4.6 NOISE

This section describes the existing noise environment in the project vicinity and potential noise impacts resulting from the proposed project. This noise analysis has been prepared using analytical methodologies and evaluation criteria outlined in the California Environmental Quality Act (CEQA) Guidelines (Appendix G), the City of Belmont General Plan, and the Belmont Municipal Code.

Much of the information and analyses contained in this section are based on the Applicant's July 2012 "*Crystal Springs Uplands School Belmont Noise Study Report Final*" (Wilson, Ihrig & Associates, Inc. [WIA] 2012a). This report and subsequent changes to the report are contained in Appendix D to this EIR.

4.6.1 Environmental Setting

4.6.1.1 Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its loudness. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 4.6-1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level or dBA.* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 4.6-2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy-equivalent sound/noise descriptor is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways

and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night (because excessive noise interferes with the ability to sleep) 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level, CNEL*, is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 p.m. - 10:00 p.m.) and a 10 dB addition to nocturnal (10:00 p.m. - 7:00 a.m.) noise levels. The *Day/Night Average Sound Level*, L_{dn}, is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Table 4.6-1: Definitions of Acoustical Terms Used in this Report

Term	Definition
Decibel (dB)	A decibel is one-tenth of a bel. It is a measure on a logarithmic scale that indicates the squared ratio of sound pressure to a reference sound pressure (unit for sound pressure level) or the ratio of sound power to a reference sound power (unit for sound power level.)
Frequency, Hertz (Hz)	The number of oscillations per second of a periodic wave sound and of a vibrating solid, expressed in units of Hertz, formerly cycles per second.
A-Weighted Sound Level (dBA)	Expressed in dBA or dB(A). Frequency-weighted sound pressure level approximating the frequency response of the human ear.
L01, L10, L50, L90	The energy-average of the A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Equivalent Noise Level (Leq)	The equivalent steady-state sound level that in a given period of time would contain the same acoustical energy as the time-varying sound level during the same period.
Community Noise Equivalent Level (CNEL)	A noise level that accounts for all the A-weighted noise energy from a source during 24 hours, and weights the evening (7 p.m. to 10 p.m.) and night (10 p.m. to 7 a.m.) noise by adding 5 and 10 dBA, respectively, during these periods.
Day/Night Noise Level(Ldn)	The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring from 10 p.m. to 7 a.m.
Lmax, Lmin	The maximum and minimum A-weighted noise level during the measurement period.
Ambient Noise	All-encompassing noise at a given place and time. This is usually a composite of sounds from all sources near and far, including any specific sources of interest.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Technical Noise Supplement (TeNS), California Department of Transportation, November 2009.

Table 4.6-2: Typical Noise Levels in the Environment

Common Outdoor Noise Source	Noise Level (dBA)	Common Indoor Noise Source
	120 dBA	
Jet fly-over at 1000 feet		Rock concert
	110 dBA	
Pile driver at 70 feet	100 dBA	
		Night club with live music
	90 dBA	
Large truck pass by at 50 feet		
	80 dBA	Noisy restaurant
		Garbage disposal at 3 feet
Gas lawn mower at 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial/Urban area daytime		Normal speech at 3 feet
Suburban expressway at 300 feet	60 dBA	
Suburban daytime		Active office environment
	50 dBA	
Urban area nighttime		Quiet office environment
	40 dBA	
Suburban nighttime		
Quiet rural areas	30 dBA	Library
		Quiet bedroom at night
Wilderness area	20 dBA	Quiet recording studio
Threshold of human hearing	10 dBA	Threshold of human hearing
	0 dBA	

Source: TeNS, California Department of Transportation, November 2009.

4.6.1.2 Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One is the Peak Particle Velocity (PPV); another is the Root Mean Square (RMS) velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration. In this section, a PPV descriptor with units of mm/sec. or in/sec. is used to evaluate construction-generated vibration for building damage and human complaints. Table 4.6-3 displays the

reactions of people and the effects on buildings that continuous vibration levels produce. The annoyance levels shown in Table 4.9-3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying.

Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Table 4.6-3: Reaction of People and Damage to Buildings for Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Sever – Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation- and Construction-Induced Vibration Guidance Manual, California Department of Transportation, June 2004.

4.6.2 Regulatory Setting

4.6.2.1 Federal

There are no federal noise standards that regulate noise or vibration related to the construction or operation of the proposed project.

4.6.2.2 State

There are no state noise standards that regulate noise or vibration related to the construction or operation of proposed project.

4.6.2.3 Local

City of Belmont General Plan Noise Element

The City's Noise Element (1996) contains noise compatibility guidelines, which apply to residential uses for new construction and intensification of existing land uses (see Figure 3 of the 1996 Noise Element). For single-family residential land uses, the City's compatibility guidelines identify noise levels up to 60 L_{dn} as "normally acceptable" and noise levels from 55 dBA to 70 L_{dn} as "conditionally acceptable". For school land uses, the City's compatibility guidelines identify noise levels up to 65 L_{dn} as normally acceptable, while noise levels from 60 to 70 L_{dn} are conditionally acceptable. The City's guidelines define normally acceptable as meaning the specified land use is satisfactory, on the assumption that any buildings involved are of normal construction, and conditionally acceptable as meaning new construction should only be undertaken after an analysis of noise reduction requirements has been made and noise insulation features have been included in the project design. Noise levels above 70 L_{dn} considered "normally unacceptable," while noise levels above 75 dBA are "clearly unacceptable," meaning new construction should be discouraged or prohibited.

