THE ESTUARY @ TERRA
NOISE AND VIBRATION ASSESSMENT

San José, California

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Prepared for:

Desiree Dei Rossi
Assistant Project Manager
David J. Powers & Associates, Inc.
1736 Franklin Street, Suite 300
Oakland, CA 94612

Prepared by:

Michael S. Thill

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

Project: 19-189

INTRODUCTION

The Estuary @ Terra project site (APN 015-39-020) is an approximately 6.23-acre undeveloped lot located south of North First Street and north of Highway 237 in the Alviso area of San José. The site is bound by the Guadalupe River to the south, State-owned open space to the east, and privately-owned parcels to the north and west. The site is within the boundaries of the Alviso Master Plan.

The project proposes construction of a 108,702 square foot, 215-room hotel in a five-story building. The northeastern corner of the site would include a surface parking lot with 43 parking spaces, and a four-story parking garage with 192 spaces, for a total of 235 parking spaces.

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 and groundborne vibration, summarizes applicable regulatory criteria, and discusses existing noise conditions in the project vicinity; 2) the General Plan Consistency Section discusses land use compatibility utilizing policies in the City's General Plan; and, 3) 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* (*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 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.

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.

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 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
0.25	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 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 – Noise

The State of California and the City of San José have established regulatory criteria that are applicable in this assessment. The State of California Environmental Quality Act (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 of California

State CEQA Guidelines. CEQA contains guidelines 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.

2019 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 DNL/CNEL in any habitable room.

City of San José

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies with the goal of minimizing 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-1.1 Locate new development in areas where noise levels are appropriate for the proposed uses. Consider federal, state, and City noise standards and guidelines as a part of new development review. Applicable standards and guidelines for land uses in San José include:

Interior Noise Levels

- The City's standard for interior noise levels in residences, hotels, motels, residential care facilities, and hospitals is 45 dBA DNL. Include appropriate site and building design, building construction and noise attenuation techniques in new development to meet this standard. For sites with exterior noise levels of 60 dBA DNL or more, an acoustical analysis following protocols in the City-adopted California Building Code is required to demonstrate that development projects can meet this standard. The acoustical analysis shall base required noise attenuation techniques on expected Envision General Plan traffic volumes to ensure land use compatibility and General Plan consistency over the life of this plan.

Exterior Noise Levels

- The City's acceptable exterior noise level objective is 60 dBA DNL or less for residential and most institutional land uses (Table EC-1). The acceptable exterior noise level objective is established for the City, except in the environs of the San José International Airport and the Downtown, as described below:

    - For new multi-family residential projects and for the residential component of mixed-use development, use a standard of 60 dBA DNL in usable outdoor activity areas, excluding balconies and residential stoops and porches facing existing roadways. Some common use areas that meet the 60 dBA DNL exterior standard will be available to all residents. Use noise attenuation techniques such as shielding by buildings and structures for outdoor common use areas. On sites subject to aircraft overflights or adjacent to elevated roadways, use noise attenuation techniques to achieve the 60 dBA DNL standard for noise from sources other than aircraft and elevated roadway segments.

EC-1.2 Minimize the noise impacts of new development on land uses sensitive to increased noise levels (Categories 1, 2, 3 and 6) by limiting noise generation and by requiring use of noise attenuation measures such as acoustical enclosures and sound barriers, where feasible. The City considers significant noise impacts to occur if a project would:

• Cause the DNL at noise sensitive receptors to increase by five dBA DNL or more where the noise levels would remain "Normally Acceptable"; or

• Cause the DNL at noise sensitive receptors to increase by three dBA DNL or more where noise levels would equal or exceed the "Normally Acceptable" level.

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.

Table EC-1: Land Use Compatibility Guidelines for Community Noise in San José

LAND USE CATEGORY	EXTERIOR NOISE EXPOSURE (DNL IN DECIBELS (DBA)) 55 60 65 70 75 80
1. Residential, Hotels and Motels, Hospitals and Residential Care[1]	
2. Outdoor Sports and Recreation, Neighborhood Parks and Playgrounds	
3. Schools, Libraries, Museums, Meeting Halls, Churches	
4. Office Buildings, Business Commercial, and Professional Offices	
5. Sports Arena, Outdoor Spectator Sports	
6. Public and Quasi-Public Auditoriums, Concert Halls, Amphitheaters	

[1]Noise mitigation to reduce interior noise levels pursuant to Policy EC-1.1 is required.

