NOISE AND VIBRATION IMPACT ANALYSIS

POPLAR SOUTH DISTRIBUTION CENTER PROJECT

FONTANA, CALIFORNIA

LSA

February 2023

NOISE AND VIBRATION IMPACT ANALYSIS

POPLAR SOUTH DISTRIBUTION CENTER PROJECT

CITY OF FONTANA, CALIFORNIA

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LIST OF ABBREVIATIONS AND ACRONYMS

City	City of Fontana
CNEL	Community Noise Equivalent Level
dBA	A-weighted decibel
EPA	United States Environmental Protection Agency
FHWA	Federal Highway Administration
ft	feet
FTA	Federal Transit Administration
HVAC	heating, ventilation, and air conditioning
in/sec	inches per second
L_{dn}	day-night average noise level
L_{eq}	equivalent continuous sound level
L_{max}	maximum instantaneous sound level
ONT	Ontario International Airport
ONT ALUCP	Ontario International Airport Land Use Compatibility Plan
PPV	peak particle velocity
project	Poplar South Distribution Center 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 Poplar South Distribution Center Project (project) in Fontana, California. This report is intended to satisfy the City of Fontana (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 19.08-acre proposed project is located between Poplar Avenue and Catawba Avenue approximately 650 feet (ft) south of Santa Ana Avenue in the City of Fontana, California. The project site is currently developed with 40 existing single-family residential units and accessory structures bisected by Rose Avenue. Regional access to the project site is provided by Interstate 10 (I-10) off the Citrus Avenue exit. Local access is provided via four driveways: two from Poplar Avenue and two from Catawba Avenue. Figure 1 illustrates the project site location. Figure 2 depicts the proposed project's site plan.

The project proposes the demolition of the existing 40 residences on the site and associated structures to construct an industrial building totaling 490,565 square feet (sf) of industrial warehouse including office space. The project would include approximately 62,000 sf of landscaping around the perimeter of the site and in between parking areas. Parking spaces required by City code would be maintained in one parking lot and would consist of 210 passenger parking spaces including electric vehicle (EV) and accessible Americans with Disabilities Act (ADA) spaces, 98 trailer spaces, and 42 loading dock doors.

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 anticipated to operate 24 hours per day, 7 days per week. The proposed project would generate approximately 687 average daily trips, including 547 passenger vehicle trips, 24 two-axle truck trips, 32 three-axle truck trips, and 84 four-axle truck trips.

Construction is anticipated to begin in April 2024 and be completed in 10 months, ending in January 2025. The proposed project would require the export of approximately 48,492 cubic yards and the import of 39,749 cubic yards of soil, for a net export of 8,743 cubic yards of soil. Construction activities for the project include demolition, grading and excavation, site preparation, building construction, landscape installation, paving, and architectural coatings.

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FIGURE 1

LEGEND

Project Location

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SOURCE: Bing Maps (2021)

Poplar South Distribution Center

Regional Project Location

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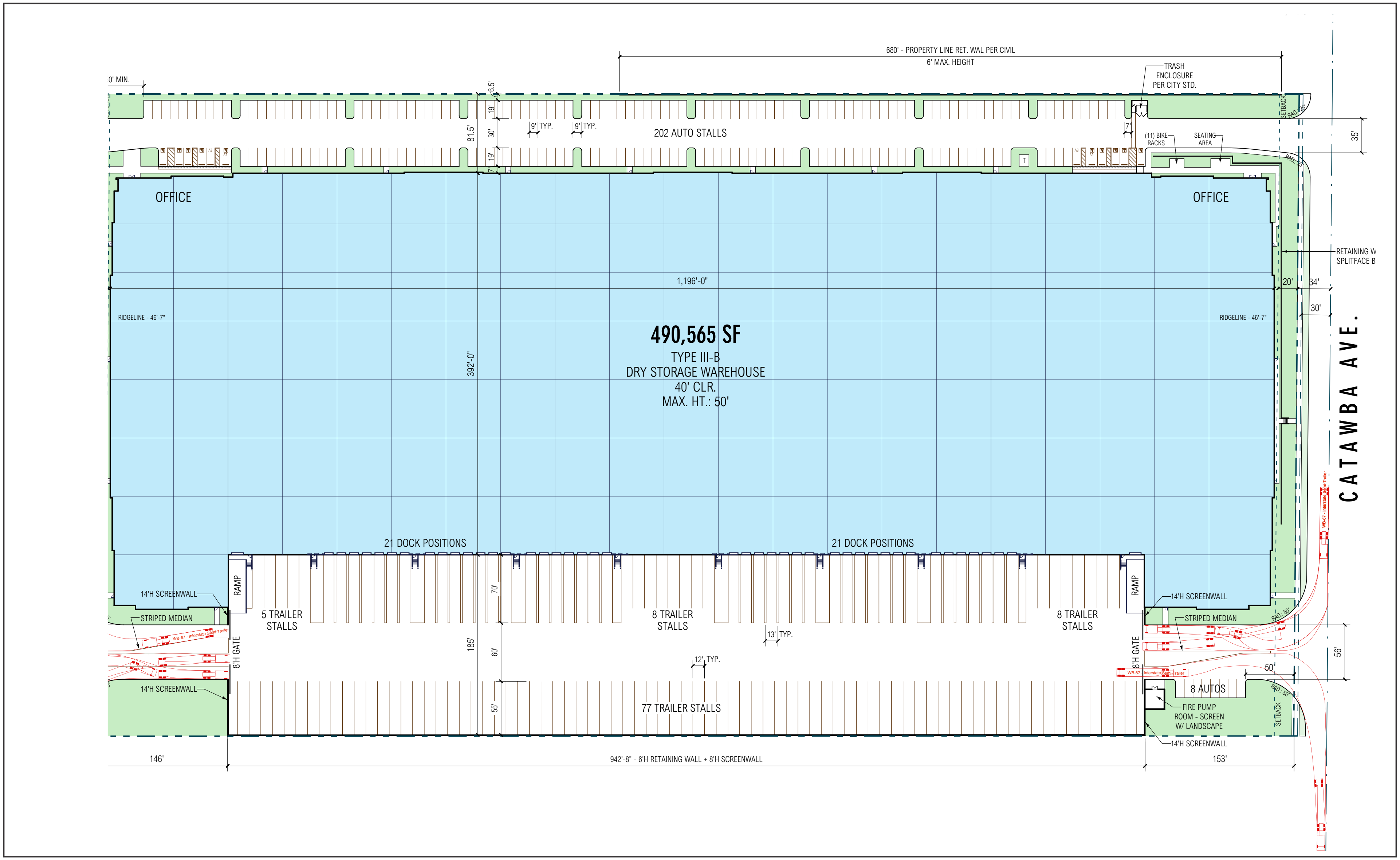

