# Environmental Noise Assessment

# West Roseville Grocery Outlet & Retail

**City of Roseville, California**

**September 16, 2022**

**Project #220507**

**Prepared for:**

**Inter-Cal Real Estate Corporation**
540 Fulton Avenue
Sacramento, California 95825

**Prepared by:**

**Saxelby Acoustics LLC**

**Luke Saxelby, INCE Bd. Cert.**
**Principal Consultant**
**Board Certified, Institute of Noise Control Engineering (INCE)**

(916) 760-8821
www.SaxNoise.com | Luke@SaxNoise.com
915 Highland Pointe Drive, Suite 250
Roseville, CA 95678

## INTRODUCTION

The West Roseville Grocery Outlet & Retail Project is located in the City of Roseville, California. The project consists of a Grocery Outlet, retail space, and a drive-thru quick-service restaurant. The primary noise sources associated with operation of the project are truck and automobile circulation, loading dock noise, HVAC equipment noise, and operation of the drive-thru speaker boxes. Single family residential uses are located directly east of the project site. The purpose of this analysis is to predict the noise generation associated with these uses and to achieve compliance with the applicable City of Roseville noise level standards.

**Figure 1** shows the project site plan. **Figure 2** shows an aerial photo of the project site and noise measurement locations.

## ENVIRONMENTAL SETTING

### BACKGROUND INFORMATION ON NOISE

#### *Fundamentals of Acoustics*

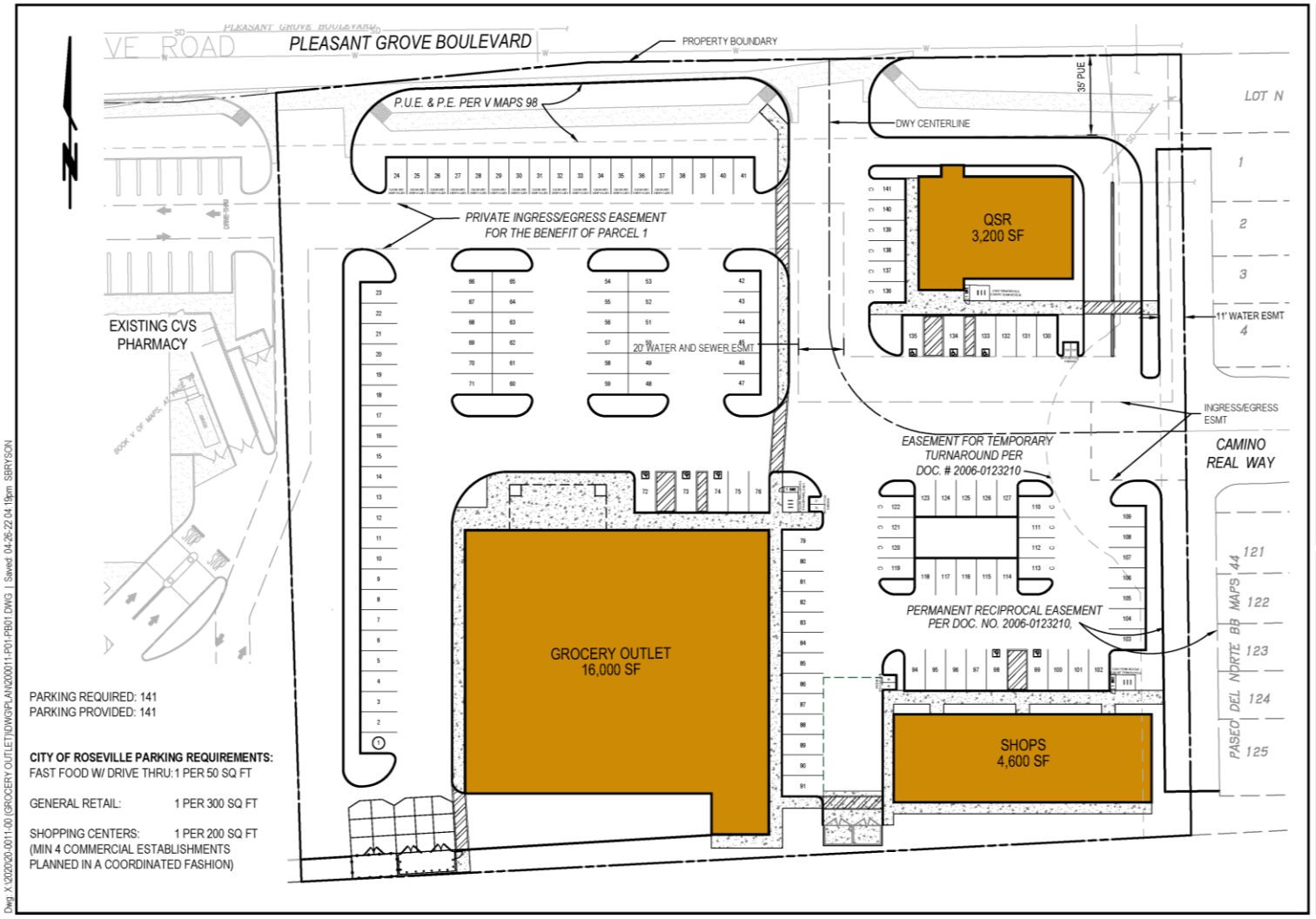
Acoustics is the science of sound. Sound may be thought of as mechanical energy of a vibrating object transmitted by pressure waves through a medium to human (or animal) ears. If the pressure variations occur frequently enough (at least 20 times per second), then they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second or Hertz (Hz).

Noise is a subjective reaction to different types of sounds. Noise is typically defined as (airborne) sound that is loud, unpleasant, unexpected or undesired, and may therefore be classified as a more specific group of sounds. Perceptions of sound and noise are highly subjective from person to person.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals), as a point of reference, defined as 0 dB. Other sound pressures are then compared to this reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB, and changes in levels (dB) correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by A-weighted sound levels. There is a strong correlation between A-weighted sound levels (expressed as dBA) and the way the human ear perceives sound. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels, but are expressed as dB, unless otherwise noted.

