II
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

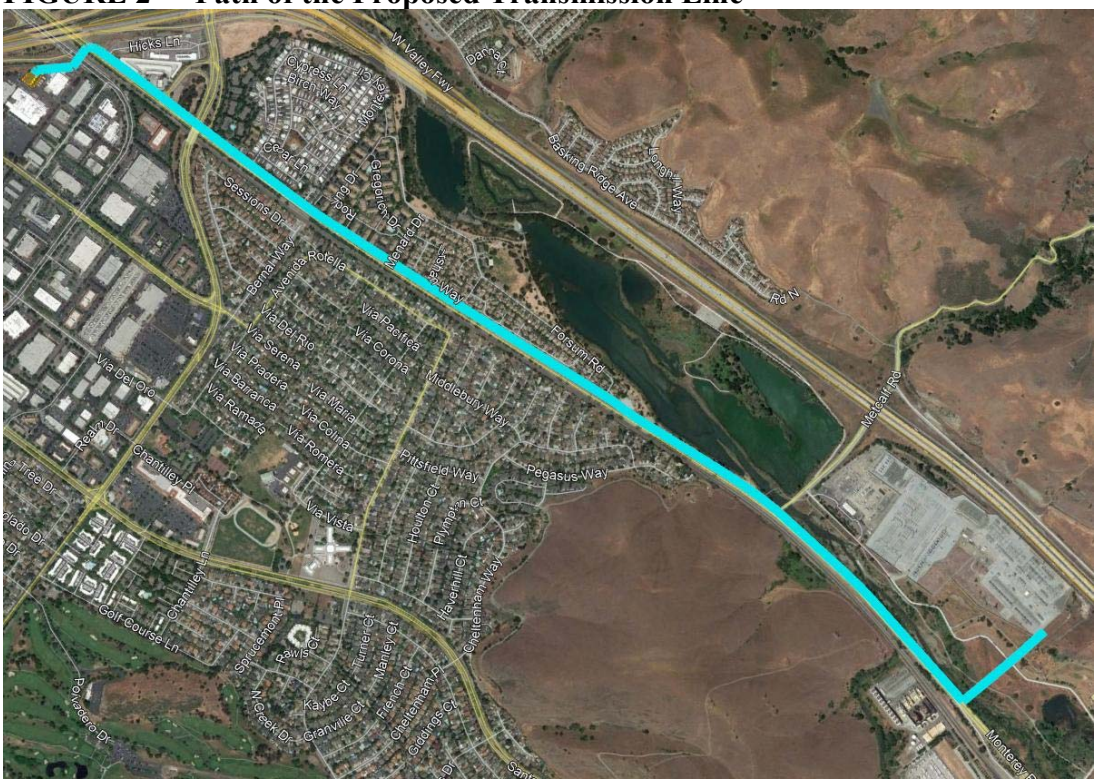
I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

Policy EC-1.7 of the City's General Plan requires that all construction operations within the City to use best available noise suppression devices and techniques and to limit construction hours near residential uses per the Municipal Code allowable hours, which are between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday when construction occurs within 500 feet of a residential land use unless permission is granted with a development permit or other planning approval by the City. Further, the City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would involve substantial noise-generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

Construction activities for the proposed project would include: 1) substation construction at the project site; 2) underground construction along the transmission line, which would run from the proposed substation to Coyote Creek where an above-ground transmission line would be required; and 3) overhead construction at Coyote Creek on the south end of the transmission line. Figure 2 shows the full extent of the transmission line. All three components of the would be constructed simultaneously, and the full duration of the proposed project would be about six months.

FIGURE 2 Path of the Proposed Transmission Line



The Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM) was used to calculate the hourly average noise levels anticipated for the worst-case scenario for each construction activity. RCNM includes representative sound levels for the most common types of construction equipment and the approximate usage factors of such equipment that were developed based on an extensive database of information gathered during the construction of the Central Artery/Tunnel Project in Boston, Massachusetts (CA/T Project or "Big Dig"). The usage factors represent the percentage of time that the equipment would be operating at full power. To estimate the worst-case scenario, the maximum amount of equipment stated was assumed to operate simultaneously. Table 6 summarizes the equipment expected to be used during each activity, the duration of each activity, and the estimated worst-case scenario noise levels expected for each activity at a distance of 50 feet. Additionally, all mobile equipment will be fitted with backup alarms per OSHA requirements. The noise level of backup alarms can vary depending on the type and directivity of the sound, but maximum noise levels are typically in the range of 65 to 75 dBA L_{max} at a distance of 50 feet.

