4.9 NOISE

4.9.1 INTRODUCTION

This section of the Revised Draft EIR presents existing noise conditions on the UC Santa Cruz campus, including the project sites, and analyzes the potential noise impacts, both temporary (i.e., construction) and long term (i.e., operational), from the implementation of the proposed Student Housing West (SHW) project. As discussed in **Chapter 3, Project Description**, the proposed housing would be constructed on two sites. Approximately 2,932 student beds would be provided in six buildings that would be located on a site off Heller Drive (Heller site) and about 140 student beds would be provided in a complex that would be located on Hagar Drive (Hagar site) in the eastern portion of the campus. Noise impacts are analyzed below for both sites.

This section also presents potential noise impacts from the anticipated construction and operation of the separate, but related, Porter and Rachel Carson Colleges dining facilities expansion project, which would serve residents of the SHW project and the existing colleges (see **Section 4.9.5** below).

The analysis in this section is tiered from the noise analysis contained in the 2005 LRDP EIR, supplemented by project-specific analysis prepared by Illingworth & Rodkin. The technical memorandum prepared by Illingworth & Rodkin is included in **Appendix 4.9** of this Draft EIR.

The section is substantially the same as the section in the Draft EIR, because the revised project would be located on the same two project sites that were evaluated in the Draft EIR and would not involve a substantial change in the number of beds or the facilities to be built at each site. However, 140 beds and a childcare facility would be built on the Hagar site instead of the 148 beds previously proposed, and the site plan for the site has been altered to include two right-in and right out driveways on both Hagar Drive and Coolidge Drive. As the result, the traffic circulation at the site would be different from the circulation that was analyzed in the Draft EIR. To account for this change at the Hagar site, the traffic noise impact on the project site residents and childcare facility have been reanalyzed. In addition, comments received on the Draft EIR related to noise impacts were reviewed and the key issues raised in the comments are summarized below:

- The Draft EIR's noise analysis fails to analyze the noise impacts of housing thousands of more students in previously quiet, undeveloped areas of the campus. The EIR discusses traffic and construction noise only. But thousands of students will create noise and its attendant impacts on wildlife.

- It is possible that the traffic study was flawed or mistimed leading to an inaccurate analysis of the traffic noise impacts, especially on the children in the childcare facility. As the analysis may be flawed due to an incorrect traffic, it is possible that the noise levels at the childcare center may reach unacceptable levels.

- There is an apparent inconsistency in the noise analysis. It is unclear why the noise levels would be higher at the Employee Housing than at the childcare facility.
- The addition of housing on the Hagar site will inevitably bring more noise, which is what residents in faculty/staff housing on Hagar Court do not want.

These comments are addressed in the revised analysis presented in this section.

4.9.2 ENVIRONMENTAL SETTING

4.9.2.1 Characteristics of Noise

Noise is usually defined as unwanted sound that is disturbing or annoying. It is an undesirable by-product of society's normal day-to-day activities. Sound becomes unwanted when it interferes with normal activities, when it causes actual physical harm, and/or when it has adverse effects on health. The objectionable nature of sound may be caused by its pitch, its loudness, or both. Pitch is the height or depth of a tone or sound, depending on the relative rapidity (i.e., frequency) of the vibrations by which it is produced. Higher-pitched signals sound louder to humans than sounds with a lower pitch. Loudness is the amplitude of sound waves combined with the reception characteristics of the ear. Amplitude may be compared with the height of an ocean 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 tenfold 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 decibel level. Each 10-decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms for noise are defined in **Table 4.9-1, Definitions of Acoustical Terms**.

Table 4.9-1
Definitions of Acoustical Terms

Term	Definitions
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals

Term	Definitions
	(micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dB(A)	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, Leq	The average A-weighted noise level during the measurement period. The hourly Leq used for this report is denoted as dB(A) Leq[h].
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 PM to 10:00 PM and after addition of 10 decibels to sound levels in the night between 10:00 PM and 7:00 AM.
Day/Night Noise Level, Ldn	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 PM and 7:00 AM.
L01, L10, L50, L90	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
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.

There are several methods of characterizing sound. The most common in California is the A-weighted sound level, referenced in units of dB(A).[1] This method is used because sound pressure level alone is not a reliable indicator of loudness, as the human ear does not respond uniformly to sounds at all frequencies. For example, it is less sensitive to low and high frequencies than to the medium frequencies that more closely correspond to human speech. The A-weighted noise level was developed to better correspond with peoples' subjective judgment of sound levels. In general, changes in community noise levels of less than 3 dB(A) are not typically noticed by the human ear (FHA 1980). Changes from 3 to 5 dB(A) may be noticed by some individuals who are especially sensitive to changes in noise. An increase greater than 5 dB(A) is readily noticeable, while, as noted above, the human ear perceives a 10 dB(A) increase in sound level to be a doubling of sound volume. A doubling of sound wave energy (for example, from doubling the volume of traffic on a roadway) would result in a 3 dB increase in sound, a barely perceptible change in sound level.

Noise sources occur in two forms: (1) point sources, such as stationary equipment or individual motor vehicles; and (2) line sources, such as a roadway with a large number of point sources (motor vehicles).

1 All sound levels discussed in this section use the A-weighting scale.

Sound generated by a point source typically diminishes (attenuates) at a rate of 6.0 dB(A) for each doubling of distance from the source to the receptor at acoustically "hard" sites and 7.5 dB at acoustically "soft" sites.[2] For example, a 60 dB(A) noise level measured at 50 feet from a point source at an acoustically hard site would be 54 dB(A) at 100 feet from the source and 48 dB(A) at 200 feet from the source. Sound generated by a line source typically attenuates at a rate of 3.0 dB(A) and 4.5 dB(A) for each doubling of distance from the source to the receptor for hard and soft sites, respectively. Sound levels can also be attenuated by man-made or natural barriers (e.g., sound walls, berms, ridges), as well as elevation differences. In addition, noise attenuates as a result of building construction. The minimum noise attenuation provided by typical building construction in California is provided in **Table 4.9-2, Outside to Inside Noise Attenuation**.

Table 4.9-2
Outside to Inside Noise Attenuation (dB(A))

Building Type	Open Windows	Closed Windows
Residences	17	25
Schools	17	25
Churches	20	30
Hospitals/Convalescent Homes	17	25
Offices	17	25
Theaters	20	30
Hotels/Motels	17	25

Source: Transportation Research Board, National Research Council, Highway Noise: A Design Guide for Highway Engineers, National Cooperative Highway Research Program Report 117.