**Attachment 2**

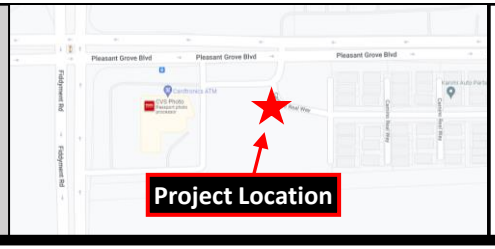



## West Roseville Grocery Outlet and Retail

**City of Roseville, California**

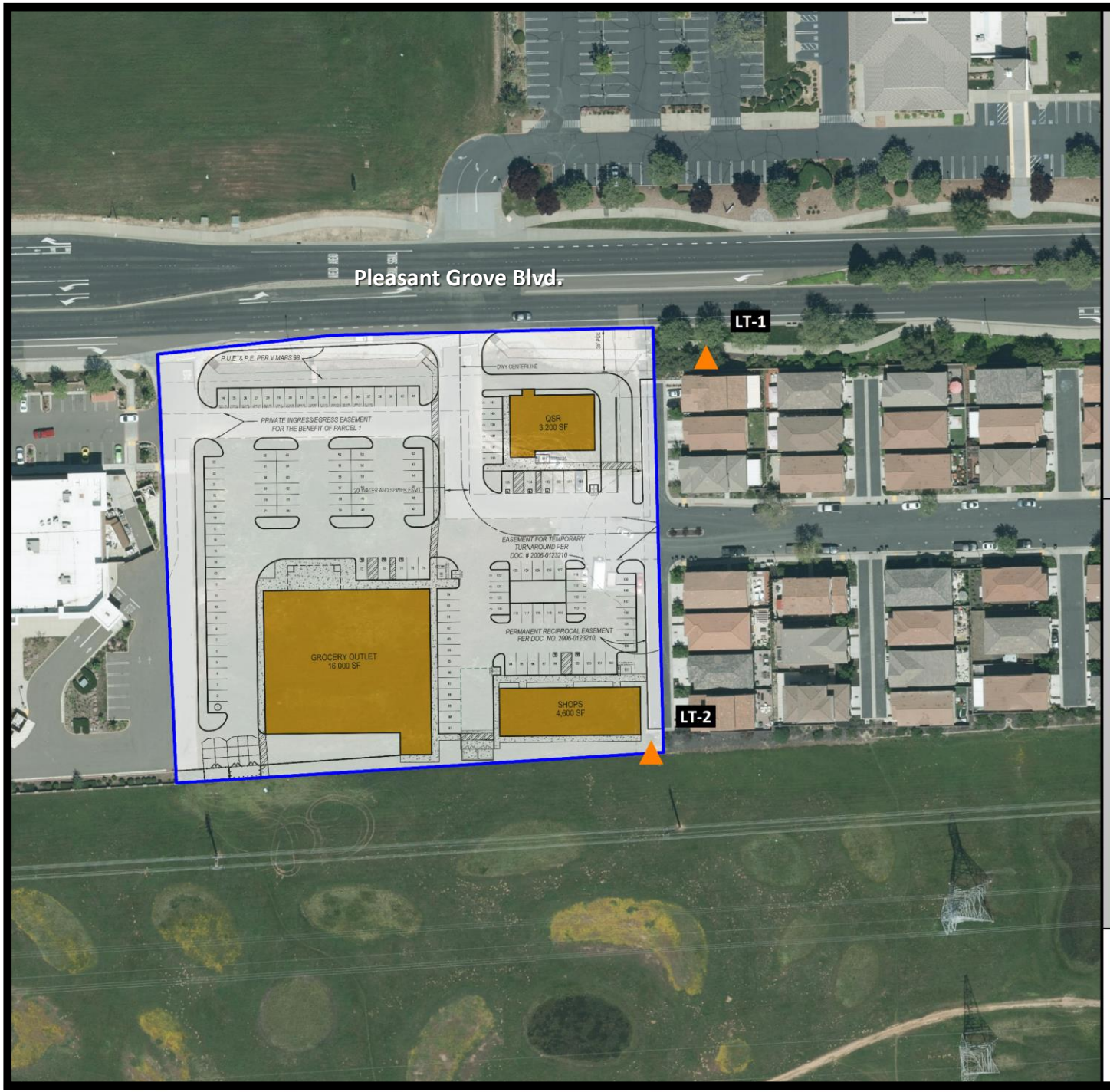
**Figure 1**

**Project Site Plan**




SAXELBY ACOUSTICS
Acoustics · Noise · Vibration

# Attachment 2




## West Roseville Grocery Outlet and Retail

City of Roseville, California

Figure 2

Noise Measurement Sites

**Legend**

- Project Site
- Noise Measurement Site - Long Term

0 ft 100 ft 200 ft

Projection: UTM Zone 10 / WGS84 / meters
Rev. Date: 05/31/2022

SAXELBY ACOUSTICS
Acoustics · Noise · Vibration

The decibel scale is logarithmic, not linear. In other words, two sound levels 10-dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted, an increase of 10-dBA is generally perceived as a doubling in loudness. For example, a 70-dBA sound is half as loud as an 80-dBA sound, and twice as loud as a 60 dBA sound.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given environment. A common statistical tool is the average, or equivalent, sound level ($L_{eq}$), which corresponds to a steady-state A weighted sound level containing the same total energy as a time varying signal over a given time period (usually one hour). The $L_{eq}$ is the foundation of the composite noise descriptor, $L_{dn}$, and shows very good correlation with community response to noise.

The day/night average level ($L_{dn}$) is based upon the average noise level over a 24-hour day, with a +10-decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because $L_{dn}$ represents a 24-hour average, it tends to disguise short-term variations in the noise environment.

**Table 1** lists several examples of the noise levels associated with common situations. **Appendix A** provides a summary of acoustical terms used in this report.

**TABLE 1: TYPICAL NOISE LEVELS**

| Common Outdoor Activities | Noise Level (dBA) | Common Indoor Activities |
|---|---|---|
| | --110-- | Rock Band |
| Jet Fly-over at 300 m (1,000 ft.) | --100-- | |
| Gas Lawn Mower at 1 m (3 ft.) | --90-- | |
| Diesel Truck at 15 m (50 ft.), at 80 km/hr. (50 mph) | --80-- | Food Blender at 1 m (3 ft.)<br>Garbage Disposal at 1 m (3 ft.) |
| Noisy Urban Area, Daytime<br>Gas Lawn Mower, 30 m (100 ft.) | --70-- | Vacuum Cleaner at 3 m (10 ft.) |
| Commercial Area<br>Heavy Traffic at 90 m (300 ft.) | --60-- | Normal Speech at 1 m (3 ft.) |
| Quiet Urban Daytime | --50-- | Large Business Office<br>Dishwasher in Next Room |
| Quiet Urban Nighttime | --40-- | Theater, Large Conference Room (Background) |
| Quiet Suburban Nighttime | --30-- | Library |
| Quiet Rural Nighttime | --20-- | Bedroom at Night, Concert Hall (Background) |
| | --10-- | Broadcast/Recording Studio |
| Lowest Threshold of Human Hearing | --0-- | Lowest Threshold of Human Hearing |

*Source: Caltrans, Technical Noise Supplement, Traffic Noise Analysis Protocol. September, 2013.*

***Effects of Noise on People***

The effects of noise on people can be placed in three categories:

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as hearing loss or sudden startling

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience noise in the last category. There is no completely satisfactory way to measure the subjective effects of noise or the corresponding reactions of annoyance and dissatisfaction. A wide variation in individual thresholds of annoyance exists and different tolerances to noise tend to develop based on an individual's past experiences with noise.

Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the so-called ambient noise level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it.

With regard to increases in A-weighted noise level, the following relationships occur:

- Except in carefully controlled laboratory experiments, a change of 1-dBA cannot be perceived;
- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference;
- A change in level of at least 5-dBA is required before any noticeable change in human response would be expected; and
- A 10-dBA change is subjectively heard as approximately a doubling in loudness, and can cause an adverse response.

Stationary point sources of noise – including stationary mobile sources such as idling vehicles – attenuate (lessen) at a rate of approximately 6-dB per doubling of distance from the source, depending on environmental conditions (i.e. atmospheric conditions and either vegetative or manufactured noise barriers, etc.). Widely distributed noises, such as a large industrial facility spread over many acres, or a street with moving vehicles, would typically attenuate at a lower rate.

