NOISE ANALYSIS

THE CAMBRIDGE SCHOOL
SAN DIEGO, CA

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1.0 INTRODUCTION AND SUMMARY

This report evaluates potential noise affecting and produced by The Cambridge School project. The project site is at the southwest corner of Camino Del Sur and Coyote Bush Drive, in the Black Mountain Ranch neighborhood of the City of San Diego, CA (Figure 1).

The project proposes site grading and new construction of a pre-K–12 campus with a 3-story classroom building, a 1-story multipurpose building, and a track and sports field over a semi-subterranean parking garage.

The report is intended to accompany a Consistency Review assessing the project's consistency with the Black Mountain Ranch Subarea 1 Environmental Impact Report (EIR) 96-7902, certified in 1998, as addended in 2009.

The primary noise source in the project vicinity is vehicular traffic on Camino Del Sur. The project outdoor use areas are the playground, plaza, and field deck. Future exterior roadway noise levels on the project site would range from below 60 dBA CNEL to approximately 68 dBA CNEL. Noise levels at project outdoor usable areas would be 65 dBA CNEL or less, and would comply with City of San Diego General Plan requirements. Noise levels at the track lanes would be as high as 68 dBA CNEL, and would comply with City of San Diego General Plan requirements.

Future exterior noise levels would exceed 65 dBA CNEL at some project building façades. Therefore, noise levels could exceed the City of San Diego General Plan Noise Element requirement of 45 dBA CNEL at indoor uses. To avoid a potential land use impact, as a condition of project approval, an interior noise analysis would be required. This interior noise analysis must identify the sound transmission loss requirements for building façade elements (windows, walls, doors, and exterior wall assemblies) necessary to limit noise to 45 dBA CNEL at indoor uses.

Upgraded windows and/or doors with Sound Transmission Class (STC) ratings of 30 or higher may be necessary. If the interior noise limit can be achieved only with the windows closed, the building design must include mechanical ventilation that meets CBC requirements. With the implementation of the findings of the interior noise analysis, noise levels would be 45 dBA CNEL or below at indoor uses, and the project would comply with the City of San Diego requirement.

At its property lines, the project would produce daytime noise levels of 60 dBA Leq or less, evening noise levels of 55 dBA Leq or less, and nighttime noise levels of 52.5 dBA Leq or less. The project would comply with San Diego Municipal Code (SDMC) noise limits.

Construction would occur within the hours prescribed by the SDMC. Construction noise levels at residential properties would be 75 dBA Leq (12 hours) or below. The project would comply with SDMC construction noise limits. The impact of project construction noise would be less than significant.

The following details the methodology and findings of the analysis.