City of Belmont Noise Regulations (Chapter 15, Article VIII of the City Code)

Chapter 15, Article VIII of the Belmont City Code (Noise Control) was developed in accordance with the adopted noise goals and policies of the Belmont General Plan. The Code contains standards designed to protect the city's citizens from unreasonable noises.

Section 15-102 of the Code establishes the sound limits constituting a noise disturbance. For non-residential properties, these limits are 65 dBA during the day (8:00 a.m. to sunset Monday through Friday) and 55 dBA during the night (the period outside of the daytime), as measured at the receiving property. The Code permits these standards to be reduced by 5 dB in the event the offending sound contains a steady audible tone such as a whine, beating, throbbing, or hum. The Code also establishes that any and all excessively annoying, loud, or unusual noises or vibrations shall be considered a disturbance if they offend the peace and quiet of reasonable persons or interfere with comfortable enjoyment of life or property. The Belmont City Code does permit the City to issue an exception to the noise limits listed above for special events.

Regarding construction noise, Section 15-102(f) of the Code restricts construction and related activities to the hours of 8:00 a.m. to 5:00 p.m. Monday through Friday and 10:00 a.m. to 5:00 p.m. on Saturday; grading activities are prohibited on Saturdays, and all construction activities are prohibited on Sundays and holidays. The Code also requires gasoline-powered construction equipment to be equipped with an operating muffler or baffling system originally provided by the equipment manufacturer.

4.6.3 Existing Noise Environment

The proposed project would be situated in the southern portion of the City of Belmont, within the City's Western Hills neighborhood. The project area currently consists of developed lands comprised of vacant commercial office buildings. The project area is approximately 300 feet south of Ralston Avenue and is bordered by an existing commercial building to the north, Davis Drive and commercial facilities to the east, Water Dog Lake Park to the south, and Ralston Middle School to the west. The project area is at the same elevation as most of the surrounding

facilities with the exception of Ralston Middle School, which is situated approximately 30 feet higher than the proposed school site, and Water Dog Lake Park, which largely sits in a ravine.

According to the City of Belmont General Plan, which dates to 1982, the City is generally a quiet community, with the most pervasive sources of noise being automobile, motorcycle, and truck traffic, airplanes, and industrial activities. The 1982 General Plan does indicate that, at the time the General Plan was prepared, Ralston Middle School was partially exposed to noise levels exceeding 60 dBA. The existing ambient noise levels described in Section 4.6.3.1 below are considered most representative of the existing noise environment at the site since the information from the City's General Plan dates to 1982 or earlier.

The proposed CSUS school site is located approximately three miles east and 7.75 southeast of San Carlos Airport and San Francisco International Airport, respectively. The proposed site is within San Francisco International Airport Land Use Compatibility Plan (ALUCP) Influence Area "A", but is outside of all noise compatibility zones identified in the ALUCP.[1] Similarly, the proposed site is also located outside of impacted areas associated with San Carlos Airport.[2]

4.6.3.1 Existing Ambient Noise Levels

The proposed school site does not include many noise sources or noise generating activities. The existing buildings are vacant and do not produce noise from heating, air conditioning, and ventilation (HVAC) equipment or employee related vehicle trips; Parking areas at the vacant site are currently used for bus parking by a transportation company. Employees from the surrounding commercial developments use the site during break for exercise and visitors use the site to access Water Dog Lake Park.

Existing ambient noise levels in the project area and vicinity were monitored during two surveys in September 2011 and March 2015.[3] The surveys included six long-term (LT, i.e., 24-hour) locations. These locations were selected to: 1) provide direct observation of potential sources of local noise in the project area; 2) to determine and update normal ambient noise levels in the project area and vicinity; and 3) to evaluate project noise levels at nearby receptor locations (see Section 0). The noise monitoring locations are shown on Figure 4.6-1 and described below.

- **Location LT-1** was sited approximately 1,840 feet southwest of the project area. The long-term noise monitor was mounted on a tree at a height of approximately 12 feet, along the hiking trail at the west end of the canyon. The primary source of ambient noise at location LT-1 is hiking trail use. This measurement location documents the typical environment for homes with backyards facing the proposed project.
- **Location LT-2** was sited approximately 70 feet west of the project area. The long-term noise monitor was mounted on a tree at a height of approximately 10 feet, at the easternmost corner of the Ralston Middle School athletic field. The primary sources of ambient noise at location LT-2 are traffic on Ralston Avenue and outdoor activities at Ralston Middle School. The school was in session during the noise survey.

