NOISE AND VIBRATION IMPACT ANALYSIS

12300 LAKELAND ROAD WAREHOUSE PROJECT

SANTE FE SPRINGS, CALIFORNIA

LSA

June 2022

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SANTE FE SPRINGS, CALIFORNIA

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LIST OF ABBREVIATIONS AND ACRONYMS

City	City of Santa Fe Springs
CNEL	Community Noise Equivalent Level
dBA	A-weighted decibel
EPA	United States Environmental Protection Agency
ft	feet
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HVAC	heating, ventilation, and air conditioning
in/sec	inches per second
FUL	Fullerton Municipal Airport
L_{dn}	day-night average noise level
L_{eq}	equivalent continuous sound level
L_{max}	maximum instantaneous sound level
PPV	peak particle velocity
project	12300 Lakeland Road Warehouse Project
RMS	root-mean-square
sf	square feet
SPL	sound power level
VdB	vibration velocity decibels

INTRODUCTION

This noise and vibration impact analysis has been prepared to evaluate the potential noise and vibration impacts and reduction measures associated with the proposed 12300 Lakeland Road Warehouse Project (project) in Santa Fe Springs, California. This report is intended to satisfy the City of Santa Fe Springs (City) requirement for a project-specific noise impact analysis by examining the impacts of the project site and evaluating noise reduction measures that the project may require.

PROJECT LOCATION AND DESCRIPTION

The proposed project is located on the southwest corner of Lakeland Drive and Getty Drive in the City of Santa Fe Springs, California. The total project size would be approximately 8.45 acres of which 185,450 square feet would be used to construct a warehouse and office space.

The project proposes to remove the existing Coast Iron and Steel Co. to construct a 177,450 square-foot warehouse, including a two-story office space of 8,000 square feet (4,000 square feet per floor). The speculative warehouse and office space will cover about 50% of the total project site and would have approximately 53,952 square feet of landscape area. In addition, the proposed project would include a total of 233 parking spaces, 24 dock doors, 6 stalls for trailer parking, and 14 bicycle stalls of which 7 would be long term stalls and 7 would be short term stalls. The proposed project would not require a change to the General Plan land use designation or the current zoning and would be consistent with the City's General Plan and Zoning Ordinance.

Typical operational characteristics include employees traveling to and from the site, delivery of products to the site, truck loading and unloading, and truck maintenance operations. The project is assumed to operate 24 hours a day, 7 days a week; however, this may shift depending on the tenant, as the hours of operation are unknown. The proposed project would generate approximately 318 average daily trips, including 230 vehicle trips and 88 truck trips.

Construction would begin the first quarter of 2023 and would be anticipated to last for approximately 9 months, ending in early 2024. The proposed project would include the following sustainability features: drought tolerant landscaping, energy efficient water fixtures, and LEED Silver. Figure 1 illustrates the project site location. Figure 2 depicts the proposed project's site plan.

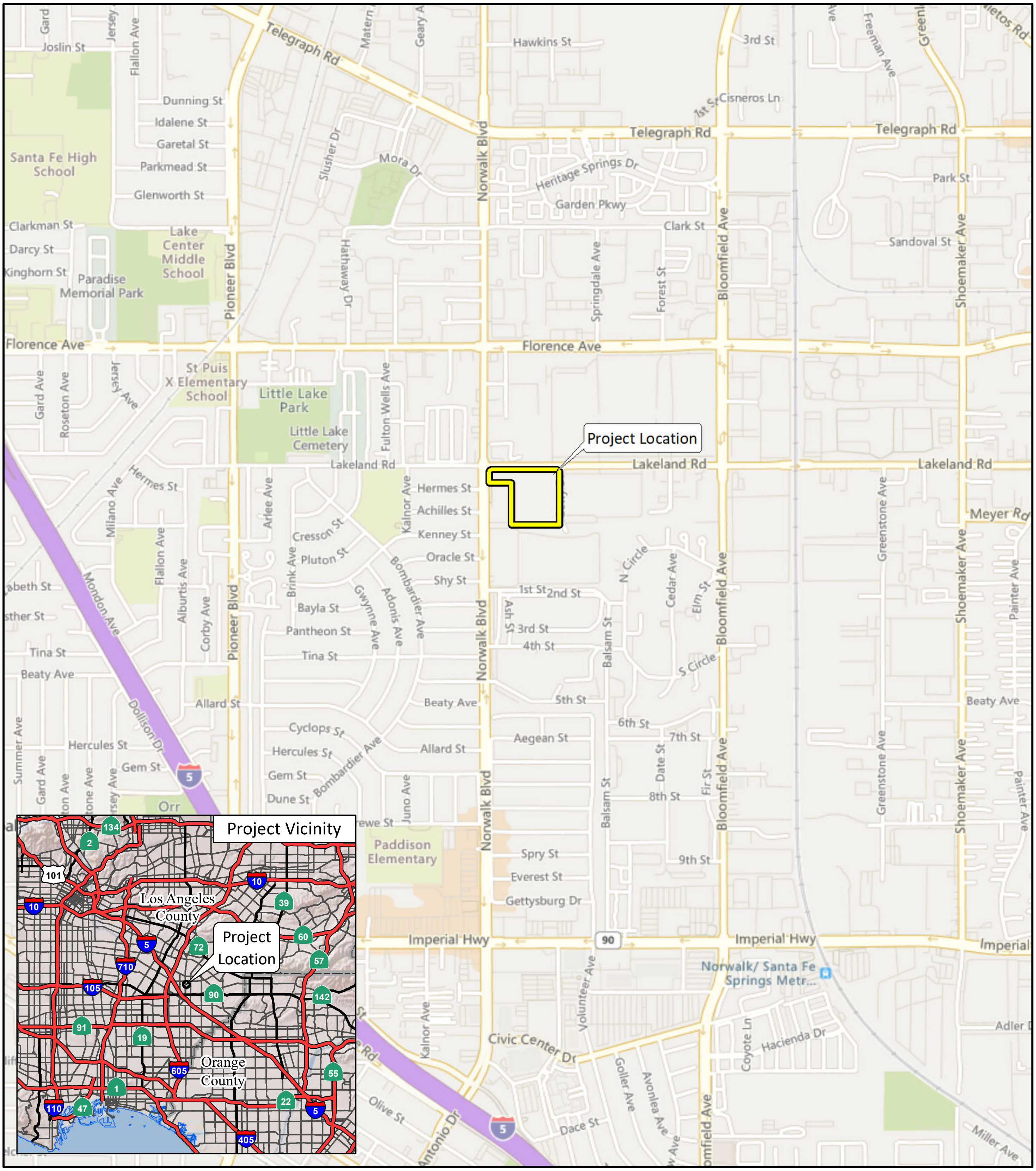
EXISTING LAND USES IN THE PROJECT AREA

The project site is surrounded primarily by commercial and residential uses. The areas adjacent to the project site include the following uses:

- **North:** Existing commercial uses opposite of Lakeland Road;
- **East:** Existing Industrial uses including Crate & Barrel Warehouse opposite of Getty Drive;
- **South:** Existing commercial uses bound of project site; and
- **West:** Existing single-family home opposite of Norwalk Boulevard.

The closest sensitive receptors to the project site are:

- **West:** Existing single-family homes located approximately 100 feet from the project site opposite of Norwalk Boulevard;
- **Northwest:** Existing Lakeland Villa Mobile Home Park located approximately 175 feet opposite of Lakeland Road; and
- **Southeast:** Existing Metropolitan State Hospital located approximately 800 feet from the project site.