TABLE 6 Summary of Construction Noise Modeling Source Levels at a Distance of 50 feet

Activity	Type of Work (Duration)	Equipment	L_{eq}[a]
Overhead Construction – southern end of the transmission line	Various foundation and line construction; average of 7 pieces of equipment at a time, no more than 12 (1 month)	Excavator with Auger Excavator with Bucket Rubber-Tired Backhoe Loader Line Trucks Reel Truck Dump Truck Pickup Truck Trailer Crane	83-85 dBA
Underground Construction – from the substation to the southern end of the transmission line	Trenching; average of 12 pieces of equipment at a time, no more than 18 (6 months)	Excavator Integrated Tool Carrier/Loader Rubber-Tired Loader Dump Trucks Broom Water Truck Pickup Trucks Trailers Directional Boring Machine Jack and Bore Machine Motor Grader Paving Machine Rollers	89-91 dBA
Substation – northern end of the transmission line	Installation of equipment; average of 7 pieces of equipment at a time, no more than 12 (5 month)	Excavator with Auger Excavator with Bucket Rubber-Tired Backhoe Loader Line Trucks Reel Truck Dump Truck Pickup Truck Trailer Crane	83-85 dBA

[a] Range of equipment represents the noise levels when the average pieces of equipment is operational to the maximum pieces of equipment operational.

The modeled noise levels in Table 6 represent the worst-case scenario construction noise at a distance of 50 feet from the center of the busy construction site. However, the overhead construction and substation construction sites are located approximately 2.5 miles apart and would, therefore, potentially impact different receptors. The underground construction would move along the entire 2.5 miles, potentially impacting noise-sensitive receptors for short durations along the corridor. Using the combined source levels from Table 6, the construction noise levels are propagated to the nearest surrounding receptors during the overhead construction activities and summarized in Table 7. The propagation distances were estimated from the center of the active

construction site to the property lines of the surrounding receptors. No shielding effects were assumed for the estimated noise levels shown in Table 7.

TABLE 7 Estimated Construction Noise Levels at Nearby Land Uses – Overhead Construction Activities

Number of Active Construction Equipment	Calculated Hourly Average L_{eq}, dBA			
	Metcalf Energy Center (430 ft)	Bad Boy Body Graphics (1,125 ft)	Res. – on Coyote Ranch Rd (1,275 ft)	Res. – on Pegasus Ct (3,620 ft)
Average of 7 pieces of equipment	65	56	55	46
Maximum of 12 pieces of equipment	66	58	57	48

As underground construction activities progress along the project corridor from the proposed substation at 6321 San Ignacio Avenue to the PG&E Metcalf substation, multiple residences would be exposed to construction noise at any given time. However, as shown in Table 6, the total construction period would last for six months, which means that any single residence along the corridor would be exposed to noisy construction activities for a period of two months or less. The path of the transmission line is proposed to run along the east side of Monterey Road. The property lines of the residences along the eastern side of the roadway, which include single- and multi-family residences and mobile homes, would range from 20 to 85 feet from the transmission line construction activity. Additionally, the property lines of the storage facility and commercial uses would be approximately 20 to 30 feet from the transmission line. Along the western side of Monterey Road, the property lines of the single-family residences would be 145 to 185 feet from the construction area, while the commercial and industrial buildings would be as close as 20 feet from the transmission line construction when activities occur near the proposed substation to 165 feet from the construction area when activities occur east of Monterey Road. Table 8 summarizes the estimated noise levels that would occur along transmission line corridor, as measured at the surrounding receptors. While Table 8 assumes no reductions due to the intervening barriers, it should be noted that existing sound walls line Monterey Road where residences are located. These sound walls could provide up to 5 dBA reduction from the levels summarized in Table 8.

