# 11. NOISE

This EIR chapter describes the existing noise environment in the Precise Plan area, anticipated changes in that noise environment as a result of Precise Plan-facilitated development, and related significant adverse noise impacts and mitigation needs. The technical analyses for this EIR chapter were conducted by the EIR acoustical consultants, Illingworth & Rodkin, Inc.

## 11.1 SETTING

### 11.1.1 Fundamentals of Acoustics

(a) Definitions of Noise. Noise is defined as unwanted sound. The effects of noise can range from interference with sleep, concentration, and communication, to physiological stress, and at higher noise levels, hearing loss. Sound levels are usually measured and expressed in decibels (dB), with 0 dB corresponding roughly to the threshold of hearing. The term "decibels" and other related technical terms are defined in Table 11.1.

(b) Human Sensitivity to Noise. The method commonly used to quantify environmental noise involves measurement of all frequencies of sound, with an adjustment to reflect the fact that human hearing is less sensitive to low and high frequencies than to midrange frequencies. This measurement adjustment is called "A" weighting. A noise level so measured is called an A-weighted sound level (dBA).[1] Examples of typical A-weighted noise levels in the environment and industry are provided in Table 11.2.

Environmental noise fluctuates in intensity over time. Therefore, time-averaged noise level computations are typically used to quantify noise levels and determine impacts. The two average noise level descriptors most commonly used are $L_{dn}$ and CNEL. $L_{dn}$, the day/night average noise level, is the 24-hour average, with a 10 dBA penalty added for nighttime noise (10:00 PM to 7:00 AM) to account for the greater human sensitivity to noise during this period. CNEL, the community equivalent noise level, is similar to $L_{dn}$, but adds a five-dBA penalty to evening noise (7:00 PM to 10:00 PM).

One way of anticipating a person's subjective reaction to a new noise is to compare the new noise with the existing noise environment to which the person has become adapted, i.e., the so-called "ambient" noise level. With regard to increases in A-weighted noise levels, knowledge of the following relationships will be helpful in understanding this EIR chapter:

- Except in carefully controlled laboratory experiments, a change of one dBA cannot be perceived.

[1] In practice, the level of a sound source is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting curve.

Table 11.1
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, which is 20 micropascals (20 micronewtons per square meter). |
| Frequency | The number of complete pressure fluctuations per second above and below atmospheric pressure. |
| A-Weighted Sound Level, dBA | 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. All sound levels in this report are A-weighted. |
| $L_{01}$, $L_{10}$, $L_{50}$, $L_{90}$ | The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period. |
| Equivalent Noise Level, $L_{eq}$ | The average A-weighted noise level during the measurement period. |
| 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, $L_{dn}$ | 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. |
| $L_{max}$, $L_{min}$ | The maximum and minimum A-weighted noise level 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. |
| Single-Event Noise Exposure Level (SEL) | The sound exposure level of a single noise event (such as an aircraft flyover or a train passby) measured over the time interval between the initial and final times for which the sound level of the single event exceeds the background noise level. |

SOURCE: Illingworth & Rodkin, Inc.

Table 11.2
TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT AND INDUSTRY

| At a Given Distance from Noise Source | A-Weighted Sound Level in Decibels | Noise Environments | Subjective Impression |
|---|---|---|---|
| | 140 | | |
| Civil Defense Siren (100') | 130 | | |
| Jet Takeoff (200') | 120 | | Pain Threshold |
| | 110 | Rock Music Concert | |
| Pile Driver (50') | 100 | | Very Loud |
| Ambulance Siren (100') | | | |
| | 90 | Boiler Room | |
| Freight Cars (50') | | Printing Press Plant | |
| Pneumatic Drill (50') | 80 | In Kitchen With Garbage Disposal Running | |
| Freeway (100') | | | |
| | 70 | | Moderately Loud |
| Vacuum Cleaner (10') | 60 | Data Processing Center | |
| | | Department Store | |
| Light Traffic (100') | 50 | Private Business Office | |
| Large Transformer (200') | | | |
| | 40 | | Quiet |
| Soft Whisper (5') | 30 | Quiet Bedroom | |
| | 20 | Recording Studio | |
| | 10 | | Threshold of Hearing |
| | 0 | | |

SOURCE: Illingworth & Rodkin, Inc

- Outside of the laboratory, a three dBA change is considered a just-perceivable difference.