LSA

LEGEND

Project Location

FIGURE 1

N

0 750 1500
FEET

SOURCE: Bing Maps (2022)

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12300 Lakeland Warehouse Project

Regional Project Location

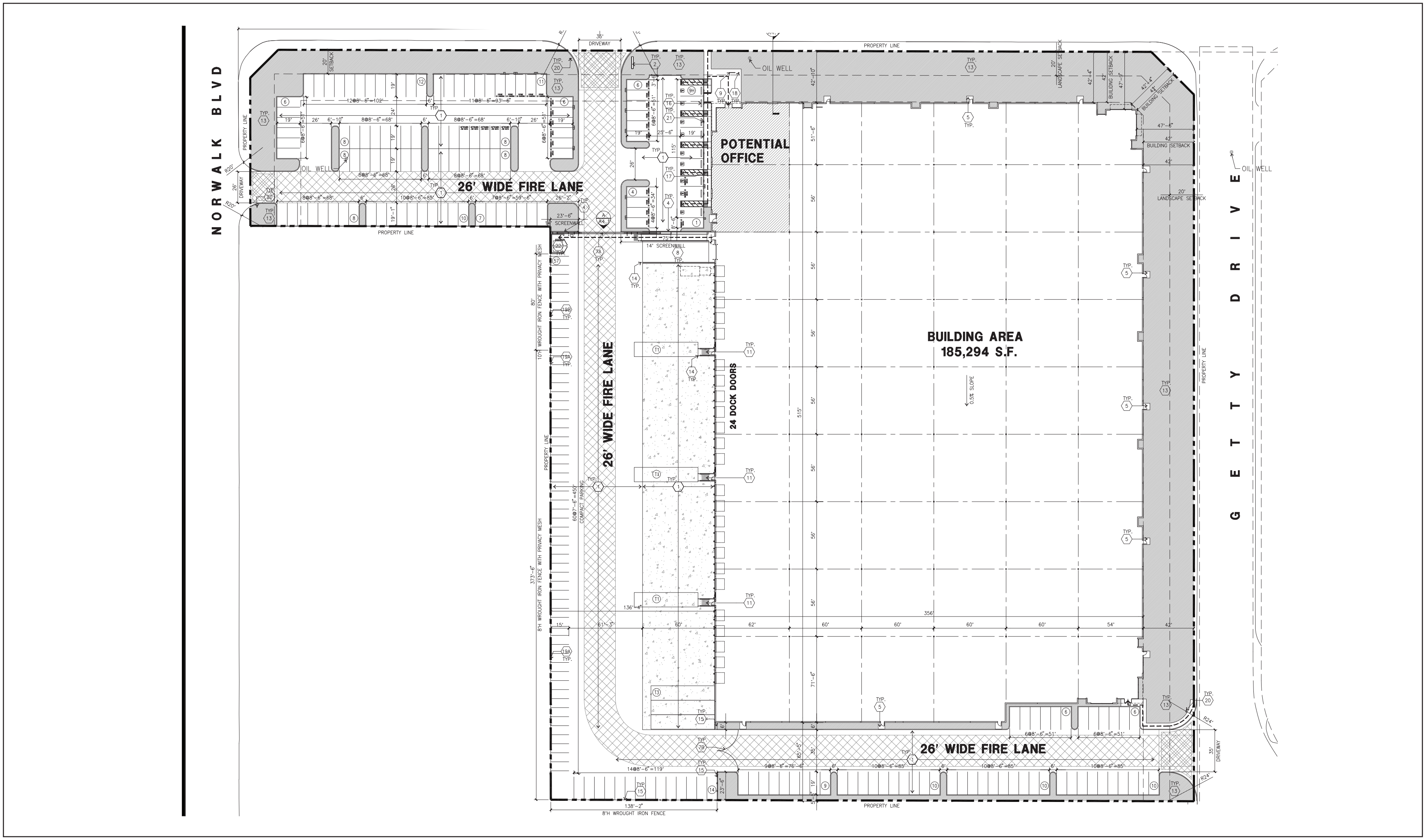

FIGURE 2

SOURCE: HPA Architecture

12300 Lakeland Warehouse Project
Site Plan

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NOISE AND VIBRATION FUNDAMENTALS

CHARACTERISTICS OF SOUND

Noise is usually defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep.

To the human ear, sound has two significant characteristics: pitch and loudness. Pitch is generally an annoyance, while loudness can affect the ability to hear. Pitch is the number of complete vibrations, or cycles per second, of a sound wave, which results in the tone's range from high to low. Loudness is the strength of a sound, and it describes a noisy or quiet environment; it is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear. Sound intensity is the average rate of sound energy transmitted through a unit area perpendicular to the direction in which the sound waves are traveling. This characteristic of sound can be precisely measured with instruments. The analysis of a project defines the noise environment of the project area in terms of sound intensity and its effect on adjacent sensitive land uses.

MEASUREMENT OF SOUND

Sound intensity is measured with the A-weighted decibel (dBA) scale to correct for the relative frequency response of the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound, similar to the human ear's de-emphasis of these frequencies. Decibels (dB), unlike the linear scale (e.g., inches or pounds), are measured on a logarithmic scale representing points on a sharply rising curve.

For example, 10 dB is 10 times more intense than 0 dB, 20 dB is 100 times more intense than 0 dB, and 30 dB is 1,000 times more intense than 0 dB. Thirty decibels (30 dB) represents 1,000 times as much acoustic energy as 0 dB. The decibel scale increases as the square of the change, representing the sound pressure energy. A sound as soft as human breathing is about 10 times greater than 0 dB. The decibel system of measuring sound gives a rough connection between the physical intensity of sound and its perceived loudness to the human ear. A 10 dB increase in sound level is perceived by the human ear as only a doubling of the sound's loudness. Ambient sounds generally range from 30 dB (very quiet) to 100 dB (very loud).

Sound levels are generated from a source, and their decibel level decreases as the distance from that source increases. Sound levels dissipate exponentially with distance from their noise sources. For a single point source, sound levels decrease approximately 6 dB for each doubling of distance from the source. This drop-off rate is appropriate for noise generated by stationary equipment. If noise is produced by a line source (e.g., highway traffic or railroad operations), the sound decreases 3 dB for each doubling of distance in a hard site environment. Line source sound levels decrease 4.5 dB for each doubling of distance in a relatively flat environment with absorptive vegetation.

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

Other noise rating scales of importance when assessing the annoyance factor include the maximum instantaneous noise level (L_{max}), which is the highest sound level that occurs during a stated time period. The noise environments discussed in this analysis for short-term noise impacts are specified in terms of maximum levels denoted by L_{max}, which reflects peak operating conditions and addresses the annoying aspects of intermittent noise. It is often used together with another noise scale, or noise standards in terms of percentile noise levels, in noise ordinances for enforcement purposes. For example, the L_{10} noise level represents the noise level exceeded 10 percent of the time during a stated period. The L_{50} noise level represents the median noise level. Half the time the noise level exceeds this level, and half the time it is less than this level. The L_{90} noise level represents the noise level exceeded 90 percent of the time and is considered the background noise level during a monitoring period. For a relatively constant noise source, the L_{eq} and L_{50} are approximately the same.

Noise impacts can be described in three categories. The first category includes audible impacts, which are increases in noise levels noticeable to humans. Audible increases in noise levels generally refer to a change of 3 dB or greater because this level has been found to be barely perceptible in exterior environments. The second category, potentially audible, refers to a change in the noise level between 1 dB and 3 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category includes changes in noise levels of less than 1 dB, which are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

Physiological Effects of Noise

Physical damage to human hearing begins at prolonged exposure to sound levels higher than 85 dBA. Exposure to high sound levels affects the entire system, with prolonged sound exposure in excess of 75 dBA increasing body tensions, thereby affecting blood pressure and functions of the heart and the nervous system. In comparison, extended periods of sound exposure above 90 dBA would result in permanent cell damage. When the sound level reaches 120 dBA, a tickling sensation occurs in the human ear, even with short-term exposure. This level of sound is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by a feeling of pain in the ear (i.e., the threshold of pain). A sound level of 160–165 dBA will result in dizziness or a loss of equilibrium. The ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying, less developed areas.

Table A lists definitions of acoustical terms, and Table B shows common sound levels and their sources.

Table A: Definitions of Acoustical Terms

Term	Definitions
Decibel, dB	A unit of sound measurement that denotes the ratio between two quantities that are proportional to power; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.
Frequency, Hz	Of a function periodic in time, the number of times that the quantity repeats itself in 1 second (i.e., the number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. 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. (All sound levels in this report are A-weighted unless reported otherwise.)
L_{01}, L_{10}, L_{50}, L_{90}	The fast A-weighted noise levels that are equaled or exceeded by a fluctuating sound level 1%, 10%, 50%, and 90% of a stated time period, respectively.
Equivalent Continuous Noise Level, L_{eq}	The level of a steady sound that, in a stated time period and at a stated location, has the same A-weighted sound energy as the time-varying sound.
Community Noise Equivalent Level, CNEL	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 5 dBA to sound levels occurring in the evening from 7:00 p.m. to 10:00 p.m. and after the addition of 10 dBA to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
Day/Night Noise Level, L_{dn}	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 10 dBA to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
L_{max}, L_{min}	The maximum and minimum A-weighted sound levels measured on a sound level meter, during a designated time interval, using fast time averaging.
Ambient Noise Level	The all-encompassing noise associated with a given environment at a specified time. Usually a composite of sound from many sources from many directions, near and far; no particular sound is dominant.
Intrusive	The noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, 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 1991).

