CYPRESS POINT AFFORDABLE HOUSING PROJECT NOISE AND VIBRATION ASSESSMENT

SAN MATEO COUNTY, CALIFORNIA

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INTRODUCTION

The Cypress Point affordable housing project is located on approximately 10.88 acres of vacant land northeast of the intersection of Carlos Street and Sierra Street in Moss Beach, an unincorporated community within San Mateo County, California. The project proposes to develop 71 affordable housing units on this lot, consisting of approximately 22 two-story buildings holding 2 to 4 units each. The project would provide a mixture of 1, 2, and 3-bedroom units, including a combination of two-story townhouses and ADA-accessible 1-story flats. In addition to the housing units, the development will include an approximately 3,200 square foot community building that will include the general office, the manager's office, a community room, kitchen, computer room, laundry, and maintenance and storage areas. The project would also include several outdoor amenities, including a community garden, a children's play area, upper and lower greens, and BBQ areas. The total developed area would be approximately 235,000 square feet.

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 three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions; 2) the Policy Consistency Section discusses the noise and land use compatibility of the proposed project utilizing applicable policies; and 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts on sensitive receptors, provides a discussion of each project impact, and presents measures, where necessary, to mitigate the identified impacts to a less-than-significant level.

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 a combination of the intensity of sound waves and 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.

Several noise measurement scales 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 the perception of 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 used in this analysis are defined in Table 1.

There are several methods of characterizing sound when multiple frequencies exist or sound intensities change over time. 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 different durations.

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* (*DNL* or L_{dn}) 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 interference with conversation 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 CNEL. Typically, the highest steady traffic noise level during the daytime is about equal to the CNEL 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 to 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 to 62 dBA CNEL with open windows and 65 to 70 dBA CNEL if the windows are closed. Levels of 55 to 60 dBA CNEL are common

along collector streets and secondary arterials, while 65 to 70 dBA CNEL is a typical value for a primary/major arterial. Levels of 75 to 80 dBA CNEL 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 adequate ventilation, heating, and cooling with 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 that result from 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 CNEL 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 CNEL. At a CNEL of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the CNEL increases to 70 dBA, the percentage of the population highly annoyed increases to about 25 to 30 percent of the population. There is, therefore, an increase of about 2 percent in perceived annoyance for each 1 dBA increase between a CNEL of 60 to 70 dBA. Between a CNEL of 70 to 80 dBA, each decibel increase results in an increase of about 3 percent in the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the CNEL is 60 dBA, approximately 30 to 35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA CNEL adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA CNEL, 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 (i.e. there is no net motion). 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 vibration levels produce.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much 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 complaints for vibrations levels where there is very little risk of actual structural damage.

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 (i.e. periodic, not continuous), 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 induce structural 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. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. 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.

Damage caused by vibration can be classified as cosmetic or structural. Cosmetic damage includes minor cracking of building elements (exterior pavement, room surfaces, etc.). Structural damage involves threats to the integrity of buildings. Damage resulting from construction related vibration typically results only in cosmetic damage. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. 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.

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 sounds 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	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

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

Regulatory Background

The State of California and San Mateo County have established regulatory criteria that are applicable to this assessment. The State 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. Appendix G of the CEQA Guidelines provides criteria with which to evaluate the significance of effects of a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

(b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;

(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

(e) For a project located within an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the

project would expose people residing or working in the project area to excessive noise levels;

(f) For a project within the vicinity of a private airstrip, if the project would expose people residing or working in the project area to excessive noise levels.

Pursuant to recent court decisions, the impacts on project residents of off-site noise or vibration sources unconnected to the project as described in Checklist Questions (a), (e), and (f) are not included in the Impacts and Mitigation Section of this report. These items are discussed in a separate section addressing Noise and Land Use Compatibility, which evaluates the consistency of the proposed project with the policies set forth in the County's General Plan.

CEQA does not define what noise level increase would be considered substantial. Typically, an increase in the CNEL 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 CNEL or greater would be considered a significant impact when projected noise levels would remain within those considered acceptable for the affected land use.

2016 California Building Code, Title 24, Part 2. The current version of the California Building Code (CBC) requires interior noise levels attributable to exterior environmental noise sources to be limited to a level not exceeding 45 dBA L_{dn}/CNEL in any habitable room.

California Coastal Act. There are no relevant noise policies in the California Coastal Act that would be applicable to the proposed project.

San Mateo County Mid-Coast Local Coastal Program. The San Mateo County Mid-Coast Local Coastal Program offers qualitative noise goals and objectives, including to 1) require that engines use muffler systems, 2) minimize noise impacts on surrounding land uses, especially residential, and 3) require that all development minimize the impacts of noise on adjacent properties and the community at large.