[1] CCAG, 2012.
[2] C/CAG, 2014
[3] WIA 2012a, MIG 2015, see Appendix D.

Legend

- Noise Monitoring Location
- Modeled Noise Receptor Location
- Project Site

0 125 250 500 Feet

N

Belmont Crystal Springs School
Belmont, CA

Figure 4.6-1
Noise Monitoring Location Plan

- **Location LT-3** was sited approximately 410 feet north of the project area. The long-term noise monitor was mounted on a utility pole at a height of approximately 12 feet, on Ralston Avenue near the intersection with Davis Drive. The primary source of ambient noise at location LT-3 is traffic on Ralston Avenue.
- **Location LT-4** was sited approximately 10 feet south of the project area. The long-term noise monitor was mounted on a tree, at a height of approximately 10 feet, on the downward slope of the canyon edge by the south edge of the property. The primary sources of ambient noise at location LT-4 are hiking trail use and outdoor activities at Ralston Middle School.
- **Location LT-5** was sited within the project area, approximately 100 feet from the northern boundary of the project area, at a height of five feet. The primary source of ambient noise at location LT-5 was traffic on Ralston Avenue and outdoor activities at Ralston Middle School.
- **Location LT-6** was sited within the project area, approximately 265 feet from the northern boundary of the project area, at a height of five feet. The primary source of ambient noise at location LT-6 was traffic on Ralston Avenue and outdoor activities at Ralston Middle School.

Table 4.6-4 summarizes the results of the noise survey. The primary sources of ambient noise at these locations include plane flyovers, traffic along Ralston Avenue, hiking trail use, and outdoor activities at Ralston Middle School.

Table 4.6-4: Summary of Ambient Noise Levels

Noise Measurement	Nearby Street	Noise (dBA)			Noise Environment / Comments
		Ldn	Typical Daytime Leq	Typical Nighttime Leq	
LT-1	Lassen Dr.	48	46	40 – 46	Trail Use
LT-2	Davis Dr.	53	52	44 – 49	School / Athletic Fields
LT-3	Ralston Ave.	72	72	63 – 69	Ralston Ave.
LT-4	Davis Dr.	48	48	38 - 47	Trail Use, School / Athletic Fields
LT-5	Davis Dr.	49	48	41	School / Athletic Fields, Trail Use
LT-6	Davis Dr.	49	49	40	Commercial Park, School / Athletic Fields, Trail Use

Source: WIA 2012a, MIG 2015 (see Appendix D)

L_{dn} presents the 24-hour average of ambient noise levels, Typical Daytime L_{eq} summarizes noise levels from 7 a.m. to 10 p.m., and Typical Nighttime L_{eq} summarizes noise levels from 10 p.m. – 7 a.m. Most of the activities listed above (planes, traffic, and outdoor use) decrease or cease entirely during the nighttime, leading to lower L_{eq} values.

4.6.3.2 Noise Sensitive Receptors

Noise sensitive receptors are buildings or areas where unwanted sound or increases in sound may have an adverse effect on people or land uses. Residential areas, hospitals, schools, and parks are examples of noise sensitive receptors that could be sensitive to changes in existing environmental noise levels. The noise sensitive receptors adjacent or in close proximity to the perimeter of the proposed project include:

- Ralston Middle School, located adjacent to (west of) the project area at 2675 Ralston Avenue
- Water Dog Lake Park, located adjacent to (south of) the project area
- Gloria Dei Lutheran Elementary School, located approximately 680 feet from the project area at 2600 Ralston Avenue
- Residences located 420 feet north of the project area (across Ralston Avenue)
- Residences located approximately 925 feet south of the project area (across the ravine in which Water Dog Lake is situated)
- Residences located approximately 800 feet east of the project area (existing commercial development is present between the project area and these receptors)
- Residences located approximately 975 feet west of the project area

4.6.4 Impacts and Mitigation Measures

This subsection analyzes impacts related to noise and vibration that could result from implementation of the project. It begins with the criteria of significance, which establish the thresholds for determining whether an impact is significant, and concludes with noise and vibration impacts associated with the project.

4.6.4.1 Criteria of Significance

The proposed project would have a significant impact on noise and vibration if it would:

- Expose people to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Expose people to or generate excessive groundborne vibration or groundborne noise levels;
- Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
- Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

- For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airstrip, expose people residing or working in the project area to excessive noise levels; or
- For a project within the vicinity of a private airstrip, expose people residing or working in the project area to excessive noise levels.

The City of Belmont's General Plan and Municipal Code noise standards are summarized in Section 4.6.2.3; however, the City does not have a specific definition for what constitutes a "substantial" increase in noise under CEQA. Under controlled conditions in an acoustical laboratory, the trained, healthy human ear is able to discern one dB changes in sound levels when exposed to steady, single frequency ("pure tone") signals in the mid frequency (1,000–8,000 Hz) range. In typical noisy environments, changes in noise of one to two dB are generally not perceptible. However, it is widely accepted that people can begin to detect sound level increases of three dB in typical noisy environments. Further, a five dB increase is generally perceived as a distinctly noticeable increase, and a 10 dB increase is generally perceived as a doubling of loudness.