Table B: Common Sound Levels and Their Noise Sources

Noise Source	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Evaluations
Near Jet Engine	140	Deafening	128 times as loud
Civil Defense Siren	130	Threshold of Pain	64 times as loud
Hard Rock Band	120	Threshold of Feeling	32 times as loud
Accelerating Motorcycle at a Few Feet Away	110	Very Loud	16 times as loud
Pile Driver; Noisy Urban Street/Heavy City Traffic	100	Very Loud	8 times as loud
Ambulance Siren; Food Blender	95	Very Loud	—
Garbage Disposal	90	Very Loud	4 times as loud
Freight Cars; Living Room Music	85	Loud	—
Pneumatic Drill; Vacuum Cleaner	80	Loud	2 times as loud
Busy Restaurant	75	Moderately Loud	—
Near Freeway Auto Traffic	70	Moderately Loud	Reference level
Average Office	60	Quiet	One-half as loud
Suburban Street	55	Quiet	—
Light Traffic; Soft Radio Music in Apartment	50	Quiet	One-quarter as loud
Large Transformer	45	Quiet	—
Average Residence without Stereo Playing	40	Faint	One-eighth as loud
Soft Whisper	30	Faint	—
Rustling Leaves	20	Very Faint	—
Human Breathing	10	Very Faint	Threshold of Hearing
—	0	Very Faint	—

Source: Compiled by LSA (2022).

FUNDAMENTALS OF VIBRATION

Vibration refers to ground-borne noise and perceptible motion. Ground-borne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem outdoors, where the motion may be discernible, but without the effects associated with the shaking of a building there is less adverse reaction. Vibration energy propagates from a source through intervening soil and rock layers to the foundations of nearby buildings. The vibration then propagates from the foundation throughout the remainder of the structure. Building vibration may be perceived by occupants as the motion of building surfaces, the rattling of items sitting on shelves or hanging on walls, or a low-frequency rumbling noise. The rumbling noise is caused by the vibration of walls, floors, and ceilings that radiate sound waves. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 dB or less. This is an order of magnitude below the damage threshold for normal buildings.

Typical sources of ground-borne vibration are construction activities (e.g., blasting, pile-driving, and operating heavy-duty earthmoving equipment), steel-wheeled trains, and occasional traffic on rough roads. Problems with both ground-borne vibration and noise from these sources are usually localized to areas within approximately 100 ft from the vibration source, although there are examples of ground-borne vibration causing interference out to distances greater than 200 ft (FTA 2018). When roadways are smooth, vibration from traffic, even heavy trucks, is rarely perceptible. It is assumed for most projects that the roadway surface will be smooth enough that ground-borne vibration from street traffic will not exceed the impact criteria; however, construction of the project could result in ground-borne vibration that may be perceptible and annoying.

Ground-borne noise is not likely to be a problem because noise arriving via the normal airborne path will usually be greater than ground-borne noise.

Ground-borne vibration has the potential to disturb people and damage buildings. Although it is very rare for train-induced ground-borne vibration to cause even cosmetic building damage, it is not uncommon for construction processes such as blasting and pile-driving to cause vibration of sufficient amplitudes to damage nearby buildings (FTA 2018). Ground-borne vibration is usually measured in terms of vibration velocity, either the root-mean-square (RMS) velocity or peak particle velocity (PPV). The RMS is best for characterizing human response to building vibration, and PPV is used to characterize the potential for damage. Decibel notation acts to compress the range of numbers required to describe vibration. Vibration velocity level in decibels is defined as

$$L_v = 20 \log_{10} [V/V_{ref}]$$

where "L_v" is the vibration velocity in decibels (VdB), "V" is the RMS velocity amplitude, and "V_{ref}" is the reference velocity amplitude, or 1×10^{-6} inches/second (in/sec) used in the United States.

REGULATORY SETTING

APPLICABLE NOISE STANDARDS

The applicable noise standards governing the project site include the criteria in the City of Santa Fe Springs Noise Element and Section 155.424 of the City of Santa Fe Springs Code of Ordinances (SFSCO). The criteria for noise standards in the City of Norwalk Municipal code is also discussed as the identified sensitive receptors to the west are within the Norwalk city limits.

City of Santa Fe Springs

City of Santa Fe Springs Code of Ordinances

The Noise Element provides the City's goals and policies related to noise, including the land use compatibility guidelines for community exterior noise environments. The City has identified the following goal, Goal N-2, and policies N-2.1 through N-2.5 in the Noise Element to address noise and land use planning intergration:

Goal N-2: Land Use Decisions That Minimize Noise Exposure

Policy N-2.1: Noise Standards. Review and update as necessary noise standards in the Municipal Code to ensure they sufficiently address community noise conditions, issues, and concerns for various land uses.

Policy N-2.2: Land Use Compatability. Include the noise/land use compatibility standards of Table N-1 and compliance with the Municipal Code noise regulations as part of development review.

Policy N-2.3: Noise Studies. Require developers of projects that are considered potential sources of noise, or when the projects are proposed next to existing or planned noise-sensitive land uses to prepare an acoustical study that describes the existing and future noise environments and defines noise-reducing design incorporated into the project that will achieve a noise environment consistent with City standards and guidelines.

Policy N-2.4: Truck Access. Require that site design for new industrial and commercial developments and remodels address proximity to residential uses by locating automobile and truck access at the maximum practical distance from residential uses and with adequate noise shielding provided to achieve noise standards.

Policy N-2.5: Noise Generating Industrial Facilities. Locate noise-generating industrial facilities at the maximum practical distance from residential neighborhoods. Require additional setbacks between noise-generating equipment and noise-sensitive uses and limit the operation of noise-generating activities to daytime hours where such activities may affect residential uses.

City of Santa Fe Springs Code of Ordinances

The City addresses noise in Section 155.424, *Permitted Noise Levels*, of the SFSCO. The SFSCO sets the maximum allowable noise exposure for receiving areas as presented in Table C. As a conservative approach, the levels assigned for 30 minutes of cumulative minutes duration in any 1-hour period are used in this assessment. It is also stated that "In the event the ambient noise level exceeds a permitted noise level set forth in division (E) [Refer to table C] of this section, the permissible noise level for the corresponding duration and receiving area shall be the ambient level". The existing ambient levels are discussed in the "Overview of the Existing Noise Environment" section of this report.

Additionally, Section 155.425 (B), *Special Noise Sources*, states that the operation of equipment or the construction of projects is prohibited in between the hours of 7:00 p.m. of one day and 7:00 a.m. of the next day when the project is located within a radius of 500 feet from a residential area.

Table C: Maximum Allowable Noise Exposure

Receiving Area	Daytime (7:00 a.m. to 10:00 p.m.)					Nighttime (10:00 p.m. to 7:00 a.m.)				
	Maximum Cumulative Minutes Duration in Any 1-Hour Period				Absolute Maximum	Maximum Cumulative Minutes Duration in Any 1-Hour Period				Absolute Maximum
	30	**15**	**5**	**1**		**30**	**15**	**5**	**1**	
Outdoor Noise at Lot Line Of:	**A-Weighted Sound Level in Decibels (dBA)**									
Any school, church, or hospital	45	50	55	60	65	45	50	55	60	65
Any other use:										
In the A-1, R-1 or R-3 Zone	50	55	60	65	70	45	50	55	60	65
In the C-1 or C-4 Zone	60	65	70	75	80	55	60	65	70	75
1 In the ML, PF or BP Zone	60	65	70	75	80	60	65	70	75	80
In the M-1 or M-2 Zone	70	75	80	85	90	70	75	80	85	90
Residential Building Interior:										
In the A-1 or R-1 Zone	45	50	55	60	65	45	50	55	60	65
In the R-3 Zone	45	50	55	60	65	45	50	55	60	65
Sound levels at or above each decibel level given in the table shall not occur for a duration longer than that given in the corresponding column heading.										

