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MEMORANDUM

DATE: November 4, 2022

TO: Byron Walker, All-Era Properties, LLC

FROM: Jason Lui, Associate/Senior Noise Specialist

SUBJECT: Noise and Vibration Impact Analysis for the Linden Bloomington Condos Project in the Unincorporated Community of Bloomington, San Bernardino County, California (LSA Project No. APO2201)

INTRODUCTION

This noise and vibration impact analysis has been prepared to evaluate the potential noise and vibration impacts and reduction measures associated with the Linden Bloomington Condos Project (project) in the unincorporated community of Bloomington, San Bernardino County, California. This report is intended to satisfy the County of San Bernardino's (County) requirements and the California Environmental Quality Act (CEQA) for a project-specific noise and vibration impact analysis by examining the impacts of the proposed uses on the project site and evaluating the reduction measures that the project requires. All references cited in this memorandum are included in Attachment A.

Project Location

The project site spans four undeveloped parcels, Assessor's Parcel Numbers 0257-021-28, 0257-031-35, 0257-012-12, and 0257-021-02 encompassing approximately 12.87 acres in the unincorporated community of Bloomington, in southwestern San Bernardino County, and is located at 10719 Linden Avenue. Figure 1 shows the regional and project location (all figures are provided in Attachment B of this document).

Project Description

The project includes development of 180 condominiums. The project would include a 6-foot (ft) high perimeter wall. In addition, the project would not have to import or export soil during grading, and construction is expected to start in May 2023 and be completed by April 2027. Figure 2 shows the conceptual site plan.

CHARACTERISTICS OF SOUND

Sound is increasing to such disagreeable levels in the environment that it can threaten quality of life. 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 wave resulting in the tone's range from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment and 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 refers to how hard the sound wave strikes an object, which in turn produces the sound's effect. 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 through the A-weighted scale to correct for the relative frequency response of the human ear. That is, an A-weighted noise level deemphasizes 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, which is a scale based on powers of 10.

For example, 10 decibels 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 loudness of the sound. 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 dissipates exponentially with distance from the noise source. 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; however, line source noise in a relatively flat environment with absorptive vegetation decreases 4.5 dB for each doubling of distance.

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 (dBA). CNEL is the time-varying 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 evening hours. CNEL and L_{dn} are within 1 dBA of each other and are normally interchangeable.

Other noise rating scales of importance when assessing the annoyance factor include the maximum noise level (L_{max}), which is the highest exponential time-averaged 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 that refer to 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 noise levels higher than 85 dBA. Exposure to high noise levels affects the entire system, with prolonged noise 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 noise exposure above 90 dBA would result in permanent cell damage. When the noise level reaches 120 dBA, a tickling sensation occurs in the human ear, even with short-term exposure. This level of noise is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by the feeling of pain in the ear (the threshold of pain). A sound level of 160–165 dBA will result in dizziness or loss of equilibrium. The ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying, less developed area. Table A lists definitions of acoustical terms, and Table B shows common sound levels and their sources.

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 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

Table A: Definitions of Acoustical Terms

Term	Definitions
Decibel, dB	A unit of 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., number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter deemphasizes 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.
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 PM to 10:00 PM and after the addition of 10 dBA to sound levels occurring in the night between 10:00 PM and 7:00 AM.
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 PM and 7:00 AM.
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 at 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, and time of occurrence and tonal or informational content, as well as the prevailing ambient noise level.

Source: *Handbook of Acoustical Measurements and Noise Control* (Harris 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	—
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).

radiate sound waves. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 vibration velocity decibels (VdB) 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. 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 (see the Federal Transit Administration's [FTA] 2018 *Transit Noise and Vibration Impact Assessment Manual*). 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, both construction of a project and freight train operations on railroad tracks 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 cosmetic building damage, it is not uncommon for heavy duty construction processes (e.g., 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 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 Lv is the VdB, "V" is the RMS velocity amplitude, and "Vref" is the reference velocity amplitude, or 1×10^{-6} inches/second (in/sec) used in the United States.

REGULATORY SETTING

Federal Guidelines

Federal Transit Administration

Vibration standards included in the FTA's *Transit Noise and Vibration Impact Assessment Manual* (2018) are used in this analysis for ground-borne vibration impacts on human annoyance. Table C provides the criteria for assessing the potential for interference or annoyance from vibration levels in a building.

Table C: Interpretation of Vibration Criteria for Detailed Analysis

Land Use	Maximum 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 ⅓-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

The criteria for environmental impact from ground-borne vibration and noise are based on the maximum levels for a single event. Table D lists the potential vibration building damage criteria associated with construction activities, as suggested in the FTA's *Transit Noise and Vibration Impact Assessment Manual* (2018). These FTA guidelines show that a vibration level of up to 0.5 in/sec in PPV (FTA 2018) 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. For a fragile building, the construction vibration damage criterion is 0.12 PPV (in/sec).

Table D: Construction Vibration Damage Criteria

Building Category	PPV (in/sec)	Approximate L_V (VdB)[1]
Reinforced concrete, steel, or timber (no plaster)	0.50	102
Engineered concrete and masonry (no plaster)	0.30	98
Non-engineered timber and masonry buildings	0.20	94
Buildings extremely susceptible to vibration damage	0.12	90

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).

[1] RMS vibration velocity in decibels (VdB) re 1 µin/sec.

µin/sec = microinches per second
FTA = Federal Transit Administration
in/sec = inches per second
L_V = velocity in decibels
PPV = peak particle velocity
RMS = root-mean-square
VdB = vibration velocity decibels

Local Regulations

County of San Bernardino

Development Code. Section 83.01.080(c) of the County of San Bernardino Development Code establishes the noise standards for stationary noise sources that affect adjacent properties. Table E provides the County's noise standards based on the affected land use and the time period. The noise metric used for stationary sources is defined as noise levels that cannot be exceeded for certain percentages of time, or L_n.

Section 83.01.080(g)(3) of the County Code limits temporary construction, maintenance, repair, or demolition activities to between the hours of 7:00 a.m. and 7:00 p.m., except Sundays and federal holidays.

Section 83.01.090 of the County Code requires that no ground vibration shall be allowed that can be felt without the aid of instruments at or beyond the lot line, nor shall any vibration be allowed which produces a particle velocity greater than or equal to two-tenths (0.2) in/sec measured at or beyond the lot line. In addition, vibration generated from temporary construction, maintenance, repair, or demolition activities between 7:00 a.m. and 7:00 p.m. is exempt, except on Sundays and federal holidays.

Table E: County of San Bernardino Noise Level Standards

Affected Land Use (Receiving Noise)	Time Period	L_{50} (30 min)	L_{25} (15 min)	L_8 (5 min)	L_2 (1 min)	L_{max} (Anytime)
Residential	7:00 a.m. to 10:00 p.m.	55	60	65	70	75
	10:00 p.m. to 7:00 a.m.	45	50	55	60	65
Professional Services	Anytime	55	60	65	70	75
Other Commercial	Anytime	60	65	70	75	80
Industrial	Anytime	70	75	80	85	90

Source: County of San Bernardino, County Code (2021).
Note: If the measured ambient level exceeds any of the first four noise limit categories above, the allowable noise exposure standard shall be increased to reflect the ambient noise level. If the ambient noise level exceeds the fifth noise limit category above, the maximum allowable noise level under this category shall be increased to reflect the maximum ambient noise level.
dBA = A-weighted decibel
min = minutes
L_2 = The noise standard plus 15 dBA for a cumulative period of more than 1 minute in any hour.
L_8 = The noise standard plus 10 dBA for a cumulative period of more than 5 minutes in any hour.
L_{25} = The noise standard plus 5 dBA for a cumulative period of more than 15 minutes in any hour.
L_{50} = The noise standard plus up to 5 dBA for a cumulative period of more than 30 minutes in any hour.
L_{max} = The noise standard plus 20 dBA or the maximum measured ambient noise level for any period of time.

