



# 200 North Las Posas Road Project

## Noise and Vibration Study

*prepared for*

**A & S Engineering**  
28405 Sand Canyon Road, Suite B  
Canyon County, California 91387

*prepared by*

**Rincon Consultants, Inc.**  
2215 Faraday Avenue, Suite A  
Carlsbad, California 92008

**May 2022**



**RINCON CONSULTANTS, INC.**

Environmental Scientists | Planners | Engineers

[rinconconsultants.com](http://rinconconsultants.com)



# Table of Contents

---

1	Project Description and Impact Summary .....	1
1.1	Introduction .....	1
1.2	Project Summary.....	1
2	Background .....	5
2.1	Overview of Sound Measurement .....	5
2.2	Vibration .....	6
2.3	Sensitive Receivers.....	7
2.4	Project Noise Setting.....	7
2.5	Applicable Regulatory Setting.....	9
3	Methodology .....	13
3.1	Construction Noise.....	13
3.2	Groundborne Vibration.....	13
3.3	Operational Noise Sources.....	15
3.4	Traffic Noise .....	17
4	Significance Thresholds .....	18
5	Impact Analysis .....	19
5.1	Item 1 – Temporary and Permanent Noise Increase .....	19
5.2	Item 2 – Vibration .....	21
5.3	Item 3 – Airport Noise.....	22
6	Conclusions .....	23
7	References .....	24

## Tables

Table 1	Summary of Impacts .....	1
Table 2	Project Site Vicinity Sound Level Monitoring Results .....	9
Table 3	Sound Level Monitoring Traffic Counts .....	9
Table 4	Noise and Land Use Compatibility Guidelines for Exterior Noise .....	11
Table 5	Exterior Noise Standards by Zone .....	12
Table 6	Vibration Levels Measured during Construction Activities.....	14
Table 7	AASHTO Maximum Vibration Levels for Preventing Damage.....	14
Table 8	Human Response to Steady State Vibration .....	15
Table 9	Human Response to Transient Vibration .....	15
Table 10	Modeled Equipment .....	17
Table 11	Existing and Proposed ADT Volume.....	17
Table 12	Operational Noise Levels at Off-site Receivers.....	21

## Figures

Figure 1	Regional Location.....	2
Figure 2	Project Site Location .....	3
Figure 3	Site Plan.....	4
Figure 4	Noise Measurement Locations .....	8
Figure 5	Modeled Receivers and Daytime Noise Contours .....	20

## Appendices

Appendix A	Noise Measurement Data
Appendix B	Roadway Construction Noise Model (RCNM) Results
Appendix C	Car Wash Blower Specifications
Appendix D	Greencheck Fan Specifications
Appendix E	Drive-Through Speaker Specifications
Appendix F	HVAC Specifications

# 1 Project Description and Impact Summary

## 1.1 Introduction

This study analyzes the potential noise and vibration impacts of the proposed 200 North Las Posas Road Project (project) in the City of San Marcos, San Diego County, California. The purpose of this study is to analyze the project's noise and vibration impacts related to both temporary construction activity and long-term operation of the project. Table 1 provides a summary of project impacts.

**Table 1 Summary of Impacts**

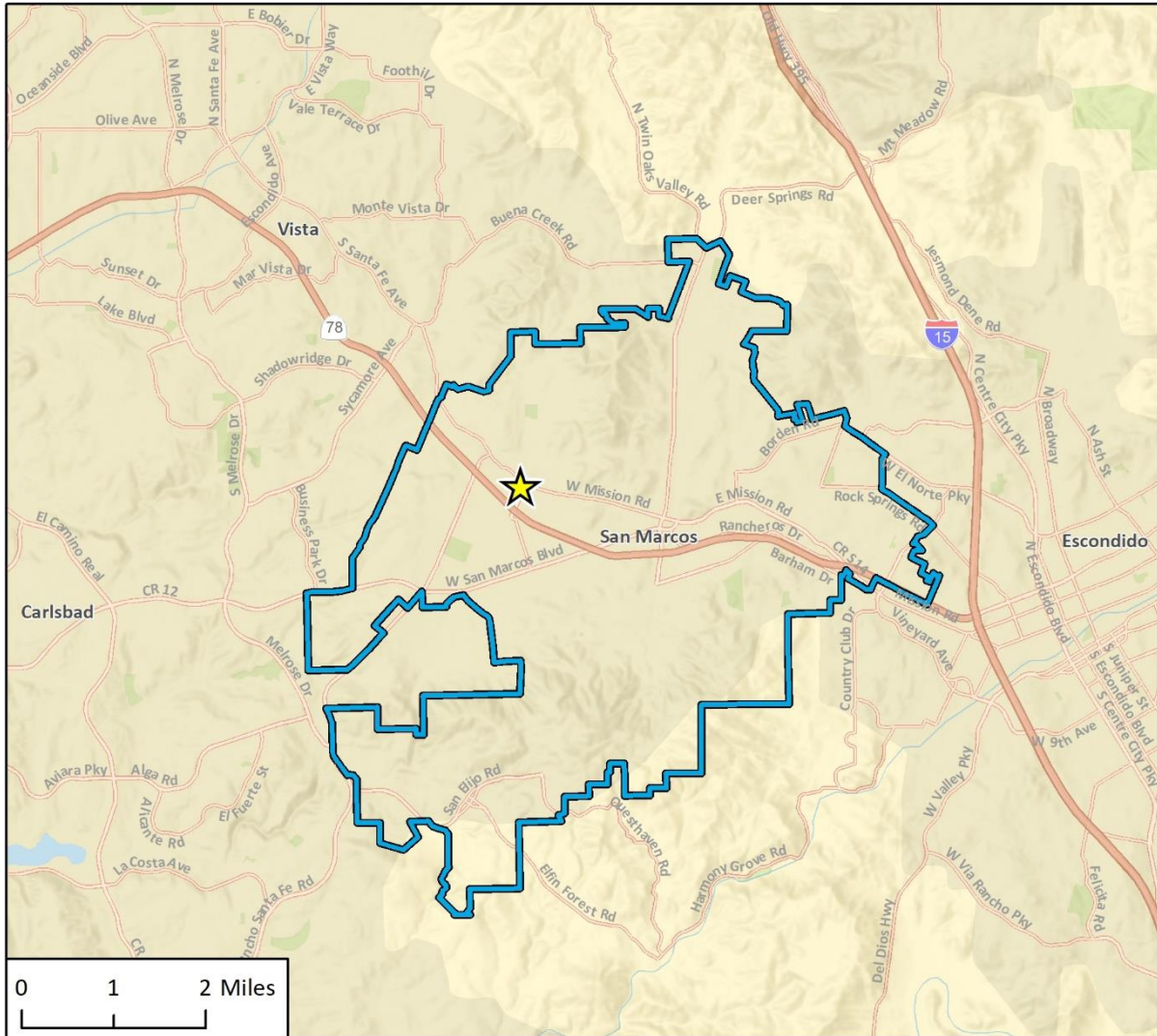
Impact Statement	Level of Significance	Applicable Recommendations
Would the project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	Less Than Significant Impact (Construction) Less Than Significant Impact (Operation)	None
Would the project result in generation of excessive ground-borne vibration or ground-borne noise levels?	Less Than Significant Impact	None
For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	No Impact	None

## 1.2 Project Summary

The project would include development of 5,000 square foot (sf) food mart, 2,000 sf car wash (with 1,000 sf equipment room), and 6,232 sf gas station canopy with 9 fuel dispensing pumps (see Figure 3). The proposed project would be developed on a currently vacant parcel of land with a current land use designation of Mixed-Use Non-Residential (MU-3). Operational hours of the car wash would be between 7:00 a.m. to 10:00 p.m., while operational hours of the drive-through would be between 5:00 a.m. to 12:00 a.m.

Construction activities include site preparation, grading, building construction, paving, and architectural coating (e.g., painting). Figure 1 shows the regional location of the site, and Figure 2 shows the project site in the existing neighborhood context.

Figure 1 Regional Location



Imagery provided by Esri and its licensors © 2020.

- ★ Project Site
- ▭ City of San Marcos

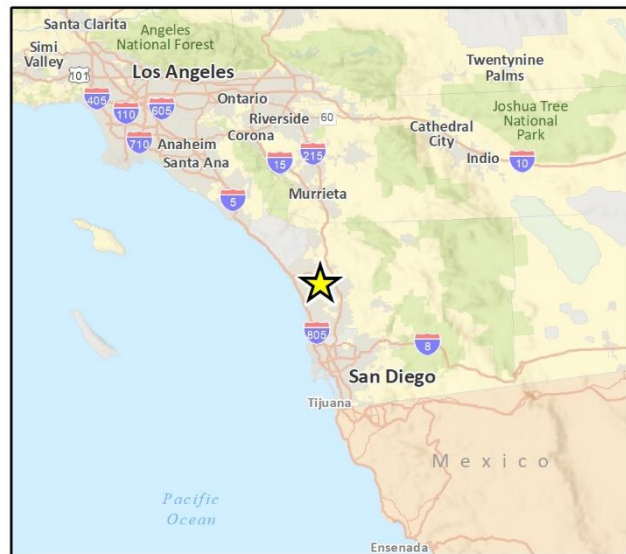
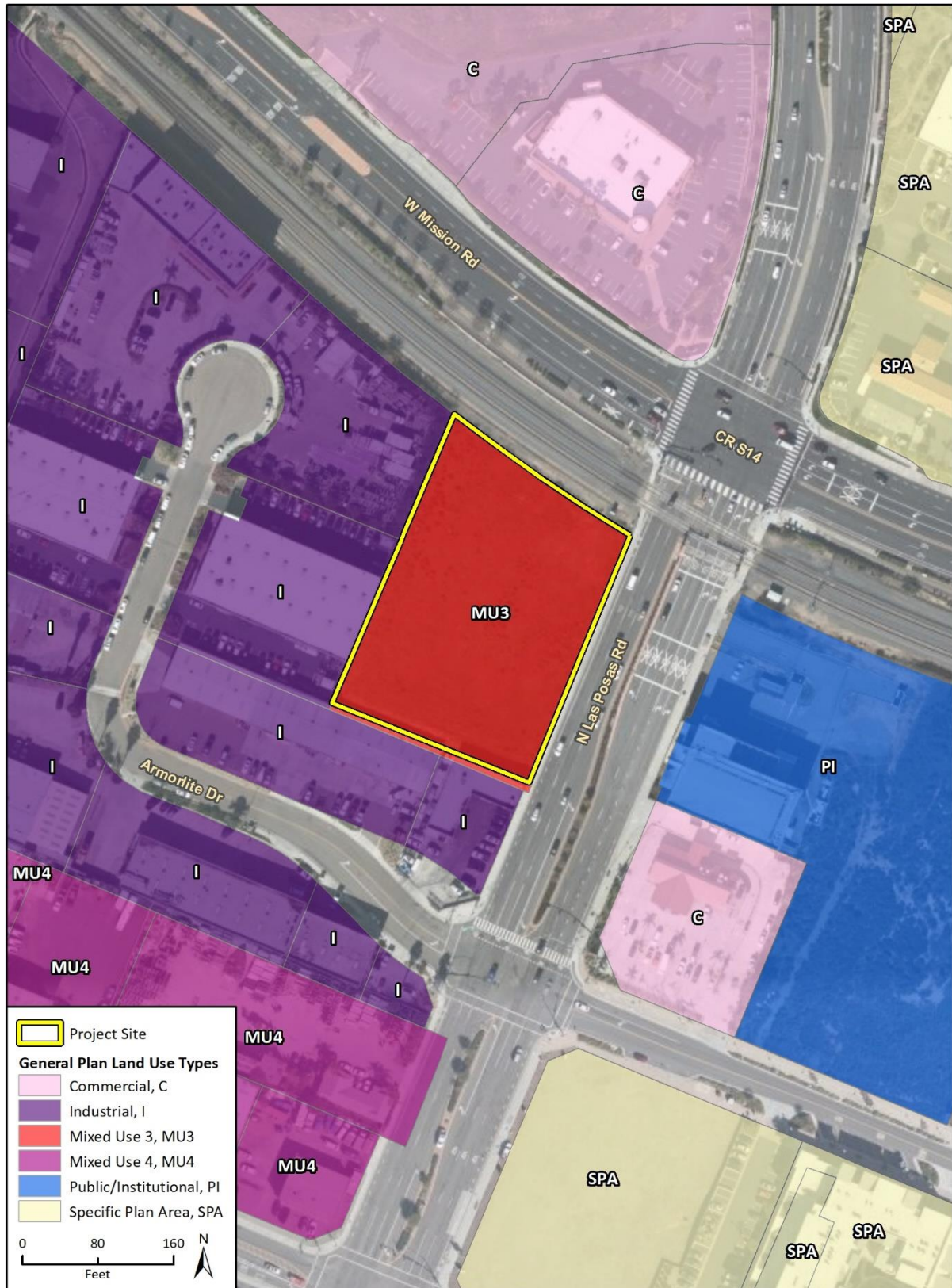


Fig 1 Project Location

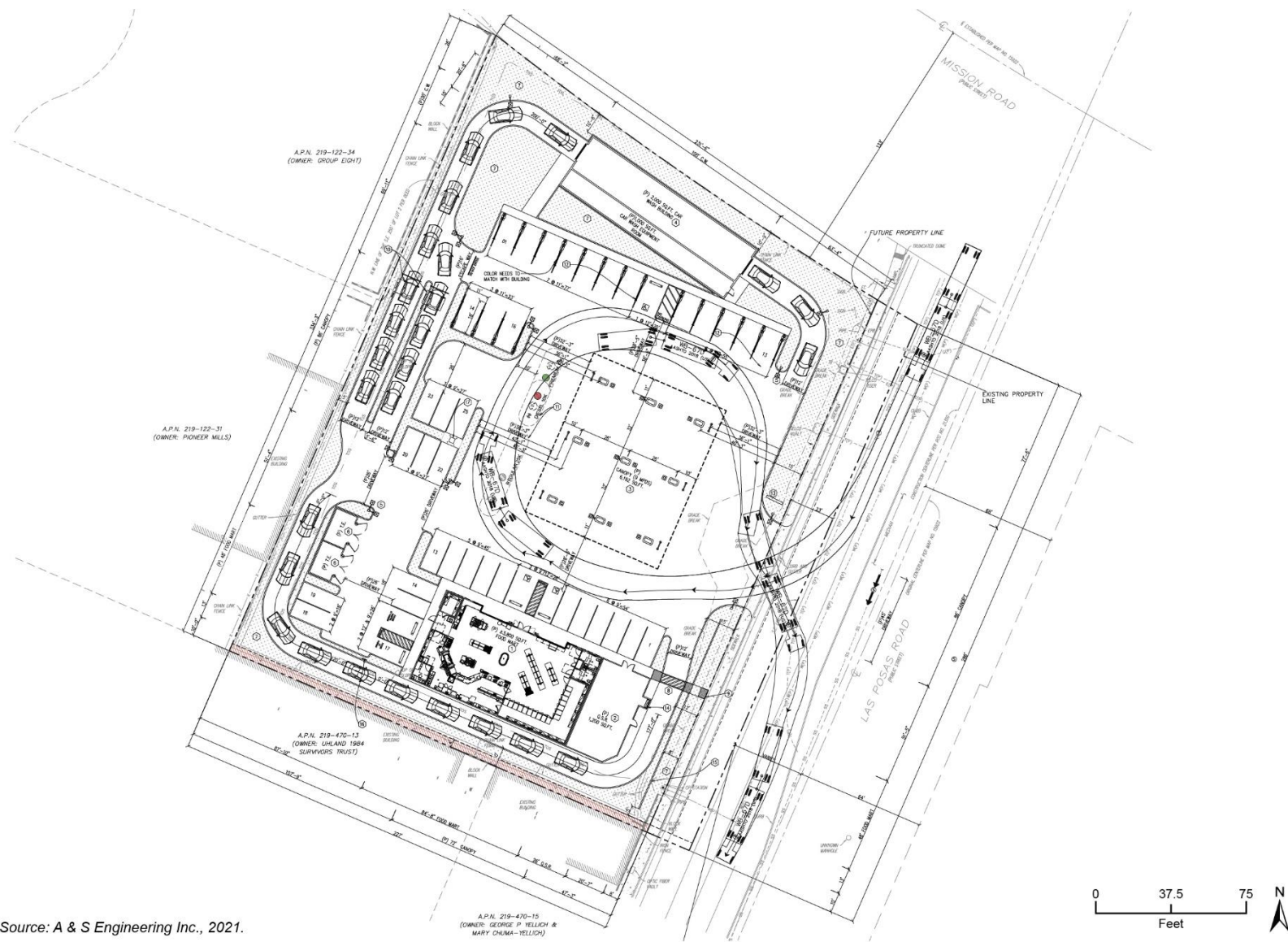
Figure 2 Project Site Location



Imagery provided by Microsoft Bing and its licensors © 2020.  
Additional data provided by City of San Marcos General Plan Land Use, 2018.

Fig. 2 Surrounding Land Use

Figure 3 Site Plan



Source: A & S Engineering Inc., 2021.



## 2 Background

---

### 2.1 Overview of Sound Measurement

Sound is a vibratory disturbance created by a moving or vibrating source, which is capable of being detected by the hearing organs. Noise is defined as sound that is loud, unpleasant, unexpected, or undesired and may therefore be classified as a more specific group of sounds. The effects of noise on people can include general annoyance, interference with speech communication, sleep disturbance, and, in the extreme, hearing impairment (Caltrans 2013).

Noise levels are commonly measured in decibels (dB) using the A-weighted sound pressure level (dBA). The A-weighting scale is an adjustment to the actual sound pressure levels so that they are consistent with the human hearing response, which is most sensitive to frequencies around 4,000 Hertz and less sensitive to frequencies around and below 100 Hertz (Kinsler, et. al. 1999). Decibels are measured on a logarithmic scale that quantifies sound intensity in a manner similar to the Richter scale used to measure earthquake magnitudes. A doubling of the energy of a noise source, such as doubling of traffic volume, would increase the noise level by 3 dB; dividing the energy in half would result in a 3 dB decrease (Crocker 2007).

Human perception of noise has no simple correlation with sound energy: the perception of sound is not linear in terms of dBA or in terms of sound energy. Two sources do not “sound twice as loud” as one source. It is widely accepted that the average healthy ear can barely perceive changes of 3 dBA, increase or decrease (i.e., twice the sound energy); that a change of 5 dBA is readily perceptible (8 times the sound energy); and that an increase (or decrease) of 10 dBA sounds twice (half) as loud ([10.5x the sound energy] Crocker 2007).

Sound changes in both level and frequency spectrum as it travels from the source to the receiver. The most obvious change is the decrease in level as the distance from the source increases. The manner by which noise reduces with distance depends on factors such as the type of sources (e.g., point or line, the path the sound will travel, site conditions, and obstructions). Noise levels from a point source typically attenuate, or drop off, at a rate of 6 dBA per doubling of distance (e.g., construction, industrial machinery, ventilation units). Noise from a line source (e.g., roadway, pipeline, railroad) typically attenuates at about 3 dBA per doubling of distance (Caltrans 2013). The propagation of noise is also affected by the intervening ground, known as ground absorption. A hard site, such as a parking lot or smooth body of water, receives no additional ground attenuation and the changes in noise levels with distance (drop-off rate) result from simply the geometric spreading of the source. An additional ground attenuation value of 1.5 dBA per doubling of distance applies to a soft site (e.g., soft dirt, grass, or scattered bushes and trees) (Caltrans 2013). Noise levels may also be reduced by intervening structures; the amount of attenuation provided by this “shielding” depends on the size of the object and the frequencies of the noise levels. Natural terrain features such as hills and dense woods, and man-made features such as buildings and walls, can significantly alter noise levels. Generally, any large structure blocking the line of sight will provide at least a 5-dBA reduction in source noise levels at the receiver (Federal Highway Administration [FHWA] 2011). Structures can substantially reduce exposure to noise as well. The FHWA’s guidelines indicate that modern building construction generally provides an exterior-to-interior noise level reduction of 20 to 35 dBA with closed windows.

