Environmental Noise Analysis

Napa Airport Corporate Center (NACC)

American Canyon, California

BAC Job # 2014-106

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Introduction

The proposed Napa Airport Corporate Center (Project) is a 50-acre industrial warehouse development project proposed by Panattoni Development Inc. (Applicant). The Project is located at South Kelly Road and Devlin Road near S.R. 29 in the City of American Canyon (City). Figures 1 and 2 show the project site vicinity and proposed site plan, respectively.

While the Project site and virtually all of the surrounding properties are zoned for industrial uses, there is an existing single family residence south of the Project site. The owners currently access S.R. 29 via an easement over the applicant's property that fronts SR-29. The Applicant has incorporated an alternative access path across Building B's parcel from South Kelly Road to the residential property to provide alternative access in the future. Figure 1 shows the project site vicinity including the existing residence.

There are two site plans being considered for this development. Those plans are shown as Figures 2 and 3. Figure 2 represents Site Plan Option A, which includes a gas station at the corner of S.R. 29 and South Kelly Road. Figure 3 represents Site Plan Option B, which includes a commercial warehouse at the corner of S.R. 29 and South Kelly Road.

Acoustical Fundamentals and Terminology

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough, they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second, called Hertz (Hz).

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

The perceived loudness of sounds is dependent upon many factors, including sound pressure level, sound duration, time of day of occurrence, and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and is typically approximated by the A-weighted network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and the way the human ear perceives noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels. Table 1 contains definitions of acoustical terminology used in this section. Table 2 shows examples of noise levels for several common noise sources and environments.