EXISTING SETTING

Sensitive Land Uses in the Project Vicinity

Existing land uses within the project area include residential uses, vacant/undeveloped land, and a drug and alcohol treatment (rehab) facility. Single-family residences surround the project site on all sides (north, east, south, and west). Vacant/undeveloped land is located east of the project site. The rehab facility is located southwest of the project site.

Overview of the Existing Noise Environment

The primary existing noise sources in the project area are transportation facilities. Traffic on Slover Avenue, Santa Ana Avenue, Linden Avenue, Cedar Avenue, Interstate 10 (I-10), and other local streets contribute to the ambient noise levels in the project vicinity. Noise from motor vehicles is generated by engines, the interaction between the tires and the road, and the vehicles' exhaust systems. In addition, train operations along the Union Pacific Railroad north of the project and aircraft noise from airports nearby contribute to the background ambient noise in the project vicinity.

Ambient Noise Measurements

Short-Term Noise Measurements

Short-term (20-minute) noise level measurements were conducted on February 16, 2022, using a Larson Davis Model 831 Type 1 sound level meter. Table F shows the results of the short-term noise level measurements along with a description of the measurement locations and noise sources that occurred during the measurement. As shown in Table F, the measured average noise levels on the project site range from 46.8 to 48.6 dBA L_{eq}, and the instantaneous maximum noise levels range from 63.8 to 67.6 dBA L_{max}. Figure 3, Noise Monitoring Locations, shows the short-term monitoring locations.

Table F: Short-Term Ambient Noise Level Measurements

Monitor No.	Location	Start Time	Noise Level (dBA)			Noise Source(s)
			L_{eq}	L_{max}	L_{min}	
ST-1	Western project boundary between properties of 10709 and 10731 Linden Avenue near chain-link fence.	9:46 a.m.	46.8	63.8	40.8	Very light traffic on Linden Avenue and Ash Street. Faint traffic noise on Cedar Avenue. Faint noise train braking.
ST-2	Eastern project boundary. On the western edge of the gravel road.	9:18 a.m.	48.6	67.6	42.5	Traffic on Cedar Avenue. Faint noise from trains braking to the northeast. Faint noise from roosters crowing at residences to the southwest, aircraft noise, and bird noise.

Source: Compiled by LSA (2022).

dBA = A-weighted decibel
L_{eq} = equivalent continuous sound level
L_{max} = maximum measured sound level
L_{min} = minimum measured sound level

Long-Term Noise Measurements

Two long-term (24-hour) noise level measurements were conducted from February 16, 2021, to February 17, 2021, using Larson Davis Spark 706RC dosimeters. Tables G and H show the hourly L_{eq}, L_{max}, and L_{min} results from the long-term noise level measurements. Table I summarizes the daytime and nighttime L_{eq} and L_{max} noise levels from the short-term and long-term noise level measurements as well as the calculated CNEL levels. The 24-hour noise levels at the short-term noise level measurement locations were calculated based on the noise level profile at the long-term noise level measurement LT-1. As shown in Table I, daytime noise levels range between 48.4 and 65.6 dBA L_{eq} and between 62.2 and 81.4 dBA L_{max}. The calculated CNEL levels range between 59.7 and 70.2 dBA CNEL. Figure 3 shows the long-term monitoring locations.

Existing Aircraft Noise

The nearest airports to the project site are the Flabob Airport, Riverside Municipal Airport, San Bernardino International Airport, and Ontario International Airport, which are located 4.8 miles south, 7.8 miles south, 8.6 miles east, and 10.5 miles west of the project site, respectively. Based on the Riverside County Airport Land Use Commission's (RCALUC) Land Use Compatibility Plan (RCALUC 2004), the project site is outside the 55 dBA CNEL noise contours of Flabob Airport and Riverside Municipal Airport. Based on the LA/Ontario International Airport Land Use Compatibility Plan (City of Ontario 2011) and draft Environmental Impact Report for the San Bernardino Countywide Plan (County of San Bernardino 2019), the project site is outside the 60 dBA CNEL noise contours of San Bernardino International Airport and Ontario International Airport, respectively. Additionally, there are no private airstrips located within the vicinity of the project site.

Existing Traffic Noise

The guidelines included in the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (1977; FHWA RD-77-108) were used to evaluate highway traffic-related noise conditions along roadway segments in the project vicinity. This model requires various parameters, including traffic volumes, vehicle mix, vehicle speed, and roadway geometry to compute typical equivalent noise levels during daytime, evening, and nighttime hours. The resultant noise levels are weighted and summed over 24-hour periods to determine the CNEL values.

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

	Hour	Date	Noise Level (dBA)		
			L_{eq}	L_{max}	L_{min}
1	9:00 AM	2/16/22	55.4	70.1	44.0
2	10:00 AM	2/16/22	55.6	79.0	43.1
3	11:00 AM	2/16/22	56.1	76.4	43.3
4	12:00 PM	2/16/22	55.4	72.9	45.1
5	1:00 PM	2/16/22	60.8	75.1	46.1
6	2:00 PM	2/16/22	59.6	81.4	46.0
7	3:00 PM	2/16/22	57.0	78.9	47.5
8	4:00 PM	2/16/22	57.0	71.0	49.6
9	5:00 PM	2/16/22	57.7	73.8	50.2
10	6:00 PM	2/16/22	55.9	68.5	49.8
11	7:00 PM	2/16/22	56.4	71.7	46.6
12	8:00 PM	2/16/22	54.7	74.5	42.7
13	9:00 PM	2/16/22	55.0	70.7	42.3
14	10:00 PM	2/16/22	56.8	78.2	43.8
15	11:00 PM	2/16/22	56.0	72.1	46.5
16	12:00 AM	2/16/22	55.7	74.1	47.9
17	1:00 AM	2/17/22	56.7	72.1	48.3
18	2:00 AM	2/17/22	--[1]	--	--
19	3:00 AM	2/17/22	--	--	--
20	4:00 AM	2/17/22	--	--	--
21	5:00 AM	2/17/22	--	--	--
22	6:00 AM	2/17/22	--	--	--
23	7:00 AM	2/17/22	--	--	--
24	8:00 AM	2/17/22	--	--	--

Source: Compiled by LSA (2022).

[1] Noise levels not shown due to noise contamination from high wind speeds.