The impact of noise is not a function of loudness alone. The time of day when noise occurs and the duration of the noise are also important factors of project noise impact. Most noise that lasts for more than a few seconds is variable in its intensity. Consequently, a variety of noise descriptors have been developed. One of the most frequently used noise metrics is the equivalent noise level ( $L_{eq}$ ); it considers both duration and sound power level.  $L_{eq}$  is defined as the single steady A-weighted level equivalent to the same amount of energy as that contained in the actual fluctuating levels over time. Typically,  $L_{eq}$  is summed over a one-hour period.  $L_{max}$  is the highest root mean squared (RMS) sound pressure level within the sampling period, and  $L_{min}$  is the lowest RMS sound pressure level within the measuring period (Crocker 2007).

Noise that occurs at night tends to be more disturbing than that occurring during the day. Community noise is usually measured using Day-Night Average Level ( $L_{dn}$ ), which is the 24-hour average noise level with a +10 dBA penalty for noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. It is also measured using CNEL, which is the 24-hour average noise level with a +5 dBA penalty for noise occurring from 7:00 p.m. to 10:00 p.m. and a +10 dBA penalty for noise occurring from 10:00 p.m. to 7:00 a.m. (Caltrans 2013). Noise levels described by  $L_{dn}$  and CNEL usually differ by about 1 dBA. The relationship between the peak-hour  $L_{eq}$  value and the  $L_{dn}$ /CNEL depends on the distribution of traffic during the day, evening, and night. Quiet suburban areas typically have CNEL noise levels in the range of 40 to 50 dBA, while areas near arterial streets are in the 50 to 60-plus CNEL range. Normal conversational levels are in the 60 to 65-dBA  $L_{eq}$  range; ambient noise levels greater than 65 dBA  $L_{eq}$  can interrupt conversations (FHWA 2018).

## 2.2 Vibration

Groundborne vibration of concern in environmental analysis consists of the oscillatory waves that move from a source through the ground to adjacent structures. The number of cycles per second of oscillation makes up the vibration frequency, described in terms of Hz. The frequency of a vibrating object describes how rapidly it oscillates. The normal frequency range of most groundborne vibration that can be felt by the human body starts from a low frequency of less than 1 Hz and goes to a high of about 200 Hz (Crocker 2007).

While people have varying sensitivities to vibrations at different frequencies, in general they are most sensitive to low-frequency vibration. Vibration in buildings, such as from nearby construction activities, may cause windows, items on shelves, and pictures on walls to rattle. Vibration of building components can also take the form of an audible low-frequency rumbling noise, referred to as groundborne noise. Groundborne noise is usually only a problem when the originating vibration spectrum is dominated by frequencies in the upper end of the range (60 to 200 Hz), or when foundations or utilities, such as sewer and water pipes, physically connect the structure and the vibration source (Federal Transit Administration [FTA] 2018). Although groundborne vibration is sometimes noticeable in outdoor environments, it is almost never annoying to people who are outdoors. The primary concern from vibration is that it can be intrusive and annoying to building occupants and vibration-sensitive land uses.

Vibration energy spreads out as it travels through the ground, causing the vibration level to diminish with distance away from the source. High-frequency vibrations diminish much more rapidly than low frequencies, so low frequencies tend to dominate the spectrum at large distances from the source. Discontinuities in the soil strata can also cause diffractions or channeling effects that affect the propagation of vibration over long distances (Caltrans 2020). When a building is impacted by vibration, a ground-to-foundation coupling loss will usually reduce the overall vibration level.

However, under rare circumstances, the ground-to-foundation coupling may actually amplify the vibration level due to structural resonances of the floors and walls.

Vibration amplitudes are usually expressed in peak particle velocity (PPV) or root mean squared (RMS) vibration velocity. The PPV and RMS velocity are normally described in inches per second (in./sec.). PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is often used in monitoring of blasting vibration because it is related to the stresses that are experienced by buildings (Caltrans 2020).

## 2.3 Sensitive Receivers

Noise exposure goals for various types of land uses reflect the varying noise sensitivities associated with those uses. According to the City of San Marcos Noise Element, the following land uses are considered noise-sensitive: schools, libraries, hospitals, parks, and residential neighborhoods (City of San Marcos 2012).

Sensitive receivers nearest to the project site include Palomar College, located approximately 520 feet across West Mission Road to the east of the project's northeastern corner, single family housing located approximately 745 feet across West Mission Road northwest of the project site's northwestern corner, and multi-family residences located approximately 550 feet east of the project site's southeastern corner across Las Posas road.

## 2.4 Project Noise Setting

The most common source of noise in the project site vicinity is vehicular traffic from Las Posas Road and West Mission Road and railway noise from the adjacent SPINTER commuter line. To characterize ambient sound levels at and near the project site, three 15-minute sound level measurements were conducted on December 16, 2020. Noise Measurement (NM) 1 was taken at the eastern edge of the project site to capture noise levels from Las Posas Road. NM2 was taken at the southwestern edge of the project site to capture ambient noise levels at the site. NM3 was taken at the northern edge of the project site to also capture ambient noise levels. Noise sources for all measurements included roadway traffic and SPINTER trains, which are two compartment commuter trains. One train passed during NM1 and NM2; two trains passed during NM3. The train noise included the train itself, the train horn, as well as warning bells at the intersection crossing. Each pass was approximately one minute long for the warning bells, and 30 seconds long for the train horn and train noise. The loudest noise levels on each measurement occurred during a train pass. NM1 was paused for approximately one minute due to pedestrians playing music.

Table 2 summarizes the results of the noise measurement, and Table 3 shows the recorded traffic volumes from NM1. See Figure 4 for noise measurement locations. The site measurements were conducted during a regional stay at home order in San Diego County in response to the global novel coronavirus pandemic. Due to this response, many businesses and schools were closed at the time noise measurements were collected, and the number of vehicles on the local roadways were reduced compared to typical conditions. Therefore, measured noise levels may have been lower than under typical conditions.

Figure 4 Noise Measurement Locations



Imagery provided by Microsoft Bing and its licensors © 2020.

Fig. 6 Noise Measurement Locations

**Table 2 Project Site Vicinity Sound Level Monitoring Results**

Measurement	Measurement Location	Sample Times	Approximate Distance to Primary Noise Source	L <sub>eq</sub> (dBA)	L <sub>min</sub> (dBA)	L <sub>max</sub> (dBA)
1	Eastern property boundary, adjacent to Las Posas Road	12:18 – 12:34 p.m.	Approximately 60 feet to centerline of Las Posas Road	62.1	49.7	73.5
2	Southeastern property boundary	12:38 – 12:53 p.m.	Approximately 250 feet to centerline of Las Posas Road	52.8	49.3	60.9
3	Northern property boundary, adjacent to railway	12:57 – 1:12 p.m.	50 feet to railway line and 140 feet to centerline of West Mission Road	60.3	48.3	83.8

Detailed sound level measurement data are included in Appendix A.

**Table 3 Sound Level Monitoring Traffic Counts**

Measurement	Roadway	Traffic	Autos	Medium Trucks	Heavy Trucks
NM1	Las Posas Road	15-minute count	195	1	1
		One-hour equivalent	780	4	4
<b>Percent</b>			<b>98%</b>	<b>1%</b>	<b>1%</b>

Detailed sound level measurement data are included in Appendix A.

## 2.5 Applicable Regulatory Setting

### Federal

No federal noise requirements or regulations apply directly to the implementation of the project, but federal agencies have established guidelines and thresholds pertaining to noise and groundborne vibration as they relate to land use compatibility, human response, and structural integrity. These thresholds, as applicable, are discussed below in Section 4, *Impact Analysis*.

### State

The state of California regulates freeway noise, sets standards for sound transmission, provides occupational noise control criteria, identifies noise standards, and provides guidance for local land use compatibility. State law requires each county and city to adopt a General Plan that includes a Noise Element prepared per guidelines adopted by the Governor's Office of Planning and Research. The purpose of the Noise Element is to limit the exposure of the community to excessive noise levels. The California Environmental Quality Act requires all known environmental effects of a project be analyzed, including environmental noise impacts.

#### *California Noise Control Act of 1973*

California Health and Safety Code Sections 46000 through 46080, known as the California Noise Control Act, find that excessive noise is a serious hazard to public health and welfare and that exposure to certain levels of noise can result in physiological, psychological, and economic damage.

The act also finds that there is a continuous and increasing bombardment of noise in urban, suburban, and rural areas. The California Noise Control Act declares that the State of California has a responsibility to protect the health and welfare of its citizens by the control, prevention, and abatement of noise. It is the policy of the State to provide an environment for all Californians that is free from noise that jeopardizes their health or welfare.

### *California General Plan Guidelines*

The California General Plan Guidelines, published by the Governor's Office of Planning and Research, indicate acceptable, specific land use types in areas with specific noise exposure. The guidelines also offer adjustment factors that may be used to arrive at noise acceptability standards that reflect the noise control goals of the community, the particular community's sensitivity to noise, and the community's assessment of the relative importance of noise pollution. These guidelines are advisory and local jurisdictions, including the City of San Marcos, have the responsibility to set specific noise standards based on local conditions. Please refer to the discussion below, under City of San Marcos General Plan, for the compatibility guidelines adopted by the City.

## **Local**

### *City of San Marcos General Plan*

The City has adopted a General Plan Noise Element to control and abate environmental noise, and to protect the citizens of the City from excessive exposure to noise. The Noise Element specifies the maximum allowable unmitigated exterior noise levels for new developments impacted by transportation noise sources such as arterial roads, freeways, airports, and railroads. In addition, the Noise Element identifies several policies to minimize the impacts of excessive noise levels throughout the community (City of San Marcos 2013).

**Goal N-1:** Promote a pattern of land uses compatible with current and future noise levels.

**Policy N-1.2:** Ensure that acceptable noise levels are maintained near noise-sensitive uses.

**Policy N-1.3:** Incorporate design features into residential land use projects that can be used to shield residents from excessive noise. Design features may include, but are not limited to: berms, walls, and sound attenuating architectural design and construction methods.

**Policy N-1.4:** Require new development projects to provide barriers to reduce noise levels, or provide sufficient spatial buffers to separate excessive noise generating land uses and noise-sensitive land uses.

**Policy N-1.5:** Require an acoustical study for proposed developments in areas where the existing and projected noise level exceeds or would exceed the Normally Acceptable levels identified in Table 7-3 (adapted and shown in Table 4 below)

The Noise Element establishes compatibility standards for land uses in the City. As shown in Table 4, the Noise Element sets normally acceptable, conditionally acceptable, and generally unacceptable ambient noise levels for proposed developments based on land use.

**Table 4 Noise and Land Use Compatibility Guidelines for Exterior Noise**

Land Use Category	Exterior Noise Level (CNEL)		
	Normally Acceptable	Conditionally Acceptable	Conditionally Unacceptable
Residential – Single Family, mobile homes, senior/age-restricted housing	<60	60-75	>75
Residential – Multi-family, mixed use (residential/commercial)	<65	65-75	>75
Lodging – Hotels, motels	<65	65-75	>75
Schools, churches, hospitals, residential care facility, child care facilities	<65	65-75	>75
Passive recreational parks, nature preserves, contemplative spaces, cemeteries	<65	65-75	>75
Active parks, golf courses, athletic fields, outdoor spectator sports, water recreation	<65	65-75	>75
Office/professional, government, medical/dental, commercial, retail, laboratories	<65	65-75	>75
Industrial, manufacturing, utilities, agriculture, mining, stables, ranching, warehouse, maintenance/repair	<65	>65	N/A

**Acceptable:** Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

**Conditionally Acceptable:** New construction or development should be undertaken only after a detailed analysis of the noise reduction measures necessary to achieve acceptable levels for land use. If a project cannot mitigate noise to a level deemed Acceptable, the appropriate County decision-maker must determine that mitigation has been provided to the greatest extent practicable or that extraordinary circumstances exist.

**Unacceptable:** New construction or development should generally not be undertaken.

Source: City of San Marcos 2013, Table 7-3 *Noise and Land Use Compatibility Guidelines for Transportation-related Noise*.

### *City of San Marcos Municipal Code*

The City of San Marcos Municipal Code (SMMC) sets forth the City's standards, guidelines, and procedures concerning the regulation of operational noise. Specifically, noise levels in the City are regulated by SMMC Chapter 10.24.010, Noise Ordinance. These regulations are intended to implement the goals, objectives, and policies of the General Plan, protect the public health, safety, and welfare of the City, and to control unnecessary excessive, and/or annoying noise in the City.

SMMC Chapter 17.32.180 states that grading, extraction, and construction activities are allowed between 7:00 a.m. to 4:30 p.m., Monday through Friday. Grading, extraction, or construction activities are not permitted in the City on weekends or holidays. The City's municipal code does not set noise limits on construction activities, though the City has commonly utilized the County of San Diego's Noise Ordinance construction noise threshold of 75 dBA  $L_{eq}$  (8-hour), listed in Section 36.409 of the San Diego County Code of Regulatory Ordinances.

Chapter 20.300.070 of the City of San Marcos Municipal Code (Performance Standards) establishes exterior noise standards, which require noise levels from sources maintain certain noise levels for

single-family residences, multi-family, commercial uses, and industrial uses. Table 5 shows the allowable exterior noise levels.

**Table 5 Exterior Noise Standards by Zone**

Zone	Allowable Noise Level (dBA L <sub>eq</sub> ) Measured from the Property Line
<b>Single-Family Residential (A,R-1, R-2)<sup>1,2</sup></b>	
7:00 a.m. to 10:00 p.m. (daytime)	60
10:00 p.m. to 7:00 a.m. (overnight)	50
<b>Multifamily Residential (R-3)<sup>1,2</sup></b>	
7:00 a.m. to 10:00 p.m. (daytime)	65
10:00p.m. to 7:00 a.m. (overnight)	55
<b>Commercial (C, O-P, SR)<sup>3</sup></b>	
7:00 a.m. to 10:00 p.m. (daytime)	65
10:00 p.m. to 7:00 a.m. (overnight)	55
<b>Industrial</b>	
7:00 a.m. to 10:00 p.m. (daytime)	65
10:00 p.m. to 7:00 a.m. (overnight)	60

<sup>1</sup> For single-family detached dwelling units, the “exterior noise level” is defined as the noise level measured at an outdoor living area which adjoins and is on the same lot as the dwelling, and which contains at least the following minimum net lot area: (i) for lots less than 4,000 square feet in area, the exterior area shall include 400 square feet, (ii) for lots between 4,000 square feet to 10 acres in area, the exterior area shall include 10 percent of the lot area; (iii) for lots over 10 acres in area, the exterior area shall include 1 acre.

<sup>2</sup> For all other residential land uses, “exterior noise level” is defined as noise measured at exterior areas which are provided for private or group usable open space purposes. “Private Usable Open Space” is defined as usable open space intended for use of occupants of one dwelling unit, normally including yards, decks, and balconies. When the noise limit for Private Usable Open Space cannot be met, then a Group Usable Open Space that meets the exterior noise level standard shall be provided. “Group Usable Open Space” is defined as usable open space intended for common use by occupants of a development, either privately owned and maintained or dedicated to a public agency, normally including swimming pools, recreation courts, patios, open landscaped areas, and greenbelts with pedestrian walkways and equestrian and bicycle trails, but not including off-street parking and loading areas or driveways.

<sup>3</sup> For non-residential noise sensitive land uses, exterior noise level is defined as noise measured at the exterior area provided for public use.

Source: San Marcos Municipal Code Table 20.300-4



## 3 Methodology

---

### 3.1 Construction Noise

Construction noise was estimated using the FHWA Roadway Construction Noise Model (RCNM) (FHWA 2006). RCNM predicts construction noise levels for a variety of construction operations based on empirical data and the application of acoustical propagation formulas. Using RCNM, construction noise levels were estimated at noise sensitive receivers near the project site. RCNM provides reference noise levels for standard construction equipment, with an attenuation rate of 6 dBA per doubling of distance for stationary equipment.

Variation in power imposes additional complexity in characterizing the noise source level from construction equipment. Power variation is accounted for by describing the noise at a reference distance from the equipment operating at full power and adjusting it based on the duty cycle of the activity to determine the  $L_{eq}$  of the operation (FHWA 2018). Each phase of construction has a specific equipment mix, depending on the work to be accomplished during that phase. Each phase also has its own noise characteristics; some will have higher continuous noise levels than others, and some have high-impact noise levels.

Construction activity would result in temporary noise in the project site vicinity, exposing surrounding nearby receivers to increased noise levels. Construction noise would typically be higher during the heavier periods of initial construction (i.e., site preparation and grading) and would be lower during the later construction phases (i.e., building construction and paving). Typical heavy construction equipment during project grading could include dozers, loaders, and dump trucks. It is assumed that diesel engines would power all construction equipment. Construction equipment would not all operate at the same time or location. In addition, construction equipment would not be in constant use during the 8-hour operating day.

Construction noise would typically be higher during the heavier periods of initial construction (i.e., site preparation and grading work) and would be lower during the later construction phases (i.e., interior building construction). Typical heavy construction equipment during project grading and site preparation would include dozers and front-end loaders. It is assumed that diesel engines would power all construction equipment. Construction equipment would not all operate at the same time or location. In addition, construction equipment would not be in constant use during the 8-hour operating day. A dozer and front-end loader were analyzed together for construction noise impacts due to their likelihood of being used in conjunction with one another and therefore a conservative scenario for the greatest noise generation during construction. Using RCNM to estimate noise associated with a dozer and front-end loader, noise levels are calculated to be 74 dBA  $L_{eq}$  at 100 feet (RCNM calculations are included in Appendix B).

### 3.2 Groundborne Vibration

The project does not include any substantial vibration sources associated with operation. Thus, construction activities have the greatest potential to generate ground-borne vibration affecting nearby receivers, especially during grading and excavation of the project site. The greatest vibratory source during construction within the project vicinity would be a dozer. Neither blasting nor pile driving would be required for construction of the project. Construction vibration estimates are

based on vibration levels reported by Caltrans and the FTA (Caltrans 2020, FTA 2018). Table 6 shows typical vibration levels for various pieces of construction equipment used in the assessment of construction vibration (FTA 2018).

**Table 6 Vibration Levels Measured during Construction Activities**

Equipment	PPV at 25 ft. (in./sec.)
Large Bulldozer	0.089
Loaded Trucks	0.076
Small Bulldozer	0.003

Source: FTA 2018

Although groundborne vibration is sometimes noticeable in outdoor environments, it is almost never annoying to people who are outdoors; therefore, the vibration level threshold is assessed at occupied structures (FTA 2018). Therefore, all vibration impacts are assessed at the structure of an affected property.

Although groundborne vibration is sometimes noticeable in outdoor environments, it is almost never annoying to people who are outdoors; therefore, the vibration level threshold is assessed at occupied structures (FTA 2018). Therefore, all vibration impacts are assessed at the structure of an affected property.

Vibration limits used in this analysis to determine a potential impact to local land uses from construction activities, such as blasting, pile-driving, vibratory compaction, demolition, drilling, or excavation, are based on information contained in Caltrans' *Transportation and Construction Vibration Guidance Manual* and the Federal Transit Administration and the FTA *Transit Noise and Vibration Impact Assessment Manual* (Caltrans 2020; FTA 2018). Maximum recommended vibration limits by the American Association of State Highway and Transportation Officials (AASHTO) are identified in Table 7.

**Table 7 AASHTO Maximum Vibration Levels for Preventing Damage**

Type of Situation	Limiting Velocity (in./sec.)
Historic sites or other critical locations	0.1
Residential buildings, plastered walls	0.2–0.3
Residential buildings in good repair with gypsum board walls	0.4–0.5
Engineered structures, without plaster	1.0–1.5

Source: Caltrans 2020

Based on AASHTO recommendations, limiting vibration levels to below 0.2 in./sec. PPV in./sec. at residential structures would prevent structural damage regardless of building construction type. These limits are applicable regardless of the frequency of the source. However, as shown in Table 8 and Table 9, potential human annoyance associated with vibration is usually different if it is generated by a steady state or a transient vibration source.