**EXISTING AMBIENT NOISE LEVELS**

To quantify the existing ambient noise environment in the project vicinity, Saxelby Acoustics conducted a continuous (24-hr.) noise level measurement at two locations on the project site. Noise measurement locations are shown on **Figure 2**. A summary of the noise level measurement survey results is provided in **Table 2**. **Appendix B** contains the complete results of the noise monitoring.

The sound level meters were programmed to record the maximum, median, and average noise levels at each site during the survey. The maximum value, denoted $L_{max}$, represents the highest noise level measured. The average value, denoted $L_{eq}$, represents the energy average of all of the noise received by the sound level meter microphone during the monitoring period. The median value, denoted $L_{50}$, represents the sound level exceeded 50 percent of the time during the monitoring period.

Larson Davis Laboratories (LDL) model 820 precision integrating sound level meters were used for the ambient noise level measurement survey. The meters were calibrated before and after use with a CAL 200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4).

**Table 2: Summary of Existing Background Noise Measurement Data**

| Location | Date | $L_{dn}$ | Daytime $L_{eq}$ | Daytime $L_{50}$ | Daytime $L_{max}$ | Nighttime $L_{eq}$ | Nighttime $L_{50}$ | Nighttime $L_{max}$ |
|---|---|---|---|---|---|---|---|---|
| LT-1: 60 ft. to CL of Pleasant Grove Blvd. | 5/26/2022 to 5/27/2022 | 72 | 71 | 69 | 87 | 64 | 53 | 80 |
| LT-2: 380 ft. to CL of Pleasant Grove Blvd. | 5/26/2022 to 5/27/2022 | 53 | 50 | 49 | 69 | 46 | 44 | 59 |

*Notes:*

- *All values shown in dBA*
- *Daytime hours: 7:00 a.m. to 10:00 p.m.*
- *Nighttime Hours: 10:00 p.m. to 7:00 a.m.*
- *Source: Saxelby Acoustics 2022*

## REGULATORY CONTEXT

### FEDERAL

There are no federal regulations related to noise that apply to the Proposed Project.

### STATE

There are no state regulations related to noise that apply to the Proposed Project.

### LOCAL

#### *City of Roseville General Plan*

The City of Roseville General Plan Noise Element Table IX-1 (**Table 3**) establishes an acceptable interior and exterior noise levels for various uses within the City. The relevant criteria are reproduced below:

**TABLE 3: CITY OF ROSEVILLE LAND USE COMPATIBILITY CHART IX-1**

| Land Use | Outdoor Activity, Areas[1] $L_{dn}$/CNEL, dB | Interior Spaces | |
|---|---|---|---|
| | | $L_{dn}$/CNEL, dB | $L_{eq}$, dB[2] |
| **Residential** | 60[3] | 45 | -- |
| **Transient Lodging** | 60[3] | 45 | -- |
| **Hospitals. Nursing Homes** | 60[3] | 45 | -- |
| **Theaters, Auditoriums, Music Halls** | -- | -- | 35 |
| **Churches, Meeting Halls** | 60[3] | -- | 40 |
| **Office Buildings** | 65 | -- | 45 |
| **Schools, Libraries, Museums** | -- | -- | 45 |
| **Playground, Neighborhood Parks** | 70 | -- | -- |

[1]*Outdoor activity areas for residential developments are considered to be the backyard patios or decks of single family dwelling, and the patios or common areas where people generally congregate for multi family developments.*

*Outdoor activity areas for non-residential developments are considered to be those common areas where people generally congregate, including pedestrian plazas, seating areas, and outside lunch facilities.*

*Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use.*

[2]*As determined for a typical worst-case hour during periods of use.*

[3]*Where it is not possible to reduce noise in outdoor activity areas to 60 dB $L_{dn}$/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 75 dBA $L_{dn}$/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.*

*Source: City of Roseville General Plan Noise Element 2035.*

The City of Roseville General Plan Noise Element Table 1X-3 (**Table 4**) establishes an acceptable exterior noise levels for stationary noise sources.

**TABLE 4: CITY OF ROSEVILLE NOISE ELEMENT TABLE 1X-3**

| Noise Level Descriptor | Daytime (7 a.m. to 10 p.m.) | Nighttime (10 p.m. to 7 a.m.) |
|---|---|---|
| **Hourly $L_{eq}$, dB** | 50 | 45 |
| **Maximum Level, dB** | 70 | 65 |

*For municipal power plants consisting primarily of broadband, stead state noise sources, the hourly ($L_{eq}$) noise standards may be increased up to 10 dB(A), but no exceed 55 dB(A) Hourly $L_{eq}$, dB.*

*Each of the noise levels specified above should be lowered by five dB for simple tone noises, noises consisting primarily of speech or music, or for recuring 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 resident units established in conjunction with industrial or commercial uses.*

*No standards have been included for interior noise levels. Standard construction practices should, with exterior noise levels identified, result in acceptable interior noise levels.*

*Source: City of Roseville General Plan Noise Element 2035.*

## EVALUATION OF PROJECT OPERATIONAL NOISE ON EXISTING SENSITIVE RECEPTORS

### STATIONARY NOISE MODELING METHODOLOGY

The following is a list of assumptions used for the noise modeling. The data used is based upon a combination of manufacturer's provided data and Saxelby Acoustics data from similar operations.

On-Site Circulation: The commercial component of the project is projected to generate 279 trips in the evening peak hour (Fehr & Peers, 2022). Saxelby Acoustics assumed that 5 of these trips could be trucks. Parking lot movements are predicted to generate a sound exposure level (SEL) of 71 dBA SEL at 50 feet for cars and 85 dBA SEL at 50 feet for trucks. Nighttime traffic outside of the AM or PM peak hour is estimated to be approximately 1/4 of daytime trips during nighttime hours (10:00 p.m. to 7:00 a.m.). Saxelby Acoustics data.

Drive-Thru: Saxelby Acoustics estimated that project activity would occur continuously during the peak day and night hour of usage. One speaker per drive-through aisle at 68 dBA $L_{eq}$ and 78 dBA $L_{max}$ at 3 feet. Saxelby Acoustics data.

HVAC Units: Saxelby Acoustics assumed the quick-service restaurant would have three ten-ton packaged units and one ten-ton air-cooled chiller unit. Saxelby Acoustics also assumed that each retail space would be serviced by one ten-ton packaged unit. In addition, Saxelby Acoustics assumed that the proposed Grocery Outlet would include a 50-ton packaged HVAC rooftop unit to predict mechanical noise levels. The unit is estimated to produce noise levels of 59 dBA $L_{eq}$ at 50 feet. All equipment is assumed to operate continuously during the daytime, and 50% of the time at night. Manufacturer's data.

Loading Docks: Saxelby Acoustics assumed the proposed loading docks would generate an average noise level of 61 dBA $L_{eq}$ and 81 dBA $L_{max}$ at a distance of 100 feet from the center of the loading dock truck maneuvering lanes. Activities during the peak hour of loading dock activities include truck arrival/departures, truck idling, truck backing, air brake release, and operation of truck-mounted refrigeration units. Saxelby Acoustics data.