TABLE 8 Estimated Construction Noise Levels at Nearby Land Uses – Underground Construction Activities

Number of Active Construction Equipment	Calculated Hourly Average L_{eq}, dBA[a]			
	East Res. (20 to 85 ft)	East Comm. & Ind. (20 to 30 ft)	West Res. (145 to 185 ft)	West Comm. & Ind. (20 to 165 ft)
Average of 12 pieces of equipment	84 to 97	93 to 97	77 to 79	78 to 97
Maximum of 18 pieces of equipment	87 to 99	96 to 99	80 to 82	81 to 99

[a] Estimated construction noise levels do not include reduction due to existing sound walls along residential property lines.

Table 9 summarizes the construction noise levels expected at the property lines of the nearest receptors to the proposed substation. Three buildings in the industrial park would have unobstructed lines-of-sight to the proposed substation, with distances of 75 to 430 feet from the center of the substation construction site. Existing buildings would provide shielding for the remaining buildings in the industrial park, which could reduce noise levels by 5 to 10 dBA. Other surrounding land uses include the commercial uses opposite Monterey Road, the data center opposite SR 85, and the single-family residences to the north, opposite both roadways.

TABLE 9 Estimated Construction Noise Levels at Nearby Land Uses – Substation Construction Activities

Number of Active Construction Equipment	Calculated Hourly Average L_{eq}, dBA			
	Industrial Park Buildings (75 to 430 ft)	Comm. opposite Monterey Rd (785 ft)	Res. – north (775 ft)	Equinix Data Center (820 ft)
Average of 7 pieces of equipment	65 to 80	59	59	59
Maximum of 12 pieces of equipment	66 to 81	61	60	61

For the proposed project, nighttime construction work is not expected; however, some nighttime work may be required if absolutely necessary to maintain schedule. Daytime ambient noise levels at the residences along the project corridor would range from 63 to 70 dBA L_{eq}, as described above. Nighttime ambient levels would range from 56 to 63 dBA L_{eq}. As shown in Tables 7 and 9, overhead and substation construction activities are not expected to generate noise levels exceeding daytime ambient conditions, while falling within the range of existing nighttime ambient conditions, at the residential land uses. Due to the close proximity of the underground construction work, however, noise levels would temporarily exceed ambient conditions at the residences located along Monterey Road between SR 85 and the PG&E Metcalf Substation during both daytime and nighttime hours. Additionally, existing commercial and industrial buildings in the industrial park would be within 200 feet of the substation project site, and other commercial buildings adjoining Monterey Road would be within 200 feet of the transmission line construction. Daytime and nighttime ambient noise levels would potentially be exceeded.

While construction levels during the proposed project would at times exceed ambient noise levels at nearby residences and commercial/industrial uses, the construction noise nuisance resulting from construction activities would be short-term. Further, during the underground work, construction activities would move along the corridor as work is completed; therefore, residences

and commercial uses located along the corridor would only be exposed to limited periods of elevated construction noise levels when activities would occur in close proximity to the land uses.

Since all three construction activities are to occur simultaneously, total construction is expected to occur for a period of less than one year, and the temporary noise impact due to project construction would be minimized with the incorporation of the City's standard permit conditions, shown below.

Standard Permit Conditions:

- Limit construction hours to between 7:00 a.m. and 7:00 p.m., Monday through Friday, unless permission is granted with a development permit or other planning approval. No construction activities are permitted on the weekends at site within 500 feet of a residence. Construction outside of these hours may be approved through a development permit based on a site-specific "construction noise mitigation plan" and a finding by the Director of Planning, Building and Code Enforcement that the construction noise mitigation plan is adequate to prevent noise disturbance of affected residential uses.

- Construct solid plywood fences around ground level construction sites adjacent to operational businesses, residences, or other noise-sensitive land uses.

- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Prohibit unnecessary idling of internal combustion engines.

- Locate stationary noise-generating equipment such as air compressors or portable power generators as far as possible from sensitive receptors. Construct temporary noise barriers to screen stationary noise-generating equipment when located near adjoining sensitive land uses.

- Utilize "quiet" air compressors and other stationary noise sources where technology exists.

- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.

- Notify all adjacent business, residences, and other noise-sensitive land uses of the construction schedule, in writing, and provide a written schedule of "noisy" construction activities to the adjacent land uses and nearby residences.