**Table 8 Human Response to Steady State Vibration**

PPV (in./sec.)	Human Response
3.6 (at 2 Hz)–0.4 (at 20 Hz)	Very disturbing
0.7 (at 2 Hz)–0.17 (at 20 Hz)	Disturbing
0.10	Strongly perceptible
0.035	Distinctly perceptible
0.012	Slightly perceptible

Source: Caltrans 2020

**Table 9 Human Response to Transient Vibration**

PPV (in./sec.)	Human Response
2.0	Severe
0.9	Strongly perceptible
0.24	Distinctly perceptible
0.035	Barely perceptible

Source: Caltrans 2020

As shown in Table 8, the vibration level threshold at which steady vibration sources are considered to be distinctly perceptible is 0.035 in./sec. PPV. However, as shown in Table 9, the vibration level threshold at which transient vibration sources (such as construction equipment) are considered to be distinctly perceptible is 0.24 in./sec. PPV. This analysis uses the distinctly perceptible threshold for purposes of assessing vibration impacts.

Although groundborne vibration is sometimes noticeable in outdoor environments, groundborne vibration is almost never annoying to people who are outdoors; therefore, the vibration level threshold for human perception is assessed at occupied structures (FTA 2018). Therefore, all vibration impacts are assessed at the structure of an affected property.

### 3.3 Operational Noise Sources

On site-noise sources were modeled with SoundPLAN. Propagation of modeled stationary noise sources was based on ISO Standard 9613-2, “Attenuation of Sound during Propagation Outdoors, Part 2: General Method of Calculation.” The assessment methodology assumes that all receivers would be downwind of stationary sources. This is a conservative assumption for total noise impacts since only some receivers would be downwind at any one time.

On-site noise source would include general conversations, landscape maintenance, waste hauling, car wash facilities (blowers and vacuums), a drive-through speaker, and heating, ventilation, and air conditioning (HVAC) equipment. There are no large gathering areas on the project site and these sources would be transient in nature. Therefore, general conversations would not represent a substantial noise source. Landscape maintenance and waste hauling are regulated by the noise ordinance with allowable hours and other limitations. The vacuums would be powered by a central vacuum system within the car wash building and noise generated from the system would be negligible outside of the building. Thus, the primary noise source of concern would be associated with the car wash equipment (blowers), drive-through speaker, and mechanical equipment (HVAC units). Based on applicant provided information, this analysis assumes that the car wash equipment

and HVAC would operate between the hours of 7:00 a.m. to 10:00 p.m., and drive-through speaker would operate between the hours of 5:00 a.m. to 12:00 a.m., with car wash equipment, drive-through speaker, and mechanical equipment operating simultaneously between the daytime hours of 7:00 a.m. to 10:00 p.m. Each source is further described below.

### **Car Wash Equipment**

Primary noise-generating components of the car wash include the blowers (to dry the cars). The project applicant identified Sonny's The CarWash Factory Air Drying Systems that would be used in the car wash. According to the manufacturer's specifications (see Appendix C), the blowers generate a noise level of 90 dBA at 10 feet from the exit with the doors open. For a conservative analysis, it was assumed that the car wash would operate with the doors open. This analysis also conservatively assumes the equipment would operate continuously for a full hour (100 percent for 60 minutes) during operating hours (7:00 a.m. to 10:00 p.m.).

The car wash equipment room would also include a Greencheck CSP-A510-VG Direct Drive Cabinet Fan on the rooftop. This fan would only generate a sound power level of 34 dBA at the source (see Appendix D for manufacturer's specifications). This noise level would be negligible at the adjacent properties and this equipment is not discussed further.

### **Drive-through Speaker**

The project was assumed to use a drive-through speaker similar to a 3M XT-1 Intercom System. According to 3M's specifications for the system, the speaker would generate a noise level of 65 dBA at a distance of 4 feet (see Appendix E for specifications). This is equivalent to a sound power level of 74.7 dBA.

### **Mechanical Equipment**

Noise-generating mechanical equipment on the rooftop include several HVAC units and an exhaust fan. The equipment was assumed to be placed on the approximate center of the rooftop; noise levels for the equipment are described below. This analysis conservatively assumes the equipment would operate continuously for a full hour (100 percent for 60 minutes) during the daytime and nighttime. For a worst-case assessment, it has been assumed that the equipment would not include any type of screening.

One HVAC 10-ton Trane Precedent Gas/Electric Packaged Rooftop HVAC unit was placed on the car wash equipment room. Additionally, the project food mart was assumed to contain three HVAC units based upon one ton of HVAC per 600 sf of building space, as shown in Table 10 (see Appendix F for manufacturer's specifications). The HVAC model was chosen based on its use on similar projects.

**Table 10 Modeled Equipment**

Use/Description	Model	Unit Model Number	Unit Type	Estimated Units	Sound Power Level per Unit
Equipment Room	DX cooling, gas heat	YHC120F3RYA	HVAC	1	95
Food Mart	DX cooling, gas heat	YHC120F3RYA	HVAC	3	100

See Appendix F for sample Manufacturer specification sheets.

### 3.4 Traffic Noise

Noise affecting the project site is primarily from traffic on Las Posas Road. The traffic consultant, Linscott, Law & Greenspan, provided project-specific trip generations based on SANDAG rates for a “Gas Station with Food Mart and Car Wash.” The trip rate was estimated to be 155 trips per fuel station, and the average daily traffic (ADT) was predicted to be 1,395 vehicles for nine fueling stations. However, to account for the food mart drive-through traffic, the ADT was increased by 20 percent for an ADT of 1,674 vehicles. Existing traffic count estimates along the adjacent street segments from the project site combined with project average daily trips (ADTs) are shown in Table 11. Existing traffic counts were obtained from the City of San Marcos Public Works Transportation Engineering ADT data in 2019 (City of San Marcos 2019).

**Table 11 Existing and Proposed ADT Volume**

Street	From:	To:	Existing ADT	Project ADT	Existing With Project ADT
Las Posas Road	SR-78 WB	Grand Avenue	38,306	1,674	39,980
Las Posas Road	Avenida Azul	West Mission Road	22,488	1,674	24,162
South Santa Fe <sup>1</sup>	Las Flores Drive	Rancho Santa Fe Road	16,909	1,674	18,583

<sup>1</sup>South Santa Fe to West Mission Road is nearest segment with traffic data at approximately 0.8 miles north of project site.

Source: City of San Marcos Public Works- Transportation Engineering (2019)

The posted speed limit on West Mission Road is 40 miles per hour, while the speed limit for Las Posas Road is 45 miles per hour. To determine the vehicle classification mix for modeling, the observed mix from the site measurement on Las Posas Road was used which was observed at 98 percent automobiles, 1 percent medium trucks, and 1 percent heavy trucks. Peak hour traffic was assumed to be approximately 10 percent of the roadway’s total ADT in the model as 10 percent peak hour traffic noise level is considered equivalent to CNEL.

## 4 Significance Thresholds

---

The following thresholds are based on City noise standards and Appendix G of the CEQA Guidelines. Noise impacts would be considered significant if:

1. **Issue 1:** The project would result in the generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
  - **Temporary**
    - For purposes of analyzing impacts from this project, the City has determined that using County of San Diego construction noise thresholds would be applicable to the project. Therefore, construction noise would be significant if it exceeds a daytime threshold of 75 dBA  $L_{eq}$  (8 hour); or
    - If construction occurs between the hours of 4:30 p.m. and 7:00 a.m., or on weekends or national holidays.
  - **Permanent**
    - Operational noise would be significant if the noise levels exceed limits in Chapter 20.300.070 of the SMMC, which are as follows:
      - For multi-family and commercial use, the applicable exterior threshold is 65 dBA  $L_{eq}$  from 7:00 a.m. to 10:00 p.m. and 55 dBA  $L_{eq}$  from 10:00 p.m. to 7:00 a.m.
      - For single family use, the applicable exterior threshold is 60 dBA  $L_{eq}$  from 7:00 a.m. to 10:00 p.m. and 50 dBA  $L_{eq}$  from 10:00 p.m. to 7:00 a.m.
      - For industrial use, the applicable exterior threshold is 65 dBA  $L_{eq}$  from 7:00 a.m. to 10:00 p.m. and 60 dBA  $L_{eq}$  from 10:00 p.m. to 7:00 a.m.
    - For traffic-related noise, impacts would be considered significant if project-generated traffic would result in exposure of sensitive receptors to an unacceptable increase in noise levels. For purposes of this analysis, a significant impact would occur if project-related traffic increases the ambient noise environment of noise-sensitive locations by 3 dBA or more if the locations are subject to noise levels in excess of the normally acceptable noise land use compatibility guidelines in Table 4, or by 5 dBA or more if the locations are not subject to noise levels in excess of the aforementioned standards.
2. **Issue 2:** The project would result in the generation of excessive ground-borne vibration or ground-borne noise levels.
  - For purposes of analyzing impacts from this project, the City has determined that using Caltrans and AASHTO vibration thresholds would be applicable to the project. Therefore, a significant vibration impact would occur if the project would subject vibration-sensitive land uses to construction-related ground-borne vibration that exceeds the distinctly perceptible vibration annoyance potential criteria for human receivers of 0.24 in./sec. PPV, or the residential structural damage criteria of 0.2 in./sec. PPV.
3. **Issue 3:** For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, if the project exposes people residing or working in the project area to excessive noise levels.

## 5 Impact Analysis

---

### 5.1 Item 1 – Temporary and Permanent Noise Increase

**Item:** Would the project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies? (*Less Than Significant Impact*)

#### Construction

Project construction would occur nearest to the industrial area south of the project site. Over the course of a typical construction day, construction equipment would be located as close as 25 feet to adjacent properties (e.g., the industrial use to the south) but would typically be located at an average distance farther away due to the nature of construction and the lot size of the project. Therefore, it is assumed that over the course of a typical construction day the construction equipment would operate at an average distance of 100 feet from the nearest property.

At a distance of 100 feet, a front-end loader and a dozer would generate a noise level of 74 dBA  $L_{eq}$  (8-hour; RCNM calculations are included in Appendix B). This would be below the County of San Diego's threshold of 75 dBA  $L_{eq}$  (8-hour) for construction activity. In addition, construction would not occur outside the Municipal Code allowed hours of 7:00 a.m. and 4:30 p.m., Monday through Friday. Therefore, impacts from construction equipment would be less than significant.

#### Operation

The proposed car wash would be a new noise source that may be audible at nearby properties, which are developed with a mix of commercial, industrial, and residential uses. These receivers may periodically be subject to project stationary noise from HVAC, car wash blowers, drive-thru speaker, and increased traffic noise from project vehicles. Assumptions for modeling these sources are provided in Section 3.3. Noise levels at adjacent properties are shown in Table 12 and displayed in Figure 5 as receivers OFF-1 through OFF-18. As shown in Table 12, noise levels would not exceed City noise limits from stationary sources. Operational noise contours are also shown in Figure 5. Noise levels from project operation would result in less than significant impacts.

#### *Off-site Traffic Noise*

The project would generate new vehicle trips that would increase noise levels on nearby roadways. As estimated under Section 3.4, the project would generate 1,674 total vehicle trips Las Posas Road and West Mission Road. Assuming all vehicle trips occur on each roadway, this would result in traffic increases Las Posas Road from SR-78 WB to Grand Avenue, Las Posas Road from Avenida Azul to Mission Road, South Santa Fe (West Mission Road) from Las Flores Drive to Rancho Santa Fe of 4 percent, 7 percent, and 10 percent, respectively. This would result in approximate noise level increases of 0.2 dBA, 0.3 dBA, and 0.4 dBA, respectively. Therefore, the project's traffic noise increase would not exceed 3 dBA or more, and impacts would be less than significant.

Figure 5 Modeled Receivers and Daytime Noise Contours



Imagery provided by Microsoft Bing and its licensors © 2021.



**Table 12 Operational Noise Levels at Off-site Receivers**

Receiver	Description	Daytime Noise Level (dBA) <sup>1</sup>	Exceed Daytime Thresholds? <sup>2</sup>	Nighttime Noise Level (dBA) <sup>1</sup>	Exceed Nighttime Thresholds? <sup>2</sup>
OFF-1	Industrial	55	No	33	No
OFF-2	Industrial	37	No	29	No
OFF-3	Commercial	51	No	23	No
OFF-4	Specific Plan Area (Colluccci/Mobile)	52	No	17	No
OFF-5	Commercial	53	No	18	No
OFF-6	Commercial	48	No	15	No
OFF-7	Single-Family Residential	45	No	12	No
OFF-8	Public Institutional	43	No	11	No
OFF-9	Single-Family Residential	45	No	10	No
OFF-10	Specific Plan Area (Multi-Family Residential)	33	No	13	No
OFF-11	Specific Plan Area (Multi-Family Residential)	42	No	17	No
OFF-12	Commercial	43	No	15	No
OFF-13	Single-Family Residential	48	No	13	No
OFF-14	Single-Family Residential	47	No	13	No
OFF-15 <sup>1</sup>	Single-Family Residential	46	No	12	No
OFF-16	Single-Family Residential	46	No	12	No
OFF-17	Single-Family Residential	46	No	12	No
OFF-18	Mixed Use	46	No	12	No

<sup>1</sup>Car wash blowers are anticipated to operate between the hours of 7:00 a.m. to 10:00 p.m. per client, and are therefore only analyzed during the daytime. HVAC and drive-through speaker noise levels are analyzed during the daytime and nighttime hours.

<sup>2</sup>For multi-family and commercial use, the applicable exterior threshold is 65 dBA  $L_{eq}$  from 7:00 a.m. to 10:00 p.m. and 55 dBA  $L_{eq}$  from 10:00 p.m. to 7:00 a.m. For single family use, the applicable exterior threshold is 60 dBA  $L_{eq}$  from 7:00 a.m. to 10:00 p.m. and 50 dBA  $L_{eq}$  from 10:00 p.m. to 7:00 a.m. For industrial use, the applicable exterior threshold is 65 dBA  $L_{eq}$  from 7:00 a.m. to 10:00 p.m. and 55 dBA  $L_{eq}$  from 10:00 p.m. to 7:00 a.m.

## 5.2 Item 2 – Vibration

**Item:** Would the project result in generation of excessive ground-borne vibration or ground-borne noise levels? (*Less Than Significant Impact*)

Construction activities known to generate excessive ground-borne vibration, such as pile driving, would not be conducted by the project. The greatest anticipated source of vibration during general project construction activities would be from a dozer, which may be used within 25 feet of the nearest off-site structure. A dozer creates approximately 0.089 in./sec. PPV at a distance of 25 feet (Caltrans 2013). This vibration level is lower than the threshold of 0.24 in./sec. PPV. Therefore, temporary impacts associated with construction would be less than significant.

The project does not include any substantial vibration sources associated with operation. Therefore, operational vibration impacts would be less than significant.

## 5.3 Item 3 – Airport Noise

**Item:** For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels? (*No Impact*)

The McClellan Palomar Airport is the nearest public airport, located approximately 4.7 miles to the west of the project site. The project is not located within two miles of a public airport or public use airport. Therefore, no substantial noise exposure from airport noise would occur to construction workers, users, or employees of the project, and no impacts would occur.

## 6 Conclusions

---

The project would generate both temporary construction-related noise and long-term noise associated with operation of the project. Construction noise would not exceed the County's construction noise threshold of 75 dBA  $L_{eq}$  for an 8-hour period and impacts from construction noise would be less than significant.

The project's stationary noise sources (HVAC unit, car wash blowers, and drive-through speaker) would not exceed City standards at the nearest property lines. Therefore, stationary noise impacts would be less than significant.

Project-generated traffic would generate an increase of up to 0.4 dBA at adjacent roadways. This is below the threshold of 3 dBA; therefore, the off-site traffic noise increase would be less than significant.

The project would generate groundborne vibration during construction. Groundborne vibration would not exceed the applicable vibration threshold at the nearest structures, and construction-related vibration impacts would be less than significant.

The project site is not within two miles of any public airport or public use airport. Therefore, no substantial noise exposure would occur to construction workers, employees, or users of the project from aircraft noise.

Given the aforementioned, the project as designed would result in less than significant impacts and no mitigation is necessary.

## 7 References

---

- Bollard Acoustical Consultants, Inc. 2016. Environmental Noise Assessment, Quick Quack Car Wash at Lichen Drive. December 20. Available at:  
<http://www.citrusheights.net/AgendaCenter/ViewFile/Item/2303?fileID=16405>
- California Department of Transportation (Caltrans). 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol*. (CT-HWANP-RT-13-069.25.2) September. Available at:  
[http://www.dot.ca.gov/hq/env/noise/pub/TeNS\\_Sept\\_2013B.pdf](http://www.dot.ca.gov/hq/env/noise/pub/TeNS_Sept_2013B.pdf)
- \_\_\_\_\_. 2020. *Transportation and Construction Vibration Guidance Manual*. Available at:  
<https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tcvgm-apr2020-a11y.pdf>
- City of San Marcos. 2012. General Plan. February 14. Available at: <https://www.san-marcos.net/work/economic-development/general-plan>
- Federal Highway Administration (FHWA). 2006. *FHWA Highway Construction Noise Handbook*. (FHWAHEP-06-015; DOT-VNTSC-FHWA-06-02). Available at:  
[http://www.fhwa.dot.gov/environment/construction\\_noise/handbook](http://www.fhwa.dot.gov/environment/construction_noise/handbook). Accessed November 2018.
- \_\_\_\_\_. 2011. *Highway Traffic Noise: Analysis and Abatement Guidance* (FHWA-HEP-10-025). Available at:  
[https://www.fhwa.dot.gov/environment/noise/regulations\\_and\\_guidance/analysis\\_and\\_abatement\\_guidance/revguidance.pdf](https://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/analysis_and_abatement_guidance/revguidance.pdf)
- \_\_\_\_\_. 2018. Noise Measurement Handbook – Final Report. June 1. Available at:  
<https://www.fhwa.dot.gov/ENVIRONMENT/noise/measurement/handbook.cfm>
- Federal Transit Administration (FTA). 2018. *Transit Noise and Vibration Impact Assessment*. November. Available at: [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](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)
- Institute of Transportation Engineers (ITE). 2017. Trip Generation Manual, 10<sup>th</sup> Edition. Volume 2: Data. September 2017.
- Lawrence E. Kinsler and R. Frey, Austin and B. Coppens, Alan and V. Sanders, James. *Fundamentals*
- Malcolm J. Crocker (Editor). 2007. *Handbook of Noise and Vibration Control Book*, ISBN: 978-0-471-39599-7, Wiley-VCH, October.
- San Diego Association of Governments. 2020. *Transportation and Forecast Information Center*. Available at: <https://tfic.sandag.org/map.html>
- San Diego County Airport Land Use Commission. 2011. McClellan-Palomar Airport Land Use Compatibility Plan. December 1. [https://www.lee-associates.com/elee/sandiego/LeeLandTeam/Ponto/McClellan-Palomar\\_ALUCP\\_20111.pdf](https://www.lee-associates.com/elee/sandiego/LeeLandTeam/Ponto/McClellan-Palomar_ALUCP_20111.pdf)

# Appendix A

---

Noise Measurement Data

Data Logger 2

SET 3

NM1

A

SLOW

Range 40-100

L05 67.8

L10 66.2

L50 57.2

L90 51.3

L95 50.5

Max dB 73.5

2020/12/16 12:26:59

SEL 91.6

Leq 62.1

No.s	Date	Time	dB
1	2020/12/16	12:18:26	62.5
2	2020/12/16	12:18:29	57.2
3	2020/12/16	12:18:32	56.2
4	2020/12/16	12:18:35	54.5
5	2020/12/16	12:18:38	56.6
6	2020/12/16	12:18:41	57.7
7	2020/12/16	12:18:44	65.7
8	2020/12/16	12:18:47	62.8
9	2020/12/16	12:18:50	56.5
10	2020/12/16	12:18:53	52.5
11	2020/12/16	12:18:56	51.8
12	2020/12/16	12:18:59	54.4
13	2020/12/16	12:19:02	65.5
14	2020/12/16	12:19:05	62.3
15	2020/12/16	12:19:08	56.3
16	2020/12/16	12:19:11	52.2
17	2020/12/16	12:19:14	52.2
18	2020/12/16	12:19:17	51.0
19	2020/12/16	12:19:20	54.4
20	2020/12/16	12:19:23	66.1
21	2020/12/16	12:19:26	60.0
22	2020/12/16	12:19:29	55.8
23	2020/12/16	12:19:32	54.4
24	2020/12/16	12:19:35	55.6
25	2020/12/16	12:19:38	56.6
26	2020/12/16	12:19:41	58.7
27	2020/12/16	12:19:44	60.8
28	2020/12/16	12:19:47	63.8
29	2020/12/16	12:19:50	61.8
30	2020/12/16	12:19:53	60.2
31	2020/12/16	12:19:56	65.6
32	2020/12/16	12:19:59	69.3
33	2020/12/16	12:20:02	64.8
34	2020/12/16	12:20:05	62.9
35	2020/12/16	12:20:08	59.7
36	2020/12/16	12:20:11	63.4
37	2020/12/16	12:20:14	62.5
38	2020/12/16	12:20:17	64.3
39	2020/12/16	12:20:20	62.6