Figure 1

Napa Airport Corporate Center - American Canyon, California

Project Area and Noise Monitoring Location

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Figure 2

Napa Airport Corporate Center - American Canyon, California

Site Plan Option A - Gas Station Option

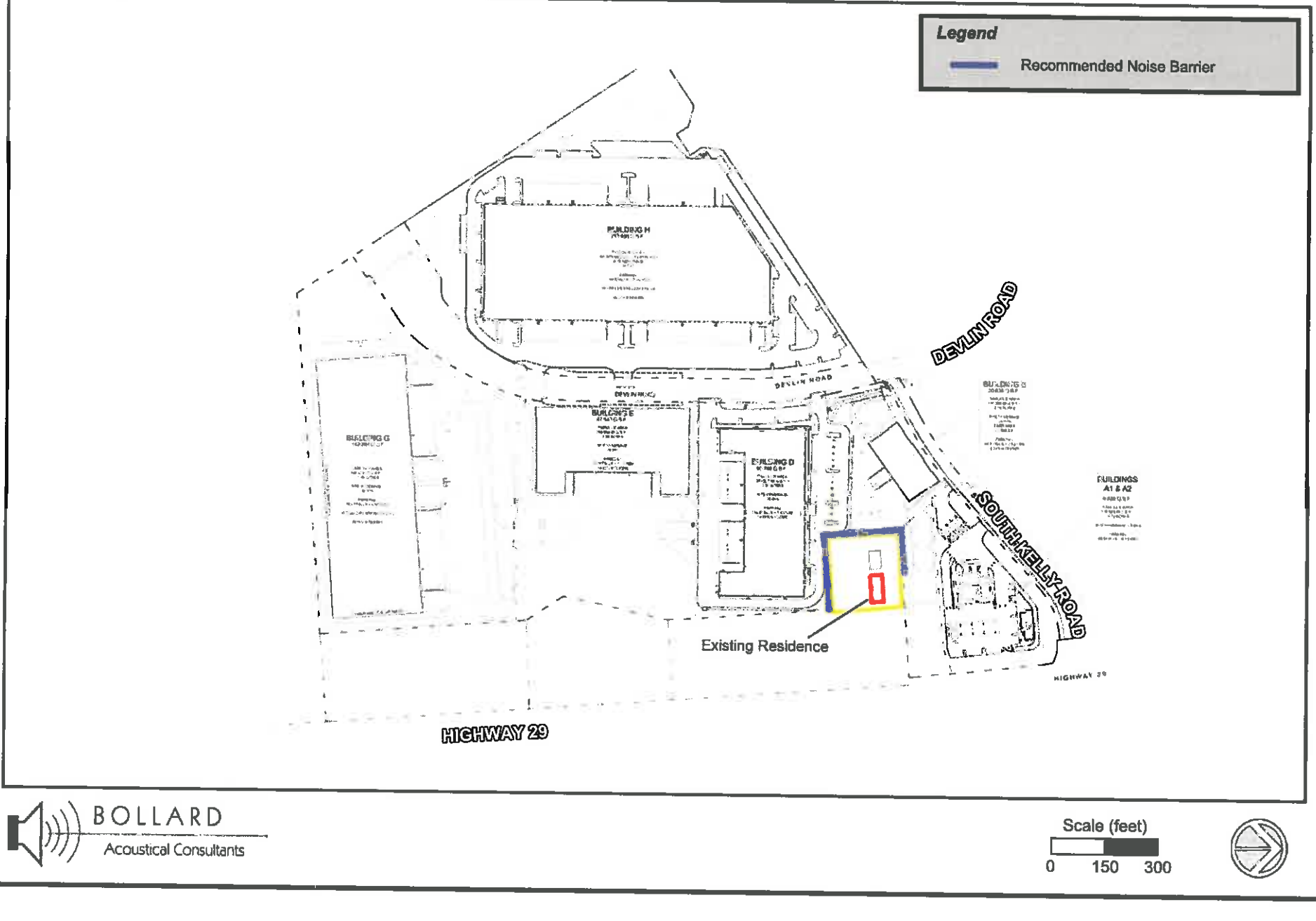

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Figure 3

Napa Airport Corporate Center - American Canyon, California

Site Plan Option B - Warehouse Option

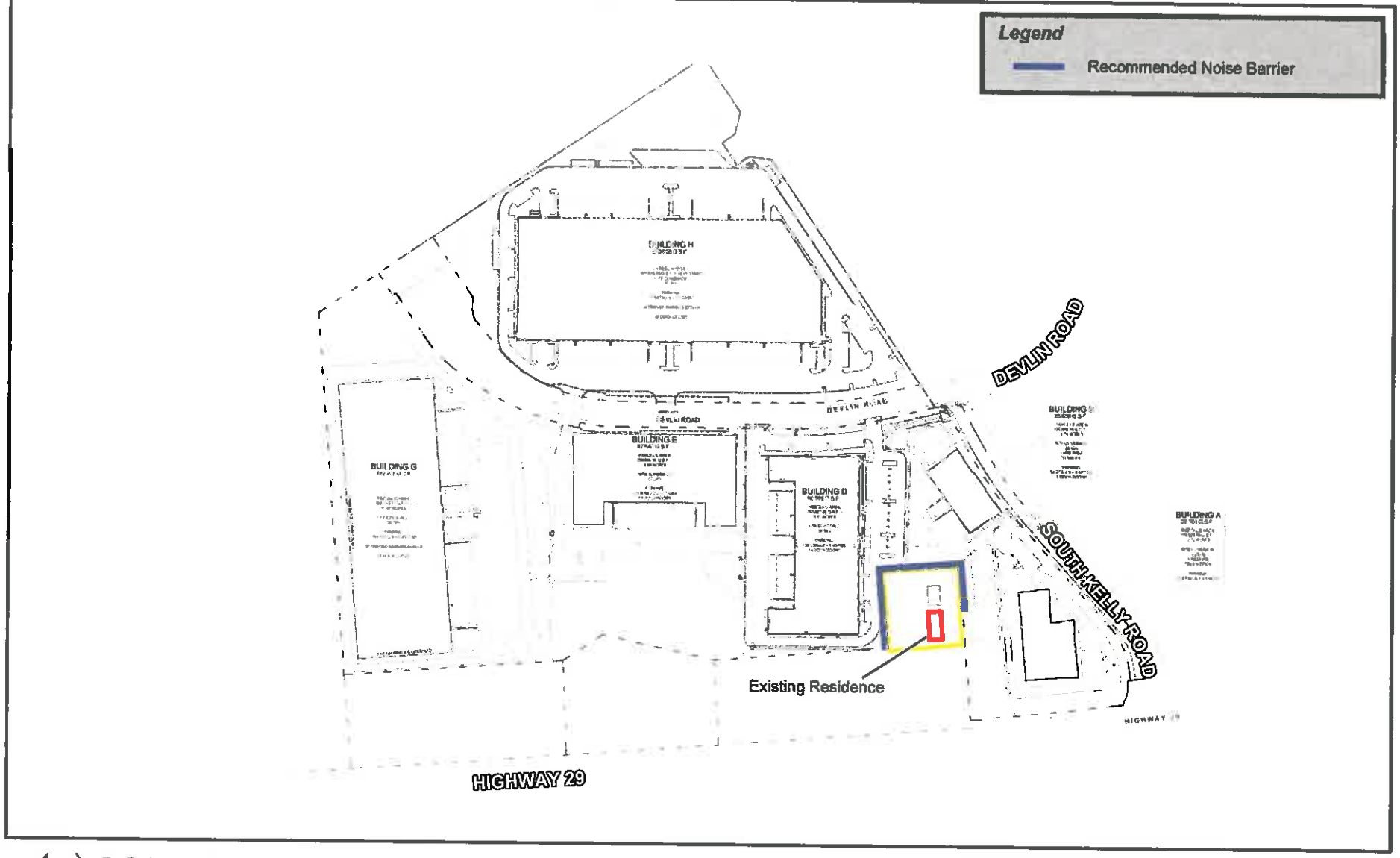

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Table 1
Acoustical Terminology Definitions

Term	Definition
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human auditory response.
Decibel or dB	Fundamental unit of sound. A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 – 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
L_n	The sound level exceeded "n" percent of the time during a sample interval (L_{50}, L_{25}, L_8, L_2 etc.). L_{50} equals the level exceeded 50 percent of the time, whereas L_2 equals the level exceeded 2 percent of the time.
L_{dn}	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
L_{eq}	Equivalent or energy-averaged sound level.
L_{max}	The highest root-mean square (RMS) sound level measured over a given period of time.
Masking	The amount (or the process) by which the threshold of audibility for one sound is raised by the presence of another (masking) sound.
Noise	Unwanted sound.
SEL	A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.

Source: Bollard Acoustical Consultants, Inc., 2012

Table 2
Typical A-Weighted Sound Levels of Common Noise Sources

Decibels	Description
120	Jet aircraft take-off at 100 feet / Threshold of Pain
110	Riveting machine at operators position
100	Shotgun at 200 feet
90	Bulldozer at 50 feet