When assessing community reaction to noise, there is an obvious need for a scale that averages varying noise exposures over time and that quantifies the result in terms of a single number descriptor. Several scales have been developed that address community noise level. Those that are applicable to this analysis are the Equivalent Noise Level (Leq), the Day-Night Noise Level (Ldn), and the Community Noise Equivalent Level (CNEL).

- L_{eq} is the average A-weighted sound level measured over a given time interval. L_{eq} can be measured over any period, but is typically measured for 1-minute, 15-minute, 1-hour, or 24-hour periods.

2 Examples of "hard" or reflective sites include asphalt, concrete, and hard and sparsely vegetated soils. Examples of acoustically "soft" or absorptive sites include soft sand, plowed farmland, grass, crops, or heavy ground cover.

- L_{dn} is a 24-hour L_{eq} with a "penalty" of 10 dB added during the nighttime hours (10:00 PM to 7:00 AM), which is typically sleeping time.
- CNEL is another average A-weighted sound level measured over a 24-hour period. However, the CNEL noise scale is adjusted to account for some individuals' increased sensitivity to noise levels during the evening as well as the nighttime hours. A CNEL noise measurement is obtained after adding a "penalty" of 5 dB to sound levels occurring during the evening from 7:00 PM to 10:00 PM, and 10 dB to sound levels occurring during the nighttime from 10:00 PM to 7:00 AM.[3]

4.9.2.2 Characteristics of Vibration

Vibration is minute variation in pressure through structures and the earth, whereas noise is minute variation in pressure through air. Thus, vibration is felt rather than heard. Some vibration effects can be caused by noise, e.g., the rattling of windows from truck pass-bys. This phenomenon is related to the production of acoustic energy at frequencies that are close to the resonant frequency of the material being vibrated. Groundborne vibration attenuates rapidly as distance from the source of the vibration increases.

Peak particle velocity (PPV) is used to describe vibration impacts to both buildings and humans. PPV represents the maximum instantaneous peak of a vibration signal, and it is usually measured in inches per second.[4] For damage to structures, the California Department of Transportation recommends a vibration limit of 0.5 inches/second, peak particle velocity (in/sec PPV) for buildings structurally sound and designed to modern engineering standards, 0.3 in/sec PPV for older residential buildings, and 0.25 for historic and some old buildings. Groundborne vibrations in excess of 0.1 in/sec PPV, produced by continuous/frequent intermittent sources of vibration, are considered strongly perceptible and capable of causing human annoyance.

4.9.2.3 Noise-Sensitive Land Uses Within and Adjacent to the Campus

The nearest existing noise-sensitive residential land uses in the vicinity of the Heller site and the associated utility corridor include the Rachel Carson College about 350 feet to the east of the project site and Porter/Kresge residences within approximately 200 feet of the utility corridor.[5]

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3 The logarithmic effect of adding these penalties to the peak-hour L_{eq} measurement results in a CNEL measurement that is within approximately 3 dB(A) (plus or minus) of the peak-hour L_{eq}. California Department of Transportation, *Technical Noise Supplement; A Technical Supplement to the Traffic Noise Analysis Protocol*, October 1998, pp. N51-N54.

4 California Department of Transportation, *Transportation and Construction Vibration Guidance Manual*, September 2013b.

5 Illingworth & Rodkin, Inc., *UC Santa Cruz Student Housing West, Santa Cruz, CA – Noise and Vibration Levels associated with Construction Activities.* December 2017.

The nearest sensitive receptors near the Hagar site include UC Santa Cruz employee housing within 220 feet to the southeast and 320 feet to the southwest of the project site. Sensitive receptors near the associated utility corridor include residential housing within 200 feet to the south of the utility corridor, and UC Santa Cruz Barn (which houses administrative functions) within 270 feet of the utility corridor.[6]

4.9.2.4 Existing Noise Levels

An ambient noise level survey was conducted for the 2005 LRDP EIR on February 22, February 23, April 14, and April 15, 2005. The noise survey was conducted at selected sites in the project area, including the Family Student Housing residences at what is the Heller project site. Other off-site measurements were conducted, including a long-term measurement at 955 High Street and a short-term measurement that was conducted at the intersection of High and Cardiff Streets, which are the nearest monitoring locations to the Hagar site.

Table 4.9-3
Noise Measurement Data Summary

Measurement Location	Long-Term CNEL (dBA)	Short-Term Leq (dBA)
Family Student Housing (Heller site)	58.0	55.5
Residences along High Street between Cardiff Place and Moore Street (near Hagar site)	70.0	66.0

Source: 2005 UCSC LRDP Final EIR.

4.9.3 REGULATORY CONSIDERATIONS

4.9.3.1 Federal Laws and Regulations

There are no federal noise standards that are applicable to the UC Santa Cruz campus.

4.9.3.2 State Laws and Regulations

Title 24 of the California Code of Regulations codifies Sound Transmission Control requirements, which establish uniform minimum noise insulation performance standards for new hotels, motels, dormitories, apartment houses, and dwellings other than detached single-family dwellings. Specifically, Title 24 states that interior noise levels attributable to exterior sources shall not exceed 45 dB(A) CNEL in any habitable room of new dwellings. Dwellings are to be designed so that interior noise levels will meet this standard

6 Ibid.

for at least 10 years from the time of building permit application. This standard applies to all new student housing developed on the UC Santa Cruz campus.

4.9.4 PROJECT IMPACTS AND MITIGATION MEASURES

4.9.4.1 Significance Criteria

The impacts related to noise from the implementation of the proposed project would be considered significant if they would exceed the following standards of significance, in accordance with Appendix G of the State CEQA Guidelines and the 2005 LRDP EIR:

- Expose persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinances, or applicable standards of other agencies;

  For purposes of evaluating noise impacts from traffic and other permanent noise sources, the following exterior noise standards consistent with State guidelines and City of Santa Cruz General Plan were used:

  - 60 dBA CNEL for single-family residences
  - 65 dBA CNEL for multi-family residences
  - 70 dBA CNEL for schools and parks

- Cause a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

  A substantial permanent increase in exterior noise levels was evaluated based on the following criteria:

  - A 3 dBA or greater increase in CNEL for Without Project scenario if equal to or greater than 65 dBA
  - A 5 dBA or greater increase in CNEL for Without Project scenario is 50-65 dBA
  - A 10 dBA or greater increase in CNEL for Without Project is <50 dBA

- Cause a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

  A substantial temporary increase in ambient exterior noise levels (associated mainly with construction activities) was evaluated based on the exceedance of the following criteria:

  - 80 dBA $L_{eq\ (8h)}$[7] daytime (defined as 7:00 AM to 7:00 PM)

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7 $L_{eq\ (8h)}$ is an average measurement over an eight-hour period.