2014 Final Airport Land Use Compatibility Plan (ALUCP) for the Environs of Half Moon Bay Airport (HAF). The ALUCP adopted by the San Mateo County Airport Land Use Commission contains standards for projects within the vicinity of Half Moon Bay Airport, which are relevant to this project:

4.2.1.1 ***Aircraft Noise Contours.*** Existing (2012) and 20-year future (2032) Community Noise Equivalent Level (CNEL) aircraft noise exposure contours were prepared for HAF and are depicted in Chapter Two of this ALUCP. The 20-year noise exposure contour is slightly larger due to a projected increase in operations as indicated in the *2013 Airport Layout Plan Narrative Report*. Therefore, the 2032 noise exposure contours shall be used for evaluation of airport/land use noise compatibility for HAF.

The 60 dB CNEL noise exposure contour is the threshold for residential noise compatibility for HAF.

4.2.1.3 ***Residential Uses.*** Residential uses are considered conditionally compatible in areas exposed to noise levels between 60-64 dB CNEL only if the proposed use is on a lot of record zoned exclusively for residential use as of the effective date of the ALUCP. In such a case, the detached single-family dwellings must be sound-insulated to achieve an indoor noise level of CNEL 45 dB or less from exterior sources. Residential uses are not considered compatible above 65 CNEL.

San Mateo County General Plan, Chapter 16. San Mateo County offers qualitative noise goals and objectives, including to 1) strive toward a livable noise environment, 2) reduce noise impacts through noise and land use compatibility and noise mitigation, 3) promote protection of noise sensitive land uses and noise reduction in quiet areas and noise impact areas, 4) give priority to reducing noise at the source rather than at the receiver, and 5) promote noise reduction through the use of techniques such as site planning, noise barriers, and architectural design and construction.

The San Mateo County General Plan identifies "normal acceptable" exterior noise levels at residential land uses as 60 CNEL or less and interior noise levels in residences as 45 CNEL or less.

San Mateo County Code of Ordinances.

4.88.330 – Exterior noise standards. It is unlawful for any person at any location within the incorporated area of the County to create any noise, or to allow the creation of any noise on property owned, leased, occupied, or otherwise controlled by such person which causes the exterior noise level when measured at any single or multiple family residence, school, hospital, church, or public library situated in either the incorporated of unincorporated area to exceed the noise level standards as set forth in Table 4, below:

TABLE 4 Receiving Land Use: Single or Multiple Family Residence, School, Hospital, Church, or Public Library Properties.

Category	Cumulative Number of Minutes in Any One Hour Time Period	Daytime, dBA 7 am – 10 pm	Nighttime, dBA 10 pm – 7 am
1	30	55	50
2	15	60	55
3	5	65	60
4	1	70	65
5	0	75	70

a) In the event the measured background noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted in five (5) dBA increments so as to encompass the background noise level.

b) Each of the noise standards specified above shall be reduced by 5 dBA for simple tone noises, consisting primarily of speech or music, or for recurring or intermittent impulsive noises.

c) If the intruding noise source is continuous and cannot reasonably be stopped for a period of time whereby the background noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards in Table 4.

4.88.340 – Interior noise standards. No person shall, at any location within the unincorporated area of the County operate, or cause to be operated within a dwelling unit, any source of sound, or create, or allow the creation of, any noise which causes the noise level when measured inside a receiving dwelling unit with windows in their normal seasonal configuration to exceed the following noise level standards as set forth in Table 5:

TABLE 5 Interior Noise Level Standards – Dwelling Unit

Category	Cumulative Number of Minutes in Any One Hour Time Period	Daytime, dBA 7 am – 10 pm	Nighttime, dBA 10 pm – 7 am
1	5	45	40
2	1	50	45
3	0	55	50

a) In the event the measured background noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted in five (5) dBA increments so as to encompass the background noise level.
b) Each of the noise standards specified above shall be reduced by 5 dBA for simple tone noises, consisting primarily of speech or music, or for recurring or intermittent impulsive noises.
c) If the intruding noise source is continuous and cannot reasonably be stopped for a period of time whereby the background noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards in Table 5.

4.88.360 – Exemptions. The following activities shall be exempted from the provisions of this chapter:

d) Any mechanical device, apparatus, or equipment used, related to or connected with emergency machinery, vehicle, or work.
e) Noise sources associated with demolition, construction, repair, remodeling, or grading of any real property, provided said activities do not take place between the hours of 6:00 pm and 7:00 am on weekdays, 5:00 pm and 9:00 am on Saturdays, or at any time on Sundays, Thanksgiving, and Christmas.

4.88.380 – Exemption. Whenever, for the good of the public, a government agency, public utility, or private utility determines a project must be done before 7:00 am or after 6:00 pm, or weekends, and so states in its contract, change order(s), or bid documents, said work shall be exempted from this chapter.