- A change in noise level of at least five dBA is required before any noticeable change in community response would be expected.

- A 10 dBA increase is subjectively heard as approximately a doubling in loudness, and would almost certainly cause an adverse change in community response.

(b) Structural Attenuation. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA $L_{dn}$ with open windows and 65-70 dBA $L_{dn}$ if the windows are closed.

(c) Typical Noise Levels. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed; those facing major roadways and freeways typically need special-glass windows.

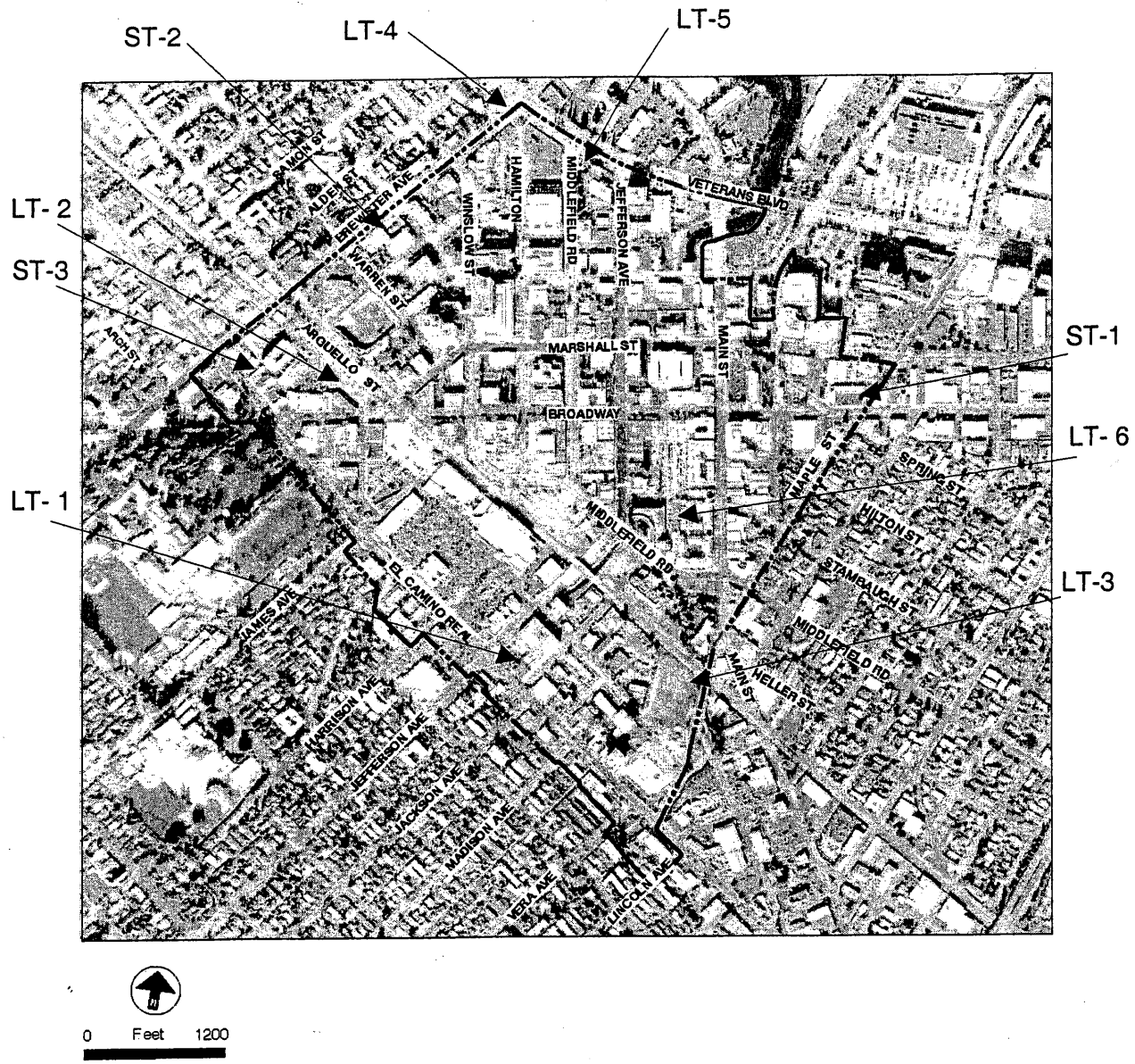
### 11.1.2 Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noise of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA $L_{dn}$. Typically, the highest steady traffic noise level during the daytime is about equal to the $L_{dn}$, and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses.