- 80 dBA $L_{eq\ (8h)}$ evening (defined as 7:00 PM to 10:00 PM)

- 70 dBA $L_{eq\ (8h)}$ nighttime (defined as 10:00 PM to 7:00 AM)

- Expose persons to or generation of excessive groundborne vibration or groundborne noise levels;

  For evaluating the potential for groundborne vibrations to result in significant impacts related to damage to nearby buildings or cause substantial human annoyance, the following criteria were used:

  - for damage to structures, vibration levels greater than 0.5 inches/second, peak particle velocity (in/sec PPV) for structurally sound buildings designed to modern engineering standards, 0.3 in/sec PPV for older residential buildings, and 0.25 in/sec PPV for historic and some old buildings.

  - for vibrations to cause human annoyance, vibration levels greater than 0.1 in/sec PPV, produced by continuous/frequent intermittent sources of construction vibration.

More information regarding the thresholds of significance set forth above is provided in the 2005 LRDP EIR. Note that all impacts were estimated and evaluated not at the source of noise but at the site where the nearest noise-sensitive receptor is located.

4.9.4.2 Impacts Adequately Analyzed at the 2005 LRDP Level or Not Applicable to the Project

- For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 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 analysis in the 2005 LRDP Initial Study that accompanied the 2005 LRDP EIR concluded that the campus is not located within an airport land use plan, is not within 2 miles of public airport or public use airport, and is not located within 2 miles of a private airstrip. People living and working within the project area, including the Heller and Hagar sites, would not be exposed to excessive aircraft noise levels; therefore, no impact would occur and no additional project-level analysis is needed.

4.9.4.3 Methodology

The primary sources of noise and vibration associated with the proposed project would be construction activities. Noise levels associated with anticipated construction activities were estimated for locations in the vicinity of the proposed construction where sensitive receptors are located, using the Federal Highway Administration's Road Construction Noise Model (RCNM) and project-specific data on types of equipment that would be used and the durations of use for each piece of equipment. Vibration levels were calculated using Federal Transit Administration (FTA) reference vibration levels, and then attenuating these levels with increasing distance at the rate of $(D_{ref}/D)^{1.1}$, where D is the distance from the source in feet, and D_{ref} is the reference distance of 25 feet.[8] Noise and vibration levels were calculated from the center of the project site to the nearest receptors as these would be representative of average noise and vibrations conditions that would be experienced at the receptors. Noise and vibration levels that would be received at the nearest receptors when construction occurs the closest to the receptor were also calculated. The estimated levels were compared with adopted standards to determine whether significant noise and vibration impacts would occur during project construction.

With respect to noise from project operations, the proposed residential development would not include any stationary noise sources and therefore no analysis of impacts from stationary noise sources is required. Potential increases in noise levels due to traffic are not anticipated because as the analysis in **Section 4.10, Transportation and Traffic** shows, the proposed project would reduce both daily and peak hour traffic compared to the no project condition and compared to current conditions. Because the project would not increase traffic to and from the campus, it would have no potential to increase on-and off-campus traffic-related noise levels. However, because the proposed project would place housing and a childcare facility near the intersection of Glenn Coolidge and Hagar Drives, the project may cause a small increase in the traffic volumes near that intersection compared to existing conditions. Therefore the analysis below examines the effect of changed traffic near that intersection on existing receptors located in the UC Santa Cruz employee housing to the south of the Hagar site.

Although CEQA does not require an evaluation of the impacts of the environment on the project, the 2005 LRDP EIR included an evaluation of the effect of ambient noise levels on future residents on the campus. Consistent with the 2005 LRDP EIR, this EIR also estimates and reports noise levels that future residents of the proposed housing would be exposed to from existing traffic noise sources in the project vicinity.

4.9.4.4 2005 LRDP EIR Mitigation Measures Included in the Proposed Project

Table 4.9-4, 2005 LRDP EIR Mitigation Measures, presents the mitigation measures in the 2005 LRDP EIR that are applicable to the proposed project. Since these previously adopted mitigation measures are already being carried out as part of implementation of the 2005 LRDP, they are included in and are a part of the proposed project and will not be readopted. Implementation of these mitigation measures is assumed as part of the project impact analysis.

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8 These levels are based on calculations assuming normal propagation conditions, using a standard equation of $PPV_{eqmt}=PPV_{ref}*(25/D)^{1.1}$. Reference vibration levels are from the FTA *Transit Noise and Vibration Impact Assessment*, May 2006.

Table 4.9-4
2005 LRDP EIR Mitigation Measures

Mitigation Measure	Description
NOIS-1	Prior to initiation of construction of a specific development project, the Campus shall approve a construction noise mitigation program that shall be implemented for each construction project. This shall include but not be limited to the following: Construction equipment used on campus is properly maintained and has been outfitted with feasible noise-reduction devices to minimize construction-generated noise. Laydown and construction vehicle staging areas are located at least 100 feet away from noise-sensitive land uses as feasible. Stationary noise sources such as generators or pumps are located at least 100 feet away from noise-sensitive land uses as feasible. Whenever possible, academic, administrative, and residential areas that will be subject to construction noise will be informed in writing at least a week before the start of each construction project. Loud construction activity (i.e., construction activity such as jackhammering, concrete sawing, asphalt removal, and large-scale grading operations) within 100 feet of a residential or academic building shall not be scheduled during finals week. Loud construction activity as described above within 100 feet of an academic or residential use shall, to the extent feasible, be scheduled during holidays, Thanksgiving break, Christmas break, Spring break, or Summer break. Loud construction activity within 100 feet of a residential building shall be restricted to the hours between 7:30 AM and 7:30 PM, Monday through Saturday. Loud construction activity within 100 feet of an academic building shall be scheduled to the extent feasible on weekends.