Normally Acceptable:

- Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable:

- Specified land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.

Unacceptable:

- New construction or development should generally not be undertaken because mitigation is usually not feasible to comply with noise element policies.

Santa Clara County

Santa Clara County Airport Land Use Commission Comprehensive Land Use Plan. The Comprehensive Land Use Plan adopted by the Santa Clara County Airport Land Use Commission contains standards for projects within the vicinity of San José International Airport, which are relevant to this project:

Policy N-3 Noise impacts shall be evaluated according to the Aircraft Noise Contours presented on Figure 5 (2022 Aircraft Noise Contours).

Policy N-4 No residential or transient lodging construction shall be permitted within the 65 dB CNEL contour boundary unless it can be demonstrated that the resulting interior sound levels will be less than 45 dB CNEL and there are no outdoor patios or outdoor activity areas associated with the residential portion of a mixed use residential project or a multi-unit residential project. (Sound wall noise mitigation measures are not effective in reducing noise generated by aircraft flying overhead.)

Regulatory Background – Vibration

City of San José

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies to achieve the goal of minimizing vibration impacts on people, residences, and business operations in the City of San José. The following policies are applicable to the proposed project:

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.

Existing Noise Environment

Figure 1 is an aerial image of the site vicinity overlaid with the project site plan. Existing noise-sensitive receptors in the project vicinity include Mayne Elementary School, the Alviso Branch Library, single-family residences north of North First Street, and the Summerset Mobile Estates west of the Guadalupe River.

Due to Shelter-in-Place restrictions implemented by the State of California[1] at the time of this study, traffic volumes along the surrounding roadways were lower. A noise monitoring survey was not completed to document ambient noise levels during this time period because resultant noise levels would not be representative of typical conditions.

In order to establish the environmental baseline for the project, noise data contained in the City of San José General Plan were reviewed along with noise data from a nearby project. A review of these data indicates that the noise environment in the project vicinity is primarily the result of

1 Cal. Exec. Order No. N-33-20, March 19, 2020.

vehicular traffic along Highway 237 and North First Street. In 2008, Highway 237 produced a noise level of approximately 82 dBA DNL at 75 feet from the near direction of travel.[2] The General Plan noise contour information shows that noise levels at boundaries of the project site nearest to Highway 237 are approximately 65 dBA DNL, as shown in Figure 2. Noise levels along Highway 237 are not projected to measurably increase by 2035.

Noise data quantified by *Bollard Acoustical Consultants* for the Topgolf @ Terra Project[3] in 2015 indicate that ambient noise levels ranged from 65 to 66 dBA DNL at Location A, which is representative of the noise environment at the nearest residences on North First Street, and from 62 to 64 dBA DNL at Location B, which is representative of residences west of the Guadalupe River.