For the purposes of this EIR, a substantial permanent increase in noise levels is considered to be an increase in noise that causes the ambient noise environment to change from one acceptability category to the next (i.e,. changes from "normally acceptable" to "conditionally acceptable".

For the purposes of this EIR, a substantial temporary increase in noise levels is considered to be an increase in noise levels that causes interference with ordinary daytime and/or nighttime activities, such as speech interference. Speech interference can occur if the noise level in the interior of a building exceeds 45 to 60 dBA.[4] A typical building can reduce noise levels by 25 dBA with the windows closed.[5] Thus, an exterior noise level of 70 dBA (Leq) at receptors would maintain an acceptable interior noise environment of 45 dBA.

4.6.4.2 Methodology

The applicant previously contracted with a qualified acoustical engineering firm to prepare an evaluation of the project's potential noise impacts, guide the project's design process, provide information regarding potential noise effects on nearby sensitive noise receptors, and identify possible noise control techniques that could be integrated into the project to ensure compliance with local noise ordinances and impact criteria.

This evaluation, the *Crystal Springs Uplands School District Noise Study Report Final*, was finalized in 2012.[6] This report concluded:

- The proposed school project would be compatible with the existing noise environment.

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[4] For indoor noise environments, the highest noise level that permits relaxed conversation with 100 percent intelligibility throughout the room is 45 dBA. Speech interference is considered to become intolerable when normal conversation is precluded at 3 feet, which occurs when background noise levels exceed 60 dBA. For outdoor environments, the highest noise level that permits normal conversation at 3 feet with 95 percent sentence intelligibility is 66 dBA (U.S. EPA, 1974).

[5] U.S. EPA, 1974.

[6] WIA 2012a

- Sounds from the proposed pool would potentially exceed the standards of the Belmont Noise Ordinance at the Lutheran Day School, and would require noise measures.
- Project-related demolition and construction activities would cause temporary noise impacts at Ralston Middle School and would require a temporary sound barrier and demolition phasing strategies to reduce this impact to less than significant levels.

A peer review of the applicant's noise report conducted in July 2012 concurred with the findings listed above.[7] The applicant subsequently revised the project to fully enclose the proposed pool, and provide updated findings in August 2012 that reflected the enclosed pool.

In September 2012, the applicant responded to public comments and concerns regarding potential athletic field noise levels from project made at a City Council meeting.[8] This response acknowledged and corrected certain errors identified by the public, but generally affirmed the peer-reviewed findings of the July 2012 noise report.

The City's EIR consultant has reviewed the proposed CSUS middle school layout (see Figure 3-5) and design and found that it remains substantially the same as described in the applicant's July 2012 noise report, August 2012 updated report, and September 2012 response to comments document.[9]

As such, the information and findings contained in these documents are considered relevant to the proposed project, and the methodology used to evaluate the temporary and permanent noise effects of the proposed project is described below.

Construction Noise

Construction equipment noise levels were evaluated at noise-sensitive land uses based on published noise data and the information contained in the project description that detailed the proposed project's phasing, construction activities, equipment, and hours.

Table 4.6-5 list the typical construction equipment proposed for use during project construction activities (e.g., demolition, foundation work, trenching, building construction), information on the percentage of time the equipment would be used during a typical daytime hour, and the equivalent noise levels produced by the equipment at a distance of 50 feet. Project construction would generally involve stationary equipment or slow moving vehicles; noise levels from these types of sources would attenuate six dBA for each doubling of distance from the source.

Regarding construction noise, Section 15-102(f) of the Code restricts construction and related activities to the hours of 8:00 a.m. to 5:00 p.m. Monday through Friday and 10:00 a.m. to 5:00 p.m. on Saturday; grading activities are prohibited on Saturdays, and all construction activities are prohibited on Sundays and holidays. The Code also requires gasoline-powered construction equipment to be equipped with an operating muffler or baffling system originally provided by the equipment manufacturer.

[7] WIA, 2012b.
[8] WIA, 2012c.
[9] WIA, 2012a-c.

Table 4.6-5: Noise Levels and Operational Parameters for Construction Equipment

Construction Equipment	Approximate Usage per Hour	Noise Level (dBA) at 50 feet		Phase
		Lmax	Leq (one hour)	
Backhoe	40%	78	74	Foundation
Backup Alarms**	1-5%	85 – 115 55 – 75 Class D	59 – 89 <50 Class D	Throughout
Bulldozer	40%	82	78	Demolition
Compressors and Generators*	40%	70 – 85 60 "quiet"	66 – 81 56 "quiet"	Foundation, Erection
Concrete Mixer Truck	40%	79	75	Foundation
Crane	16%	81	73	Erection
Dump/Haul Truck	40%	77	73	Utilities
Excavator	40%	81	77	Demo, Utilities
Forklifts and similar	40%	79	75	Erection
Grader	40%	85	81	Site Prep
Hoe Ram attachment	10%	90	80	Demo
Loader	40%	79	75	Demo, Utilities
Scraper	40%	84	80	Demo
Vibratory Roller Compactor	20%	83	76	Utilities
Water truck/Street sweeper	40%	75	71	Demo, Site Prep