dBA = A-weighted decibels

L_{eq} = equivalent continuous sound level

L_{max} = maximum instantaneous noise level

L_{min} = minimum instantaneous noise level

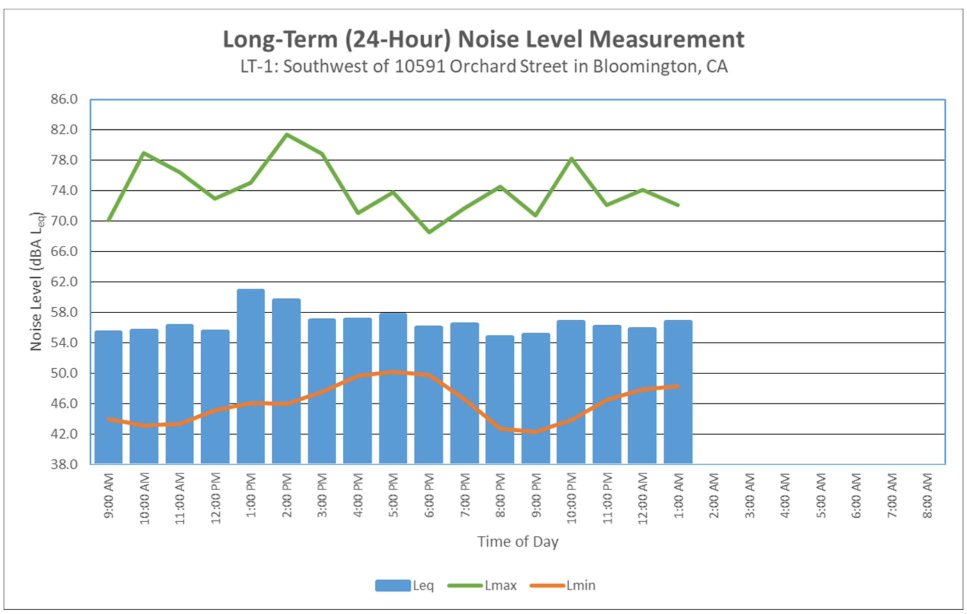


Table H: Long-Term (24-Hour) Noise Level Measurement Results at LT-2

	Hour	Date	Noise Level (dBA)		
			L_{eq}	L_{max}	L_{min}
1	9:00 AM	2/16/22	59.4	74.0	51.4
2	10:00 AM	2/16/22	59.8	80.9	51.3
3	11:00 AM	2/16/22	58.8	74.4	51.3
4	12:00 PM	2/16/22	59.2	79.1	51.1
5	1:00 PM	2/16/22	60.2	79.1	51.9
6	2:00 PM	2/16/22	59.5	75.0	51.7
7	3:00 PM	2/16/22	59.9	71.8	52.9
8	4:00 PM	2/16/22	60.8	75.6	52.7
9	5:00 PM	2/16/22	59.7	74.9	52.0
10	6:00 PM	2/16/22	59.2	79.0	49.7
11	7:00 PM	2/16/22	59.4	76.0	48.9
12	8:00 PM	2/16/22	58.1	75.7	47.7
13	9:00 PM	2/16/22	59.5	72.4	47.7
14	10:00 PM	2/16/22	59.8	78.0	48.6
15	11:00 PM	2/16/22	59.0	78.2	48.7
16	12:00 AM	2/16/22	58.6	70.3	48.5
17	1:00 AM	2/17/22	59.7	73.9	49.1
18	2:00 AM	2/17/22	--[1]	--	--
19	3:00 AM	2/17/22	--	--	--
20	4:00 AM	2/17/22	--	--	--
21	5:00 AM	2/17/22	--	--	--
22	6:00 AM	2/17/22	--	--	--
23	7:00 AM	2/17/22	--	--	--
24	8:00 AM	2/17/22	--	--	--

Source: Compiled by LSA (2022).

[1] Noise levels not shown due to noise contamination from high wind speeds.

dBA = A-weighted decibels

L_{eq} = equivalent continuous sound level

L_{max} = maximum instantaneous noise level

L_{min} = minimum instantaneous noise level

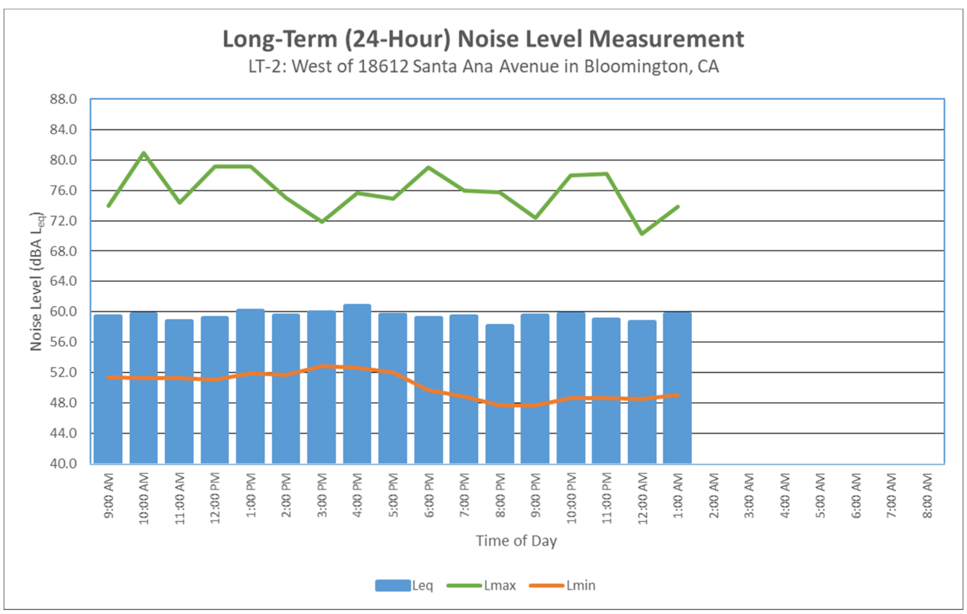


Table I: Long-Term Ambient Noise Monitoring Results

Monitor No.	Location	Noise Level (dBA)				Noise Sources
		Daytime[1]		Nighttime[2]		
		L_{eq}	L_{max}	L_{eq}	L_{max}	
LT-1	Southwest of 10591 Orchard Street. At the north edge of the project site on a tree.	54.7-60.8	68.5-81.4	55.7-56.8	72.1-78.2	Very light traffic on Linden Avenue and Ash Street. Faint traffic on Cedar Avenue. Faint train braking noise.
LT-2	West of 18612 Santa Ana Avenue. On utility pole approximately 400 ft north of the centerline for Santa Ana Avenue.	58.1-60.8	71.8-80.9	58.6-59.8	70.3-78.2	Traffic on Cedar Avenue and Santa Ana Avenue. HVAC noise at 18612 Santa Ana Avenue. Faint noise from trains braking to the northeast, faint aircraft noise, and bird noise.
ST-1[3]	Western project boundary between properties of 10709 and 10731 Linden Avenue near chain-link fence.	46.6-52.7	60.4-73.3	47.6-48.7	64.0-70.1	Very light traffic on Linden Avenue and Ash Street. Faint traffic noise on Cedar Avenue. Faint train braking noise.
ST-2[3]	Eastern project boundary. On the western edge of the gravel road.	50.6-56.7	64.4-77.3	51.6-52.7	68.0-74.1	Traffic on Cedar Avenue. Faint noise from trains braking to the northeast. Faint noise from roosters crowing at residences to the southwest, aircraft noise, and bird noise.

Source: Compiled by LSA (2022).

Note: Long-term (24-hour) noise level measurements were conducted from February 16, 2022, to February 17, 2022.

[1] The daytime noise level range are based on the hours between 9:00 a.m. and 10:00 p.m. due to noise contamination from high wind speeds for the remaining hours of the long-term noise level measurement.

[2] The nighttime noise level range are based on the hours between 10:00 p.m. and 2:00 a.m. due to noise contamination from high wind speeds for the remaining hours of the long-term noise level measurement.

[3] Noise levels were calculated based on the long-term noise level measurement at LT-1.

CNEL = Community Noise Equivalent Level
dBA = A-weighted decibels
ft = foot/feet
HVAC = heating, ventilation, and air conditioning
L_{eq} = equivalent continuous sound level
L_{max} = maximum instantaneous noise level

The existing (2022) average daily traffic (ADT) volumes were derived from traffic counts. The standard vehicle mix for southern California roadways were used for traffic on these roadway segments. Table J provides the existing traffic noise levels in the project vicinity. These noise levels represent the worst-case scenario, which assumes that no shielding is provided between the traffic and the location where the noise contours are drawn. Attachment C provides the specific assumptions used in developing these noise levels and model printouts.

Table J shows that traffic noise levels along Linden Avenue and Santa Ana Avenue are low whereas traffic noise levels along Slover Avenue are high. Also, Table J shows that the 70, 65, and 60 dBA CNEL impact zones along Slover Avenue extend up to 60 ft, 120 ft, and 254 ft, respectively, from the roadway centerline.

Table J: Existing (2021) Traffic Noise Levels

Roadway Segment	ADT	Centerline to 70 dBA CNEL (ft)	Centerline to 65 dBA CNEL (ft)	Centerline to 60 dBA CNEL (ft)	CNEL (dBA) 50 ft from Centerline of Outermost Lane
Linden Avenue between Slover Avenue and Ash Street	3,061	< 50	< 50	< 50	55.6
Linden Avenue between Ash Street and Santa Ana Avenue	2,979	< 50	< 50	< 50	55.5
Slover Avenue between Maple Avenue and Linden Avenue	15,306	60	120	254	68.4
Slover Avenue between Linden Avenue and Orchard Street (South Branch)	11,639	< 50	101	212	67.2
Slover Avenue between Orchard Street (South Branch) and Valencia Street	11,344	< 50	99	209	67.1
Santa Ana Avenue between Maple Avenue and Linden Avenue	6,327	< 50	< 50	97	63.6
Santa Ana Avenue between Linden Avenue and Cedar Avenue	6,004	< 50	< 50	94	63.4

Source: Compiled by LSA (2022).
Note: Traffic noise within 50 ft of the roadway centerline should be evaluated with site-specific information.

