C. Noise

1. Introduction

This section presents the potential noise impacts of both the Original Project and the Business Plan Project Alternative. Wherever a discernible difference exists between the two projects, it is clearly called out for the reader. Unless otherwise indicated, the reader should assume that the impacts of the two projects would be identical.

In order to more thoroughly assess the existing noise environment as requested by commenters on the previous Draft EIR, SCCRTC performed additional noise measurements in the corridor on September 20 and 21, 2004. (See Figure 3.) Measurements included long-term (24-hour) readings to confirm the existing condition for homes along the rail line right-of-way. The SCCRTC also commissioned actual measurements from an operating BUDD rail car providing recreational rail service in Portland, Oregon.

The results of these analyses are presented in this section, and show that while the existing 1-hour average sound level in the corridor is similar to what was presented in the original Draft EIR, the existing 24-hour average sound level is actually greater than what was presented in the original Draft EIR. Based on these data, the potential impacts of both the Original Project and the Business Plan Project Alternative on the sound level in the corridor are somewhat less than originally estimated, although the potential impacts of both projects are still found to be potentially significant without mitigation.

The section also details the SCCRTC efforts to establish a community quiet zone within the corridor, which would preclude the use of train horns and would greatly reduce the potential noise impact of either project. If the SCCRTC is unsuccessful in establishing the community quiet zone because the Federal Railroad Administration chooses not to allow such a zone, both the Original Project and the Business Plan Project would result in a significant and unavoidable temporary or periodic noise impacts from whistle soundings and warning bells at at-grade crossings.

2. Approach and Methodology

This section describes the existing noise environment of the project area and surroundings during the proposed hours of operation: 11:00 a.m. to 8:00 p.m. In addition, potential impacts from construction activities and increases in traffic and operation of both proposed projects are discussed and compared to the existing environment to establish the potential impact of the proposed project. Mitigation measures are proposed to reduce impacts, as necessary.

Information in this section is based on the *Noise and Vibration Assessment* prepared by Illingworth & Rodkin, Inc. (December 2004), which measured existing noise levels and analyzed projected increases in noise levels as a result of the project. Terminology, standard practices and assumptions of noise analysis are described throughout the section. All technical reports are available for public review between the hours of 8:00 a.m. and 5:00 p.m. at the Santa Cruz County Recreational Transportation Commission (SCCRTC): 1523 Pacific Avenue, Santa Cruz, CA. Technical reports are also available online at www.sccrtc.org

Pursuant to the methodologies of both local and federal jurisdictions, the potential impact of train noise is not evaluated based on the instantaneous sound level produced as a train passes by. Both the local jurisdictions and the Federal Transit Administration (FTA) utilize *average* sound levels to determine whether an impact would occur. As described in the Standards of Significance, the FTA standards utilize the highest hourly average (L_{eq}), which is much stricter than the local standards, which are based on a 24-hour average (L_{dn}). The stricter FTA standards are utilized in this analysis even though the project is not subject to FTA review or approval.

Instantaneous sound levels are taken into account, though they are placed in context, so that short-term noise spikes, by themselves, are not a sufficient basis for considering noise impacts to be significant. Although the L_{eq} and L_{dn} methodologies are conservative insofar as they *do* account for single noise events, there is no accepted environmental noise criterion for single-events, with the exception of methodologies employed to measure single event noise from jet aircraft.

Community response (annoyance) is related to three factors: the noise level and duration of an event, the number of events over a given time period (such as an hour or a day), and the quality or type of noise. The measurements used in the EIR – the hourly average noise level (L_{eq}) and the 24-hour average noise level (L_{dn}) – are generally accepted criteria and are the criteria used by the County of Santa Cruz and the FTA. These criteria take into account the magnitude of individual noise levels, and also their duration and the number of events per hour. For an additional discussion of this subject the reader is referred to *Community Noise Rating, 2nd Edition*, by Theodore J. Schultz.

a. Fundamental Concepts of Environmental Acoustics

Definition of 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 lower pitched signals. 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 that 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.

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. 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. Representative outdoor and indoor noise levels in units of dBA are shown in Table III.C.1.

TABLE III.C.1 – Typical Noise Levels in the Environment

External Noise Sources		Internal Noise Sources
	120 dBA	
Jet fly-over at 300 meters		Rock concert
	110 dBA	
Pile driver at 20 meters	100 dBA	
		Night club with live music
	90 dBA	
Freight train pass by at 8 meters Large truck pass by at 15 meters		
	80 dBA	Noisy restaurant
		Garbage disposal at 1 meter
Gas lawn mower at 30 meters	70 dBA	Vacuum cleaner at 3 meters
Commercial/Urban area daytime		Normal speech at 1 meter
Suburban expressway at 90 meters	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	
Most quiet remote areas	10 dBA	Quiet recording studio
Threshold of human hearing	0 dBA	Threshold of human hearing

L_{eq} – a one-hour average sound level

The L_{eq} is a measurement of the average sound level occurring during a one hour period. The L_{eq} measures the hour during which the highest hourly average level of sound occurs. To identify the highest hourly L_{eq}, measurements are taken throughout a 24-hour period and then the data is reviewed to establish which hour produced the highest average level of sound. This hour then becomes the $L_{eq.}$

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.

L_{dn} – a 24-hour average sound level

The L_{dn} is a measurement of the average sound level occurring during a 24-hour period. To calculate the L_{dn}, a series of continuous measurements (i.e., measurements recorded every second) are taken throughout a 24-hour period. The L_{dn} measurement also includes a 10 decibel penalty for all sound occurring after 10 p.m. and before 7 a.m., since the sensitivity to noise increases during the evening and especially at night when excessive noise interferes with the ability to sleep. For instance, if a sound level is measured at 45 dB at 11 p.m., a reading of 55 dB is used in the calculation of the 24-hour average. The L_{dn}, or day/night average sound level, is therefore a measure of the cumulative noise exposure in a community.