Source: WIA 2012a; FHWA, 2011; Caltrans, 2009
* Quiet generators such as the MQ "Whisperwatt" series can generate 60 dBA or less at 50 feet. Electric powered compressors are quieter than diesel compressors.
** SAE J994, Class D ambient-adjusting alarms

Operational Noise

Operational noise levels were evaluated at noise-sensitive land uses based on the site layout and design, proposed school activities and distance to sensitive receptor locations. The following project noise sources were considered in the evaluation:

- Field noise from whistles and cheering crowds during daily physical education classes, athletic practices and games. Table 4.6-6 lists the sound power levels assumed for these noise sources. The evaluation assumed up to three physical education classes, weather permitting, and that the athletic field would be available for use by CSUS as well as the community, therefore, a variety of games could be played on weekday afternoons and weekend days throughout the year. For a typical game it is assumed that the whistles will be blown a total of 15 minutes in any hour, accounting for about 450 whistle blows per hour. In other words, the whistles will not be blown continually for 15 minutes, but the total accumulated time of whistles being blown, assuming duration of whistle blow to be two seconds each, will be equivalent to 15 minutes. The time duration of cheering from the game spectators is assumed

to be at least 45 minutes. The evaluation assumed a maximum of five hours of field activities per day.

Table 4.6-6: Sound Power Levels for Field Whistles and Crowds

Noise Source	Reference Level (Sound Power)	Comment
Whistles	106 dBA	Based on sound pressure levels measured at LT-2 from Ralston Middle School athletic field, 50' nominal distance
Cheering crowds	95 dBA	

Source: WIA 2012a

- Pool noise from whistles air horns, and cheering crowds during practices and swim meets was originally assumed to be generated on weekday afternoons for a maximum of four hours; however, current plans call for the pool to be fully enclosed. The evaluation assumed the full-enclosure building would be constructed of 10-inch pre-cast concrete with interior framing, rigid insulation and backerboard tile. The roof for the pool building was assumed to a membrane over rigid insulation over metal deck. Windows were assumed to dual–glazed, with ¼-inch thick glazing and ½-inch air gap. This design was estimated to reduce pool noise by 25 to 30 dBA or more.

Operational noise levels were modeled using the SoundPlan noise model. The model includes reflection effects off of the proposed buildings, attenuation from soft ground cover, and topographic effects.

4.6.4.3 Less Than Significant Impacts

Project implementation would result in the following less-than-significant noise and vibration impacts.

Impact NOI-1: Construction of the project would not result in the exposure of sensitive receptors to excessive groundborne vibration levels. (LTS)

For structural damage, the California Department of Transportation uses a vibration limit of 0.3 inches/second, peak particle velocity (inches/second, PPV) for older residential buildings (see Table 4.6-3). If this groundborne vibration level threshold is exceeded, the result may be "architectural" damage to normal dwellings.

Site construction and development would involve the use of construction equipment such as graders and bulldozers that would generate ground-borne vibration. Vibratory rollers / compactors, large bulldozers, haul trucks, and jack hammers are estimated to produce ground-borne vibration levels, in terms of PPV, of approximately 0.11, 0.09, 0.08, and 0.04 inches per second, respectively, at a distance of 25 feet.[10]

These values are below the Caltrans' 0.3 inches per second PPV standard. Construction activities would be located at least 100 feet away from the closest building (the commercial building at 2 Davis Drive) and more than 300 feet from any building associated with Ralston Middle School

[10] FTA, 2006.

and would not generate ground-borne noise or vibration levels that that exceed Caltrans' vibration standard of 0.3 PPV. Therefore, this impact would be ***less than significant.***

Impact NOI-2: Operation of the project would not expose new noise sensitive receptors to incompatible noise levels. (LTS)

As shown in Table 4.6-4, ambient noise measurements collected at the site in 2011 and 2015 indicate the project is compatible with the ambient noise environment of the site and its vicinity. Ambient noise levels at measurement location LT-2, LT-4, LT-5, and LT-6 (See Figure 4.6-1) ranged from 48 to 59 L_{dn}, with typical daytime L_{eq} values ranging from 48 to 62.

These values are below the "normally acceptable" exterior noise levels for school land uses set by Figure 3 of the Belmont General Plan Noise Element (65 L_{dn}) and below the daytime noise limits considered to cause a noise disturbance in the Belmont Municipal Code (65 dBA L_{eq}). Therefore, this impact would be ***less than significant***.

Impact NOI-3: Operation of the project could result in noise levels that exceed standards at Ralston Middle School, but would not result in a substantial, permanent increase in ambient noise levels at sensitive residential, park, and school receptors. (LTS)

Project operation would generate noise from off-site vehicle traffic and on-site school activities. As described below, project noise levels would not exceed applicable noise standards established by the City of Belmont for residential or park land uses, nor result in a substantial, permanent increase in ambient noise levels at any sensitive residential or park receptor.