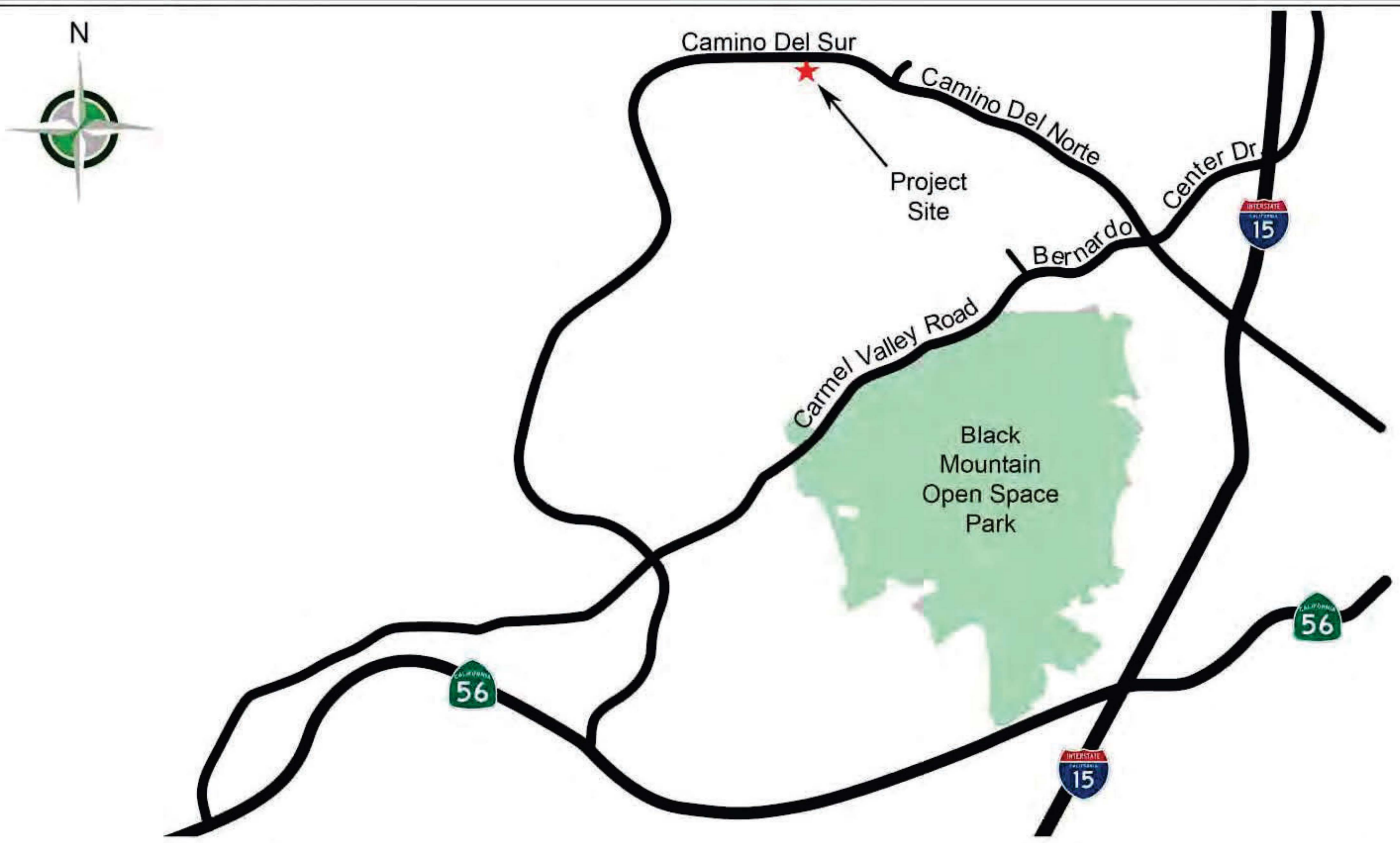

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FIGURE 1
Vicinity Map

1.1 NOISE BACKGROUND

Noise is generally defined as loud, unpleasant, unexpected, or undesired sound that is typically associated with human activity and that interferes with or disrupts normal activities. The human environment is characterized by a certain consistent noise level that varies by location and is termed ambient noise. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise, perceived importance of the noise and its appropriateness in the setting, time of day and type of activity during which the noise occurs, and sensitivity of the individual.

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Sound is generally characterized by several variables, including frequency and intensity. Frequency describes the sound's pitch and is measured in cycles per second, or hertz (Hz), whereas intensity describes the sound's loudness and is measured in decibels (dB). Decibels are measured using a logarithmic scale. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above about 120 dB begin to be felt inside the human ear as discomfort and eventually as pain at still higher levels. The minimum change in the sound level of individual events that an average human ear can detect is about 3 dB. The average person perceives a change in sound level of about 10 dB as a doubling (or halving) of the sound's loudness; this relation holds true for sounds of any loudness. Sound levels of typical noise sources and environments are provided in Table 1.

Because of the logarithmic nature of the decibel unit, sound levels cannot be added or subtracted directly and are somewhat cumbersome to handle mathematically. A simple rule is useful, however, in dealing with sound levels. If a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. Thus, for example, 60 dB + 60 dB = 63 dB, and 80 dB + 80 dB = 83 dB.

The normal human ear can detect sounds that range in frequency from about 20 Hz to 20,000 Hz. However, all sounds in this wide range of frequencies are not heard equally well by the human ear, which is most sensitive to frequencies in the range of 1,000 Hz to 4,000 Hz. This frequency dependence can be taken into account by applying a correction to each frequency range to approximate the human ear's sensitivity within each range. This is called A-weighting and is commonly used in measurements of community environmental noise. The A-weighted sound pressure level (abbreviated as dBA) is the sound level with the "A-weighting" frequency correction. In practice, the level of a noise source is conveniently measured using a sound level meter that includes a filter corresponding to the dBA curve.

Table 1. Sound Levels of Typical Noise Sources and Noise Environments

Noise Source (at Given Distance)	Noise Environment	A-Weighted Sound Level	Human Judgment of Noise Loudness (Relative to Reference Loudness of 70 Decibels*)
Military Jet Takeoff with Afterburner (50 ft)	Carrier Flight Deck	140 Decibels	128 times as loud
Civil Defense Siren (100 ft)		130	64 times as loud
Commercial Jet Take-off (200 ft)		120	32 times as loud **Threshold of Pain**
Pile Driver (50 ft)	Rock Music Concert Inside Subway Station (New York)	110	16 times as loud
Ambulance Siren (100 ft) Newspaper Press (5 ft) Gas Lawn Mower (3 ft)		100	8 times as loud **Very Loud**
Food Blender (3 ft) Propeller Plane Flyover (1,000 ft) Diesel Truck (150 ft)	Boiler Room Printing Press Plant	90	4 times as loud
Garbage Disposal (3 ft)	Noisy Urban Daytime	80	2 times as loud
Passenger Car, 65 mph (25 ft) Living Room Stereo (15 ft) Vacuum Cleaner (10 ft)	Commercial Areas	70	Reference Loudness **Moderately Loud**
Normal Speech (5 ft) Air Conditioning Unit (100 ft)	Data Processing Center Department Store	60	1/2 as loud
Light Traffic (100 ft)	Large Business Office Quiet Urban Daytime	50	1/4 as loud
Bird Calls (distant)	Quiet Urban Nighttime	40	1/8 as loud **Quiet**
Soft Whisper (5 ft)	Library and Bedroom at Night Quiet Rural Nighttime	30	1/16 as loud
	Broadcast and Recording Studio	20	1/32 as loud **Just Audible**
		0	1/64 as loud **Threshold of Hearing**

Source: Compiled by dBF Associates, Inc.