Source: UC Santa Cruz 2006

4.9.4.4 Project Impacts and Mitigation Measures

SHW Impact NOIS-1: Implementation of the proposed project would not expose project residents to noise levels in excess of applicable standards. (*Less than Significant*)

The 2005 LRDP EIR included an evaluation of the effect of ambient noise levels on future residents on the campus. Although based on direction provided by the courts in the last few years, CEQA no longer requires an evaluation of the impact of the environment on the proposed project except under certain circumstances, consistent with the 2005 LRDP EIR, this EIR also estimates and reports noise levels that future residents of the proposed housing would be exposed to from existing noise sources in the project vicinity.

Heller Site

The 2005 LRDP EIR included an evaluation of whether new student housing on the central campus, including the redevelopment of the FSH complex along Heller Drive in the western portion of the campus, would expose the future residents to excessive noise levels from traffic on campus streets. Note that the Heller site is developed and is currently exposed to noise from roadway traffic along Heller Drive. As a result, it is not located in a previously quiet, undeveloped portion of the campus. The analysis reported the ambient noise levels as well as projected noise levels in 2020 that would result as traffic on campus roadways increases as a result of campus enrollment and employment growth under the 2005 LRDP. With the increase in traffic along Heller Drive as a result of campus growth under the 2005 LRDP, the noise levels at the Heller site were estimated to increase to about 58 dBA CNEL by 2020 (UCSC 2006). As the estimated CNEL was well below 65 dBA CNEL, the 2005 LRDP EIR concluded that the impact on future residents of the redeveloped FSH site would be less than significant.

This prior analysis is applicable to the proposed project because the Heller site development under the proposed project would be located no closer to Heller Drive than the previously proposed FSH redevelopment project. Furthermore, this estimate is considered conservative because, based on periodic gateway counts at the campus entrances, the current trip generation rate for the campus is lower than the trip generation rate that was used in the 2005 LRDP EIR. In addition, as demonstrated by the data in **Section 4.11, Transportation and Traffic**, which has been updated for this Revised Draft EIR, the proposed project (and other reasonably foreseeable campus housing projects) would reduce the number of daily trips to the campus compared to the number of trips analyzed in the 2005 LRDP EIR. Therefore, the new receptors at the Heller site would not be exposed to noise levels exceeding 58 CNEL due to traffic on Heller Drive and the impact would be less than significant.

Hagar Site

A similar analysis was not included in the 2005 LRDP EIR for the Hagar site because the 2005 LRDP did not envision that housing would be developed on the Hagar site. Therefore, current and projected traffic volumes near the intersection of Glenn Coolidge and Hagar Drives were obtained from the traffic study prepared for the Hagar site, and traffic noise levels were estimated using the Federal Highway Administration's Traffic Noise Model (TNM) Version 2.5 (TNM2.5). Please note that both the previous and updated studies were prepared in accordance with current traffic analysis standards, and thus are not flawed. Table 4.9-5, Calculated Traffic Noise Levels for Project Site Receptors, below, shows the estimated noise levels at the proposed housing and the childcare center with and without the proposed project. Note that the noise levels at the on-site receptors were estimated as they would result from the combined effect of traffic on the roadway closest to the receptor as well as the traffic on the other nearby roadway segments.

Table 4.9-5
Calculated Traffic Noise Levels for Project Site Receptors

Roadway Segment/Receptor	Estimated dBA, CNEL			
	Existing Conditions (2017)	Future Without Project (2020)	Future With Project (2020)	Increase from Future Without Project to Future with Project
Coolidge Drive from Hagar Drive Eastbound (Hagar Student Housing)	53.5	54.0	54.5	0.5
Hagar Drive from Coolidge Drive Northbound (Childcare Center)	61.2	61.6	61.9	0.3

Source: TNM2.5 outputs modeled by Impact Sciences.

The analysis demonstrates that receptors at the Hagar site would not be exposed to noise levels in excess of 65 dBA CNEL due to traffic on Glenn Coolidge and Hagar Drives.

In summary, the proposed project would not expose the project residents to traffic noise levels in excess of applicable standards. The impact would be less than significant.

Mitigation Measures: No mitigation is required.

SHW Impact NOIS-2: Implementation of the proposed project would not cause a substantial permanent increase in noise levels existing without the project. (*Less than Significant*)

Heller Site

As discussed above, the proposed project (and other reasonably foreseeable campus housing projects) would reduce the number of daily trips to the campus compared to the number of trips analyzed in the 2005 LRDP EIR. However, compared to existing (2017) conditions, there would be an increase in traffic on Heller Drive under both without and with project conditions. Traffic volumes are anticipated to increase by 12.57 percent under the 2023 Without Project scenario, and 9.81 percent under the 2023 With Project scenario. Traffic noise levels increase by approximately 3 dBA for every doubling of traffic on a given roadway. Based on this general rule and using a formula provided by Caltrans,[9] sound level increases under the 2023 Without Project scenario and the 2023 With Project scenario are calculated to be approximately 0.5 dBA and 0.4 dBA, respectively. Both of these sound level increases would be below the threshold of 5 decibel increase in areas where ambient levels are between 50 and 65 dBA CNEL. Therefore, the existing receptors on Heller Drive (primarily residents of Rachel Carson College) would not be exposed to a substantial permanent increase in noise levels that would exist in the area without the project.

The Heller site MBR plant would also not result in a substantial permanent increase in noise levels on and near the Heller site. Equipment that would produce noise includes blowers in the underground tanks, pumps in underground vaults, and partially-underground headworks (screening equipment) that will be located inside the WWTP building, which would be located in the southwestern corner of the parking lot on the Heller site. Furthermore, the headworks room and pump room would be insulated, which will help reduce sound transmitted outside the building. While some noise may be audible next to the building, but it would not be audible at the nearest graduate and undergraduate buildings.

With respect to other stationary noise sources such as HVAC equipment, that equipment would be located on roof tops of the project buildings and surrounded by a parapet, and would not result in a noise increase that would be audible to off-site or on-site receptors. The noise impact from stationary and mobile sources would be less than significant.

Hagar Site

The potential for the Hagar site traffic to affect existing sensitive receptors living in the employee housing south of Glenn Coolidge Drive was evaluated. As **Table 4.9-6, Calculated Traffic Noise Levels for Nearest Off-site Receptors,** below shows, these receptors would experience an approximately 0.5 dBA increase in traffic noise levels due to the project, which is not considered an audible increase, and is well below the threshold of a 5 decibel increase in areas where the ambient levels are between 50 and 65 dBA CNEL.