FIGURE 2

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SOURCE: RGA Architecture

Poplar South Distribution Center

Site Plan

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EXISTING LAND USES IN THE PROJECT AREA

The project site is surrounded primarily by general industrial facilities. The areas adjacent to the project site include the following uses:

- **North:** Existing industrial uses
- **East:** Existing industrial uses opposite Catawba Avenue
- **South:** Existing industrial uses
- **West:** Existing industrial uses opposite Poplar Avenue

The nearest sensitive receptors are:

- **Northeast:** Single-family residences approximately 1,325 ft northeast of the project boundary line south of Tyrol Drive

- **South:** Single-family residences approximately 1,500 ft south of the project boundary line south of Jurupa Avenue

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 x 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's Noise Element of the General Plan (Noise Element) and the City of Fontana Municipal Code (FMC).

City of Fontana

Noise Element of the General Plan

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 policies in the Noise Element:

Policy. *Residential land uses and areas identified as noise-sensitive shall be protected from excessive noise from non-transportation sources including industrial, commercial, and residential activities and equipment.*

Actions.

A. Projects located in commercial areas shall not exceed stationary- source noise standards at the property line of proximate residential or commercial uses.

B. Industrial uses shall not exceed commercial or residential stationary source noise standards at the most proximate land uses.

C. Non-transportation noise shall be considered in land use planning decisions.

D. Construction shall be performed as quietly as feasible when performed in proximity to residential or other noise sensitive land uses.

City of Fontana Municipal Code

Operational Noise Standards. The City's noise control guidelines for determining and mitigating non-transportation or stationary noise source impacts from operations in neighboring residential areas are found in Section 30-543. For industrial zoning districts, Section 30-543 indicates that "*no person shall create or cause to be created any sound which exceeds the noise levels in this section as measured at the property line of any residentially zoned property"*. The performance standards found in Section 30-543 limit the exterior noise level to 70 dBA L_{eq} during the daytime hours, and 65 dBA L_{eq} during the nighttime hours at sensitive receiver locations as shown in Table C.

Construction Noise Standards. The City has set restrictions to control noise impacts associated with the construction of the proposed Project. According to Section 18-63(b)(7), *Construction or repairing of buildings or structures,* construction activity is limited: *between the hours of 7:00 a.m. and 6:00 p.m. on weekdays and between the hours of 8:00 a.m. and 5:00 p.m. on Saturdays except in the case of urgent necessity*.

Table C: Operational Noise Standards

Noise Level Descriptor	Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)
Hourly Equivalent Level (L_{eq}), dBA	70	65

Source: City of Fontana (2021).

Notes:

[a] These standards apply to new or existing noise-sensitive land uses affected by new or existing non-transportation noise sources, as determined at the outdoor activity area of the receiving land use. However, these noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).

[b] Each of the noise levels specified above should be lowered by 5 dB for simple-tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. Such noises are generally considered by residents to be particularly annoying and are a primary source of noise complaints. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).

[c] No standards have been included for interior noise levels. Standard construction practices that comply with the exterior noise levels identified in this table generally result in acceptable interior noise levels.

[d] The City of Fontana may impose noise level standards that are more or less restrictive than those specified above based on determination of existing low or high ambient noise levels. If the existing ambient noise level exceeds the standards listed in this table, then the noise level standards shall be increased at 3 dB increments to encompass the ambient environment. Noise level standards incorporating adjustments for existing ambient noise levels shall not exceed a maximum of 70 dBA L_{eq}.

dBA = A-weighted decibels

L_{eq} = equivalent continuous sound level

State of California Green Building Standards Code

The State of California's Green Building Standards Code (CALGreen) contains mandatory measures for non-residential building construction in Section 5.507 on Environmental Comfort. These noise standards are applied to new construction in California for controlling interior noise levels resulting from exterior noise sources. The regulations specify that acoustical studies must be prepared when non-residential structures are developed in areas where the exterior noise levels exceed 65 dBA CNEL, such as within a noise contour of an airport, freeway, railroad, and other noise source. If the development falls within an airport or freeway 65 dBA CNEL noise contour, buildings shall be construction to provide an interior noise level environment attributable to exterior sources that does not exceed an hourly equivalent level of 50 dBA L_{eq} in occupied areas during any hour of operation.