Source: City of Santa Fe Springs (2022).

City of Norwalk Municipal Code

The City of Norwalk Municipal Code addresses noise in Article III. *Noise*, of the Norwalk Municipal code (NMC). Section 9.04.120, Ambient noise level, of NMC sets the assumed ambient noise levels for the various zones as presented in Table D. The NMC also states that unless sound-level meter readings determine the ambient noise level in a given environment to be higher, the ambient noise levels in Norwalk are presumed to be those in Table D.

Table D: Allowable Ambient Noise Levels

Decibels (dBA)	Time	Zone
45	Night	Residential
55	Day	Residential
60	Anytime	Commercial
65	Anytime	All other zones

Source: City of Norwalk (2022).
Notes:
[1] Day = Time period from 7:00 a.m. to 10:00 p.m.
[3] Night = Time period from 10:00 p.m. to 7:00 a.m.
dBA = A-weighted decibels
L_{eq} = equivalent continuous sound level

Federal Transit Administration

Because the City does not have construction noise level limits, construction noise was assessed using criteria from the *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). Table E shows the FTA's General Assessment Construction Noise Criteria based on the composite noise levels per construction phase.

Table E: General Assessment Construction Noise Criteria

Land Use	Daytime 1-hour L_{eq} (dBA)	Nighttime 1-hour L_{eq} (dBA)
Residential	90	80
Commercial	100	100
Industrial	100	100

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
dBA = A-weighted decibels
L_{eq} = equivalent continuous sound level

APPLICABLE VIBRATION STANDARDS

Federal Transit Administration

Vibration standards included in the Federal Transit Administration's (FTA) *Transit Noise and Vibration Impact Assessment Manual* (2018) (FTA Manual) are used in this analysis for ground-borne vibration impacts on human annoyance. The criteria for environmental impact from ground-borne vibration and noise are based on the maximum levels for a single event. Table F provides the criteria for assessing the potential for interference or annoyance from vibration levels in a building.

Table F: Interpretation of Vibration Criteria for Detailed Analysis

Land Use	Max L_v (VdB)[1]	Description of Use
Workshop	90	Vibration that is distinctly felt. Appropriate for workshops and similar areas not as sensitive to vibration.
Office	84	Vibration that can be felt. Appropriate for offices and similar areas not as sensitive to vibration.
Residential Day	78	Vibration that is barely felt. Adequate for computer equipment and low-power optical microscopes (up to 20×).
Residential Night and Operating Rooms	72	Vibration is not felt, but ground-borne noise may be audible inside quiet rooms. Suitable for medium-power microscopes (100×) and other equipment of low sensitivity.

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
[1] As measured in 1/3-Octave bands of frequency over the frequency range 8 to 80 Hertz.
FTA = Federal Transit Administration
L_V = velocity in decibels
VdB = vibration velocity decibels
Max = maximum

Table G lists the potential vibration building damage criteria associated with construction activities, as suggested in the FTA Manual. FTA guidelines show that a vibration level of up to 0.5 in/sec in PPV is considered safe for buildings consisting of reinforced concrete, steel, or timber (no plaster), and would not result in any construction vibration damage. For non-engineered timber and masonry buildings, the construction building vibration damage criterion is 0.2 in/sec in PPV.

Table G: Construction Vibration Damage Criteria

Building Category	PPV (in/sec)
Reinforced concrete, steel, or timber (no plaster)	0.50
Engineered concrete and masonry (no plaster)	0.30
Non-engineered timber and masonry buildings	0.20
Buildings extremely susceptible to vibration damage	0.12

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
FTA = Federal Transit Administration
PPV = peak particle velocity
in/sec = inch/inches per second

OVERVIEW OF THE EXISTING NOISE ENVIRONMENT

The primary existing noise sources in the project area are transportation facilities such as Lakeland Road and Norwalk Boulevard and surrounding commercial, office, and industrial uses.

AMBIENT NOISE MEASUREMENTS

Long-Term Noise Measurements

Long-term (24-hour) noise level measurements were conducted on March 29 and 30, 2022, using two (2) Larson Davis Spark 706RC Dosimeters. Table H provides a summary of the measured hourly noise levels and calculated CNEL level from the long-term noise level measurements. As shown in Table H, the calculated CNEL levels range from 71.0 dBA CNEL to 71.3 dBA CNEL. Hourly noise levels at surrounding sensitive uses are as low as 56.2 dBA L_{eq} during nighttime hours and 63.9 dBA L_{eq} during daytime hours. Long-term noise monitoring survey sheets are provided in Appendix A. Figure 3 shows the long-term monitoring locations.

Table H: Long-Term 24-Hour Ambient Noise Monitoring Results[1]

Location		Daytime Noise Levels[1] (dBA L_{eq})	Evening Noise Levels[2] (dBA L_{eq})	Nighttime Noise Levels[3] (dBA L_{eq})	Daily Noise Levels (dBA CNEL)
LT-1	12300 Lakeland Road, on the southeast corner of the property. On a utility pole. Approximately 60 feet from Getty Drive centerline.	63.9-69.0	62.2-63.3	56.2-67.8	71.0
LT-2	12172 Hermes Street, by Norwalk Boulevard. On the first tree south of Hermes Street, approximately 75 feet from Norwalk Boulevard centerline.	66.6-68.9	65.0-65.8	60.0-67.3	71.3

Source: Compiled by LSA (2022).
Note: Noise measurements were conducted from March 29 to March 30, 2022, starting at 11:00 a.m.
[1] Daytime Noise Levels = noise levels during the hours from 7:00 a.m. to 7:00 p.m.
[2] Evening Noise Levels = noise levels during the hours from 7:00 p.m. to 10:00 p.m.
[3] Nighttime Noise Levels = noise levels during the hours from 10:00 p.m. to 7:00 a.m.
dBA = A-weighted decibels
L_{eq} = equivalent continuous sound level
CNEL = Community Noise Equivalent Level

Since the measured ambient levels exceed the applicable noise standards, the permissible noise levels for the corresponding duration and receiving area shall be the levels presented in Table H.

EXISTING AIRCRAFT NOISE

Airport-related noise levels are primarily associated with aircraft engine noise made while aircraft are taking off, landing, or running their engines while still on the ground. Fullerton Municipal Airport (FUL) is the closest airport use located approximately 6.45 miles southeast of the project site. Because the project site is not located within the 65 dBA CNEL and 60 dBA CNEL noise contours, no further analysis associated with aircraft noise impacts is necessary. Additionally, there are no helipads or private airstrips within 2 miles from the project area.

LSA

LEGEND

- Project Site Boundary

LT-1 - Long-Term Noise Monitoring Location

0 150 300
FEET

SOURCE: Google Earth 2022

FIGURE 3

12300 Lakeland Warehouse Project

Noise Monitoring Locations

PROJECT IMPACTS

SHORT-TERM CONSTRUCTION NOISE IMPACTS

Two types of short-term noise impacts could occur during the construction of the proposed project. First, construction crew commutes and the transport of construction equipment and materials to the site for the proposed project would incrementally increase noise levels on access roads leading to the site. Although there would be a relatively high single-event noise-exposure potential causing intermittent noise nuisance (passing trucks at 50 ft would generate up to 84 dBA L_{max}), the effect on longer-term ambient noise levels would be small when compared to existing daily traffic volumes on Lakeland Road and Norwalk Boulevard. Because construction-related vehicle trips would not approach existing daily traffic volumes, traffic noise would not increase by 3 dBA CNEL. A noise level increase of less than 3 dBA would not be perceptible to the human ear in an outdoor environment. Therefore, short-term, construction-related impacts associated with worker commute and equipment transport to the project site would be less than significant.

The second type of short-term noise impact is related to noise generated during construction which includes demolition of the existing structures, site preparation, grading, building construction, paving, and architectural coating on the project site. Construction is completed in discrete steps, each of which has its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated on the site and, therefore, the noise levels surrounding the site as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. Table I lists typical construction equipment noise levels recommended for noise impact assessments, based on a distance of 50 ft between the equipment and a noise receptor, taken from the FHWA *Roadway Construction Noise Model* (FHWA 2006).