However, project noise levels do have the potential to exceed applicable standards set by the City of Belmont for Ralston Middle School (due to the fact it is immediately adjacent to the site). Although the project noise levels may exceed established standards at the Ralston Middle School property line, they would not constitute a significant noise impact. This is because noise-generating activities would not disturb or otherwise interfere with classes requiring lower noise levels at Ralston Middle School due to distance to classrooms and the scheduling of activities with the potential to exceed the standards would not coincide with class schedules at Ralston Middle School.

Off-Site Vehicle Trips

Potential noise from off-site vehicle trips added to the roadway system as a result of the project would not be substantial. As described in the transportation impact analysis prepared for the project, the new school could result in a total of 243 daily a.m. peak hour (7 to 9 a.m.), 149 daily mid-day (3 to 4 p.m.), and 186 daily p.m. peak hour (4 to 6 p.m.) vehicle trips.[11]

This level of trip generation would, at maximum, constitute less than seven percent of the existing roadway trip volumes during these time periods. Caltrans considers a doubling of total traffic volume to result in a three dBA increase in traffic-related noise levels.[12] The proposed project would result in substantially less than a doubling of traffic volumes on Ralston Avenue and would therefore not result in a substantial, permanent increase in noise levels along Ralston Avenue.

[11] Kimley-Horn, 2015.
[12] Caltrans, 2009.

On-Site School Activities

Potential noise from on-site activities, such as use of the proposed athletic field, was modeled at eight sensitive residential receptor locations, as shown in Table 4.6-7 and Figure 4.6-1.

Table 4.6-7: Predicted Noise Levels at Receptors Surrounding the Proposed Project

Rec. No.	Address/ Description	Existing Environment Representative Loc. [Ldn]	Predicted Noise Levels with Game at Sports Field1		Predicted Noise Levels with Swim Meet2		Worst Case Total Project Ldn[4]
			Hourly L_{eq}[3] (dBA)	L_{max}[3] (dBA)	Hourly L_{eq}[3] (dBA)	L_{max}[3] (dBA)	
1	11 Bryce Ct. / residential backyard	LT-1 [48]	10	21	3	14	20
2	1112 Lassen Dr. / residential backyard	LT-1 [48]	12	23	9	21	26
3	2700 Comstock Cir. / residential backyard	LT-1 [48]	17	25	13	25	30
4	2840 Wakefield Dr. / residential backyard	LT-1[48]	32	44	3	14	26
5	10 Soho Cir. / residential backyard	LT-1 [48]	15	25	9	21	26
6	2600 Ralston Ave. / Lutheran Day School	LT-3 [72]	33	45	22	33	49
7	2621 Belmont Canyon Rd. / residential backyard	LT-3[5] [72]	37	49	20	22	38
8	North bank of Water Dog Lake	LT-4 [48]	17	28	1	10	17

Source: WIA 2012a, modified by MIG to account for 25 dB of attenuation from pool enclosure (WIA 2012b)

[1] A game includes whistles and spectator noise as well as noise generated by the players.

[2] A swim meet includes spectator noise as well as noise from air horns. Predicted noise levels assume the full enclosure would reduce predicted noise levels by 25 dbA; the actual attenuation may be substantially higher.

[3] The hourly Leq evaluated is the maximum hourly Leq for the specific event time period. The Lmax is the maximum short-duration noise level expected,

[4] The total project contribution to the Ldn would be well below the existing conditions. This estimate is based on an unenclosed pool and therefore is an overestimate of the project's Ldn exposure.

[5] Modeled receptor #7 is shielded from Ralston Avenue by the topography of the area; however, LT-3 is considered the most representative measurement location for this receptor.

As shown in Table 4.6-7, the potential hourly L_{eq} and L_{max} noise levels generated from on-site activities at sensitive residential and park receptors would be substantially lower than the ambient noise environment in these locations and would not exceed any standard established by the City's Municipal Code (65 dBA) or General Plan (65 L_{dn}). In addition, since in all cases the

L_{dn} generated by the proposed project would be well below the existing ambient noise levels, the noise increase caused by the proposed project is estimated to be less than 0.01 decibels.[13]

Potential noise levels at the common property line shared by the existing Ralston Middle School and the proposed CSUS middle school were not modeled using SoundPlan. Nonetheless, it is estimated that noise levels from whistles and cheering crowds on the proposed CSUS athletic field could exceed the hourly noise limit contained in the City's Municipal Code (65 dBA) at this location. As shown in Table 4.6-6, the sound levels generated by whistles and crowds typical of school athletic games are 95 to 106 dBA as measured at 50 feet, which is the closest distance between the proposed field and the shared property line.

The actual noise levels produced by whistles and cheering crowds at this property line are expected to be lower since CSUS would use low-decibel, higher frequency whistles been designed for facilities in close proximity to residential uses, the proposed CSUS field is situated approximately 30 feet below the shared property line, and acoustically soft ground cover (i.e., earth and vegetation that would attenuate noise levels) is located between the field and the property line.