### 11.1.3 Existing Noise Environment

Residential and commercial uses are interspersed throughout the Precise Plan area. The primary noise sources in the Precise Plan area are automobile and truck traffic along downtown streets. Intermittent aircraft overflights and Caltrain activity are also audible. In addition, ambient noise is generated by existing commercial development throughout the area.

(a) Noise Monitoring Survey Results. A noise monitoring survey was conducted by Illingworth & Rodkin in the Precise Plan area from June 6 to June 8, 2006, and from October 10 through October 11, 2006, including long-term (24-hour) noise measurements at six locations and short-term (10-minute) noise measurements at three locations. The noise measurement locations are mapped on Figure 11.1 and summarized in Table 11.3. The recorded hourly trends in noise levels at locations LT-1, LT-2, LT-3, LT-4, LT-5, and LT-6 are shown graphically in appendix 20.3 of this EIR. Locations LT-1 through LT-5 were selected because they are adjacent to substantial vehicular and/or Caltrain traffic; location LT-6 was selected because it is adjacent to a residential use in the Precise Plan area.




SOURCE: Illingworth & Rodkin, Inc.

Figure 11.1

# NOISE MEASUREMENT LOCATIONS

Table 11.3
SUMMARY OF LONG-TERM AND SHORT-TERM NOISE MEASUREMENTS

| Site | Location | Duration | $L_{eq}$ | $L_1$ | $L_{10}$ | $L_{50}$ | $L_{90}$ | Est. CNEL | Primary Noise Sources |
|---|---|---|---|---|---|---|---|---|---|
| LT-1 | Caltrain near Arguello St. ~20 feet to Caltrain tracks | 24 hrs. | See EIR appendix 20.3 | | | | | 79 | Caltrain operations |
| LT-2 | El Camino Real near Jefferson St. ~50 feet from Centerline of El Camino Real | 24 hrs. | See EIR appendix 20.3 | | | | | 74 | El Camino Real traffic |
| LT-3 | Maple St. near Caltrain ~250 feet from Caltrain crossing | 24 hrs. | See EIR appendix 20.3 | | | | | 70 | Caltrain warning horns |
| LT-4 | Brewster Ave. near Veterans Blvd. ~35 feet from centerline of Brewster St. | 24 hrs. | See EIR appendix 20.3 | | | | | 67 | Brewster Ave. traffic |
| LT-5 | Veterans Blvd. near Middlefield Rd. ~35 feet from centerline of Veterans Blvd. | 24 hrs. | See EIR appendix 20.3 | | | | | 72 | Veterans Blvd. traffic |
| LT-6 | City Hall parking lot behind senior residential housing complex | 24 hrs. | See EIR appendix 20.3 | | | | | 60 | Distant traffic noise with localized sources such as cars in parking lots |
| ST-1 | Maple St. between Broadway and Marshall St. ~ 25 feet to Maple St. centerline | 10 min. | 61 | 70 | 64 | 58 | 54 | 64 | Traffic on Broadway and Maple Street |
| ST-2 | Brewster Ave. near Allerton St. ~ 25 feet to Brewster Ave. centerline | 10 min. | 66 | 77 | 71 | 62 | 52 | 68 | Local traffic |
| ST-3 | El Camino Real near Brewster Ave. ~ 50 feet to El Camino Real centerline | 10 min. | 71 | 78 | 74 | 68 | 61 | 74 | El Camino Real traffic |

SOURCE: Illingworth & Rodkin, Inc.