In addition to the reference maximum noise level, the usage factor provided in Table I is used to calculate the hourly noise level impact for each piece of equipment based on the following equation:

$$L_{eq}(equip) = E.L. + 10\log(U.F.) - 20\log\left(\frac{D}{50}\right)$$

where: *L_{eq} (equip)* = L_{eq} at a receiver resulting from the operation of a single piece of equipment over a specified time period.

E.L. = noise emission level of the particular piece of equipment at a reference distance of 50 ft.

U.F. = usage factor that accounts for the fraction of time that the equipment is in use over the specified period of time.

D = distance from the receiver to the piece of equipment.

Table I: Typical Construction Equipment Noise Levels

Equipment Description	Acoustical Usage Factor (%)[1]	Maximum Noise Level (L_{max}) at 50 Feet[2]
Auger Drill Rig	20	84
Backhoes	40	80
Compactor (ground)	20	80
Compressor	40	80
Cranes	16	85
Dozers	40	85
Dump Trucks	40	84
Excavators	40	85
Flat Bed Trucks	40	84
Forklift	20	85
Front-end Loaders	40	80
Graders	40	85
Impact Pile Drivers	20	95
Jackhammers	20	85
Paver	50	77
Pickup Truck	40	55
Pneumatic Tools	50	85
Pumps	50	77
Rock Drills	20	85
Rollers	20	85
Scrapers	40	85
Tractors	40	84
Trencher	50	80
Welder	40	73

Source: FHWA Roadway Construction Noise Model User's Guide, Table 1 (FHWA 2006).
Note: Noise levels reported in this table are rounded to the nearest whole number.
1 Usage factor is the percentage of time during a construction noise operation that a piece of construction equipment is operating at full power.
2 Maximum noise levels were developed based on Specification 721.560 from the Central Artery/Tunnel program to be consistent with the City of Boston's Noise Code for the "Big Dig" project.
FHWA = Federal Highway Administration
L_{max} = maximum instantaneous sound level

Each piece of construction equipment operates as an individual point source. Using the following equation, a composite noise level can be calculated when multiple sources of noise operate simultaneously:

$$Leq\ (composite) = 10 * \log_{10}\left(\sum_{1}^{n} 10^{\frac{Ln}{10}}\right)$$

Using the equations from the methodology above, the reference information in Table I, and the construction equipment list provided, the composite noise level of each construction phase was calculated. The project construction composite noise levels at a distance of 50 feet would range from 74 dBA L_{eq} to 88 dBA L_{eq} with the highest noise levels occurring during the site preparation phase.

Once composite noise levels are calculated, reference noise levels can then be adjusted for distance using the following equation:

$$Leq\ (at\ distance\ X) = Leq\ (at\ 50\ feet) - 20 * \log_{10}\left(\frac{X}{50}\right)$$

In general, this equation shows that doubling the distance would decrease noise levels by 6 dBA while halving the distance would increase noise levels by 6 dBA.

Table J shows the nearest sensitive uses to the project site, their distance from the center of construction activities, and composite noise levels expected during construction. These noise level projections do not take into account intervening topography or barriers. Construction equipment calculations are provided in Appendix B.

Table J: Potential Construction Noise Impacts at Nearest Receptor

Receptor (Location)	Composite Noise Level (dBA L_{eq}) at 50 feet[1]	Distance (feet)	Composite Noise Level (dBA L_{eq})
Industrial Uses (Southwest)	88	200	76
Industrial Uses (North)		340	71
Industrial Uses (East)		405	70
Residence (West)		550	67
Hospital (Southeast)		1,230	60

Source: Compiled by LSA (2022).

0 The composite construction noise level represents the grading phase which is expected to result in the greatest noise level as compared to other phases.

dBA L_{eq} = average A-weighted hourly noise level

While construction noise will vary, it is expected that composite noise levels during construction at the nearest off-site sensitive uses directly southwest of the project would reach 76 dBA L_{eq}. These predicted noise levels would only occur when all construction equipment is operating simultaneously; and therefore, are assumed to be rather conservative in nature. While construction-related short-term noise levels have the potential to be higher than existing ambient noise levels in the project area under existing conditions, the noise impacts would no longer occur once project construction is completed.

As stated above, noise impacts associated with construction activities are regulated by the City's noise ordinance. The proposed project will be required to comply with the construction hours specified in the City's Noise Ordinance, which states that construction activities are not allowed between the hours of 7:00 pm on one day and 7:00 am of the following day.

As it relates to off-site uses, construction-related noise impacts would remain below the 90 dBA L_{eq} and 100 dBA L_{eq} 1-hour construction noise level criteria as established by the FTA for residential and industrial land uses, respectively, for the average daily condition as modeled from the center of the project site and therefore would be considered less than significant. Best construction practices presented at the end of this analysis shall be implemented to minimize noise impacts to surrounding receptors.

LONG-TERM TRAFFIC-RELATED VIBRATION IMPACTS

The proposed project would not generate vibration levels related to on-site operations. In addition, vibration levels generated from project-related traffic on the adjacent roadways are unusual for on-road vehicles because the rubber tires and suspension systems of on-road vehicles provide vibration isolation. Vibration levels generated from project-related traffic on the adjacent roadways would be less than significant and no mitigation measures are required.

SHORT-TERM CONSTRUCTION VIBRATION IMPACTS

This construction vibration impact analysis discusses the level of human annoyance using vibration levels in VdB and assesses the potential for building damages using vibration levels in PPV (in/sec). This is because vibration levels calculated in RMS are best for characterizing human response to building vibration, while vibration level in PPV is best for characterizing potential for damage.

Table K shows the PPV and VdB values at 25 ft from the construction vibration source. As shown in Table K, bulldozers and other heavy-tracked construction equipment (expected to be used for this project) generate approximately 0.089 PPV in/sec or 87 VdB of ground-borne vibration when measured at 25 ft, based on the FTA Manual. The distance to the nearest buildings for vibration impact analysis is measured between the nearest off-site buildings and the project construction boundary (assuming the construction equipment would be used at or near the project setback line).

Table K: Vibration Source Amplitudes for Construction Equipment

Equipment	Reference PPV/L_V at 25 ft	
	PPV (in/sec)	L_V (VdB)[1]
Pile Driver (Impact), Typical	0.644	104
Pile Driver (Sonic), Typical	0.170	93
Vibratory Roller	0.210	94
Hoe Ram	0.089	87
Large Bulldozer[2]	**0.089**	**87**
Caisson Drilling	0.089	87
Loaded Trucks[2]	**0.076**	**86**
Jackhammer	0.035	79
Small Bulldozer	0.003	58

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
[1] RMS vibration velocity in decibels (VdB) is 1 µin/sec.
[2] Equipment shown in **bold** is expected to be used on site.
µin/sec = microinches per second
ft = foot/feet
FTA = Federal Transit Administration
in/sec = inch/inches per second
L_V = velocity in decibels
PPV = peak particle velocity
RMS = root-mean-square
VdB = vibration velocity decibels

The formulae for vibration transmission are provided below and Tables L and M below provide a summary of off-site construction vibration levels.

$$L_v dB\ (D) = L_v dB\ (25\ ft) - 30\ Log\ (D/25)$$

$$PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$$

As shown in Table F above, the threshold at which vibration levels would result in annoyance would be 78 VdB for daytime residential uses. As shown in Table G, the FTA guidelines indicate that for a non-engineered timber and masonry building, the construction vibration damage criterion is 0.2 in/sec in PPV.

Table L: Potential Construction Vibration Annoyance Impacts at Nearest Receptor

Receptor (Location)	Reference Vibration Level (VdB) at 25 feet[1]	Distance (feet)[2]	Vibration Level (VdB)
Industrial Uses (Southwest)	87	200	60
Industrial Uses (North)		340	53
Industrial Uses (East)		405	51
Residence (West)		550	47

Source: Compiled by LSA (2022).

1 The reference vibration level is associated with a large bulldozer which is expected to be representative of the heavy equipment used during construction.