ADT = average daily traffic
CNEL = Community Noise Equivalent Level
dBA = A-weighted decibels
ft = foot/feet

IMPACTS

Short-Term Construction Noise Impacts

Two types of short-term noise impacts would occur during project construction. The first type would be from construction crew commutes and the transport of construction equipment and materials to the project site and would incrementally raise noise levels on roadways leading to the site. The pieces of construction equipment for construction activities would move on site, would remain for the duration of each construction phase, and would not add to the daily traffic volume in the project vicinity. 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 a maximum of 84 dBA), the effect on longer-term ambient noise levels would be small because the number of daily construction-related vehicle trips would be small compared to the existing daily traffic volume on Slover Avenue, Santa Ana Avenue, Linden Avenue, and Cedar Avenue. The building construction phase would generate the most trips out of all of the construction phases, at 172 trips per day based on the California Emissions Estimator Model (Version 2020.4.0) results contained in Attachment C of the *Linden Bloomington Condos Project Air Quality, Greenhouse Gas Emissions, and Energy Analysis Memorandum* (LSA 2022b). Roadways that would be used to access the project site are Linen Avenue, Slover Avenue, and Santa Ana Avenue. Based on Table J, Linden Avenue, Slover Avenue, and Santa Ana Avenue have estimated existing average daily traffic (ADT) volumes of 2,979, 11,344, and 6,004, respectively, near the project site. Based on the information above, construction-related traffic would increase noise by up to 0.2 dBA. A noise level increase of less than 3 dBA would not be perceptible to the human ear in an outdoor environment. Therefore, no short-term, construction-related impacts associated with worker commutes and transport of construction equipment and material to the project site would occur, and no noise reduction measures would be required.

The second type of short-term noise impact is related noise generated from construction activities. The proposed project anticipates site preparation, grading, building construction, paving, and architectural coating phases of construction. Construction is performed in discrete steps, each of which has its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases change the character of the noise generated on a project site. Therefore, the noise levels vary 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 K lists the L_{max} recommended for noise impact assessments for typical construction equipment included in the FHWA *Highway Construction Noise Handbook* (FHWA 2006), based on a distance of 50 ft between the equipment and a noise receptor.

Typical noise levels range up to 88 dBA L_{max} at 50 ft during the noisiest construction phases. The demolition, site preparation, and grading phase tends to generate the highest noise levels because the noisiest construction equipment is earthmoving equipment. Earthmoving equipment includes excavating machinery such as backfillers, bulldozers, draglines, and front-end loaders. Earthmoving and compacting equipment includes compactors, scrapers, and graders.

Project construction is expected to require the use of graders, bulldozers, and water trucks/pickup trucks. Noise associated with the use of each type of construction equipment for the site preparation phase is estimated to be between 55 dBA L_{max} and 85 dBA L_{max} at a distance of 50 ft from the active construction area. As shown in Table K, the maximum noise level generated by each grader is assumed to be approximately 85 dBA L_{max} at 50 ft. Each bulldozer would generate approximately 85 dBA L_{max} at 50 ft. The maximum noise level generated by water trucks/pickup trucks is approximately 55 dBA L_{max} at 50 ft from these vehicles. Each doubling of the sound sources with equal strength increases the noise level by 3 dBA. Assuming that each piece of construction equipment operates at some distance from the other equipment, the worst-case combined noise level during this phase of construction would be 88 dBA L_{max} at a distance of 50 ft from the active construction area. Based on a usage factor of 40 percent, the worst-case combined noise level during this phase of construction would be 84 dBA L_{eq} at a distance of 50 ft from the active construction area.

The closest residential property line is within 50 ft of the project construction boundary and may be subject to short-term construction noise reaching 88 dBA L_{max} (84 dBA L_{eq}) or higher generated by construction activities in the project area. Daytime ambient noise levels in the project vicinity range between 46.6 and 60.8 dBA L_{eq} and 60.4 and 81.4 dBA L_{max} based on short-term and long-term noise level measurements shown in Table I. Although noise generated by project construction activities would be higher than the ambient noise levels and would result in a temporary increase in the ambient noise levels, construction noise would stop once project construction is completed.

Table K: Typical Construction Equipment Noise Levels

Equipment Description	Acoustical Usage Factor[1] (%)	Maximum Noise Level (L_{max}) at 50 ft[2]
Backhoe	40	80
Compactor (ground)	20	80
Compressor	40	80
Crane	16	85
Dozer	40	85
Dump Truck	40	84
Excavator	40	85
Flatbed Truck	40	84
Forklift	20	85
Front-End Loader	40	80
Grader	40	85
Impact Pile Driver	20	95
Jackhammer	20	85
Pavement Scarifier	20	85
Paver	50	85
Pickup Truck	40	55
Pneumatic Tools	50	85
Pump	50	77
Rock Drill	20	85
Roller	20	85
Scraper	40	85
Tractor	40	84
Welder	40	73

Source: Table 9.1, *FHWA Highway Construction Noise Handbook* (FHWA 2006).

Note: The 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 CA/T program to be consistent with the City of Boston, Massachusetts, Noise Code for the “Big Dig” project.

CA/T = Central Artery/Tunnel
FHWA = Federal Highway Administration
ft = foot/feet
L_{max} = maximum instantaneous noise level

Implementation of the standard conditions for construction, which include compliance with the construction hours specified in Section 83.01.080(g)(3) of the County Code, would minimize construction noise. Therefore, no noise impacts from construction activities would occur. No noise reduction measures are required.

- The construction contractor shall limit construction activities to between the hours of 7:00 a.m. and 7:00 p.m. on weekdays and Saturdays. Construction is prohibited outside these hours or at any time on Sundays and federal holidays.

- During all project site excavation and grading, the project contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers consistent with manufacturers' standards.
- The construction contractor shall locate equipment staging in areas that will create the greatest distance between construction-related noise sources and most noise-sensitive receptors nearest the project site during all project construction.
- The construction contractor shall place all stationary construction equipment so that the emitted noise is directed away from the sensitive receptors nearest the project site.

Short-Term Construction Vibration Impacts

Although vibration levels generated from short-term construction are exempted from Section 83.01.090 of the County Code (County of San Bernardino 2021), vibration levels generated from short-term construction were evaluated for the level of human annoyance and potential for building damage. This construction vibration impact analysis discusses the level of human annoyance using vibration levels in VdB and assesses the potential for building damage using vibration levels in PPV (in/sec). Vibration levels calculated in RMS are best for characterizing human response to building vibration, whereas vibration levels in PPV are best for characterizing damage potential. As shown in Table D, the FTA guidelines indicate that a vibration level up to 102 VdB (equivalent to 0.5 PPV [in/sec]) is considered safe for buildings consisting of reinforced concrete, steel, or timber (no plaster), and would not result in any construction vibration damage (FTA 2018). For a non-engineered timber and masonry building, the construction vibration damage criterion is 94 VdB (0.2 PPV [in/sec]). For a fragile building, the construction vibration damage criterion is 90 VdB (0.12 PPV [in/sec]).

Table L shows the reference vibration levels at a distance of 25 ft for each type of standard construction equipment from the FTA's *Transit Noise and Vibration Impact Assessment Manual* (2018). Outdoor site preparation and grading for the proposed project would require the use of a large bulldozer and loaded trucks, which would generate ground-borne vibration of up to 87 VdB (0.089 PPV [in/sec]) and 86 VdB (0.076 PPV [in/sec]), respectively, when measured at 25 ft.

The formulas for vibration transmission are provided below.

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

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

The greatest vibration levels are anticipated to occur during the site preparation and grading phases. All other phases are expected to result in lower vibration levels. The distance to the nearest buildings for vibration impact analysis is measured between the nearest off-site buildings and the project boundary (assuming the construction equipment would be used at or near the project boundary), because vibration impacts normally occur within the buildings.