80	Diesel locomotive at 300 feet
70	Commercial jet aircraft interior during flights
60	Normal conversation speech at 5 – 10 feet
50	Open office background level
40	Background level with a residence
30	Soft whisper at 2 feet
20	Interior of recording studio

Source: Bollard Acoustical Consultants, Inc., 2011

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

The Day-Night Average Level (L_{dn}) is based upon the average noise level over a 24-hour day, with a +10 decibel weighting applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures.

Existing Ambient Noise Environment

The ambient noise environment in the immediate project vicinity is defined primarily by noise from S.R. 29. Activities at the solid waste transfer station to the north of the project site and aircraft operations associated with the nearby Napa County Airport also contribute to the project vicinity noise environment, but to a far lesser extent. To generally quantify existing ambient noise levels in the project vicinity, continuous ambient noise level measurements were conducted from the front yard of the residences located near the northern corner of the property. That residence is identified on Figures 1-3.

The noise measurement survey was conducted on May 14, 2014 at the location shown on Figure 1. The noise measurement site was selected to represent the nearest potentially affected existing residence to the project site.

A Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meter was used for the ambient surveys. The meter was calibrated before use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 (precision) sound level meters (ANSI S1.4). The results of the continuous measurements are presented in Table 3. Detailed results of the ambient noise survey are shown in Appendices B and C.