Federal Transit Administration

Though the City does not have daytime construction noise level limits for activities that occur with the specified hours of Section 18-63(b)(7), to determine potential CEQA noise impacts, construction noise was assessed using criteria from the Federal Transit Administration's (FTA) *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018) (FTA Manual). Table D shows the FTA's Detailed Assessment Construction Noise Criteria based on the composite noise levels per construction phase.

Table D: Detailed Assessment Daytime Construction Noise Criteria

Land Use	Daytime 1-hour L_{eq} (dBA)
Residential	80
Commercial	85
Industrial	90

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 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 E provides the criteria for assessing the potential for interference or annoyance from vibration levels in a building.

Table E: 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 F 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 F: 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 industrial uses surrounding the project site and road traffic, including some heavy-duty truck traffic.

AMBIENT NOISE MEASUREMENTS

Long-Term Noise Measurements

Long-term (24-hour) noise level measurements were conducted on April 25 and 26, 2022, using two Larson Davis Spark 706RC dosimeters. Table G provides a summary of the measured hourly noise levels and calculated CNEL levels from the long-term noise level measurements. As shown in Table G, the calculated CNEL levels range from 65.0 dBA CNEL to 69.8 dBA CNEL. Hourly noise levels at surrounding sensitive uses are as low as 49.9 dBA L_{eq} during nighttime hours and 56.9 dBA L_{eq} during daytime and evening hours. Long-term noise monitoring data results are provided in Appendix A. Figure 3 shows the long-term monitoring locations.

Table G: Long-Term 24-Hour Ambient Noise Monitoring Results

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	11053 Catawba Ave., on a power line pole approximately 25 feet east of Catawba Ave. centerline and 40 feet from the east boundary of the project site	57.0–64.7	56.9–59.2	49.9–60.9	65.0
LT-2	On a tree near southeast corner of Catawba Ave. and Jurupa Ave. intersection, approximately 100 feet away from Jurupa Ave. centerline	65.9–69.2	63.9–65.9	58.1–65.5	69.8

Source: Compiled by LSA (2023).
Note: Noise measurements were conducted from April 25 to April 26, 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
CNEL = Community Noise Equivalent Level
L_{eq} = equivalent continuous sound level

EXISTING AIRCRAFT NOISE

Aircraft flyovers may be audible on the project site due to aircraft activity in the vicinity. The nearest airport to the project site is Ontario International Airport (ONT), a commercial airport approximately 7 miles to the west. The project site is located within the ONT Airport Influence Area according to Policy Map 2-1 and the 60–65 dBA CNEL airport noise impact zone consistent with Policy Map 2-3 of the *Ontario International Airport Land Use Compatibility Plan* (ONT ALUCP).