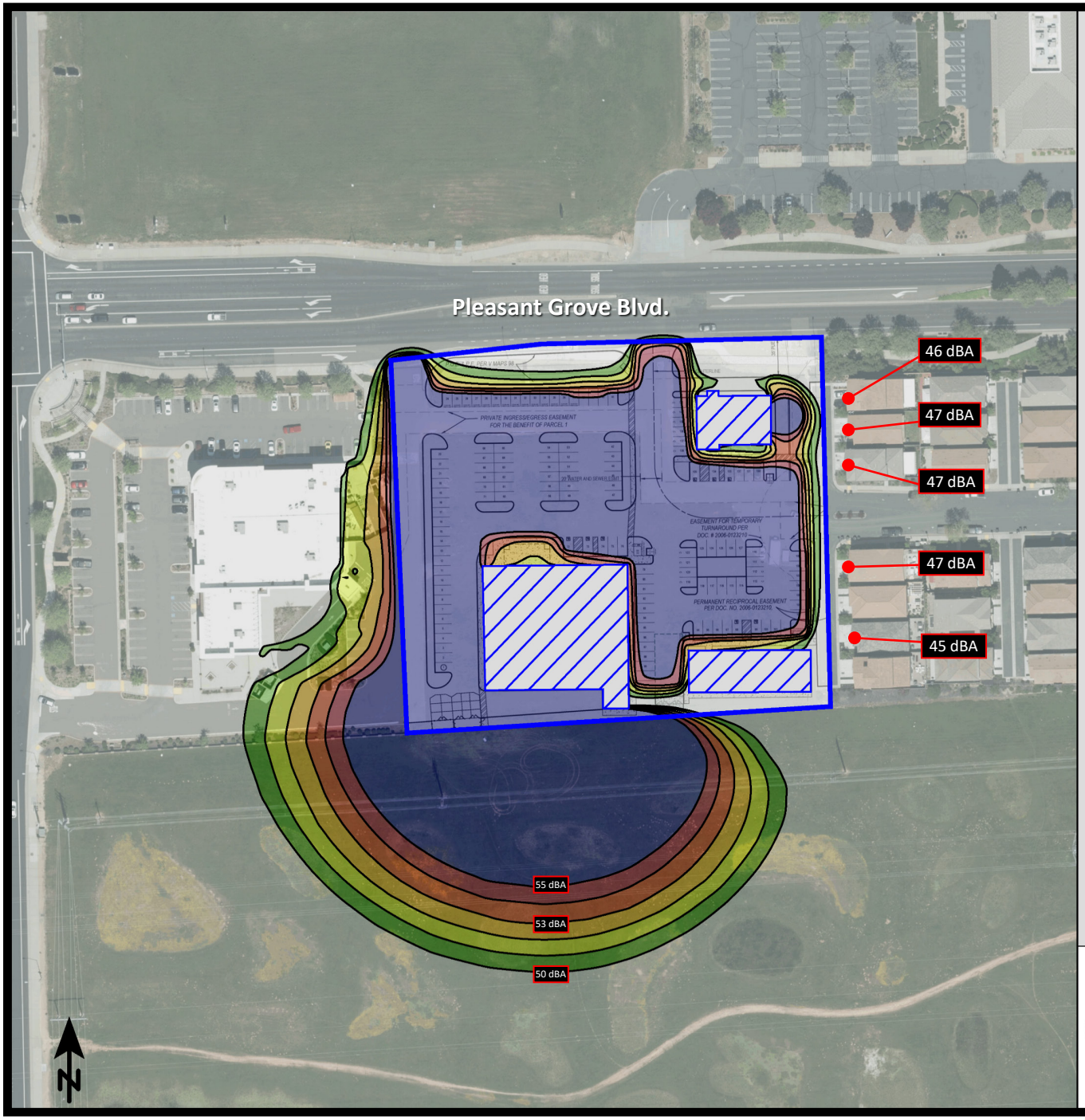
It should be noted that the noise-generating uses associated with the proposed project are not predicted to generate maximum noise levels more than 20 dBA above the average ($L_{eq}$) noise levels. The City of Roseville maximum noise level standards for both daytime and nighttime hours are 20 dBA above the average noise level standards. Therefore, where the average project-generated noise levels comply with the City's standards, project-generated maximum noise levels will also comply.

Saxelby Acoustics used the SoundPLAN noise prediction model. Inputs to the model included sound power levels for the proposed commercial uses, existing and proposed buildings, terrain type, and locations of sensitive receptors. These predictions are made in accordance with International Organization for Standardization (ISO) standard 9613-2:1996 (Acoustics – Attenuation of sound during propagation outdoors). ISO 9613 is the most commonly used method for calculating exterior noise propagation. **Figure 3** shows the noise level contours resulting from operation of the project during daytime (7:00 a.m. to 10:00 p.m.) hours. **Figure 4** shows noise levels during nighttime (10:00 p.m. to 7:00 a.m.) hours.

**RESULTS OF ANALYSIS**

As shown on **Figures 3 and 4,** operation of the proposed project is predicted to generate average noise levels of 47 dBA $L_{eq}$ during daytime hours and 45 dBA $L_{eq}$ during nighttime hours at the nearest sensitive receptors. Therefore, the overall project-generated noise levels comply with the City of Roseville noise level standards of 50 dBA $L_{eq}$ during daytime and 45 dBA $L_{eq}$ during nighttime, at the nearest sensitive receptors.

# Attachment 2




## West Roseville Grocery Outlet and Retail

**City of Roseville, California**

**Figure 3**

**Daytime Project Noise Contours (dBA $L_{eq}$)**

Signs and symbols

- Property Line
- Proposed Building

Levels in dB(A)