The Community Noise Equivalent Level (CNEL) is an adjusted average A-weighted sound level for a 24-hour day. It is calculated by adding a 5-dB adjustment to sound levels during evening hours (7:00 p.m. to 10:00 p.m.) and a 10-dB adjustment to sound levels during nighttime hours (10:00 p.m. to 7:00 a.m.). These adjustments compensate for the increased sensitivity to noise during the typically quieter evening and nighttime hours. CNEL is used by the State of California and City of San Diego to evaluate land-use compatibility with regard to noise.

Sound Transmission Class (STC) is a single-number rating of the effectiveness of a material or construction assembly to impede the transmission of airborne sound.

2.0 APPLICABLE NOISE STANDARDS

2.1 CITY OF SAN DIEGO

2.1.1 General Plan

The City of San Diego requires new projects to meet noise level standards as established in the Noise Element of the General Plan [City of San Diego 2008, Amended 2015: Policy NE-A.4]. These standards are shown in Table NE-3: Land Use – Noise Compatibility Guidelines (Table 2 of this report).

In the Institutional – Kindergarten through Grade 12 Educational Facilities land use category, noise levels up to 60 dBA CNEL are considered unconditionally Compatible with outdoor use areas. Noise levels up to 65 dBA CNEL are considered Conditionally Compatible; the building structure must attenuate exterior noise in interior occupied areas to 45 dBA CNEL or below.

In the Outdoor Spectator Sports land use category, noise levels up to 70 dBA CNEL are considered unconditionally Compatible with outdoor use areas.

Table 2. City of San Diego Land Use – Noise Compatibility Guidelines

Land Use Category	Exterior Noise Exposure (dBA CNEL)				
	60	65	70	75	
Parks and Recreational					
Parks, Active and Passive Recreation					
Outdoor Spectator Sports, Golf Courses; Water Recreational Facilities; Indoor Recreation Facilities					
Agricultural					
Crop Raising & Farming; Community Gardens, Aquaculture, Dairies; Horticulture Nurseries & Greenhouses; Animal Raising, Maintain & Keeping; Commercial Stables					
Residential					
Single Dwelling Units; Mobile Homes		45			
Multiple Dwelling Units **For uses affected by aircraft noise, refer to Policies NE-D.2. & NE-D.3.*		45	45*		
Institutional					
Hospitals; Nursing Facilities; Intermediate Care Facilities; Kindergarten through Grade 12Educational Facilities; Libraries; Museums; Child Care Facilities		45			
Other Educational Facilities including Vocational/Trade Schools and Colleges and Universities		45	45		
Cemeteries					
Retail Sales					
Building Supplies/Equipment; Food, Beverages & Groceries; Pets & Pet Supplies; Sundries Pharmaceutical, & Convenience Sales; Wearing Apparel & Accessories			50	50	
Commercial Services					
Building Services; Business Support; Eating & Drinking; Financial Institutions; Maintenance & Repair; Personal Services; Assembly & Entertainment (includes public and religious assembly); Radio & Television Studios; Golf Course Support			50	50	
Visitor Accommodations		45	45	45	
Offices					
Business & Professional; Government; Medical, Dental & Health Practitioner; Regional & Corporate Headquarters			50	50	
Vehicle and Vehicular Equipment Sales and Services Use					
Commercial or Personal Vehicle Repair & Maintenance; Commercial or Personal Vehicle Sales & Rentals; Vehicle Equipment & Supplies Sales & Rentals; Vehicle Parking					
Wholesale, Distribution, Storage Use Category					
Equipment & Materials Storage Yards; Moving & Storage Facilities; Warehouse; Wholesale Distribution					
Industrial					
Heavy Manufacturing; Light Manufacturing; Marine Industry; Trucking & Transportation Terminals; Mining & Extractive Industries					
Research & Development				50	

	Compatible	**Indoor Uses**	Standard construction methods should attenuate exterior noise to an acceptable indoor noise level. Refer to Section I.
		Outdoor Uses	Activities associated with the land use may be carried out.
45, 50	**Conditionally Compatible**	**Indoor Uses**	Building structure must attenuate exterior noise to the indoor noise level indicated by the number (45 or 50) for occupied areas. Refer to Section I.
		Outdoor Uses	Feasible noise mitigation techniques should be analyzed and incorporated t make the outdoor activities acceptable. Refer to Section I.
	Incompatible	**Indoor Uses**	New construction should not be undertaken.
		Outdoor Uses	Severe noise interference makes outdoor activities unacceptable.