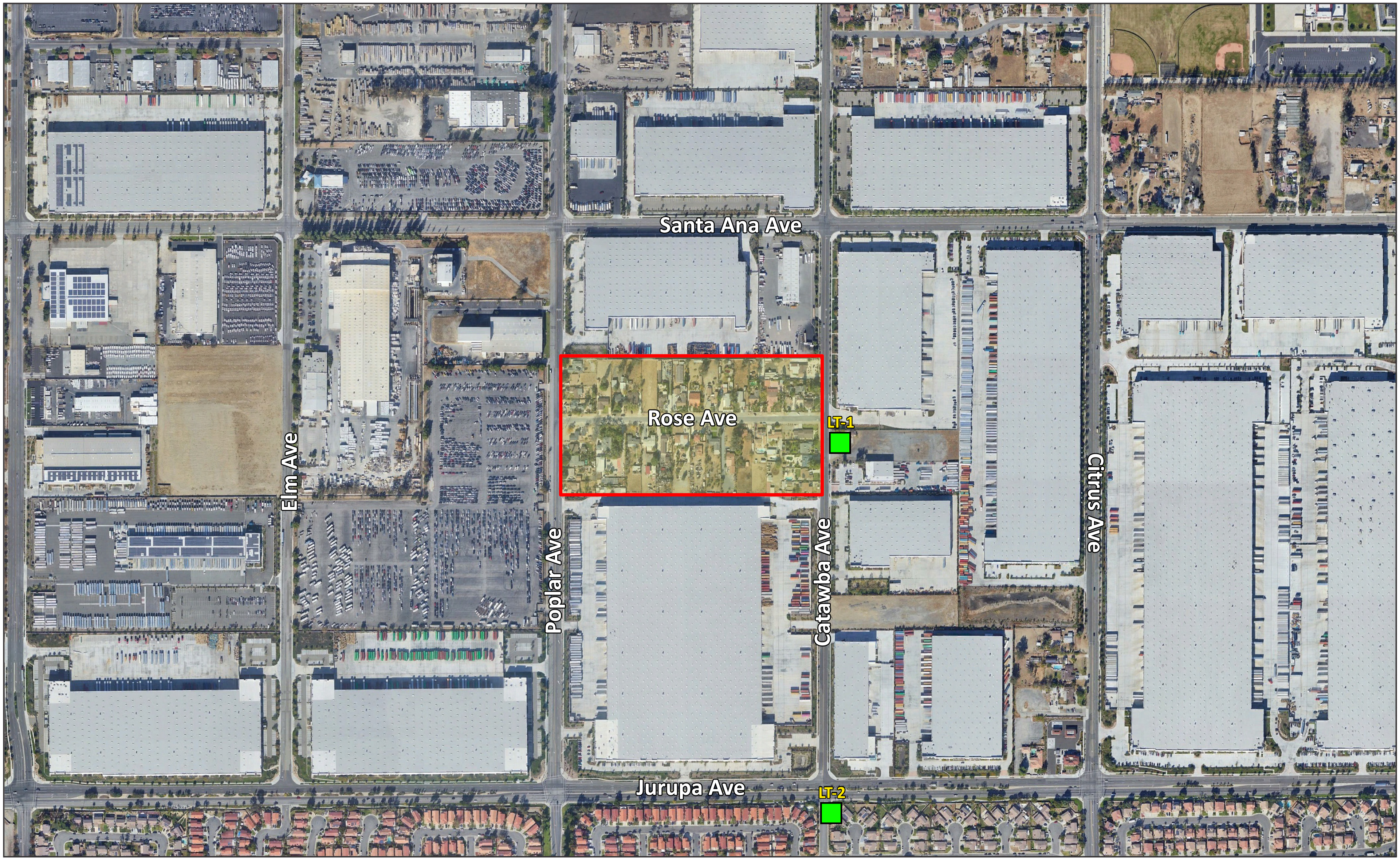

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FIGURE 3

LEGEND

Project Location

LT-1 Long-term Noise Monitoring Location

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SOURCE: Google Earth 2022

Poplar South Distribution Center

Noise Monitoring Locations

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According to Table 2-3 of the ONT ALUCP, industrial land uses within the 60–65 dBA CNEL noise level contours of ONT, such as the project, are considered *normally compatible land use* and must reduce interior noise levels to 50 dBA CNEL. Standard building construction practices required under the CALGreen typically provide up to 25 dBA CNEL of attenuation. With respect to noise generated by the ONT facilities and activities, application of standard CALGreen construction practices would yield acceptable project interior noise levels of approximately 40 dBA CNEL. In addition, the project does not propose or require facilities or actions that would contribute to or exacerbate noise generated by ONT facilities and activities. Therefore, the project would not be adversely affected by airport/airfield noise, nor would the project contribute to or result in adverse airport/airfield noise impacts.

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 Catawba Avenue and Poplar Avenue. 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 and other site improvements, 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 H 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 H 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 H: 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 H, 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 ft 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 I 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 consider intervening topography or barriers. Construction equipment calculations are provided in Appendix B.

Table I: Potential Construction Noise Impacts at Nearest Receptor

Receptor (Location)	Composite Noise Level (dBA L_{eq}) at 50 feet[1]	Distance (feet)	Construction Noise Level Standard (dBA L_{eq})	Composite Noise Level (dBA L_{eq})
Industrial Uses (South)	88	400	90	70
Industrial Uses (North)		525	90	67
Industrial Uses (East)		740	90	64
Industrial Uses (West)		800	90	64
Residence (South)		1,860	80	56
Residence (Northeast)		1,940	80	56

Source: Compiled by LSA (2023).
[1] The composite construction noise level represents the site preparation 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 industrial uses to the south would reach 70 dBA L_{eq} while construction noise levels would approach 56 dBA L_{eq} at the nearest sensitive residential uses to the south and northeast during daytime hours. 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 would comply with the construction hours specified in the City's Noise Ordinance, which states that construction activities are allowed between the hours of 7:00 a.m. and 6:00 p.m. on weekdays and between the hours of 8:00 a.m. and 5:00 p.m. on Saturdays except in the case of urgent necessity.

As it relates to off-site uses, construction-related noise impacts would remain below the 80 dBA L_{eq} and 90 dBA L_{eq} 1-hour construction noise level criteria for daytime construction noise level criteria as established by the FTA for residential and industrial land uses, respectively, 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.

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 J shows the PPV and VdB values at 25 ft from the construction vibration source. As shown in Table J, 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 J: 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 Table K below provides 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, 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. Based on the information provide in Table K, vibration levels are expected to approach 0.027 at the surrounding structures and would be below the 0.2 PPV in/sec threshold.

Table K: Summary of Construction Vibration Levels

Land Use	Direction	Equipment	Reference Vibration Level (VdB) at 25 ft	Reference Vibration Level (PPV) at 25 ft	Distance (ft)[1]	Maximum Vibration Level (VdB)	Maximum Vibration Level (PPV)
Industrial	South	Large Bulldozers	87	0.089	55	77	0.027
Industrial	East				75	73	0.017
Industrial	West				110	68	0.010
Industrial	North				140	65	0.007

Source: Compiled by LSA (2022).

[1] Distances reflect the closest single-family residence to the construction equipment in each direction. All other homes in a given direction would experience lower vibration levels.

ft = foot/feet
FTA = Federal Transit Administration
in/sec = inch/inches per second
PPV = peak particle velocity
VdB = vibration velocity decibels

As shown in Table E above, the threshold at which vibration levels would result in annoyance would be 90 VdB for workshop or industrial type uses and 78 VdB for daytime residential uses. Based on the information provided in Table K, vibration levels are expected to approach 77 VdB at the closest industrial uses.

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 Vehicle Miles Traveled (VMT) Screening Analysis* (EPD Solutions, Inc. 2022). The proposed project would generate a net of 300 daily trips with an even distribution between Catawba Avenue and Poplar Avenue. The existing (2016) average daily trips on Catawba Avenue and Poplar Avenue are 600 and 2,100, respectively (City of Fontana General Plan Community Mobility and Circulation Element 2018). While the current traffic volumes on the adjacent street segments are likely higher, using the 2016 volumes would be considered conservative. The following equation was used to determine the potential impacts of the project:

$$\text{Change in CNEL} = 10\ log_{10}\left[V_{e+p}/V_{existing}\right]$$

where: $V_{existing}$ = existing daily volumes
V_{e+p} = existing daily volumes plus project
Change in CNEL = increase in noise level due to the project

The results of the calculations show that an increase of approximately 1.0 dBA CNEL and 0.3 dBA CNEL are expected along Catawba Avenue and Poplar Avenue, respectively. A noise level increase of less than 3 dBA would not be perceptible to the human ear in an outdoor environment; therefore, the traffic noise increase in the vicinity of the project site resulting from the proposed project would be less than significant. No mitigation is required.

