Noise & Vibration Study
Duke Warehouse at Perry Street and Barrett Avenue
City of Perris

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1.0 INTRODUCTION

The Duke Perry Warehouse at Perry Street and Barrett Avenue is being proposed within the Perris Valley Commerce Center (PVCC) Specific Plan in the City of Perris. The proposed project has the potential to generate changes in the existing noise environment. Under the California Environmental Quality Act (CEQA), projects of this type are required to undergo environmental review to assess potential impacts. The following noise analysis has been prepared to the support the Mitigated Negative Declaration (MND) for the proposed project and to demonstrate consistency with all applicable federal, state and local noise regulations.

The following noise study describes the proposed project, provides information regarding noise fundamentals, describes the applicable federal, state and local noise guidelines, characterizes the existing noise environment, provides the study methods and procedures used to perform the traffic noise analysis and evaluates off-site traffic noise impacts, presents stationary-related noise impacts from loading and unloading activities and construction noise impacts near sensitive residential communities. The recommend noise mitigation measures included in this study have been designed to reduce the exterior noise levels for the off-site sensitive residential areas.

1.1 Project Location and Site Description

The proposed project site is located on an undeveloped parcel at the southeast corner of Perris Street and Barrett Avenue in the City of Perris, Riverside County, California. Figure 1 depicts the project area in a regional context, while Figure 2 presents the proposed project site. The site is accessed via Perry Street and is currently vacant. No buildings or structures currently exist at the site. This area is within the South Coast Air Basin. Figure 3 provides the proposed site plan of the proposed warehouse.

1.2 Project Description

One project alternative is being considered for the project site. This alternative consists of the construction and operation of an approximately 148,297 square feet (sf) industrial high-cube, non-refrigerated warehouse/distribution center (Case # PLN18-00011). This alternative would be constructed in one phase. Additionally, per the City of Perris, the alternative should evaluate two access options, as follows:

- Access Option 1-Right In Right Out (RIRO): Intersection of Indian Avenue and Perry Street continues to operate as right-in right-out. Currently, the Perry Street/Indian Avenue intersection is restricted and only allows right in and right out access on to Perry Street.

- Access Option 2-Signal: Intersection of Indian Avenue and Perry Street is modified to install a traffic signal and allow full access. The proposed project ,, as well as the warehouse to the west of Indian Avenue to be developed by IDI, should analyze a 4-legged traffic intersection at Perry Street and Indian Avenue. This signalized intersection would replace the existing right in and right out access on to Perry Street. The 4-legged traffic intersection would allow trucks direct access to and from the PVCCSP-designated truck route on Harley Knox Boulevard to the Project site.

The propose project alternative is discussed below.

Proposed Project -Warehouse

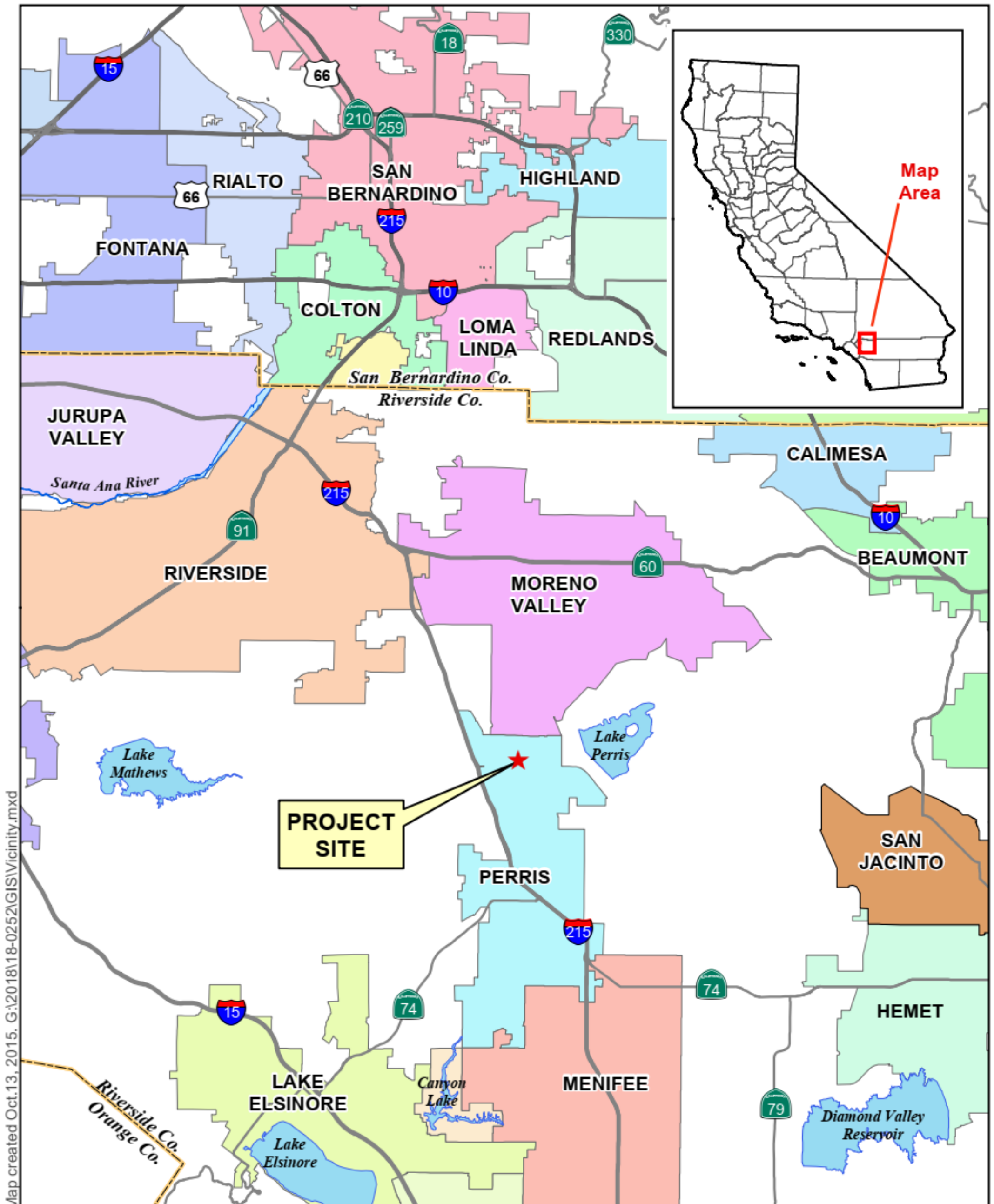
The proposed Project involves the construction and operation of an approximately 148,297 square feet (sf) industrial high-cube, non-refrigerated warehouse/distribution use that includes 3,000 square feet of office space and 3,000 square feet of mezzanine space on the approximate 7.25-acre site as shown in Figure 4. One building is proposed on the portion of the Project site located south of Perry Street and east of Barrett Ave. There will be one truck and vehicle entrance on Barrett Avenue and two entrances on Perry Street. The western driveway will be car access only and the east driveway will be for truck and vehicle access.

As part of proposed Project , a 12-inch water line in Barrett Avenue would be constructed to connect to an existing 20-inch waterline in Perry Street.

Perry Street has been designated a 60-foot wide local road adjacent to the Project site to the north. It has been constructed to its ultimate 60-foot wide width; the Project applicant will be responsible for constructing a six-foot wide sidewalk along the Project frontage. Barrett Avenue, along the western Project site boundary, has currently been constructed to 28-feet of its ultimate 60-foot width as a local road. The Project applicant will be responsible for constructing Barrett Avenue to its ultimate width east of the centerline; this includes four-feet of pavement, two-foot curb and gutter and a six-foot sidewalk along the Project frontage. On the west side of the centerline, the Project includes constructing four-feet of pavement and a two-foot curb and gutter. At the southern terminus of Barrett Avenue, the Project applicant will construct a cul-de-sac to provide trucks access to the Site as well as to provide the existing residential property to the south of the Project site, access to its property.

Trucks would use PVCCSP-designated truck routes to travel to and from the Project site. Automobile and trailer parking would be provided on site and the number of parking spaces provided would be consistent with the parking requirements outlined in Section 19.69 of the Perris Zoning Ordinance for high-cube warehousing. Propose Project Alternative 2 includes 82 standard parking stalls, 5 American Disabilities Act-compliant (ADA) handicapped parking spaces, 5 electrical vehicle (EV) parking stalls, one ADA EVE parking space, one van EV parking space , and 11 clean air/vanpool parking spaces for a total of 105 vehicle parking spaces. There are also 21 trailer parking spaces proposed.

Construction of the proposed Project would involve mass grading of the Project site. Final design of the Project site includes a net import of 17,900 cubic yards of fill. Construction is expected to be initiated in 2019 and completed in 2020.



Source: County of Riverside GIS, 2018.

Figure 1 – Vicinity Map

Duke Warehouse at Perry St. and Barrett Ave.