40	2020/12/16	12:20:23	61.3
41	2020/12/16	12:20:26	61.2
42	2020/12/16	12:20:29	59.8
43	2020/12/16	12:20:32	58.3
44	2020/12/16	12:20:35	57.4
45	2020/12/16	12:20:38	67.1
46	2020/12/16	12:20:41	63.3
47	2020/12/16	12:20:44	58.3
48	2020/12/16	12:20:47	52.5
49	2020/12/16	12:20:50	51.1
50	2020/12/16	12:20:53	50.8
51	2020/12/16	12:20:56	50.5
52	2020/12/16	12:20:59	52.6
53	2020/12/16	12:21:02	54.1
54	2020/12/16	12:21:05	66.7
55	2020/12/16	12:21:08	59.9
56	2020/12/16	12:21:11	53.8
57	2020/12/16	12:21:14	50.6
58	2020/12/16	12:21:17	50.2
59	2020/12/16	12:21:20	50.8
60	2020/12/16	12:21:23	54.1
61	2020/12/16	12:21:26	55.3
62	2020/12/16	12:21:29	55.2
63	2020/12/16	12:21:32	53.2
64	2020/12/16	12:21:35	50.8
65	2020/12/16	12:21:38	50.6
66	2020/12/16	12:21:41	53.5
67	2020/12/16	12:21:44	63.9
68	2020/12/16	12:21:47	62.2
69	2020/12/16	12:21:50	62.6
70	2020/12/16	12:21:53	61.4
71	2020/12/16	12:21:56	55.4
72	2020/12/16	12:21:59	52.8
73	2020/12/16	12:22:02	53.6
74	2020/12/16	12:22:05	59.9
75	2020/12/16	12:22:08	65.8
76	2020/12/16	12:22:11	58.4
77	2020/12/16	12:22:14	51.3
78	2020/12/16	12:22:17	49.6
79	2020/12/16	12:22:20	52.6
80	2020/12/16	12:22:23	57.8
81	2020/12/16	12:22:26	59.2
82	2020/12/16	12:22:29	58.3
83	2020/12/16	12:22:32	56.8
84	2020/12/16	12:22:35	54.0
85	2020/12/16	12:22:38	56.9
86	2020/12/16	12:22:41	63.6
87	2020/12/16	12:22:44	59.1
88	2020/12/16	12:22:47	55.6
89	2020/12/16	12:22:50	54.6
90	2020/12/16	12:22:53	55.3
91	2020/12/16	12:22:56	55.1
92	2020/12/16	12:22:59	55.5
93	2020/12/16	12:23:02	56.0

94	2020/12/16	12:23:05	55.0
95	2020/12/16	12:23:08	53.1
96	2020/12/16	12:23:11	50.6
97	2020/12/16	12:23:14	49.6
98	2020/12/16	12:23:17	51.5
99	2020/12/16	12:23:20	58.7
100	2020/12/16	12:23:23	69.6
101	2020/12/16	12:23:26	67.6
102	2020/12/16	12:23:29	63.0
103	2020/12/16	12:23:32	60.4
104	2020/12/16	12:23:35	66.2
105	2020/12/16	12:23:38	67.9
106	2020/12/16	12:23:41	61.8
107	2020/12/16	12:23:44	59.0
108	2020/12/16	12:23:47	62.7
109	2020/12/16	12:23:50	58.7
110	2020/12/16	12:23:53	68.3
111	2020/12/16	12:23:56	60.9
112	2020/12/16	12:23:59	59.2
113	2020/12/16	12:24:02	55.6
114	2020/12/16	12:24:05	52.1
115	2020/12/16	12:24:08	49.9
116	2020/12/16	12:24:11	50.2
117	2020/12/16	12:24:14	49.7
118	2020/12/16	12:24:17	49.8
119	2020/12/16	12:24:20	50.7
120	2020/12/16	12:24:23	50.1
121	2020/12/16	12:24:26	51.7
122	2020/12/16	12:24:29	53.0*
123	2020/12/16	12:24:32	61.2*
124	2020/12/16	12:24:35	56.5*
125	2020/12/16	12:24:38	52.2*
126	2020/12/16	12:24:41	52.8*
127	2020/12/16	12:24:44	52.5*
128	2020/12/16	12:24:47	60.6*
129	2020/12/16	12:24:50	55.6*
130	2020/12/16	12:24:53	59.3*
131	2020/12/16	12:24:56	55.2*
132	2020/12/16	12:24:59	54.4*
133	2020/12/16	12:25:02	52.3*
134	2020/12/16	12:25:05	58.4*
135	2020/12/16	12:25:08	69.2*
136	2020/12/16	12:25:11	69.4
137	2020/12/16	12:25:14	69.2
138	2020/12/16	12:25:17	62.2
139	2020/12/16	12:25:20	59.4
140	2020/12/16	12:25:23	66.3
141	2020/12/16	12:25:26	59.4
142	2020/12/16	12:25:29	56.6
143	2020/12/16	12:25:32	65.6
144	2020/12/16	12:25:35	68.2
145	2020/12/16	12:25:38	64.6
146	2020/12/16	12:25:41	63.0
147	2020/12/16	12:25:44	62.4



148	2020/12/16	12:25:47	56.5
149	2020/12/16	12:25:50	52.7
150	2020/12/16	12:25:53	51.5
151	2020/12/16	12:25:56	52.9
152	2020/12/16	12:25:59	56.5
153	2020/12/16	12:26:02	51.8
154	2020/12/16	12:26:05	51.1
155	2020/12/16	12:26:08	52.0
156	2020/12/16	12:26:11	55.3
157	2020/12/16	12:26:14	57.9
158	2020/12/16	12:26:17	62.1
159	2020/12/16	12:26:20	60.3
160	2020/12/16	12:26:23	62.5
161	2020/12/16	12:26:26	64.8
162	2020/12/16	12:26:29	58.3
163	2020/12/16	12:26:32	51.2
164	2020/12/16	12:26:35	50.7
165	2020/12/16	12:26:38	50.6
166	2020/12/16	12:26:41	62.6
167	2020/12/16	12:26:44	61.3
168	2020/12/16	12:26:47	56.7
169	2020/12/16	12:26:50	62.8
170	2020/12/16	12:26:53	72.2
171	2020/12/16	12:26:56	73.3
172	2020/12/16	12:26:59	71.2
173	2020/12/16	12:27:02	68.1
174	2020/12/16	12:27:05	65.7
175	2020/12/16	12:27:08	68.1
176	2020/12/16	12:27:11	68.1
177	2020/12/16	12:27:14	61.5
178	2020/12/16	12:27:17	56.8
179	2020/12/16	12:27:20	64.4
180	2020/12/16	12:27:23	60.1
181	2020/12/16	12:27:26	54.2
182	2020/12/16	12:27:29	51.8
183	2020/12/16	12:27:32	50.5
184	2020/12/16	12:27:35	51.7
185	2020/12/16	12:27:38	52.2
186	2020/12/16	12:27:41	51.8
187	2020/12/16	12:27:44	54.2
188	2020/12/16	12:27:47	53.0
189	2020/12/16	12:27:50	52.9
190	2020/12/16	12:27:53	52.8
191	2020/12/16	12:27:56	55.3
192	2020/12/16	12:27:59	54.8
193	2020/12/16	12:28:02	55.6
194	2020/12/16	12:28:05	53.1
195	2020/12/16	12:28:08	52.0
196	2020/12/16	12:28:11	51.9
197	2020/12/16	12:28:14	51.9
198	2020/12/16	12:28:17	52.3
199	2020/12/16	12:28:20	52.2
200	2020/12/16	12:28:23	55.6
201	2020/12/16	12:28:26	54.4

202	2020/12/16	12:28:29	52.5
203	2020/12/16	12:28:32	51.0
204	2020/12/16	12:28:35	51.2
205	2020/12/16	12:28:38	51.2
206	2020/12/16	12:28:41	52.4
207	2020/12/16	12:28:44	63.9
208	2020/12/16	12:28:47	68.8
209	2020/12/16	12:28:50	66.4
210	2020/12/16	12:28:53	61.6
211	2020/12/16	12:28:56	67.4
212	2020/12/16	12:28:59	66.6
213	2020/12/16	12:29:02	67.3
214	2020/12/16	12:29:05	60.6
215	2020/12/16	12:29:08	56.5
216	2020/12/16	12:29:11	54.3
217	2020/12/16	12:29:14	56.2
218	2020/12/16	12:29:17	62.8
219	2020/12/16	12:29:20	67.4
220	2020/12/16	12:29:23	63.5
221	2020/12/16	12:29:26	57.1
222	2020/12/16	12:29:29	54.1
223	2020/12/16	12:29:32	54.6
224	2020/12/16	12:29:35	55.0
225	2020/12/16	12:29:38	52.3
226	2020/12/16	12:29:41	54.1
227	2020/12/16	12:29:44	61.2
228	2020/12/16	12:29:47	66.7
229	2020/12/16	12:29:50	63.6
230	2020/12/16	12:29:53	58.1
231	2020/12/16	12:29:56	53.2
232	2020/12/16	12:29:59	51.9
233	2020/12/16	12:30:02	53.4
234	2020/12/16	12:30:05	55.3
235	2020/12/16	12:30:08	53.2
236	2020/12/16	12:30:11	54.9
237	2020/12/16	12:30:14	56.1
238	2020/12/16	12:30:17	57.4
239	2020/12/16	12:30:20	58.2
240	2020/12/16	12:30:23	55.2
241	2020/12/16	12:30:26	55.3
242	2020/12/16	12:30:29	58.1
243	2020/12/16	12:30:32	61.5
244	2020/12/16	12:30:35	64.8
245	2020/12/16	12:30:38	71.9
246	2020/12/16	12:30:41	68.8
247	2020/12/16	12:30:44	58.7
248	2020/12/16	12:30:47	59.9
249	2020/12/16	12:30:50	59.6
250	2020/12/16	12:30:53	54.9
251	2020/12/16	12:30:56	54.0
252	2020/12/16	12:30:59	54.3
253	2020/12/16	12:31:02	55.2
254	2020/12/16	12:31:05	56.2
255	2020/12/16	12:31:08	56.2

256	2020/12/16	12:31:11	57.2
257	2020/12/16	12:31:14	56.8
258	2020/12/16	12:31:17	67.7
259	2020/12/16	12:31:20	62.1
260	2020/12/16	12:31:23	59.9
261	2020/12/16	12:31:26	59.0
262	2020/12/16	12:31:29	56.8
263	2020/12/16	12:31:32	56.3
264	2020/12/16	12:31:35	57.0
265	2020/12/16	12:31:38	57.3
266	2020/12/16	12:31:41	55.0
267	2020/12/16	12:31:44	54.9
268	2020/12/16	12:31:47	59.6
269	2020/12/16	12:31:50	68.3
270	2020/12/16	12:31:53	71.5
271	2020/12/16	12:31:56	68.2
272	2020/12/16	12:31:59	63.5
273	2020/12/16	12:32:02	65.9
274	2020/12/16	12:32:05	62.8
275	2020/12/16	12:32:08	58.7
276	2020/12/16	12:32:11	68.7
277	2020/12/16	12:32:14	64.4
278	2020/12/16	12:32:17	59.1
279	2020/12/16	12:32:20	55.6
280	2020/12/16	12:32:23	53.6
281	2020/12/16	12:32:26	53.4
282	2020/12/16	12:32:29	52.8
283	2020/12/16	12:32:32	59.4
284	2020/12/16	12:32:35	70.8
285	2020/12/16	12:32:38	65.4
286	2020/12/16	12:32:41	67.8
287	2020/12/16	12:32:44	68.0
288	2020/12/16	12:32:47	63.8
289	2020/12/16	12:32:50	62.7
290	2020/12/16	12:32:53	58.9
291	2020/12/16	12:32:56	58.8
292	2020/12/16	12:32:59	64.2
293	2020/12/16	12:33:02	64.2
294	2020/12/16	12:33:05	63.0
295	2020/12/16	12:33:08	66.4
296	2020/12/16	12:33:11	61.2
297	2020/12/16	12:33:14	59.2
298	2020/12/16	12:33:17	64.1
299	2020/12/16	12:33:20	57.2
300	2020/12/16	12:33:23	55.1
301	2020/12/16	12:33:26	53.9
302	2020/12/16	12:33:29	52.6
303	2020/12/16	12:33:32	51.9
304	2020/12/16	12:33:35	52.3
305	2020/12/16	12:33:38	51.9
306	2020/12/16	12:33:41	51.9
307	2020/12/16	12:33:44	51.4
308	2020/12/16	12:33:47	52.0
309	2020/12/16	12:33:50	56.9

310	2020/12/16	12:33:53	67.9
311	2020/12/16	12:33:56	65.2
312	2020/12/16	12:33:59	63.6
313	2020/12/16	12:34:02	61.7
314	2020/12/16	12:34:05	63.7

Data Logger 2

SET 3

NM2

A

SLOW

Range 40-100

L05 54.8

L10 54.3

L50 52.4

L90 50.8

L95 50.4

Max dB 60.9

2020/12/16 12:42:52

SEL 82.3

Leq 52.8

No.s	Date	Time	dB
1	2020/12/16	12:38:10	52.7
2	2020/12/16	12:38:13	53.0
3	2020/12/16	12:38:16	52.0
4	2020/12/16	12:38:19	52.8
5	2020/12/16	12:38:22	52.1
6	2020/12/16	12:38:25	54.1
7	2020/12/16	12:38:28	52.8
8	2020/12/16	12:38:31	51.9
9	2020/12/16	12:38:34	51.9
10	2020/12/16	12:38:37	52.0
11	2020/12/16	12:38:40	51.3
12	2020/12/16	12:38:43	51.4
13	2020/12/16	12:38:46	51.7
14	2020/12/16	12:38:49	52.1
15	2020/12/16	12:38:52	52.7
16	2020/12/16	12:38:55	53.2
17	2020/12/16	12:38:58	52.5
18	2020/12/16	12:39:01	50.9
19	2020/12/16	12:39:04	51.4
20	2020/12/16	12:39:07	50.1
21	2020/12/16	12:39:10	52.1
22	2020/12/16	12:39:13	51.2
23	2020/12/16	12:39:16	50.8
24	2020/12/16	12:39:19	51.6
25	2020/12/16	12:39:22	52.1
26	2020/12/16	12:39:25	54.7
27	2020/12/16	12:39:28	54.9
28	2020/12/16	12:39:31	51.3
29	2020/12/16	12:39:34	52.7
30	2020/12/16	12:39:37	53.9
31	2020/12/16	12:39:40	51.6
32	2020/12/16	12:39:43	52.5
33	2020/12/16	12:39:46	51.7
34	2020/12/16	12:39:49	53.0
35	2020/12/16	12:39:52	55.2
36	2020/12/16	12:39:55	53.1
37	2020/12/16	12:39:58	52.9
38	2020/12/16	12:40:01	52.1
39	2020/12/16	12:40:04	52.2

40	2020/12/16	12:40:07	52.2
41	2020/12/16	12:40:10	52.1
42	2020/12/16	12:40:13	54.0
43	2020/12/16	12:40:16	56.8
44	2020/12/16	12:40:19	53.8
45	2020/12/16	12:40:22	52.3
46	2020/12/16	12:40:25	50.6
47	2020/12/16	12:40:28	50.9
48	2020/12/16	12:40:31	51.5
49	2020/12/16	12:40:34	51.5
50	2020/12/16	12:40:37	51.9
51	2020/12/16	12:40:40	51.6
52	2020/12/16	12:40:43	51.8
53	2020/12/16	12:40:46	51.7
54	2020/12/16	12:40:49	52.5
55	2020/12/16	12:40:52	53.4
56	2020/12/16	12:40:55	52.4
57	2020/12/16	12:40:58	52.2
58	2020/12/16	12:41:01	51.6
59	2020/12/16	12:41:04	51.5
60	2020/12/16	12:41:07	53.2
61	2020/12/16	12:41:10	51.5
62	2020/12/16	12:41:13	51.3
63	2020/12/16	12:41:16	50.6
64	2020/12/16	12:41:19	51.0
65	2020/12/16	12:41:22	50.4
66	2020/12/16	12:41:25	51.1
67	2020/12/16	12:41:28	50.6
68	2020/12/16	12:41:31	50.1
69	2020/12/16	12:41:34	51.3
70	2020/12/16	12:41:37	51.6
71	2020/12/16	12:41:40	52.7
72	2020/12/16	12:41:43	52.1
73	2020/12/16	12:41:46	50.9
74	2020/12/16	12:41:49	51.0
75	2020/12/16	12:41:52	51.2
76	2020/12/16	12:41:55	51.7
77	2020/12/16	12:41:58	51.5
78	2020/12/16	12:42:01	51.2
79	2020/12/16	12:42:04	52.0
80	2020/12/16	12:42:07	50.3
81	2020/12/16	12:42:10	51.1
82	2020/12/16	12:42:13	50.3
83	2020/12/16	12:42:16	51.1
84	2020/12/16	12:42:19	50.1
85	2020/12/16	12:42:22	52.9
86	2020/12/16	12:42:25	53.4
87	2020/12/16	12:42:28	53.0
88	2020/12/16	12:42:31	53.0
89	2020/12/16	12:42:34	54.8
90	2020/12/16	12:42:37	54.0
91	2020/12/16	12:42:40	54.1
92	2020/12/16	12:42:43	55.5
93	2020/12/16	12:42:46	54.8

94	2020/12/16	12:42:49	60.4
95	2020/12/16	12:42:52	58.5
96	2020/12/16	12:42:55	56.2
97	2020/12/16	12:42:58	55.8
98	2020/12/16	12:43:01	54.6
99	2020/12/16	12:43:04	54.5
100	2020/12/16	12:43:07	55.1
101	2020/12/16	12:43:10	53.1
102	2020/12/16	12:43:13	52.0
103	2020/12/16	12:43:16	52.3
104	2020/12/16	12:43:19	52.5
105	2020/12/16	12:43:22	54.1
106	2020/12/16	12:43:25	54.2
107	2020/12/16	12:43:28	53.7
108	2020/12/16	12:43:31	52.3
109	2020/12/16	12:43:34	51.4
110	2020/12/16	12:43:37	51.4
111	2020/12/16	12:43:40	52.8
112	2020/12/16	12:43:43	52.8
113	2020/12/16	12:43:46	52.9
114	2020/12/16	12:43:49	51.5
115	2020/12/16	12:43:52	52.2
116	2020/12/16	12:43:55	51.8
117	2020/12/16	12:43:58	52.2
118	2020/12/16	12:44:01	52.7
119	2020/12/16	12:44:04	53.5
120	2020/12/16	12:44:07	52.7
121	2020/12/16	12:44:10	51.5
122	2020/12/16	12:44:13	51.8
123	2020/12/16	12:44:16	52.6
124	2020/12/16	12:44:19	53.3
125	2020/12/16	12:44:22	54.0
126	2020/12/16	12:44:25	54.0
127	2020/12/16	12:44:28	55.3
128	2020/12/16	12:44:31	54.2
129	2020/12/16	12:44:34	53.3
130	2020/12/16	12:44:37	53.4
131	2020/12/16	12:44:40	51.7
132	2020/12/16	12:44:43	52.1
133	2020/12/16	12:44:46	53.0
134	2020/12/16	12:44:49	53.0
135	2020/12/16	12:44:52	53.1
136	2020/12/16	12:44:55	53.0
137	2020/12/16	12:44:58	53.2
138	2020/12/16	12:45:01	51.5
139	2020/12/16	12:45:04	52.6
140	2020/12/16	12:45:07	52.1
141	2020/12/16	12:45:10	52.5
142	2020/12/16	12:45:13	50.7
143	2020/12/16	12:45:16	52.0
144	2020/12/16	12:45:19	51.4
145	2020/12/16	12:45:22	51.8
146	2020/12/16	12:45:25	52.4
147	2020/12/16	12:45:28	54.5