Although the noise levels emanating from whistles and cheering crowds at the proposed CSUS field may exceed Belmont Municipal Code standards at the shared property line between the two schools, this is not considered a significant impact because these noise levels are not expected to disturb Ralston Middle School activities for several reasons. First, most whistles and crowd noise would occur on weekday afternoons and weekend days when school is not in session. Second, whistles and crowd noise would be most audible at Ralston Middle Schools outdoor athletic fields and ball courts, and not interfere with interior education instruction. Finally, the athletic fields and ball courts where CSUS noise and crowd noise would be most noticeable produce similar noise levels from whistles already occurring at Ralston Middle School and thus noise from CSUS whistles would not be perceived as a new or intrusive noise source. For these reasons, whistles and crowd noise from the CSUS field would not disturb interior or exterior activities at Ralston Middle School.

Therefore, this impact would be ***less than significant***.

Impact NOI-4: The project would not expose people residing or working in the project area to excessive noise levels from an airport or private airstrip. (LTS)

The project area is approximately 3.1 miles from the San Carlos Airport and would not expose people or workers to excessive noise levels from San Carlos Airport. There are no private airstrips within two miles of the project area. Therefore, this impact would be ***less than significant***.

4.6.4.4 Significant Impacts

Project implementation would result in one potentially significant impact from construction noise levels; however, with mitigation, this impact would be reduced to a less than significant level.

[13] WIA, 2012a.

Impact NOI-5: Project construction could result in a potentially substantial, temporary increase in ambient noise levels during the 17-month construction period. (S)

As described in Section 4.6.2.3, neither the Belmont General Plan nor the Belmont Municipal Code (Chapter 15, Article VIII) establish noise limits for construction activities; however, the Municipal Code does limit construction activities to the hours of 8:00 a.m. to 5:00 p.m. Monday thru Friday and 10:00 a.m. to 5:00 p.m. on Saturday. The Code prohibits construction activities on Sundays and holidays.

In addition, the Municipal Code also requires gasoline-powered construction equipment to be equipped with an operating muffler or baffling system originally provided by the equipment manufacturer (i.e., un-modified by the construction contractor). As stated in the Project Description (see Section 3.4.8), construction hours would be limited to the allowable hours in the City's Municipal Code and would comply with all City of Belmont noise regulations.

Construction workers, equipment deliveries, and soil hauling are anticipated to access the project site via Highway 101 or 280, to Ralston Avenue, to the project site. As noted in the transportation impact analysis prepared for the project, the number of trips generated by construction activities is estimated to be kept at or less than the trips generated during project operation, which is less than seven percent of peak hour traffic volumes on Ralston Avenue. Construction traffic, therefore, would not result in a substantial temporary increase in noise along Ralston Avenue.

Nonetheless, project construction activities would generate noise over the course of the approximately 17-month construction period. Potential construction noise levels were modeled at nearby noise sensitive properties including Ralston Middle School and a representative receptor on each of the north, east, west, and south sides of the proposed school site, using the typical equipment, equipment usage factors, and reference noise level at 50 feet shown in Table 4.6-5. The resulting construction noise levels are shown in Table 4.6-8.

Table 4.6-8: Summary of Construction Noise Effects

Receptor	Approximate Distance (ft)	Construction Phase									
		Demolition		Foundations		Erection		Utilities		Site Prep	
		Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax
Ralston School field	260	72	76	64	65	64	67	68	69	67	71
Ralston School	460	67	71	59	60	59	62	63	64	62	66
Lutheran Day School	490	66	70	58	59	58	61	62	63	62	65
Residences (North) – Belmont Canyon	515	61	65	53	54	53	56	57	58	56	60
Residences (East) - Arroyo View	690	63	67	55	56	55	58	59	60	59	62

Residences (South) – Wakefield Drive	890	61	65	53	54	53	56	57	58	57	60
Residences (West) – Tahoe Drive	910	61	65	53	54	53	56	57	58	56	60

Source: WIA 2012a
Bold entries indicate noise levels could exceed 70 dBA for hourly Leq or individual Lmax events

As shown in Table 4.6-8, hourly L_{eq} construction noise levels would range from approximately 53 dBA to 72 dBA at worst-case. L_{max} levels would be higher, reaching as much 76 dBA at the Ralston Middle School field.

At Lutheran Day School, worst-case hourly construction noise levels (L_{eq} values) would range from approximately six to 19 dBA below typical daytime L_{eq} values listed in Table 4.6-4 (location LT-3). Similarly, at Lutheran Day School, L_{max} construction levels would range from two to 18 dBA below typical daytime L_{eq} values. Therefore, project construction would not result in a substantial temporary increase in noise levels at this location.