Existing Noise Environment

The project site is located northeast of the Carlos Street and Sierra Street intersection in Moss Beach, California. Figure 1 shows the project site plan superimposed on an aerial image of the site vicinity. As shown on Figure 1, residential land uses (sensitive receptors) bound the project site to the south, east, and north. There are also commercial buildings associated with the Montara Sanitary District to the west opposite California State Highway 1 (Highway 1).

A noise monitoring survey was made at the project site between Wednesday, August 30, 2017 and Friday, September 1, 2017. The noise monitoring survey included two long-term noise measurements (LT-1 and LT-2) and three short-term noise measurements (ST-1 through ST-3),

as shown in Figure 1. The long-term measurements were made to quantify the daily trends in noise levels near the westernmost and easternmost site boundaries. The 10-minute short-term measurements were made to quantify specific noise sources affecting the project vicinity and characterize the range of noise levels throughout the site. The noise environment at the site and at the nearby land uses results primarily from vehicular traffic along Highway 1.

Long-term noise measurement LT-1 was made in the northeast corner of the project site, approximately 125 feet west of the Lincoln Street centerline. This noise measurement was made to quantify existing noise levels near the adjacent sensitive-receptors. Hourly average noise levels at this location typically ranged from 39 to 55 dBA L_{eq} during the day and from 34 to 47 dBA L_{eq} at night. The average community noise equivalent level on Thursday, August 31, 2017 was 51 dBA CNEL. The daily trend in noise levels at LT-1 is shown in Figure 2.

Long-term noise measurement LT-2 was made along the western boundary of the project site, approximately 60 feet east of the Carlos Street centerline and 200 feet east from the centerline of Highway 1. This noise measurement quantified existing noise levels primarily from vehicular traffic along Highway 1. Hourly average noise levels at this location typically ranged from 48 to 57 dBA L_{eq} during the day and from 41 to 52 dBA L_{eq} at night. The average community noise equivalent level on Thursday, August 31, 2017 was 55 dBA CNEL. The daily trend in noise levels at LT-2 is shown in Figure 3.

Short-term noise measurement ST-1 was made on the southeast corner of the Stetson Street and Sierra Street intersection, approximately 20 feet east of the Stetson Street centerline and approximately 30 feet south of the Sierra Street centerline. The 10-minute average noise level measured at this location between 12:20 p.m. and 12:30 p.m. on Wednesday, August 30, 2017 was 44 dBA L_{eq}. Short-term noise measurement ST-2 was made along 16th Street, approximately 15 feet south of the 16th Street centerline and approximately 260 feet east of the Carlos Street centerline. The 10-minute average noise level measured at this location between 12:40 p.m. and 12:50 p.m. on Wednesday, August 30, 2017 was 53 dBA L_{eq}. Short-term noise measurement ST-3 was made near the center of the project site, approximately 400 feet east of the Carlos Street centerline and approximately 510 feet north of the Sierra Street centerline. The 10-minute average noise level measured at this location between 9:40 a.m. and 9:50 a.m. on Friday, September 1, 2017 was 43 dBA L_{eq}. Table 4 summarizes the results of the short-term noise measurements.

FIGURE 1 Noise Measurement Locations

Source: Google Earth, 2018.