- If complaints are received or excessive noise levels cannot be reduced using the measures above, erect a temporary noise control blanket barrier along surrounding building facades that face the construction sites.

- Designate a "disturbance coordinator" who shall be responsible for responding to any complaints about construction noise. The disturbance coordinator shall determine the cause of the noise complaint (e.g., bad muffler, etc.) and shall require that reasonable measures be implemented to correct the problem. Conspicuously post a telephone number for the

disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule.

Implementation of the above measures would reduce construction noise levels emanating from the site, limit construction hours, and minimize disruption and annoyance. With the incorporation of the City's standard permit conditions, the impact would be considered less-than-significant in accordance with Policy EC-1.7 of the City's General Plan.

Mitigation Measure 1a: No further mitigation required.

Impact 1b: Project Operational Noise. The proposed project would not result in noise levels exceeding 55 dBA DNL at the nearest noise-sensitive receptors. Additionally, the project would not result in a substantial permanent noise level increase at the existing residential land uses in the project vicinity. **This is a less-than-significant impact.**

Project Traffic

According to Policy EC-1.2 of the City's General Plan, a significant permanent noise increase would occur if the project would increase noise levels at noise-sensitive receptors by 3 dBA DNL or more where ambient noise levels exceed the "normally acceptable" noise level standard. Where ambient noise levels are at or below the "normally acceptable" noise level standard, noise level increases of 5 dBA DNL or more would be considered significant. The City's General Plan defines the "normally acceptable" outdoor noise level standard for the residential land uses to be 60 dBA DNL. Existing ambient levels, based on the measurements made at the nearest noise-sensitive receptors, exceed 60 dBA DNL. Therefore, a significant impact would occur if traffic due to the proposed project would permanently increase ambient levels by 3 dBA DNL.

The proposed energy storage building would be monitored remotely, with maintenance staff visiting the facility approximately four times per month. No permanent fulltime or part-time employees would occupy the building. According to the project description, no more than 1 or 2 roundtrips would be generated by the project per week, and no heavy-duty vehicles would be needed. One to 2 trips per week would not result in a measurable noise level increase.

Under atypical circumstances when unplanned equipment repairs and/or replacements would be required, up to six to eight contractors would be needed for a time period of one to two weeks. However, this is not a typical scenario, and this scenario would occur for a short time period. Therefore, the proposed project would not result in a permanent noise level increase due to project-generated traffic. This would be a less-than-significant impact.

Mechanical Equipment Noise

Policies EC-1.3 and EC-1.6 require that noise generated at new industrial uses be maintained at or below 55 dBA DNL at adjacent residential land uses. While no residential uses adjoin the project site, the mechanical equipment noise generated at the project site is evaluated at the nearest residential property line.

Additionally, Table 20-135 of the City's Municipal Code includes noise standards for conformance with the zoning code. For all adjacent properties that are used or zoned for industrial uses, noise levels generated at the project site would be limited to 70 dBA DNL at the shared property lines. For commercial properties, noise levels generated at the project site would be limited to 60 dBA DNL at the shared property line. While exceeding these zoning code noise standards would not be considered a significant impact, the exposure of the surrounding land uses to operational noise levels generated by the proposed project are also discussed here in comparison to these zoning code standards.

The project site is located within an industrial/office park, and the existing uses surrounding the site research and development operations at BAE Systems, office buildings, a gas station, and a self-storage facility. The nearest residences are located more than 700 feet north of the project site.

Energy Storage Building

For the proposed project, the batteries, inverters, and medium-voltage transformers would be installed within the existing building at 6321 San Ignacio Avenue. A Generation 4 Utility Scale Inverter with a capacity of 1,200 kVA/kW has been selected for the proposed project. According to the specifications provided for this study, this inverter generates noise levels of 80 dBA at a distance of 1 meter (3.28 feet). Compared to these noise levels, noise due to the batteries and transformers would be insignificant. Therefore, the worst-case mechanical equipment noise from the interior of the proposed energy storage building would be 80 dBA at 3.28 feet. Typical interior-to-exterior noise reduction for an industrial building is approximately 25 dBA, and this noise level reduction was assumed for all noise level calculations regarding interior noise sources. The day-night average noise levels estimated at the property lines of the nearest surrounding land uses are summarized in Table 10. All noise levels due to interior noise sources would be below the City's thresholds. This would be a less-than-significant impact.