2.1.2 Municipal Code

2.1.2.1 Operational Noise

Operational noise within the City is governed by Municipal Code Section 59.5.401: Sound Level Limits.

> It shall be unlawful for any person to cause noise by any means to the extent that the one–hour average sound level exceeds the applicable limit given in the following table, at any location in the City of San Diego on or beyond the boundaries of the property on which the noise is produced. The noise subject to these limits is that part of the total noise at the specified location that is due solely to the action of said person.
>
> **TABLE OF APPLICABLE LIMITS**
>
Land Use	Time of Day	One-Hour Average Sound Level (decibels)
1. Single Family Residential	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m.	50 45 40
2. Multi-Family Residential (up to a maximum density of 1/2000)	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m.	55 50 45
3. All other Residential	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m.	60 55 50
4. Commercial	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m.	65 60 60
5. Industrial or Agricultural	any time	75
>
> The sound level limit at a location on a boundary between two zoning districts is the arithmetic mean of the respective limits for the two districts. Permissible construction noise level limits shall be governed by Section 59.5.0404 of this article.
> …
> *(Amended 9-11-1989 by O-17337 N.S.)*
> *(Amended 11-28-2005 by O-19446 N.S.; effective 2-9-2006.)*

Surrounding land uses include a roadway to the north, commercial to the west, and multifamily residential to the south and east. For purposes of this evaluation, the project land use was considered to be "commercial."

At the north and west project property lines, the operational sound level limits are:

- 65 dBA Leq during daytime hours (7:00 a.m. to 7:00 p.m.),
- 60 dBA Leq during evening hours (7:00 p.m. to 10:00 p.m.), and
- 60 dBA Leq during nighttime hours (10:00 p.m. to 7:00 a.m.).

At the south and east project property lines, the operational sound level limits are:

- 60 dBA Leq during daytime hours (7:00 a.m. to 7:00 p.m.),
- 55 dBA Leq during evening hours (7:00 p.m. to 10:00 p.m.), and
- 52.5 dBA Leq during nighttime hours (10:00 p.m. to 7:00 a.m.).

2.1.2.2 Construction Noise

Construction noise within the City is governed by Municipal Code Section 59.5.0404: Construction Noise.

> It shall be unlawful for any person, between the hours of 7:00 p.m. of any day and 7:00 a.m. of the following day, or on legal holidays as specified in Section 21.04 of the San Diego Municipal Code, with exception of Columbus Day and Washington's Birthday, or on Sundays, to erect, construct, demolish, excavate for, alter or repair any building or structure in such a manner as to create disturbing, excessive or offensive noise unless a permit has been applied for and granted beforehand by the Noise Abatement and Control Administrator. In granting such permit, the Administrator shall consider whether the construction noise in the vicinity of the proposed work site would be less objectionable at night than during the daytime because of different population densities or different neighboring activities; whether obstruction and interference with traffic particularly on streets of major importance, would be less objectionable at night than during the daytime; whether the type of work to be performed emits noises at such a low level as to not cause significant disturbances in the vicinity of the work site; the character and nature of the neighborhood of the proposed work site; whether great economic hardship would occur if the work were spread over a longer time; whether proposed night work is in the general public interest; and he shall prescribe such conditions, working times, types of construction equipment to be used, and permissible noise levels as he deems to be required in the public interest.

> Except as provided in [Municipal Code Section 59.5.0404] subsection C. hereof, it shall be unlawful for any person, including The City of San Diego, to conduct any construction activity so as to cause, at or beyond the property lines of any property zoned residential, an average sound level greater than 75 decibels during the 12-hour period from 7:00 a.m. to 7:00 p.m.
>
> The provisions of [Municipal Code Section 59.5.0404] subsection B. of this section shall not apply to construction equipment used in connection with emergency work, provided the Administrator is notified within 48 hours after commencement of work.
>
> *(Amended 1-3-1984 by O-16100 N.S.)*

2.2 EIR MITIGATION MEASURES

In addition to the standards and limits listed above, the project was evaluated for consistency with mitigation measures listed in the Black Mountain Ranch Subarea Plan, adopted July 1998 and amended in 2020, which incorporates the mitigation measures in the Black Mountain Ranch Subarea 1 EIR 96-7902, certified in 1998, as addended in 2009.