ALBERT A. WEBB ASSOCIATES

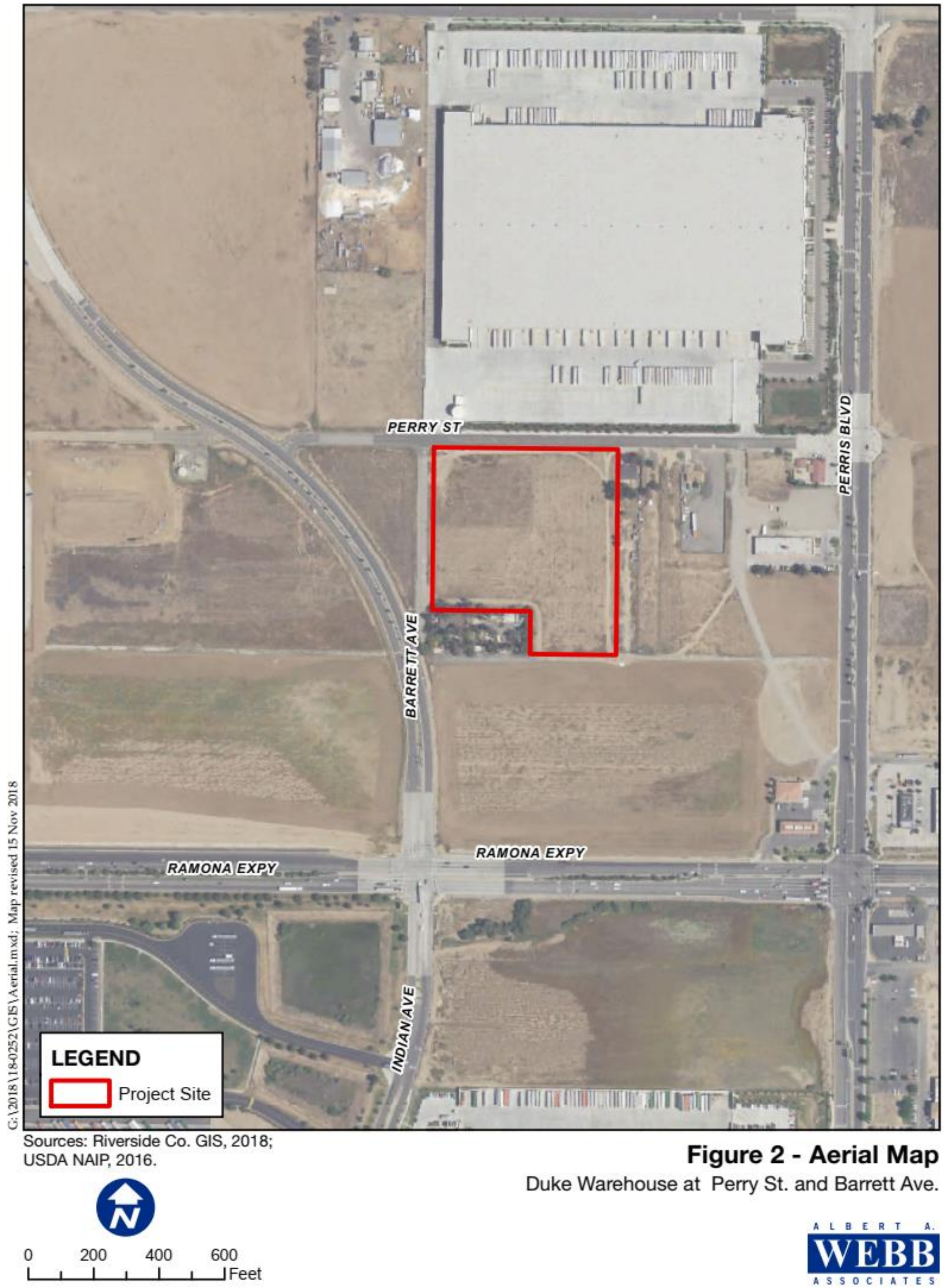


Figure 2 - Aerial Map
Duke Warehouse at Perry St. and Barrett Ave.

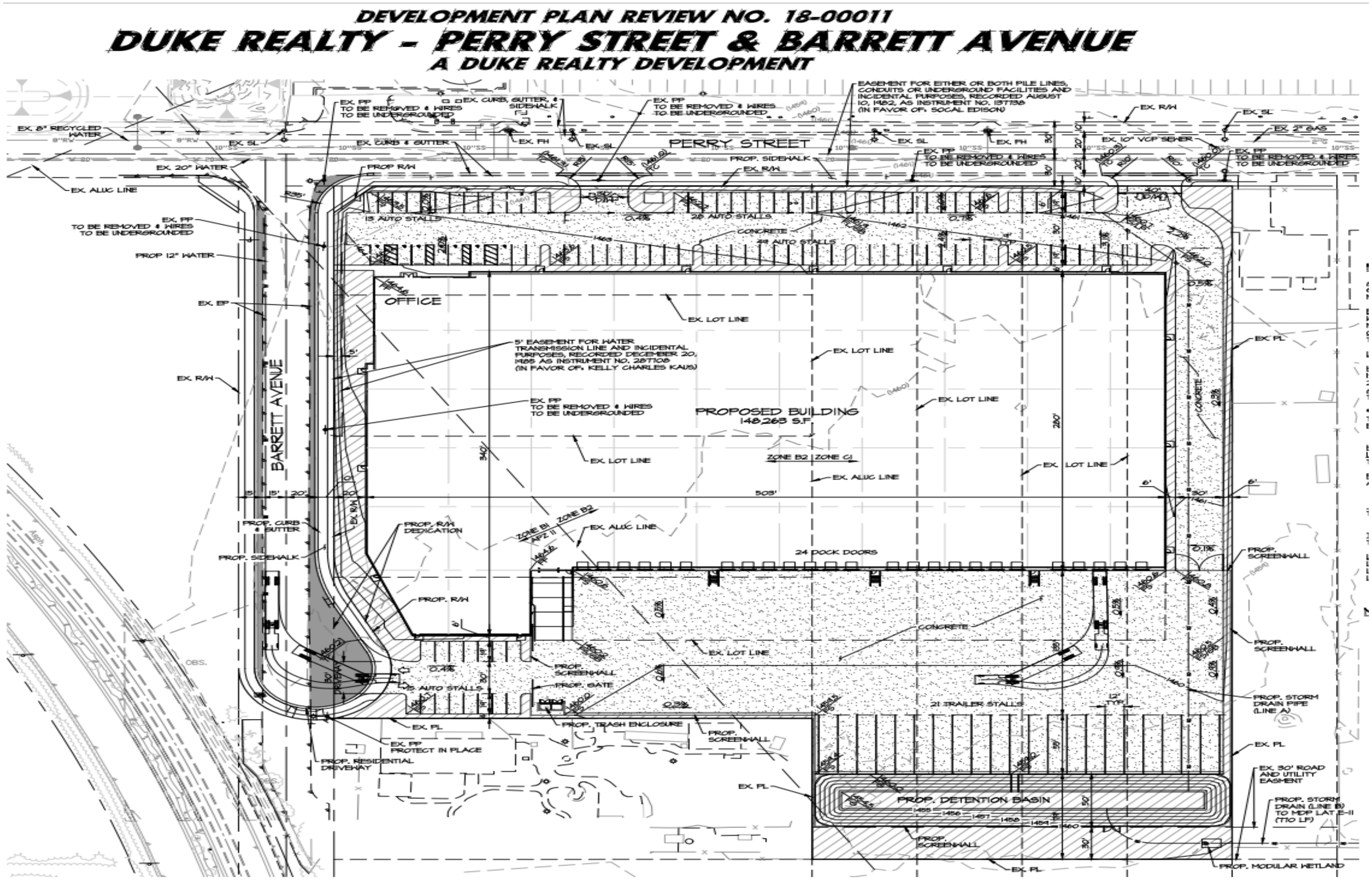


Figure 3. Proposed Project Alternative-Warehouse

2.0 FUNDAMENTALS OF SOUND

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. Noise is generally defined as unwanted or excessive sound, which can vary in intensity by over one million times within the range of human hearing; therefore, a logarithmic scale, known as the decibel scale (dB), is used to quantify sound intensity. Community noise varies continuously over a period of time with respect to the contributing sound sources of the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors unidentifiable. As such, background noise level changes throughout a typical day, corresponding with the addition and subtraction of distant noise sources such as traffic, and single-event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual.

Because the noise environment is continually changing, average noise over a period of time is generally used to describe the community noise environment, which requires the measurement of noise over a period of time to accurately characterize a community noise environment. This time-varying characteristic of environmental noise is described using various noise descriptors, which are defined below:

L_{eq}: The L_{eq}, or equivalent sound level, is used to describe noise over a specified period of time in terms of a single numerical value; the L_{eq} of a time-varying signal and that of a steady signal are the same if they deliver the same acoustic energy over a given time. The L_{eq} may also be referred to as the average sound level.

Lmax: The maximum, instantaneous noise level experienced during a given period of time.

Lmin: The minimum, instantaneous noise level experienced during a given period of time.

Lx: The noise level exceeded a percentage of a specified time period. The "x" represents the percentage of time a noise level is exceeded. For instance, L50 and L90 represents the noise levels that are exceeded 50 percent and 90 percent of the time, respectively.

Ldn: Also termed the day-night average noise level (DNL), the Ldn is the average A-weighted noise level during a 24-hour day, obtained after an addition of 10 dBA to measured noise levels between the hours of 10:00 pm to 7:00 am to account nighttime noise sensitivity.

CNEL: CNEL, or Community Noise Equivalent Level, is the average A-weighted noise level during a 24-hour day that is obtained after an addition of 5 dBA to measured noise levels between the hours of 7:00 pm to 10:00 pm and after an addition of 10 dBA to noise levels between the hours of 10:00 pm to 7:00 am to account for noise sensitivity in the evening and nighttime, respectively.

In addition, sound is characterized by both its amplitude and frequency (or pitch). The human ear does not hear all frequencies equally. In particular, the ear deemphasizes low and very high frequencies. To approximate the sensitivity of human hearing, the A-weighted decibel scale (dBA) is used. On this scale, the human range of hearing extends from approximately 3 dBA to around 140 dBA. **Table 2-1** includes examples of A-weighted noise levels from common indoor and outdoor activities.

Table 2-1. Typical A-Weighted Noise Levels

Common Outdoor Noise	Noise Level (dBA)	Common Indoor Noise
	— 110 —	Rock band (noise to some, music to others)
Jet fly-over at 1000 feet		
	— 100 —	
Gas lawn mower at 3 feet		
	— 90 —	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	— 80 —	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	— 70 —	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	— 60 —	
		Large business office
Quiet urban daytime	— 50 —	Dishwasher in neighboring room
Quiet urban nighttime	— 40 —	Theater, large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night
	— 20 —	
		Broadcast/recording studio
	— 10 —	
Lowest threshold of human hearing	— 0 —	Lowest threshold of human hearing
SOURCE: Caltrans 1998.		

Using the decibel scale, sound levels from two or more sources cannot be directly added together to determine the overall sound level. Rather, the combination of two sounds at the same level yields an increase of 3 dBA. The smallest recognizable change in sound levels is approximately 1 dBA. A 3-dBA increase is generally considered perceptible, whereas a 5-dBA increase is readily perceptible. A 10-dBA increase is judged by most people as an approximate doubling of the sound loudness.

Two of the primary factors that reduce levels of environmental sounds are increasing the distance between the sound source to the receiver and having intervening obstacles such as walls, buildings, or terrain features between the sound source and the receiver. Factors that act to increase the loudness of environmental sounds include moving the sound source closer to the receiver, sound enhancements caused by reflections, and focusing caused by various meteorological conditions.

2.1. Effects of Noise on People

Noise is generally loud, unpleasant, unexpected, or undesired sound that is typically associated with human activity that is a nuisance or disruptive. The effects of noise on people can be placed into four general categories:

- Subjective effects (e.g., dissatisfaction, annoyance)
- Interference effects (e.g., communication, sleep, and learning interference)
- Physiological effects (e.g., startle response)
- Physical effects (e.g., hearing loss)

Although exposure to high noise levels has been demonstrated to cause physical and physiological effects, the principal human responses to typical environmental noise exposure are related to subjective effects and interference with activities. Interference effects refer to interruption of daily activities and include interference with human communication activities, such as normal conversations, watching television, telephone conversations, and interference with sleep. Sleep interference effects can include both awakening and arousal to a lesser state of sleep. With regard to the subjective effects, the responses of individuals to similar noise events are diverse and are influenced by many factors, including the type of noise, the perceived importance of the noise, the appropriateness of the noise to the setting, the duration of the noise, the time of day and the type of activity during which the noise occurs, and individual noise sensitivity.

Overall, a wide variation of tolerance to noise exists, based on an individual's past experiences with noise. Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted (i.e., comparison to the ambient noise environment). In general, the more a new noise level exceeds the previously existing ambient noise level, the less acceptable the new noise level will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships generally occur:

- Except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived.
- Outside of the laboratory, a 3 dBA change in noise levels is considered to be a barely perceivable difference.

- A change in noise levels of 5 dBA is considered to be a readily perceivable difference.
- A change in noise levels of 10 dBA is subjectively heard as doubling of the perceived loudness.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion, hence the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, but rather logarithmically. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA.