9 The sound level increase due to traffic can be calculated using the formula $SPL_{Total} = SPL_1 + 10\log_{10}(N)$, where SPL1 is the sound pressure level from one source and N is the number of identical sources to be added to the sound level (California Department of Transportation 2013a). For example, N = 2 would represent a doubling in traffic, and would increase noise levels by approximately 3 dBA. Using this formula, N = 1.1257 under the No Project scenario and 1.0981 under the With Project Scenario. This results in sound level increases of approximately 0.5 dBA and 0.4 dBA, respectively.

Table 4.9-6
Calculated Traffic Noise Levels for Nearest Off-site Receptors

Roadway Segment/Receptor	Estimated dBA, CNEL			
	Existing Conditions (2017)	Future Without Project (2020)	Future With Project (2020)	Increase from Future Without Project to Future with Project
Hagar Court from Coolidge Drive Southbound (Employee Housing)	63.5	64.1	64.6	0.5

Source: TNM2.5 outputs modeled by Impact Sciences.

Please note that traffic noise levels are higher at the employee housing complex than traffic noise levels reported in **Table 4.9-5** for the proposed childcare center adjacent to Hagar Drive. This is because noise levels at the employee housing are dominated by the traffic on Glenn Coolidge Drive whereas the noise levels at the childcare facility are dominated by the traffic on Hagar Drive. Under 2020 plus project conditions, Glenn Coolidge Drive would have an average daily traffic (ADT) of about 15,000 vehicles whereas the ADT on Hagar Drive would be about 9,500 vehicles.

The Hagar site MBR plant would also not result in a substantial permanent increase in noise levels at and near the Hagar site. Equipment that would produce noise includes blowers in the underground tanks, pumps in underground vaults, and partially-underground headworks (screening equipment) that will be located inside the enclosed concrete masonry unit (CMU) building. As the majority of equipment would be below grade and all equipment would be within the CMU building, noise levels from this equipment would be minimal adjacent to the CMU building, and would be inaudible across the street.

The proposed Hagar site development would not include HVAC equipment on rooftops and all heating equipment would be located indoors. As a result there would not be an increase in off-site noise levels from heating and cooling equipment. Although increased human activities on the Hagar site would have the potential to elevate noise levels locally, given the small size of the proposed development (140 units and about 420 residents) and the distance between the proposed development and existing receptors, the increase would not be perceptible at the receptors over noise from traffic on Glenn Coolidge and Hagar Drives.

In summary, the traffic and other noise sources associated with the proposed project would not result in a substantial permanent increase in noise levels above those that would exist without the project. The project's impact would be less than significant.

Mitigation Measures: No mitigation is required.

SHW Impact NOIS-3: Construction associated with the proposed project would not cause a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project. (*Less than Significant*)

Heller Site

Construction activities planned at the Heller site are anticipated to begin in Fall 2020 and end in Fall 2023, lasting approximately 3 years. Project construction phases would include demolition and site preparation, grading, building construction, paving, and architectural coating. **Figure 4.9-1** shows the project site, utility corridor, and the nearest sensitive receptors. Construction activities would occur on the 13-acre site in phases with work underway in different portions of the site at different points in time over the construction period. Consequently, construction noise levels received at the nearby receptors would vary depending on the noise producing activity underway and its location relative to the receptors. To analyze both the typical or average noise exposure as well as worst-case noise exposure during project construction, two scenarios were modeled. The typical/average noise exposure scenario included modeling noise levels that would be received at the nearest receptor assuming that all noise producing equipment is located in the center of the 13-acre site, whereas under the worst-case noise exposure scenario, noise levels were modeled assuming that the noise producing equipment is located near the perimeter of the Heller site closest to the receptors.

Anticipated typical construction noise levels, by construction activity and phase, are summarized in **Table 4.9-7, Calculated Typical Construction Noise Levels at Nearest Receptors – Heller Site.** The predicted typical construction noise levels resulting from construction activities at distances ranging from 400 feet to 650 feet from the nearest sensitive receptors (i.e., residences at Porter, Kresge, and Rachel Carson Colleges) would not exceed the significance thresholds of 80 dBA L_{eq} (8-hour) during daytime and evening periods.

Table 4.9-7
Calculated Typical Construction Noise Levels at Nearest Receptors -Heller Site

Construction Phase	Average Equivalent Noise Level (dBA, L_{eq})	
	Utility Corridor	Heller Development
	Porter/Kresge College Residences (400 feet)	Rachel Carson College Residences (650 feet)
Site Preparation	NA	67
Grading	74	70

Building Construction	NA	69
Paving	NA	64
Architectural Coatings	NA	65
Overall Range of Construction Noise Levels	74	64-70

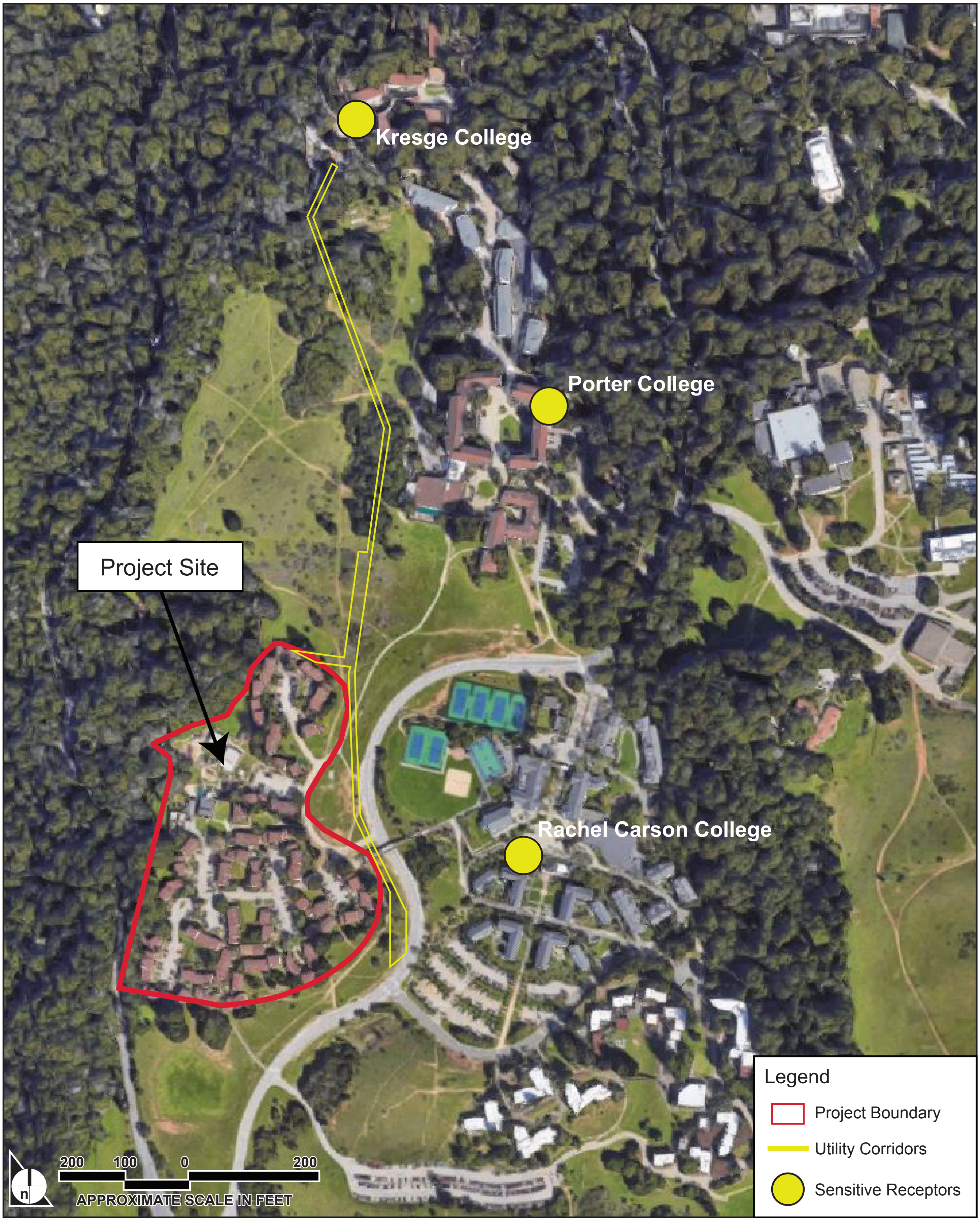
Source: Illingworth & Rodkin, Inc. 2017.