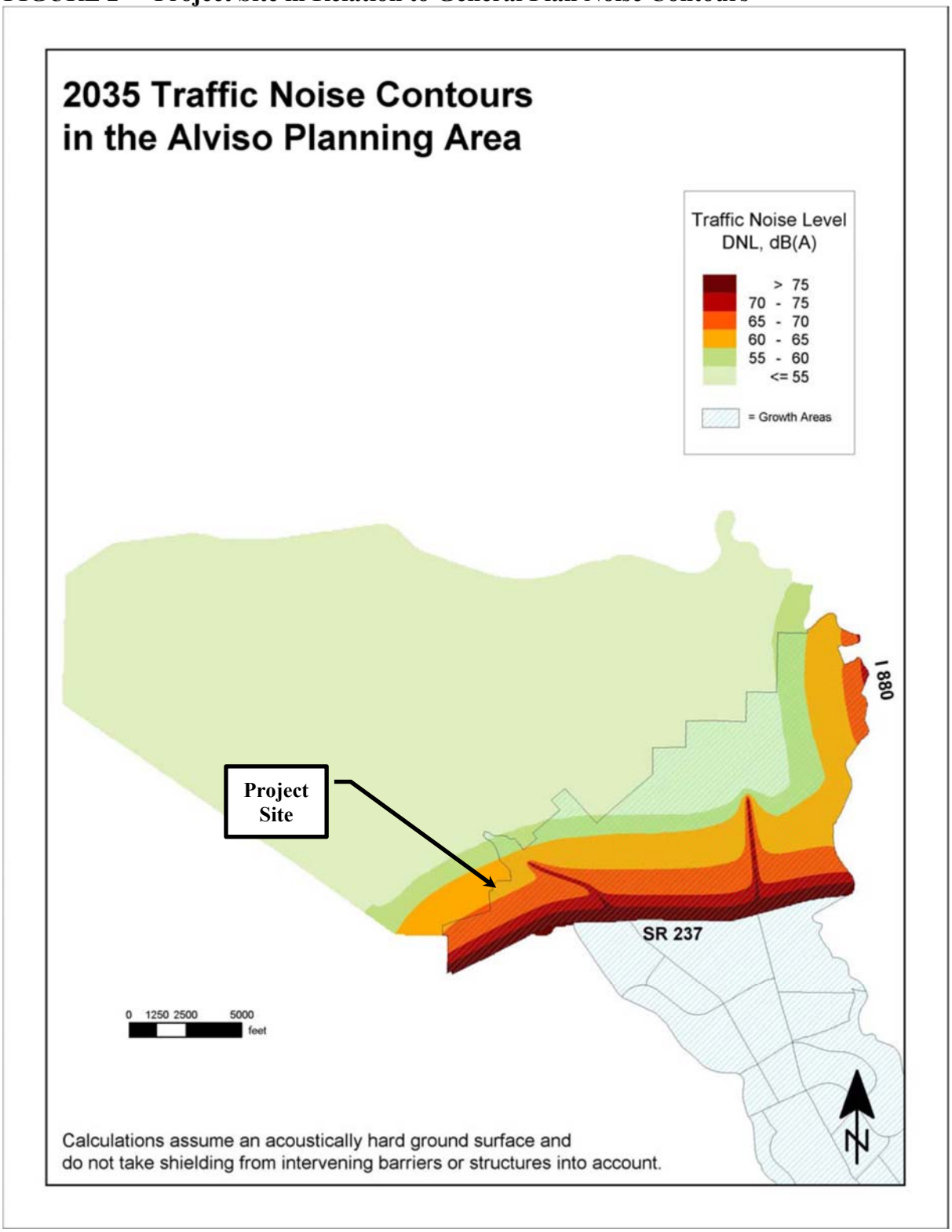
2 Illingworth & Rodkin, Inc., "Envision San Jose 2040 General Plan Comprehensive Update Environmental Noise Assessment," December 2010.

3 City of San Jose, Initial Study Topgolf @ Terra Project, Table 4.12-1, September 2016.

FIGURE 1 Project Vicinity and Site Plan

Source: Google Earth, 2020.

FIGURE 2 Project Site in Relation to General Plan Noise Contours



Source: Illingworth & Rodkin, Inc., "Envision San José 2040 General Plan Comprehensive Update Environmental Noise Assessment," December 2010.

GENERAL PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

Future Exterior Noise Environment

The exterior noise threshold established in the City's General Plan for new hotel projects is 60 dBA DNL at usable outdoor activity areas, excluding private balconies and porches. The project site plan identifies a small amenity deck south of the hotel lobby that would be exposed to future exterior noise levels of approximately 65 dBA DNL. Exterior noise levels at the amenity deck would exceed the City's 60 dBA DNL threshold at the center of the outdoor use area by up to 5 dBA DNL and would be considered to be "conditionally acceptable" with respect to the noise environment. Due to the limited size and open nature of this amenity deck, the City could allow the outdoor use area without additional measures to reduce noise levels because future exterior noise levels would fall within the conditionally acceptable noise level range for hotels. However, if the City does not allow the amenity deck in a conditionally acceptable noise environment, noise control measures would be required to meet the City's normally acceptable threshold of 60 dBA DNL.

Measures to Reduce Exterior Noise Levels

Methods available to reduce exterior noise levels at the amenity deck include site planning alternatives (e.g., using the proposed buildings as noise barriers), the construction of traditional noise barriers, or a combination of the above. A minimum 5-foot high noise barrier, as measured from the base elevation of the deck, could be constructed along the southern perimeter of the amenity deck to reduce noise levels by 5 dBA. The noise barrier should be solid from grade to top, with no cracks or gaps, in order to be effective. Barrier materials should have a minimum surface density of three lbs./ft.^{2}, and a clear barrier would be optimal in order to maintain aesthetic appeal (i.e., ½-inch laminated glass). With the implementation of this barrier, the exterior noise environment at the amenity deck would be maintained at or below 60 dBA DNL.