FIGURE 2 Daily Trend in Noise Levels at LT-1

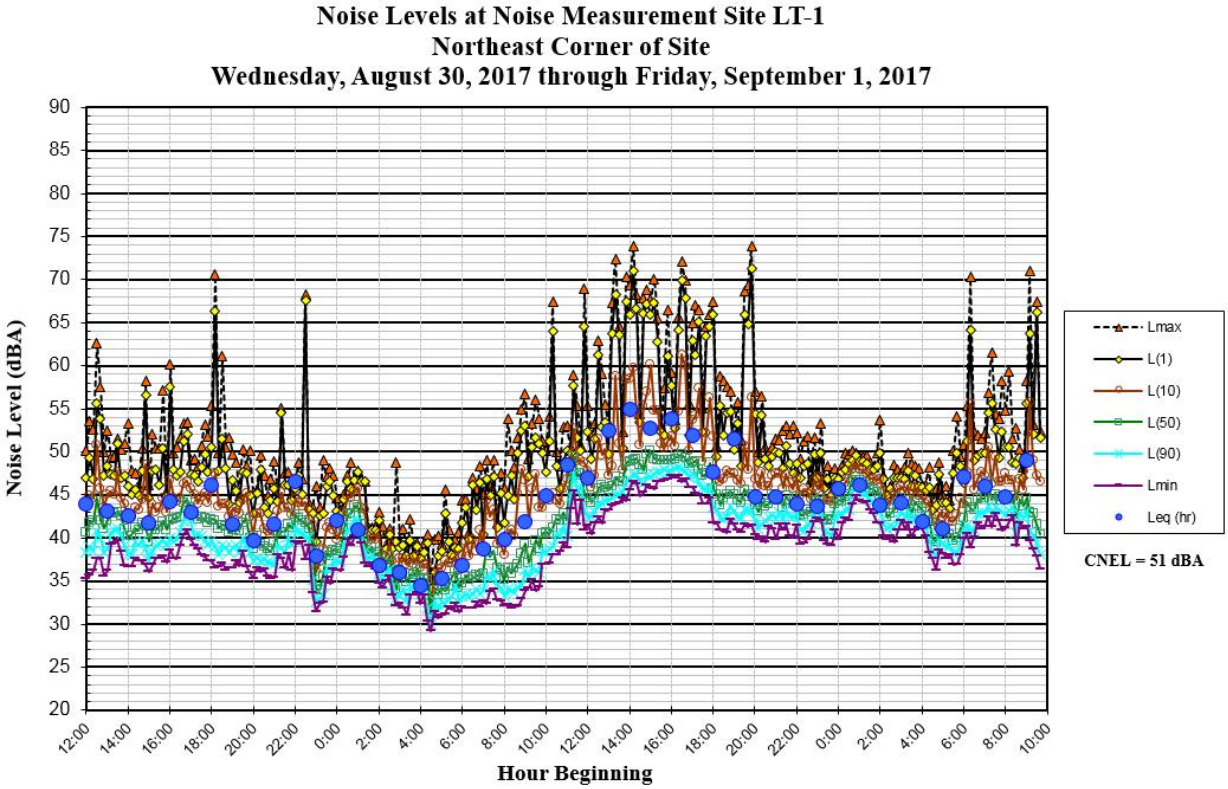


FIGURE 3 Daily Trend in Noise Levels at LT-2

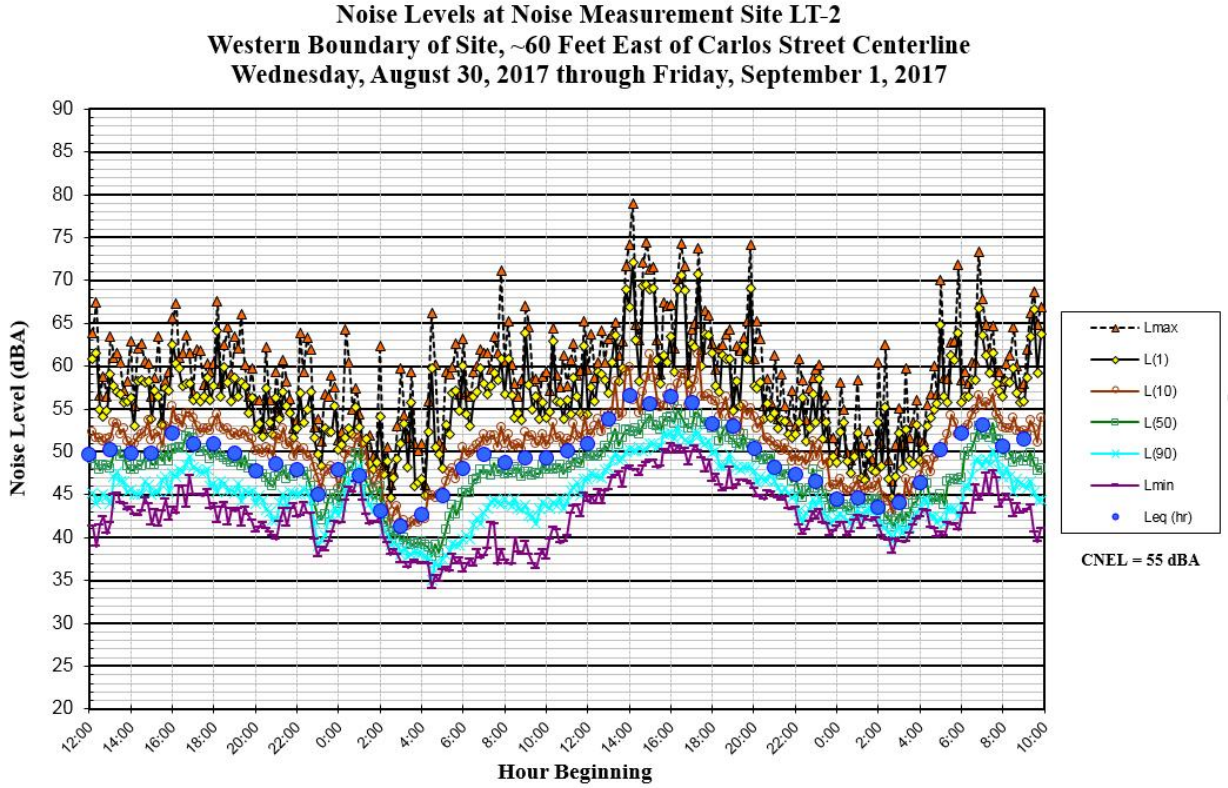


TABLE 4 Summary of Short-Term Noise Measurement Data (dBA)