*Long-term measurement LT-1* was located on Arguello Street, across from the Caltrain parking lot, approximately 20 feet to the nearest Caltrain tracks. The primary source of noise at this location was Caltrain and Arguello Street traffic. As the trains passed by, noise levels reached a maximum ($L_{max}$) of 90 to 100 dBA. The highest noise levels were due to train horns. Typical hourly Leq noise levels ($L_{eq(h)}$) ranged from 68 to 76 dBA during the day, and dropped to 49 dBA at night when train passages did not occur. The ambient background $L_{eq}$ at this location is approximately 60 dBA during the day without any Caltrain noise; however, since the measurement was taken so close to the Caltrain tracks, train passages with horns dominate ambient noise levels. The calculated CNEL at LT-1 was 79 dBA.

*Long-term measurement LT-2* was located near the southeast corner of El Camino Real and Jefferson Street in a parking lot. The measurement position was about 50 feet from the centerline of El Camino Real. The land uses surrounding the measurement site are comprised primarily of commercial uses. This measurement site was located adjacent to a dry cleaner, across the street from both Safeway and Whole Foods, with the nearest residence located over 500 feet to the southwest. The primary noise source at this location was traffic along both El

Camino Real and Jefferson Street. Hourly noise levels ranged from 68 to 73 dBA $L_{eq(h)}$ during the day and dropped to 60 dBA $L_{eq(h)}$ at night. The CNEL at this location was 74 dBA.

*Long-term measurement LT-3* was located in front of the Franklin Street Apartments, on Maple Street (at Franklin Street). The primary noise source at this location was both vehicular traffic and Caltrain. The measurement site was located approximately 250 feet away from the railroad tracks. Land uses surrounding the measurement location were comprised of various commercial and multifamily residences. Typical hourly noise levels ranged from 63 to 71 dBA $L_{eq(h)}$ during the day and dropped to 53 dBA $L_{eq(h)}$ at night. Trains generated maximum noise levels of 80 to 85 dBA as they used their warning horns at the Maple Street crossing. Ambient noise levels without Caltrain interference were about 60 to 65 dBA $L_{eq}$ during the day. The CNEL at this location was 70 dBA.

*Long-term measurement LT-4* was located near the corner of Brewster Avenue and Veterans Boulevard in the parking lot for a daycare facility. The measurement's position was about 35 feet from the centerline of Brewster Avenue. The primary noise source at this location was local traffic. Typical hourly noise levels ranged from 60 to 70 dBA $L_{eq(h)}$ during the day, with most of the daily levels between 60 and 65 dBA $L_{eq(h)}$. At night noise levels dropped to 50 dBA $L_{eq(h)}$, and the CNEL at this location is 67 dBA.

*Long-term measurement LT-5* was located at the corner of Veterans Boulevard and Middlefield Road in the Happy Donut's parking lot. The measurement position was about 65 feet from the centerline of Veterans Boulevard and 70 feet from the centerline of Middlefield Road. The primary noise source at this location was traffic from Veterans Boulevard. Typical hourly noise levels ranged from 62 to 75 dBA $L_{eq(h)}$ during the day, and dropped to 55 dBA $L_{eq(h)}$ at night. The CNEL at this location is 72 dBA.

*Long-term measurement LT-6* was located at the City Hall parking lot behind the senior residential housing complex. This measurement position provided noise data typical of existing residential areas Downtown. The measurement position was set back from all roadways (about 300 feet from Middlefield Road), so that localized noise and background sources were measured. The primary noise source at this location was distant traffic and local activity. Typical hourly noise levels ranged form 55 to 65 dBA $L_{eq(h)}$ during the day, with most of the daily levels between 55 and 60 dBA $L_{eq(h)}$. At night, noise levels dropped to about 45 dBA $L_{eq(h)}$. The CNEL at this location is 60 dBA.

Attended *short-term noise measurements* and corresponding traffic counts were conducted in 10-minute intervals along roadways throughout the Precise Plan area on Thursday June 8, 2006, between 11:50 AM and 12:50 PM. The short-term measurements are summarized in Table 11.3.

The recorded noise measurements results listed in Table 11.3 indicate that existing noise levels in downtown Redwood City range from approximately 60 dBA CNEL away from primary noise sources to about 80 dBA CNEL adjacent to the Caltrain line. Local noise levels may increase in the future along roadways that are anticipated to experience traffic increases. Noise increases could also occur in the future along the Caltrain line as a result of increased train traffic.