148	2020/12/16	12:45:31	55.8
149	2020/12/16	12:45:34	57.1
150	2020/12/16	12:45:37	58.0
151	2020/12/16	12:45:40	53.5
152	2020/12/16	12:45:43	51.7
153	2020/12/16	12:45:46	52.1
154	2020/12/16	12:45:49	52.7
155	2020/12/16	12:45:52	53.3
156	2020/12/16	12:45:55	53.1
157	2020/12/16	12:45:58	52.8
158	2020/12/16	12:46:01	52.7
159	2020/12/16	12:46:04	51.9
160	2020/12/16	12:46:07	52.9
161	2020/12/16	12:46:10	52.6
162	2020/12/16	12:46:13	52.4
163	2020/12/16	12:46:16	53.4
164	2020/12/16	12:46:19	52.5
165	2020/12/16	12:46:22	54.3
166	2020/12/16	12:46:25	54.4
167	2020/12/16	12:46:28	53.0
168	2020/12/16	12:46:31	54.0
169	2020/12/16	12:46:34	52.7
170	2020/12/16	12:46:37	54.3
171	2020/12/16	12:46:40	52.4
172	2020/12/16	12:46:43	53.7
173	2020/12/16	12:46:46	51.9
174	2020/12/16	12:46:49	52.0
175	2020/12/16	12:46:52	51.2
176	2020/12/16	12:46:55	51.6
177	2020/12/16	12:46:58	51.8
178	2020/12/16	12:47:01	51.6
179	2020/12/16	12:47:04	51.4
180	2020/12/16	12:47:07	52.2
181	2020/12/16	12:47:10	51.5
182	2020/12/16	12:47:13	51.8
183	2020/12/16	12:47:16	52.3
184	2020/12/16	12:47:19	52.2
185	2020/12/16	12:47:22	52.9
186	2020/12/16	12:47:25	52.2
187	2020/12/16	12:47:28	53.3
188	2020/12/16	12:47:31	55.4
189	2020/12/16	12:47:34	54.5
190	2020/12/16	12:47:37	54.5
191	2020/12/16	12:47:40	54.1
192	2020/12/16	12:47:43	52.9
193	2020/12/16	12:47:46	52.8
194	2020/12/16	12:47:49	51.8
195	2020/12/16	12:47:52	51.4
196	2020/12/16	12:47:55	50.9
197	2020/12/16	12:47:58	53.0
198	2020/12/16	12:48:01	54.4
199	2020/12/16	12:48:04	52.8
200	2020/12/16	12:48:07	54.0
201	2020/12/16	12:48:10	53.7



202	2020/12/16	12:48:13	52.9
203	2020/12/16	12:48:16	53.3
204	2020/12/16	12:48:19	52.3
205	2020/12/16	12:48:22	53.0
206	2020/12/16	12:48:25	52.0
207	2020/12/16	12:48:28	52.6
208	2020/12/16	12:48:31	54.0
209	2020/12/16	12:48:34	54.7
210	2020/12/16	12:48:37	54.5
211	2020/12/16	12:48:40	53.7
212	2020/12/16	12:48:43	53.4
213	2020/12/16	12:48:46	54.4
214	2020/12/16	12:48:49	53.7
215	2020/12/16	12:48:52	53.4
216	2020/12/16	12:48:55	53.6
217	2020/12/16	12:48:58	55.5
218	2020/12/16	12:49:01	54.3
219	2020/12/16	12:49:04	53.5
220	2020/12/16	12:49:07	53.0
221	2020/12/16	12:49:10	52.3
222	2020/12/16	12:49:13	53.3
223	2020/12/16	12:49:16	53.0
224	2020/12/16	12:49:19	52.6
225	2020/12/16	12:49:22	52.8
226	2020/12/16	12:49:25	54.3
227	2020/12/16	12:49:28	51.8
228	2020/12/16	12:49:31	53.7
229	2020/12/16	12:49:34	53.5
230	2020/12/16	12:49:37	53.0
231	2020/12/16	12:49:40	53.3
232	2020/12/16	12:49:43	55.9
233	2020/12/16	12:49:46	53.2
234	2020/12/16	12:49:49	51.8
235	2020/12/16	12:49:52	53.8
236	2020/12/16	12:49:55	54.1
237	2020/12/16	12:49:58	52.9
238	2020/12/16	12:50:01	53.8
239	2020/12/16	12:50:04	54.0
240	2020/12/16	12:50:07	53.5
241	2020/12/16	12:50:10	51.8
242	2020/12/16	12:50:13	52.3
243	2020/12/16	12:50:16	53.6
244	2020/12/16	12:50:19	53.0
245	2020/12/16	12:50:22	51.1
246	2020/12/16	12:50:25	52.6
247	2020/12/16	12:50:28	53.7
248	2020/12/16	12:50:31	52.0
249	2020/12/16	12:50:34	53.1
250	2020/12/16	12:50:37	54.5
251	2020/12/16	12:50:40	53.6
252	2020/12/16	12:50:43	55.2
253	2020/12/16	12:50:46	52.8
254	2020/12/16	12:50:49	53.3
255	2020/12/16	12:50:52	53.4

256	2020/12/16	12:50:55	53.1
257	2020/12/16	12:50:58	52.4
258	2020/12/16	12:51:01	52.0
259	2020/12/16	12:51:04	52.7
260	2020/12/16	12:51:07	51.2
261	2020/12/16	12:51:10	52.1
262	2020/12/16	12:51:13	52.2
263	2020/12/16	12:51:16	55.4
264	2020/12/16	12:51:19	52.1
265	2020/12/16	12:51:22	53.1
266	2020/12/16	12:51:25	51.8
267	2020/12/16	12:51:28	50.7
268	2020/12/16	12:51:31	51.4
269	2020/12/16	12:51:34	51.1
270	2020/12/16	12:51:37	51.0
271	2020/12/16	12:51:40	52.1
272	2020/12/16	12:51:43	51.7
273	2020/12/16	12:51:46	51.5
274	2020/12/16	12:51:49	50.8
275	2020/12/16	12:51:52	50.8
276	2020/12/16	12:51:55	50.7
277	2020/12/16	12:51:58	51.6
278	2020/12/16	12:52:01	50.3
279	2020/12/16	12:52:04	50.5
280	2020/12/16	12:52:07	50.0
281	2020/12/16	12:52:10	52.1
282	2020/12/16	12:52:13	51.3
283	2020/12/16	12:52:16	50.7
284	2020/12/16	12:52:19	52.0
285	2020/12/16	12:52:22	53.0
286	2020/12/16	12:52:25	51.5
287	2020/12/16	12:52:28	50.2
288	2020/12/16	12:52:31	49.8
289	2020/12/16	12:52:34	50.4
290	2020/12/16	12:52:37	51.0
291	2020/12/16	12:52:40	51.4
292	2020/12/16	12:52:43	51.4
293	2020/12/16	12:52:46	51.8
294	2020/12/16	12:52:49	51.6
295	2020/12/16	12:52:52	49.3
296	2020/12/16	12:52:55	50.3
297	2020/12/16	12:52:58	51.6
298	2020/12/16	12:53:01	50.3
299	2020/12/16	12:53:04	54.0
300	2020/12/16	12:53:07	54.2

Data Logger 2

SET 3

NM3

A

SLOW

Range 40-100

L05 58.6

L10 56.9

L50 52.8

L90 49.8

L95 49.1

Max dB 83.8

2020/12/16 13:02:34

SEL 89.8

Leq 60.3

No.s	Date	Time	dB
1	2020/12/16	12:57:42	50.1
2	2020/12/16	12:57:45	52.2
3	2020/12/16	12:57:48	52.6
4	2020/12/16	12:57:51	51.8
5	2020/12/16	12:57:54	63.5
6	2020/12/16	12:57:57	59.1
7	2020/12/16	12:58:00	57.0
8	2020/12/16	12:58:03	53.3
9	2020/12/16	12:58:06	51.6
10	2020/12/16	12:58:09	50.5
11	2020/12/16	12:58:12	49.7
12	2020/12/16	12:58:15	50.4
13	2020/12/16	12:58:18	50.7
14	2020/12/16	12:58:21	51.2
15	2020/12/16	12:58:24	53.0
16	2020/12/16	12:58:27	53.3
17	2020/12/16	12:58:30	54.7
18	2020/12/16	12:58:33	59.5
19	2020/12/16	12:58:36	57.9
20	2020/12/16	12:58:39	55.1
21	2020/12/16	12:58:42	52.9
22	2020/12/16	12:58:45	54.1
23	2020/12/16	12:58:48	53.6
24	2020/12/16	12:58:51	51.6
25	2020/12/16	12:58:54	51.2
26	2020/12/16	12:58:57	50.6
27	2020/12/16	12:59:00	51.0
28	2020/12/16	12:59:03	51.8
29	2020/12/16	12:59:06	51.4
30	2020/12/16	12:59:09	49.9
31	2020/12/16	12:59:12	50.0
32	2020/12/16	12:59:15	51.6
33	2020/12/16	12:59:18	51.8
34	2020/12/16	12:59:21	50.6
35	2020/12/16	12:59:24	49.8
36	2020/12/16	12:59:27	48.7
37	2020/12/16	12:59:30	48.8
38	2020/12/16	12:59:33	49.1
39	2020/12/16	12:59:36	51.7

40	2020/12/16	12:59:39	52.7
41	2020/12/16	12:59:42	54.0
42	2020/12/16	12:59:45	51.7
43	2020/12/16	12:59:48	50.2
44	2020/12/16	12:59:51	50.4
45	2020/12/16	12:59:54	51.2
46	2020/12/16	12:59:57	51.7
47	2020/12/16	13:00:00	50.1
48	2020/12/16	13:00:03	50.9
49	2020/12/16	13:00:06	50.1
50	2020/12/16	13:00:09	49.8
51	2020/12/16	13:00:12	49.6
52	2020/12/16	13:00:15	49.4
53	2020/12/16	13:00:18	49.7
54	2020/12/16	13:00:21	49.6
55	2020/12/16	13:00:24	48.9
56	2020/12/16	13:00:27	48.9
57	2020/12/16	13:00:30	50.6
58	2020/12/16	13:00:33	54.3
59	2020/12/16	13:00:36	58.1
60	2020/12/16	13:00:39	56.9
61	2020/12/16	13:00:42	54.6
62	2020/12/16	13:00:45	57.7
63	2020/12/16	13:00:48	55.3
64	2020/12/16	13:00:51	50.7
65	2020/12/16	13:00:54	56.0
66	2020/12/16	13:00:57	53.3
67	2020/12/16	13:01:00	53.9
68	2020/12/16	13:01:03	55.5
69	2020/12/16	13:01:06	55.7
70	2020/12/16	13:01:09	53.6
71	2020/12/16	13:01:12	51.9
72	2020/12/16	13:01:15	51.6
73	2020/12/16	13:01:18	54.1
74	2020/12/16	13:01:21	53.1
75	2020/12/16	13:01:24	57.2
76	2020/12/16	13:01:27	53.0
77	2020/12/16	13:01:30	50.9
78	2020/12/16	13:01:33	49.6
79	2020/12/16	13:01:36	49.2
80	2020/12/16	13:01:39	50.1
81	2020/12/16	13:01:42	48.4
82	2020/12/16	13:01:45	48.3
83	2020/12/16	13:01:48	48.6
84	2020/12/16	13:01:51	48.9
85	2020/12/16	13:01:54	48.7
86	2020/12/16	13:01:57	48.7
87	2020/12/16	13:02:00	53.6
88	2020/12/16	13:02:03	55.5
89	2020/12/16	13:02:06	55.9
90	2020/12/16	13:02:09	54.4
91	2020/12/16	13:02:12	55.9
92	2020/12/16	13:02:15	56.5
93	2020/12/16	13:02:18	59.9

94	2020/12/16	13:02:21	55.6
95	2020/12/16	13:02:24	54.0
96	2020/12/16	13:02:27	72.1
97	2020/12/16	13:02:30	69.8
98	2020/12/16	13:02:33	81.0
99	2020/12/16	13:02:36	71.5
100	2020/12/16	13:02:39	60.7
101	2020/12/16	13:02:42	55.2
102	2020/12/16	13:02:45	54.1
103	2020/12/16	13:02:48	54.5
104	2020/12/16	13:02:51	54.6
105	2020/12/16	13:02:54	51.9
106	2020/12/16	13:02:57	50.2
107	2020/12/16	13:03:00	49.7
108	2020/12/16	13:03:03	50.1
109	2020/12/16	13:03:06	50.1
110	2020/12/16	13:03:09	48.8
111	2020/12/16	13:03:12	49.8
112	2020/12/16	13:03:15	49.2
113	2020/12/16	13:03:18	51.2
114	2020/12/16	13:03:21	52.0
115	2020/12/16	13:03:24	53.4
116	2020/12/16	13:03:27	56.9
117	2020/12/16	13:03:30	55.5
118	2020/12/16	13:03:33	54.2
119	2020/12/16	13:03:36	55.3
120	2020/12/16	13:03:39	55.1
121	2020/12/16	13:03:42	54.0
122	2020/12/16	13:03:45	53.3
123	2020/12/16	13:03:48	51.7
124	2020/12/16	13:03:51	50.5
125	2020/12/16	13:03:54	50.4
126	2020/12/16	13:03:57	50.6
127	2020/12/16	13:04:00	50.7
128	2020/12/16	13:04:03	50.4
129	2020/12/16	13:04:06	50.0
130	2020/12/16	13:04:09	50.1
131	2020/12/16	13:04:12	51.1
132	2020/12/16	13:04:15	53.0
133	2020/12/16	13:04:18	52.1
134	2020/12/16	13:04:21	50.3
135	2020/12/16	13:04:24	50.1
136	2020/12/16	13:04:27	50.8
137	2020/12/16	13:04:30	51.0
138	2020/12/16	13:04:33	52.0
139	2020/12/16	13:04:36	51.5
140	2020/12/16	13:04:39	50.2
141	2020/12/16	13:04:42	51.1
142	2020/12/16	13:04:45	52.0
143	2020/12/16	13:04:48	53.7
144	2020/12/16	13:04:51	53.3
145	2020/12/16	13:04:54	52.8
146	2020/12/16	13:04:57	52.6
147	2020/12/16	13:05:00	53.7

148	2020/12/16	13:05:03	52.0
149	2020/12/16	13:05:06	52.7
150	2020/12/16	13:05:09	53.4
151	2020/12/16	13:05:12	53.6
152	2020/12/16	13:05:15	53.7
153	2020/12/16	13:05:18	54.2
154	2020/12/16	13:05:21	55.5
155	2020/12/16	13:05:24	55.6
156	2020/12/16	13:05:27	56.9
157	2020/12/16	13:05:30	57.4
158	2020/12/16	13:05:33	56.1
159	2020/12/16	13:05:36	54.4
160	2020/12/16	13:05:39	55.7
161	2020/12/16	13:05:42	57.9
162	2020/12/16	13:05:45	55.2
163	2020/12/16	13:05:48	57.9
164	2020/12/16	13:05:51	57.1
165	2020/12/16	13:05:54	55.2
166	2020/12/16	13:05:57	53.7
167	2020/12/16	13:06:00	54.6
168	2020/12/16	13:06:03	53.8
169	2020/12/16	13:06:06	56.1
170	2020/12/16	13:06:09	53.8
171	2020/12/16	13:06:12	51.6
172	2020/12/16	13:06:15	51.2
173	2020/12/16	13:06:18	51.4
174	2020/12/16	13:06:21	52.6
175	2020/12/16	13:06:24	54.5
176	2020/12/16	13:06:27	53.8
177	2020/12/16	13:06:30	54.9
178	2020/12/16	13:06:33	53.6
179	2020/12/16	13:06:36	51.6
180	2020/12/16	13:06:39	51.1
181	2020/12/16	13:06:42	50.8
182	2020/12/16	13:06:45	50.5
183	2020/12/16	13:06:48	50.7
184	2020/12/16	13:06:51	50.9
185	2020/12/16	13:06:54	51.2
186	2020/12/16	13:06:57	51.0
187	2020/12/16	13:07:00	49.8
188	2020/12/16	13:07:03	49.7
189	2020/12/16	13:07:06	49.8
190	2020/12/16	13:07:09	51.1
191	2020/12/16	13:07:12	54.5
192	2020/12/16	13:07:15	56.0
193	2020/12/16	13:07:18	56.1
194	2020/12/16	13:07:21	53.5
195	2020/12/16	13:07:24	56.2
196	2020/12/16	13:07:27	54.3
197	2020/12/16	13:07:30	54.5
198	2020/12/16	13:07:33	54.4
199	2020/12/16	13:07:36	53.8
200	2020/12/16	13:07:39	54.1
201	2020/12/16	13:07:42	53.1

202	2020/12/16	13:07:45	54.1
203	2020/12/16	13:07:48	56.2
204	2020/12/16	13:07:51	58.8
205	2020/12/16	13:07:54	56.4
206	2020/12/16	13:07:57	55.5
207	2020/12/16	13:08:00	53.9
208	2020/12/16	13:08:03	50.7
209	2020/12/16	13:08:06	49.9
210	2020/12/16	13:08:09	49.6
211	2020/12/16	13:08:12	50.8
212	2020/12/16	13:08:15	50.7
213	2020/12/16	13:08:18	52.5
214	2020/12/16	13:08:21	51.0
215	2020/12/16	13:08:24	51.4
216	2020/12/16	13:08:27	50.9
217	2020/12/16	13:08:30	51.7
218	2020/12/16	13:08:33	51.8
219	2020/12/16	13:08:36	51.6
220	2020/12/16	13:08:39	51.1
221	2020/12/16	13:08:42	51.5
222	2020/12/16	13:08:45	52.2
223	2020/12/16	13:08:48	52.8
224	2020/12/16	13:08:51	52.7
225	2020/12/16	13:08:54	52.5
226	2020/12/16	13:08:57	56.8
227	2020/12/16	13:09:00	54.1
228	2020/12/16	13:09:03	52.0
229	2020/12/16	13:09:06	52.3
230	2020/12/16	13:09:09	52.8
231	2020/12/16	13:09:12	53.0
232	2020/12/16	13:09:15	54.8
233	2020/12/16	13:09:18	54.0
234	2020/12/16	13:09:21	55.9
235	2020/12/16	13:09:24	58.9
236	2020/12/16	13:09:27	57.1
237	2020/12/16	13:09:30	54.0
238	2020/12/16	13:09:33	52.3
239	2020/12/16	13:09:36	51.2
240	2020/12/16	13:09:39	50.9
241	2020/12/16	13:09:42	52.0
242	2020/12/16	13:09:45	55.7
243	2020/12/16	13:09:48	55.4
244	2020/12/16	13:09:51	53.9
245	2020/12/16	13:09:54	55.7
246	2020/12/16	13:09:57	51.7
247	2020/12/16	13:10:00	51.5
248	2020/12/16	13:10:03	56.3
249	2020/12/16	13:10:06	52.8
250	2020/12/16	13:10:09	52.5
251	2020/12/16	13:10:12	54.3
252	2020/12/16	13:10:15	52.8
253	2020/12/16	13:10:18	55.4
254	2020/12/16	13:10:21	61.1
255	2020/12/16	13:10:24	63.0

