NOISE IMPACT ANALYSIS

MISTER CAR WASH PROJECT

MERCED, CALIFORNIA

LSA

May 2021

ATTACHMENT 3

NOISE IMPACT ANALYSIS

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MERCED, CALIFORNIA

Submitted to:

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Project No. MSR2101

LSA

May 2021

TABLE OF CONTENTS

FIGURES AND TABLES

FIGURES

TABLES

APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

City	City of Merced
dB	decibel(s)
dBA	A-weighted decibel(s)
EPA	United States Environmental Protection Agency
FHWA	Federal Highway Administration
ft	foot/feet
L_{dn}	day-night average noise level
L_{eq}	equivalent continuous sound level
L_{max}	maximum instantaneous noise level
Proposed project	Mister Car Wash Project
SPL	Sound Power Level

INTRODUCTION

This noise impact analysis has been prepared to evaluate the potential noise impacts and mitigation measures associated with the proposed Mister Car Wash Project (proposed project) in Merced, California. This report is intended to satisfy the City of Merced's (City) requirement for a project-specific noise impact analysis by examining the impacts of the proposed uses on the project site and identifies whether any noise reduction measures to reduce project noise impacts would be necessary.

PROJECT LOCATION AND DESCRIPTION

The proposed Mister Carwash is located along G Street northeast of the intersection with East Yosemite Avenue in the City of Merced, California. The proposed project would construct a new, approximately 5,360-square-foot carwash within the Yosemite Crossing Shopping Center. Proposed multi-family residences and existing single-family residences are located approximately 110 feet and 430 feet to the east, respectively. A proposed day care would be located approximately 160 feet southeast of the proposed car wash. Classroom buildings within the Merced College campus are located 4,700 feet to the northwest, across G Street. The proposed project location map and site plan are presented in Figures 1 and 2, respectively.

EXISTING LAND USES IN THE PROJECT AREA

The project site is surrounded by commercial developments, residential, and school land uses. The areas adjacent to the project site include the following uses:

- **North:** Vacant land
- **East:** Residential uses; existing single-family and planned multifamily, proposed day care
- **South:** Proposed commercial uses
- **West:** Merced College, opposite G Street