Definition of Ground-Borne Vibration

Vibrations generated by trains can be annoying to persons living along the rail alignment. Vibrations could also interfere with processes such as precision manufacturing. In the noise study prepared for this project, the vibration spectrum is presented in terms of the root mean square (RMS) velocity level in decibels.[1] The measured vibration levels are presented in each one-third octave band whose center frequency ranges from 4 hertz (Hz) to 100 Hz.[2]

The amount of vibration that is impacted into the ground is a function of the speed and weight of the train, the roundness of the wheels, the type of track and the presence of switches. The distance one is from the track is an important factor in determining anticipated vibration levels. The rate of dissipation of vibration in the ground varies depending on the characteristics of the ground. Typical attenuation rates range from 3-10 VdB per doubling of distance. The vibration velocity varies with the speed of the train at a rate roughly proportional to 6 VdB per doubling or halving of the speed of the train.

b. Local and Federal Regulations

While mobile noise sources such as trains have an instantaneous effect during the period of time when they pass by, both local and federal regulations governing the evaluation of noise impacts use an average of the sound level over a longer period of time to calculate and evaluate noise impacts. Both of these methodologies are presented below and were used to analyze the potential impacts of the proposed project.

[1] The reference velocity is 1 x 10^{-6} inches/second RMS, which equals 0 VdB, and 1 inch/second equals 120 VdB. Although not a universally accepted notation, the abbreviation "VdB" is used in this document for vibration decibels to reduce the potential for confusion with sound decibels.

[2] Hertz measures the frequency of sound waves per second. Average human hearing ranges from 0 Hz to 20 kHz.

Local Regulations

Santa Cruz County and the City of Capitola require that new development conform to land use compatibility guidelines specified in the *Santa Cruz County General Plan*. Noise levels at residential or other noise-sensitive uses are not considered compatible if they exceed a day/night standard (L_{dn}) of 60 dBA outside and 45 dBA indoors. As described on page III.C.4, the L_{dn} represents a 24-hour average calculation of sound.

Santa Cruz County: Santa Cruz County has adopted the following General Plan policies to address potential noise impacts generated by ground transportation systems

6.10.1 Require environmental review of all proposed transportation projects that may increase the average day/night noise levels (L_{dn}) including any increased or new uses of the Union Pacific/Southern Pacific right-of-way**.**

6.10.2 Require the evaluation of mitigation measures for any project that could cause significant degradation of the noise environment by:

a) causing the L_{dn} in existing residential areas to increase by 5 dBA or more and remain below 60 dBA;
b) causing the L_{dn} in existing residential areas to increase by 3 dBA or more and, thereby, exceed 60 dBA; or
c) causing the L_{dn} in existing residential areas to increase by 3 dBA or more if the day/night noise level currently exceeds 60 dBA.

City of Capitola: To date, noise has not been considered a significant or widespread problem in the City of Capitola. However, the City has established a goal to minimize vehicular and stationary noise sources and noise emanating from temporary activities (e.g., construction). To achieve this goal, the City would consider the effect of any proposed rail operations on abutting properties. The Noise Element of the City's General Plan does not contain quantitative standards for evaluating noise impacts**.**

Federal Regulations

The Federal Transit Administration (FTA) noise impact criteria[3] for mass transit projects involving rail or bus facilities apply to all rail projects (e.g., rail rapid transit, light rail transit, commuter rail and automated guideway transit) as well as to fixed facilities such as storage and maintenance yards, passenger stations and terminals, parking facilities and substations. Although the proposed project is not technically subject to Federal standards and criteria, FTA guidelines provide the most consistently used and conservative methodology for evaluating potential noise impacts of rail projects. Thus, although SCCRTC is not required to use this methodology, either under federal law or under CEQA, SCCRTC has nevertheless used this methodology in order to take the most conservative accepted approach to noise impact assessment.

[3] U.S. DOT Transit Noise and Vibration Impact Assessment, April, 1995.

Based on the FTA noise criteria, SCCRTC has used the worst hour L_{eq} measurement to determine potential impacts of the project. This measurement will be compared to the quietest hour L_{eq} during the proposed hours of operation to establish the potential impact of the proposed project. Hourly L_{eq} is the appropriate measurement because although the project area includes residences and places where people normally sleep, the area also includes park and recreational lands as described under land use category 3 in Table III.C.2. Furthermore, the recreational train is proposed to be run during daylight hours, would not interfere with sleep, and would not alter freight operations.

The hourly L_{eq} measurement is based on a comparison of the existing outdoor noise levels and the future outdoor noise levels from the proposed project during the proposed hours of operation. The measurement incorporates both absolute criteria, which consider activity interference caused by the transit project alone, and relative criteria, which consider annoyance due to the change in the noise environment caused by the proposed transit project. The noise criteria and descriptors depend on land use, as defined in Table III.C.2.

The severity of a potential noise impact is based on the amount that the project would increase the hourly $L_{eq..}$ Based on the existing background noise environment within the project limits, the threshold for impact would be an increase of 10 dBA. According to the Federal Transit Administration guidelines, a project is judged to have one of three levels of impact: either no impact, impact, or severe impact. Based on these guidelines, a 10 dBA increase in the hourly L_{eq} would be considered an impact, but not a severe impact.

Table III.C.2 –Land Use Categories and Metrics for Transit Noise Impact Criteria

Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor $L_{eq}(h)$[a]	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet and such uses as outdoor amphitheatres and concert pavilions, as well as National Historic Landmarks with significant outdoor use.
2	Outdoor L_{dn}	Residences and places where people normally sleep. This category includes homes, hospitals and hotels where nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq}(h)$[a]	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries and churches, where it is important to avoid interference with such activities as speech, meditation and concentration on reading materials. Buildings with interior spaces where quiet is important, such as medical offices, conference rooms, recording studios and concert halls, fall into this category. Places for meditation or study are associated with cemeteries, monuments and museums. Certain historical sites, parks and recreational facilities are also included.

Source: U.S. Department of Transportation, *Transit Noise and Vibration Impact Assessment,* April 1995
[a] L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.