2.2. Noise Attenuation

Stationary point sources of noise, including stationary mobile sources such as idling vehicles, attenuate (lessen) at a rate between 6 dBA for hard sites and 7.5 dBA for soft sites for each doubling of distance from the reference measurement. Hard sites are those with a reflective surface between the source and the receiver, such as asphalt or concrete surfaces or smooth bodies of water. No excess ground attenuation is assumed for hard sites and the changes in noise levels with distance (drop-off rate) is simply the geometric spreading of the noise from the source. Soft sites have an absorptive ground surface such as soft dirt, grass, or scattered bushes and trees. In addition to geometric spreading, an excess ground attenuation value of 1.5 dBA (per doubling distance) is normally assumed for soft sites. Line sources (such as traffic noise from vehicles) attenuate at a rate between 3 dBA for hard sites and 4.5 dBA for soft sites for each doubling of distance from the reference measurement (Caltrans 2013).

Physical barriers between the noise source and the receiving property are also effective in reducing noise levels. Effective noise barriers can lower noise levels by 10 to 15dBA, which would substantially cut the loudness of traffic noise. A noise barrier is more effective when it's placed closest to the noise source or receiver depending upon site geometry. However, there are limitation on the effectiveness a noise barrier. Noise barriers must block the line of site between the receiving property and the noise source. When this occurs a noise barrier can achieve a 5-dBA noise level reduction. This may require the noise barrier to be sufficiently long and high enough to block the view of a road to reduce traffic noise.

2.3. Fundamentals of Vibration

Vibration is energy transmitted in waves through the ground or man-made structures. These energy waves generally dissipate with distance from the vibration source. Common sources of groundborne vibration are trains, buses on rough roads, and construction activities such as blasting, pile-driving, and operation of heavy earth-moving equipment. As described in the Federal Transit Administration's (FTA) Transit Noise and Vibration Impact Assessment (FTA 2006), ground-borne vibration can be a serious concern for nearby neighbors of a transit system route or maintenance facility, causing buildings to shake and rumbling sounds to be heard.

There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe vibration impacts to buildings. The root mean square (RMS) amplitude is most frequently used to describe the effect of vibration on the human body. The RMS amplitude is defined as the average of the squared amplitude of the signal. Decibel notation (VdB) is commonly used to measure RMS. The relationship of PPV to RMS velocity is expressed in terms of the "crest factor," defined as the ratio of the PPV amplitude to the RMS amplitude. Peak particle velocity is typically a factor of 1.7 to 6 times greater than RMS vibration velocity (FTA 2006). The decibel notation acts to compress the range of numbers required to describe vibration. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. Sensitive receptors for vibration include structures (especially older masonry structures), people (especially residents, the elderly, and sick), and vibration sensitive equipment.

The effects of ground-borne vibration include movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings. Building damage is not a factor for most projects, with the occasional exception of blasting and pile-driving during construction. Annoyance from vibration often occurs when the vibration levels exceed the threshold of perception by only a small margin. A vibration level that causes annoyance will be well below the damage threshold for normal buildings. The FTA measure of the threshold of architectural damage for conventional sensitive structures is 0.2 in/sec PPV (FTA 2006).

In residential areas, the background vibration velocity level is usually around 50 VdB (approximately 0.0013 in/sec PPV). This level is well below the vibration velocity level threshold of perception for humans, which is approximately 65 VdB. A vibration velocity level of 75 VdB is considered to be the approximate dividing line between barely perceptible and distinctly perceptible levels for many people (FTA 2006).

3.0 REGULATORY FRAMEWORK

The governing regulatory framework in the City of Perris includes federal, state, and local agencies that enforce noise and vibration standards.

3.1 Federal Regulations and Standards

There are no federal noise standards that directly regulate environmental noise related to the construction or operation of the proposed project. With regard to noise exposure and workers, the Office of Safety and Health Administration (OSHA) regulations safeguard the hearing of workers exposed to occupational noise. Federal regulations also establish noise limits for medium and heavy trucks (more than 4.5 tons, gross vehicle weight rating) under 40 Code of Federal Regulations (CFR), Part 205, Subpart B. The federal truck pass-by noise standard is 80 dB at 15 meters from the vehicle pathway centerline. These controls are implemented through regulatory controls on truck manufacturers.

3.2 Federal Transit Authority Vibration Standards

The FTA has adopted vibration standards that are used to evaluate potential building damage impacts related to construction activities. The vibration damage criteria adopted by the FTA are shown in **Table 3-1**.

Table 3-1. Construction Vibration Damage Criteria

Building Category	PPV (in/sec)
I. Reinforced-concrete, steel or timber (no plaster)	0.5
II. Engineered concrete and masonry (no plaster)	0.3
III. Non-engineered timber and masonry buildings	0.2
IV. Buildings extremely susceptible to vibration damage	0.12
SOURCE: FTA, 2006.	

The FTA has also adopted the following standards for groundborne vibration impacts related to human annoyance: Vibration Category 1 – High Sensitivity, Vibration Category 2 – Residential, and Vibration Category 3 – Institutional. The FTA defines Category 1 as buildings where vibration would interfere with operations, such as vibration-sensitive research and manufacturing facilities, hospitals with vibration-sensitive equipment, and research operations. Category 2 refers to all residential land uses and any buildings where people sleep, such as hotels and hospitals. Category 3 refers to institutional land uses such as schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment, but still have the potential for activity interference. The vibration thresholds associated with human annoyance for these three land-use categories are shown in **Table 3-2**. No thresholds have been adopted or recommended for commercial and office uses.

Table 3-2. Groundborne Vibration Impact Criteria for General Assessment

Land Use Category	Frequent Events [a]	Occasional Events [b]	Infrequent Events [c]
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB[d]	65 VdB[d]	65 VdB[d]
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB

a Frequent Events" is defined as more than 70 vibration events of the same source per day.
b Occasional Events" is defined as between 30 and 70 vibration events of the same source per day.
c Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day.
d This criterion is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes.

SOURCE: FTA, 2006

3.2 State Regulations and Standards

Noise Standards

The California Department of Health Services has established guidelines for land use and noise exposure compatibility that are listed in **Table 3-3**. In addition, the California Government Code (Section 65302(g)) requires a noise element to be included in general plans and requires that the noise element: (1) identify and appraise noise problems in the community; (2) recognize Office of Noise Control guidelines; and (3) analyze and quantify current and projected noise levels.

In addition, state noise regulations include requirements for the construction of new residential structures that are intended to limit the extent of noise transmitted into habitable spaces. These requirements are collectively known as the California Noise Insulation Standards and are found in California Code of Regulations, Title 24 (known as the Building Standards Administrative Code), Part 2 (known as the California Building Code), Appendix Chapters 12 and 12A. For limiting noise transmitted between adjacent dwelling units, the noise insulation standards specify the extent to which walls, doors, and floor ceiling assemblies must block or absorb sound. For limiting noise from exterior sources, the noise insulation standards set forth an interior standard of DNL 45 dBA in any habitable room and, where such units are proposed in areas subject to noise levels greater than DNL 60 dBA require an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard. If the interior noise level depends upon windows being closed, the design for the structure must also specify a ventilation or air conditioning system to provide a habitable interior environment.

Table 3-3. California Community Noise Exposure (Ldn or CNEL)

Land Use	Normally Acceptable[a]	Conditionally Acceptable[b]	Normally Unacceptable[c]	Clearly Unacceptable[d]
Single-family, Duplex, Mobile Homes	50 - 60	55 – 70	70 - 75	above 75
Multi-Family Homes	50 - 65	60 – 70	70 - 75	above 75
Schools, Libraries, Churches, Hospitals, Nursing Homes	50 - 70	60 – 70	70 - 80	above 80
Transient Lodging – Motels, Hotels	50 - 65	60 – 70	70 - 80	above 75
Auditoriums, Concert Halls, Amphitheaters	---	50 – 70	---	above 70
Sports Arena, Outdoor Spectator Sports	---	50 – 75	---	above 75
Playgrounds, Neighborhood Parks	50 - 70	---	67 - 75	above 75
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50 - 75	---	70 - 80	above 80
Office Buildings, Business and Professional Commercial	50 - 70	67 – 77	above 75	---
Industrial, Manufacturing, Utilities, Agriculture	50 - 75	70 – 80	above 75	---

a 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.

b Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

c Normally Unacceptable: New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

d Clearly Unacceptable: New construction or development should generally not be undertaken.

SOURCE: FTA, 2006.

The state has also established the California Noise Insulation Standards (Title 24, California Code of Regulations) that provide an interior standard of 45 dB Ldn/CNEL for any habitable room. In addition, it requires an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard where such units are proposed in areas subject to noise levels greater than 60 dB Ldn/CNEL. Title 24 standards are typically enforced by local jurisdictions through the building permit application process.

Additionally, the state has noise limits for vehicles licensed to operate on public roads. For heavy trucks, the state pass-by standard is consistent with the federal limit of 80 dBA. The state pass-by standard for light trucks and passenger cars (less than 4.5 tons, gross vehicle rating) is also 80 dBA at 15 meters from the centerline. These standards are implemented through controls on vehicle manufacturers and by legal sanction of vehicle operators by state and local law enforcement officials.

Vibration Standards

There are no state vibration standards applicable to the proposed project. In addition, the California Department of Transportation's (Caltrans) *Transportation and Construction Vibration Guidance Manual* (2013), does not provide official Caltrans standards for vibration. However, this manual provides guidelines that can be used as screening tools for assessing the potential for adverse vibration effects related to structural damage and human perception. The manual is meant to provide guidance related to vibration issues associated with the construction, operation, and maintenance of Caltrans projects. The vibration criteria established by Caltrans for assessing structural damage and human perception are shown in **Tables 3-4** and **3-5**, respectively.

Table 3-4. Caltrans Vibration Damage Potential Threshold Criteria

Structure and Condition	Maximum PPV (in/sec)	
	Infrequent Sources	Continuous / Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5
Source: Caltrans, 2006.		

Table 3-5. Caltrans Vibration Annoyance Potential Criteria

Structure and Condition	Maximum PPV (in/sec)	
	Infrequent Sources	**Continuous / Frequent Intermittent Sources**
Barely perceptible	0.035	0.019
Distinctly perceptible	0.24	0.08
Strongly perceptible	0.9	0.10
Severe	2.0	0.4-0.6
Source: Caltrans, 2006.		