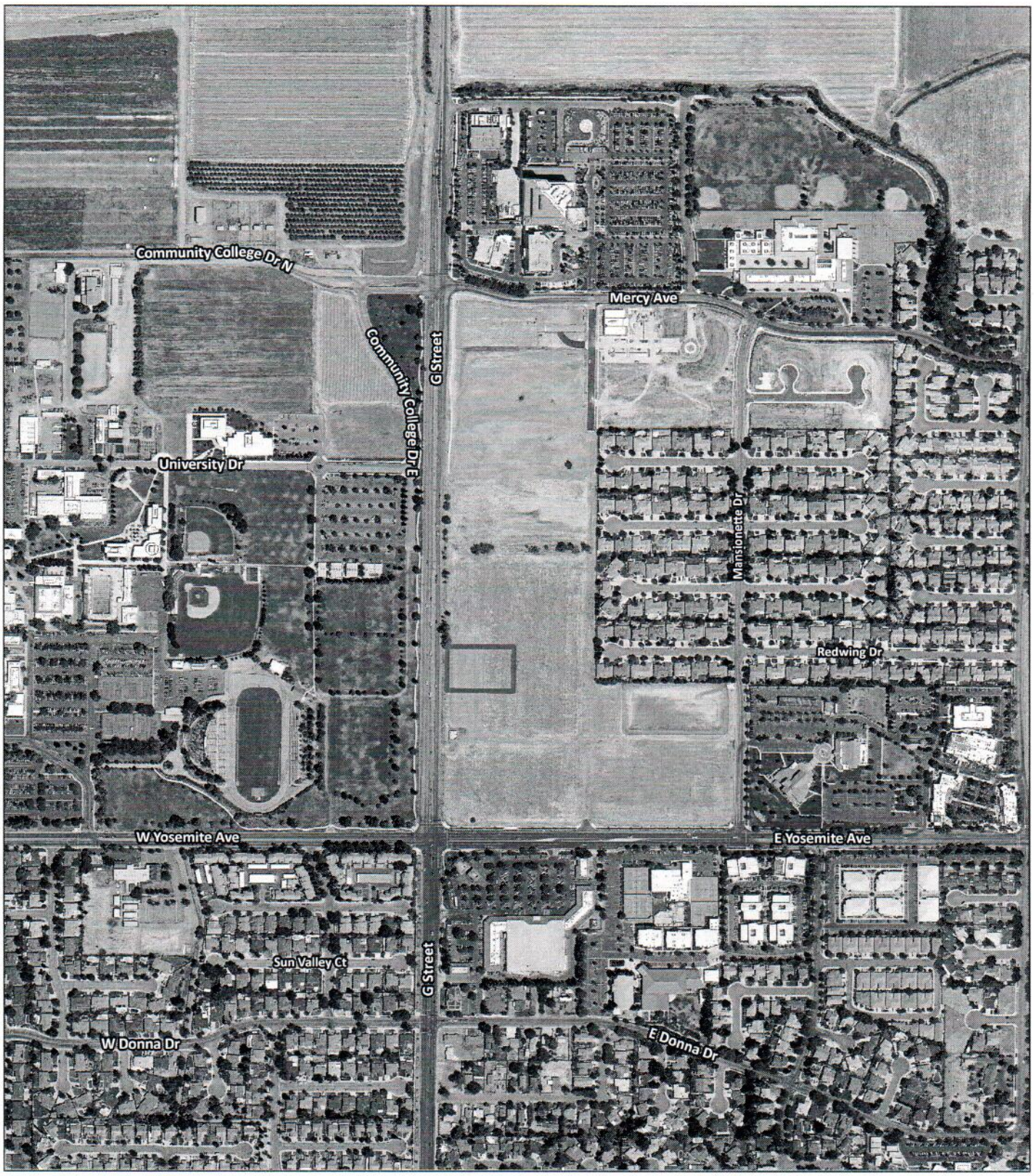

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FIGURE 1

0 350 700
FEET

N

Project Area

Mister Car Wash Project Noise Analysis
Merced, California
Project Site Location Map