Ground-Borne Vibration Impact Criteria

The criteria for environmental impact from ground-borne vibration and noise are based on the maximum levels for a single event. The criteria presented in III.C.3 account for variation in project types as well as

the frequency of events, which differ widely among transit projects. Most experience is with the community response to ground-borne vibration from rail rapid transit systems with typical headways in the range of 3 to 10 minutes and each vibration event lasting less than 10 seconds. It is intuitive that when there will be fewer events each day it should take higher vibration levels to evoke the same community response. The criteria account for this by distinguishing between projects with frequent and infrequent events. *Frequent Events* is defined as more than 70 events per day. Both the Original Project and the Business Plan Project Alternative would fall into the infrequent event category. As shown in III.C.3 Land Use Category 2 , the criteria for residential uses along a line experiencing *Infrequent Events* is 80 VdB for ground-borne vibration and 43 dBA for ground-borne noise.

Table III.C.3 –Ground-Borne Vibration and Noise Impact Criteria

Land Use Category	Ground-Borne Vibration Impact Levels (VdB re 1 micro inch/second)		Ground-Borne Noise Impact Levels (dB re micro Pascals)	
	Frequent Events[a]	Infrequent Events[b]	Frequent Events[a]	Infrequent Events[b]
1: Buildings where low ambient vibration is essential for interior operations.	65 VdB[c]	65 VdB[c]	N/A[d]	N/A[d]
2: Residences and buildings where people normally sleep.	72 VdB	80 VdB	35 dBA	43 dBA
3: Institutional land uses with primarily daytime uses.	75 VdB	83 VdB	40 dBA	48 dBA

Source: U.S. Department of Transportation, *Transit Noise and Vibration Impact Assessment,* April 1995
[a] Frequent events are defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.
[b] Infrequent events are described as fewer than 70 vibration events per day. This category includes most commuter rail systems.
[c] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels.
[d]Vibration-sensitive equipment is not sensitive to ground-borne noise.

3. Environmental Setting

a. Existing Land Uses

The corridor is characterized by single- and multi-family residential which line the railroad right-of-way throughout most of the project area. Exceptions to this condition include commercial uses in Aptos Village and recreational uses at New Brighton State Beach Park. No other sensitive receptors such as schools or elder care facilities exist along the right-of-way in the project area. Residences along the project area vary in distance from the railroad track from approximately 25 feet to more than 100 feet. The majority of residences are located more than 35 feet from the centerline of the tracks. Approximately 32 residences are located within 35 feet of the tracks, and approximately 5 residences are located within 25 feet of the tracks.

b. Existing 1-Hour Average (Leq) and 24-Hour Average (Ldn)

Measurement Locations

As shown in Figure 3 – Noise Measurement Locations and Intersections Studied, noise measurements were conducted at six locations in the project area. Locations 1, 2, and 3 were originally studied in 1995 as part of the environmental assessment for the Major Transportation and Investment Study (MTIS).[4] The MTIS data provides a historical baseline for noise levels in the corridor.

New short-term measurements (15-minute duration) were taken at these same three sites on November 10, 2003 as part of the preparation of the 2004 Draft EIR. The sites are representative of residences located in close proximity to the rail line. The measurements were conducted using Larson Davis Laboratories Model 700, 812, and 820 integrating sound level meters. The system was calibrated before each reading using a Larson Davis Acoustical Calibrator. (Instruments are also sent back to the manufacturer each year for laboratory calibration).

Long term (48-hour) noise measurements were conducted at sites A, B, and C on September 20 and 21, 2004. These measurement locations were also representative of residences located in close proximity to the rail line. The long-term measurements consisted of data taken throughout a 48-hour period at each of the three measurement locations. Measurements are continuous, i.e., a reading is recorded every second during the 48-hour period. In addition to measuring the loudest instantaneous noise level, this comprehensive amount of data allow the 1-hour average (L_{eq}) and the 24-hour average (L_{dn}) to be identified at each of the three locations. Furthermore, a freight train passed through the corridor on September 20, 2004, allowing the 24-hour L_{dn} to be calculated both with and without the train passby. Figures 4, 5, and 6 show the locations where the additional long-term measurements were taken.

1-Hour Average (L_{eq})

Table III.C.4 presents the results of the measurements taken in November 2003 and September 2004. As shown by the data, the results between the two groups of measurements are very similar.

The 2003 data determined that the 1-hour average sound level in the corridor is between 42 and 48 dB. This short-term data was collected with an observer present so that the influence of more localized activities, such as instantaneous vehicle passbys, dogs barking, yard maintenance, leaf blowers, airplane overflights, etc., would not be included. Strictly speaking, of course, these events do contribute to the background noise environment and average noise levels over an hour would be anticipated to be higher.

The 2004 data show that the existing 1-hour average sound level in the project corridor during the hours of operation is above 51 dB. However, this data was collected solely by machine during the 48-hour study period, so the influence of local factors such as local traffic is included in the measurement. When these influences are factored out (by analyzing the background noise levels) the 1-hour average noise level would be above 46 dB even at the quietest locations. This sound level is within the range determined by the 2003 measurements shown above.

[4] *Environmental Screening Technical Report for the Watsonville Junction to Santa Cruz Corridor*, Parsons Brinckerhoff Quade and Douglas, Inc., April 1, 1998.