Table 3
Ambient Noise Monitoring Results
Nearest Residence to Project Area

Site	Date	L_{dn}	Average Measured Hourly Noise Levels, dB			
			Daytime (7 am to 10 pm)		Nighttime (10 pm to 7 am)	
			L_{eq}	L_{max}	L_{eq}	L_{max}
1	Wednesday May 14, 2014	62	52	61-74	56	63-75

Note: Noise measurement locations are shown on Figure 1.
Source: Bollard Acoustical Consultants, Inc.

The ambient noise survey results shown in Table 3 indicate that existing noise conditions at the nearest residential uses to the project site are somewhat elevated due to the proximity of the existing residence to S.R. 29. The high daytime temperatures are believed to be the reason why nighttime noise levels were measured to be slightly higher than measured daytime levels, as atmospheric absorption of sound in air increases with increasing temperature.

Criteria for Acceptable Noise Exposure

American Canyon General Plan Noise Element

The City of American Canyon General Plan establishes an exterior noise level criterion of 65 dB L_{dn} (or CNEL) or less within outdoor activity areas of residential land uses. Additionally, the City requires that cumulative noise exposure from exterior noise sources within noise-sensitive dwellings not exceed 45 dB L_{dn} (or CNEL).

Noise Generation of the Project

Project Description

A Use Permit was approved by Napa County in 2008 which included four (4) buildings that were planned for winery warehouse uses. Building D (See Figures 2 & 3), which was approved as part of the existing Use Permit, is not included as part of this Project and is anticipated to be constructed in the very near future pursuant the existing Use Permit. However, the other three (3) buildings that were approved as part of the existing Use Permit are planned to be reconfigured as part of the new Project proposal.

The Project includes a request for the approval of five (5) separate Use Permits that will allow for warehouse and winery warehouse uses in connection with five (5) new buildings, comprising a total of 572,782 square feet. The total square footage would be reduced to 551,769 in the event that Building A is replaced by a 6,688 square foot Arco station project that is being proposed by a different applicant.

Major Project Noise Sources

The major noise sources identified for this project include the following:

- On-site truck circulation and loading dock access
- Parking lot movements
- Mechanical equipment (HVAC)
- Car wash proposed under site development option A.

Aside from traffic arriving and departing the gas station site, gas station uses are not otherwise inherently noisy. However, the proposed gas station shown under development Option A includes a car wash which may be a potentially significant source of noise affecting the existing nearby residence. As a result, car wash noise is evaluated in this study.

Truck traffic associated with warehouse operations at buildings G, E and H will utilize Devlin Road and South Kelly Road to access the project site. Truck circulation associated with those buildings would not pass closer than 325 feet from the existing residence located adjacent to the project site. Due to the slow speeds of traffic on South Kelly Road and this substantial setback

distance, those heavy truck passbys are not predicted to be significant sources of noise at the subject residence.

The loading docks of Building D are positioned on the opposite (south) side of that building from the existing residence. As a result, truck arrivals and departures from Building D would be completely screened from view of the existing residence by Building D, and no appreciable heavy truck noise resulting from Building D operations would occur at that residence.

Parking lot movements associated with Building D, and Building A (including the gas station option), would be located close enough to the subject residence so as to warrant evaluation of potential noise impacts. In addition, truck circulation associated with Building B and mechanical equipment associated with Buildings A, B and D could be potentially significant noise sources affecting the subject residence. As a result, these noise sources are evaluated in this study.

Noise Assessment Methodology

For a source of noise which radiates from a fixed location, such as the noise generated by stationary HVAC equipment, sound levels decrease at a rate of 6 dB per doubling of distance. This sound decay rate also applies to maximum noise levels generated by both stationary and mobile noise sources, such as the airbrake release of a heavy-truck. For example, a hypothetical reference level of 70 dB measured at a reference distance of 50 feet from a fixed location would decrease to a level of 64 dB at a distance of 100 feet from the source (6 dB decrease per doubling of distance), and further decrease to 58 dB at a distance of 200 feet from the source (another 6 dB per doubling of distance from 100 to 200 feet).