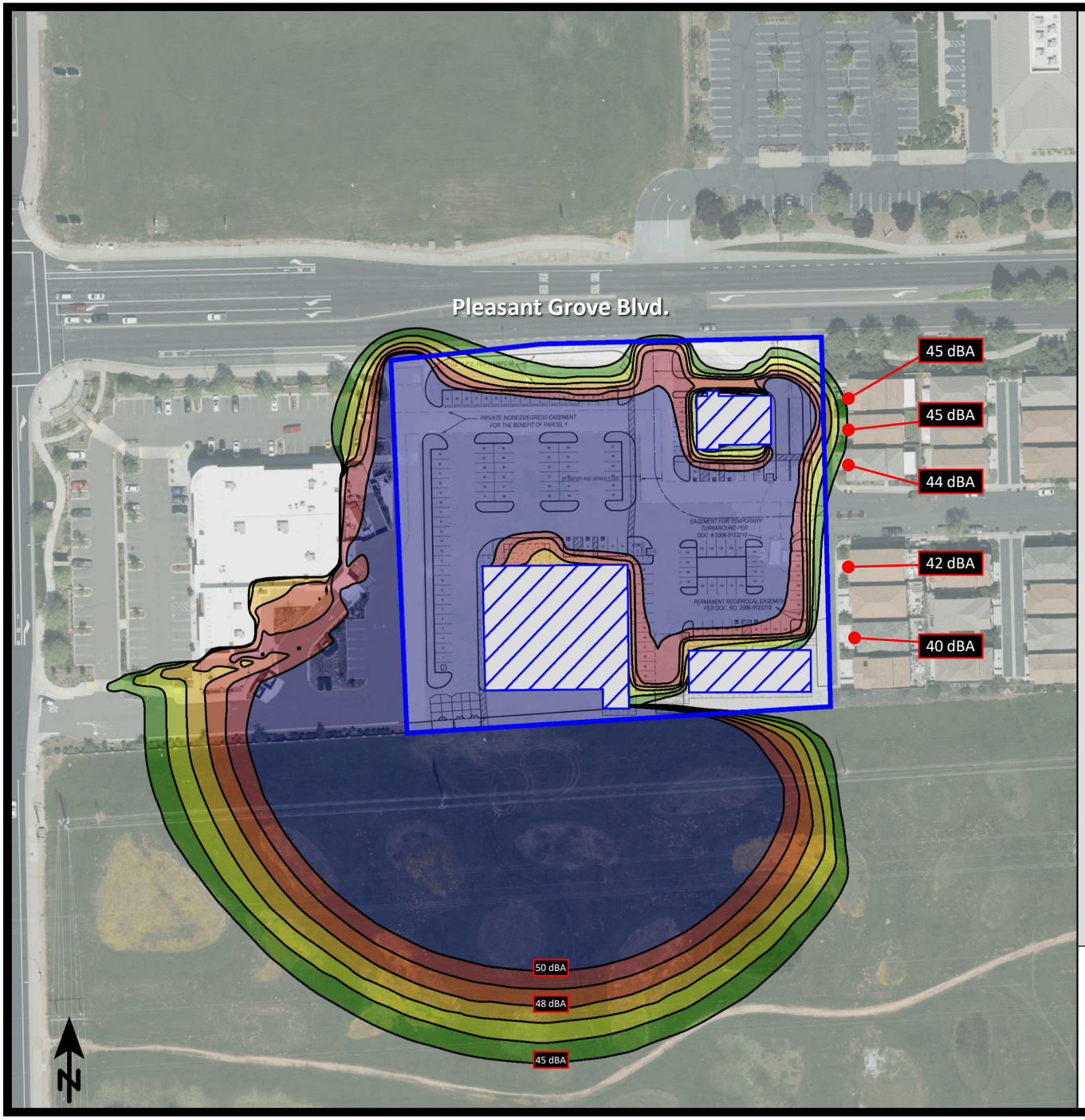
| |
|---|
| <= 50 |
| 50 - 51 |
| 51 - 52 |
| 52 - 53 |
| 53 - 54 |
| 54 - 55 |
| > 55 |

1 : 1600

0 10 20 40 60 80 m

SAXELBY ACOUSTICS
Acoustics · Noise · Vibration

# Attachment 2




## West Roseville Grocery Outlet and Retail

**City of Roseville, California**

**Figure 4**

**Nighttime Project Noise Contours (dBA $L_{eq}$)**

Signs and symbols

- Property Line
- Proposed Building

Levels in dB(A)

| |
|---|
| <= 45 |
| 45 - 46 |
| 46 - 47 |
| 47 - 48 |
| 48 - 49 |
| 49 - 50 |
| > 50 |

1 : 1600

0 10 20 40 60 80 m

SAXELBY ACOUSTICS
Acoustics · Noise · Vibration

### EVALUATION OF DRIVE-THRU SPEAKER BOX NOISE

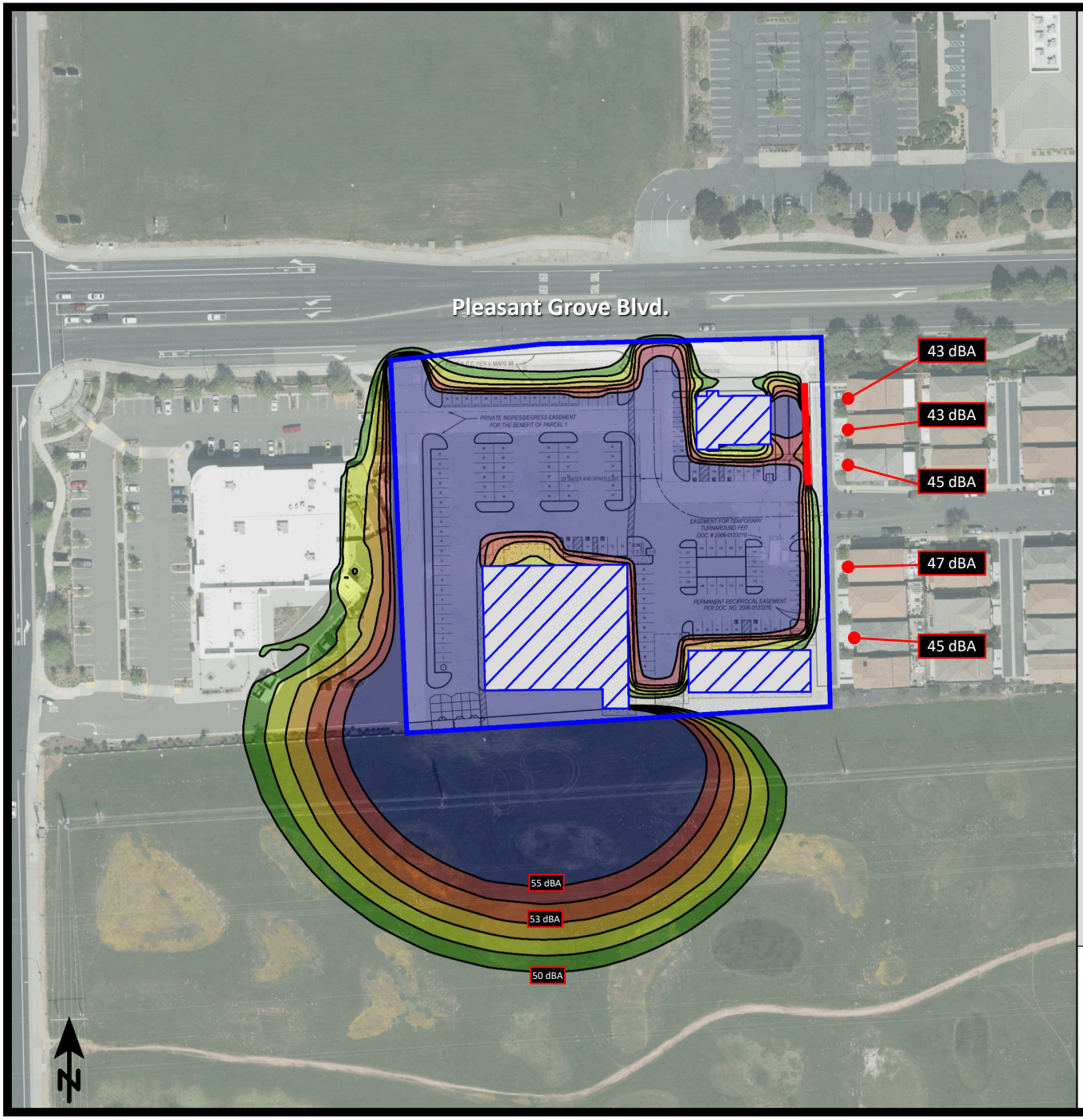
The proposed quick-service restaurant will include the use of speaker boxes at the drive-thru lanes. The City of Roseville imposes a penalty of -5 dBA for "noises consisting primarily of speech or music." This penalty would apply to the proposed speaker box noise generation. Therefore, noise generated by the speakers must adhere to adjusted noise levels standards of 45 dBA $L_{eq}$ and 65 dBA $L_{max}$ during daytime (7:00 a.m. to 10:00 p.m.) hours and 40 dBA $L_{eq}$ and 60 dBA $L_{max}$ during nighttime (10:00 p.m. to 7:00 a.m.) hours.