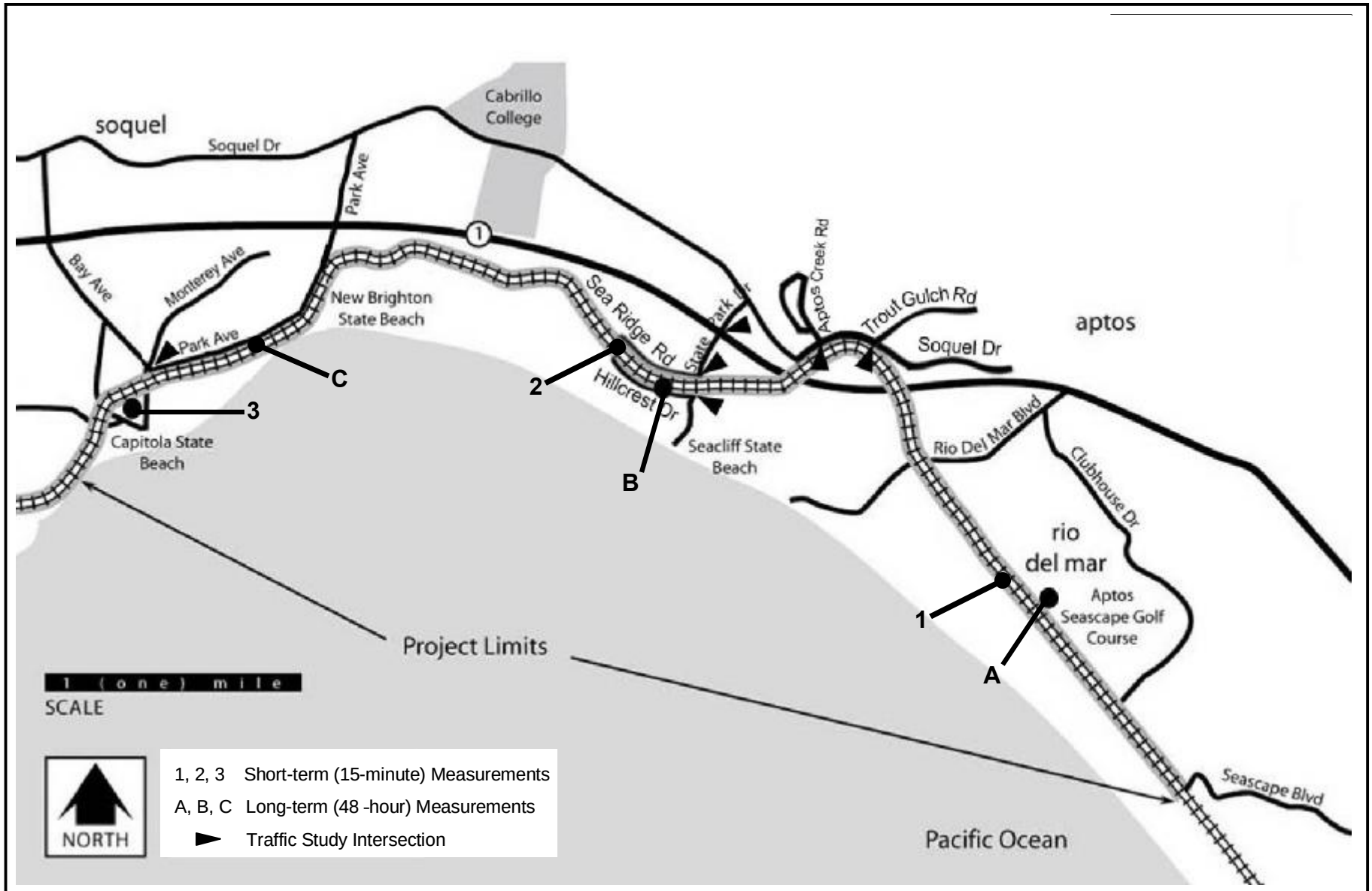

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Figure 3

Noise Measurement Locations and Intersections Studied

Not to Scale

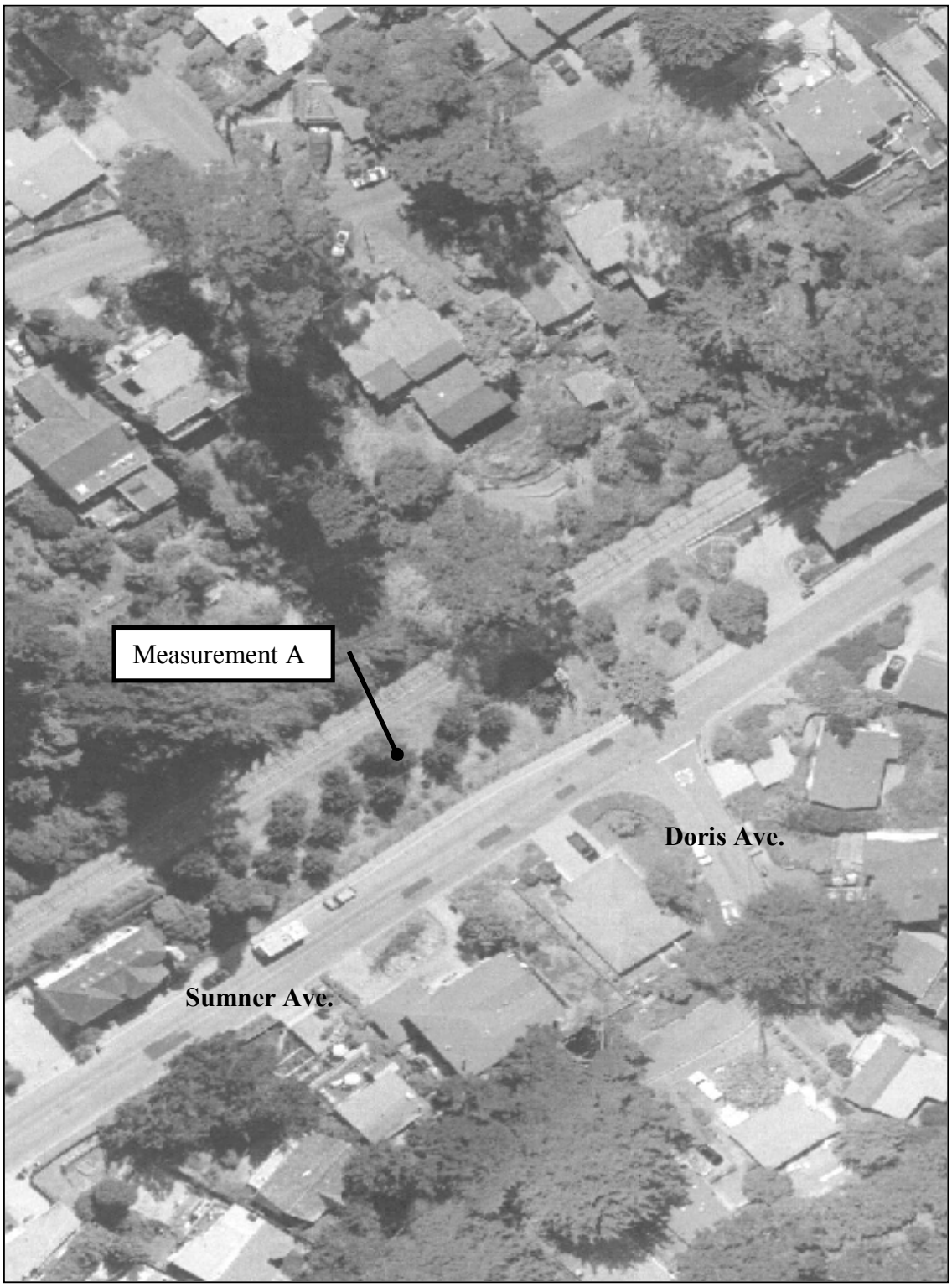

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Figure 4

Measurement Location A

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Figure 5