It is also expected that the proposed energy storage building would include HVAC equipment and converters, which would be located on the exterior of the building. In June 2018, an Environmental Impact Report (EIR) was completed for a similar facility located in Los Angeles, California. For the purposes of this study, it is assumed that source levels used for that project would apply for the proposed project. According to the noise study completed for that EIR, noise levels during the operation of two HVAC units running simultaneously ranged from 66 to 69 dBA at a distance of 35 feet. While the number and location of HVAC units for the proposed project were not provided, it is assumed that all units would be located on the roof of the energy storage building and that the adjoining land uses would be exposed to two HVAC units running continuously throughout the daytime and nighttime hours. Based on aerial pictures of the rooftop of the existing building, the existing rooftop equipment are surrounded by screens. While the noise level reduction provided by these screens was unknown at the time of this study, a conservative 5 dBA of reduction was assumed for the calculations. Table 10 summarizes the day-night average noise levels calculated at the property lines of the nearest surrounding land uses. Since operational noise levels would not exceed 55 dBA DNL at the nearest residential land use, this would be a less-than-significant impact.

As shown in Table 10, HVAC equipment could potentially generate noise levels in excess of the City's Municipal Code standards. While this would not be considered a significant impact, further

measures may be considered to reduce noise levels emanating from the site, such as locating the HVAC units to less sensitive locations further away from the edge of the building, install a better noise-reducing sound enclosures around the units, select quieter units, etc.

TABLE 10 Mechanical Equipment Noise Levels Generated at the Energy Storage Facility and Estimated at the Property Lines of Surrounding Land Uses

Noise Source	Receiving Receptor Location	Distance from Noise Source, feet	Assumed Noise Level Reduction, dBA	Estimated Noise Level, dBA DNL
Interior Noise – batteries, inverter, and transformer	BAE Systems	15	25	48
	Offices to the East	85		33
	Office to the North	130		<30
	Nearest Residence to the North	900		<30
HVAC units	BAE Systems	95	5	62
	Offices to the East	95		62
	Office to the North	130		59
	Nearest Residence to the North	980		42

Substation and Transmission Line

The proposed project also proposes the construction of a substation, which would include switchgear, a main power transformer, and additional electrical equipment. A 115 kV transmission line would be installed to connect this substation with the existing PG&E Metcalf substation. The transmission line will be installed underground within the existing right-of-way (ROW) of Monterey Road until it reaches the existing PG&E transmission line. The most notable noise source at the substation would be the transformers. While the total number of transformers is unknown, the worst-case scenario would include up to three units. Details pertaining to expected noise levels were not available at the time of this study; however, based on similar units at substations, noise levels from these units could be up to 72 dBA at a distance of 6 feet during full load with fans and pumps running. Table 11 summarizes the estimated noise levels at the surrounding land uses. Note, the specific location of the substation has not been determined; however, the distances shown in Table 11 represent the worst-case scenario.

Mechanical equipment noise from the proposed substation would not result in noise levels exceeding the City's standards. This is a less-than-significant impact.

TABLE 11 Mechanical Equipment Noise Levels Generated at the Substation and Estimated at the Property Lines of Surrounding Land Uses

Noise Source	Receiving Receptor Location	Distance from Noise Source, feet	Assumed Noise Level Reduction, dBA	Estimated Noise Level, dBA DNL
Main Power Transformer	BAE Systems	80	0	56
	Offices to the East	340		43
	Office to the North	65		58
	Nearest Residence to the North	655		38

Mitigation Measure 1b: **None required.**

Impact 2: **Excessive Groundborne Vibration due to Construction.** Construction-related vibration levels resulting from activities at the project site would not exceed 0.2 in/sec PPV at the nearest residential or commercial land uses. **This is a less-than-significant impact.**

The construction of the project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include site preparation work, foundation work, and new building framing and finishing. According to the list of construction equipment provided for the proposed project, pile driving, which can cause excessive vibration, is not expected for the proposed project.