The construction noise mitigation measures from the Subarea Plan are:

> To reduce construction-related noise impacts, all construction activities, except in an emergency, shall be limited to the hours of 7 A.M. to 7 P.M. Monday through Saturday, which are the times allowed in San Diego's Noise Ordinance Section 36.410 for operating construction equipment.
>
> Construction occurring adjacent to existing residences or the MHPA will be required to implement measures to reduce noise from construction equipment. These measures may include seasonal restrictions on grading during sensitive species breeding seasons, assuring that on-site construction equipment is properly equipped with mufflers or other noise-attenuating equipment or that temporary noise attenuating walls or barriers are installed. These measures would be included in future development proposals and shown on construction drawings or plans as mitigation measures.

The operational mitigation measure from the Subarea Plan addresses only pump stations.

The traffic noise mitigation measures from the Subarea Plan address only residences.

3.0 EXISTING NOISE ENVIRONMENT

The project site is located along the south side of Camino Del Sur, the west side of Coyote Bush Drive, and the north side of Templeton Street. The surrounding properties are developed with multi-family residential and commercial uses. The primary noise source currently affecting the project site is vehicular traffic on Camino Del Sur. Noise-sensitive land uses in the project area include the existing multi-family residences in the Avante Del Sur development to the south and the Skye at Del Sur development to the southeast, and the multifamily residences under construction to the east.

3.1 ROADWAY TRAFFIC

Camino Del Sur is a two-way Major Arterial roadway with two eastbound through lanes and two westbound through lanes, divided by a raised median. The centerline of Camino Del Sur is approximately 65 feet north of the north project property line, with a posted speed limit of 45 miles per hour (mph). Camino Del Sur has an existing (year 2019) average daily traffic (ADT) volume of 21,138 vehicles between Bernardo Lakes Drive and Rancho Bernardo Road [City of San Diego 2024]. In the project vicinity, Camino Del Sur has a grade of approximately +3% to the west.

3.2 SOUND LEVEL MEASUREMENTS

Two short-term sound level measurements were conducted to quantify the existing onsite acoustical environment.

A RION Model NL-31 American National Standards Institute (ANSI) Type 1 Integrating Sound Level Meter was used as the data-collection device. The meter was mounted to a tripod roughly five feet above local ground to simulate the average height of the human ear. The sound level meter was calibrated before and after the measurement periods.

The measurement results are summarized in Table 3 and correspond to the locations depicted on Figure 2. A review of the table shows that the measured sound levels ranged from approximately 53 dBA Leq near the south project property line to approximately 67 dBA Leq near the north project property line. Traffic noise was the primary noise source at all measurement locations.

Table 3. Sound Level Measurements (dBA)

Measurement Location	Date / Time	Leq	Lmin	Lmax	L10	L50	L90	Traffic
ML1: ~30' from Templeton Street CL	2024-05-16 12:10 – 12:20	52.5	38.7	68.7	52.5	44.3	41.5	7 cars
ML2: ~70' from Camino Del Sur CL	2024-05-16 12:30 – 12:40	66.8	49.0	75.9	71.0	64.0	54.4	EB: 94 / 2 / 1 WB: 126 / 1 / 1

Note: Traffic reported in terms of cars / medium trucks / heavy trucks

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FIGURE 2
Sound Level Measurement Locations

4.0 FUTURE NOISE ENVIRONMENT

The onsite future noise environment would primarily be a result of vehicular traffic on Camino Del Sur.

The future (year 2025-2050) ADT volume on Camino Del Sur is projected to be as high as 21,900 vehicles [SANDAG 2024]. Future traffic volumes in the project area would increase by roughly 3.6% over the existing volumes, due to regional growth, including the traffic associated with the proposed project. Accordingly, traffic noise would increase by up to approximately 0.2 dBA CNEL, which is not detectable by the human ear as it is less than 3 dBA.

Future exterior vehicular traffic noise levels on the project site would range from below 60 dBA CNEL at the center and southern portions to approximately 68 dBA CNEL at the north property line. The noise level at the north building façade would be approximately 66 dBA CNEL. The noise level at the track and sports field stands would be as high as 59 dBA CNEL. The noise level at the playground and plaza would be below 55 dBA CNEL. The noise level at the track lanes would be as high as 68 dBA CNEL.

Noise levels at outdoor usable areas of the project would be less than 65 dBA CNEL; as such, the project would be considered Conditionally Compatible by the City of San Diego General Plan Land Use – Noise Compatibility Standards for K-12 educational uses. Noise levels at the track would be less than 70 dBA CNEL; as such, the project would be considered unconditionally Compatible by the City of San Diego General Plan Land Use – Noise Compatibility Standards for Outdoor Spectator Sports uses.

4.1 INTERIOR NOISE

Because future exterior noise levels would exceed 65 dBA CNEL at some project building façades, noise levels could exceed the City of San Diego General Plan Noise Element requirement of 45 dBA CNEL at indoor uses.

To avoid a potential land use impact, as a condition of project approval, an interior noise analysis would be required. This interior noise analysis must identify the sound transmission loss requirements for building façade elements (windows, walls, doors, and exterior wall assemblies) necessary to limit noise to 45 dBA CNEL at indoor uses.