Future Interior Noise Environment

The City of San José requires that interior noise levels within hotels be maintained at 45 dBA DNL or less. 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 hotel construction methods provide approximately 25 dBA of exterior-to-interior noise reduction assuming windows are closed. In noise environments ranging from 65 to 70 dBA DNL, interior noise levels can typically be maintained below 45 dBA DNL with the incorporation of an adequate forced-air mechanical ventilation system in each hotel room, allowing the windows to be closed to control noise. In noise environments exceeding 70 dBA DNL, a combination of forced-air mechanical ventilation and sound-rated construction methods is often necessary to meet the interior noise level limit.

The southern façade of the proposed hotel building would receive the highest traffic noise exposure. At 830 feet from the center of Highway 237, the southern-facing hotel rooms would be exposed to future exterior noise levels up to 65 dBA DNL. Rooms located along the northern,

eastern, and western building façades would be exposed to lower traffic noise levels due to acoustical shielding provided by the hotel building itself and setback of the building from North First Street. In addition to the traffic noise exposure, the northern and western building façades would be exposed to operational noise associated with the Topgolf project. Figure 3 displays the noise levels expected from the Topgolf project at the proposed hotel building. Based on these data, Topgolf noise levels would reach 60 dBA L_{eq} at the hotel building, and the worst-case DNL noise level, estimated assuming this worst-case noise level during operational hours (9:00 am to 2:00 am), would reach 63 dBA. Based on the future exterior noise exposure anticipated at the site, interior noise levels attributable to exterior environmental noise sources would exceed 45 dBA DNL assuming windows are open for ventilation.

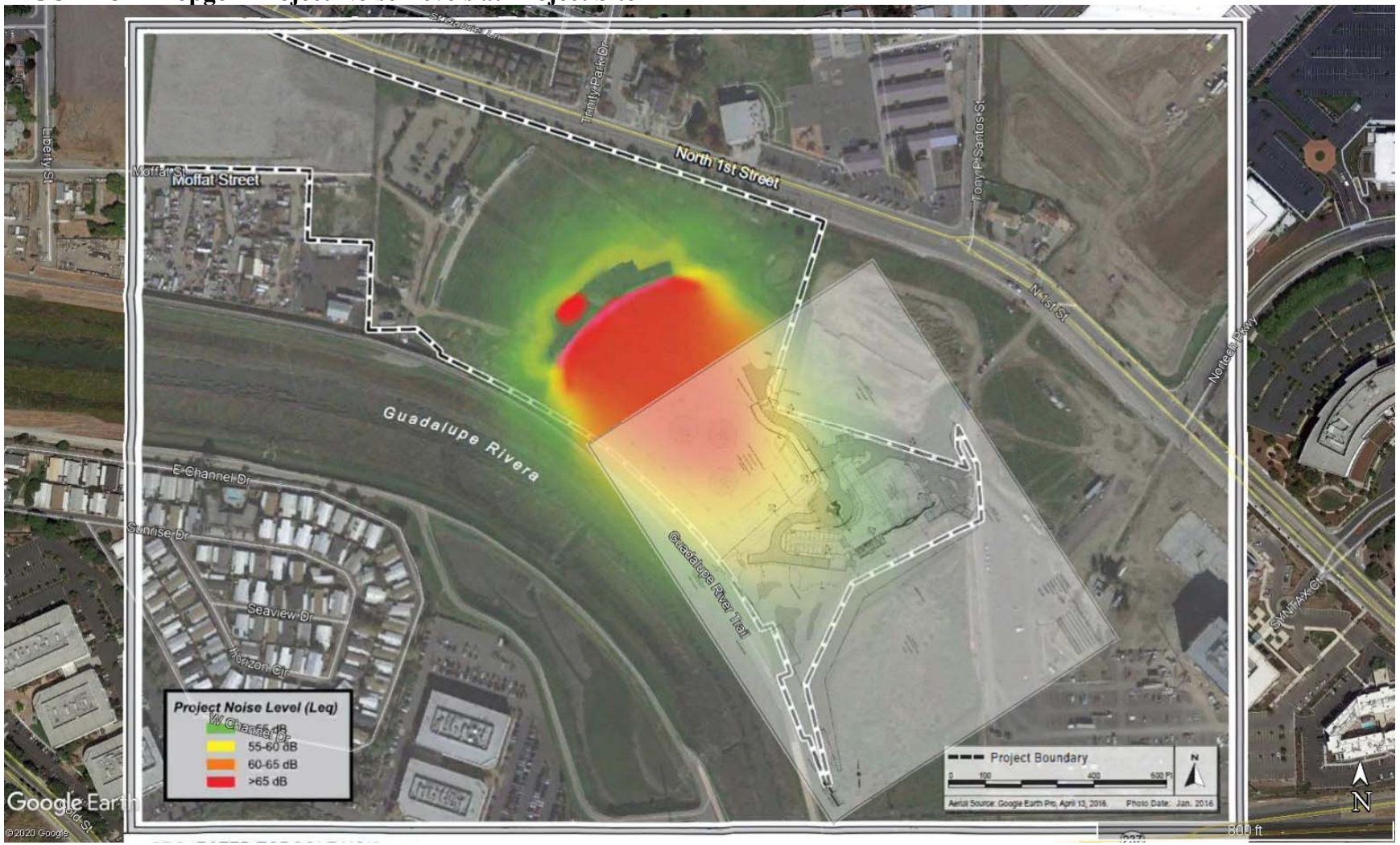
Measures to Reduce Future Interior Noise Levels