The worst-case noise levels are reported in **Table 4.9-8, Calculated Worst Case Construction Noise Levels at Nearest Receptors – Heller Site**. As the results show, during the brief periods when construction would occur at the closest point to the nearby Porter/Kresge College residences (approximately 200 feet), construction noise levels would be up to but would not exceed 80 dBA Leq. Construction noise levels could potentially exceed 70 dBA Leq (8-hour) during nighttime; however, the proposed project is required to implement applicable LRDP mitigation measures. LRDP Mitigation NOIS-1 restricts loud construction activities within 100 feet of a residential receptor to the hours between 7:30 AM and 7:30 PM, Monday through Saturday. Although in the case of Heller site construction, the nearest receptor would be more than 200 feet from the site perimeter, nonetheless, the project includes LRDP Mitigation NOIS-1 and will comply with the hours of construction noted above. Therefore, the impact from construction noise at the Heller site would be less than significant.

Table 4.9-8
Calculated Worst-Case Construction Noise at Nearest Receptors - Heller Site

Construction Phase	Average Equivalent Noise Level (dBA, L_{eq})	
	Utility Corridor	Heller Development
	Porter/Kresge College Residences (200 feet)	Rachel Carson College Residences (350 feet)
Site Preparation	NA	72
Grading	80	75
Building Construction	NA	74
Paving	NA	69
Architectural Coatings	NA	70
Overall Range of Construction Noise Levels	80	69-75

Source: Illingworth & Rodkin, Inc. 2017.



SOURCE: Google Maps, 2018

FIGURE 4.9-1

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Heller Site - Sensitive Receptors

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Hagar Site

Construction activities planned at the Hagar site are anticipated to begin in Spring 2019 and end in Spring 2020, lasting approximately 12 months. Project construction phases would include site preparation, grading, building construction, paving, and architectural coating. Off-site construction activities would include trenching, placement of utility lines, backfilling, and restoring the disturbed area. **Figure 4.9-2** shows the Hagar site and associated utility corridor and the locations of the nearest sensitive receptors. Construction activities would occur on the 17-acre site in phases with work underway in different portions of the site at different points in time over the construction period. Consequently, construction noise levels received at the nearby receptors would vary depending on the noise producing activity underway and its location relative to the receptors. As with the Heller site analysis, two scenarios were also modeled for the Hagar site. The typical/average noise exposure scenario included modeling noise levels that would be received at the nearest receptor assuming that all noise producing equipment is located in the center of the Hagar site, whereas under the worst-case noise exposure scenario, noise levels were modeled assuming that the noise producing equipment is located near the perimeter of the Hagar site closest to the receptors.

Anticipated construction noise levels, by construction activity and phase, for the typical conditions are summarized in **Table 4.9-9, Calculated Typical Construction Noise Levels at Nearest Receptors – Hagar Site**. The typical levels are used to compare to the noise thresholds established above. The predicted typical construction noise levels resulting from construction activities at distances ranging from 350 feet to 700 feet from the nearest sensitive receptors (i.e., residences to the south) would not exceed the significance thresholds of 80 dBA Leq (8-hour) during daytime and evening periods.

Table 4.9-9
Calculated Typical Construction Noise Levels at Nearest Receptors - Hagar Site

Construction Phase	Average Equivalent Noise Level (dBA, L_{eq})		
	Utility Corridor	Hagar Development	
	Southern Residence (Hagar Meadow) (350 feet)	Southeast Residence (Rockridge Lane) (650 feet)	Southwest Residence (Hagar Meadow) (700 feet)
Site Preparation	NA	65	64
Grading	74	69	68
Building Construction	NA	60	59
Paving	NA	62	61
Architectural Coatings	NA	46	45
Overall Range of Construction Noise Levels	74	46-69	45-68

Source: Illingworth & Rodkin, Inc. 2017.

SOURCE: Google Maps, 2018

FIGURE **4.9-2**

IMPACT SCIENCES

Hagar Site - Sensitive Receptors

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The worst case noise levels are reported in **Table 4.9-10, Calculated Worst Case Construction Noise Levels at Nearest Receptors – Hagar Site,** below. As the results show, during the brief periods when utility construction would occur at the closest point to the nearby southern residences (approximately 200 feet), construction noise levels would be up to 79 dBA $L_{eq.}$ Construction noise levels could potentially exceed 70 dBA L_{eq} (8-hour) during nighttime; however, the proposed project is required to implement applicable LRDP mitigation measures. LRDP Mitigation NOIS-1 restricts loud construction activities within 100 feet of a residential receptor to the hours between 7:30 AM and 7:30 PM, Monday through Saturday. Although in the case of Hagar site construction, the nearest receptor would be more than 200 feet from the site perimeter, nonetheless, the project includes LRDP Mitigation NOIS-1 and will comply with the hours of construction noted above. Therefore, the noise impact due to project construction would be less than significant.