Upgraded windows and/or doors with Sound Transmission Class (STC) ratings of 30 or higher may be necessary. If the interior noise limit can be achieved only with the windows closed, the building design must include mechanical ventilation that meets CBC requirements.

With the implementation of the findings of the interior noise analysis, noise levels would be 45 dBA CNEL or below at indoor uses, and the project would comply with the City of San Diego Noise Element requirement.

The project would result in a less than significant interior noise impact with project features incorporated in accordance with the interior noise analysis.

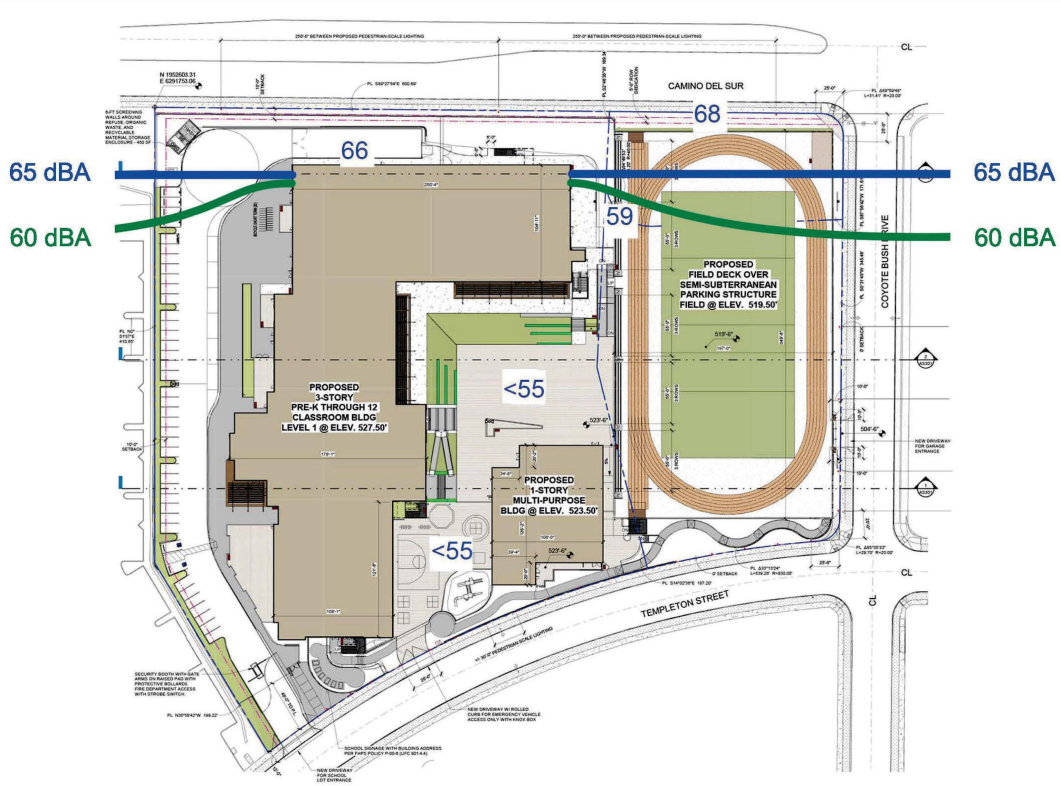

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FIGURE 3
Future Exterior Noise Levels (dBA CNEL)

5.0 OPERATIONAL NOISE

The sound level limits at the north and west project property lines are:

- 65 dBA Leq during daytime hours (7:00 a.m. to 7:00 p.m.),
- 60 dBA Leq during evening hours (7:00 p.m. to 10:00 p.m.), and
- 60 dBA Leq during nighttime hours (10:00 p.m. to 7:00 a.m.).

The sound level limits at the south and east project property lines are:

- 60 dBA Leq during daytime hours (7:00 a.m. to 7:00 p.m.),
- 55 dBA Leq during evening hours (7:00 p.m. to 10:00 p.m.), and
- 52.5 dBA Leq during nighttime hours (10:00 p.m. to 7:00 a.m.).

The mechanical system for the project has not been designed; however, based on previous projects, the project is expected to be served by approximately 115 3-5-ton roof-mounted HVAC units on the classroom building and 25 units on the multi-purpose building. A typical 3-5-ton HVAC unit produces a sound pressure level of approximately 54-65 dBA at 1 meter [Carrier].

The Datakustik Cadna/A industrial noise prediction model was used to estimate property line sound levels from sources on the project site. The locations of the project buildings and sound sources, and the topography of the site and surrounding properties, were imported from the site plans and mechanical plans.

During school hours, the project would produce a sound level up to approximately 43 dBA Leq at its southeast property line, and less at others.

Track / Sports Field

The field is expected to be used after school on weekdays for practices, which are expected to involve up to roughly 50 students and coaches generally spread evenly over the field area, and would end before 7:00 p.m.