Based upon the results of the SoundPLAN noise modeling, the noise levels generated by the speaker boxes at the nearest residence is predicted to be 41 dBA $L_{eq}$ and 51 dBA $L_{max}$ during both daytime and nighttime hours. This exceeds the Roseville nighttime noise level standards for noises consisting of speech. Therefore, additional noise control measures would be required.

### NOISE CONTROL MEASURES

To achieve compliance with the City of Roseville noise level criteria, the proposed project must include the construction of a 6-foot-tall sound wall along the eastern boundary of the proposed quick-service restaurant to shield residences to the east. The location of the sound wall and resulting noise level contours for daytime and nighttime operation are shown on **Figures 5 and 6,** respectively. Construction of this sound wall will reduce noise levels emanating from the drive-thru speakers to 39 dBA $L_{eq}$ and 49 dBA $L_{max}$.

# Attachment 2




## West Roseville Grocery Outlet and Retail

**City of Roseville, California**

**Figure 5**

**Daytime Project Noise Contours (dBA $L_{eq}$) – with Noise Protection**

Signs and symbols

- Property Line
- Recommended 6-Foot Wall
- Proposed Building

Levels in dB(A)

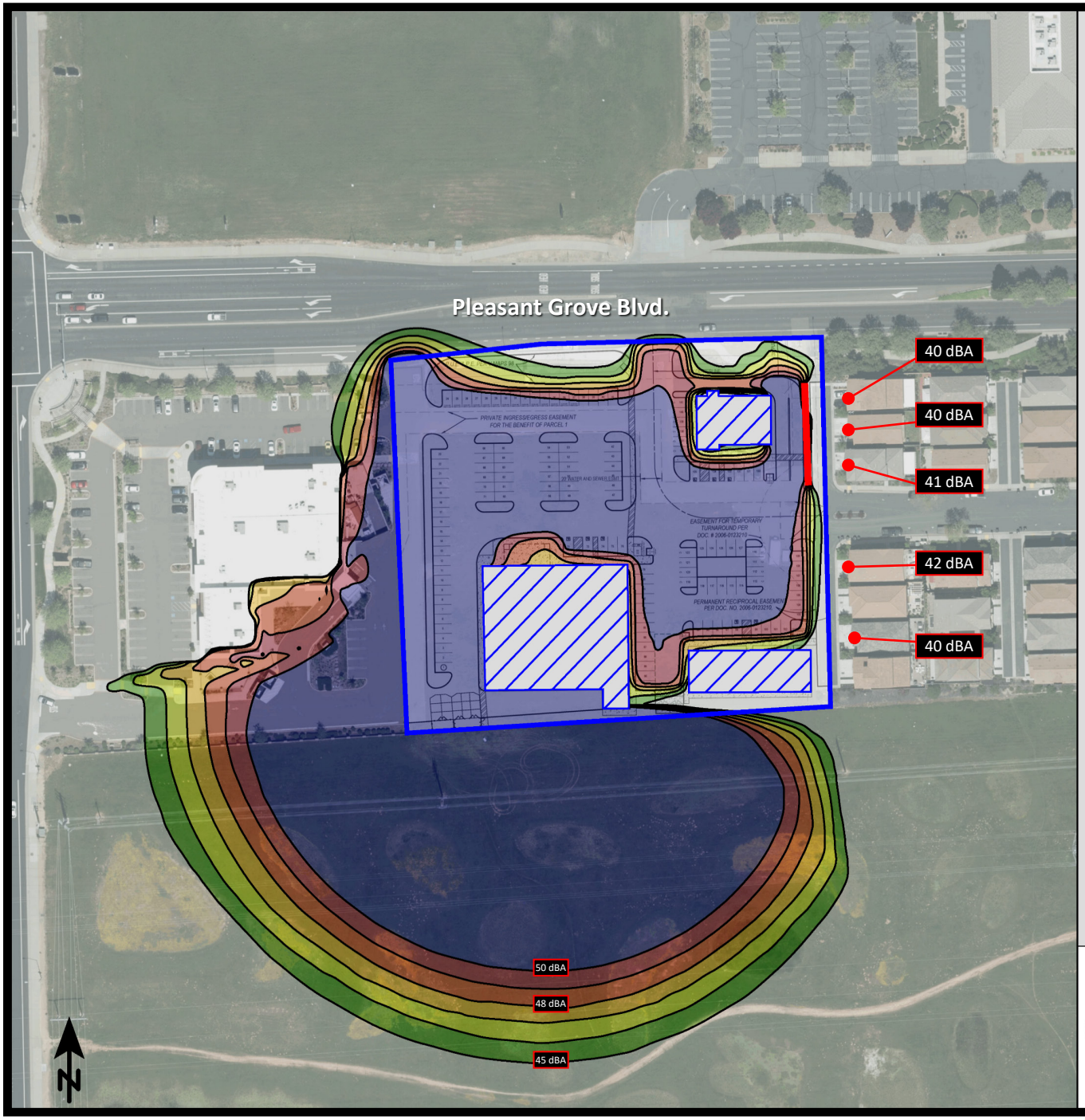
- <= 50
- 50 - 51
- 51 - 52
- 52 - 53
- 53 - 54
- 54 - 55
- > 55

1 : 1600

0 10 20 40 60 80 m

SAXELBY ACOUSTICS
Acoustics · Noise · Vibration

# Attachment 2




## West Roseville Grocery Outlet and Retail

**City of Roseville, California**

**Figure 6**

**Nighttime Project Noise Contours (dBA $L_{eq}$) – with Noise Protection**

Signs and symbols

- Property Line
- Recommended 6-Foot Wall
- Proposed Building

Levels in dB(A)

| |
|---|
| <= 45 |
| 45 - 46 |
| 46 - 47 |
| 47 - 48 |
| 48 - 49 |
| 49 - 50 |
| > 50 |

1 : 1600

0 10 20 40 60 80 m

SAXELBY ACOUSTICS
Acoustics · Noise · Vibration

**CONCLUSIONS**

The proposed project, which consists of the development of a new Grocery Outlet, quick-service restaurant, and commercial retail building, is predicted to exceed the City of Roseville nighttime (10:00 p.m. to 7:00 a.m.) noise level standard as planned. To achieve compliance with the City's standards, a 6-foot-tall noise barrier must be constructed to the east of the proposed quick-service restaurant. The location of the sound wall is shown on **Figures 5 and 6**. Implementation of this noise control measure will allow to project to achieve full compliance with the City's noise level criteria.

**REFERENCES**

American National Standards Institute. (1998). *[Standard] ANSI S1.43-1997 (R2007): Specifications for integrating-averaging sound level meters*. New York: Acoustical Society of America.

American Standard Testing Methods, *Standard Guide for Measurement of Outdoor A-Weighted Sound Levels, American Standard Testing Methods (ASTM) E1014-08*, 2008.

ASTM E1014-12. *Standard Guide for Measurement of Outdoor A-Weighted Sound Levels*. ASTM International. West Conshohocken, PA. 2012.

ASTM E1780-12. *Standard Guide for Measuring Outdoor Sound Received from a Nearby Fixed Source.* ASTM International. West Conshohocken, PA. 2012.