Table L: 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

Sources: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018), Table 7-4.

[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 = micro-inches per second
ft = foot/feet
FTA = Federal Transit Administration
in/sec = inches per second
L_V = velocity in decibels
PPV = peak particle velocity
RMS = root-mean-square
VdB = vibration velocity decibels

Table M lists the projected vibration levels from various construction equipment expected to be used on the project site in the active construction area to the closest buildings in the project vicinity. As shown in Table M, the closest residential buildings east and west of the project site are located approximately 60 ft from the active construction area and would experience vibration levels of up to 76 VdB. This vibration level would not have the potential to result in community annoyance because vibration levels would not exceed the FTA's community annoyance threshold of 78 VdB for daytime residences. It should be noted that the rehab facility was evaluated using the FTA community annoyance for daytime residence because the rehab facility would have similar sensitivity to vibration. Other building structures that surround the project site would experience lower vibration levels because they are farther away.

Similar to Table N lists the projected vibration levels from various construction equipment expected to be used on the project site at the project construction boundary to the nearest buildings in the project vicinity. As shown in Table N, the closest residential buildings east and west of the project site are located approximately 5 ft from the project construction boundary and would experience vibration levels of up to 0.995 PPV [in/sec]. This vibration level would have the potential to cause building damage because residential structures are constructed of non-engineered timber and masonry and vibration levels would exceed the FTA vibration damage threshold of 0.2 PPV (in/sec). The implementation of vibration reduction measures to restrict heavy construction equipment (e.g., large bulldozers and loaded trucks) or require the use of light construction equipment (e.g., small bulldozers and pick-up trucks) within 15 ft of the eastern and western project construction boundary would reduce construction vibration levels to 0.191 PPV (in/sec).

Other nearby structures surrounding the project site, including other residential structures and the rehab facility, are farther away and would experience a vibration level of up to 191 PPV [in/sec]. This vibration level would not have the potential to cause building damage because residential structures and the rehab facility would be constructed of non-engineered timber and masonry or better and vibration levels would not exceed the FTA vibration damage threshold of 0.2 PPV (in/sec). Therefore, no vibration impacts from project construction activities would occur with the implementation of vibration reduction measures.

Table M: Potential Construction Vibration Annoyance

Land Use	Direction	Equipment/ Activity	Reference Vibration Level (VdB) at 25 ft	Distance to Structure (ft)[1]	Vibration Level (VdB)
Residential	North	Large bulldozers	87	75	73
		Loaded trucks	86	75	72
Residential	East	Large bulldozers	87	60	76
		Loaded trucks	86	60	75
Rehab	Southeast	Large bulldozers	87	235	58
		Loaded trucks	86	235	57
Residential	South	Large bulldozers	87	545	47
		Loaded trucks	86	545	46
Residential	West	Large bulldozers	87	60	76
		Loaded trucks	86	60	75

Source: Compiled by LSA (2022).

Note: The FTA-recommended annoyance threshold of 78 VdB for residential homes was used to assess potential construction vibration annoyance.

[1] Distance from the active construction area near the center of the project site to the building structure.

ft = foot/feet

VdB = vibration velocity decibels

FTA = Federal Transit Administration

Table N: Potential Construction Vibration Damage

Land Use	Direction	Equipment/ Activity	Reference Vibration Level at 25 ft		Distance to Structure (ft)	Maximum Vibration Level	
			VdB	PPV (in/sec)		VdB	PPV (in/sec)
Residential	North	Large Bulldozer	87	0.089	15	94	0.191
		Loaded Truck	86	0.076	15	93	0.164
Residential	East	Large Bulldozer	87	0.089	5	108	0.995
		Loaded Truck	86	0.076	5	107	0.850
Rehab	Southeast	Large Bulldozer	87	0.089	155	63	0.006
		Loaded Truck	86	0.076	155	62	0.005
Residential	South	Large Bulldozer	87	0.089	480	49	0.001
		Loaded Truck	86	0.076	480	48	0.001
Residential	West	Large Bulldozer	87	0.089	5	108	0.995
		Loaded Truck	86	0.076	5	107	0.850

Source: Compiled by LSA (2022).

Note: The FTA-recommended building damage threshold is 0.2 PPV (in/sec) at the receiving residential building structures.

ft = foot/feet

FTA = Federal Transit Administration

in/sec = inches per second

PPV = peak particle velocity

VdB = vibration velocity decibels

Long-Term Aircraft Noise Impacts

Based on the Riverside County Airport Land Use Compatibility Plan (RCALUC 2004), the project site is outside the 55 dBA CNEL noise contours of Flabob Airport and Riverside Municipal Airport. Based on the LA/Ontario International Airport Land Use Compatibility Plan (City of Ontario 2011) and draft Environmental Impact Report for the San Bernardino Countywide Plan (County of San Bernardino 2019), the project site is outside the 60 dBA CNEL noise contours of San Bernardino International Airport and Ontario International Airport, respectively. Additionally, there are no private airstrips located within the vicinity of the project site. Therefore, the proposed project would not expose people residing or working in the project area to excessive noise levels.

Long-Term Traffic Noise Impacts

The guidelines included in the *FHWA Highway Traffic Noise Prediction Model* (1977; FHWA RD-77-108) were used to evaluate highway traffic-related noise conditions along roadway segments in the project vicinity. This model requires various parameters, including traffic volumes, vehicle mix, vehicle speed, and roadway geometry to compute typical equivalent noise levels during daytime, evening, and nighttime hours. The resultant noise levels are weighted and summed over 24-hour periods to determine the CNEL values. The existing (2022) ADT volumes were derived from traffic counts and the existing (2022) with project ADT volumes were derived from the project's *Trip Generation Analysis and CEQA Assessment Memorandum* (LSA 2022a) and traffic counts. The standard vehicle mix for Southern California roadways was used for traffic on these roadway segments. Table N shows the existing (2022) traffic noise levels without and with the project along roadways in the project vicinity. These noise levels represent the worst-case scenario, which assumes that no shielding is provided between the traffic and the location where the noise contours are drawn. Attachment C provides the specific assumptions used in developing these noise levels and model printouts.

Table N shows that project-related traffic would increase noise by up to 0.5 dBA in the project vicinity. The noise level increase is less than 3 dBA and would not be perceptible to the human ear in an outdoor environment. Therefore, no traffic noise impacts from project-related traffic on off-site sensitive receptors would occur. No noise reduction measures are required.

Long-Term Stationary Noise Impacts

Heating, ventilation, and air conditioning (HVAC) equipment associated with the project would potentially affect the existing off-site sensitive land uses. The following provides a detailed noise analysis and discussion of the project's on-site HVAC equipment.

HVAC Equipment

The proposed project would include on-site ground-floor HVAC units for each residence that could potentially operate 24 hours per day. Each HVAC unit would generate a sound power level (SPL) of 73.0 dBA, which would be equivalent to 41.4 dBA at 50 ft. It is assumed that off-site properties adjacent to the proposed project site would be exposed up to 3 HVAC units as a worst-case scenario, which would reach a noise level of 46.2 dBA L_{eq} at 50 ft. Also, the proposed on-site ground floor HVAC equipment would be shielded by the proposed 6 ft high perimeter wall, which would provide a minimum noise reduction of 5 dBA.