Noise Measurement Location	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}
ST-1: Northeast corner of Stetson Street/Sierra Street intersection. (8/30/2017, 12:20 p.m. - 12:30 p.m.)	51	49	47	43	40	44
ST-2: Along 16th Street. (8/30/2017, 12:40 p.m. - 12:50 p.m.)	60	58	55	52	47	53
ST-3: Center of project site. (9/1/2017, 9:40 a.m. - 9:50 a.m.)	55	51	46	41	38	43

POLICY CONSISTENCY ANALYSIS – COMPATIBILITY OF PROJECT WITH NOISE ENVIRONMENT AFFECTING THE SITE

The County of San Mateo's General Plan sets forth noise policies and programs to mitigate potential impacts through both preventative and responsive measures. The applicable General Plan policies were presented in detail in the Regulatory Background section and are summarized below for the proposed project:

- The County's normally acceptable exterior noise level standard is 60 dBA CNEL or less for the proposed residential land use.

- The County's standard for interior noise at the proposed residential land use is 45 dBA CNEL.

The ambient noise environment at the proposed project site ranges from 51 to 55 dBA CNEL. The future noise environment at the project site would continue to result primarily from vehicular traffic along Highway 1. Traffic volumes in the project vicinity were provided by *Kittelson & Associates, Inc.*[1] A comparison of the traffic volumes indicates that the future cumulative plus project conditions would result in a traffic noise level increase of 2 dBA CNEL along Highway 1 above existing conditions. To estimate the future noise environment at the project site, these increases are applied to the results of the existing measurements described above. Therefore, the future unmitigated ambient noise environment at the project site would range from 53 to 57 dBA CNEL.

Future Exterior Noise Environment

Common residential outdoor use areas would include a community garden, a children's play area, upper and lower greens, and BBQ areas. As noted above, the County's acceptable exterior noise level standard is 60 dBA CNEL or less. The future exterior noise exposure at the site would be considered compatible with the proposed residential land uses as noise levels are calculated to reach 57 dBA CNEL, and would not exceed the 60 dBA CNEL threshold.

[1] Kittelson & Associates, Inc., "Cypress Point Preliminary Traffic Assessment", June 2017.

Future Interior Noise Environment

The County requires that residential interior noise levels be maintained at 45 dBA CNEL or less. The residences closest to Highway 1 along the western boundary of the project site would experience the greatest future exterior traffic noise exposure, which would be up to 57 dBA CNEL.

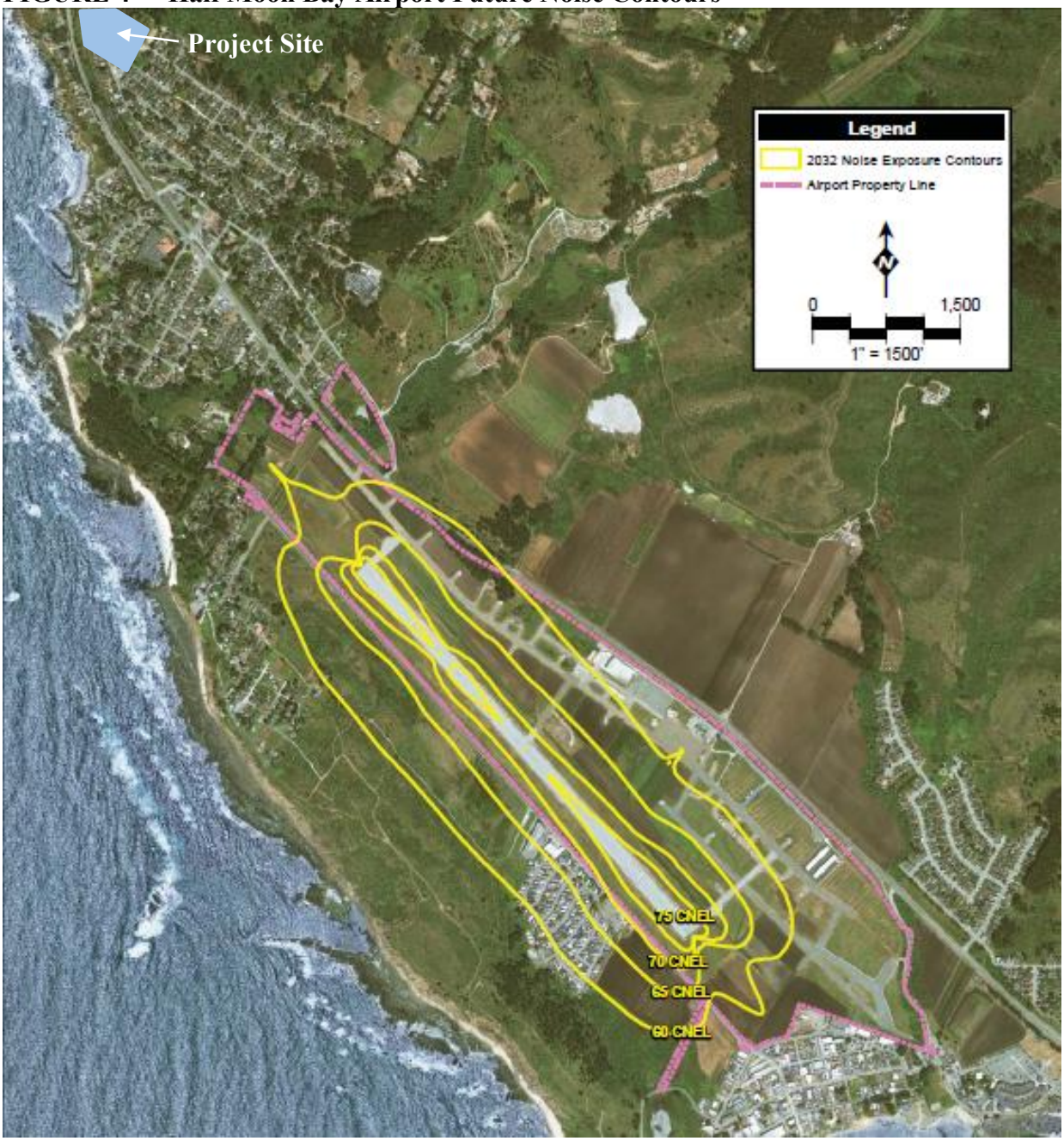
Interior noise levels would vary depending upon the design of the buildings (relative window area to wall area) and the selected construction materials and methods. Standard residential construction provides approximately 15 dBA of exterior to interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA CNEL, the inclusion of adequate forced-air mechanical ventilation is often the method selected to reduce interior noise levels to acceptable levels by closing the windows to control noise.