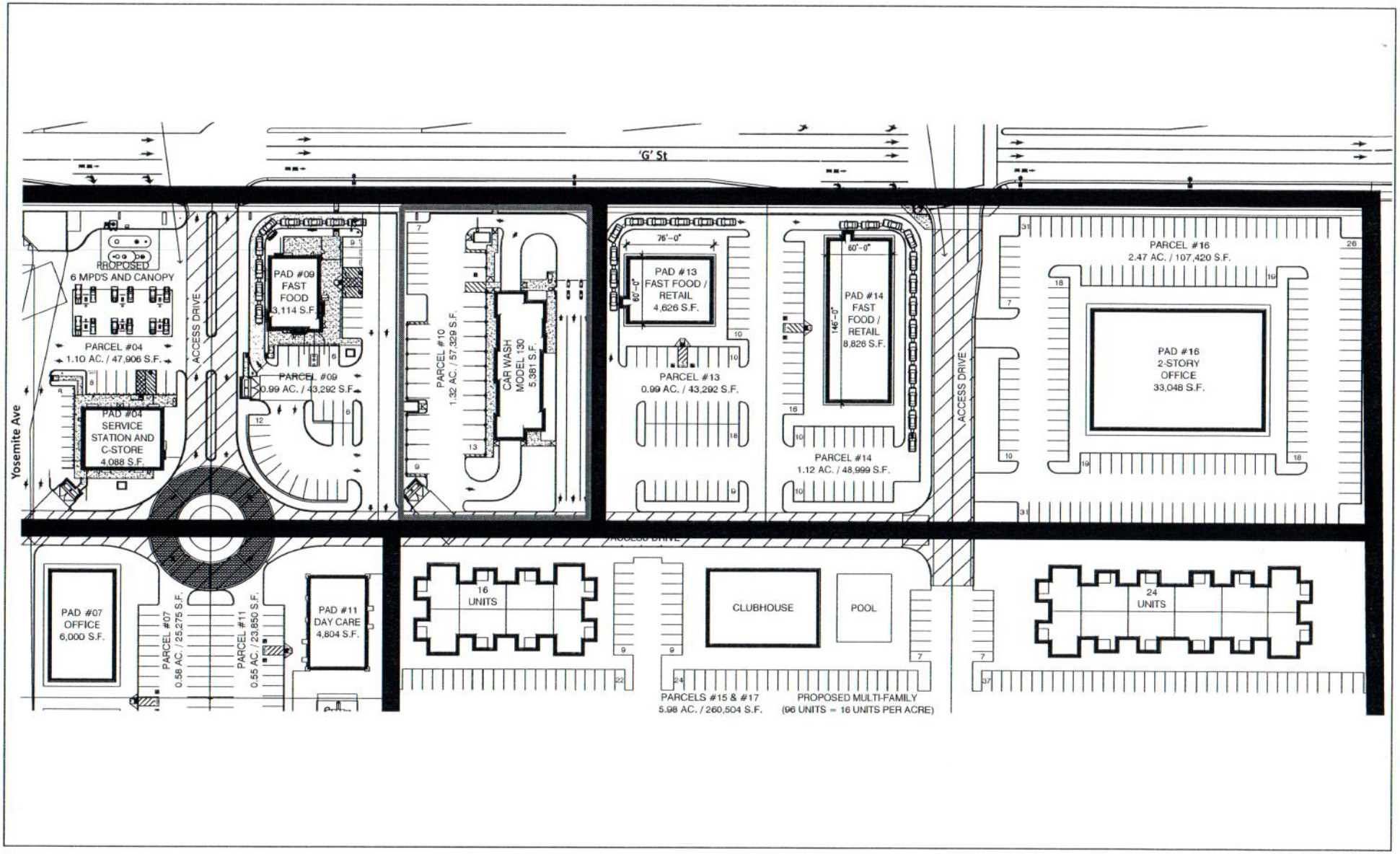

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FIGURE 2

NOT TO SCALE

Project Boundary

Mister Car Wash Project Noise Analysis
Merced, California
Site Plan

SOURCE: Centerline Design, LLC, December 2020

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NOISE AND VIBRATION FUNDAMENTALS

CHARACTERISTICS OF SOUND

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

To the human ear, sound has two significant characteristics: pitch and loudness. Pitch is generally an annoyance, while loudness can affect the ability to hear. Pitch is the number of complete vibrations, or cycles per second, of a sound wave, which results in the tone's range from high to low. Loudness is the strength of a sound, and it describes a noisy or quiet environment; it is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound wave combined with the reception characteristics of the human ear. Sound intensity refers to the power carried by sound waves per unit area in a direction perpendicular to that area. 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 pressure level and its effect on adjacent sensitive land uses.

Measurement of Sound

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

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

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

There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. The equivalent continuous

sound level (L_{eq}) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the L_{eq} and Community Noise Equivalent Level (CNEL) or the day-night average noise level (L_{dn}) based on A-weighted decibels (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 noise occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and a 10 dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale but without the adjustment for events occurring during the relaxation and sleeping 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 instantaneous 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. Additionally, an increase of more than 5 dBA is typically considered readily perceptible in an exterior environment. The second category, potentially audible, refers to a change in the noise level between 1 dB and 3 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category includes changes in noise levels of less than 1 dB, which are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

Physiological Effects of Noise

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

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

Table A: Definitions of Acoustical Terms

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

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	— 110 —	Rock band
Jet fly-over at 1,000 ft		
	— 100 —	
Gas lawn mower at 3 ft		
	— 90 —	
Diesel truck at 50 ft at 50 mph		Food blender at 3 ft
	— 80 —	Garbage disposal at 3 ft
Noisy urban area, daytime		
Gas lawn mower, 100 ft	— 70 —	Vacuum cleaner at 10 ft
Commercial area		Normal speech at 3 ft
Heavy traffic at 300 ft	— 60 —	
		Large business office
Quiet urban daytime	— 50 —	Dishwasher next room
Quiet urban nighttime	— 40 —	Theater, large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	— 20 —	
		Broadcast/recording studio
	— 10 —	
Lowest threshold of human hearing	— 0 —	Lowest threshold of human hearing

Source: *Technical Noise Supplement,* California Department of Transportation (September 2013).
dBA = A-weighted decibels
ft = feet
mph = miles per hour

REGULATORY SETTING

APPLICABLE NOISE STANDARDS

City of Merced General Plan Noise Element

Policy N-1.5.b within Chapter 10 (Noise) of Merced Vision 2030 General Plan states:

> *'Noise created by new proposed non-transportation noise sources should be mitigated to the extent feasible so as not to exceed the exterior noise level standards of Table N-1 as measured immediately within the property line of lands designated for noise-sensitive uses.'*

Table N-1 of the City's General Plan limits such fixed noise sources to 55 dBA L_{eq} (1-hour) from 7:00 a.m. to 10:00 p.m. and 45 dBA L_{eq} (1-hour) from 10:00 p.m. to 7:00 a.m.