Policy EC-2.3 of the City of San José General Plan limits vibration levels during demolition and construction to 0.08 in/sec PPV for sensitive historic structures to minimize the potential for cosmetic damage to buildings on adjacent sites. A vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction. Based on the inventory of historically documented buildings in the City of San José,[1] the only historical building in the vicinity of the project corridor would be 8215 Monterey Road, which is about 2,000 feet south of where transmission line would connect to the PG&E Metcalf Substation. Since this building would be more than 500 feet from the nearest construction activities, a significant impact would occur if buildings along the project corridor were exposed to vibration levels in excess of 0.20 in/sec PPV.

Table 12 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 12 also summarizes the distances to the 0.2 in/sec PPV threshold for buildings of normal conventional construction.

[1] http://www.sanjoseca.gov/DocumentCenter/View/35475

TABLE 12 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Minimum Distance to Meet 0.2 in/sec PPV (feet)
Clam shovel drop		0.202	26
Hydromill (slurry wall)	in soil	0.008	1
	in rock	0.017	2
Vibratory Roller		0.210	27
Hoe Ram		0.089	12
Large bulldozer		0.089	12
Caisson drilling		0.089	12
Loaded trucks		0.076	10
Jackhammer		0.035	5
Small bulldozer		0.003	<1

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006, as modified by Illingworth & Rodkin, Inc., August 2019.

For each of the construction activities (overhead work, underground work, and substation construction), vibration levels were calculated from the edge of the nearest construction activity to the nearest building façade of the surrounding land uses. Table 13 summarizes the vibration levels for each construction activity. The nearest structures, both commercial and residential, along the eastern side of Monterey Road would be approximately 30 feet from the underground construction work for the transmission line. At 30 feet, vibration levels would be at or below 0.17 in/sec PPV. Construction work at the substation and for the overhead work would be 80 feet or more from the nearest construction site boundary; therefore, vibration levels would be at or below 0.06 in/sec PPV during this construction work. Since vibration levels due to construction activities are not expected to exceed the City's threshold of 0.2 in/sec PPV for buildings of normal construction materials, this would be a less-than-significant impact.

TABLE 13 Estimated Vibration Levels for Construction Equipment at the Nearest Structures to Each Work Site

Equipment		Estimated Vibration Levels, in/sec PPV					
		Overhead Work	Underground Work			Substation Work	
		Nearest Structure (305 ft)	Nearest Comm. (30 ft)	Nearest Res. – East (30 ft)	Nearest Res. – West (145 ft)	Nearest Comm. (80 ft)	Nearest Res. (705 ft)
Clam shovel drop		0.013	0.165	0.165	0.029	0.056	0.005
Hydromill (slurry wall)	in soil	0.001	0.007	0.007	0.001	0.001	0.0002
	in rock	0.001	0.014	0.014	0.002	0.001	0.0004
Vibratory Roller		0.013	0.172	0.172	0.030	0.058	0.005
Hoe Ram		0.006	0.073	0.073	0.013	0.025	0.002
Large bulldozer		0.006	0.073	0.073	0.013	0.025	0.002
Caisson drilling		0.006	0.073	0.073	0.013	0.025	0.002
Loaded trucks		0.005	0.062	0.062	0.011	0.021	0.002
Jackhammer		0.002	0.029	0.029	0.005	0.010	0.001
Small bulldozer		0.0002	0.002	0.002	0.0004	0.001	0.0001

Mitigation Measure 2: None required.

Impact 3: **Excessive Aircraft Noise.** The project site is located approximately 10.8 miles southeast of a public airport or public use airport and would not expose people working in the project area to excessive noise levels. **This is a less-than-significant impact.**

Mineta San José International Airport is a public-use airport located approximately 10.8 miles northwest of the project site. The Santa Clara County Airport Land Use Commission considers industrial land uses generally acceptable in noise environments of 70 dBA CNEL or less.[2] As indicated in Figure 3, the project site lies outside the 2027 60 dBA CNEL noise contour shown in Norman Y. Mineta San José International Airport Master Plan, amended in June 2010. Therefore, aircraft noise at the site would be compatible with the proposed project, and this is a less-than-significant impact.

Mitigation Measure 3: **None required.**

[2] Norman Y. Mineta San José International Airport Comprehensive Land Use Plan, May 25, 2011, Amended November 16, 2016.

FIGURE 3 2027 CNEL Noise Contours for SJIA Relative to Project Site