For mobile noise sources, such as truck passages, the sound decay rate used for computation of average noise levels (Leq) is 4.5 dB per doubling of distance from the source. For example, a hypothetical reference level of 60 dB Leq measured at a reference distance of 50 feet from a truck passby route would decrease to a level of 55.5 dB at a distance of 100 feet from the source (4.5 dB decrease per doubling of distance), and further decrease to 51 dB at a distance of 200 feet from the source (another 4.5 dB per doubling of distance from 100 to 200 feet).

On-Site Truck Circulation Noise

To quantify the noise generation of slow-moving heavy-truck passbys, such as those which will occur on the project site and near the residence located adjacent to the project site, BAC utilized single-event passby noise test results conducted at the West El Camino truck stop in Sacramento, California.

The heavy truck passby measurements included heavy-truck passbys both with and without refrigeration units on their trailers. The measurements were conducted at a reference distance of 50 feet at a location suitable for isolation of individual passby events. During the truck passbys, Larson-Davis Laboratories Model 820 and 2900 sound level meters and frequency analyzers were used to quantify noise levels and event frequency content in for each event.

The results of the heavy-truck measurements indicated that maximum noise levels ranged from 69 to 77 dB Lmax, with a mean of 74 dB Lmax at the measurement distance of 50 feet. The mean sound exposure level (SEL) of the heavy truck passbys was 84 dB SEL at the 50 foot reference distance. The day/night average sound level associated with heavy truck passbys depends on the number of such passbys which occur during a 24-hour period and the percentage of those passbys which occur during nighttime hours (10 pm – 7 am).

As noted previously, the overall site design is such that truck circulation associated with Buildings D, E, and G & H would not directly affect the existing residential property located adjacent to the project site. However, Building B proposes two heavy truck loading docks and Building A under Option 2 proposes 1 heavy truck loading dock. If the gas station is constructed under Option 1, that use would also generate heavy truck traffic both through the deliveries of bulk fuel to the gas station and through the arrival of heavy trucks requiring refueling.

The precise number of daily heavy truck trips generated by these uses is difficult to predict due to the number of variables affecting such trip generation. For this analysis, it was conservatively assumed that Building B could generate as many as 20 daily heavy truck trips, with building A (non-gas station option) resulting in 10 heavy daily truck trips.

The closest distance from the nearest heavy truck passbys to the existing residence located adjacent to the project site is approximately 150 feet. Based on 30 heavy truck passbys per day with an assumed 10 occurring at night, the reference SEL of 84 dB at 50 feet, and the 150 foot distance to the residence, the computed day/night average level for heavy truck passbys at the nearest residences computes to approximately 50 dB L_{dn}. Because this level is well below the City's 65 dB L_{dn} exterior noise level criteria, consideration of noise mitigation measures relative to this noise standard is not warranted.

The maximum noise levels generated by heavy truck passbys at the 150 foot distance to the nearest house compute to approximately 65 dB L_{max}. This predicted maximum level generated by heavy truck passbys is well within the range of measured existing maximum noise levels at this residence (See Table 3). As a result, project-generated heavy truck circulation is not predicted to result in a substantial increase in ambient noise levels at the nearby residence.

Loading Dock Noise

The primary noise sources associated with the loading dock areas of the Napa Airport Corporate Center, will be the heavy-trucks stopping (air brakes), backing into the loading docks (back-up alarms), trailer coupling and decoupling, pulling out of the loading docks (engines accelerating) and potential refrigeration unit operation. Heavy-truck trailer unloading will occur directly from the inside of the trailer while docked in the recessed bays.

To determine typical loading dock noise levels associated with the proposed project, noise level measurement data collected for similar loading dock facilities were used. The results of the loading dock noise measurements indicate that typical busy daytime hour activities generated a maximum level of approximately 75 dB L_{max}, and an average noise level of 55 dB L_{eq}, at a

reference distance of 100 feet. A typical busy nighttime hour of loading dock activities yielded average noise levels 5 dB lower than those measured during daytime hours.