256	2020/12/16	13:10:27	61.5
257	2020/12/16	13:10:30	57.5
258	2020/12/16	13:10:33	54.0
259	2020/12/16	13:10:36	52.8
260	2020/12/16	13:10:39	53.6
261	2020/12/16	13:10:42	56.6
262	2020/12/16	13:10:45	55.3
263	2020/12/16	13:10:48	55.4
264	2020/12/16	13:10:51	56.3
265	2020/12/16	13:10:54	54.1
266	2020/12/16	13:10:57	55.5
267	2020/12/16	13:11:00	56.4
268	2020/12/16	13:11:03	56.0
269	2020/12/16	13:11:06	63.7
270	2020/12/16	13:11:09	72.4
271	2020/12/16	13:11:12	68.9
272	2020/12/16	13:11:15	69.2
273	2020/12/16	13:11:18	63.1
274	2020/12/16	13:11:21	57.5
275	2020/12/16	13:11:24	56.3
276	2020/12/16	13:11:27	55.7
277	2020/12/16	13:11:30	53.3
278	2020/12/16	13:11:33	53.8
279	2020/12/16	13:11:36	52.8
280	2020/12/16	13:11:39	51.2
281	2020/12/16	13:11:42	50.9
282	2020/12/16	13:11:45	51.1
283	2020/12/16	13:11:48	51.5
284	2020/12/16	13:11:51	52.0
285	2020/12/16	13:11:54	51.8
286	2020/12/16	13:11:57	52.3
287	2020/12/16	13:12:00	52.2
288	2020/12/16	13:12:03	51.7
289	2020/12/16	13:12:06	52.0
290	2020/12/16	13:12:09	53.7
291	2020/12/16	13:12:12	56.3
292	2020/12/16	13:12:15	58.6
293	2020/12/16	13:12:18	55.8
294	2020/12/16	13:12:21	54.9
295	2020/12/16	13:12:24	53.0
296	2020/12/16	13:12:27	53.1
297	2020/12/16	13:12:30	52.9
298	2020/12/16	13:12:33	53.8
299	2020/12/16	13:12:36	53.1
300	2020/12/16	13:12:39	53.2



# Appendix B

---

Roadway Construction Noise Model (RCNM) Results

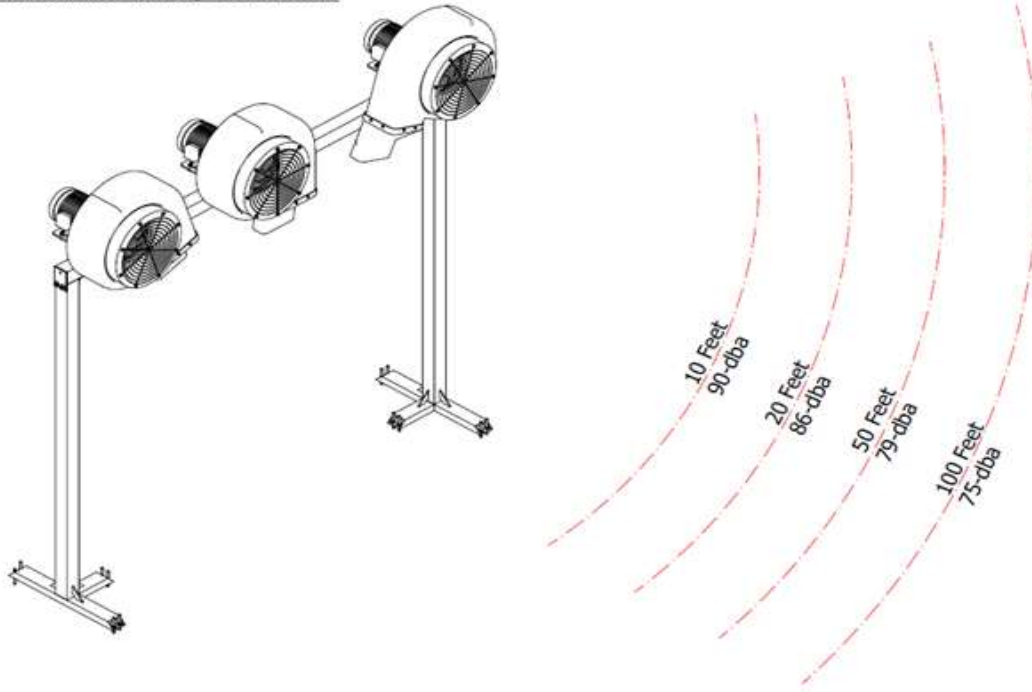


# Appendix C

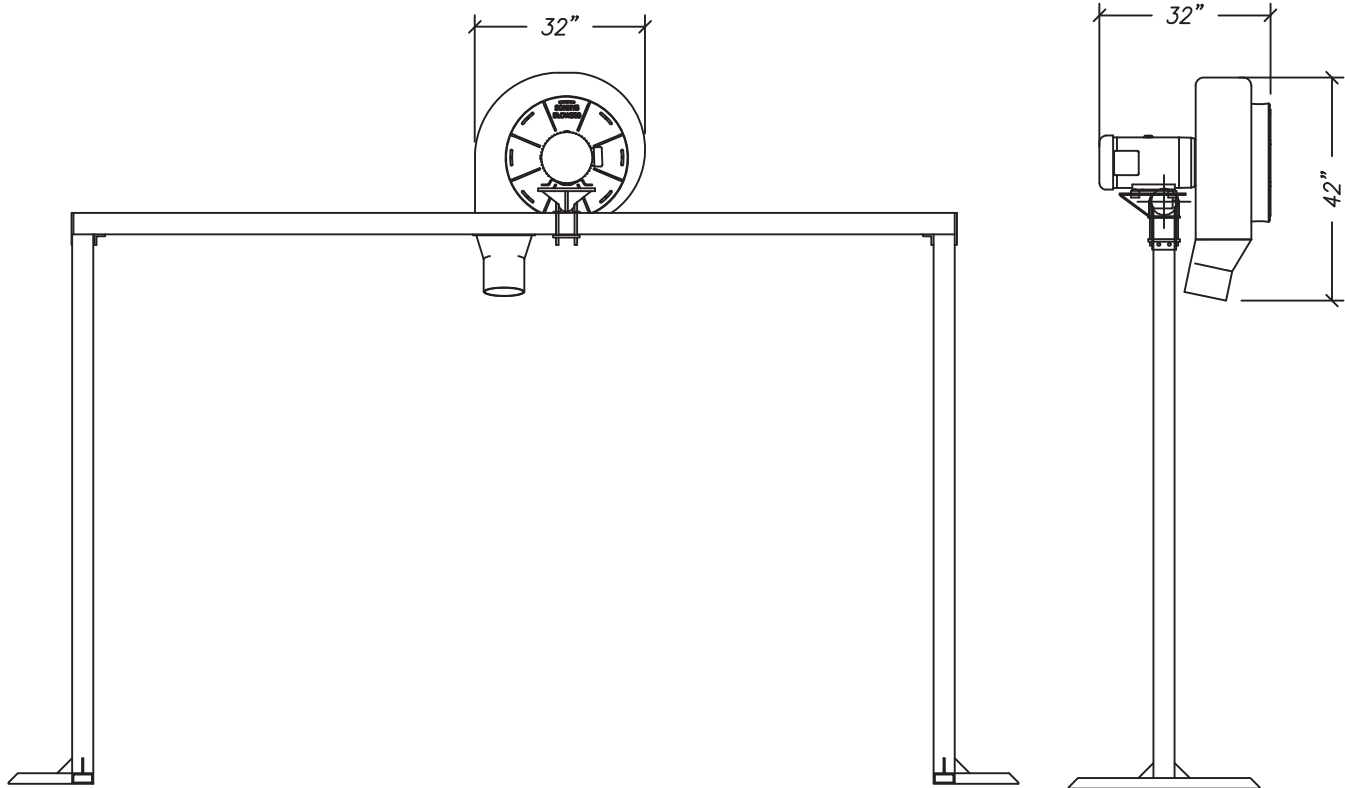
---

Car Wash Blower Specifications

Environmental Noise with Dryer OFF: 70 dba



**Figure 15. Dryer Noise DBA Reading**



**Figure 16. Producer Dimensions**

# Appendix D

---

Greencheck Fan Specifications

## Model: G-090-VG

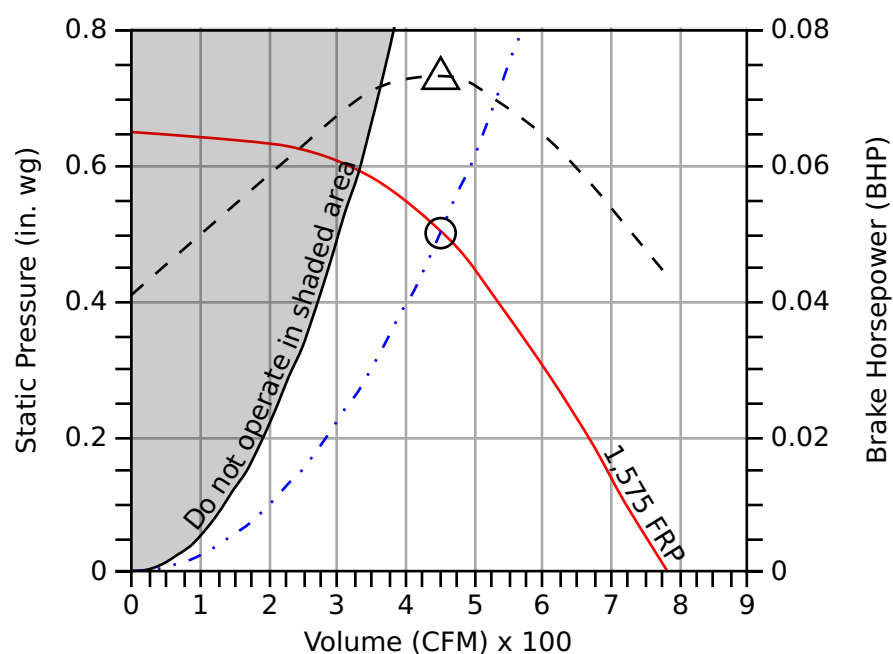
### Direct Drive Centrifugal Roof Exhaust Fan

**Standard Construction Features:** Aluminum housing. Centrifugal backward inclined aluminum wheel. Direct driven motor mounted on vibration isolation.

Fan Configuration	
Drive type	Direct

Performance	
Requested Volume (CFM)	450
Actual Volume (CFM)	450
Total External SP (in. wg)	0.5
Fan RPM	1,575
Operating Power (bhp)	0.07
Startup Power (bhp)	0.07
Air Stream Temp (F)	70
Start-up Temp (F)	70
Air Density (lbs/ft <sup>3</sup> )	0.068
Elevation (ft)	2726
Static Efficiency (%)	49
Outlet Velocity (ft/min)	643

Motor	
Enclosure	TENV
Size (hp)	1/10
V/C/P	115/60/1
NEC FLA (Amps)	2.6



- Fan curve
- - - Brake horsepower curve
- Operating Point SP
- △ Operating Bhp point
- Max system curve
- · - · - System curve

### Sound

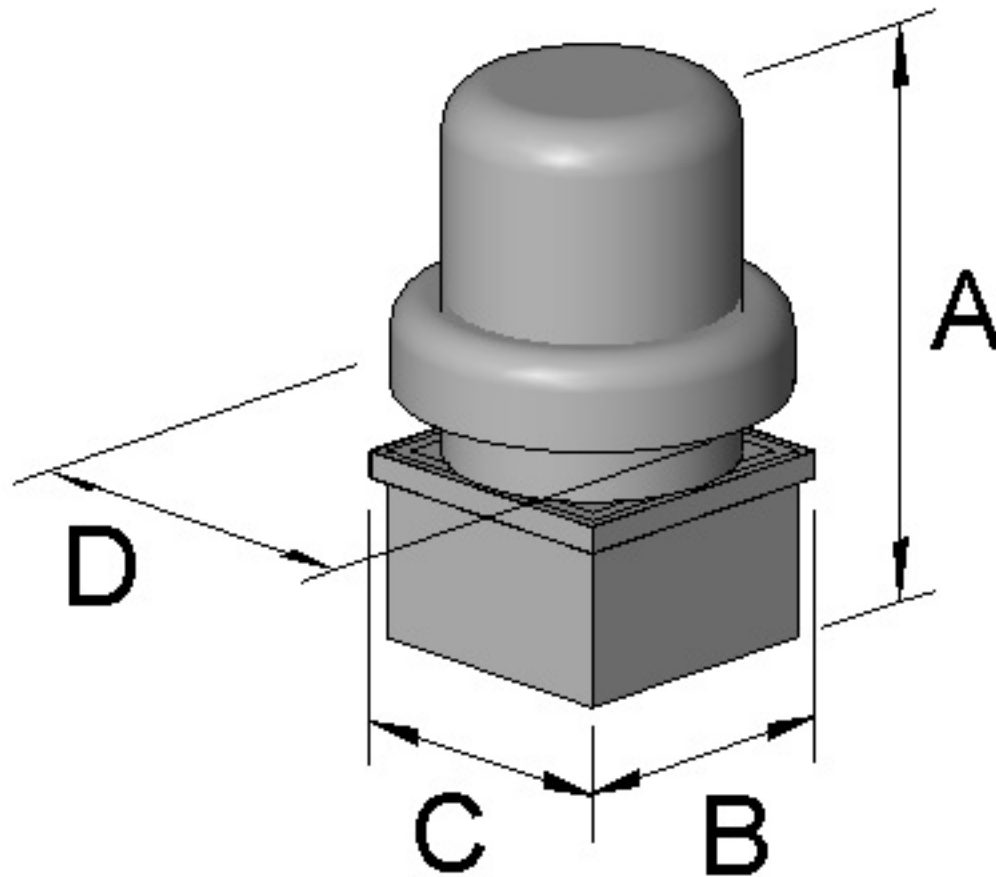
	Octave Bands (hz)								LwA	dBA	Sones
	62.5	125	250	500	1000	2000	4000	8000			
Inlet	77	74	69	63	58	55	51	44	66	55	7.6



Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation type A: Free inlet, Free outlet. Power rating (BHP/kW) does not include transmission losses. Performance ratings include the effects of birdscreen. The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for installation type A: free inlet hemispherical sone levels. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal for Sound applies to inlet sone ratings only.

FLA - based on tables 150 or 148 of National Electric Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.

Dimensions and Weights		
Label	Value	Description
-	26	Weight w/o accessories (lbs)
A	27	Overall Height (in)
D	22	Overall Width (in)
B	17	Curb Cap Width (in)
C	17	Curb Cap Length (in)
-	10	Duct / Damper Width (in)
-	10	Duct / Damper Length (in)
-	12.5	Roof Opening Width (in)
-	12.5	Roof Opening Length (in)



\*All dimensions are in inches.

## Model: CSP-A510-VG

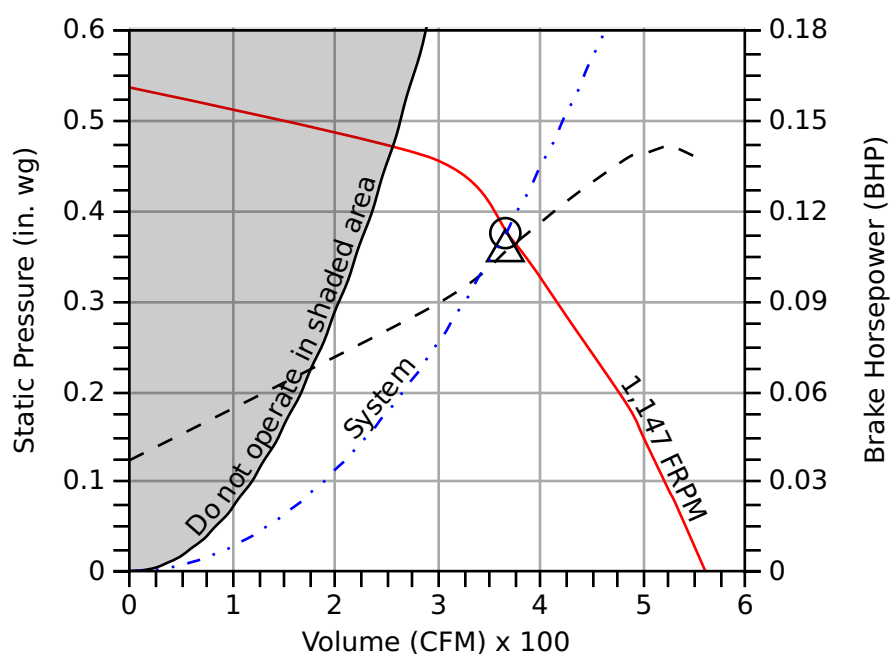
### Direct Drive Cabinet Fan

**Standard Construction Features:** Galvanized steel housing with duct collars. Centrifugal forward curved wheel. Direct driven motor in the air stream.

Fan Configuration	
Drive type	Direct

Performance	
Requested Volume (CFM)	365
Actual Volume (CFM)	365
Total External SP (in. wg)	0.38
Fan RPM	1,147
Operating Power (bhp)	0.11
Startup Power (bhp)	0.11
Air Stream Temp (F)	70
Start-up Temp (F)	70
Air Density (lbs/ft <sup>3</sup> )	0.068
Elevation (ft)	2726
Watts (W)	160
Static Efficiency (%)	20
Outlet Velocity (ft/min)	830

Motor	
Enclosure	TENV
Size (hp)	1/6
V/C/P	115/60/1
NEC FLA (Amps)	3.4



- Fan curve
- - - Brake horsepower curve
- Operating Point SP
- △ Operating Bhp point
- Max system curve
- · - · - System curve

### Sound

	Octave Bands (hz)								LwA	dBA	Sones
	62.5	125	250	500	1000	2000	4000	8000			
Inlet	53	59	55	40	35	30	33	27	49	34	1.9

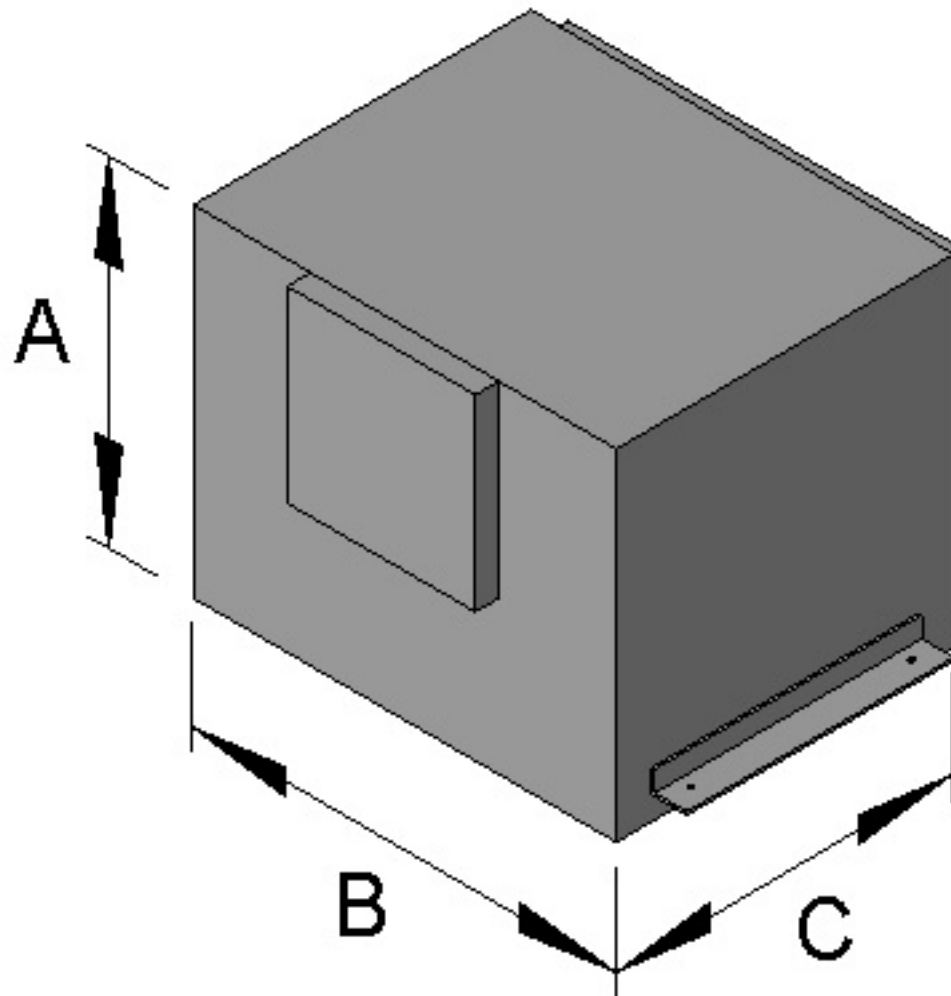


Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings only. Performance certified is for installation type D: Ducted inlet, Ducted outlet. Power rating (BHP/kW) does not include transmission losses. Performance ratings include the effects of a backdraft damper. Speed (RPM) shown is nominal. Performance is based on actual speed of test. The sound ratings shown are for loudness values in spherical sones at 5 ft. (1.5m) in a spherical free field calculated per Annex B of AMCA 311. Values shown are for installation type D: ducted inlet spherical sone levels. Ratings do not include the effects of duct end correction. Ratings are based on 10 ft. of insulated duct. The AMCA Certified Ratings Seal applies to air performance only.