Each of the noise standards specified above shall be lowered by 5 dBA for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).

The City can impose noise level standards that are more restrictive than those specified above based upon determination of existing low ambient noise levels.

The types of uses which may typically produce the noise sources described above include but are not limited to: industrial facilities including pump stations, trucking operations, tire shops, auto maintenance shops, metal fabricating shops, shopping centers, drive-up windows, car washes, loading docks, public works projects, batch plants, bottling and canning plants, recycling centers, electric generating stations, race tracks, landfills, sand and gravel operations, and athletic fields.

OVERVIEW OF THE EXISTING NOISE ENVIRONMENT

AMBIENT NOISE ENVIRONMENT

Existing noise levels in the project area are predominantly the result of traffic along G Street and East Yosemite Avenue. Overhead aircraft activity is a secondary contributor to the ambient noise environment.

Aircraft Noise

Airport-related noise levels are primarily associated with aircraft engine noise made while aircraft are taking off, landing, or running their engines while still on the ground. The closest source of aircraft noise is the Merced Regional Airport, which is approximately 4 miles southwest of the project site.

Existing Traffic Noise

The guidelines included in the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA-RD-77-108) were used to evaluate traffic-related noise conditions along local 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. To be consistent with the City's General Plan limits, 1-hour L_{eq} levels were calculated using the FHWA model. Traffic volumes on local roadways were obtained from the *Draft Traffic Impact Analysis* for the Merced Mixed-Use Development (JLB Traffic Engineering, August 6, 2019). The standard vehicle mix for California arterial roadways was used for traffic on these roadways. Table C provides the existing traffic noise levels in the project vicinity. These traffic noise levels are representative of a worst-case scenario that assumes a flat terrain and no shielding between the traffic and the noise contours. Printouts of the traffic noise model are presented in Appendix A.

Table C: Existing Traffic Noise Levels

Roadway Segment	Roadway Segment	ADT	Centerline to 65 dBA L_{eq} (feet)	L_{eq} (dBA) 50 feet from Centerline of Outermost Lane	L_{eq} (dBA) at Receptor Property Line[1]
R-1: Proposed Multi-Family Use (110 feet east of car wash tunnel exit)	G Street north of E. Yosemite Ave	32,620	518	73.1	64.7
R-2: Proposed Day Care Use (160 feet southeast of car wash tunnel exit)					64.5
R-3: Existing Single-Family Homes (430 feet east of car wash tunnel exit)					61.6
R-4: Existing Educational Uses (470 feet northwest of car wash tunnel entrance)					64.4

Source: Source: Compiled by LSA (2021).
[1] Noise levels at receptors east of G Street assume hard site conditions due to intervening proposed parking lots and uses to the west assume soft-site conditions.
ADT = average daily traffic
dBA = A-weighted decibels

PROJECT IMPACTS

LONG-TERM OPERATIONAL NOISE IMPACTS

The proposed car wash operations could affect planned and existing off-site sensitive land uses. The two main stationary sources of noise include noise generated by the proposed blowers and vacuum equipment. Operations of the car wash are expected to occur during the daytime hours of 7:00 a.m. to 10:00 p.m. No operations would occur during nighttime hours. Because ambient noise levels due to traffic noise on G Street exceed the City's noise level standard of 55 dBA L_{eq}, potential noise impacts would occur if the proposed project creates a perceptible increase at the sensitive receptors. Typically, a 3 dBA L_{eq} increase is considered perceptible in laboratory conditions and a 5 dBA increase is considered perceptible in an outdoor environment. The following provides a detailed noise analysis and discussion of each stationary noise source.