3.3 Local Regulations and Standards

City of Perris Municipal Code

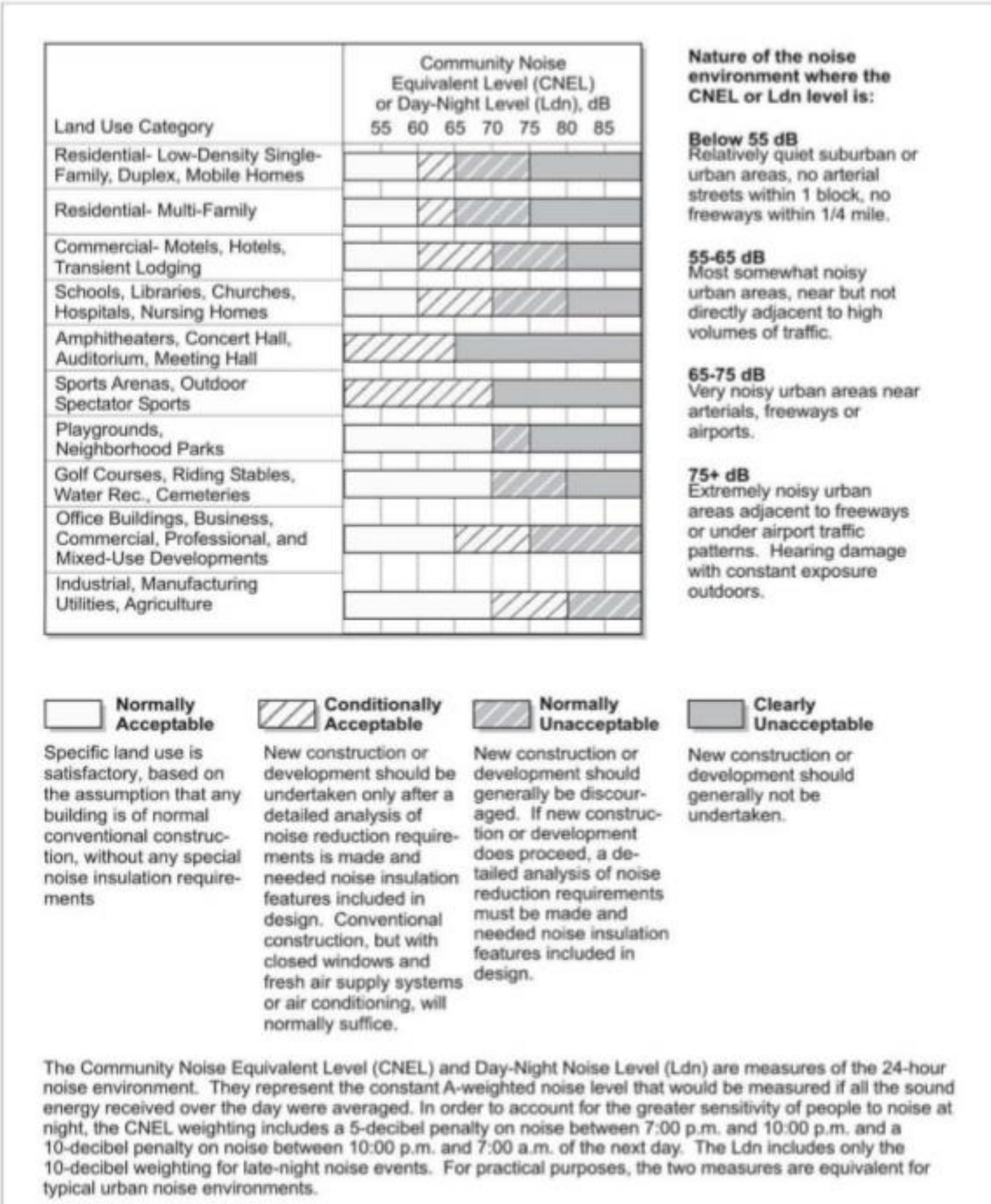
The City of Perris Municipal Code, under Chapter 7.34 (Noise Control), provides the local government ordinance relative to community noise level exposure, guidelines, and regulations.

Construction Noise Levels Pursuant to Section 7.34.060 (Construction Noise), the construction, demolition, excavation, alteration, or repair of any building or structure in such a manner as to create disturbing, excessive, or offensive noise is prohibited between the hours of 7:00 PM and 7:00 AM, on Sundays, and on a legal holiday. Construction activity shall not exceed 80 dBA in residential zones within the city.

City of Perris General Plan

The City of Perris General Plan Noise Element includes Land Use/Noise Compatibility Guidelines, Figure 5 below, which establish normally acceptable exterior noise levels for specified land uses.

Further, Policy V.A requires new large scale commercial or industrial facilities located within 160 feet of sensitive land uses shall mitigate noise impacts to attain an acceptable level as required by the State of California Noise/Land Use Compatibility Criteria.



Source: City of Perris General Plan Noise Element. 2005

Figure 4. City of Perris Land Use Compatibility Guidelines

4.0 THRESHOLDS OF SIGNIFICANCE

Appendix G of the California Environmental Quality Act (CEQA) Guidelines states that a project could have a significant adverse effect related to noise if any of the following would occur:

a) Generation of 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?

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

5.0 EXISTING NOISE MEASUREMENTS

The existing noise environment was characterized by collecting field noise measurements at sensitive residential properties within the project area. A total of two (2) long-term 24-hour measurements were taken at locations. The noise measurements were performed on November 20 and November 21, 2018. Appendix A includes the field monitoring data and Figure 6 shows the monitoring locations. **Table 5-1** presents the CNEL values and hourly day and night noise levels for the project site.

5.1 Measurement Procedure and Criteria

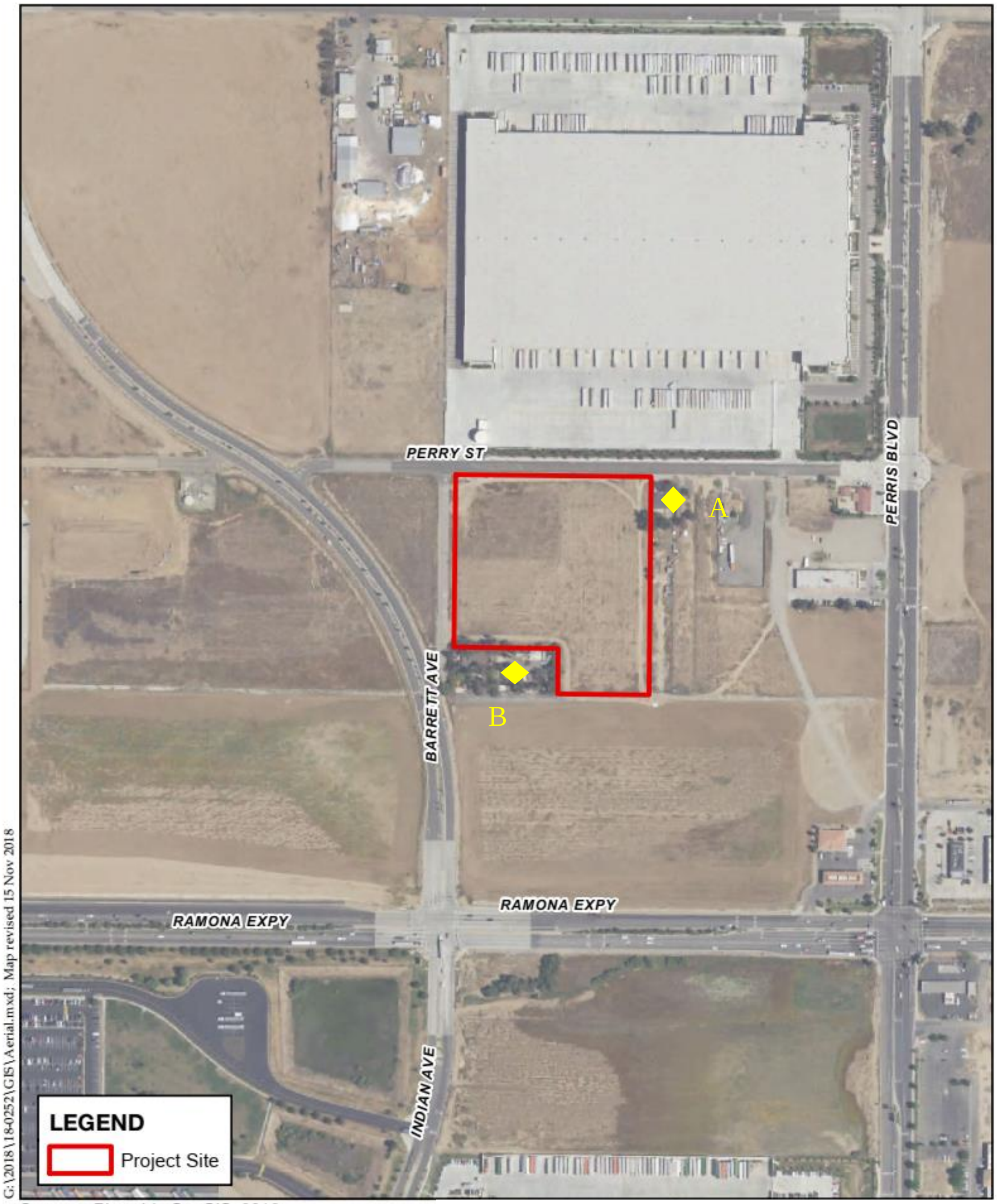
Long term noise measurements were taken using a Larson Davis Type 1 precision sound level meter. All noise meters were programmed in "fast" mode to record noise levels in "A" weighted form. The sound level meters and microphone were mounted, five feet above the ground and equipped with a windscreen during all measurements. The Larson Davis sound level meter was calibrated before the monitoring using a CAL200 calibrator. All noise level measurement equipment meets American National Standards Institute (ANSI) specifications for sound level meters (S1.4-1983 identified in Chapter 19.68.020.AA).

5.2 Noise Measurement Locations

The project site contains mostly vacant land. Noise monitoring locations were selected based on residential properties proximity to the proposed project site. Noise measurement locations A and B were monitored for a period of 24 hours. Site A is located near 111 Perry Street, northeast of the proposed project site. Site B is located at the property of 4111 Barrett Avenue, southwest of the proposed project site.

Table 5-1. Existing (Ambient) Long-Term (24-hour) Noise Level Measurements[1]						
Noise Monitoring Location ID[2,3]	Description	Hourly Noise Levels (1hr-L_{eq})				24-hour Noise Levels (CNEL)
		Daytime Minimum	Daytime Maximum	Nighttime Minimum	Nighttime Maximum	
A	111 Perry Street (near northeast west corner of the project site)	54.9	60.7	45.6	58.6	57.7
B	4111 Barrett Avenue (southwest west corner of the project site)	57.1	71.2	51.1	68.3	63.7

1 Noise measurement taken on November 20,2018- November 21, 2018
2 See Figure 5 for the location of the monitoring sites, and Appendix A for Field Monitoring Data.
3 Taken with Larson Davis Type 1 noise meter



G:\2018\18-0252\GIS\Aerial.mxd; Map revised 15 Nov 2018

Sources: Riverside Co. GIS, 2018;
USDA NAIP, 2016.

0 200 400 600 Feet

Figure 5. Long Term Noise Monitoring

Duke Warehouse at Perry St. and Barrett Ave.

6.0 ANALYSIS METHODS AND PROCEDURES

The following section outlines the analysis methods utilized to predict future noise and vibration levels from the construction and operation of the proposed project.

6.1 Construction

6.1.1 Noise Analysis Methods

The assessment of the construction noise impacts must be relatively general at this phase of the project because many of the decisions affecting noise will be at the discretion of the contractor. However, an assessment based on the type of equipment expected to be used by the contractor can provide a reasonable estimate of potential noise impacts and the need for noise mitigation. A worst-case construction noise scenario was developed to estimate the loudest activities that would be occurring at the project site. Pile driving and blasting activities are not anticipated, therefore the loudest construction activities are centered around movement of heavy construction equipment during excavation, grading operations and the erection of buildings. Noise levels were estimated based on a worst-case scenario which assumed all pieces of equipment would be operating simultaneously during each construction phase. The calculated noise level was then compared to the respective local noise regulation to determine if construction would cause a short-term noise impact at nearby residential land uses. Construction of the proposed project is expected to occur over a one-year period. Receiver distance to the construction activity along with the construction equipment operating at maximum load will have the greatest influence on construction noise levels experienced at residential land uses.