The following noise insulation features should be incorporated into the proposed project:

- Provide a suitable form of forced-air mechanical ventilation, as determined by the local building official, for all hotel rooms, so that windows can be kept closed to control noise.

The implementation of these noise insulation features would reduce interior noise levels to 45 dBA DNL or less in the hotel rooms.

FIGURE 3 Topgolf Project Noise Levels at Project Site



Source: Google Earth, 2020 and City of San José, Initial Study Topgolf @ Terra Project, Figure 4.12-2, September 2016.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

The following criteria were used to evaluate the significance of noise or vibration 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.
    - A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. The City of San José considers large or complex projects involving substantial noise-generating activities and lasting more than 12 months significant when within 500 feet of residential land uses or within 200 feet of commercial land uses or offices.
    - 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.
- 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 aircraft noise levels.

Impact 1a: **Construction Noise.** The construction of the project would temporarily increase ambient noise levels in the project vicinity, but construction activities would occur at distances greater than 500 feet from the nearest residential uses and more than 200 feet from the nearest commercial or office uses. **This is a less-than-significant impact**.

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. 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 generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The construction of the proposed project would involve grading, excavation to lay foundations, trenching, building erection, and paving. The hauling of imported and exported soil and materials would generate truck trips on local roadways as well. Grading of the site would import approximately 900 cubic yards of fill. Construction activities would last approximately eighteen months, beginning in spring of 2021.

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 50 feet are shown in Tables 4 and 5. Table 4 shows the average noise level ranges, by construction phase, and Table 5 shows the maximum noise level ranges for different construction equipment. Most construction noise falls with the range of 80 to 90 dBA at 50 feet from the source.

TABLE 4 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 5 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.

Source: Mitigation of Nighttime Construction Noise, Vibrations and Other Nuisances, National Cooperative Highway Research Program, 1999.

As shown in Table 4, construction noise levels produced by the project would typically range from 78 to 89 dBA L_{eq} at a distance of 50 feet from the source with all pertinent equipment present at the site. With the minimum required equipment present at the site, construction noise levels produced by the project would typically range from 75 to 84 dBA L_{eq} at a distance of 50 feet from the source. 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.

The nearest noise-sensitive educational and residential land uses would be located approximately 900 feet from the acoustic center of the construction site. Construction noise levels at 900 feet would range from 53 to 64 dBA L_{eq} with all pertinent equipment present at the site and from 50 to 59 dBA L_{eq} with the minimum required equipment present at the site. Construction noise levels would generally be within the range of typical daytime noise levels (58 to 63 dBA L_{eq})[4] experienced at the nearest noise-sensitive educational and residential land uses. The nearest commercial or office uses would be located approximately 600 feet from the acoustic center of the construction site. Construction noise levels at 600 feet would range from 57 to 68 dBA L_{eq} with all pertinent equipment present at the site and from 54 to 63 dBA L_{eq} with the minimum required equipment present at the site.