For this project, the set-back from Highway 1 is sufficient to ensure that the interior noise level standard would be met assuming standard construction methods with the windows open for ventilation. No additional noise insulation features (e.g., sound-rated construction methods) would be required.

Aircraft Noise

The Half Moon Bay Airport located approximately 0.8 miles southeast of the project site. The project site lies outside the 2032 60 dBA CNEL noise contour shown in the ALUCP and in Figure 4. Although noise levels resulting from aircraft would be intermittently audible, they would be less than 60 dBA CNEL at the project site and compatible with the proposed land use.

FIGURE 4 Half Moon Bay Airport Future Noise Contours



Source: Airport Land Use Compatibility Pan for the Environs of Half Moon Bay Airport, Coffman Associates, Inc., September 2014.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

Paraphrasing from the checklist contained in Appendix G of the CEQA Guidelines, a project would normally result in significant noise impacts if noise levels generated by the project conflict with adopted environmental standards or plans, if the project would generate excessive groundborne vibration levels, or if ambient noise levels at sensitive receivers would be substantially increased over a permanent, temporary, or periodic basis. The following criteria were used to evaluate the significance of potential impacts resulting from the project:

- **CEQA Checklist Question (a): Noise Levels in Excess of Standards.** A significant noise impact would be identified if the construction of the proposed project would expose persons in neighboring homes to or generate noise levels that would exceed applicable noise standards presented in the General Plan or Municipal Code. Section 4.88.360 of the San Mateo County Code of Ordinances establishes allowable hours of construction between 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 5:00 p.m. on Saturdays. No construction shall be allowed at any time on Sundays, Thanksgiving, and Christmas.

- **CEQA Checklist Question (b): Groundborne Vibration from Construction.** A significant impact would be identified if the construction of the project would expose persons to excessive vibration levels. Groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

- **CEQA Checklist Question (c): Permanent Noise Increases.** A significant impact would be identified if traffic generated by the project would substantially increase noise levels at sensitive receivers in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA CNEL or greater, with a future noise level of less than 60 dBA CNEL, or b) the noise level increase is 3 dBA CNEL or greater, with a future noise level of 60 dBA CNEL or greater.

- **CEQA Checklist Question (d): Temporary Noise Increases.** A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. Hourly average noise levels resulting from project construction exceeding 60 dBA L_{eq}, and increasing ambient noise levels by at least 5 dBA L_{eq}, for a period of more than one year would constitute a significant temporary noise increase at adjacent residential land uses.

Impact NOISE-1: Noise Levels in Excess of Standards. The proposed project would comply with the allowable hours of construction as established in the County's Code of Ordinances. **This is a less-than-significant impact.**

Construction Noise

Section 4.88.360 of the San Mateo County Code of Ordinances establishes allowable hours of construction between 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 5:00 p.m. on Saturdays. No construction is allowed to occur at any time on Sundays, Thanksgiving, and Christmas. The project proponent will be required to comply with the code limits and construction activities will only be allowed to occur during allowable hours. Project construction activities would comply with applicable noise standards and therefore, this would be a less-than-significant impact, and no mitigation is required.