6.1.2 Vibration Analysis Methods

Groundborne vibration levels resulting from construction activities within the project area were estimated using the data published by the FTA in its Transit Noise and Vibration Impact Assessment Manual (FTA, 2006). Potential vibration levels resulting from construction activities of the proposed project are identified at the nearest off-site sensitive receptor location and compared to the FTA damage criteria as shown previously in Table 2-4.

6.2 Operational Noise & Vibration Analysis

6.2.1 Operational Traffic Noise Analysis Methods

The project roadway noise impacts from vehicular traffic were predicted using the FHWA-TNM 2.5 Model. The FHWA TNM 2.5 Model arrives at a predicted noise level through a series of adjustments to the Reference Energy Mean Emission Level (REMEL). Adjustments are then made to the REMEL to account for: the roadway classification (e.g. collector, secondary, major or arterial), the roadway active width (i.e., the distance between the center of the outermost travel lanes on each side of the roadway), the total average daily traffic (ADT), the travel speed, the percentages of automobiles, medium trucks, and heavy trucks in the traffic volume, the roadway grade, the angle of view (e.g. whether the roadway view is blocked), the site conditions ("hard" or "soft" relates to the adsorption of the ground, pavement, or landscaping), and the percentage of total ADT which flows each hour throughout a 24-hour period.

6.2.2 Operational Traffic Noise Analysis Inputs

Roadway parameters, average daily traffic volumes and traffic flow distributions (vehicle mix) used in this analysis were obtained from traffic data provided by Webb & Associates (2019). The vehicle mix provides the distribution percentages of automobile, medium trucks and heavy trucks for input into the FHWA Model.

Soft site conditions were used to develop the noise contours to analyze the traffic noise impacts to the study area. Soft site conditions account for the sound propagation loss over natural surfaces such as normal earth and ground vegetation.

6.2.3 Operational Traffic Vibration Analysis

As a conservative measure, vibration vs. distance curve obtained from the Caltrans Transportation and Construction Vibration Guidance Manual will be used to represent worst-case vibration levels from truck traffic at the nearest receiver locations along Perry Street and Barrett Avenue. These vibration levels will be compared to the Caltrans and FTA vibration annoyance criteria as shown previously in **Table 3-5** for Continuous Sources. These criteria will be utilized to evaluate the level of significance associated with vibration effects from continuous truck traffic.

6.2.4 Stationary Noise Analysis Method

The primary non-transportation noise sources associated with the proposed project are rooftop HVAC equipment, on-site parking lot circulation, and the proposed 24-bay loading dock. In order to evaluate these noise sources at the nearest noise-sensitive receptors, the SoundPLAN noise prediction model was utilized. The SoundPLAN noise prediction model was used to plot noise contours and to calculate noise levels at the noise sensitive receptors located around the project site. Inputs to the SoundPLAN model included ground topography and ground type, noise source locations and heights, receiver locations, and sound power level data. These predictions are made in accordance with International Organization for Standardization (ISO) standard 9613-2:1996 (Acoustics – Attenuation of sound during propagation outdoors). It should be noted that sound power is a measure of the total acoustic energy emitted by a noise source and is irrespective of distance from the source. Sound power is input into the SoundPLAN model as a representation of the total acoustic energy emitted by a specific noise source. Sound power levels in this report are report as A-weighted decibel levels, noted as "dBA, PWL" per industry standards. The model then corrects for the many factors (i.e. distance, terrain shielding, atmospheric absorption, etc.) which effect sound propagation from the noise source to the receiver location. SoundPlan was utilized to generate noise level predictions according to the assumptions outlined below.

Mechanical Equipment Noise

Based upon similar projects, it is assumed that the proposed project building will include rooftop mechanical equipment consisting of approximately 12-units. Typical rooftop condensers for commercial use would be expected to have a sound power rating of approximately 85-90 dBA and would be screened from view by building parapets or mechanical screen walls. Therefore, the SoundPLAN model includes 12 rooftop HVAC units with a sound power level of 90 dBA.

Parking Lot Circulation

Based upon noise measurements conducted of vehicle movements in parking lots, the sound exposure level (SEL) for a single passenger vehicle is 71 dBA at a distance of 50 feet while the SEL of a tractor-trailer is 85 dBA at the same distance. Assuming a typical day/night distribution of 88% daytime (7:00 a.m. – 10:00 p.m.) trips and 12% nighttime (10:00 p.m. – 7:00 a.m.) trips, the total noise level from parking lot activity (which includes backup beeps and air brake release) is predicted to be 64.7 dBA CNEL at 50 feet, or a total sound power level of 96 dBA. This analysis assumes that trucks will not idle long term in the parking area. This analysis also assumes trucks entering the project site are non-refrigerated trucks.

Loading Dock Noise Generation

To determine typical loading dock noise levels associated with the proposed loading docks, noise level measurement data from the representative Wal-Mart store was used. The noise level measurements were conducted at a distance of 100 feet from the center of the two-bay loading dock and circulation area. Activities during the peak hour of loading dock activities included truck arrival/departures, truck idling, truck backup beeps, air brake release and operation of truck-mounted refrigeration units.

The results of the loading dock noise measurements indicate that a busy hour generated an average noise level of 61 dBA L_{eq}, at a distance of 100 feet from the center of the loading dock truck maneuvering lanes. Assuming that 25% of the docks were to operate continuously at this level of activity for every hour of the day, the CNEL noise level would be 72.7 dBA CNEL at 100 feet, or a total sound power level of 110.4 dBA.

7.0 OFF-SITE TRANSPORTATION NOISE IMPACTS

Roadway Noise

The primary off-site noise related effects from the two proposed alternatives is attributable to increases in traffic. The Traffic Noise Model (TNM 2.5) was utilized to assess noise impacts at sensitive residential receiver locations within the project area within 160 feet to determine whether exterior noise levels would cause a substantial increase of greater than 3 dBA. The proposed Project, along with future regional growth and other projects to be developed within the Project vicinity, would result in the addition of vehicle trips that would increase traffic noise. The roadway noise analysis focused on segments that experienced the greatest increase in truck traffic near sensitive residential receiver locations. Sensitive residential receivers R1 through R3 were identified near Barrett Avenue at southwest of the proposed project site. Additional sensitive residential receivers were identified near Perry Street at the northeast property line, represented by R4 and R5.

A potentially significant project impact would occur where Project traffic would increase noise levels from below 60 dB CNEL to above 60 dB CNEL (where noise sensitive land uses exist adjacent to the identified roadway segment). Where roadway noise levels are already above the applicable noise exposure standard (60 dB CNEL for residences), an increase of 3 dB CNEL or more is identified as a potentially significant noise impact.

The TNM modeling was performed for the following scenarios: existing; existing plus ambient; existing plus ambient plus cumulative and existing plus ambient plus cumulative, plus project along roadway segments identified in the traffic impact assessment (Webb Associates, 2019) . The TNM model takes into account the posted vehicle speed, average daily traffic volume, the estimated vehicle mixes and sound-attenuating effects of intervening structures, barriers, vegetation, or topography. The model assumed "pavement" site propagation conditions. Tables **7-1 and 7-2,** present the Existing and Future Roadway Traffic Noise Levels (CNEL), for the proposed project alternative.

As shown in **Table 7-1**, the proposed project noise levels do not have noticeable increases above existing noise levels. All noise levels remain below 60 dBA CNEL, except at receiver R1. Receiver R1 is the only receiver that has current noise levels near 60 dBA CNEL, however the project alternatives do not have a noticeable increase above 3 dBA for this receiver location. Therefore, the increase is not considered significant.

Table 7-1. Traffic Noise Levels Near Sensitive Receiver Locations- Proposed Project -Warehouse RIRO							
Receiver	Existing	Existing + Ambient	Cumulative Only	Existing + Ambient + Warehouse - RIRO	Difference	Existing +Ambient + Cumulative + Project- Warehouse – RIRO	Difference
R1	60.1	60.3	61.7	60.7	0.4	61.9	0.2
R2	53.4	53.6	54.6	53.8	0.2	54.7	0.1
R3	57.1	57.2	58.5	57.4	0.2	58.5	0.0
R4	48.6	48.7	49.5	49.1	0.4	49.7	0.2
R5	49.2	49.3	49.9	50.5	1.2	50.9	1.0

Table 7-2. Traffic Noise Levels Near Sensitive Receiver Locations- Proposed Warehouse Signal							
Receiver	Existing	Existing + Ambient	Cumulative Only	Existing + Ambient + Warehouse - Signal	Difference	Existing +Ambient + Cumulative + Project Warehouse - Signal	Difference
R1	60.1	60.3	61.7	60.7	0.4	61.9	0.2
R2	53.4	53.6	54.6	53.8	0.2	54.7	0.1
R3	57.1	57.2	58.5	57.5	0.3	58.5	0.0
R4	48.6	48.7	49.5	48.9	0.2	49.6	0.1
R5	49.2	49.3	49.9	49.5	0.2	50.0	0.1

8.0 STATIONARY-RELATED NOISE IMPACTS

The proposed project Warehouse Alternative was evaluated for stationary noise impacts utilizing SoundPlan to evaluate whether the proposed project alternatives would meet the City of Perris General Plan Policy V.A, which requires commercial facilities located with 160 feet of sensitive land uses to attain an acceptable exterior noise levels of 60 CNEL at residential land uses. Stationary-related noise impacts were evaluated utilizing the maximum noise levels assumptions outlined in section 6.2.4 for the rooftop HVAC equipment, on-site parking lot circulation (including backup beeps and air brake releases) and the proposed 24-bay loading dock.

The results of the SoundPlan model at nearby residential land uses are presented in **Table 8-1** and **Figures 6 and 7** .

Table 8-1. Project Noise Level Projections	
Warehouse Alternative	
Observer Location	Unmitigated (dBA, CNEL)
R1	61.9
R2	66.5
R3	61.2
R4	55.3
R5	55.2
[1] 14ft screen wall incorporated as part of the project design	

Noise Abatement for Stationary Sources

As shown in **Table 8-1**, the predicted noise levels for the proposed project would exceed City of Perris General Plan Policy V.A for sensitive residential land uses at receiver locations R1 through R3. Although, the existing background noise level is 63.7 CNEL, the proposed project is required to mitigate project noise to the acceptable compatibility standard of 60 CNEL. SoundPlan was utilized to evaluate a noise barrier along the property line of R1 through R3. It was determined that a 12-foot high sound wall with a length of 430 feet is required to meet the compatibility standard of 60 dBA CNEL. **Figure 7** presents the location of the sound wall and the mitigation noise contours for the proposed project Warehouse . SoundPlan results are presented in Appendix C. Sensitive residential receiver locations R4 and R5 are located on the northeast corner adjacent to the project site and are shielded by the warehouse building. Noise levels for R4 and R5 are below the compatibility noise standard of 60 dBA CNEL, therefore no noise abatement is required for these residential sensitive receivers.