Per General Plan Policy EC-1.7, temporary noise increases due to project construction would be considered less-than-significant as the as the construction activity would occur more than 500 feet from the nearest sensitive residential uses and more than 200 feet from the nearest commercial or office uses.

Mitigation Measure 1a: None required.

Impact 1b: Permanent Noise Level Increase. The proposed project would not result in a permanent noise level increase at existing noise-sensitive land uses in the project vicinity due to project-generated traffic. **This is a less-than-significant impact.**

A significant impact would result if traffic generated by the project would substantially increase noise levels at sensitive receptors in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or b) the noise level increase is 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater. The existing noise environment in the surrounding area would exceed 60 dBA DNL; therefore, a significant impact would occur if project-generated traffic would permanently increase noise levels by 3 dBA DNL. For reference, a 3 dBA DNL noise increase would be expected if the project would double existing traffic volumes along a roadway.

For the proposed project, peak hour turning movements were provided for seven study intersections. Existing plus project traffic volumes were compared to existing volumes to estimate the project's contribution to permanent noise level increases expected in the project vicinity. Upon comparison of these traffic conditions, traffic noise increases of less than 1 dBA DNL were estimated for the roadways serving the site. Traffic noise increases are summarized in

4 City of San Jose, Initial Study Topgolf @ Terra Project, Table 4.12-1, September 2016.

Table 6, below. The project would neither result in a doubling of traffic volumes nor result in a permanent noise increase of 3 dBA DNL or more. This is a less-than-significant impact.

TABLE 6 Traffic Noise Increase Summary

Roadway	Segment	Existing PM Peak Hour Volume	Existing Plus Project PM Peak Hour Volume	Relative Noise Level Increase, dBA DNL
North First Street	North of Trinity Pak Drive	543	577	0
	Trinity Park Drive to Bay Vista Drive	633	716	<1
	Bay Vista Drive to Nortech Parkway	633	716	<1
	South of Nortech Parkway	933	1016	0
Trinity Park Drive	East of North First Street	31	31	0
Nortech Parkway	East of North First Street	358	358	0

Source: Fehr & Peers, July 2020 and Illingworth & Rodkin, Inc., September 2020.

Mitigation Measure 1b: None required.

Impact 1c: Noise Levels in Excess of Standards. The proposed project would not generate noise in excess of standards established in the City's General Plan at the nearby sensitive receptors. This is a **less-than-significant** noise impact.

On site noise sources, including mechanical equipment for heating, ventilation, and cooling purposes, exhaust fans and other similar equipment, parking lots, truck deliveries, etc., would not occur in areas near noise-sensitive receptors. No noise-generating sources are anticipated for this project that would exceed the applicable noise limits over 600 feet from the project site. Such noise sources would produce noise levels well below ambient noise levels in the area resulting from vehicle traffic, aircraft, and other commercial and industrial operations. This is a less-than-significant impact.

Mitigation Measure 1c: None required.

Impact 2: Exposure to Excessive Groundborne Vibration. The project site is located over 200 feet from existing or proposed buildings near the project site. At this minimum distance, construction-related vibration levels would not exceed the City's thresholds for vibration levels received at historic buildings or buildings of normal conventional construction. **This is a less-than-significant impact.**

Construction phases proposed by the project include site preparation, grading/excavation, trenching/ foundation, and new building framing and finishing. Project construction activities would not include pile driving or other substantial sources of vibration.

According to Policy EC-2.3 of the City of San José General Plan, a vibration limit of 0.08 in/sec PPV shall be used to minimize the potential for cosmetic damage to sensitive historical

structures, and a vibration limit of 0.20 in/sec PPV shall be used to minimize damage at buildings of normal conventional construction.

Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 7 presents typical vibration levels that could be expected from construction equipment 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 at a distance of 25 feet. Table 7 also summarizes the distances to the 0.08 in/sec PPV threshold for historic buildings and to the 0.2 in/sec PPV threshold for all other buildings of normal conventional construction.