Table N: Existing Traffic Noise Levels Without and With Project

Roadway Segment	Without Project Traffic Conditions					With Project Traffic Conditions					
	ADT	Centerline to 70 dBA CNEL (ft)	Centerline to 65 dBA CNEL (ft)	Centerline to 60 dBA CNEL (ft)	CNEL (dBA) 50 ft from Centerline of Outermost Lane	ADT	Centerline to 70 dBA CNEL (ft)	Centerline to 65 dBA CNEL (ft)	Centerline to 60 dBA CNEL (ft)	CNEL (dBA) 50 ft from Centerline of Outermost Lane	Increase from Without Project Conditions (dBA)
Linden Avenue between Slover Avenue and Ash Street	3,061	< 50	< 50	< 50	55.6	3,485	< 50	< 50	< 50	56.1	0.5
Linden Avenue between Ash Street and Santa Ana Avenue	2,979	< 50	< 50	< 50	55.5	3,283	< 50	< 50	< 50	55.9	0.4
Slover Avenue between Maple Avenue and Linden Avenue	15,306	60	120	254	68.4	15,670	60	122	258	68.5	0.1
Slover Avenue between Linden Avenue and Orchard Street (South Branch)	11,639	< 50	101	212	67.2	11,943	< 50	102	216	67.3	0.1
Slover Avenue between Orchard Street (South Branch) and Valencia Street	11,344	< 50	99	209	67.1	11,890	< 50	102	215	67.3	0.2
Santa Ana Avenue between Maple Avenue and Linden Avenue	6,327	< 50	< 50	97	63.6	6,449	< 50	< 50	99	63.7	0.1
Santa Ana Avenue between Linden Avenue and Cedar Avenue	6,004	< 50	< 50	94	63.4	6,126	< 50	< 50	95	63.5	0.1

Source: Compiled by LSA (2022).

Note: Traffic noise within 50 ft of the roadway centerline should be evaluated with site-specific information.

ADT = average daily traffic
CNEL = Community Noise Equivalent Level
dBA = A-weighted decibels
ft = foot/feet

Table O shows the noise levels generated from three HVAC units operating simultaneously at the property lines of adjacent land uses surrounding the project site along with the distance from the HVAC equipment to the property line, distance attenuation, shielding from the proposed 6 ft high perimeter wall, the average daytime and nighttime ambient noise levels, and the daytime and nighttime ambient noise level increases from the proposed on-site HVAC units. As shown in Table O, noise levels generated from on-site HVAC units would not exceed the County's exterior daytime (7:00 a.m. to 10:00 p.m.) 30-minute (L_{50}) noise standard of 55 dBA for residential land uses surrounding the project site. The rehab facility located southeast of the project site was evaluated as a residential land use because this facility includes patients that live on site and would have similar sensitivity to noise. In addition, noise generated from on-site HVAC units would not exceed the County's exterior nighttime (10:00 p.m. to 7:00 a.m.) 30-minute (L_{50}) noise standard of 45 dBA for the rehab facility southeast of the project site. Residential uses north, east, south, and west of the project site would exceed the County's exterior nighttime (10:00 p.m. to 7:00 a.m.) 30-minute (L_{50}) noise standard of 45 dBA. However, noise generated from on-site HVAC units would increase ambient noise levels by up to 2.5 dBA during nighttime hours. This increase in noise would be less than 3 dBA, which is not perceptible to the human ear in an outdoor environment and the increase in ambient noise level would not be considered substantial. Therefore, no off-site noise impacts from on-site HVAC equipment would occur. No noise reduction measures are required.

Table O: HVAC Noise Levels

Land Use	Direction	Reference Noise Level at 50 ft (dBA L_{eq})	Distance from Source to Off-Site Property Line (ft)	Distance Attenuation (dBA)	Shielding[1] (dBA)	Exterior Noise Level (dBA L_{eq})	Average Daytime/ Nighttime Ambient Noise Level[2] (dBA L_{eq})	Daytime/ Nighttime Ambient Noise Level Increase (dBA)
Residential	North	46.2	25	-6.0	5	47.2	57.1/56.3	0.4/0.5
Residential	East	46.2	20	-8.0	5	49.1	53.0/52.2	1.5/1.7
Rehab	Southeast	46.2	50	0.0	5	41.2	59.5/59.3	0.1/0.1
Residential	South	46.2	25	-6.0	5	47.2	59.5/59.3	0.2/0.3
Residential	West	46.2	25	-6.0	5	47.2	49.0/48.2	2.2/2.5

Source: Compiled by LSA (2022).

1 The proposed on-site ground floor HVAC equipment would be shielded by the proposed 6 ft high perimeter wall, which would provide a minimum noise reduction of 5 dBA.

2 The average daytime ambient noise level was calculated based on the hours between 9:00 a.m. and 10:00 p.m. and the average nighttime ambient noise level was calculated based on the hours between 10:00 p.m. and 2:00 a.m.

dBA = A-weighted decibels

ft = foot/feet

HVAC = heating, ventilation, and air conditioning

L_{eq} = equivalent continuous sound level

Long-Term Vibration Impacts

The proposed project would not generate vibration. In addition, vibration levels generated from project-related traffic on the adjacent roadways (Linden Avenue, Santa Ana Avenue, and Slover Avenue) are unusual for on-road vehicles because the rubber tires and suspension systems of on-road vehicles provide vibration isolation. Therefore, no vibration impacts from project-related operations would occur, and no vibration reduction measures are required.

STANDARD CONDITIONS

The following measures would further minimize construction noise:

- The construction contractor shall limit construction activities to between the hours of 7:00 a.m. and 7:00 p.m. on weekdays and on Saturdays. Construction is prohibited outside these hours or at any time on Sundays and federal holidays.

- During all project site excavation and grading, the project contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers consistent with manufacturers' standards.

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

- The construction contractor shall place all stationary construction equipment so that the emitted noise is directed away from the sensitive receptors nearest the project site.

REDUCTION MEASURES

Short-Term Construction Noise Impacts

No noise reduction measures are required.

Short-Term Construction Vibration Impacts

The following measure would reduce short-term construction-related vibration impacts resulting from the proposed project:

- The construction contractor shall restrict heavy construction (e.g., large bulldozers and loaded trucks) or require the use of light construction equipment (e.g., small bulldozers and pick-up trucks) within 15 ft of the west project construction boundary.

Aircraft Noise Impacts

No noise reduction measures are required.

Traffic Noise Impacts

No noise reduction measures are required.

Long-Term Stationary Noise Impacts

No noise reduction measures are required.

Long-Term Vibration Impacts

No vibration reduction measures are required.

ATTACHMENTS

A: References
B: Figures
C: FHWA Traffic Noise Model Printouts

ATTACHMENT A

REFERENCES

City of Ontario. 2011. *Ontario International Airport Land Use Compatibility Plan*, April 19. Website: https://www.ontarioplan.org/alucp-for-ontario-international-airport/ (accessed March 2022).

County of San Bernardino. 2019. Draft Environmental Impact Report for the San Bernardino Countywide Plan. June.

_____. 2021. County Code. Chapter 83.01—General Performance Standards. Website: https://code library.amlegal.com/codes/sanbernardino/latest/sanberncty_ca/0-0-0-71407#JD_T.8Div.3 (accessed March 2022).

Federal Highway Administration (FHWA). 1977. *Highway Traffic Noise Prediction Model*, FHWA RD 77 108.

_____. 2006. *Highway Construction Noise Handbook*. Roadway Construction Noise Model, FHWA-HEP-06-015. DOT-VNTSC-FHWA-06-02. NTIS No. PB2006-109012. August.

Federal Transit Administration (FTA). 2018. *Transit Noise and Vibration Impact Assessment Manual*. FTA Report No. 0123. September. Website: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf (accessed March 2022).