Wattage is shown at free air. Wattage is approximate and may vary between motors. Fan shaft input power (bhp) is not certified. FLA - based on tables 150 or 148 of National Electric Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.



Dimensions and Weights		
Label	Value	Description
-	36	Weight w/o accessories (lbs)
A	15	Overall Height (in)
B	18	Overall Width (in)
C	14	Overall Length (in)
-	16.875	Inlet Width (in)
-	13.25	Inlet Height (in)
-	8	Outlet Width (in)
-	8	Outlet Height (in)



\*All dimensions are in inches.

# Appendix E

---

Drive-Through Speaker Specifications

# 3M™ Wireless Communication System Model XT-1 Technical Data

## 3M Wireless Communications System Model XT-1's Night Volume feature to comply with City Decibel Level output ordinance.

With the concern over environmental noise today, many communities restrict the audio level of drive-thru intercom systems during normal day-time business hours and for business operations during night time. Usually, this audio level is specified to be below some number at the property line.

Audio levels are measured in terms of "Sound Pressure Level" with the unit of change being the "Decibel". For example, the city of South Plainfield, NJ requires that sound levels not exceed 65 decibels SPL (sound pressure level) in an industrial area. Taking this into consideration, 3M intercom systems provide an adjustable menu speaker volume to assure compliance with city sound ordinances.

The 3M XT-1 Intercom System can be adjusted at installation to produce an audio sound pressure level of 65 decibels (\*) at a distance of 4 feet on axis to the center of the speaker. It is VERY easy for the installation company to verify this reading using an Audio dB meter (set to A weighing, slow response). Please note that sound diminishes at the rate of 6 decibels every time the distance from the sound source is doubled. So, at a distance of 8 feet, the level is 59 decibels, at 16 feet it is 53 decibels and so on.

The 3M XT-1 Intercom System also provides an AUTOMATIC reduction of sound volume for night time operation to maintain compliance with cities that require lower operating sound levels after normal business hours. This feature assures compliance 24 hours a day.

To give you a reference of comparative audio levels, please peruse the attached list of typical sound levels. Be aware that acoustic barriers (shrubbery, trees, fences, walls, etc) will reduce the distance faster than shown in the chart.

(\* These level measurements assume the use of recommended 3M components.)



**Building and Commercial Services Division**

St. Paul, MN 55144-1000

1-800-328-0033

[www.3M.com/XT1](http://www.3M.com/XT1)

3M is a trademark of 3M.

© 3M 2011. All rights reserved.  
1209 DMR

## Table of Sound Levels and Corresponding Sound Pressure and Sound Intensity

To get a feel for decibels, look at the table below which gives values for the sound pressure levels of common sounds in our environment. Also shown are the corresponding sound pressures and sound intensities.

From these, you can see that the decibel scale gives numbers in a much more manageable range.

<b>Chart of sound levels <math>L</math> and corresponding sound pressure and sound intensity</b>			
	Sound Pressure Level dB SPL	Sound Pressure $p$ N/m <sup>2</sup> = Pa	Sound Intensity $I$ watts/m <sup>2</sup>
Jet aircraft, 50 m away	140	200	100
Threshold of pain	130	63.2	10
Threshold of discomfort	120	20	1
Chainsaw 1m distance	110	6.3	0.1
Disco, 1 m from speaker	100	2	0.01
Diesel truck, 10 m away	90	0.63	0.001
Curbside of busy road, 5 m	80	0.2	0.0001
Vacuum cleaner, distance 1 m	70	0.063	0.00001
Conversational speech, 1m	60	0.02	0.000001
Average home	50	0.0063	1E-07
Quiet library	40	0.002	1E-08
Quiet bedroom at night	30	0.00063	1E-09
Background in TV studio	20	0.0002	1E-10
Rustling leaf	10	0.000063	1E-11
Threshold of hearing	0	0.00002	1E-12



**Building and Commercial Services Division**

St. Paul, MN 55144-1000

1-800-328-0033

www.3M.com/XT1

3M is a trademark of 3M.

© 3M 2011. All rights reserved.

1209 DMR

A given sound pressure level  $L_p$  in dBSPL without the distance of the measurement to the specific sound source is useless.

The reference for 0 dBSPL sound pressure level is  $p = 20 \mu\text{Pa} = 2 * 10^{-5}$  pascal, the threshold of hearing.

The sound pressure level decreases in the free field with 6dB per distance doubling.

**That is the 1/r law.**

Often it is argued the sound pressure would decrease after the  $1/r^2$  law (inverse square law).

**That is wrong.**

The sound pressure in a free field is inversely proportional to the distance from the mic to the source.

$p \sim 1/r$

Distance From Menu Post	3M Intercom SPL (dB)
4'	65
8'	59
16'	53
32'	47
64'	41
128'	35
256'	29
512'	23
1024'	17
2048'	11
4096'	5

**Note:** 20 dB is approximately the threshold of hearing. This occurs at approximately 700 feet from the speaker post in a very QUIET environment. In an environment of average traffic noise, a 35 dB limit is virtually inaudible and should be considered the practical limit. This occurs at approximately 125 feet from the speaker post.



**Building and Commercial Services Division**

St. Paul, MN 55144-1000

1-800-328-0033

www.3M.com/XT1

3M is a trademark of 3M.

© 3M 2011. All rights reserved.

1209 DMR

# Appendix F

---

HVAC Specifications



# Trane Precedent Gas/Electric Packaged Rooftop

## Unit Overview - YHC120F3RYA\*\*K7E0000000000000000000000

Application	Unit Size	Supply Fan		External Dimensions (in.)			Weight		EER	IEER/SEER	Elevation
DX cooling, gas heat	10 Ton	Airflow	External Static Pressure	Height	Width	Length	Minimum	Maximum	12.4 EER	15.20	
		3600 cfm	1.000 in H2O	4.24 ft		8.31 ft	1259.0 lb	1608.0 lb			

## Unit Features

<b>Fresh Air Selection</b>	Low Leak Econ-dry bulb 0-100%/bar rel 3p
<b>SupplyFan/Drive/ MotorType</b>	Multi speed fan

## Unit Electrical

<b>Voltage/phase/hertz</b>	208-230/60/3	
<b>MCA</b>	0.00 A	49.0 A
<b>MOP</b>	0.00 A	60.0 A



## Controls

<b>Unit Controls</b>	Microprocessor controls
----------------------	-------------------------

## Cooling Section

		Capacity	
<b>Entering Dry Bulb</b>	80.00 F	<b>Gross Total</b>	105.18 MBh
<b>Entering Wet Bulb</b>	64.00 F	<b>Gross Sensible</b>	94.74 MBh
<b>Ambient Temp</b>	102.00 F	<b>Net Total</b>	101.47 MBh
<b>Leaving Coil Dry Bulb</b>	55.63 F	<b>Net Sensible</b>	91.02 MBh
<b>Leaving Coil Wet Bulb</b>	53.67 F	<b>Fan Motor Heat</b>	3.71 MBh
<b>Leaving Unit Dry Bulb</b>	57.07 F	<b>Refrig Charge-circuit 1</b>	7.1 lb
<b>Leaving Unit Wet Bulb</b>	54.26 F	<b>Refrig Charge-circuit 2</b>	5.0 lb
<b>Refrigeration System Options</b>			
<b>Leaving Dew Point</b>	52.24 F		

## Heating Section

<b>Heat Type</b>	Gas Heat
<b>Heating Stages</b>	2
<b>Output Heating Capacity</b>	160.00 MBh
<b>Output Heating Capacity with Fan</b>	163.71 MBh
<b>Heating EAT</b>	62.00 F
<b>Heating LAT</b>	103.40 F
<b>Heating Temp Rise</b>	41.40 F

## Fan Section

Indoor Fan Data		Outdoor Fan Data	
<b>Drive Type</b>	Variable Direct	<b>Type</b>	Propeller
<b>Evap Fan FLA</b>	7.30 A	<b>Fan Quantity</b>	1
<b>Indoor Fan Performance</b>		<b>Drive Type</b>	Direct
<b>Airflow</b>	3600 cfm	<b>Outdoor Fan Performance</b>	
<b>Design ESP</b>	1.000 in H2O	<b>Outdoor Motor Power</b>	0.53 kW
<b>Component SP</b>	0.870 in H2O	<b>Condenser Fan FLA</b>	2.70 A
<b>Total SP</b>	1.909 in H2O		
<b>Supply Motor Horsepower</b>	2.750 hp		
<b>Indoor Motor Operating Power</b>	1.28 bhp		
<b>Indoor Motor Power</b>	0.95 kW		
<b>Indoor RPM</b>	1471 rpm		
<b>Indoor Fan FLA</b>	2.70 A		

## Compressor Section

<b>Power</b>	8.49 kW
<b>Circuit 1 RLA</b>	19.60 A
<b>Circuit 2 RLA</b>	13.20 A



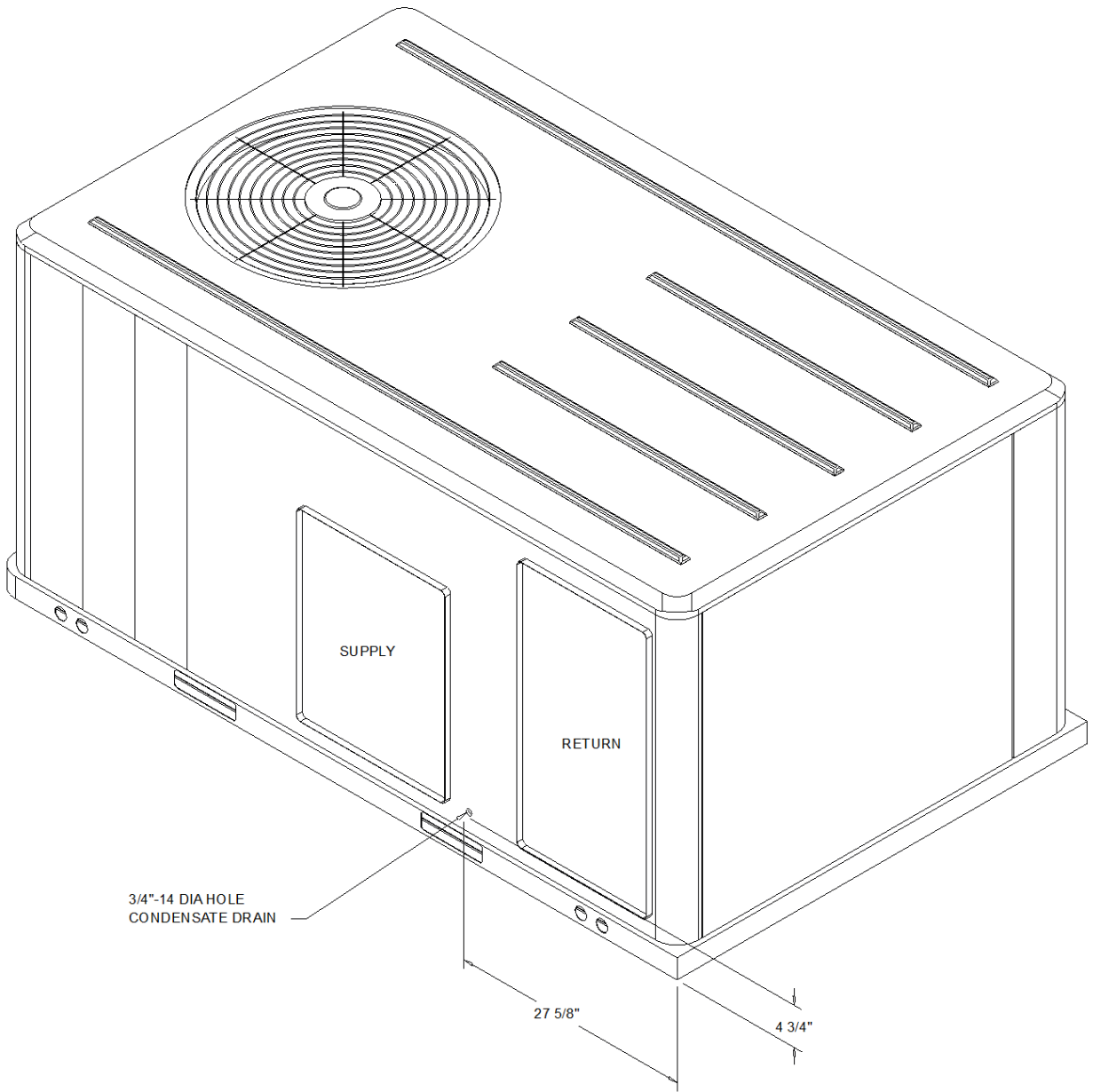
## Acoustics

Sound Path	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Ducted Discharge	80 dB	88 dB	84 dB	81 dB	77 dB	72 dB	73 dB	64 dB
Ducted Inlet	80 dB	81 dB	79 dB	69 dB	59 dB	60 dB	61 dB	51 dB
Outdoor Noise	89 dB	87 dB	91 dB	85 dB	80 dB	77 dB	73 dB	66 dB

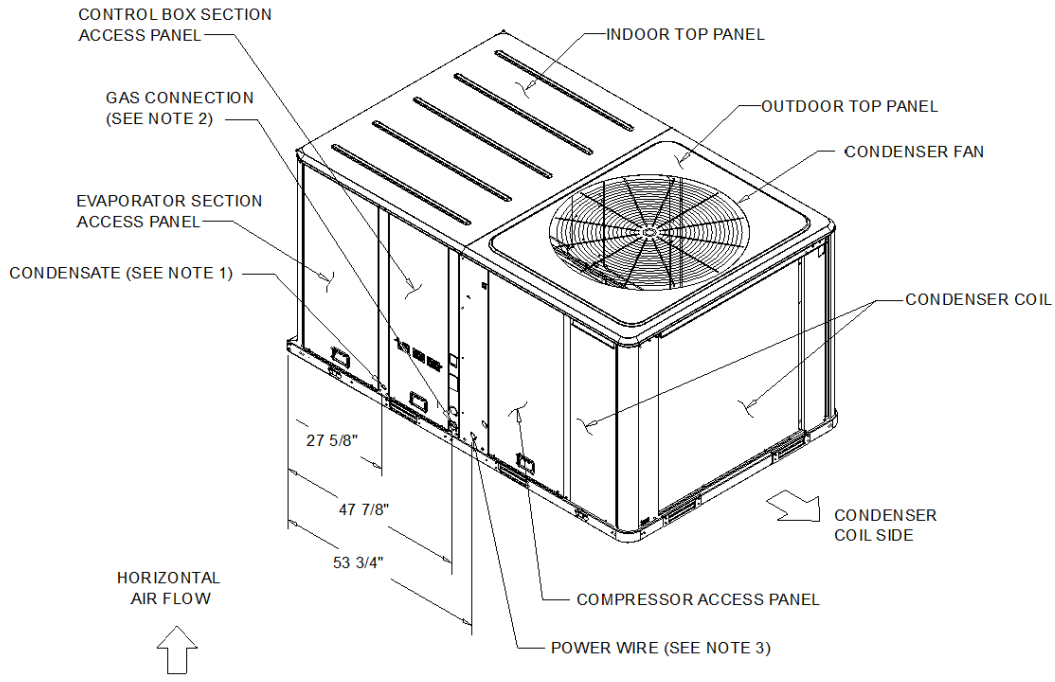
Note:Ducted Inlet and Ducted Discharge Sound Power Levels are in accordance with AHRI 260.

Note:Outdoor Sound Power Levels are in accordance with AHRI 270.



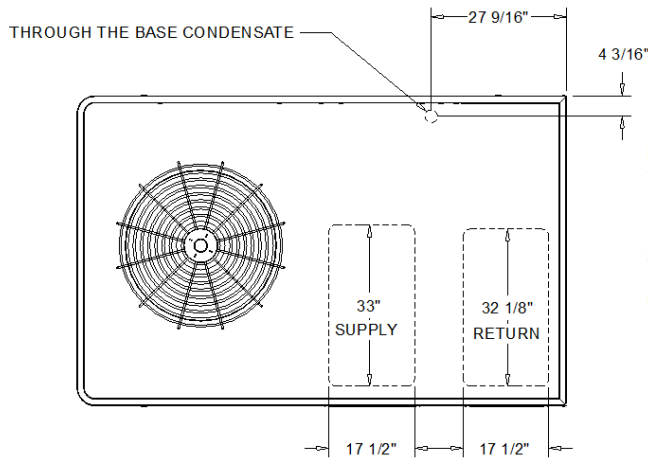


ISOMETRIC-PACKAGED COOLING



**PACKAGED GAS / ELECTRICAL**

ISOMETRIC VIEW

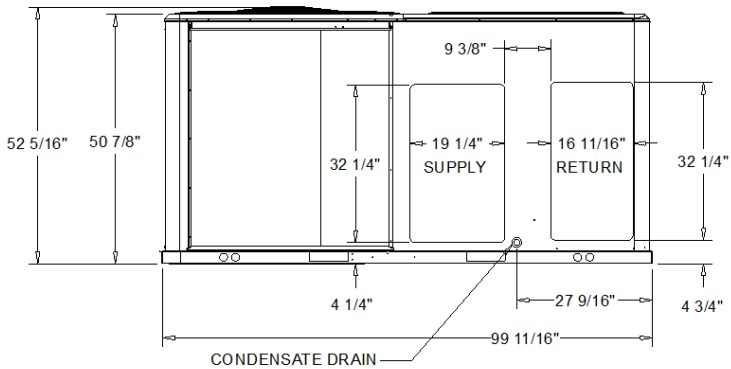


**NOTES:**

1. ALTERNATE CONDENSATE DRAIN CONNECTION  
3/4" - 14 NPT DIA. HOLE
2. 1/2" NPT GAS CONNECTION (80 mbh, 120 mbh);  
3/4" NPT GAS CONNECTION (150mbh, 200mbh, 250mbh)
3. UNIT POWER WIRE 1 3/8" DIA. HOLE.
4. THRU -THE -BASE ELECTRICAL AND GAS IS NOT STANDARD ON ALL UNITS.
5. VERIFY WEIGHT, CONNECTION, AND ALL DIMENSION WITH  
INSTALLER DOCUMENTS BEFORE INSTALLATION