TABLE 7 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Minimum Distance to Meet 0.08 in/sec PPV (feet)	Minimum Distance to Meet 0.2 in/sec PPV (feet)
Clam shovel drop		0.202	58	26
Hydromill (slurry wall)	in soil	0.008	3	1
	in rock	0.017	6	2
Vibratory Roller		0.210	60	27
Hoe Ram		0.089	28	12
Large bulldozer		0.089	28	12
Caisson drilling		0.089	28	12
Loaded trucks		0.076	24	10
Jackhammer		0.035	12	5
Small bulldozer		0.003	1	<1

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, FTA Report No. 0123, September 2018, as modified by Illingworth & Rodkin, Inc., September 2020.

Construction vibration may at times be perceptible at the common property lines of the project site but would minimal and dissipate rapidly with distance from the construction activity occurring at the time. Since the project site is located over 200 feet from buildings nearest the project site, no vibration-related impacts are identified at any of the nearest sensitive receptors to the project site. This is a less-than-significant impact.

Mitigation Measure 2: None Required.

Impact 3: **Excessive Aircraft Noise.** The project site is located approximately 3.5 miles from the nearest airport, and the proposed project would not expose people residing or working at the site to excessive aircraft noise. **This is a less-than-significant impact.**

Norman Y. Mineta San José International Airport is a public-use airport located approximately 3.5 miles south-southeast of the project site. Figure 4 shows that the project site lies well outside the 2037 60 dBA CNEL noise contour of the airport, according to the City's new Airport Master

Plan Environmental Impact Report.[5] This means that future exterior noise levels due to aircraft would not exceed 60 dBA CNEL/DNL. According to Policy EC-1.11 of the City's General Plan, the required safe and compatible threshold for exterior noise levels would be at or below 65 dBA CNEL/DNL for aircraft. Similarly, Moffett Federal Airfield is located approximately 4 miles west of the project site, and this airport produces considerably less environmental noise, as compared to Norman Y. Mineta San José International Airport. Noise levels produced by Moffett Federal Airfield aircraft are insignificant at the site and would be clearly compatible with the proposed land use. This is a less-than-significant impact.

Mitigation Measure 3: **None required.**

5 David J. Powers & Associates, Inc., Integrated Final Environmental Impact Report, Amendment to Norman Y. Mineta San Jose International Airport Master Plan, April 2020.

FIGURE 4 2037 CNEL Noise Contours for SJIA Relative to Project Site

Figure 5
Scenario 2: With Project 2037 Noise Contour Map

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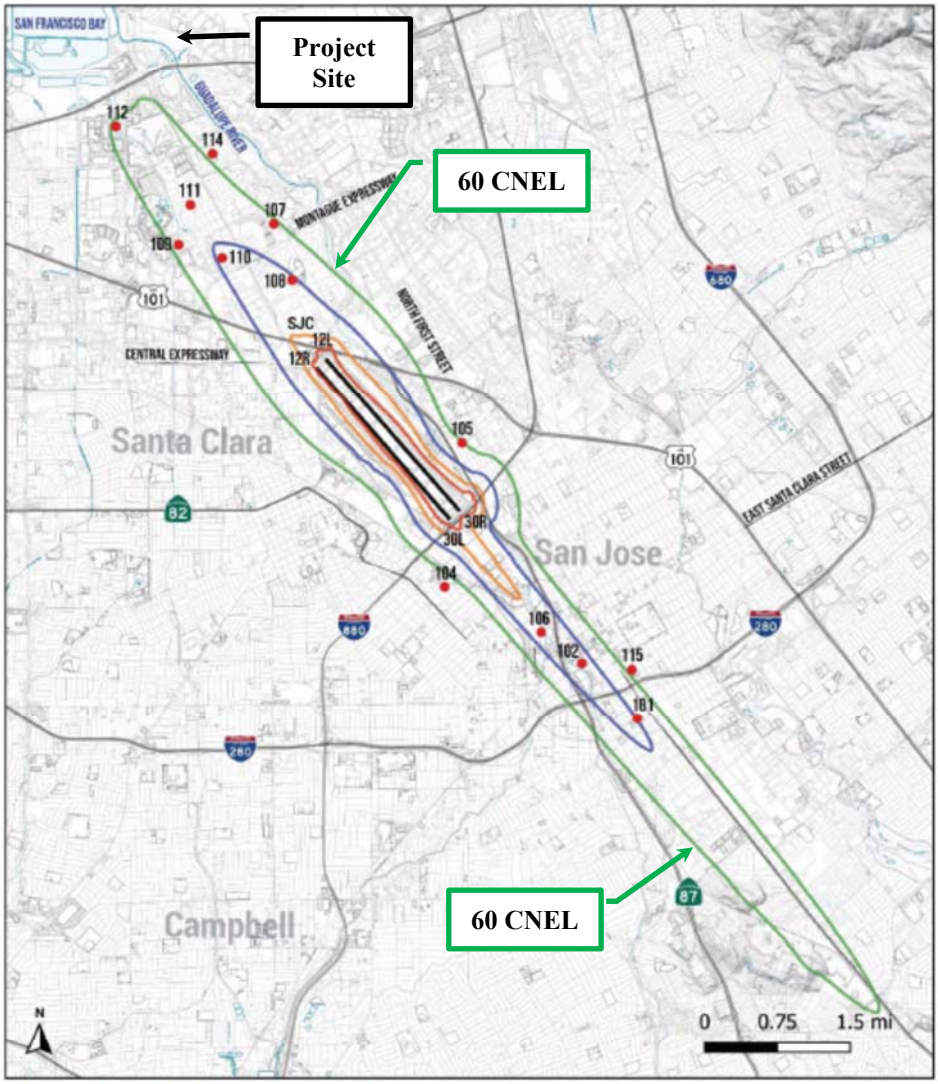