At residential receptor locations, worst-case hourly construction noise levels would be from approximately 15 to 17 dBA above typical daytime L_{eq} levels listed in Table 4.6-4 (location LT-1 [46 dBA L_{eq}] and LT-4 [48 dBA L_{eq}]) during building demolition, which is estimated to last approximately three-months. Other phases of construction, which could last approximately 14 months in total, would generate hourly L_{eq} values approximately nine to 13 dBA above typical daytime noise levels. These noise increases at residential receptors are not considered to be substantial because: 1) construction activities would occur in accordance with the City of Belmont Municipal Code; [14]2) construction noise would be intermittent, and would not be constant throughout the day; 3) the worst-case increase in ambient noise levels would last only three months; and 4) all predicted hourly L_{eq} and L_{max} construction noise levels are estimated to be less than 45 dBA inside nearby residences and, therefore, unlikely to interfere with normal residential activities (e.g., the Belmont General Plan sets 45 dBA as the "normally acceptable" level for interior residential land uses).

At Ralston Middle School, worst case hourly L_{eq} values would range from approximately 15 to 20 dBA above the typical daytime L_{eq} levels listed in Table 4.6-4 (location LT-2 [52 dBA L_{eq}]) during building demolition. Other phases of construction, which could last approximately 14 months in total, would generate hourly L_{eq} values approximately seven to 11 dBA above ambient levels. Although construction activities would occur in accordance with the City of Belmont Municipal Code and would be intermittent, project construction-related noise increase at Ralston Middle School are considered to be substantial because L_{max} construction noise levels could interfere with outdoor physical education instruction and noise levels within the school buildings closest to construction work areas could exceed 45 dBA. Therefore, Mitigation Measure NOI-5

[14] Section 15-102(f) of the City of Belmont Code restricts construction and related activities to the hours of 8:00 a.m. to 5:00 p.m. Monday through Friday and 10:00 a.m. to 5:00 p.m. on Saturday; grading activities are prohibited on Saturdays, and all construction activities are prohibited on Sundays and holidays.

to reduce potential L_{eq} and L_{max} noise levels at Ralston Middle School during project construction is required.

Mitigation Measure NOI-5: To reduce potential construction noise levels, the project contractor shall employ the following noise control techniques and best management practices during project construction:

- A temporary sound barrier shall be placed at the Ralston/CSUS property. The sound barrier should be at least 8 to 10 feet high to block line of sight between noise-generating construction equipment and the Ralston Middle School activity areas and would provide about 10 dBA noise reduction at field area and about 5 dBA noise reduction at the Ralston Middle School buildings. Sound barriers and sound enclosures shall use materials with a minimum surface density of 3 pounds per square foot (e.g., plywood) to achieve a minimum Sound Transmission Class (STC) of 25. Multiple layers of a sound barrier curtain can be used to achieve a minimum total 2 lb/sq ft surface density (instead of 3 lb sq/ft). For rigid sound barriers and sound enclosures installed close to noise generating equipment, the inside face shall also be absorptive, with a minimum Noise Reduction Coefficient of 0.60 (e.g., 1 inch thick, 3 pound per cubic feet (pcf) duct liner). The sound barrier design shall be reviewed by a qualified acoustical consultant prior to installation to ensure proper function and attenuation is achieved.
- Where feasible, demolition activities shall be phased to take advantage of the noise shielding effect provided by the existing structures to reduce demolition work noise (e.g., start from the east side of the site).
- Site equipment at the work area to maximize the distance to noise sensitive receptors, and to take advantage of shielding provided by on-site equipment.
- Maintain respectful and orderly conduct among workers, including worker conversation noise during the school hours.
- Maintain the equipment properly to minimize extraneous noise due to squeaking or rubbing machinery parts, damaged mufflers or misfiring engines, etc.
- Provide advance notice to nearby residents prior to starting demolition work that includes information regarding anticipated schedule, hours of operation, and the name of a person to contact regarding noise complaints.
- Layout the work sites to avoid reverse motions of large trucks, or sounding of any reverse motion alarms as much as possible. If this is not possible, trucks operating close to noise sensitive land uses should be outfitted with SAE J994 Class D alarms (ambient-adjusting, or “smart alarms”).
- Use “quiet” generators (e.g. MQ Whisperwatt or equivalent, rated no greater than 60 dBA at 50 feet or 67 dBA at 23 feet).
- Use a sound enclosure (e.g., three sides with a partial top) to shield stationary noise sources (portable generator, pumps, compressors, etc.) to reduce job site noise effects from noise sensitive receptors. The enclosure should be placed to provide sufficient ventilation while providing effective noise control. Nominally spacing the enclosure 3 to 5 feet from the noise source should be sufficient. Such an enclosure should provide approximately 10 to 15 dBA noise reduction of the equipment noise. To maximize the benefit of this enclosure, use NRC 0.9 absorptive material and barrier material with 5 to 8

pounds per square foot to achieve STC 40 (e.g., multiple layers of plywood, separated by 3” air gap).

Mitigation Measure NOI-5 would reduce the magnitude of the project’s potential, construction related-noise increases at Ralston Middle School, as well as other nearby receptors, to levels that would not interfere with interior or exterior school instruction. Therefore, this impact would be ***less than significant*** after mitigation. **(LTS)**