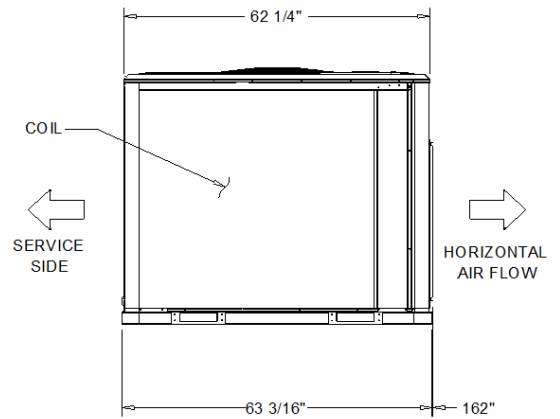
**PLAN VIEW UNIT**

DIMENSION DRAWING



**PACKAGED GAS / ELECTRICAL**

DIMENSION DRAWING





### ELECTRICAL / GENERAL DATA

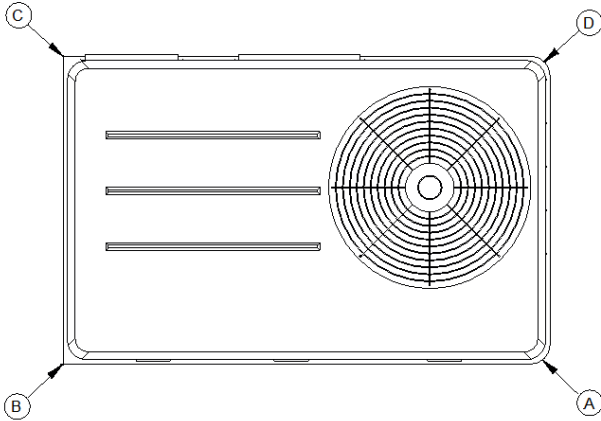
<b>GENERAL (2)(4)(6)</b> Model: YHC120F Oversized Motor Unit Operating Voltage: 187-253 Unit Primary Voltage: 208 Unit Secondary Voltage: 230 Unit Hertz: 60 Unit Phase: 3 EER: 12.4 Standard Motor MCA: 48.0 MFS: 60.0 MCB: 60.0		HEATING PERFORMANCE HEATING - GENERAL DATA Heating Model: Medium Heating Input (BTU): 200,000/140,000 Heating Output (BTU): 160,000/112,000 No. Burners: 4 No. Stages: 2 Gas Inlet Pressure Natural Gas (Min/Max): 4 1/2"/14" LP (Min/Max): 10"/14" Gas Pipe Connection Size: 3/4"	
<b>INDOOR MOTOR</b> Standard Motor Number: 1 Horsepower: 2.75 Motor Speed (RPM): -- Phase: 3 Full Load Amps: 7.3 --		Oversized Motor Number: N/A Horsepower: N/A Motor Speed (RPM): N/A Phase: N/A Full Load Amps: N/A N/A	
<b>COMPRESSOR</b> Circuit 1/2 Number: 2 Horsepower: 5.1/3.0 Phase: 3 Rated Load Amps: 19.6/13.2 --		<b>OUTDOOR MOTOR</b> Number: 1 Horsepower: 0.75 Motor Speed (RPM): 1100 Phase: 3 Full Load Amps: 2.7 --	
<b>POWER EXHAUST ACCESSORY (3,7)</b> (Field Installed Power Exhaust) Phase: N/A Horsepower: N/A Motor Speed (RPM): N/A Full Load Amps: N/A Locked Rotor Amps: N/A	<b>FILTERS</b> Type: Throwaway Furnished: Yes Number: 3 / 2 Recommended: 20"x25"x2" 20"x30"x2"	<b>REFRIGERANT (2)</b> Type: R-410 Factory Charge Circuit #1: 7.1 lb Circuit #2: 5.0 lb	

**NOTES:**

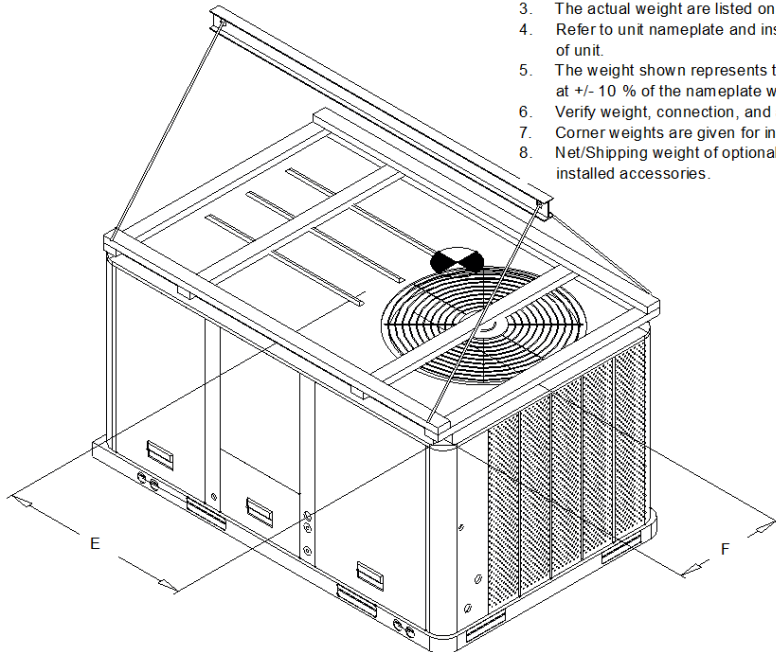
1. Maximum (HACR) Circuit Breaker sizing is for installations in the United States only.
2. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.
3. Value does not include Power Exhaust Accessory.
4. Value includes oversized motor.
5. Value does not include Power Exhaust Accessory.
6. EER is rated at AHRI conditions and in accordance with DOE test procedures.
7. Installation of this power exhaust kit will affect unit level MCA and could affect MOP sizing having a direct impact on existing field wiring and unit protection devices. The change in MCA/MOP is the sole responsibility of the field installing party. Trane will not issue new nameplates as a result of this power exhaust accessory installation. FLA of the power exhaust kit option must be added to the MCA of the unit for building supply conductor sizing determination.

### INSTALLED ACCESSORIES NET WEIGHT DATA

ACCESSORY		WEIGHTS			
ECONOMIZER		93.0 lb			
MOTORIZED OUTSIDE AIR DAMPER					
MANUAL OUTSIDE AIR DAMPER					
BAROMETRIC RELIEF					
OVERSIZED MOTOR					
BELT DRIVE MOTOR					
POWER EXHAUST					
THROUGH THE BASE ELECTRICAL/GAS (FIOPS)					
UNIT MOUNTED CIRCUIT BREAKER (FIOPS)					
UNIT MOUNTED DISCONNECT (FIOPS)					
POWERED CONVENIENCE OUTLET (FIOPS)					
HINGED DOORS (FIOPS)		12.0 lb			
HAIL GUARD					
SMOKE DETECTOR, SUPPLY / RETURN					
NOVAR CONTROL					
STAINLESS STEEL HEAT EXCHANGER		6.0 lb			
REHEAT					
ROOF CURB					
BASIC UNIT WEIGHTS		CORNER WEIGHTS		CENTER OF GRAVITY	
SHIPPING	NET	(A)	(C)	(E) LENGHT	(F) WIDTH
1453.0 lb	1259.0 lb	(B)	(D)	54"	27"



**PACKAGED GAS / ELECTRICAL**  
 CORNER WEIGHT

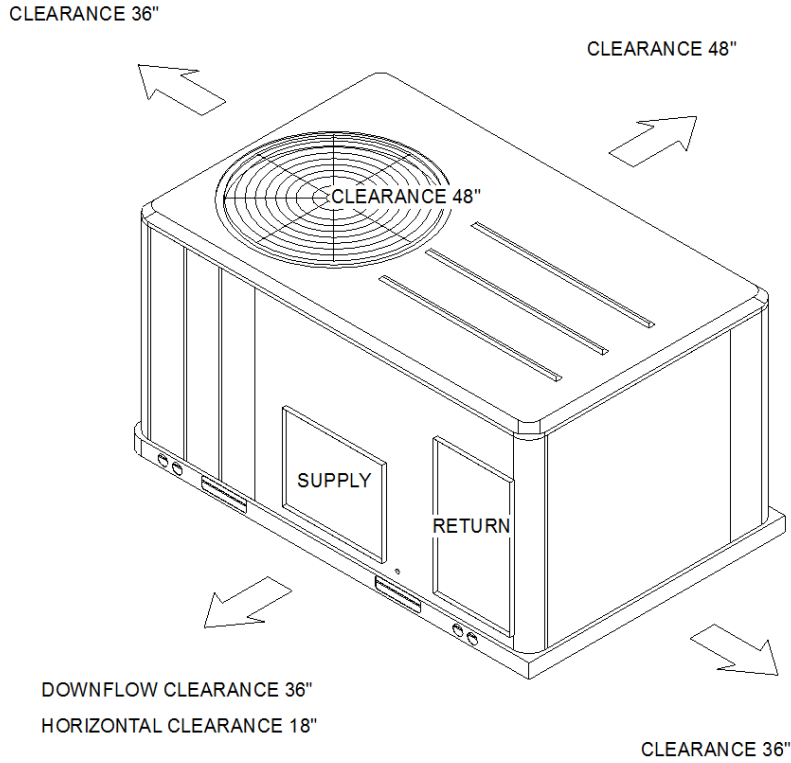


**PACKAGED GAS / ELECTRICAL**  
 RIGGING AND CENTER OF GRAVITY

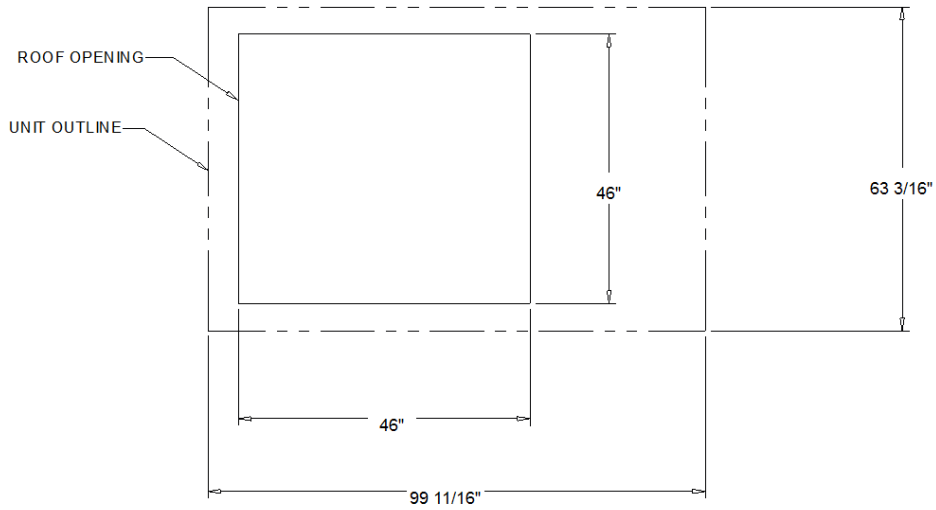
**NOTE:**

1. All weights are approximate.
2. Weights for options that are not list refer to Installation guide.
3. The actual weight are listed on the unit nameplate.
4. Refer to unit nameplate and installation guide for weights before scheduling transportation and installation of unit.
5. The weight shown represents the typical unit operating weight for the configuration selected. Estimated at +/- 10 % of the nameplate weight.
6. Verify weight, connection, and all dimension with installer documents before installation.
7. Corner weights are given for information only.
8. Net/Shipping weight of optional accessories should be added to unit weight when ordering factory or field installed accessories.

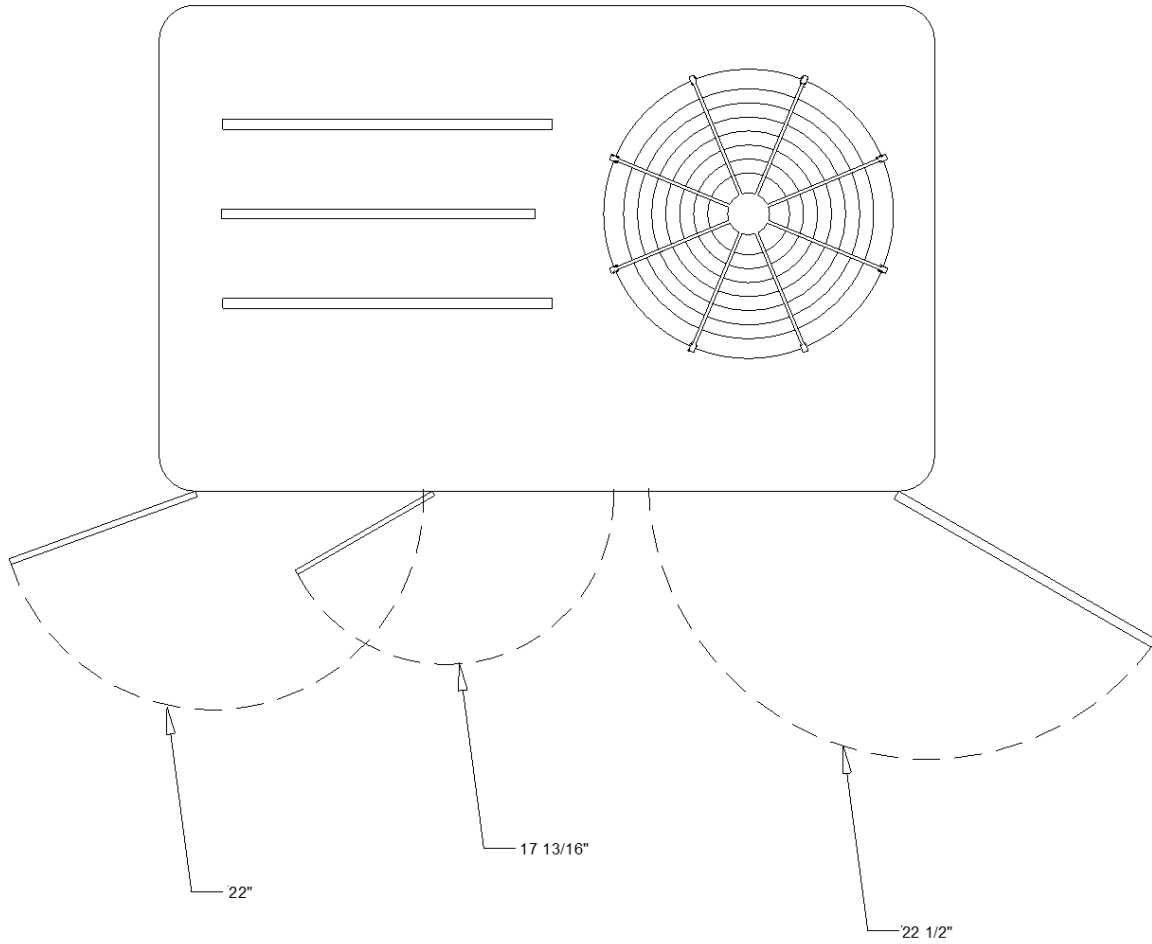
CLEARANCE FROM TOP OF UNIT 72"



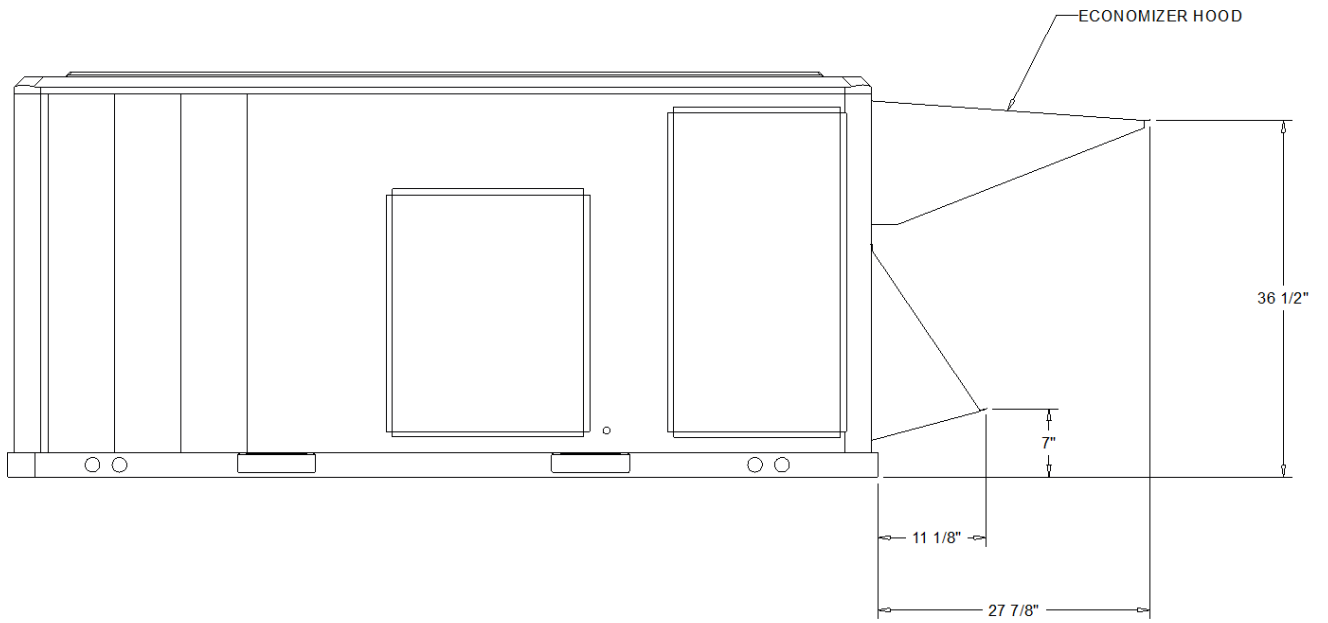
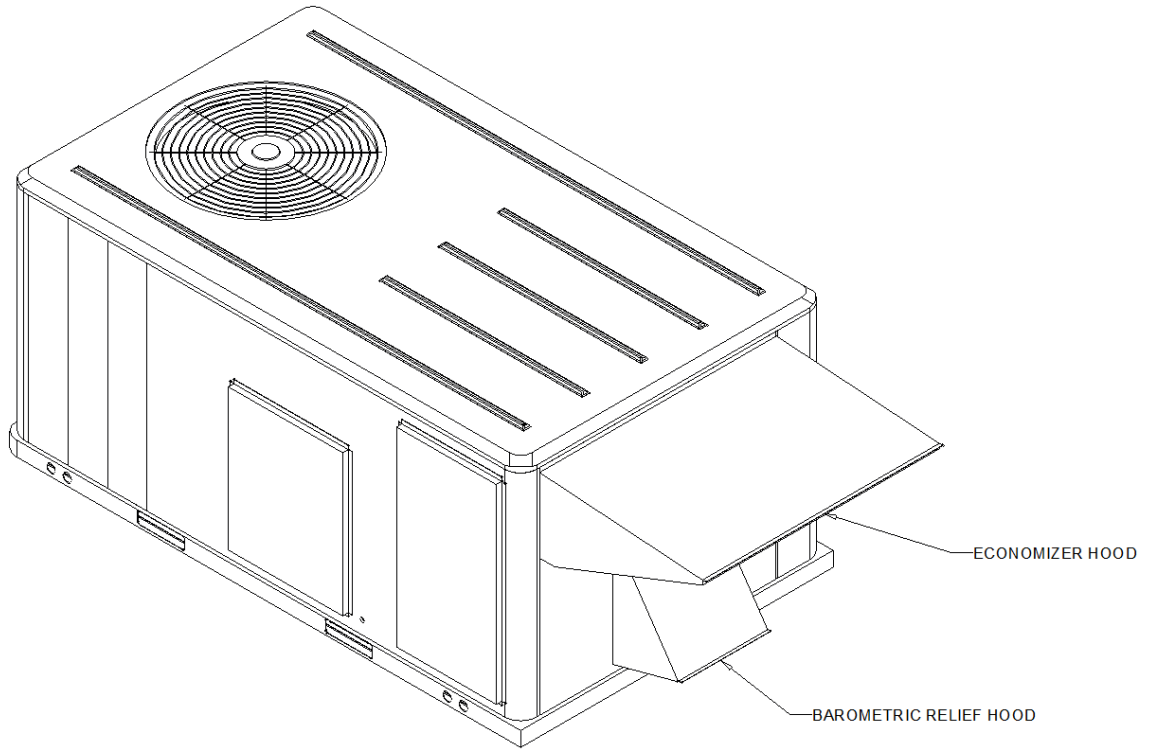
**PACKAGED GAS / ELECTRIC**  
 CLEARANCE



**PACKAGED GAS / ELECTRIC**  
 DOWNFLOW TYPICAL ROOF OPENING



**SWING DIAMETER - HINGED DOOR(S) OPTION**  
ACCESSORY



**LOW LEAK ECONOMIZER HOOD**  
**ACCESSORY**