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

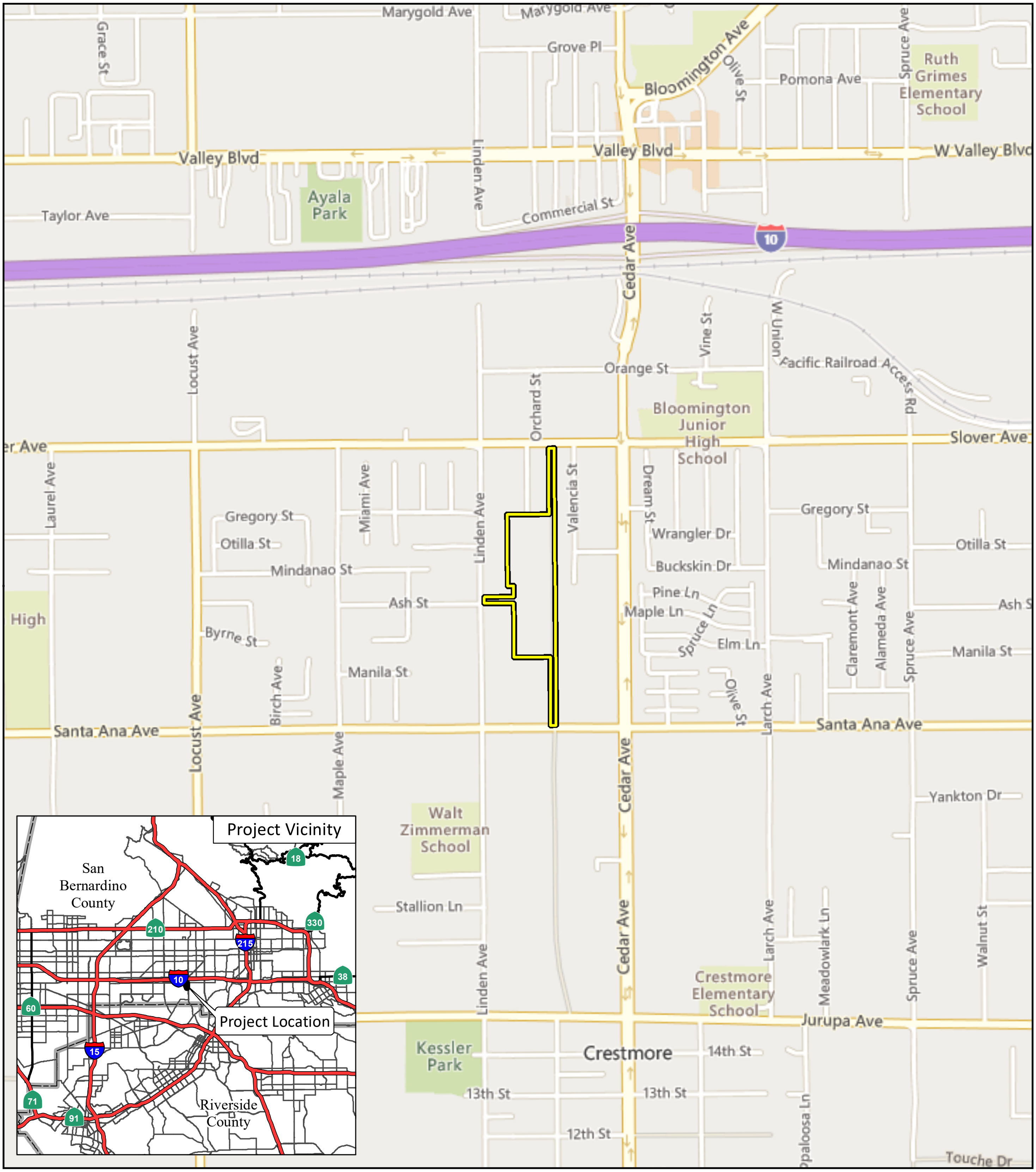
LSA Associates, Inc. (LSA). 2022a. *Linden Bloomington Condos 10598 Orchard Street Trip Generation Analysis and CEQA Assessment Memorandum*. October 12.

_____. 2022b. *Linden Bloomington Condos Project Air Quality, Greenhouse Gas Emissions, and Energy Analysis Memorandum*. November.

Riverside County Airport Land Use Commission (RCALUC). 2004. *Riverside County Airport Land Use Compatibility Plan*, October 14. Website: http://www.rcaluc.org/Plans/New-Compatibility-Plan (accessed March 2022).

ATTACHMENT B

FIGURES



LSA

LEGEND

Project Location

FIGURE 1

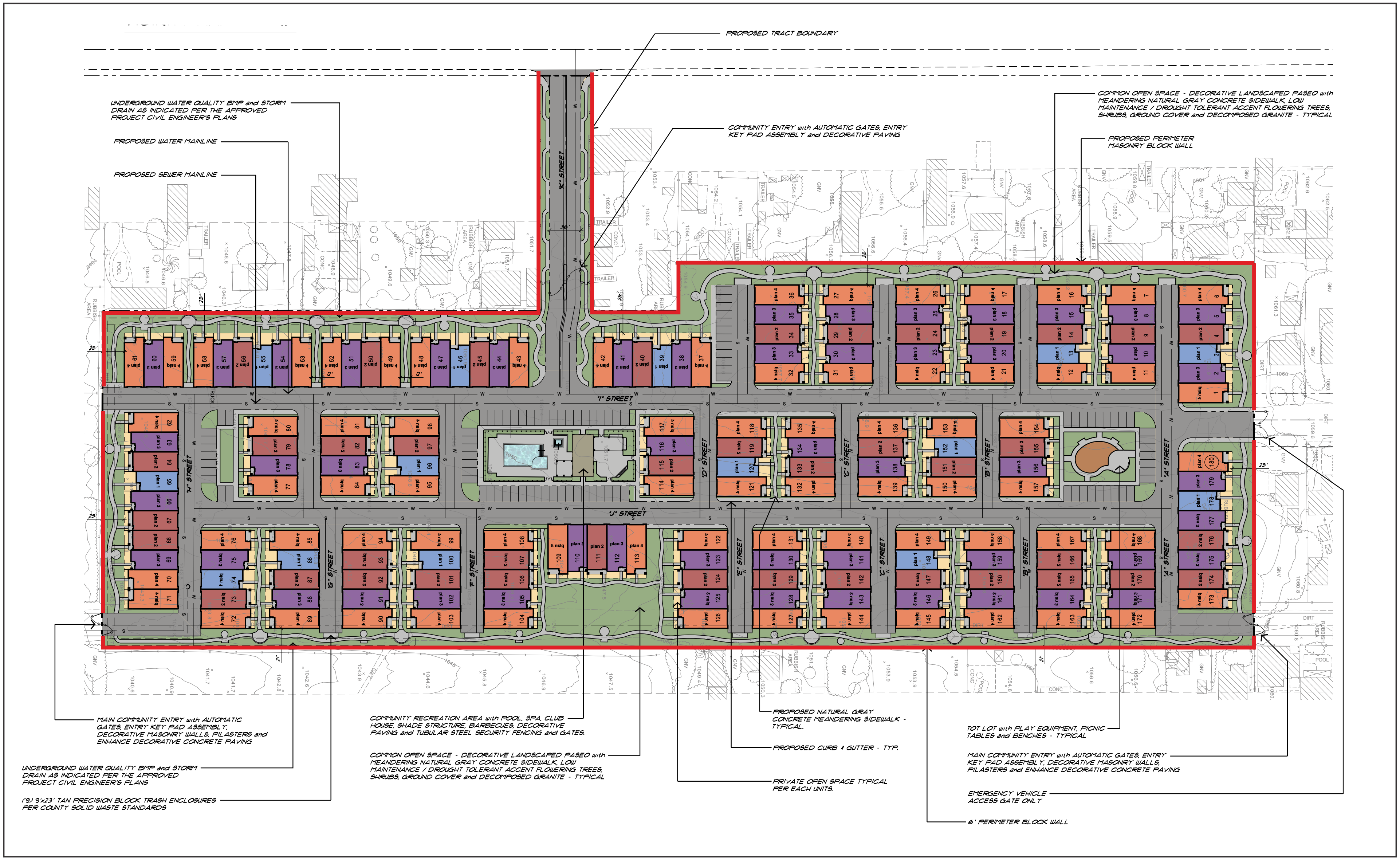
0 625 1250
FEET

SOURCE: Bing (2021)

Linden Bloomington Condos

Regional and Project Location

I:\APO2201\GIS\MXD\Noise\ProjLoc_Noise.mxd (10/28/2022)