Impact NOISE-2: Exposure to Excessive Groundborne Vibration due to Construction. Construction-related vibration levels resulting from activities at the project site would not exceed 0.3 in/sec PPV at the nearest sensitive receptor. **This is a less-than-significant impact.**

The construction of the project may generate vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include demolition, site preparation, grading, excavating, paving, and new building framing and finishing. This analysis assumes the proposed project would not require pile driving, which can cause excessive vibration.

For structural damage, the California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. Construction activities would have the potential to produce vibration levels of 0.08 in/sec PPV or more at historical structures located within 60 feet of the project site. However, there are no known ancient buildings or buildings that are documented to be structurally weakened within 60 feet of where construction will take place on the project site. Because it is not known if the buildings surrounding the project site are structurally sound and built to modern standards, this analysis conservatively assumes that ground-borne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in a significant vibration impacts on surrounding residences. For human annoyance, a vibration limit of 0.1 in/sec PPV (Table 3), produced by continuous/frequent intermittent sources of construction vibration would be strongly perceptible and would cause human annoyance.

Table 5 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 of the activity. At

a distance of 25 feet, jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

The nearest sensitive receptor to the project site is the residence located along Carlos Street approximately 80 feet southeast of the primary construction area at the project site. Construction activities occurring in the outer landscaped areas of the project site would not likely utilize heavy equipment capable of producing high vibration levels (e.g., vibratory roller). At a distance of 80 feet from the primary construction area, vibration levels attributable to project construction would be up to 0.06 in/sec PPV,[2] which is below the 0.3 in/sec PPV structural threshold and below the 0.1 in/sec PPV human annoyance threshold. Other buildings and sensitive receptors in the project vicinity located further from the project site would also experience construction vibration levels below these thresholds, as vibration attenuates with distance from the source.

At these locations, and in other surrounding areas where vibration would not be expected to cause structural damage, vibration levels may still be perceptible. MidPen has agreed to use administrative controls, such as notifying neighbors of scheduled construction activities and scheduling construction activities with the highest potential to produce perceptible vibration during hours with the least potential to affect nearby businesses, so perceptible vibration can be kept to a minimum. With these controls, and given the intermittent and short duration of the project phases that have the highest potential of producing vibration (use of jackhammers and other high power tools) these levels of vibration would not be considered significant. This would be a less-than-significant impact, and no mitigation is required.

[2] The formula to determined vibration from construction equipment is PPVequip = PPVref x (25/D)^1.1 where PPVequip is the peak particle velocity in in/sec of the equipment adjusted for distance, PPVref is the reference vibration level in in/sec at 25 feet (Table 5), D is the distance from the equipment to the receiver, and 1.1 is used for conservative soil conditions. Formula from the Caltrans Transportation and Construction Vibration Guidance Manual, September 2013.

TABLE 5 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Approximate L_v at 25 ft. (VdB)
Pile Driver (Impact)	upper range	1.158	112
	typical	0.644	104
Pile Driver (Sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

Impact NOISE-3: Substantial Permanent Noise Increase due to Project-Generated Traffic. Project-generated traffic would not cause a permanent noise level increase at existing noise-sensitive land uses in the project vicinity. **This is a less-than-significant impact.**

A significant noise impact would occur if traffic generated by the project would substantially increase noise levels at sensitive receptors in the project vicinity. A substantial increase would occur if: a) the noise level increase with the project is 5 dBA CNEL or greater, where existing noise levels are less than 60 dBA CNEL, or b) the noise level increase with the project is 3 dBA CNEL or greater, where existing noise levels are 60 dBA CNEL or greater. The nearest noise-sensitive receptor is approximately 80 feet to the southeast of the project site, where ambient noise levels are expected to remain below 60 dBA CNEL; therefore, a significant impact would occur if project-generated traffic would permanently increase noise levels by 5 dBA CNEL. For reference, traffic volumes would have to double for noise levels to increase by 3 dBA CNEL.

Peak hour traffic volumes along roadways in the project vicinity, as identified in the project's traffic study,[1] were reviewed to calculate the permanent noise increase attributable to project-generated traffic. A comparison of the volumes expected under the Existing Plus Project scenario and the Existing scenario indicated that the hourly average traffic noise level (L_{eq}) would increase by less than 1 dBA as a result of the project. The change in the CNEL would be the same as the change in the peak hour L_{eq}. The permanent noise level increase due to the project-generated traffic would be less than 1 dBA CNEL at noise-sensitive receptors in project vicinity. Therefore, the proposed project would not cause a substantial permanent noise level increase at the nearby noise-sensitive receptors. This is a less-than-significant impact and no mitigation is required.