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. Based on a reference vibration level of 0.076 in/sec PPV, structures greater than 20 feet from the roadways which contain project trips would experience vibration levels below the most conservative standard of 0.12 in/sec PPV, and therefore, vibration levels generated from project-related traffic on the adjacent roadways would be less than significant and no mitigation 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 42 loading docks would be active at all times. Additionally, it is assumed that within any given hour, 21 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 would have various rooftop mechanical equipment including HVAC units on the proposed building. To be conservative, it is assumed the project could have eight rooftop HVAC units and operate 24 hours per day and would generate sound power levels (SPL) of up to 76 dBA SPL or 63 dBA L_{eq} at 5 ft, based on manufacturer data (Allied Commercial 2019).

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]). Shorter term noise levels that occur during the docking process taken by LSA were measured to be 76.3 dBA L_8 at 20 ft. 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 truck arrivals and departure activities could occur at 21 docks for a period of less than 5 minutes each and unloading activities could occur at 21 docks simultaneously for a period of more than 30 minutes in a given hour.

Tables L and M below show the combined hourly noise levels generated by HVAC equipment and truck delivery activities at the closest off-site sensitive land uses. The project-related noise level impacts would range from 26.3 dBA L_{eq} to 42.6 dBA L_{eq} at the surrounding sensitive receptors. These levels would be well below the City's exterior daytime noise standard of 70 dBA L_{eq} and nighttime noise standard of 65 dBA L_{eq}. Additionally, when the project generated noise level is more than 10 dBA below existing ambient noise levels, the proposed project would not result in a quantifiable noise level increase. Because project noise levels would not generate a noise level that exceeds existing ambient noise levels by 3 dBA or more or exceed the City's thresholds, the impact would be less than significant, and no noise reduction measures are required.

Table L: Daytime Exterior Noise Level Impacts

Receptor	Direction	Existing Quietest Daytime Noise Level (dBA L_{eq})	Project Generated Noise Levels (dBA L_{eq})	Potential Operational Noise Impact?[1]
Residential (15876 Del Obisbo Road)	South	65.9	42.6	No
Residential (15917 Tyrol Drive)	Northeast	57.0	26.3	No

Source: Compiled by LSA (2023).

[1] A potential operational noise impact would occur if (1) the quietest daytime ambient hour is less than 70 dBA L_{eq} and project noise impacts are greater than 70 dBA L_{eq}, OR (2) the quietest daytime ambient hour is greater than 70 dBA L_{eq} and project noise impacts are 3 dBA greater than the quietest daytime ambient hour.

dBA = A-weighted decibels

L_{eq} = equivalent noise level

Table M: Nighttime Exterior Noise Level Impacts

Receptor	Direction	Existing Quietest Nighttime Noise Level (dBA L_{eq})	Project Generated Noise Levels (dBA L_{eq})	Potential Operational Noise Impact?[1]
Residential (15876 Del Obisbo Road)	South	58.1	42.6	No
Residential (15917 Tyrol Drive)	Northeast	49.9	26.3	No

Source: Compiled by LSA (2023).

[1] A potential operational noise impact would occur if (1) the quietest nighttime ambient hour is less than 65 dBA L_{eq} and project noise impacts are greater than 65 dBA L_{eq}, OR (2) the quietest nighttime ambient hour is greater than 65 dBA L_{eq} and project noise impacts are 3 dBA greater than the quietest nighttime ambient hour.

dBA = A-weighted decibels

L_{eq} = equivalent noise level

BEST CONSTRUCTION PRACTICES

In addition to compliance with the City's Municipal Code allowed hours of construction of 7:00 a.m. to 6:00 p.m. on weekdays and 8:00 a.m. to 5:00 p.m. on Saturdays except in the case of urgent necessity, 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.

REFERENCES

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Harris, Cyril M., editor. 1991. *Handbook of Acoustical Measurements and Noise Control*. Third Edition.

LSA Associates, Inc. (LSA). 2016. *Operational Noise Impact Analysis for Richmond Wholesale Meat Distribution Center*. May.

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United States Environmental Protection Agency (EPA). 1978. *Protective Noise Levels, Condensed Version of EPA Levels Document*, EPA 550/9-79-100. November.

APPENDIX A

NOISE MONITORING DATA

Noise Measurement Survey – 24 HR

Project Number: ESL2201.19
Project Name: Catawba Avenue Industrial

Test Personnel: Kevin Nguyendo
Equipment: Spark 706RC (SN:18905)