Table 4.9-10
Calculated Worst-Case Construction Noise Levels at Nearest Receptors - Hagar Site

Construction Phase	Average Equivalent Noise Level (dBA, L_{eq})		
	Utility Corridor	Hagar Development	
	Southern Residence (Hagar Meadow) (200 feet)	Southeast Residence (Rockridge Lane) (220 feet)	Southwest Residence (Hagar Meadow) (320 feet)
Site Preparation	NA	74	71
Grading	79	78	75
Building Construction	NA	69	66
Paving	NA	71	68
Architectural Coatings	NA	55	52
Overall Range of Construction Noise Levels	79	55-78	52-75

Source: Illingworth & Rodkin, Inc. 2017.

Mitigation Measures: No mitigation is required.

SHW Impact NOIS-4: Construction associated with the proposed project would not generate and expose nearby receptors and buildings to excessive groundborne vibration or groundborne vibrations. (*Less than Significant*)

The LRDP EIR determined that construction of future projects on the campus would not expose sensitive receptors to excessive groundborne vibration or groundborne noise because construction techniques having the potential of yielding relatively high vibration levels, such as pile driving or blasting, were not anticipated. Nonetheless, an evaluation was conducted to confirm that the construction activities associated with the proposed project would not result in excessive groundborne vibrations.

Table 4.9-11, Vibration Levels for Construction Equipment, below, presents typical vibration levels that could be expected from construction equipment at 25 feet. Vibration levels are highest close to the source, and then attenuate with increasing distance at the rate $(D_{ref}/D)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet.[10] Vibration levels produced by a vibratory roller (0.210 in/sec PPV at 25 feet) would represent a credible worst-case scenario for proposed construction activities, because as **Table 4.9-11** below shows, of the equipment that would be used, a vibratory roller would produce the highest vibrations. Therefore, that piece of equipment was used to calculate worse-case off-site vibrations and the assumption was made that the equipment would be operating near the perimeter of the site, closest to the nearest receptors. Note that off-site vibrations were calculated to analyze two potential effects: the potential for construction vibrations to cause damage to nearby buildings and the potential for construction vibrations to cause human annoyance. As noted earlier in this section, the threshold for damage to structures is vibration levels greater than 0.5 inches/second, peak particle velocity (in/sec PPV) for structurally sound buildings designed to modern engineering standards, 0.3 in/sec PPV for older residential buildings, and 0.25 in/sec PPV for historic and some old buildings. For vibrations to cause human annoyance, vibration levels produced by continuous/frequent intermittent sources of construction vibration must exceed 0.1 in/sec PPV at the receptors.

Table 4.9-11
Vibration Levels for Construction Equipment

Equipment		Vibration Levels at Representative Distances			
		PPV at 25 feet (in/sec)	PPV at 200 feet (in/sec)	PPV at 220 feet (in/sec)	PPV at 350 feet (in/sec)
Clam Shovel Drop		0.202	0.021	0.018	0.011
Hydromill	In soil	0.008	0.001	0.001	0.000
	In rock	0.017	0.002	0.002	0.001
Vibratory Roller		0.210	0.021	0.019	0.012
Hoe Ram		0.089	0.009	0.008	0.005
Large Bulldozer		0.089	0.009	0.008	0.005
Caisson Drilling		0.089	0.009	0.008	0.005

10 These levels are based on calculations assuming normal propagation conditions, using a standard equation of $PPV_{eqmt}=PPV_{ref} *(25/D)^{1.1}$.

Equipment	Vibration Levels at Representative Distances			
	PPV at 25 feet (in/sec)	PPV at 200 feet (in/sec)	PPV at 220 feet (in/sec)	PPV at 350 feet (in/sec)
Loaded trucks	0.076	0.008	0.007	0.004
Jackhammer	0.035	0.004	0.003	0.002
Small Bulldozer	0.003	0.000	0.000	0.000

Source: Federal Transit Administration, *Transit Noise and Vibration Impact Assessment.* May 2006.

Heller Site

Using the attenuation rate above, a vibratory roller would produce vibration levels of 0.021 in/sec PPV at Porter and Kresge Colleges which would be within 200 feet of the utility corridor for the Heller site. At the Rachel Carson College residences about 350 feet east of the Heller site, vibration levels would be about 0.012 in/sec PPV threshold. There would be no potential for damage to the buildings in the vicinity of the project site as these levels would be well below the applicable thresholds.

Groundborne vibration levels resulting from proposed construction equipment could be perceptible at times. A vibration limit of 0.1 in/sec PPV, produced by continuous/frequent intermittent sources of construction vibration would be strongly perceptible and would cause human annoyance. As reported above, the vibration levels at Porter and Kresge Colleges would be 0.021 in/sec PPV, and at the Rachel Carson College would be 0.012 in/sec PPV, both well below the threshold and therefore would not result in human annoyance.

Hagar Site

Similarly, a vibratory roller operating near the perimeter of the Hagar site would produce vibration levels of 0.019 in/sec PPV at the nearest residences which are 220 feet south of the Hagar site, and vibration levels would be 0.021 in/sec PPV when construction in the utility corridor occurs near the receptors to the south of the corridor. These vibration levels would not exceed applicable thresholds for damage to structures and also would not produce human annoyance.

The impact from construction phase vibrations at both sites would be less than significant.

Mitigation Measures: No mitigation is required.

4.9.5 PORTER AND RACHEL CARSON DINING FACILITIES EXPANSION PROJECT IMPACTS AND MITIGATION MEASURES

Environmental Setting

The proposed dining facilities expansion project would add to existing facilities on the west side of Rachel Carson College and to the southern end of Porter College. In both instances, the facilities would be located above or adjacent to existing buildings, or would replace the existing buildings with larger buildings. The ambient noise levels near Rachel Carson dining hall are affected by traffic on Heller Drive and activities within the college including the use of nearby sports facilities. The area where the Porter dining facilities would be expanded is relatively quieter as it is away from roadways and other noise sources.