LSA

LEGEND

6 ft High Walls

FIGURE 2

N

0 25 50

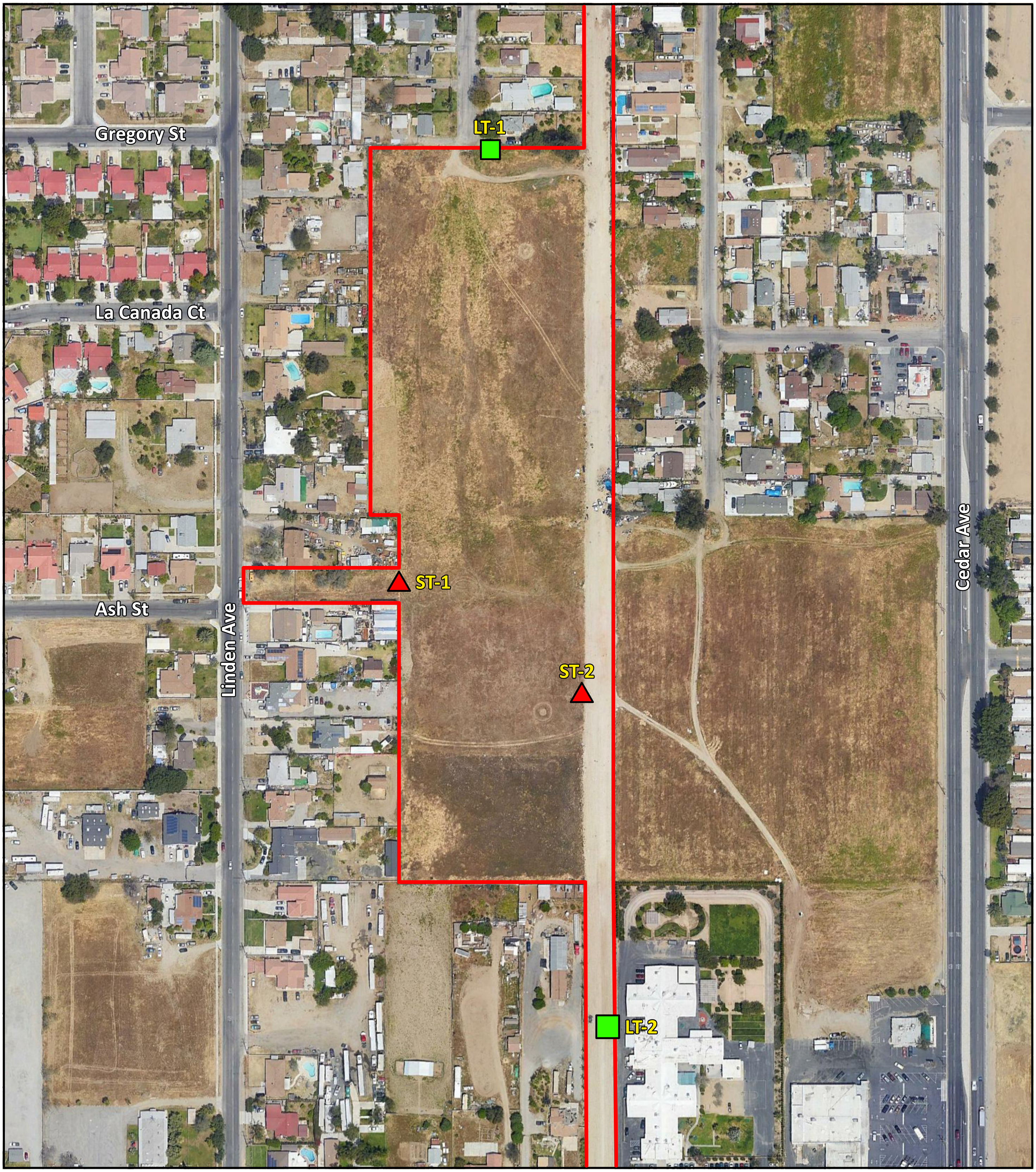
FEET

SOURCE: TK Management Services LLC

I:\APO2201\G\Site_Plan.ai (11/2/2022)

Linden Bloomington Condos

Conceptual Site Plan



LSA

LEGEND

- Project Site Boundary

ST-1 - Short-Term Noise Monitoring Location

LT-1 - Long-Term Noise Monitoring Location

FIGURE 3

N

0 160 320

FEET

SOURCE: Google Earth 2021

Linden Bloomington Condos

Noise Monitoring Locations

I:\APO2201\G\Noise_Locs.ai (11/2/22)

ATTACHMENT C

FHWA HIGHWAY TRAFFIC NOISE MODEL PRINTOUTS

TABLE Existing No Project-01

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022

ROADWAY SEGMENT: Linden Avenue between Slover Avenue and Ash Street

NOTES: Linden Bloomington Condos - Existing No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 3061   SPEED (MPH): 25   GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6   SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 55.58

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	0.0	61.2

TABLE Existing No Project-02

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022
ROADWAY SEGMENT: Linden Avenue between Ash Street and Santa Ana Avenue
NOTES: Linden Bloomington Condos - Existing No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 2979 SPEED (MPH): 25 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 55.47

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	0.0	60.1

TABLE Existing No Project-03
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022
ROADWAY SEGMENT: Slover Avenue between Maple Avenue and Linden Avenue
NOTES: Linden Bloomington Condos - Existing No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 15306   SPEED (MPH): 50   GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24   SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.38

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
59.6	120.0	254.3	545.9

TABLE Existing No Project-04
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022
ROADWAY SEGMENT: Slover Avenue between Linden Avenue and Orchard Street (South Branch)
NOTES: Linden Bloomington Condos - Existing No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 11639 SPEED (MPH): 50 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 67.19

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	100.8	212.3	455.1

TABLE Existing No Project-05

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022

ROADWAY SEGMENT: Slover Avenue between Orchard Street (South Branch) and Valencia Street

NOTES: Linden Bloomington Condos - Existing No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 11344 SPEED (MPH): 50 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 67.08

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	99.2	208.8	447.4

TABLE Existing No Project-06

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022
ROADWAY SEGMENT: Santa Ana Avenue between Maple Avenue and Linden Avenue
NOTES: Linden Bloomington Condos - Existing No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 6327   SPEED (MPH): 40   GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6   SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 63.63

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	97.3	209.3

TABLE Existing No Project-07
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022
ROADWAY SEGMENT: Santa Ana Avenue between Linden Avenue and Cedar Avenue
NOTES: Linden Bloomington Condos - Existing No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 6004   SPEED (MPH): 40   GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6   SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 63.40

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	94.0	202.1

TABLE Existing Project-01

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022

ROADWAY SEGMENT: Linden Avenue between Slover Avenue and Ash Street

NOTES: Linden Bloomington Condos - Existing Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 3485 SPEED (MPH): 25 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 56.15

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	0.0	66.7

TABLE Existing Project-02

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022
ROADWAY SEGMENT: Linden Avenue between Ash Street and Santa Ana Avenue
NOTES: Linden Bloomington Condos - Existing Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 3283   SPEED (MPH): 25   GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6   SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 55.89

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	0.0	64.1

TABLE Existing Project-03

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022
ROADWAY SEGMENT: Slover Avenue between Maple Avenue and Linden Avenue
NOTES: Linden Bloomington Condos - Existing Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 15670 SPEED (MPH): 50 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.48

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
60.4	121.8	258.3	554.5

TABLE Existing Project-04

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022

ROADWAY SEGMENT: Slover Avenue between Linden Avenue and Orchard Street (South Branch)

NOTES: Linden Bloomington Condos - Existing Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 11943   SPEED (MPH): 50   GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24   SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 67.30

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	102.5	216.0	463.0

TABLE Existing Project-05

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022
ROADWAY SEGMENT: Slover Avenue between Orchard Street (South Branch) and Valencia Street
NOTES: Linden Bloomington Condos - Existing Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 11890 SPEED (MPH): 50 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 67.28

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	102.2	215.3	461.6

TABLE Existing Project-06

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022
ROADWAY SEGMENT: Santa Ana Avenue between Maple Avenue and Linden Avenue
NOTES: Linden Bloomington Condos - Existing Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 6449   SPEED (MPH): 40   GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6   SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 63.71

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	98.5	211.9

TABLE Existing Project-07

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 10/27/2022

ROADWAY SEGMENT: Santa Ana Avenue between Linden Avenue and Cedar Avenue

NOTES: Linden Bloomington Condos - Existing Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 6126 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 63.49

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	95.2	204.8