Site Number: LT-1 Date: 4/25/22

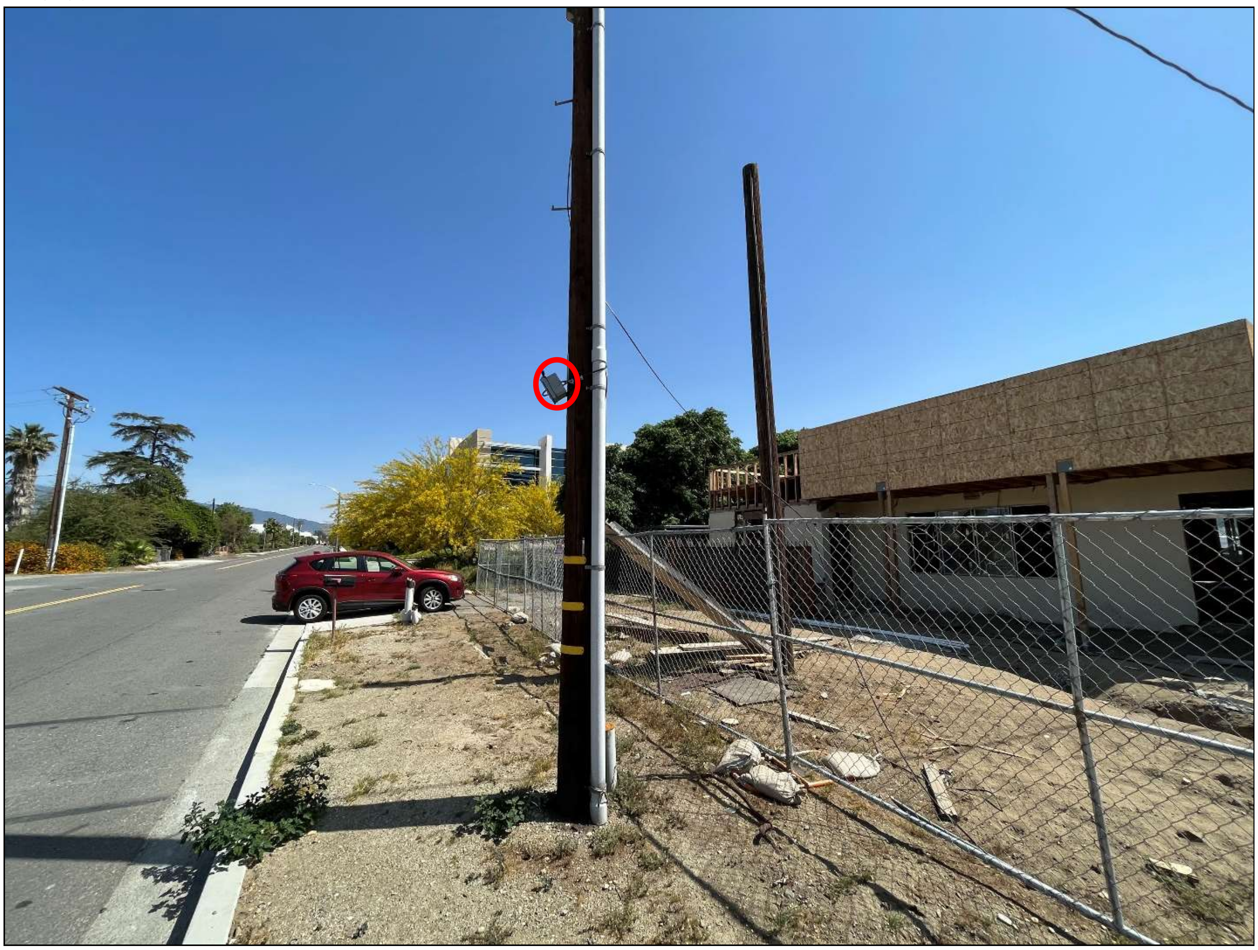
Time: From 11:00 a.m. To 11:00 a.m.

Site Location: Located on a power line pole in front of the property 11053 Catawba Ave. Closest pole on Catawba Ave.

Primary Noise Sources: Light traffic on Catawba Ave. Some heavy-duty truck traffic.

Comments: 11053 Catawba Ave was fenced off and undergoing construction/demolition. Pole closest to the road was the monitoring location due to the ongoing construction.

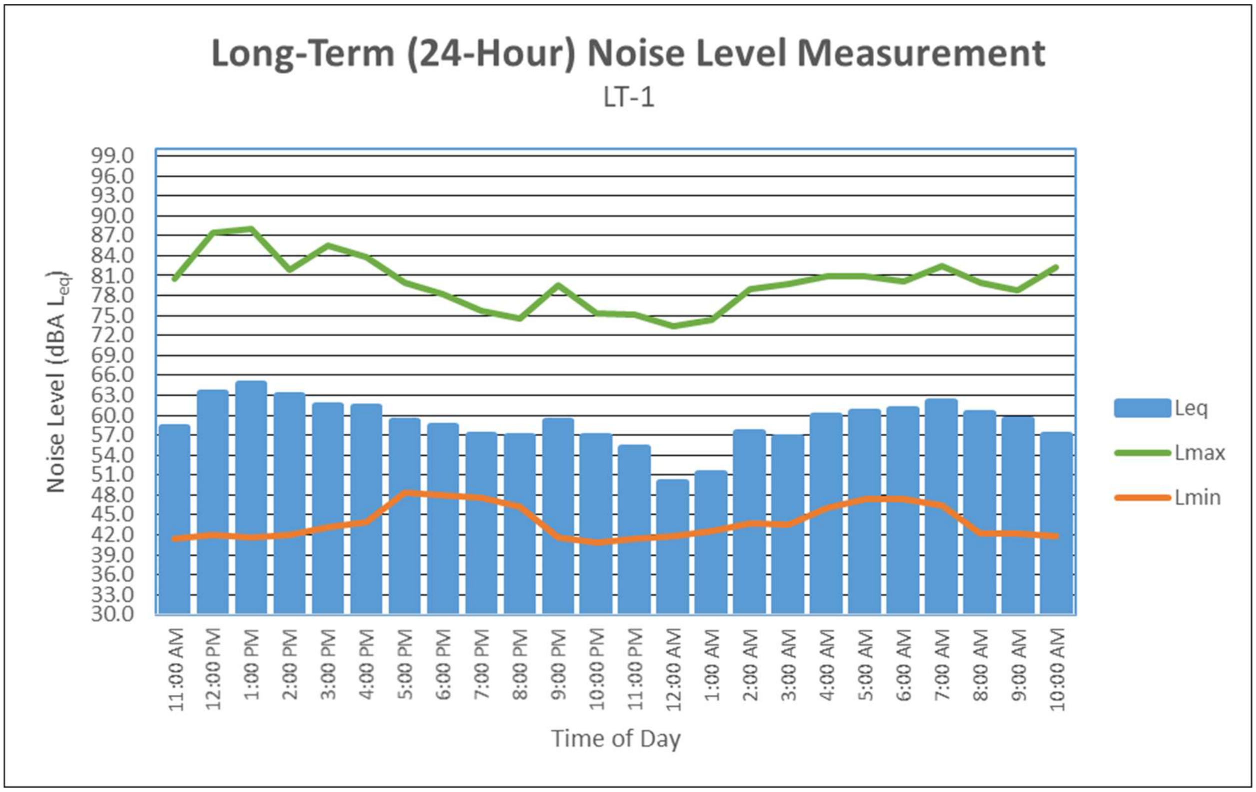
Photo:



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

Start Time	Date	Noise Level (dBA)		
		L_{eq}	L_{max}	L_{min}
11:00 AM	4/25/22	58.1	80.5	41.5
12:00 PM	4/25/22	63.4	87.5	42.0
1:00 PM	4/25/22	64.7	88.0	41.7
2:00 PM	4/25/22	62.9	81.8	42.1
3:00 PM	4/25/22	61.5	85.5	43.1
4:00 PM	4/25/22	61.2	83.8	44.0
5:00 PM	4/25/22	59.1	79.9	48.3
6:00 PM	4/25/22	58.4	78.3	47.9
7:00 PM	4/25/22	57.0	75.7	47.6
8:00 PM	4/25/22	56.9	74.6	46.3
9:00 PM	4/25/22	59.2	79.6	41.6
10:00 PM	4/25/22	56.8	75.4	40.9
11:00 PM	4/25/22	55.0	75.1	41.4
12:00 AM	4/26/22	49.9	73.3	41.8
1:00 AM	4/26/22	51.2	74.3	42.5
2:00 AM	4/26/22	57.3	78.9	43.8
3:00 AM	4/26/22	56.6	79.8	43.6
4:00 AM	4/26/22	59.9	80.9	46.1
5:00 AM	4/26/22	60.4	80.9	47.4
6:00 AM	4/26/22	60.9	80.2	47.4
7:00 AM	4/26/22	62.1	82.5	46.5
8:00 AM	4/26/22	60.3	80.0	42.2
9:00 AM	4/26/22	59.4	78.8	42.2
10:00 AM	4/26/22	57.0	82.2	41.8

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


Long-Term (24-Hour) Noise Level Measurement
LT-1
99.0
96.0
93.0
90.0
87.0
84.0
81.0
78.0
75.0
72.0
69.0
66.0
63.0
60.0
57.0
54.0
51.0
48.0
45.0
42.0
39.0
36.0
33.0
30.0
Noise Level (dBA Leq)
11:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
6:00 PM
7:00 PM
8:00 PM
9:00 PM
10:00 PM
11:00 PM
12:00 AM
1:00 AM
2:00 AM
3:00 AM
4:00 AM
5:00 AM
6:00 AM
7:00 AM
8:00 AM
9:00 AM
10:00 AM
Time of Day
Leq
Lmax
Lmin

Noise Measurement Survey – 24 HR

Project Number: ESL2201.19
Test Personnel: Kevin Nguyendo
Project Name: Catawba Avenue Industrial
Equipment: Spark 706RC (SN:18906)

Site Number: LT-2 Date: 4/25/22
Time: From 11:00 a.m. To 11:00 a.m.

Site Location: Located on opposite tree from original planned location. On a tree near the south east corner of Catawba Ave and Jurupa Ave intersection.

Primary Noise Sources: Dogs barking on the opposite side of Catawba Ave. Regular traffic on Jurupa Ave. and Catawba Ave.

Comments: Due to frequent barking by three dogs, LT2 was relocated to across the street. 5 foot and 6 inch retaining wall behind monitoring location.

Photo:

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

Start Time	Date	Noise Level (dBA)		
		L_{eq}	L_{max}	L_{min}
11:00 AM	4/25/22	66.3	81.2	43.4
12:00 PM	4/25/22	66.3	82.3	39.7
1:00 PM	4/25/22	66.5	80.0	39.6
2:00 PM	4/25/22	67.9	81.7	42.5
3:00 PM	4/25/22	68.5	81.9	43.6
4:00 PM	4/25/22	69.2	84.7	45.2
5:00 PM	4/25/22	68.9	85.7	46.1
6:00 PM	4/25/22	67.2	78.6	47.5
7:00 PM	4/25/22	65.9	84.9	45.0
8:00 PM	4/25/22	64.4	82.2	45.6
9:00 PM	4/25/22	63.9	82.1	41.5
10:00 PM	4/25/22	61.7	84.3	41.7
11:00 PM	4/25/22	60.1	75.4	42.4
12:00 AM	4/26/22	60.1	81.1	42.4
1:00 AM	4/26/22	58.1	78.4	41.9
2:00 AM	4/26/22	58.1	78.4	43.6
3:00 AM	4/26/22	59.1	81.3	43.2
4:00 AM	4/26/22	62.2	79.8	45.4
5:00 AM	4/26/22	64.0	79.5	47.8
6:00 AM	4/26/22	65.5	80.6	46.9
7:00 AM	4/26/22	68.0	81.1	47.0
8:00 AM	4/26/22	68.0	83.3	40.9
9:00 AM	4/26/22	66.1	80.0	40.6
10:00 AM	4/26/22	65.9	81.7	41.6