Impacts and Mitigation Measures

DF Impact NOI-1: **Construction activities associated with the dining facilities expansion project would substantially increase noise levels at residential uses in the vicinity but would not expose persons to excessive groundborne vibration. The proposed project would not increase traffic-related noise levels.** (***Significant; Significant and Unavoidable***)

Permanent Increase in Noise Levels

The operation of the expanded dining facilities would not raise ambient noise levels in the vicinity of Rachel Carson and Porter Colleges as the activities would take place inside buildings. Due to the nature of the dining facilities expansion project, it would not result in an increase in daily traffic to and from the campus. As a result there would be no permanent increase in traffic-related noise on campus and city roadways due to the project. There would be no impact.

Construction Noise

Construction activities for the proposed dining facilities expansion project would involve adding a second story to existing buildings or an expansion of an existing building. If the former, construction would not involve grading or laying of foundations, whereas if the latter, there would be some ground disturbing activities such as grading and laying of foundations followed by building erection. Construction activities would occur within less than 100 feet of student residences and learning facilities, and the nearby students living and studying in Porter and Rachel Carson Colleges would be exposed to noise levels in excess of thresholds set forth in the 2005 LRDP EIR (exceed 80 dBA Leq (8h) daytime; 80

dBA Leq (8h) evening; 70 dBA Leq (8h) nighttime). Although LRDP Mitigation NOIS-1 would be implemented as part of the dining facilities expansion project, it is likely that noise levels would not be adequately controlled to stay below the threshold for daytime noise. Therefore, the noise impact would be expected to be significant and unavoidable.

The potential for construction noise associated with infill development that would be close to existing receptors on the campus was analyzed in the 2005 LRDP EIR and was found to be significant and unavoidable. This impact was adequately analyzed in the 2003 LRDP EIR and was fully addressed in the Findings and Statement of Overriding Considerations adopted by The Regents in connection with its approval of the 2005 LRDP. No conditions have changed and no new information has become available since certification of the 2005 LRDP EIR that would alter this previous analysis.

Groundborne Vibration

Table 4.9-7 above reports the types of construction equipment that produce vibrations. Most of the equipment would not be used for the dining facilities expansion project and it is anticipated that of these pieces, only jackhammers, load trucks and small bulldozers would be used, all of which produce low vibrations. Although the existing Rachel Carson and Porter College buildings are immediately adjacent to the construction sites, because these buildings are of recent construction and structurally sound, the low vibrations produced by the intermittent use of this equipment would not result in building damage. Although there would be some potential for vibrations to result in human annoyance, LRDP Mitigation NOIS-1 will be a part of the project which limits the time of the day when construction may occur near campus receptors. Therefore, the proposed dining facilities expansion project would be unlikely to result in a significant impact related to vibration. The impact would be less than significant.

Mitigation Measures: No further mitigation is feasible.

Significance after Mitigation: The impact from construction noise would be significant and unavoidable.

4.9.6 CUMULATIVE IMPACTS AND MITIGATION MEASURES

SHW Impact C-NOIS-1: **Implementation of the proposed project would not result in significant cumulative noise impacts. (*Less than Significant*)**

Long Term Cumulative Operational Traffic Noise Impacts

The cumulative operational traffic noise impacts of campus development under the 2005 LRDP are analyzed in the 2005 LRDP EIR under LRDP Impact NOIS-2. That impact evaluates the increase in noise in 2020 under two scenarios: a Without Project scenario that estimates the increase in noise levels along city streets as a result of 2020 background traffic volumes, and a With Project scenario that adds 2005 LRDP-related traffic volumes to 2020 background traffic volumes and then estimates the increased noise levels. The analysis presented under LRDP Impact NOIS-2, therefore, presents the cumulative noise impacts in the study area and finds that the traffic added to city streets as a result of campus growth under the 2005 LRDP would not increase noise levels substantially to result in significant cumulative noise impacts (UCSC 2006). As discussed above, the proposed SHW project (along with other reasonably foreseeable student housing projects) would decrease the total amount of daily and peak hour traffic to and from the campus compared to the traffic volumes projected and analyzed in the 2005 LRDP EIR. Therefore, the proposed project will not contribute to the previously evaluated cumulative noise impact and would, in fact, reduce the severity of the previously analyzed cumulative traffic noise impact.

Near Term Cumulative Construction Phase Impacts

With respect to cumulative construction noise and vibration impacts, those would occur if other projects were to be under construction at the same time as the proposed project, and if these concurrent projects would be in close proximity of the same sensitive receptor. **Table 4.0-1** (in **Section 4.0**) present the other reasonably foreseeable campus projects that would be under construction during the same time period as the proposed project. The potential for construction phase cumulative noise impacts is discussed below.

Heller Site

Construction of the proposed housing on the Heller site would occur between 2020 and 2023 over a period of about 3 years. Construction of the dining facilities at Rachel Carson and Porter College and the construction of the Kresge College improvements would also occur during this time period. However, students living in Kresge College would not be exposed to a cumulative construction noise impact because the Heller site is too distant from Kresge College to affect the receptors there, and as far as the Heller site utility corridor activities are concerned, those would not generate high levels of noise and would be completed in 2019 before construction at Kresge College commences. There would be no construction-phase cumulative impact at the Kresge receptors.

With respect to receptors in Porter and Rachel Carson Colleges, they would be exposed to noise from both the ongoing construction of the dining facilities as well as construction of the SHW project. As noted above, construction noise from the SHW project would not exceed the construction noise threshold at the receptors at either college. Furthermore, although the SHW construction noise would combine with the noise from the construction of the dining facilities expansion project, it would only cause a marginal, inaudible increase in ambient noise levels. This combined noise level would not cause the ambient noise levels to be audibly higher than they would be due to the construction of the dining facilities alone. Therefore, the SHW project would not significantly contribute to a cumulative noise impact at the receptors (the significant impact at the college receptors would be solely due to the dining facilities expansion project).

Hagar Site

With the exception of one project, none of the reasonably foreseeable campus projects are in the vicinity of the Hagar site, and therefore there is no potential for the proposed project to result in a cumulative construction noise impact on nearby receptors. Although the Campus is in the early stages of planning for development of new employee housing, potentially utilizing the Ranch View Terrace Phase 2 site, the number and type of units and the location have not been determined. Therefore, construction schedule for a potential project at the Ranch View Terrace Phase 2 site is not known at this time and it is unlikely that that project would be constructed in 2019-20, the same time as the project construction on the Hagar site. There would be no construction-phase cumulative impact at the nearby receptors.

Mitigation Measures: No mitigation is required.

4.9.7 REFERENCES

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