Measurement Location B

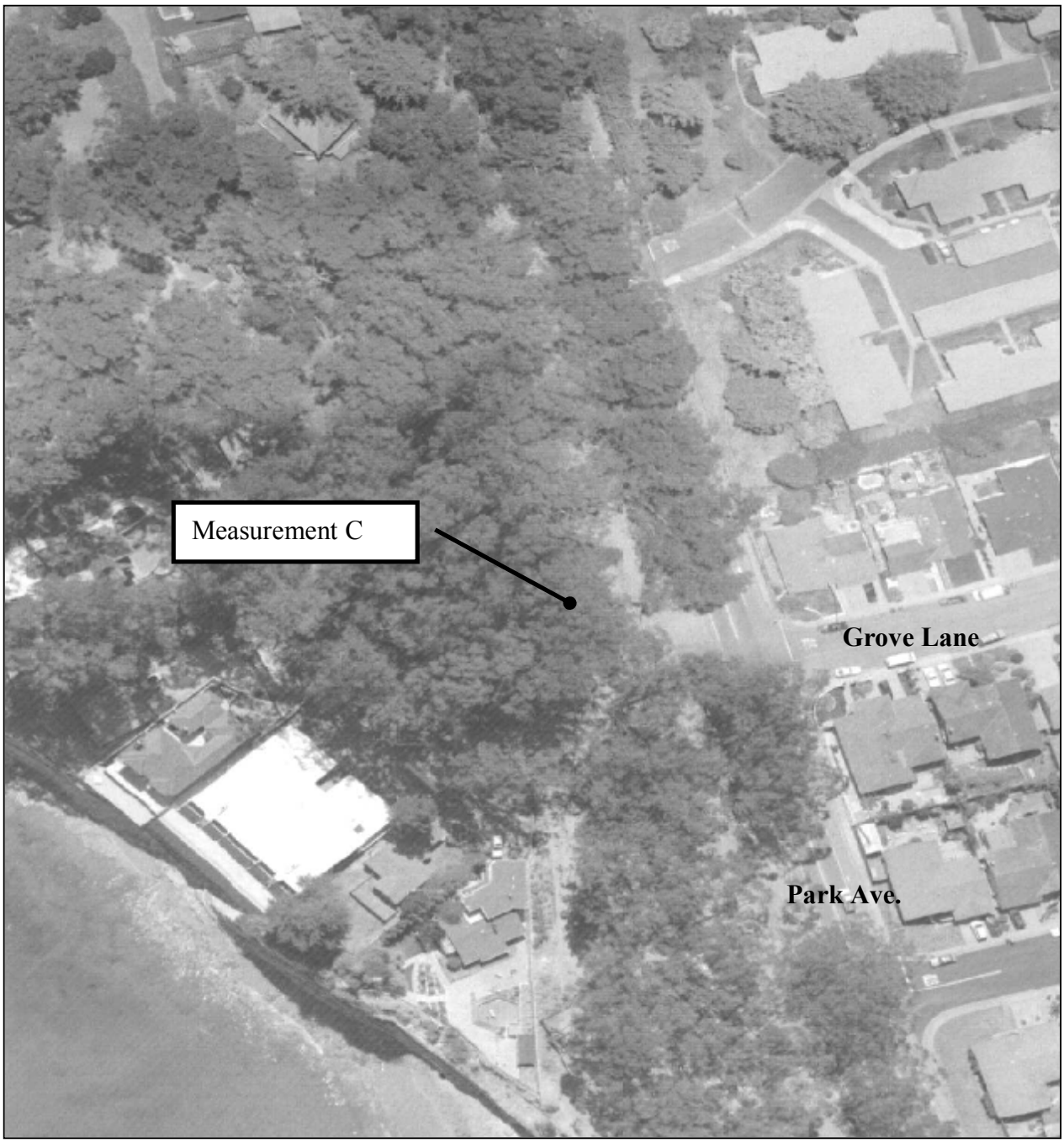

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Figure 6

Measurement Location C

For the purposes of this revised Draft EIR, a 1-hour average (L_{eq}) of 46 dB is utilized to represent the existing daytime background noise level in the corridor.