The proposed loading dock configurations of the nearest buildings (A & B) would locate the effective noise center of the loading docks approximately 150-250 feet from the existing residence located adjacent to the project site. The reference average noise level of 55 dB data was extrapolated to the nearest residence (150-250 feet), and the computed resulting day night average level was computed to be approximately 50 dB L_{dn}. Because this predicted level is well below the City's 65 dB L_{dn} exterior noise level criteria, consideration of noise mitigation measures relative to this noise standard is not warranted.

The maximum noise levels generated by loading dock activities at the nearest house compute to approximately 65-70 dB L_{max}. This predicted maximum level generated by loading dock activities is well within the range of measured existing maximum noise levels at this residence (See Table 3). As a result, project-related loading dock activities are not predicted to result in a substantial increase in ambient noise levels at the nearby residence.

Mechanical Equipment

The HVAC systems for the warehouse uses will likely consist of packaged rooftop air conditioning systems. Such units are typically evenly distributed across the roof of the buildings. Packaged rooftop HVAC units, which typically stand about 4-5 feet tall, would be shielded from view of the existing residence by the building parapets. Measured noise levels for similar sized buildings at a reference distance of 100 feet from the building façade registered 45 dB Leq, including shielding by the building parapet. If such equipment were to operate continuously for an entire 24-hour period, the resulting day night average noise level at the nearest residence would be below 50 dB L_{dn}. Because this predicted level is well below the City's 65 dB L_{dn} exterior noise level criteria, consideration of noise mitigation measures relative to this noise standard is not warranted.

The average noise levels generated by rooftop HVAC operations compute to approximately 40-45 dB L_{eq} at the nearest house. This predicted average level is well below measured average daytime and nighttime noise levels at this residence (See Table 3). As a result, project-related HVAC equipment is not predicted to result in a substantial increase in ambient noise levels at the nearby residence.

Parking Areas

According to the project site plans, parking spaces are proposed approximately 175 feet southwest, 130 feet north, and 160 feet south of the existing residence located adjacent to the project site.

As a means of determining the noise levels due to parking lot activities, Bollard Acoustical Consultants, Inc. file data was utilized. A typical SEL due to automobile arrivals and departures, including car doors opening and closing, and people conversing is approximately 70 dB SEL at a distance of 50 feet. Based on ITE trip generation figures for warehousing facilities, the 90,000 square foot Building D and 20,000 square foot Building B would generated approximately 300 and 70 daily vehicle trips, respectively. Not all of these trips would result in vehicles parking in close proximity to the existing residence. To provide a conservative estimate of parking lot noise generation from all of the nearby parking areas, a daily total of 400 parking lot arrivals and departures were assumed for a busy day. Give this assumption, the daily parking lot L_{dn} can be determined using the following formula:

$$\text{Daily } L_{dn} = 70 + 10 * (\log N_E) - 49.4, \text{ dB where:}$$

70 is the mean sound exposure level (SEL) for an individual automobile arrival or departure (i.e. one parking lot movement), N_E is the number of automobile arrivals and departures during the day with a factor of 10 penalty for nighttime operations, and 49.4 is 10 times the logarithm of the number seconds in a day.

Based upon the equation above, and accounting for distance from the effective noise center of the parking area to the existing residence, the L_{dn} associated with daily parking lot activities would be approximately 53 dB L_{dn}. Because this predicted level is well below the City's 65 dB L_{dn} exterior noise level criteria, consideration of noise mitigation measures relative to this noise standard is not warranted.

Car Wash Noise Generation

Site development Option 1 (see Figure 2) proposes a car wash as part of the ARCO AM/PM gas station located at the northern portion of the project site. The proposed car wash tunnel would be located approximately 200 feet from the existing residence to the south. The car wash tunnel would be located in the east-west direction, with the tunnel openings facing away from the nearest residence.