(b) Existing Caltrain Noise. Long-term noise measurements LT-1 and LT-3 were primarily influenced by Caltrain events. The measured CNEL was 79 dBA at 30 feet and 70 dBA at 250 feet from the train line. The vast majority of the train passages are Caltrain passenger trains,

which occur approximately four times per hour during weekdays (2 northbound and 2 southbound), with additional train operations during commuting hours. Caltrain is not scheduled to operate passenger trains between about 12:45 AM and 5:15 AM, although freight trains could operate during these times, and it appears from the measurement data that at least two trains operated during the late night period.

Based on the published Caltrain schedule (dated January 1, 2006), 96 Caltrain passenger trains pass through Redwood City each weekday with about 30 Caltrains on each Saturday/Sunday. Noise exposure in the Caltrain area is dependent on proximity to the train line and crossings where trains use warning horns, as well as shielding from buildings. Estimated noise levels within approximately 200 to 300 feet of the Caltrain would exceed 70 dBA CNEL. Estimated Caltrain noise levels farther than 300 feet drop off at a rate of 5 dBA or more due to increased distance and building shielding.

(c) Traffic Noise. Traffic noise levels in the downtown Redwood City result from a combination of local and distant traffic. Most roadways within the area have relatively low traffic speeds and moderate to low volumes (see section 9.1 herein). The combination of local and distant traffic combined with Caltrains creates an ambient noise environment that generally exceeds 60 dBA CNEL throughout the Downtown. The primary sources of traffic noise in the Precise Plan area are El Camino Real, Veterans Boulevard, and Broadway. A typical sidewalk setback location from El Camino Real (about 60 feet from the roadway centerline) experiences a noise level of about 75 dBA CNEL. A similar setback location on Veterans Boulevard has slightly lower noise levels (about 70 to 72 dBA). Noise levels at similar setback locations along other Downtown roadways (e.g., Brewster Avenue, Main Street, Broadway) are about 65 to 70 dBA CNEL.

(d) Aircraft Noise. Individual aircraft operations also produce intermittent noise in the Precise Plan area; however, these noise events do not noticeably affect the overall measured noise levels. A portion of the Plan area is located within San Carlos Airport Influence Area B, designated as a Referral Area in anticipation of potential airport noise related land use compatibility impacts (see EIR chapters 5, Land Use and Planning, and13, Hazards and Hazardous Materials). However, the Plan area is located beyond the 55 dB CNEL contour published in the Redwood City Strategic General Plan *Noise Element* ("Airport Noise Contours") and in the San Carlos Airport Land Use Plan (Map SC-15 and Map SC-18). Noise from airport operations, therefore, is not expected to substantially affect the Precise Plan area.

(e) Miscellaneous Noise Sources. Noise in urban environments is typically characterized by a variety of noise sources, including persistent (continual) transient (short-term and occasional) noise events. Due to its relatively continual operation, vehicular traffic tends to dominate the noise environment over a 24-hour period. Typical examples of *transient* noise sources include car horns, car alarms, loud vehicles or motorcycles, emergency sirens, loud music, mechanical equipment, trucks, and people talking or yelling. Many of these transient sources are common in the Precise Plan area. Although some of these transient sources may be annoying, they are not persistent and do not contribute substantially to the overall ambient noise level in one particular area.

Parking lots adjacent to residential areas can be sources of transient noise from car starts and movements and from people talking. Typical instantaneous maximum noise levels associated with normal parking lot activities are about 60 to 65 dBA at 50 feet from the source. Car alarms, horns, or loud vehicles can produce noise levels of up to 90 dBA at 50 feet. Measurement LT-6 represents a typical existing parking lot noise level measurement near a Downtown multifamily

residential development in the Downtown. Although transient short-term noise events in the parking lot and vicinity were captured by the long-term (24-hour) LT-6 measurement, these events affected the overall noise measurement (CNEL level) by less than 1 dBA.