Table III.C.4 Results of Short-Term Noise Measurements (November 1995 and November 2003)

Site	Location	Start Time/Date	L_{eq}	L_{90}	L_{50}	L_{10}	Noise Sources
1	Farmer Way near Cherry St.	2:55 PM, Nov. 28, 1995	44	40	42	44	Background sources, Capitola traffic
		12:47 PM/Nov. 10, 2003	45	42	44	46	Capitola traffic
2	Rio Del Mar - Dry Creek Rd. near Sumner Ave.	5:15 PM/Nov. 28, 1995	48	42	46	50	Sumner Ave. traffic
		11:28 AM/Nov. 10, 2003	47	34	42	50	Summer Ave. traffic
3	Seacliff residential area; Hillscrest Dr. near Beachgate Way	3:32 PM/Nov. 28, 1995	44	39	42	47	Background traffic.
		12:18 PM/Nov. 10, 2003	42	35	39	46	Distant traffic and general aviation aircraft.

24-Hour Average (L_{dn})

The range for the 24-hour average sound level in the corridor was determined to be 45 to 50 dB as presented in the original Draft EIR.

Additional measurements conducted on September 20 and 21, 2004 provided more data to substantiate the analysis of the existing sound level in the corridor. As shown in Table III.C.5, the data from the three measurement locations show that the existing 24-hour average sound level in the project corridor, without a train passby, ranges from 56 to 61 dB, depending on the location. With a train passby, the 24-hour average sound level ranges from 57 to 63 dB, depending on the location.

Both of these ranges are higher than the 45 to 50 dB 24-hour average that was estimated using the short-term measurements collected in 2003.

For the purposes of this revised Draft EIR, a 24-hour average (L_{dn}) of between 56 and 61 dB is utilized to represent the existing daytime background noise level in the corridor.

Table III.C.5 Long-Term Noise Measurements Taken in September 2004 (Train Passby – 6 to 7 p.m.)				
Site	**Location**	**Highest Measurement (L_{max})**	**1-hour L_{eq} Range (dBA)**	**24-hour L_{dn} Range (dBA) (without/with train passby)**
A	Rio Del Mar	86 dBA between 11 to 12 noon and again between 6 to 7 p.m.	51 to 63 Train passby 64	56.2 / 57.5
B	Sea Cliff Area	80 dBA between 11 to 12 noon and again between 6 to 7 p.m.	51 to 55 Train passby 70	57.7 / 59.6
C	Capitola	103 dB between 6 to 7 p.m. when the train sounded its horn	55 to 68.6 Train passby 73	60.9 / 62.7

Instantaneous Sound

The existing Union Pacific freight trains operating on the rail line were measured and found to produce an instantaneous sound level of 83 to 91 dBA at a distance of 25 feet from the rail road track, depending on the throttle setting. The maximum or peak measurement of existing sound in the corridor is therefore 91 dBA.

Pursuant to the methodologies of both local and federal jurisdictions, the potential impact of train noise is not evaluated based on the instantaneous sound level (83 to 91 dBA) produced as a train passes by. Both the local jurisdictions and the FTA utilize *average* sound levels to determine whether an impact would occur. As described in Section 2.b Local and Federal Regulations, the FTA standards use the highest hourly average (L_{eq}), which is much stricter than the local standards, which are based on the 24-hour average (L_{dn}). The stricter FTA standards are used for this analysis even though the project is not subject to FTA review or approval.

BUDD Rail Car Noise Assessment

The actual train that would be used for the project has not been selected by SCCRTC. The SCCRTC is considering the BUDD diesel unit or another similar diesel mechanical unit because these rail vehicles meet Federal Railroad Administration requirements allowing them to share tracks with freight trains. The noise modeling was based on published data provided for self-powered diesel mechanical units that are typically used for commuter service. These units are much quieter than freight trains. A good summary of this information is in a report prepared for the Southern New Jersey Light-Rail Transit System by Daniel,

Mann, Johnson, Mendehall and Booze, Allen and Hamilton entitled *Report on Visit to European Manufacturers of Diesel Rail Vehicles*. A copy of this report is available at the SCCRTC offices.

In order to obtain more accurate data regarding the operation of the proposed BUDD rail car, the SCCRTC commissioned noise measurements to be taken from a BUDD recreational rail car that operates in Portland, Oregon as part of the Lewis & Clark Explorer Train Program. The train was operated between May and September on Friday, Saturday, Sunday, and Monday.

The noise measurements taken during September 2004 indicate that at a distance of 50 feet, the train generates a sound level of 77 dBA when it travels at 15 miles per hour (mph) and 84 dBA when it travels 35 mph. The train horn was also measured and the maximum noise level was 105 dBA at a distance of 30 feet from the train. The train horn measurement was made when the train was approaching the meter (train horns are directional, with the highest levels emitted toward the front). Train horns can vary in the level of sound produced, with some horns capable of producing a sound level of more than 100 dBA at a distance of 700 feet. To be conservative, this analysis utilizes the worst case train horn sound level to evaluate the potential impacts of the project.

Existing Ground-borne Vibration and Noise

Ground-borne vibration in the project corridor was measured to range from 78 to 85 VdB at a distance of 25 feet during freight train passbys. Ground-borne vibration was measured using a Bruel and Kjaer Type 4366 Accelerometer connected to a Larson-Davis Laboratories Model 3100 Real Time Analyzer. The system was calibrated using a Bruel and Kjaer Type 4294 Calibration Exciter.

4. Impacts and Mitigation

a. Standards of Significance

Based on inquiries found in the sample Initial Study Checklist attached as Appendix G to the CEQA Guidelines, as well as local and federal regulations and the professional judgment of SCCRTC staff and consultants, the proposed project would have a significant impact if any of the following criteria are met:

Criterion 1: Pursuant to Policy 6.10.2 of the General Plan of Santa Cruz County, the project resulted in any of the following conditions:

a. causing the L_{dn} in existing residential areas to increase by 5 dBA or more and remain below 60 dBA;

b. causing the L_{dn} in existing residential areas to increase by 3 dBA or more and, thereby, exceed 60 dBA; or

c. causing the L_{dn} in existing residential areas to increase by 3 dBA or more if the day/night noise level currently exceeds 60 dBA.

Criterion 2: Pursuant to criteria of the FTA, the proposed project would cause the hourly L_{eq} at a sensitive receptor to increase by 10 dBA or more.