Car Wash Operations

The project would construct a drive-through car wash with a total of 25 vacuum stations, which would generate operational noise. Based on reference noise specifications from similar car wash operations, each vacuum motor would have generate a noise level 56 dBA at 10 feet based on a sound power level (SPL) of 65 dBA from the vacuum stanchion and a SPL of 73 dBA from the motor. For the purpose of this noise analysis, all 25 vacuum stations were assumed to be in operation simultaneously.

Based on measurements gathered at a similar car wash (WSP October 2018), noise levels at the car wash tunnel exit are typically 84.8 dBA L_{eq} at a distance of 51 feet. These measured noise levels include the same blowers proposed for the project.

To determine the future noise levels generated by the proposed project to noise sensitive uses, a 3-D noise model, SoundPLAN, was used to incorporate the site topography, proposed buildings, and stationary noise sources. Printouts of the SoundPLAN noise model are presented in Appendix B.

Cumulative Unmitigated Impact Assessment

Table D shows the noise levels from the car wash tunnel and vacuum stations at the surrounding sensitive land uses to the proposed project without mitigation. As shown in Table D, noise levels generated by the car wash operations would cause a 10.5 dBA L_{eq} increase at the proposed multi-family residential uses and a 5.8 dBA L_{eq} increase at the proposed day care use which would constitute a noise impact. Noise levels at the other sensitive receptors would not generate a noise increase of 5 dBA L_{eq} or more.

Table D: Unmitigated Car Wash Noise Levels

Receptor	Direction	Ambient Noise Level (dBA L_{eq})	Composite Car Wash Noise Level (dBA L_{eq})	Combined Noise Level (dBA L_{eq})	Noise Level Increase (dBA L_{eq})
R-1	East	64.7	74.8	75.2	10.5
R-2	Southeast	64.7	69.2	70.5	5.8
R-3	East	61.6	59.5	63.7	2.1
R-4	Northwest	64.4	59.0	65.5	1.1

Source: Compiled by LSA Associates, Inc. (2021).
dBA = A-weighted decibels
L_{eq} = equivalent continuous sound level

Cumulative Mitigated Impact Assessment

Due to an expected noise increase of 10.5 dBA L_{eq} at the planned multi-family uses to the east and a noise increase of 5.8 dBA L_{eq} at the planned daycare use to the southeast, noise reduction features in the form of noise walls near the car wash exit were evaluated. Table E shows the noise levels from the car wash tunnel and vacuum stations at the surrounding sensitive land uses with the incorporation two walls, one 13 feet high and a second 10 feet high, near the car wash exit, as shown in Figure 3. As demonstrated in Table E, noise levels generated by the car wash operations with the noise reduction features would result in an increase of up to 4.9 dBA L_{eq} at the surrounding sensitive receptors and planned future sensitive receptors; and would not result in a perceptible noise increase of 5 dBA L_{eq} or more. The location and height of the proposed walls is shown on Figure 3.

Table E: Mitigated Car Wash Noise Levels

Receptor	Direction	Ambient Noise Level (dBA L_{eq})	Composite Car Wash Noise Level (dBA L_{eq})	Combined Noise Level (dBA L_{eq})	Noise Level Increase (dBA L_{eq})
R-1	East	64.7	66.4	68.6	3.9
R-2	Southeast	64.7	67.9	69.6	4.9
R-3	East	61.6	56.6	62.8	1.2
R-4	Northwest	64.4	59.0	65.5	1.1

Source: Compiled by LSA Associates, Inc. (2021).
dBA = A-weighted decibels
L_{eq} = equivalent continuous sound level

CONCLUSION

With the construction of the two walls at the tunnel exit, the proposed project would not generate on-site stationary noise from car wash operations resulting in a perceptible increase at off-site sensitive receptor locations. Therefore, potential stationary source noise impacts would be less than significant.