There would be an occasional small weekend daytime athletic event which could reasonably draw 150 spectators to the bleachers located east of midfield, with the same roughly 50 students and coaches over the field area.

There may be one yearly Saturday graduation ceremony which could draw the full 354-person capacity to the bleachers and the roughly 50-student-per-grade capacity to the general center of the field during daytime.

The Datakustik Cadna/A industrial noise prediction model was used to estimate sound levels from field use. The average sound power level produced by an area of multiple people was assumed to be 15logN + 64 dBA, where N is the number of people [Hayne, et. al. 2011]. The sound source height was assumed to be 5 feet above ground level.

During graduation, the most intense use, the field would produce a sound level of approximately 53 dBA Leq at its south property line, 52 dBA Leq at its west property line, and less at others.

At its property lines, the project would produce daytime sound levels of 60 dBA Leq or less, evening sound levels of 55 dBA Leq or less, and nighttime sound levels of 52.5 dBA Leq or less. The project would comply with SDMC noise limits.

5.1 PROJECT-GENERATED TRAFFIC

The project would generate 2,181 trips [Los Engineering, Inc. 2024]. The traffic on any given segment is not expected to increase by 100% or more, and thus would not result in a sound level increase of more than 3 dBA CNEL. Project-generated traffic noise increases are considered less than significant by the City CEQA Significance Determination Thresholds.

6.0 CONSTRUCTION

The primary noise from project construction would be from site grading. Construction of the project would generate a short-term temporary increase in noise in the project area. The increase in noise level would be primarily experienced close to the noise source. The magnitude of the impact would depend on the type of construction activity, noise level generated by various pieces of construction equipment, duration of the construction phase, acoustical shielding and distance between the noise source and receiver.

Construction activity and delivery of construction materials and equipment would be limited to daytime hours (between 7:00 a.m. and 7:00 p.m.), Monday through Saturday.

This project would implement conventional construction techniques and equipment. The project proponent anticipates the use of one Caterpillar D8 bulldozer and one John Deere 770G scraper, with an occasional water truck and backhoe. These pieces of equipment produce 80 dBA, 81 dBA, 81 dBA, and 69 dBA at 10 meters, respectively. No correction was applied for downtime associated with equipment maintenance, breaks, or similar situations. No blasting would be necessary.

The Datakustik Cadna/A industrial noise prediction model was used to estimate noise levels from noise sources on the project site. It was assumed that all equipment would operate continuously within the grading area boundary. Construction of the project would generate noise levels up to approximately 68 dBA Leq (12 hours) at its property lines.

Construction would occur within the hours prescribed by the SDMC. Construction noise levels would be below 75 dBA Leq (12 hours), as allowed by the SDMC. Therefore, the project would comply with the noise limits and hours in the SDMC.

6.1 CONSTRUCTION VIBRATION

The City of San Diego does not provide vibration limits. In their absence, Federal Transit Administration guidelines were used.

Table 4. Guideline for Determining the Significance of Ground-Borne Vibration and Noise Impacts

Land Use Category	Ground-Borne Vibration Impact Levels (inches/sec rms)		Ground-Borne Noise Impact Levels (dB re 20 microPascals)	
	Frequent Events [1]	Occasional or Infrequent Events [2]	Frequent Events [1]	Occasional or Infrequent Events [2]
Category 1. Buildings where low ambient vibration is essential for interior operations. (research & manufacturing facilities with special vibration constraints)	0.0018 [3]	0.0018 [3]	Not applicable [5]	Not applicable [5]
Category 2. Residences and buildings where people normally sleep. (hotels, hospitals, residences, & other sleeping facilities)	0.004	0.01	35 dBA	43 dBA
Category 3. Institutional land uses with primarily daytime use. (schools, churches, libraries, other institutions, & quiet offices)	0.0056	0.014	40 dBA	48 dBA

Source: U.S Department of Transportation, Federal Transit Administration, "Transit Noise and Vibration Impact Assessment," May 2006.

Notes:

1. "Frequent Events" is defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.
2. "Occasional or Infrequent Events" are defined as fewer than 70 vibration events per day. This combined category includes most commuter rail systems.
3. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research will require detailed evaluation to define acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.
4. Vibration-sensitive equipment is not sensitive to ground-borne noise.
5. There are some buildings, such as concert halls, TV and recording studios, and theaters that can be very sensitive to vibration and noise but do not fit into any of the three categories. Table 5 gives criteria for acceptable levels of ground-borne vibration and noise for these various types of special uses.
6. For Categories 2 and 3 with occupied facilities, isolated events such as blasting are significant when the peak particle velocity (PPV) exceeds one inch per second. Non-transportation vibration sources such as impact pile drivers or hydraulic breakers are significant when their PPV exceeds 0.1 inch per second. More specific criteria for structures and potential annoyance were developed by Caltrans (2004) and will be used to evaluate these continuous or transient sources in San Diego County.