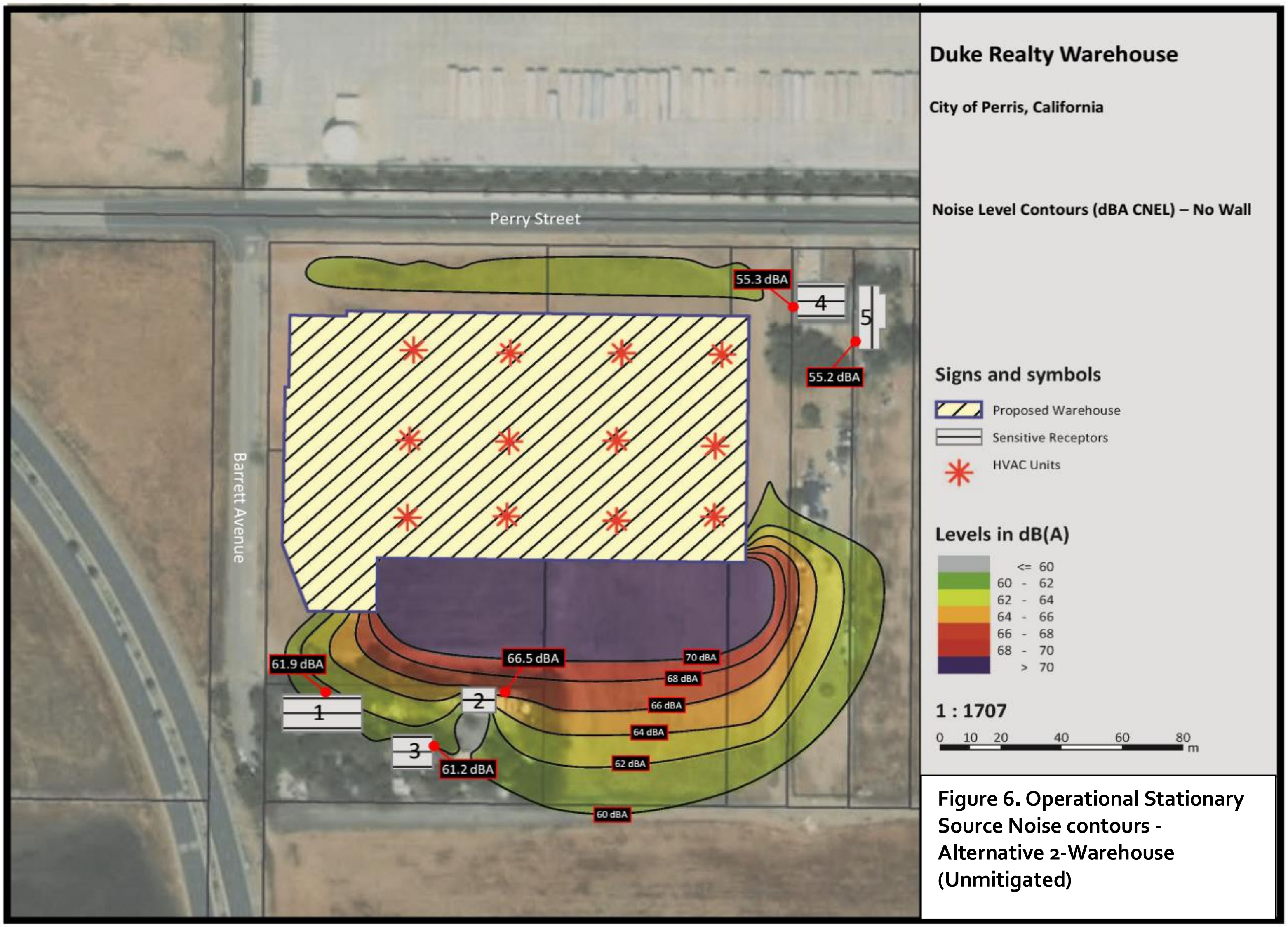


Figure 6. Operational Stationary Source Noise contours - Alternative 2-Warehouse (Unmitigated)

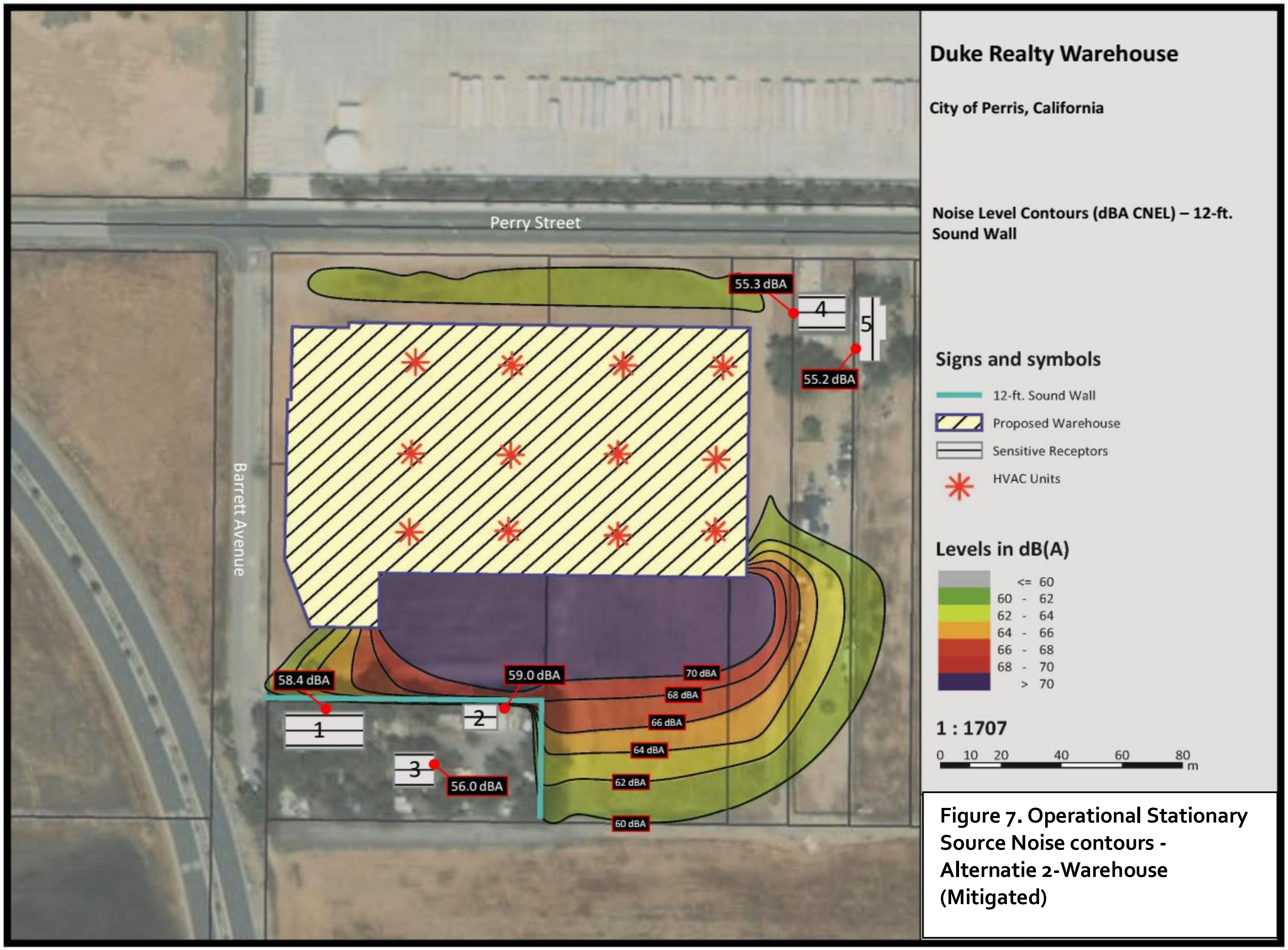


Figure 7. Operational Stationary Source Noise contours - Alternatie 2-Warehouse (Mitigated)

9.0 OPERATIONAL VIBRATION ANALYSIS

The proposed project alternatives will increase truck traffic within the project area. Per the Caltrans Transportation Noise and Vibration Manual traffic, including heavy trucks, traveling on roadways rarely generates vibration amplitudes high enough to cause structural or cosmetic damage. However, a qualitative analysis was provided in this study to evaluate the likelihood of vibration impacts from the proposed project.

The Caltrans Noise and Vibration Manual provides a collection of measure vibration data for truck passbys. This data demonstrations that truck passbys can be characterized by a peak in vibration that are considerably higher than those generated by automobiles for a few seconds. Vibration from these trucks drop off dramatically with distance. As truck volumes increase, more peaks will occur but not necessarily higher peaks. Vibration wave fronts emanating from several trucks closely together may either cancel or partially cancel (destructive interference) or reinforce or partially reinforce (constructive interference) each other, depending on their phases and frequencies. Since traffic vibrations can be considered random, the probabilities of total destructive or constructive interference are extremely small. Coupled with the fact that two trucks cannot occupy the same space, and the rapid drop-off rates, it is understandable that two or more trucks normally do not contribute significantly to each other's peaks.

In order to predict the maximum highway truck traffic vibrations from the proposed project, the curve in **Figure 8** was used which compiles the highest measured vibrations available from previous studies to demonstrate possible vibration levels from truck traffic. **Figure 8** provides the maximum highway truck traffic vibrations vs. distance from the centerline of the nearest freeway lane. The graph indicates that the highest traffic generated vibrations measured on freeway shoulders (5 m from center line of nearest lane) have never exceeded 2.0 mm/s or (0.08 in/sec) with the worst combinations of heavy trucks. This amplitude coincides with the maximum recommended "safe amplitude" for historical buildings. The graph illustrates the rapid attenuation of vibration amplitudes, which dip below the threshold of perception for most people at about 45 m (150 ft). Based on **Figure 8**, the maximum worse-case vibration that would be experience at the homes along Perry Street and Barrett Avenue within 15m (50 feet) of the centerline of the nearest travel lane would be 0.08 mm/s or (0.0032 in/sec).