2 The reference distance is associated with the average condition, identified by the distance from the center of construction activities to surrounding uses

ft = foot/feet

VdB = vibration velocity decibels

Table M: Potential Construction Vibration Damage Impacts at Nearest Receptor

Receptor (Location)	Reference Vibration Level (PPV) at 25 feet[1]	Distance (feet)[2]	Vibration Level (PPV)
Industrial Uses (Southwest)	0.089	20	0.124
Industrial Uses (North)		120	0.008
Industrial Uses (East)		70	0.019
Residence (West)		110	0.010

Source: Compiled by LSA (2022).

1 The reference vibration level is associated with a large bulldozer which is expected to be representative of the heavy equipment used during construction.

2 The reference distance is associated with the peak condition, identified by the distance from the perimeter of construction activities to surrounding structures

ft = foot/feet

in/sec = inch/inches per second

PPV = peak particle velocity

Based on the information provided in Table L, vibration levels are expected to approach 60 VdB at the closest industrial uses located immediately southwest of the project site and 47 VdB at the closest residential use to the west which is below the 90 VdB and 78 VdB annoyance threshold for workshop or industrial types uses and for daytime residential uses, respectively. Based on the information provide in Table M, vibration levels are expected to approach 0.124 PPV in/sec at the surrounding structures and would be below the 0.2 PPV in/sec damage threshold.

Because construction activities are regulated by the City's Code of Ordinance which states temporary construction, maintenance, or demolition activities are not allowed between the 7:00

p.m. on one day and 7:00 a.m. of the following day, vibration impacts would not occur during the more sensitive nighttime hours.

Other building structures surrounding the project site are farther away and would experience further reduced vibration. Therefore, no construction vibration impacts would occur. No vibration reduction measures are required.

LONG-TERM OFF-SITE TRAFFIC NOISE IMPACTS

As a result of the implementation of the proposed project, off-site traffic volumes on surrounding roadways have the potential to increase. The proposed project trips generated were obtained from the *Trip Generation and VMT Screening Analysis for 12300 Lakeland Warehouse* (EPD Solutions, Inc. 2022). The proposed project would generate four (4) fewer daily vehicle trips as compared to the existing uses. Due to the daily decrease in traffic volumes associates with the proposed project, there would be no traffic noise impacts from project-related traffic to off-site sensitive receptors. No noise reduction measures are required.

LONG-TERM OFF-SITE STATIONARY NOISE IMPACTS

Adjacent off-site land uses would be potentially exposed to stationary-source noise impacts from the proposed on-site heating, ventilation, and air conditioning (HVAC) equipment and truck deliveries and loading and unloading activities. The potential noise impacts to off-site sensitive land uses from the proposed HVAC equipment and truck delivery activities are discussed below. To provide a conservative analysis, it is assumed that operations would occur equally during all hours of the day and that half the 24 loading docks would be active at all times. Additionally, it is assumed that within any given hour, 12 heavy trucks would maneuver to park near or back into one of the proposed loading docks. To determine the future noise impacts from project operations to the noise sensitive uses, a 3-D noise model, SoundPLAN, was used to incorporate the site topography as well as the shielding from the proposed building on-site. A graphic representation of the operational noise impacts is presented in Appendix C.

Heating, Ventilation, and Air Conditioning Equipment

The project is estimated to have twelve (12) rooftop HVAC units on the proposed building to provide ventilation to the proposed office spaces. The HVAC equipment could operate 24 hours per day and would generate sound power levels (SPL) of up to 87 dBA SPL or 72 dBA L_{eq} at 5 feet, based on manufacturer data (Trane).

Truck Deliveries and Truck Loading and Unloading Activities

Noise levels generated by delivery trucks would be similar to noise readings from truck loading and unloading activities, which generate a noise level of 75 dBA L_{eq} at 20 ft based on measurements taken by LSA (*Operational Noise Impact Analysis for Richmond Wholesale Meat Distribution Center* [LSA 2016]). Delivery trucks would arrive on site and maneuver their trailers so that trailers would be parked within the loading docks. During this process, noise levels are associated with the truck engine noise, air brakes, and back-up alarms while the truck is backing into the dock. These noise levels would occur for a shorter period of time (less than 5 minutes). After a truck enters the loading dock, the doors would be closed and the remainder of the truck loading activities would be enclosed and therefore much less perceptible. To present a conservative assessment, it is assumed that unloading activities could occur at all twenty-four (24) docks simultaneously for a period of more than 30 minutes in a given hour. Maximum noise levels that occur during the docking process taken by LSA were measured to be 86 dBA L_{max} at a distance of 20 feet.

Tables N and O below show the combined hourly noise levels generated by HVAC equipment and truck delivery activities at the closest off-site land uses. The project-related noise level impacts would range from 39.8 dBA L_{eq} to 55.4 dBA L_{eq} at the surrounding sensitive receptors. These levels would be below the City's exterior daytime noise standard of 55 dBA L_{eq} at the residential land uses to the west within the limits of Norwalk and the daytime noise standard of 45 dBA Leq at the hospital land use to the southeast. While project noise level impacts during the nighttime noise hours have the potential to exceed the Norwalk exterior nighttime noise standard of 45 dBA L_{eq} for residential uses, the quietest ambient noise level during nighttime hours was 56.2 dBA L_{eq} where project impacts would approach 55.4 dBA L_{eq}. Because project noise levels would not exceed the current ambient noise level by 3 dBA or more, the impact would be less than significant and no noise reduction measures are required.

Table N: Daytime Exterior Noise Level Impacts

Receptor	Direction	Daytime Noise Level Standard (dBA Leq)	Existing Quietest Daytime Noise Level (dBA L_{eq})	Project Generated Noise Levels (dBA L_{eq})	Potential Operational Noise Impact?[1]
Residential	West	55	63.9	55.4	No
Hospital	Southeast	45	66.6	39.8	No

Source: Compiled by LSA (2022).

[1] A potential operational noise impact would occur if (1) the quietest daytime ambient hour is less than the applicable noise standard and project noise impacts are greater than the applicable noise standard, OR (2) the quietest daytime ambient hour is greater than the applicable noise standard and project noise impacts are 3 dBA greater than the quietest daytime ambient hour.

dBA = A-weighted decibels

L_{eq} = equivalent noise level

Table O: Nighttime Exterior Noise Level Impacts

Receptor	Direction	Nighttime Noise Level Standard (dBA Leq)	Existing Quietest Nighttime Noise Level (dBA L_{eq})	Project Generated Noise Levels (dBA L_{eq})	Potential Operational Noise Impact?[1]
Residential	West	45	56.2	55.4	No
Hospital	Southeast	45	60.0	39.8	No

Source: Compiled by LSA (2022).

[1] A potential operational noise impact would occur if (1) the quietest nighttime ambient hour is less than 45 dBA Leq and project noise impacts are greater than 45 dBA Leq, OR (2) the quietest nighttime ambient hour is greater than 45 dBA Leq and project noise impacts are 3 dBA greater than the quietest nighttime ambient hour.

[2] This analysis assumes the school is not in typical daily operations between the hours of 10:00 p.m. and 7:00 a.m. the next day.

dBA = A-weighted decibels

L_{eq} = equivalent noise level

BEST CONSTRUCTION PRACTICES

In addition to compliance with the City's Code of Ordinances allowed hours of construction of 7:00 a.m. to 7:00 p.m., the following best construction practices would further minimize construction noise impacts:

- The project construction contractor shall equip all construction equipment, fixed or mobile, with properly operating and maintained noise mufflers consistent with manufacturer's standards.
- The project construction contractor shall locate staging areas away from off-site sensitive uses during the later phases of project development.
- The project construction contractor shall place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site whenever feasible.

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City of Santa Fe Springs. 2022. *Code of Ordinances*. June.

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APPENDIX A

NOISE MONITORING SHEETS

Noise Measurement Survey – 24 HR

Project Number: ESL2201.10
Project Name: 12300 Lakeland Road

Test Personnel: Corey Knips
Equipment: Spark 906RC (SN:18905)

Site Number: LT-1 Date: 3/29/2022

Time: From 12:00 p.m. To 12:00 p.m.

Site Location: 12300 Lakeland Road, Santa Fe Springs, on the southeast corner of the property. On a utility pole.

Primary Noise Sources: Faint traffic on local roadways and trucks on Getty Drive, operations at nearby warehouses (trucks idling), and aircraft.