NORMAN Y. MINETA SAN JOSE INTERNATIONAL AIRPORT

- Noise Monitoring Station
- 101 Site ID
- Runway
- 75 dBA and Greater CNEL Contour
- 70 dBA and Greater CNEL Contour
- 65 dBA and Greater CNEL Contour
- 60 dBA and Greater CNEL Contour

Figure 5 Scenario 2: With Project 2037 Noise Contour Map

Source: BridgeNet International 2019

Appendix A
Qualifications of Technical Expert

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

429 East Cotati Avenue
Cotati, California 94931

Tel: 707-794-0400 *Fax: 707-794-0405*
www.illingworthrodkin.com *mthill@illingworthrodkin.com*

MICHAEL S. THILL

Mr. Thill is a principal of the firm with 22 years of professional experience in the field of acoustics. His expertise includes performing field research, analyzing data, and noise modeling. He has conducted numerous field surveys in a variety of acoustical environments to quantify airborne noise levels, groundborne vibration levels, and hydro-acoustic noise levels. He has analyzed and summarized complex sets of data for inclusion into noise models. Mr. Thill has been trained, and is a regular user of FHWA's Traffic Noise Model (TNM), and is familiar with federal and State procedures for preparing highway noise study reports.

Mr. Thill has authored technical noise reports for various land use proposals including residential, commercial, educational, and industrial developments. He has managed the General Plan Update noise studies for several communities in California and has recommended policy language in order to maintain compatible noise levels community-wide. Some of his recent major projects have included the assessment of noise and vibration from data center projects, quarry expansion projects, groundwater recharge projects, and winery projects where operations and special events have been of concern in rural settings. He has vast experience explaining acoustical concepts and the results of his analyses in public forums to the general public and project decision-makers.

Mr. Thill has also led traffic noise investigations for major transportation projects including the Route 4 Bypass project (2003 to 2013) and the I-680/Route 4 Interchange project (2014 to 2015) in Contra Costa County, California. He managed the noise study reports the US Highway 101 and State Route 85 Express Lanes projects for the Santa Clara County Valley Transit Authority (2011 to 2013), proposed along 66 miles, combined, of project study area between Mountain View and Morgan Hill, California. In 2013, Mr. Thill led the analyses of noise impacts due to the Jennings Avenue Pedestrian and Bicycle Rail Crossing Project, and in 2015, Mr. Thill led the analysis of noise impacts and noise abatement for the US Highway 101 / Hearn Avenue Interchange Project in Santa Rosa, California.

PROFESSIONAL EXPERIENCE

2009 - Present Principal	Illingworth & Rodkin, Inc. Petaluma, California
2005 - 2009 Senior Consultant	Illingworth & Rodkin, Inc. Petaluma, California
1998 - 2005 Staff Consultant	Illingworth & Rodkin, Inc. Petaluma, California

EDUCATION

1998	University of California at Santa Barbara B.S., Major: Environmental Science

PROFESSIONAL SOCIETIES

Institute of Noise Control Engineering
Association of Environmental Professionals