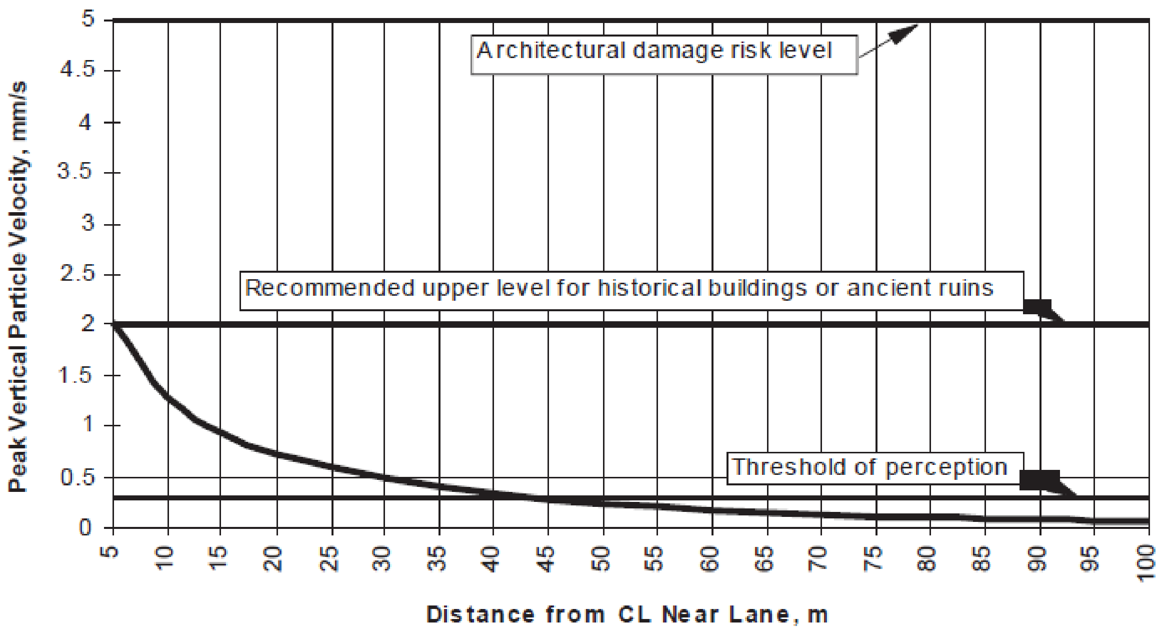


Figure 8. Maximum Truck Traffic Vibration Levels vs. Distance

Caltrans and FTA provide a range of perceptible annoyance levels and the predicted vibration level falls well below the distinctly perceptible level of 0.08 PPV (in/sec) and below the FTA damage criteria of 0.3 PPV (in/sec). Further this worst-case vibration level from truck traffic would not exceed the Caltrans threshold of 0.2 PPV (in/sec).

It is not expected that actual vibration levels within the project area from truck traffic will be lower than this worst-case level when soil type and pavement conditions are considered.

On this basis, the potential for the Project to result in exposure of persons to, or generation of, excessive ground-borne vibration is determined to be less than significant.

10.0 SHORT-TERM CONSTRUCTION NOISE & VIBRATION IMPACTS

Construction noise represents a temporary impact on the ambient noise levels. Construction noise is primarily caused by diesel engines (trucks, dozers, backhoes), impacts (jackhammers, pile drivers, hoe rams); and backup alarms. Construction equipment can be stationary or mobile. Stationary equipment operates in one location for hours or days in a constant mode (generators, compressors) or generates variable noise operation (pile drivers, jackhammers) producing constant noise for a period of time. Mobile equipment moves around the site and is characterized by variations in power and location, resulting in significant variations in noise levels over time. Grading activities and rock blasting typically generate the greatest noise impacts during construction. This section assesses the potential noise impacts to the existing sensitive residential land uses during construction.

10.1 Noise Sensitive Uses and Construction Noise Standards

The City of Perris has set exterior noise limits to control noise impacts associated with the construction of the proposed project alternatives. Construction Noise Levels Pursuant to Section 7.34.060 (Construction Noise), the construction, demolition, excavation, alteration, or repair of any building or structure in such a manner as to create disturbing, excessive, or offensive noise is prohibited between the hours of 7:00 PM and 7:00 AM, on Sundays, and on a legal holiday. Construction activity shall not exceed 80 dBA in residential zones within the city.

10.2 Construction Schedule

The construction schedule for the proposed project alternative is described below.

<u>Proposed Project Alternative- Warehouse</u>

Construction activities associated with this of this option includes grading, building construction, paving and painting. Construction would commence in September of 2019 for a duration of 12 months. The following outlines the type of equipment expected to operation and the duration of each construction phase.

1. Construction schedule: Beginning no sooner than September 2019
    - Grading: 1 month
    - Building Construction: 9 months
    - Paving: 1 month, during the last month of building construction
    - Painting: 1 month, during the last month of building construction

2. Construction equipment:
    - Grading:
        - 1 Excavators
        - 1 Grader
        - 1 Rubber Tired Dozer
        - 3 Tractors/Loaders/Backhoes
    - Building Construction equipment:
        - 1 Crane
        - 3 Forklifts

- o 1 Generator Set
- o 3 Tractors/Loaders/Backhoes
- o 1 Welder

- Paving Construction Equipment:
  - o 2 Pavers
  - o 2 Paving Equipment
  - o 2 Rollers
- Architectural Coating (Painting):
  - o 1 Air Compressors

10.2 Construction Noise Levels

The RCNM model was used to determine which phase of activity for the proposed project would generate the greatest construction noise level. It was assumed that construction activity would occur within an average distance of 175 feet from construction equipment/activity on the project site to edges of the property where a sensitive receiver is located. **Table 10-1** presents the hourly noise levels in L_{eq} for each construction phase. The highest noise level that would be experience by sensitive residential receivers adjacent to the project site is 75.0 dBA L_{eq}. This noise level occurs during the grading phase of the proposed project. This noise level is less than the City of Perris noise threshold of 80 dBA within residential zones.

Table 10-1. Construction Noise Levels by Construction Phase	
Proposed Project Phase	Construction Hourly dBA, L_{eq}
Grading	75.0
Building	73.3
Paving	74.8
Painting	62.8

Because construction activities are typically limited to weekdays, during daylight hours, this noise level is considered a nuisance or annoying, rather than a significant impact

10.3 Construction Vibration

Ground-borne vibration levels resulting from construction activities occurring within the Project site were estimated by data published by the FTA. Construction activities that would occur within the Project site include grading, building construction, paving, painting, parking lot construction and landscaping. These activities have the potential to generate low levels of ground-borne vibration. No pile driving or other impact construction activities are anticipated.

Using the vibration source level of construction equipment provided on Table 9-2 and the construction vibration assessment methodology published by the FTA, it is possible to estimate the Project vibration impacts. **Table 10-2** presents the expected Project related vibration levels at 50 feet along Perry Street and Barrett Avenue.

Table 10-2. Construction Equipment Vibration Levels				
Noise Receiver	Distance to Property Line	Large Bulldozer Reference Vibration Level PPV (in/sec) at 25ft	Peak Vibration PPV (in/sec) at 50ft	Significant Impact
Residences along Perry Street	50 feet	0.089	0.0315	No

Based on the reference vibration levels provided by the FTA, a large bulldozer represents the peak source of vibration with a reference level of 0.089 (in/sec) at a distance of 25 feet. At 50 feet, construction vibration levels are expected to approach 0.0315 (in/sec). Using the construction vibration assessment annoyance criteria provided by the FTA for infrequent events, as shown in Table 3-5, the proposed project site will not include nor require equipment, facilities, or activities that would result in a perceptible human response (annoyance). Further, impacts at the site of the closest sensitive receptor are unlikely to be sustained during the entire construction period, but will occur rather only during the times that heavy construction equipment is operating in proximity to the Project site perimeter. Moreover, construction at the Project site will be restricted to daytime hours, thereby eliminating potential vibration impact during the sensitive nighttime hours. On this basis, the potential for the proposed project to result in exposure of persons to, or generation of, excessive ground-borne vibration is determined to be less than significant.

10.4 Construction Mitigation Measures

Construction noise is of short-term duration and will not present any long-term impacts on the project site or the surrounding area. The recommended mitigation measures discussed below will be employed as applicable and will serve to reduce the construction noise impacts to the nearby residential areas.

During all Project site excavation and grading on-site, the construction contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers, consistent with the manufacturers' standards. The construction contractors shall place all stationary construction equipment so that emitted noise is directed away from the noise sensitive receptors (residences) nearest the Project site.

The construction contractor shall locate equipment staging in areas that will create the greatest distance between construction-related noise sources and noise sensitive receptors nearest the Project site during all project construction.

The construction contractor shall limit all construction-related activities that would result in high noise levels according to the construction hours provided in the City of Perris noise ordinance for construction.

The construction contractor shall limit haul truck deliveries to the same hours specified for construction equipment. To the extent feasible, haul routes shall not pass sensitive land uses or residential dwellings.

10.5 Construction Vibration Impacts

Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods used, distance to the affected structures and soil type. It is expected that ground-borne vibration from project construction activities would cause only intermittent, localized intrusion. The proposed Project's construction activities most likely to cause vibration impacts are:

• Heavy Construction Equipment: Although all heavy mobile construction equipment has the potential of causing at least some perceptible vibration while operating close to building, the vibration is usually short-term and is not of sufficient magnitude to cause building damage. It is not expected that heavy equipment such as large bulldozers would operate close enough to any residences to cause a vibration impact.

• Trucks: Trucks hauling building materials to construction sites can be sources of vibration intrusion if the haul routes pass through residential neighborhoods on streets with bumps or potholes. Repairing the bumps and potholes generally eliminates the problem.

11.0 REFERENCES

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Federal Highway Administration (FHWA), Roadway Construction Noise Model (RCNM) (2008).

Federal Transit Administration (FTA). 2006. Transit Noise and Vibration Impact Assessment. https://www.transit.dot.gov/regulations-and-guidance/environmental-programs/fta-noise-and-vibration-impact-assessment

SoundPlan, June 2015.

Webb Associates (2019) Traffic Impact Analysis Report for Duke Perry High-Cube Warehouse in the City of Perris, CA.

Appendix A Noise Monitoring Data

Site A- CNEL Values							
	Background Leq and Hour Averaging DNL						
	Background		LEQ DNL is		LEQ DNL		DNL/hour
Hour	Leq		Leq +10		10^(D/10)		10*LOG10(E)
0	53.9	10	50.2	DNL	104712.9	93325430	38.26947476
1	52.1	10	50.3	DNL	107151.9	2290868	38.49199659
2	51.1	10	50.8	DNL	120226.4	30199517	38.62999512
3	54.9	10	47.7	DNL	58884.37	30199517	36.39454423
4	56.9	10	45.6	DNL	36307.81	91201084	38.74920386
5	60.2	10	52.8	DNL	190546.1	60255959	47.77590116
6	59.7	10	56.2	DNL	416869.4	954992.6	46.40137004
7	63.5		57.7		588843.7	1479108	47.67033768
8	71.2		56.4		436515.8	2290868	49.34833648
9	69.6		60.7		1174898	537031.8	50.46388065
10	67.4		57.1		512861.4	309029.5	46.33799581
11	67.4		56.9		489778.8	4365158	66.07263258
12	62.5		65.2		3311311	933254.3	48.1968763
13	60.3		59.7		933254.3	1047129	47.51269281
14	57.2		58.2		660693.4	2398833	47.38119073
15	57.9		55.3		338844.2	11481536	48.45761959
16	57.1		57.5		562341.3	5495409	46.11148985
17	61.4		56.9		489778.8	5370318	48.6610162
18	62.3		54.9		309029.5	6309573	45.42660714
19	64.6	5	57.8	CNEL	602559.6	7413102	44.5972212
20	61.3	5	58.6	CNEL	724436	6918310	43.41513398
21	68.3	5	57.5	CNEL	562341.3	11481536	42.37481917
22	58.7	10	61	DNL	1258925	29512092	45.71170927
23	54.2	10	54.3	DNL	269153.5	87096359	40.23786771
	54.4			Average=	594177.7		
			10LOG10 of (Average		57.73916	DNL hr Avgn	