Comments:

Photo:

Long-Term (24-Hour) Noise Level Measurement Results at LT-1

Start Time	Date	Noise Level (dBA)		
		L_{eq}	L_{max}	L_{min}
12:00 PM	3/29/2020	66.4	89.1	61.4
1:00 PM	3/29/2020	66.3	85.5	60.8
2:00 PM	3/29/2020	66.7	85.3	62.0
3:00 PM	3/29/2020	65.9	83.1	61.4
4:00 PM	3/29/2020	64.1	83.1	61.1
5:00 PM	3/29/2020	64.5	85.2	61.5
6:00 PM	3/29/2020	63.9	73.9	61.4
7:00 PM	3/29/2020	63.3	79.8	60.6
8:00 PM	3/29/2020	62.3	73.7	60.4
9:00 PM	3/29/2020	62.2	76.1	57.9
10:00 PM	3/29/2020	61.7	86.8	57.8
11:00 PM	3/29/2020	62.2	77.4	58.2
12:00 AM	3/30/2020	62.3	82.6	54.3
1:00 AM	3/30/2020	63.4	79.7	55.2
2:00 AM	3/30/2020	56.2	69.7	53.2
3:00 AM	3/30/2020	63.6	86.9	53.3
4:00 AM	3/30/2020	65.0	85.2	52.2
5:00 AM	3/30/2020	67.8	86.9	53.5
6:00 AM	3/30/2020	66.8	85.8	57.9
7:00 AM	3/30/2020	67.2	86.1	56.8
8:00 AM	3/30/2020	66.2	92.5	56.3
9:00 AM	3/30/2020	65.7	88.5	56.1
10:00 AM	3/30/2020	69.6	90.8	54.4
11:00 AM	3/30/2020	65.1	83.6	54.4

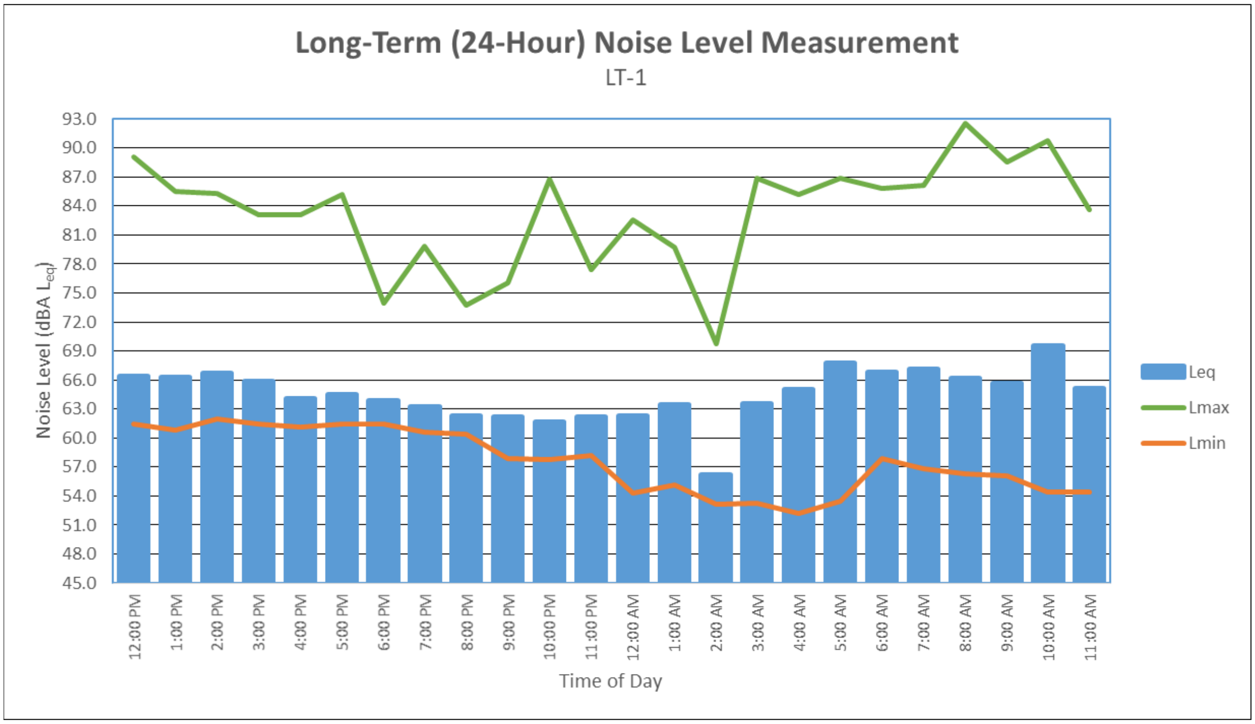
Source: Compiled by LSA Associates, Inc. (2022).

dBA = A-weighted decibel

L_{eq} = equivalent continuous sound level

L_{max} = maximum instantaneous noise level

L_{min} = minimum measured sound level



Noise Measurement Survey – 24 HR

Project Number: ESL2201.10
Project Name: 12300 Lakeland Road
Test Personnel: Corey Knips
Equipment: Spark 906RC (SN:18906)

Site Number: LT-2 Date: 3/29/2022
Time: From 12:00 p.m. To 12:00 p.m.

Site Location: 12172 Hermes Street, near Norwalk Boulevard. On the first tree on the south side of Hermes Street, approximately 75 feet from the centerline of Norwalk Boulevard.

Primary Noise Sources: Traffic on Norwalk Boulevard and light traffic on Hermes Street, aircraft, and birds.

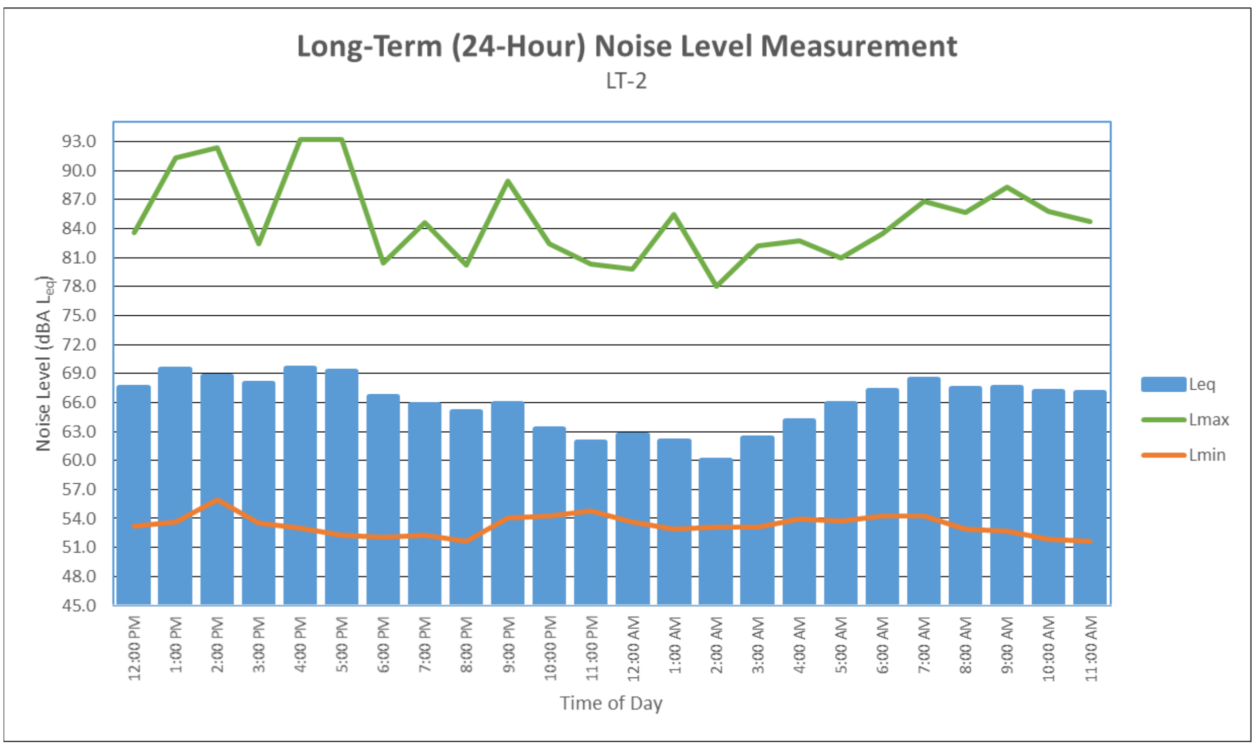
Comments:

Photo:

Long-Term (24-Hour) Noise Level Measurement Results at LT-2

Start Time	Date	Noise Level (dBA)		
		L_{eq}	L_{max}	L_{min}
12:00 PM	3/29/2020	67.5	83.6	53.2
1:00 PM	3/29/2020	69.5	91.3	53.6
2:00 PM	3/29/2020	68.7	92.4	55.9
3:00 PM	3/29/2020	67.9	82.4	53.5
4:00 PM	3/29/2020	69.6	93.2	53.0
5:00 PM	3/29/2020	69.2	93.2	52.3
6:00 PM	3/29/2020	66.6	80.4	52.1
7:00 PM	3/29/2020	65.8	84.6	52.3
8:00 PM	3/29/2020	65.0	80.2	51.6
9:00 PM	3/29/2020	65.9	88.9	54.0
10:00 PM	3/29/2020	63.3	82.4	54.3
11:00 PM	3/29/2020	62.0	80.3	54.8
12:00 AM	3/30/2020	62.6	79.8	53.6
1:00 AM	3/30/2020	62.0	85.5	52.9
2:00 AM	3/30/2020	60.0	78.0	53.1
3:00 AM	3/30/2020	62.3	82.2	53.1
4:00 AM	3/30/2020	64.1	82.7	53.9
5:00 AM	3/30/2020	65.8	81.0	53.7
6:00 AM	3/30/2020	67.3	83.5	54.3
7:00 AM	3/30/2020	68.4	86.8	54.3
8:00 AM	3/30/2020	67.5	85.7	52.9
9:00 AM	3/30/2020	67.6	88.3	52.7
10:00 AM	3/30/2020	67.2	85.8	51.9
11:00 AM	3/30/2020	67.0	84.7	51.6

Source: Compiled by LSA Associates, Inc. (2022).
dBA = A-weighted decibel
L_{eq} = equivalent continuous sound level
L_{max} = maximum instantaneous noise level
L_{min} = minimum measured sound level



APPENDIX B

CONSTRUCTION NOISE LEVEL CALCULATIONS

Construction Calculations

Phase: Demolition

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Leq
Concrete Saw	1	90	20	50	0.5	90	83
Excavator	3	81	40	50	0.5	81	82
Dozer	2	82	40	50	0.5	82	81
					Combined at 50 feet	**91**	**87**
					Combined at Receptor 200 feet	**79**	**75**

Phase: Site Preparation

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Leq
Dozer	3	82	40	50	0.5	82	83
Tractor	4	84	40	50	0.5	84	86
					Combined at 50 feet	**86**	**88**
					Combined at Receptor 200 feet	**74**	**76**
					Combined at Receptor 340 feet	**69**	**71**
					Combined at Receptor 405 feet	**68**	**70**
					Combined at Receptor 550 feet	**65**	**67**
					Combined at Receptor 1230 feet	**58**	**60**

Phase: Grading

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Leq
Excavator	1	81	40	50	0.5	81	77
Grader	1	85	40	50	0.5	85	81
Dozer	1	82	40	50	0.5	82	78
Tractor	3	84	40	50	0.5	84	85
					Combined at 50 feet	**89**	**87**
					Combined at Receptor 200 feet	**77**	**75**

Phase:Building Construstion

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Leq
Crane	1	81	16	50	0.5	81	73
Man Lift	3	75	20	50	0.5	75	73
Generator	1	81	50	50	0.5	81	78
Tractor	3	84	40	50	0.5	84	85
Welder / Torch	1	74	40	50	0.5	74	70
					Combined at 50 feet	**82**	**76**
					Combined at Receptor 200 feet	**70**	**64**

Phase:Paving

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Leq
Paver	2	77	50	50	0.5	77	77
All Other Equipment > 5 HP	2	85	50	50	0.5	85	85
Roller	2	80	20	50	0.5	80	76
					Combined at 50 feet	**87**	**86**
					Combined at Receptor 200 feet	**75**	**74**

Phase:Architectural Coating

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Leq
Compressor (air)	1	78	40	50	0.5	78	74
					Combined at 50 feet	**78**	**74**
					Combined at Receptor 200 feet	**66**	**62**

Sources: RCNM

[1]- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

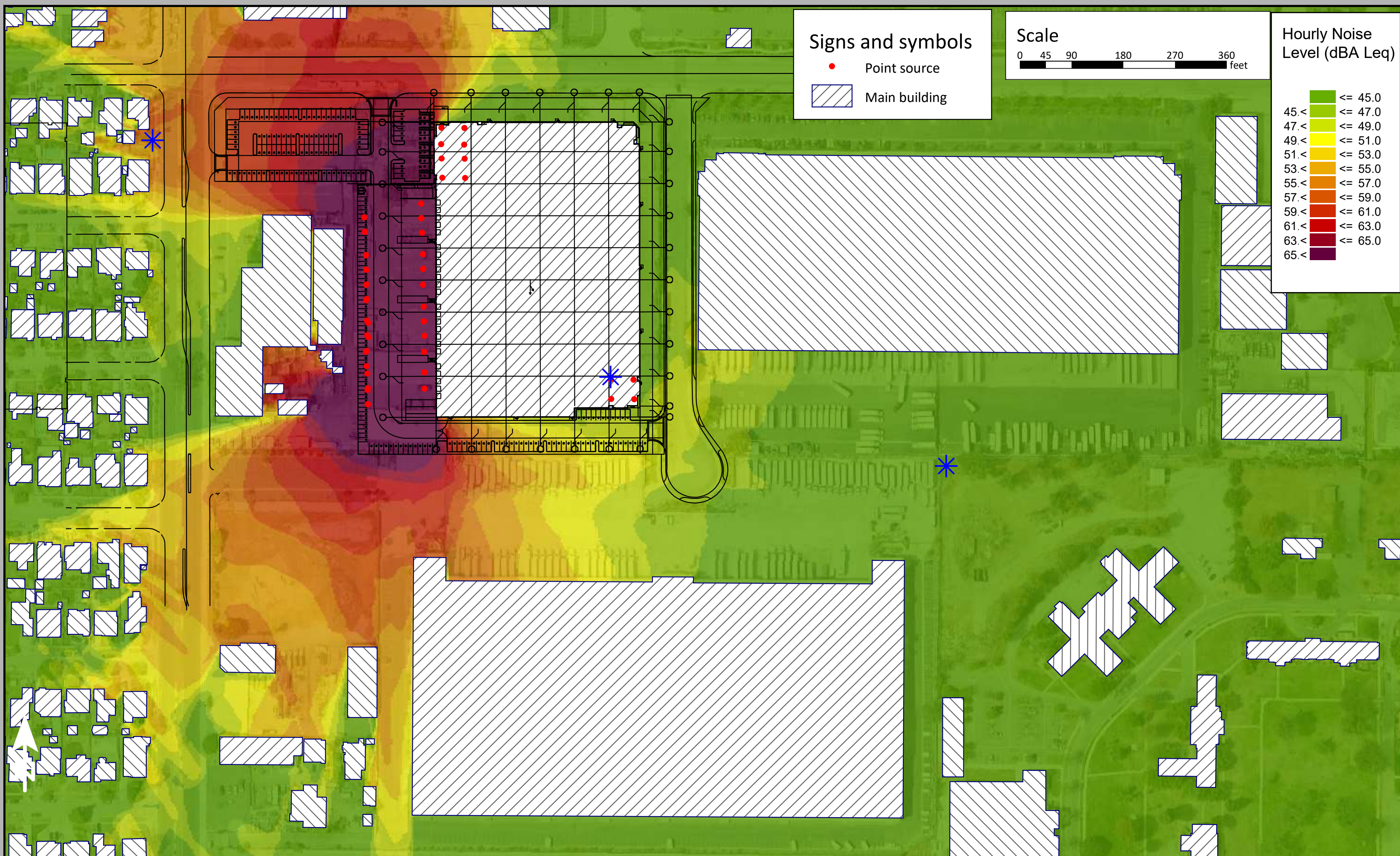
APPENDIX C

SOUNDPLAN NOISE MODEL PRINTOUTS

12300 Lakeland

Project No. ESL2201.10

Project Operational Noise Levels



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