Barry, T M. (1978). *FHWA highway traffic noise prediction model* (FHWA-RD-77-108). Washington, DC: U.S. Department of transportation, Federal highway administration, Office of research, Office of environmental policy.

California Department of Transportation (Caltrans), *Technical Noise Supplement, Traffic Noise Analysis Protocol*, September 2013.

California Department of Transportation (Caltrans), *Traffic Noise Analysis Protocol*, May 2011.

Egan, M. D. (1988). Architectural acoustics. United States of America: McGraw-Hill Book Company.

Federal Highway Administration. *FHWA Roadway Construction Noise Model User's Guide.* FHWA-HEP-05-054 DOT-VNTSC-FHWA-05-01. January 2006.

Hanson, Carl E. (Carl Elmer). (2006). *Transit noise and vibration impact assessment*. Washington, DC: U.S. Department of Transportation, Federal Transit Administration, Office of Planning and Environment.

International Electrotechnical Commission. Technical committee 29: Electroacoustics. International Organization of Legal Metrology. (2013). *Electroacoustics: Sound level meters*.

International Organization for Standardization. (1996). *Acoustic - ISO 9613-2: Attenuation of sound during propagation outdoors. Part 2: General methods of calculation*. Ginevra: I.S.O.

Kimley-Horn. *Acoustic Study Traffic Data*. October 1, 2020.

Miller, L. N., Bolt, Beranek, & and Newman, Inc. (1981). *Noise control for buildings and manufacturing plants*. Cambridge, MA: Bolt, Beranek and Newman, Inc.

SoundPLAN. SoundPLAN GmbH. Backnang, Germany. http://www.soundplan.eu/english/

## Appendix A: Acoustical Terminology

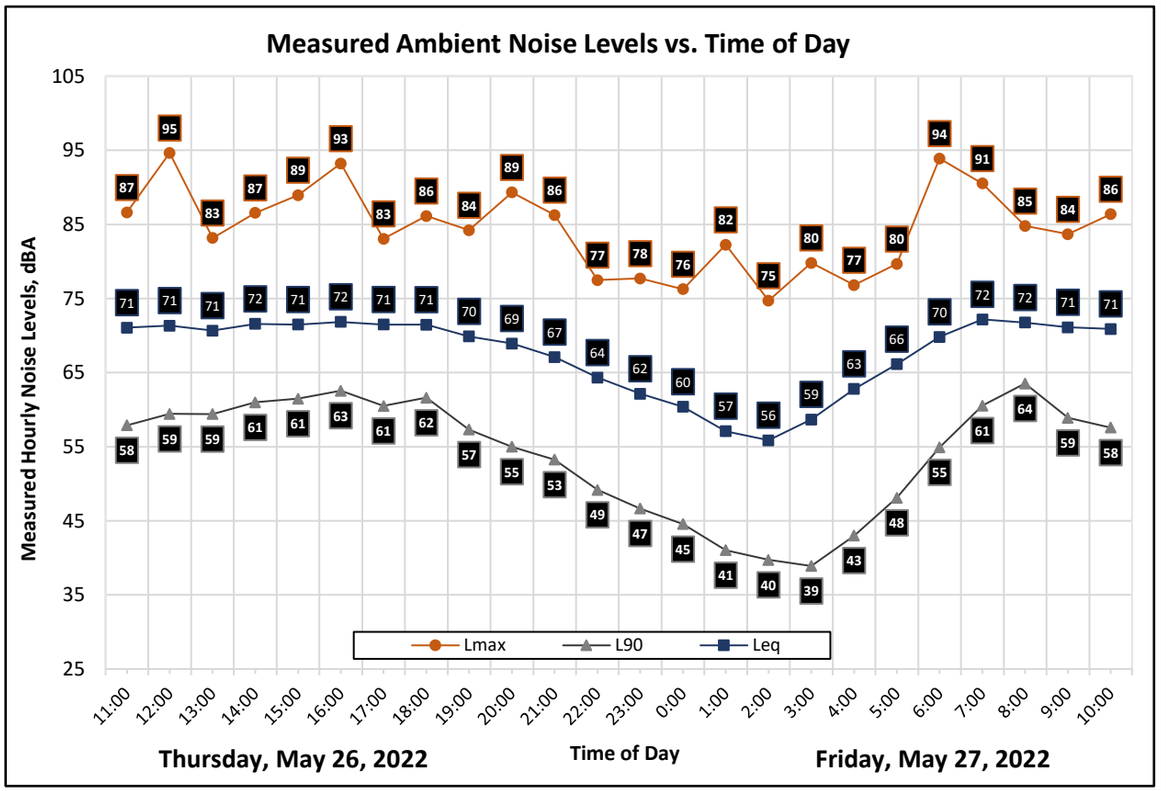
| | |
|---|---|
| **Acoustics** | The science of sound. |
| **Ambient Noise** | The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study. |
| **ASTC** | Apparent Sound Transmission Class. Similar to STC but includes sound from flanking paths and correct for room reverberation. A larger number means more attenuation. The scale, like the decibel scale for sound, is logarithmic. |
| **Attenuation** | The reduction of an acoustic signal. |
| **A-Weighting** | A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response. |
| **Decibel or dB** | Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell. |
| **CNEL** | Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by +5 dBA and nighttime hours weighted by +10 dBA. |
| **DNL** | See definition of Ldn. |
| **IIC** | Impact Insulation Class. An integer-number rating of how well a building floor attenuates impact sounds, such as footsteps. A larger number means more attenuation. The scale, like the decibel scale for sound, is logarithmic. |
| **Frequency** | The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz (Hz). |
| **Ldn** | Day/Night Average Sound Level. Similar to CNEL but with no evening weighting. |
| **Leq** | Equivalent or energy-averaged sound level. |
| **Lmax** | The highest root-mean-square (RMS) sound level measured over a given period of time. |
| **L(n)** | The sound level exceeded a described percentile over a measurement period. For instance, an hourly L50 is the sound level exceeded 50% of the time during the one-hour period. |
| **Loudness** | A subjective term for the sensation of the magnitude of sound. |
| **NIC** | Noise Isolation Class. A rating of the noise reduction between two spaces. Similar to STC but includes sound from flanking paths and no correction for room reverberation. |
| **NNIC** | Normalized Noise Isolation Class. Similar to NIC but includes a correction for room reverberation. |
| **Noise** | Unwanted sound. |
| **NRC** | Noise Reduction Coefficient. NRC is a single-number rating of the sound-absorption of a material equal to the arithmetic mean of the sound-absorption coefficients in the 250, 500, 1000, and 2,000 Hz octave frequency bands rounded to the nearest multiple of 0.05. It is a representation of the amount of sound energy absorbed upon striking a particular surface. An NRC of 0 indicates perfect reflection; an NRC of 1 indicates perfect absorption. |
| **RT60** | The time it takes reverberant sound to decay by 60 dB once the source has been removed. |
| **Sabin** | The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 Sabin. |
| **SEL** | Sound Exposure Level. SEL is a rating, in decibels, of a discrete event, such as an aircraft flyover or train pass by, that compresses the total sound energy into a one-second event. |
| **SPC** | Speech Privacy Class. SPC is a method of rating speech privacy in buildings. It is designed to measure the degree of speech privacy provided by a closed room, indicating the degree to which conversations occurring within are kept private from listeners outside the room. |
| **STC** | Sound Transmission Class. STC is an integer rating of how well a building partition attenuates airborne sound. It is widely used to rate interior partitions, ceilings/floors, doors, windows and exterior wall configurations. The STC rating is typically used to rate the sound transmission of a specific building element when tested in laboratory conditions where flanking paths around the assembly don't exist. A larger number means more attenuation. The scale, like the decibel scale for sound, is logarithmic. |
| **Threshold of Hearing** | The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing. |
| **Threshold of Pain** | Approximately 120 dB above the threshold of hearing. |
| **Impulsive** | Sound of short duration, usually less than one second, with an abrupt onset and rapid decay. |
| **Simple Tone** | Any sound which can be judged as audible as a single pitch or set of single pitches. |