Criterion 3: The project would expose persons to or generate excessive ground-borne vibrations (>80 VdB) or ground-borne noise levels (>43 dBA) pursuant to FTA criteria.

Criterion 4: Pursuant to the criteria of the FTA, the project would result in a substantial permanent increase of more than 10 dBA in ambient noise levels in the project vicinity above levels existing without the project.

Criterion 5: Pursuant to the criteria of the FTA, the project would result in a substantial temporary or periodic increase of more than 10 dbA in ambient noise levels in the project vicinity above levels existing without the project.

Criterion 6: The project is located within an airport land use plan or within two miles of a public airport and would expose people residing or working in the project area to excessive noise levels.

Criterion 7: The project is located within the vicinity of a private air strip and would expose people residing or working in the project area to excessive noise levels.

The following section presents the project's potential impacts relative to each of these criteria.

b. Less Than Significant Impacts

Criterion 3 (Ground Borne Vibration): The proposed project would not expose the public to excessive ground-borne vibrations or noise levels.

The proposed self-propelled diesel train units would generate vibration levels of approximately 78 VdB at 25 feet, which is similar to a rapid transit vehicle[5], and is considerably less than what is currently generated by the freight trains operating along the rail line. Freight trains currently generate between 78-85 VdB with each passby. The 78 VdB generated by either the Original Project or the Business Plan Project Alternative is within the 78-85 VdB of vibration currently experienced in the corridor, and is also below the 80 VdB criterion for infrequent events as described in Table III.C.3. No mitigation would be required.

Ground-borne noise is only a problem where the railroad is underground. There would be no ground-borne noise generation due to the project.

Table III.C.6 Comparison of Project to Ground-Borne Vibration Standards

Federal standard (FTA criteria)	Existing VdB	Project VdB	Impact
(>80 VdB) ground-borne vibration	78-85 VdB	78 VdB	No Impact (Project would not increase existing level of vibration)

Criteria 6 and 7 (proximity to a public or private airport): The proposed project is not located within two miles of a public airport or within the vicinity of a private airstrip and therefore would not be anticipated to create an adverse impact.

[5] Rapid transit refers to urban transportation systems which utilize either at-grade or underground rail systems, or a combination of both.

c. Potentially Significant Impacts

Criterion 1 (local regulations)

Train Noise

Regarding the operation of the train itself, neither the Original Project nor the Business Plan Project Alternative would result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project. The 24-hour average sound level (L_{dn}) at any individual location studied would increase by 1 dB or less with the addition of either the Original Project or the Business Plan Project Alternative, as explained in more detail below.

The current estimate of 24-hour L_{dn} in the project corridor ranges from a low of 56.2 dBA at Location A to a high of 60.9 dBA at Location C. The projected future L_{dn} with the Original Project would range from 57 dBA at location A to 61 dBA at Location C at a distance of 25 feet from the tracks. The projected future L_{dn} with the Business Plan Project Alternative would range from 56 dBA at Location A and 61 dBA at Location C at a distance of 25 feet from the tracks.

As shown in Table III.C.7, pursuant to the local criteria that utilize L_{dn} as the measure of significant impact, the train noise from both the Original Project and the Business Plan Project Alternative would result in an increase of less than 5 dB or more over the existing L_{dn} at any location studied within the project corridor. The L_{dn} does not increase dramatically because it is a 24-hour average and each train passby represents a very short period of time within the 24-hour period.

Table III.C.7 Comparison of Projected Train Noise to Local Standards

Local standards (Santa Cruz County and Capitola)	Existing L_{dn} Range	Original Project Future L_{dn} Range	Business Plan Project Future L_{dn} Range	Impact
>5 dBA increase over existing L_{dn}	56-61 dBA	57-61 dBA	56-61 dBA	Less than Significant

Train Noise plus Train Horn Noise at Crossings

Trains are required to sound a horn as they approach a grade crossing to warn motorists and pedestrians of their approach. Noise levels generated by train horns within a 700-foot radius of the crossing could be expected to reach over 100 dBA,

When the sounding of the train horn is added to the noise generated by the train itself, and the number of horn soundings at a given location is calculated over a 24-hour period, a 24-hour combined average sound level can be calculated. This average will vary depending on the location within the corridor, since average sound levels vary throughout the corridor from 56 dBA in the quietest locations to 61 dBA in the loudest locations as described in Table III.C.5.

As shown in Table III.C.8, for the Original Project, with 9 round trips and 18 horn soundings per day at a given crossing location, the 24-hour average (L_{dn}) within 700 feet of a crossing would range between 66 dBA at the quietest locations and 67 dBA at the loudest locations in the corridor.

For the Business Plan Project Alternative, with 4 round trips and 8 horn soundings per day at a given crossing location, the 24-hour average (L_{dn}) within 700 feet of a crossing would range between 63 dBA at the quietest locations and 65 dBA at the loudest locations in the corridor.

According to the criteria established by the Santa Cruz County General Plan, both the Original Project and the Business Plan Project Alternative would result in a potential significant impact because at both the quietest and loudest locations studied, both projects would result in either a greater than 5 dB increase or a 3 dBA increase where the existing sound level is above 60 dBA.

Table III.C.8 Comparison of Projected Train Horn Noise to Local Standards (all measurements are dBA)

		Original Project		Business Plan Project Alternative	
	Existing 24-hour noise level	Future 24-hour Avg.	Significant Impact?	Future 24-hour avg.	Significant Impact?
Quietest Location	56	66	Yes	63	Yes
Loudest Location	61	67	Yes	65	Yes

Criterion 2 and 4 (Federal Regulations):

Regarding the 1-hour average sound level, (L_{eq}), both the Original Project and the Business Plan Project Alternative could cause the existing L_{eq} at a residence to increase by 10 dB or more. For the measurement locations shown in Figure 3, the current hourly average noise level (L_{eq}) without the project is 46 dBA at a distance of 25 feet from the rail line, while the future projected L_{eq} when the train is operating would be 54 dBA at 25 feet, representing an 8 dBA increase. This result is the same for both the Original Project and the Business Plan Project Alternative since both projects would result in a maximum of one round trip (two passbys) in any given hour.