Based on BAC file data, noise levels generated by car washes are primarily due to the drying portion of the operation. As a means of determining the potential noise impacts associated with the proposed car wash, BAC utilized noise level data provided by Ryker Manufacturing Company for the Ryko Thrustpro Dryer model with the noise reduction package. The reference noise level at the entrance of the Thrustpro model is 67 dB L_{max} at 60 feet.

Because the drying cycle represents a small portion of the overall wash, the dryers are anticipated to operate for no more than 15 minutes during any given hour. The calculated Hourly L_{eq} given 15 minute usage of the dryer cycle at the entrance would be 61 dB L_{eq} at a reference distance of 60 feet. Given the shielding provided by the tunnel orientation and the additional distance to the nearby residence, car wash noise levels are predicted to be approximately 45 dB L_{eq} at that residence. The computed L_{dn} based on reasonable estimates of daily car wash operations would also be approximately 45 dB L_{dn} at the nearby residence. Because this predicted level is well below the City's 65 dB L_{dn} exterior noise level criteria, consideration of noise mitigation measures relative to this noise standard is not warranted.

The average noise levels generated by car wash activities of 45 dB L_{eq} at the nearest house is well below measured average daytime and nighttime noise levels at this residence (See Table 3). As a result, car wash equipment is not predicted to result in a substantial increase in ambient noise levels at the nearby residence.

Conclusions and Recommendations

Noise generated by normal operation of the proposed Napa Airport Corporate Center project are predicted to satisfy the American Canyon Noise Element standards at the existing residence located adjacent to the project site. However, due to the proximity of that residence to a number of new noise sources which will result from the project, and the cumulative contribution of noise from those sources, the following specific measures are recommended to minimize the potential for adverse reaction to noise generated by the project at the existing residences:

1. A property line noise barriers of 8 feet in height should be constructed along the project borders as indicated in Figures 2 and 3.

2. Rooftop mechanical equipment shall be shielded from view of the nearest residence by intervening parapets.

These conclusions are based on the site plans shown on Figures 2 & 3, and on the assumptions contained herein. Deviation from the site plan and assumptions could cause actual noise levels to vary. Implementation of the above-described measures is expected to fully mitigate noise impacts associated with on-site activities at the proposed Napa Airport Corporate Center.

This concludes our environmental noise assessment for the proposed Napa Airport Corporate Center in American Canyon, California. Please contact BAC at (916) 663-0500 or paulb@bacnoise.com with any questions or requests for additional information.

Appendix A

Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
Ldn	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
Lmax	The highest root-mean-square (RMS) sound level measured over a given period of time.
Loudness	A subjective term for the sensation of the magnitude of sound.
Masking	The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.
Noise	Unwanted sound.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the Maximum level, which is the highest RMS level.
RT_{60}	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
SEL	A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.

Appendix B

Ambient Noise Measurement Results
Napa Airport Corporate Center
Wednesday, May 14, 2014

Hour	Leq	Lmax	L50	L90
0:00	53	63	50	43
1:00	53	66	49	40
2:00	53	67	49	40
3:00	55	75	52	45
4:00	57	67	56	52
5:00	60	71	59	56
6:00	60	68	59	57
7:00	56	72	55	52
8:00	52	67	51	47
9:00	52	68	51	47
10:00	52	70	50	46
11:00	53	74	50	46
12:00	51	62	49	46
13:00	50	63	49	46
14:00	51	72	50	47
15:00	50	66	49	46
16:00	51	64	50	47
17:00	50	63	48	43
18:00	48	61	47	43
19:00	52	63	51	45
20:00	54	67	52	48
21:00	52	61	52	48
22:00	53	68	52	47
23:00	54	70	52	46

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	56	48	52	60	53	56
Lmax (Maximum)	74	61	66	75	63	68
L50 (Median)	55	47	50	59	49	53
L90 (Background)	52	43	47	57	40	47