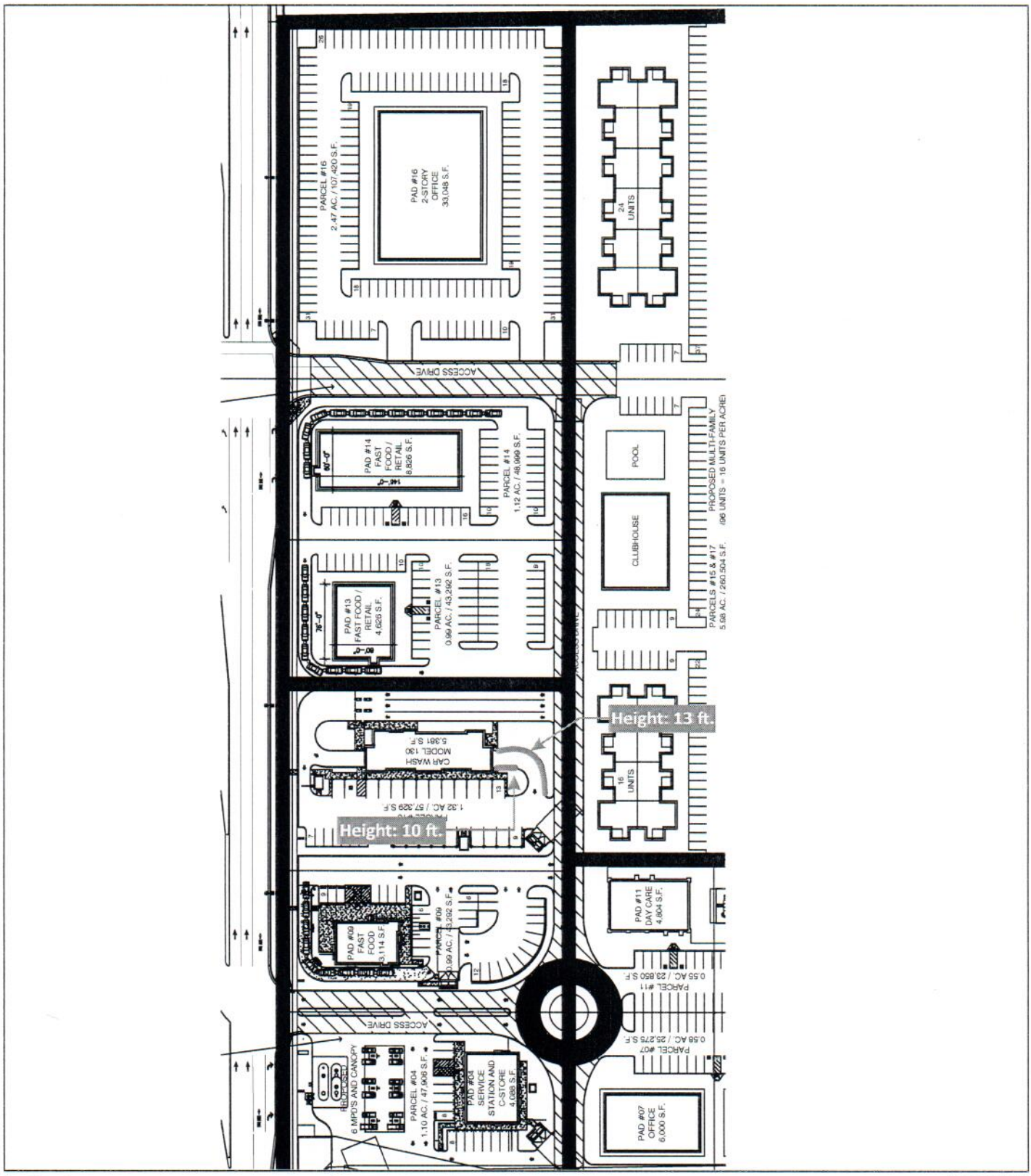

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FIGURE 3

N NOT TO SCALE

Walls Location

Mister Car Wash Project Noise Analysis
Merced, California
Proposed Walls Location

SOURCE: Centerline Design, LLC, December 2020

REFERENCES

City of Merced. *Merced Vision 2030 General Plan*. Chapter 10 - Noise.

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

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

JLB Traffic Engineering. 2019. *Draft Traffic Impact Analysis for the Merced Mixed-Use Development Project.* August.

WSP. 2018. Prestige Car Wash Noise Measurements. October.