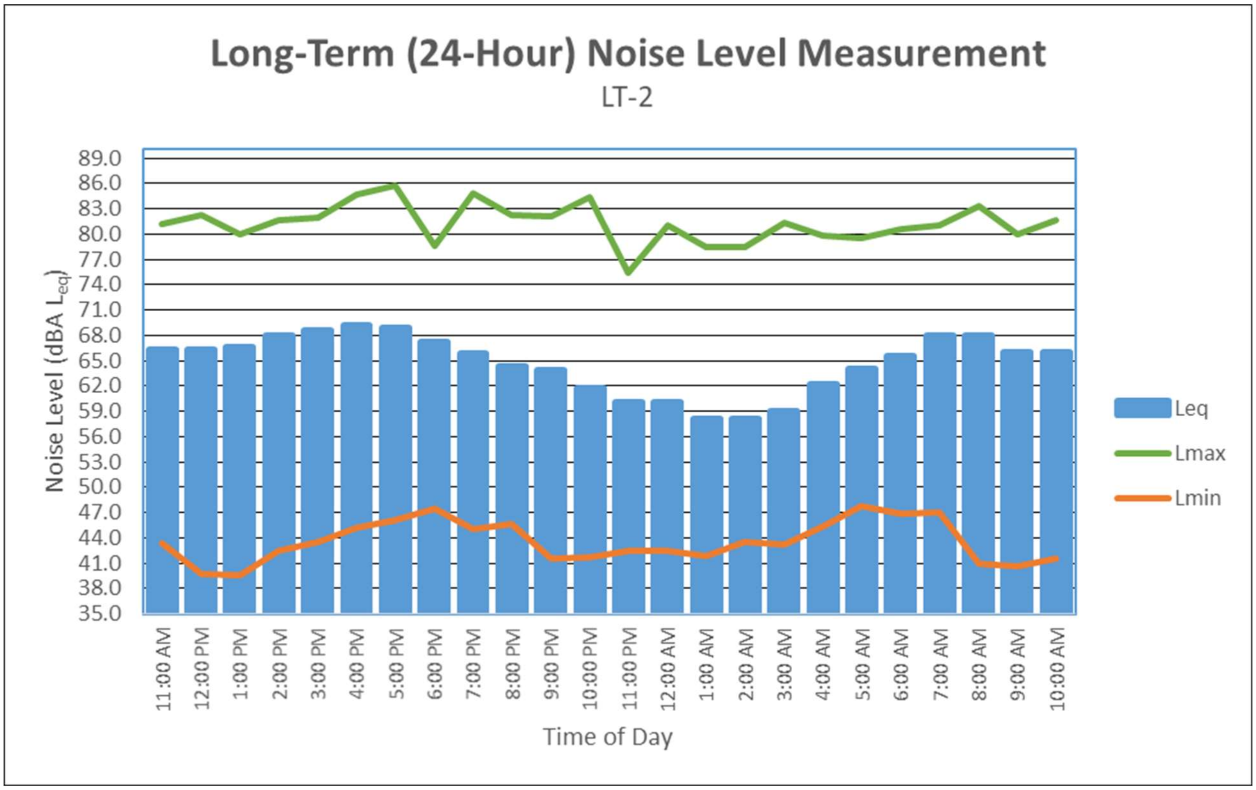
Source: Compiled by LSA Associates, Inc. (2022).

dBA = A-weighted decibel

L_{eq} = equivalent continuous sound level

L_{max} = maximum instantaneous noise level

L_{min} = minimum measured sound level


Long-Term (24-Hour) Noise Level Measurement
LT-2
Noise Level (dBA L_{eq})
89.0
86.0
83.0
80.0
77.0
74.0
71.0
68.0
65.0
62.0
59.0
56.0
53.0
50.0
47.0
44.0
41.0
38.0
35.0
11:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
6:00 PM
7:00 PM
8:00 PM
9:00 PM
10:00 PM
11:00 PM
12:00 AM
1:00 AM
2:00 AM
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4:00 AM
5:00 AM
6:00 AM
7:00 AM
8:00 AM
9:00 AM
10:00 AM
Time of Day
Leq
Lmax
Lmin

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 400 feet	**73**	**69**

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 400 feet	**68**	**70**
					Combined at Receptor 525 feet	**66**	**67**
					Combined at Receptor 740 feet	**63**	**64**
					Combined at Receptor 800 feet	**62**	**64**
					Combined at Receptor 1860 feet	**55**	**56**
					Combined at Receptor 1940 feet	**54**	**56**

Phase: Grading

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Leq
Excavator	2	81	40	50	0.5	81	80
Grader	1	85	40	50	0.5	85	81
Dozer	1	82	40	50	0.5	82	78
Scraper	2	84	40	50	0.5	84	83
Tractor	2	84	40	50	0.5	84	83
					Combined at 50 feet	**88**	**85**
					Combined at Receptor 400 feet	**70**	**67**

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	**87**	**86**
					Combined at Receptor 400 feet	**69**	**68**

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 400 feet	**69**	**68**

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 400 feet	**60**	**56**

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

Poplar South Distribution Center

Project No. ESL2201.19

Project Operational Noise Levels

C:\SoundPlan\ESL2201.19 - Catawba\Sheet1.sgs - last edit 1/17/2023