## Appendix B1: Continuous Noise Monitoring Results

**Site:** LT-1
**Project:** West Roseville Grocery Outlet & Retail
**Meter:** LDL 820-3
**Location:** North-East Project Boundary
**Calibrator:** CAL200
**Coordinates:** 38.7660836°, -121.3556668°

| Date | Time | Measured Level, dBA | | | |
|---|---|---|---|---|---|
| | | $L_{eq}$ | $L_{max}$ | $L_{50}$ | $L_{90}$ |
| Thursday, May 26, 2022 | 11:00 | 71 | 87 | 69 | 58 |
| Thursday, May 26, 2022 | 12:00 | 71 | 95 | 69 | 59 |
| Thursday, May 26, 2022 | 13:00 | 71 | 83 | 69 | 59 |
| Thursday, May 26, 2022 | 14:00 | 72 | 87 | 70 | 61 |
| Thursday, May 26, 2022 | 15:00 | 71 | 89 | 70 | 61 |
| Thursday, May 26, 2022 | 16:00 | 72 | 93 | 70 | 63 |
| Thursday, May 26, 2022 | 17:00 | 71 | 83 | 70 | 61 |
| Thursday, May 26, 2022 | 18:00 | 71 | 86 | 70 | 62 |
| Thursday, May 26, 2022 | 19:00 | 70 | 84 | 68 | 57 |
| Thursday, May 26, 2022 | 20:00 | 69 | 89 | 66 | 55 |
| Thursday, May 26, 2022 | 21:00 | 67 | 86 | 64 | 53 |
| Thursday, May 26, 2022 | 22:00 | 64 | 77 | 59 | 49 |
| Thursday, May 26, 2022 | 23:00 | 62 | 78 | 54 | 47 |
| Friday, May 27, 2022 | 0:00 | 60 | 76 | 51 | 45 |
| Friday, May 27, 2022 | 1:00 | 57 | 82 | 46 | 41 |
| Friday, May 27, 2022 | 2:00 | 56 | 75 | 44 | 40 |
| Friday, May 27, 2022 | 3:00 | 59 | 80 | 44 | 39 |
| Friday, May 27, 2022 | 4:00 | 63 | 77 | 52 | 43 |
| Friday, May 27, 2022 | 5:00 | 66 | 80 | 59 | 48 |
| Friday, May 27, 2022 | 6:00 | 70 | 94 | 66 | 55 |
| Friday, May 27, 2022 | 7:00 | 72 | 91 | 71 | 61 |
| Friday, May 27, 2022 | 8:00 | 72 | 85 | 70 | 64 |
| Friday, May 27, 2022 | 9:00 | 71 | 84 | 70 | 59 |
| Friday, May 27, 2022 | 10:00 | 71 | 86 | 69 | 58 |

| Statistics | Leq | Lmax | L50 | L90 |
|---|---|---|---|---|
| Day Average | 71 | 87 | 69 | 59 |
| Night Average | 64 | 80 | 53 | 45 |
| Day Low | 67 | 83 | 64 | 53 |
| Day High | 72 | 95 | 71 | 64 |
| Night Low | 56 | 75 | 44 | 39 |
| Night High | 70 | 94 | 66 | 55 |
| Ldn | 72 | Day % | | 89 |
| CNEL | 73 | Night % | | 11 |




## Appendix B2: Continuous Noise Monitoring Results

**Site:** LT-2
**Project:** West Roseville Grocery Outlet & Retail
**Meter:** LDL 820-2
**Location:** South-East Project Boundary
**Calibrator:** CAL200
**Coordinates:** 38.7652076°, -121.35584288°

| Date | Time | Measured Level, dBA | | | |
|---|---|---|---|---|---|
| | | $L_{eq}$ | $L_{max}$ | $L_{50}$ | $L_{90}$ |
| Thursday, May 26, 2022 | 11:00 | 51 | 76 | 50 | 47 |
| Thursday, May 26, 2022 | 12:00 | 51 | 69 | 50 | 47 |
| Thursday, May 26, 2022 | 13:00 | 50 | 70 | 49 | 46 |
| Thursday, May 26, 2022 | 14:00 | 51 | 66 | 49 | 47 |
| Thursday, May 26, 2022 | 15:00 | 50 | 69 | 48 | 46 |
| Thursday, May 26, 2022 | 16:00 | 49 | 65 | 49 | 46 |
| Thursday, May 26, 2022 | 17:00 | 50 | 68 | 49 | 46 |
| Thursday, May 26, 2022 | 18:00 | 50 | 64 | 49 | 46 |
| Thursday, May 26, 2022 | 19:00 | 50 | 68 | 48 | 45 |
| Thursday, May 26, 2022 | 20:00 | 50 | 67 | 48 | 45 |
| Thursday, May 26, 2022 | 21:00 | 51 | 74 | 47 | 44 |
| Thursday, May 26, 2022 | 22:00 | 46 | 62 | 45 | 42 |
| Thursday, May 26, 2022 | 23:00 | 45 | 59 | 44 | 41 |
| Friday, May 27, 2022 | 0:00 | 45 | 59 | 44 | 41 |
| Friday, May 27, 2022 | 1:00 | 43 | 58 | 42 | 38 |
| Friday, May 27, 2022 | 2:00 | 42 | 53 | 41 | 37 |
| Friday, May 27, 2022 | 3:00 | 42 | 55 | 40 | 37 |
| Friday, May 27, 2022 | 4:00 | 44 | 54 | 43 | 39 |
| Friday, May 27, 2022 | 5:00 | 48 | 64 | 46 | 43 |
| Friday, May 27, 2022 | 6:00 | 50 | 68 | 49 | 46 |
| Friday, May 27, 2022 | 7:00 | 50 | 67 | 50 | 47 |
| Friday, May 27, 2022 | 8:00 | 51 | 71 | 50 | 48 |
| Friday, May 27, 2022 | 9:00 | 49 | 64 | 48 | 45 |
| Friday, May 27, 2022 | 10:00 | 49 | 69 | 47 | 45 |

| Statistics | Leq | Lmax | L50 | L90 |
|---|---|---|---|---|
| Day Average | 50 | 69 | 49 | 46 |
| Night Average | 46 | 59 | 44 | 41 |
| Day Low | 49 | 64 | 47 | 44 |
| Day High | 51 | 76 | 50 | 48 |
| Night Low | 42 | 53 | 40 | 37 |
| Night High | 50 | 68 | 49 | 46 |
| Ldn | 53 | Day % | | 82 |
| CNEL | 54 | Night % | | 18 |