APPENDIX A

FHWA TRAFFIC NOISE MODEL PRINTOUTS

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/29/2021
ROADWAY SEGMENT: G Street north of Yosemite Ave

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 32620 DAY PEAK HOUR: 1957.2 NITE PEAK HOUR: 2935.8
SPEED (MPH): 55 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): 40 SITE CHARACTERISTICS: HARD

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* * CALCULATED NOISE LEVELS * *

DAY PEAK LEQ AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 71.31

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO DAY PEAK LEQ

72 LEQ	65 LEQ	55 LEQ
79.5	346.5	3442.3

NITE PEAK LEQ AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 73.07

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO NITE PEAK LEQ

72 LEQ	65 LEQ	55 LEQ
110.5	517.7	5162.1

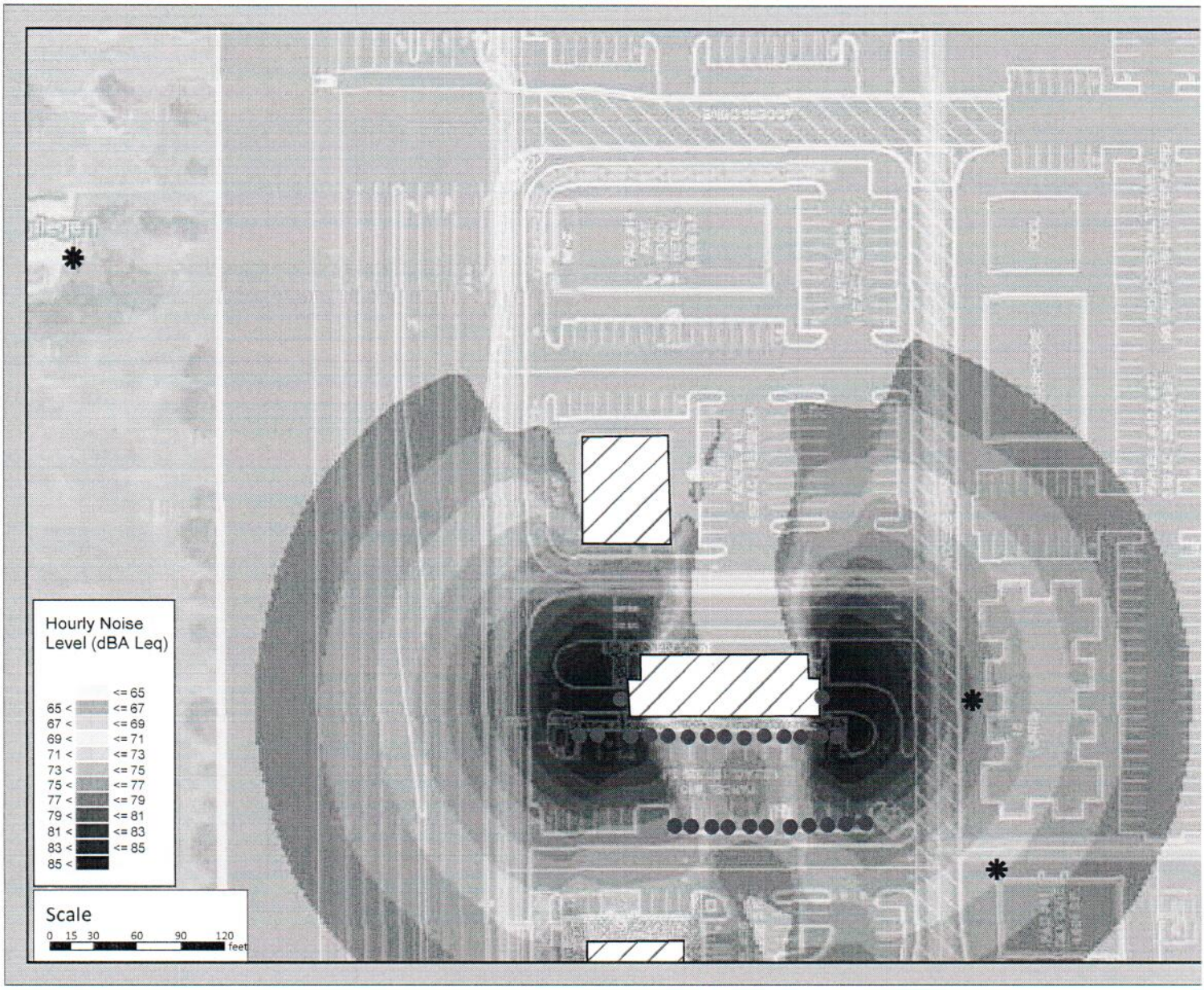
APPENDIX B

SOUNDPLAN NOISE MODEL PRINTOUTS

Mister Car Wash

Project No. MSR2101

Project Operational Noise Levels - Unmitigated



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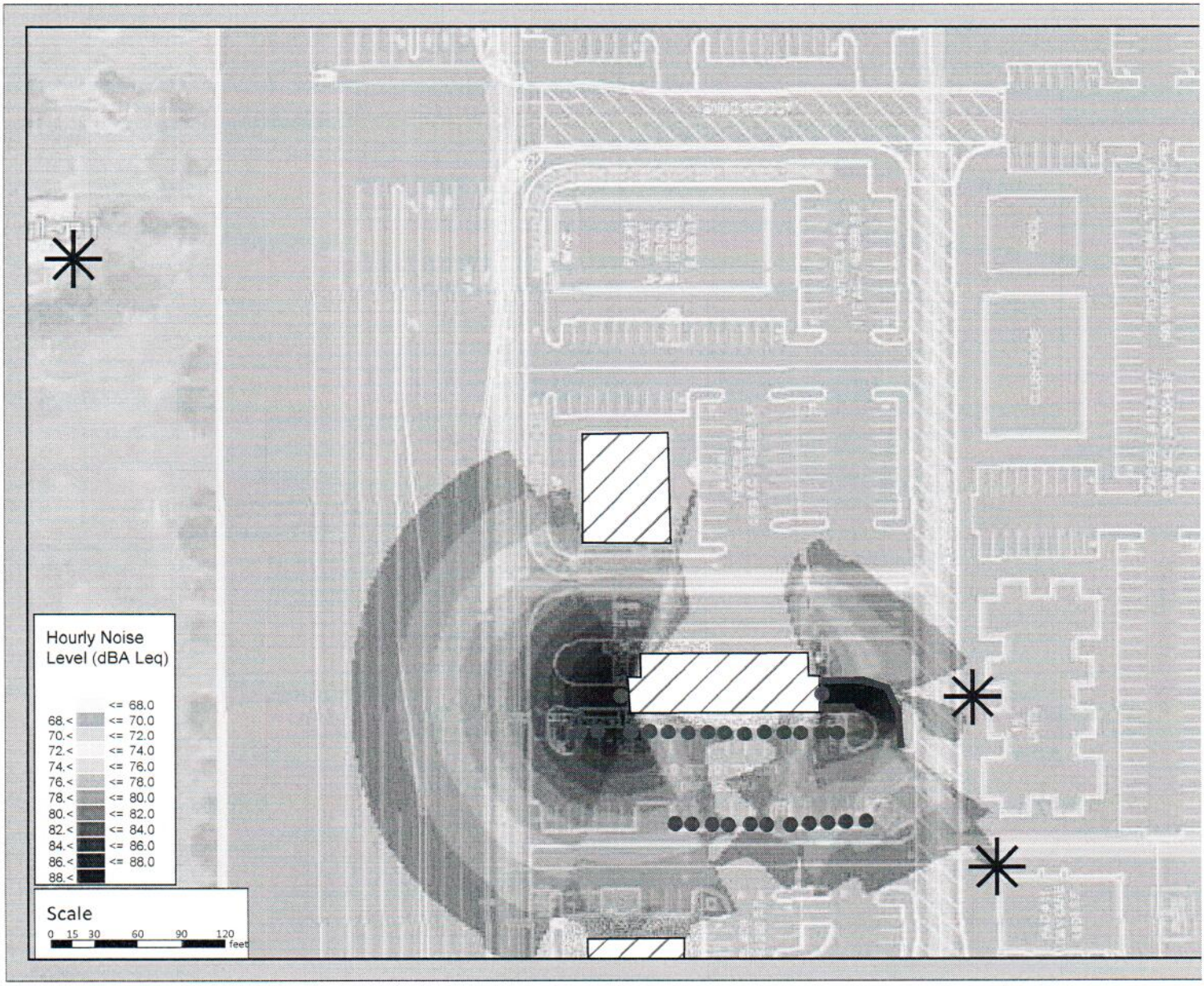
Mister Car Wash

Project No. MSR2101

Project Operational Noise Levels - Mitigated



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