Table 5. Guideline for Determining the Significance of Ground-Borne Vibration and Noise Impacts for Special Buildings

Type of Building or Room	Ground-Borne Vibration Impact Levels (inches/sec rms)		Ground-Borne Noise Impact Levels (dB re 20 microPascals)	
	Frequent Events [1]	Occasional or Infrequent Events [2]	Frequent Events [1]	Occasional or Infrequent Events [2]
Concert Halls, TV Studios, and Recording Studios	0.0018	0.0018	25 dBA	25 dBA
Auditoriums	0.004	0.01	30 dBA	38 dBA
Theaters	0.004	0.01	40 dBA	48 dBA

Source: U.S Department of Transportation, Federal Transit Administration, "Transit Noise and Vibration Impact Assessment," May 2006.

Notes:

1. "Frequent Events" is defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.
2. "Occasional or Infrequent Events" are defined as fewer than 70 vibration events per day. This combined category includes most commuter rail systems.
3. If the building will rarely be occupied when the trains are operating, there is no need to consider impact.
4. For historic buildings and ruins, the allowable upper limit for continuous vibration to structures is identified to be 0.056 inches/second rms. Transient conditions (single-event) would be limited to approximately twice the continuous acceptable value.

The closest vibration-sensitive land uses in the project vicinity are the residences (land use category 2) across Templeton Street to the south. Construction operations are considered occasional or infrequent events. The vibration limit applicable to the project is 0.01 in/sec rms at the residences.

Vibration levels in terms of in/sec rms (root-mean-square) can be expressed as velocity decibels (VdB), as described by Equation 5-1 in the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual [FTA 2018]:

$$L_v = 20 \log\left(\frac{v}{v_{ref}}\right)$$

where:

L_v = velocity level, VdB

v = rms velocity amplitude

v_{ref} = 1×10^{-6} in/sec in the USA

v_{ref} = 1×10^{-8} m/sec internationally

Using this equation, 0.01 in/sec rms is equal to 80 VdB.

FTA Equation 7-3 was used to estimate vibration levels at a distance:

$$L_{v.distance} = L_{vref} - 30log(\frac{D}{25})$$

where:

$L_{v.distance}$ = the rms velocity level adjusted for distance, VdB
L_{vref} = the source reference vibration level at 25 ft, VdB
D = distance from the equipment to the receiver, ft

The closest residential structure is approximately 70 feet from the nearest project property line. The project construction equipment that would generate the highest vibration levels is the bulldozer, which could produce a vibration level of 87 dBA [FTA 2018]. At 70 feet, the vibration level would be approximately 74 VdB, which is equal to approximately 0.005 in/sec rms.

Construction vibration levels at vibration-sensitive land uses would not exceed 0.01 in/sec rms. Project construction vibration impacts would be less than significant.

7.0 CONCLUSIONS

7.1 VEHICULAR TRAFFIC NOISE

Future exterior vehicular traffic noise levels at outdoor usable areas on the project site would be less than 65 dBA CNEL, and would comply with City of San Diego General Plan requirements as designed. The project would result in no noise exposure impact. No mitigation is required.

7.2 OPERATIONAL (NON-CONSTRUCTION) NOISE

At its property lines, the project would produce daytime noise levels of 60 dBA Leq or less, evening noise levels of 55 dBA Leq or less, and nighttime noise levels of 52.5 dBA Leq or less. The project would comply with SDMC noise limits. The project would result in no permanent noise increase impact. No mitigation is required.

7.3 CONSTRUCTION NOISE

Construction would occur within the hours proscribed by the SDMC. Construction noise levels would be below 75 dBA Leq (12 hours), as allowed by the SDMC. The project would result in no temporary or periodic noise increase impact. No mitigation is required. However, minimization of disturbance from construction noise is often desired. The following measures should be considered but are not required to comply with the SDMC:

- Select equipment capable of performing the necessary tasks with the lowest sound level and the lowest acoustic height possible.
- Implement alternatives to the standard backup beepers as feasible. These alternatives include strobe lights or products such as the Brigade Electronics, Inc. Broadband Sound system, which is equally effective while generating a lower noise level.
- Use specially-quieted equipment, such as quieted and enclosed air compressors and properly-working manufacturer-recommended mufflers on all engines.
- Construct enclosures around noise-producing stationary sources such as generators used for night lighting.
- Perform construction vehicle maintenance as far from any residential land use as possible.
- Place the laydown area as far as possible from the closest noise sensitive receptors.
- Limit the delivery of material to the hours between 7:00 a.m. and 7:00 p.m.

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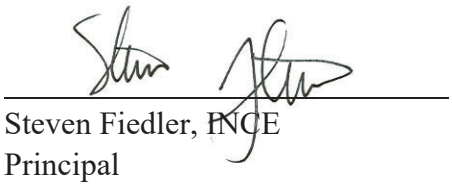
9.0 LIST OF PREPARERS



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