Site B-CNEL Values							
	Background Leq and Hour Averaging DNL						
	Background		LEQ DNL is		LEQ DNL		DNL/hour
Hour	Leq		Leq +10		10^(D/10)		10*LOG10(E)
0	53.9	10	54.4	DNL	275422.8703	93325430.1	38.2694748
1	52.1	10	53.9	DNL	245470.8916	2290867.65	38.4919966
2	51.1	10	52.1	DNL	162181.0097	30199517.2	38.6299951
3	54.9	10	51.1	DNL	128824.9552	30199517.2	36.3945442
4	56.9	10	54.9	DNL	309029.5433	91201083.9	38.7492039
5	60.2	10	56.9	DNL	489778.8194	60255958.6	47.7759012
6	59.7	10	60.2	DNL	1047128.548	954992.59	46.40137
7	63.5		59.7		933254.3008	1479108.39	47.6703377
8	71.2		63.5		2238721.139	2290867.65	49.3483365
9	69.6		71.2		13182567.39	537031.8	50.4638806
10	67.4		69.6		9120108.394	309029.54	46.3379958
11	67.4		67.4		5495408.739	4365158.32	66.0726326
12	62.5		67.4		5495408.739	933254.3	48.1968763
13	60.3		62.5		1778279.41	1047128.55	47.5126928
14	57.2		60.3		1071519.305	2398832.92	47.3811907
15	57.9		57.2		524807.4602	11481536.2	48.4576196
16	57.1		57.9		616595.0019	5495408.74	46.1114899
17	61.4		57.1		512861.384	5370317.96	48.6610162
18	62.3		61.4		1380384.265	6309573.44	45.4266071
19	64.6	5	64.6	CNEL	2884031.503	7413102.41	44.5972212
20	61.3	5	61.3	CNEL	1348962.883	6918309.71	43.415134
21	68.3	5	68.3	CNEL	6760829.754	11481536.2	42.3748192
22	58.7	10	58.7	DNL	741310.2413	29512092.3	45.7117093
23	54.2	10	54.2	DNL	263026.7992	87096359	40.2378677
	54.4			Average=	2375246.389		
			10LOG10 of (Average=		63.75708667	DNL hr Avgn	

Appendix B-TNM Files

TNM files provided electronically.

Appendix C- Sound Plan Results

Duke Realty Warehouse no Wall
Run info

Project description

Project title:	Duke Realty Warehouse no Wall
Project No.:	
Project engineer:	
Customer:	
Description:	

Run description

Calculation type:	Single Point Sound
Title:	
Group:	
Run file:	
Result number:	211
Local calculation (ThreadCount=12)	
Calculation start:	4/17/2019 3:39:53 PM
Calculation end:	4/17/2019 3:39:54 PM
Calculation time:	00:00:219 [m:s:ms]
No. of points:	4
No. of calculated points:	4
Kernel version:	7/4/2016

Run parameters

Reflection order:	1	
Maximum reflection distance to receiver		200 m

Duke Realty Warehouse no Wall
Run info

Maximum reflection distance to source		50 m
Search radius	5000 m	
Weighting:	dB(A)	
Allowed tolerance (per individual source):	0.001 dB	
Create ground effect areas from road surfaces:		Yes

Standards:
- Industry: ISO 9613-2: 1996
- Air absorption: ISO 9613-1
- alternative ground effect (chapter 7.3.2)
- Limitation of screening loss:
  - single/multiple 20.0 dB /25.0 dB
- Side diffraction: Outdated method (side paths also around terrain)
- Environment:
  - Air pressure 1013.3 mbar
  - rel. humidity 70.0 %
  - Temperature 10.0 °C
  - Meteo. corr. C0(0-1h)[dB]=0.0; C0(1-2h)[dB]=0.0; C0(2-3h)[dB]=0.0;
  - Ignore Cmet for Lmax industry calculation: No
- Parameter for screening: C2=20.0
- Dissection parameters:
  - Distance to diameter factor 8
  - Minimal distance 1 m
  - Max. difference ground effect + diffraction 1.0 dB
  - Max. number of iterations 4
- Attenuation
  - Foliage: ISO 9613-2
  - Built-up area: ISO 9613-2
  - Industrial site: ISO 9613-2

Assessment: SPessential

Duke Realty Warehouse no Wall
Run info

Reflection of "own" facade is suppressed

Geometry data

GeoObjs.geo	4/17/2019 3:39:50 PM
GeoIndu.geo	4/17/2019 3:39:50 PM
RDGM0001.dgm	4/10/2019 1:24:00 AM

Duke Realty Warehouse no Wall
Octave spectra of the sources in dB(A) -

3

Name	Source type	I or A m,m²	Li dB(A)	R'w dB	L'w dB(A)	Lw dB(A)	KI dB	KT dB	LwMax dB(A)	DO-Wall dB	Day histogram	Emission spectrum	500Hz dB(A)	
hvac	Point				0.0	90.0	0.0	0.0		0	hvac		90.0	
hvac1	Point				0.0	90.0	0.0	0.0		0	hvac1		90.0	
hvac3	Point				0.0	90.0	0.0	0.0		0	hvac3		90.0	
hvac4	Point				0.0	90.0	0.0	0.0		0	hvac4		90.0	
hvac5	Point				0.0	9.0	0.0	0.0		0	hvac5		9.0	
hvac6	Point				0.0	90.0	0.0	0.0		0	hvac6		90.0	
hvac7	Point				0.0	90.0	0.0	0.0		0	hvac7		90.0	
hvac8	Point				0.0	90.0	0.0	0.0		0	hvac8		90.0	
hvac9	Point				0.0	90.0	0.0	0.0		0	hvac9		90.0	
hvac10	Point				0.0	90.0	0.0	0.0		0	hvac10		90.0	
hvac11	Point				0.0	90.0	0.0	0.0		0	hvac11		90.0	
hvac12	Point				0.0	90.0	0.0	0.0		0	hvac12		90.0	
Loading Dock	Area	2222.23			0.0	110.4	0.0	0.0		0	Loading Dock		110.4	
Parking Lot	Area	8778.90			0.0	96.0	0.0	0.0		0	Parking Lot		96.0	

Duke Realty Warehouse no Wall
Assessed receiver levels

2

Receiver	Usage	Fl	Dir	CNEL,lim dB(A)	Leq2,lim dB(A)	Leq3,lim dB(A)	Lmax,lim dB(A)	CNEL dB(A)	
R1	GI	GF		0	0	0	0	61.9	
R2	GI	GF		0	0	0	0	66.5	
R3	GI	GF		0	0	0	0	61.2	
R4	GI	GF		0	0	0	0	55.3	
R5	GI	GF		0	0	0	0	52.2	

Duke Realty Warehouse with Wall
Run info

Project description

Project title:	Duke Realty Warehouse with Wall
Project No.:	
Project engineer:	
Customer:	
Description:	

Run description

Calculation type:	Single Point Sound
Title:	
Group:	
Run file:	
Result number:	211
Local calculation (ThreadCount=12)	
Calculation start:	4/17/2019 3:39:16 PM
Calculation end:	4/17/2019 3:39:17 PM
Calculation time:	00:00:199 [m:s:ms]
No. of points:	4
No. of calculated points:	4
Kernel version:	7/4/2016

Run parameters

Reflection order:	1	
Maximum reflection distance to receiver		200 m

Duke Realty Warehouse with Wall
Run info

Maximum reflection distance to source		50 m
Search radius	5000 m	
Weighting:	dB(A)	
Allowed tolerance (per individual source):	0.001 dB	
Create ground effect areas from road surfaces:		Yes

Standards:
- Industry: ISO 9613-2: 1996
- Air absorption: ISO 9613-1
- alternative ground effect (chapter 7.3.2)
- Limitation of screening loss:
  - single/multiple 20.0 dB /25.0 dB
- Side diffraction: Outdated method (side paths also around terrain)
- Environment:
  - Air pressure 1013.3 mbar
  - rel. humidity 70.0 %
  - Temperature 10.0 °C
  - Meteo. corr. C0(0-1h)[dB]=0.0; C0(1-2h)[dB]=0.0; C0(2-3h)[dB]=0.0;
  - Ignore Cmet for Lmax industry calculation: No
- Parameter for screening: C2=20.0
- Dissection parameters:
  - Distance to diameter factor 8
  - Minimal distance 1 m
  - Max. difference ground effect + diffraction 1.0 dB
  - Max. number of iterations 4
- Attenuation
  - Foliage: ISO 9613-2
  - Built-up area: ISO 9613-2
  - Industrial site: ISO 9613-2

Assessment: SPessential

Duke Realty Warehouse with Wall
Run info

Reflection of "own" facade is suppressed

Geometry data

GeoObjs.geo	4/17/2019 3:39:14 PM
GeoIndu.geo	4/17/2019 3:39:14 PM
RDGM0001.dgm	4/10/2019 1:24:00 AM

Duke Realty Warehouse with Wall
Octave spectra of the sources in dB(A) -

3

Name	Source type	l or A m,m²	Li dB(A)	R'w dB	L'w dB(A)	Lw dB(A)	KI dB	KT dB	LwMax dB(A)	DO-Wall dB	Day histogram	Emission spectrum	500Hz dB(A)
hvac	Point				0.0	90.0	0.0	0.0		0	hvac		90.0
hvac1	Point				0.0	90.0	0.0	0.0		0	hvac1		90.0
hvac3	Point				0.0	90.0	0.0	0.0		0	hvac3		90.0
hvac4	Point				0.0	90.0	0.0	0.0		0	hvac4		90.0
hvac5	Point				0.0	90.0	0.0	0.0		0	hvac5		90.0
hvac6	Point				0.0	90.0	0.0	0.0		0	hvac6		90.0
hvac7	Point				0.0	90.0	0.0	0.0		0	hvac7		90.0
hvac8	Point				0.0	90.0	0.0	0.0		0	hvac8		90.0
hvac9	Point				0.0	90.0	0.0	0.0		0	hvac9		90.0
hvac10	Point				0.0	90.0	0.0	0.0		0	hvac10		90.0
hvac11	Point				0.0	90.0	0.0	0.0		0	hvac11		90.0
hvac12	Point				0.0	90.0	0.0	0.0		0	hvac12		90.0
Loading Dock	Area	2222.23			0.0	110.4	0.0	0.0		0	Loading Dock		110.4
Parking Lot	Area	8778.90			0.0	96.0	0.0	0.0		0	Parking Lot		96.0

Duke Realty Warehouse with Wall
Assessed receiver levels

2

Receiver	Usage	Fl	Dir	CNEL,lim dB(A)	Leq2,lim dB(A)	Leq3,lim dB(A)	Lmax,lim dB(A)	CNEL dB(A)	
R1	GI	GF		0	0	0	0	58.4	
R2	GI	GF		0	0	0	0	59.0	
R3	GI	GF		0	0	0	0	56.0	
R4	GI	GF		0	0	0	0	55.3	
R5	GI	GF		0	0	0	0	55.2	

Appendix D-RCNM Results

RCNM files provided electronically.