Computed Ldn, dB	62
% Daytime Energy	39%
% Nighttime Energy	61%

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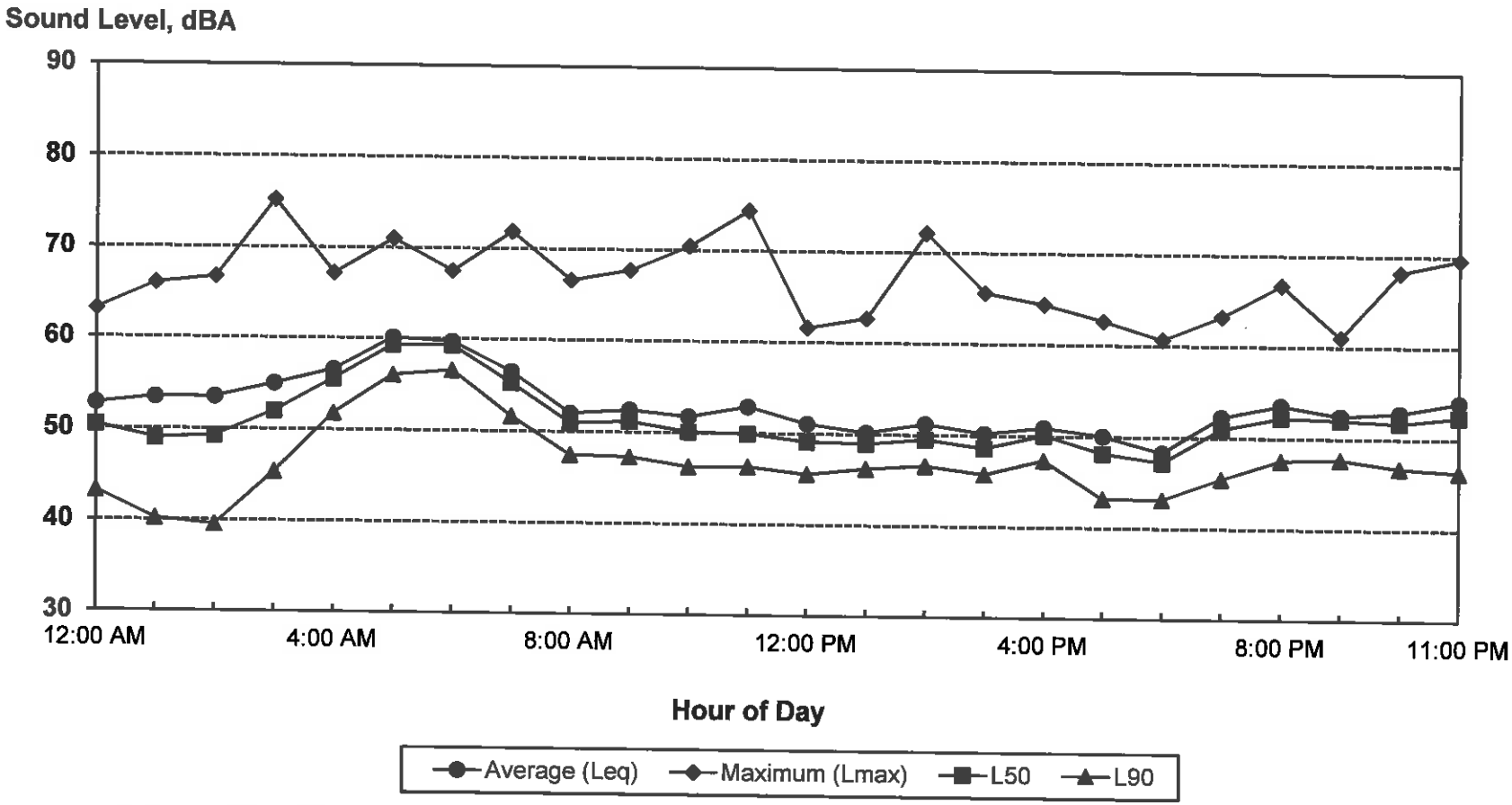
Appendix C
Napa Airport Corporate Center
Ambient Noise Measurement Results
Wednesday, May 14, 2014



Ldn: 62 dB

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