Impact NOISE-4: Substantial Temporary Noise Increase due to Construction. Existing noise-sensitive land uses would be exposed to construction noise levels in excess of the significance thresholds for a period of more than one year. **This is a potentially significant 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. Project construction is anticipated to occur over an approximate period of 14 month.

While noise level thresholds for temporary construction are not provided in the County's General Plan or Code of Ordinances, the Fundamentals section of this report provides a threshold of 45 dBA for speech interference indoors. Assuming a 15 dBA exterior-to-interior reduction for standard residential construction, this would correlate to an exterior threshold of 60 dBA L_{eq} at residential land uses. Additionally, temporary construction would likely be considered to be annoying to surrounding land uses if the ambient noise environment increased by at least 5 dBA L_{eq} over an extended period of time. The temporary construction noise impact would be considered significant if project construction activities exceeded 60 dBA L_{eq} at nearby residences and exceeded the ambient noise environment by 5 dBA L_{eq} or more for a period longer than one year.

The noise-sensitive receptors to the south of the project site along Carlos Street would have existing daytime ambient noise levels similar to the noise levels recorded at LT-2. Based on these data, the average hourly noise level during daytime construction hours would range from 48 to 57 dBA L_{eq}. The noise-sensitive receptors to the east of the project site would have existing daytime ambient noise levels similar to the noise levels recorded at LT-1. Based on these data, the average hourly noise level during daytime construction hours would range from 39 to 55 dBA L_{eq}.

Construction activities for individual projects are typically carried out in stages. During each stage of construction, there would be a different mix of equipment operating, and noise levels would vary by stage and vary within stages, based on the amount of equipment in operation and the location at which the equipment is operating. Typical construction noise levels at a distance of 50 feet are shown in Tables 6 and 7. Table 6 shows the average noise level ranges, by construction phase, and Table 7 shows the maximum noise level ranges for different construction equipment. Most demolition and construction noise falls with the range of 80 to 90 dBA at a distance of 50 feet from the source.

TABLE 6 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.

TABLE 7 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

Equipment Category	L_{max} Level (dBA)1,2	Impact/Continuous
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.
Source: Mitigation of Nighttime Construction Noise, Vibrations and Other Nuisances, National Cooperative Highway Research Program, 1999.

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The construction of the proposed project would include demolition, site preparation, grading and excavating, paving, and building erection and finishing. The hauling of excavated materials and construction materials would generate truck trips on local roadways as well.

Noise sensitive land uses located near the project site include residences to the south, east, and north. Hourly average noise levels due to construction activities during busy construction periods outdoors would range from about 74 to 88 dBA L_{eq} at a distance of 50 feet. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. The noise sensitive land uses (residences) are approximately 80 feet to 270 feet from the project site's central primary construction area. At these distances, hourly average noise levels during busy construction periods would range from 70 to 84 dBA L_{eq} at the closest residence to the south, from 63 to 77 dBA L_{eq} at the closest residence to the north, and from 59 to 73 dBA L_{eq} at the closest residence to the east. Construction noise levels would be expected to exceed 60 dBA L_{eq} and to exceed the ambient noise environment by at least 5 dBA L_{eq} at noise-sensitive residential uses in the project vicinity for a period exceeding one year. The impact would be considered significant.

Mitigation Measure NOISE-1: Reduce Construction Noise

Construction activities will be conducted in accordance with the provisions of Section 4.88.360 of the San Mateo County Code of Ordinances, which limits construction work to the hours of 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 5:00 p.m. on Saturdays. No construction shall occur at any time on Sundays, Thanksgiving, and Christmas.

The noise impacts of construction equipment may be minimized through modification of the equipment, the placement of equipment on the site, and by imposing constraints on equipment operations. Construction equipment should be well-maintained and used judiciously to be as quiet as possible. The project proponent shall include the following best management practices in all contracts related to project construction activities near 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.

- Unnecessary idling of internal combustion engines should be strictly prohibited.

- Locate stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from sensitive receptors as feasible. If they must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) shall be used reduce noise levels at the adjacent sensitive receptors. Any enclosure openings or venting shall face away from sensitive receptors.

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

- Establish construction staging areas at locations that will create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

- Locate material stockpiles, as well as maintenance/equipment staging and parking areas, as far as feasible from residential receptors.

- 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.

- Designate a "disturbance coordinator" who would be responsible for responding to any complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., bad muffler, etc.) and will 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 in it 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 implementation of these measures, and recognizing that noise generated by construction activities would occur over a temporary period, the temporary increase in ambient noise levels would be less-than-significant.

APPENDIX A: REFERENCES

California Building Standards Commission, *2016 California Building Code, Title 24, Part 2, Volumes 1 of 2, Chapter 12 Interior Environment, Section 1207 Sound Transmission, 1207.4 Allowable Interior Noise Levels*, Pg. 635, July 2016.

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