As shown in Table III.C.9, although an 8 dBA increase is less than the 10 dBA increase identified by FTA as the threshold of significance, this increase is nevertheless considered potentially significant because the projected increase approaches 10 dBA and there is uncertainty about the level of noise emission of the actual train to be used by the SCCRTC.

Table III.C.9 Comparison of Project to Federal Noise Standards

Standard (FTACriteria)	Existing L_{eq}	Future L_{eq}	Impact
>10 dBA increase over existing L_{eq}	46 dBA	54 dBA	8 dBA increase - Potentially significant, since uncertainty of actual noise emission could result in >10 dBA increase during operation.

Criterion 5 (temporary or periodic increase in ambient noise): The frequency of train horn soundings at at-grade crossings and the sounding of grade crossing warning bells would increase proportionally with the increase in train trips. The frequency of this type of sound would increase during the days of operation, representing a potentially significant temporary or periodic increase in ambient sound.

Train Horns

Noise levels generated by train whistles within a 700-foot radius of the crossing could be expected to reach over 100 dBA which would generate an hourly L_{eq} noise level of up to 70 dBA, which would be more than 10 dBA above the existing hourly average of 46 dBA. This periodic increase in whistle soundings would be considered substantial and would be considered a significant impact**.**

Crossing Bells

Crossing bells typically generate a sound level of 69 to 71 dBA at a distance of 100 feet, which would generate an hourly L_{eq} noise level of 56 dBA, which would be 10 dBA above the existing hourly average of 46 dBA This periodic increase in warning bell soundings would also be considered a substantial increase and would represent a potentially significant impact.

Establishment of Community Quiet Zone

In December 2003, the Department of Transportation Federal Railroad Administration (FRA) issued an Interim Final Rule (49 CFR Parts 222 and 229 Use of Locomotive Horns at Highway-Rail Grade Crossings) regarding the use of locomotive horns at highway-rail crossings. The rule provides exemptions for the creation of community quiet zones. In order to determine whether an area or community is eligible for an exemption, the SCCRTC would coordinate with the FRA to create a risk index by which a prospective Capitola to Seascape quiet zone could be rated. If an exemption is granted, supplementary safety measures may be required.

In accordance with the Federal Railroad Administration (FRA) guidance, the SCCRTC has taken the following steps towards creation of a community quiet zone:

On February 2, 2005, SCCRTC staff conducted a site visit of all proposed crossings with FRA representatives and staff from other affected local jurisdictions: Capitola, Aptos, Santa Cruz County, and California State Parks.

In anticipation of possible project approval, and in order to obtain information that could affect the SCCRTC's decision whether to approve the Original Project, the Business Plan Project Alternative, or another alternative or whether, instead, not to approve any recreational rail project, the SCCRTC staff will submit an application to the Federal Railroad Administration for the establishment of a quiet zone in the project corridor. The Final EIR will include an update on the progress towards creation of the community quiet zone**.**

d. Mitigation Measures

Mitigation Measure C-1: To ensure that noise generated by the proposed project is minimized, the specifications for new trains shall require that under cruising conditions at 25 mph, the maximum noise level during a train passby shall not exceed 83 dBA at a distance of 50 feet from the centerline of the

track, which would correspond to an L_{eq} of 56 dBA or less. Implementation of this requirement would ensure that operation of the train itself will not result in an increase in sound of more than 8 dB over existing conditions. According to the FTA thresholds outlined in criterion 2, an increase of less than 10 dB is not considered significant. This mitigation measure will insure that the train finally selected will not be noisier than the Budd train and will have the noise characteristics of a self-contained diesel mechanical unit rather than a freight engine.

Mitigation Measure C-2: Pursuant to FTA regulations, the Santa Cruz County Regional Transportation Commission (SCCRTC) shall agree to install for willing homeowners sound attenuation measures for those homes that could experience an increase of 10 dBA in ambient noise during the proposed period of service. With the implementation of Mitigation Measure C-1, homes along the rail line would not experience a significant increase in sound level from the operation of the train itself. However, homes within 700 feet of the train horn and homes within 100 feet of the crossing gates would experience a substantial temporary or periodic increase in ambient sound.

Sound attenuation measures could include double-paned windows as well as other sound insulating techniques, such as a sound wall or home insulation appropriate for the location. Implementation of this measure would ensure that the project would not result in a temporary or periodic increase in ambient sound of more than 10 dB over existing conditions.

There are approximately 16 residential dwellings within 100 feet of the 10 grade crossings. To replace windows facing the grade crossing could cost up to approximately $5,000 per home. However, the cost of implementing sound attenuation techniques for all of the homes within 700 feet of the sounding of a train horn is likely to be prohibitively expensive and therefore infeasible.

The establishment of a community quiet zone, discussed under Mitigation Measure 3 below, would allow the sounding of train horns to be discontinued within the project corridor except in emergency situations. The successful implementation of a community quiet zone would therefore remove the impact of train horn noise from both the Original Project and the Business Plan Project Alternative. However, if a community quiet zone cannot be established, then either project would result in a significant and unavoidable impact related to the sounding of the train horn**.**

Mitigation Measure C-3: The SCCRTC shall establish a community quiet zone for the proposed project corridor, if the Secretary of Transportation determines that the creation of a community quiet zone and the cessation of the use of train horns at rail crossings would not present a significant risk with respect to loss of life or serious personal injury.

This measure shall be based upon the rules outlined in the Federal Register, Department of Transportation Federal Railroad Administration *Use of Locomotive Horns at Highway-Rail Grade Crossings; Interim Final Rule* (December 18, 2003).

If the SCCRTC is unsuccessful in establishing the community quiet zone, both the Original Project and the Business Plan Project Alternative would result in a significant and unavoidable noise impact, due to the sounding of the train horn.