## 11.2 PERTINENT PLANS AND POLICIES

The City of Redwood City, the Airport Land Use Commission (ALUC) for San Mateo County, and the State of California have established regulations, plans, and policies designed to prevent creation of land use/noise incompatibilities and limit noise exposure at existing noise-sensitive land uses. These noise provisions include the Redwood City Strategic General Plan *Noise Element*, the Redwood City Municipal Code, the San Carlos Airport Land Use Plan (ALUP) noise policies, and the State of California Building Code.

### 11.2.1 Redwood City Strategic General Plan

Redwood City addresses issues of land use compatibility, transportation noise, and community noise in the *Noise Element* of the Redwood City Strategic General Plan (adopted in 1990). The City establishes objectives and policies in the *Noise Element* to promote compatible development throughout the City. A Noise and Land Use Compatibility Table (Table 11.4) is also presented in the Element to identify acceptable and unacceptable noise level ranges for specific land use types.

The following "general land use recommendations" are listed in the *Noise Element's* Land Use Compatibility Table. Unlike adopted General Plan policy, these recommendations are intended as planning guidelines and are not mandatory standards.

- *Residential land uses are considered satisfactory in noise environments of less than 55 dBA CNEL.*
- *Noise environments between 55 dBA and 60 dBA CNEL are considered "conditionally acceptable" for residential development. Under these conditions, new construction or development should be undertaken only after a detailed analysis of noise reduction requirements is made and needed noise insulation features are included in the project's design.*
- *New residential construction should not be undertaken in noise environments exceeding 60 dBA CNEL.*
- *Commercial land uses are considered satisfactory in noise environments of less than 70 dBA CNEL*.
- *Noise environments between 70 dBA and 80 dBA CNEL are considered "conditionally acceptable" for commercial development. Under these conditions, new construction or development should be undertaken only after a detailed analysis of noise reduction requirements is made and needed noise insulation features are included in the project's design.*

The *Noise Element* also contains the following objectives and policies pertinent to the proposed project:

Table 11.4
REDWOOD CITY NOISE GUIDELINES FOR LAND USE PLANNING

| Generalized Land Use | CNEL Range | General Land Use Recommendation |
|---|---|---|
| Residential and Educational | Less than 55 | Satisfactory, with little noise impact and requiring no special noise insulation for new construction. |
| | 55 to 60 | New construction or development should be undertaken only after an analysis of noise reduction requirement is made and needed noise insulation features included in the design. |
| | Greater than 60 | New construction or development should not be undertaken. |
| Commercial | Less than 70 | Satisfactory, with little noise impact and requiring no special noise insulation for new construction. |
| | 70 to 80 | New construction or development should be undertaken only after an analysis of noise reduction requirement is made and needed noise insulation features included in the design. |
| | Greater than 80 | New construction or development should not be undertaken unless related to airport activities or services. Conventional construction will generally be inadequate, and special noise insulation features should be included in construction. |
| Industrial | Less than 75 | Satisfactory, with little noise impact and requiring no special noise insulation for new construction. |
| | 75 to 85 | New construction or development should be undertaken only after an analysis of noise reduction requirement is made and needed noise insulation features included in the design. |
| | Greater than 85 | New construction or development should not be undertaken unless related to airport activities or services. Conventional construction will generally be inadequate, and special noise insulation features should be included in construction. |
| Open | Less than 75 | Satisfactory, with little noise impact and requiring no special noise insulation for new construction. |
| | Greater than 75 | Land uses involving concentrations of people (spectator sports and some recreational facilities) or of animals (livestock farming and animal breeding) should generally be avoided. |

SOURCE: Redwood City Strategic General Plan (adopted 1990), *Noise Element,* p. 11-14.

- *Minimize the impacts of noise on people through noise reduction and project suppression techniques, and through appropriate land use policies.* (Objective 1, page 11-12)

- *Reduce future impact of all types of point source noises.* (Objective 2, page 11-12)

- *Reduce ambient noise levels in all parts of the City to safe, optimum levels.* (Objective 3, page 11-12)

- *Limit the hours of operation at all noise generation sources wherever practicable, unless an emergency exists.* (Policy N-2, page 11-12)

- *Require all exterior noise sources (construction operations, air compressors, pumps, fans, and leaf blowers) to use available noise suppression devices and techniques to bring exterior noise down to acceptable levels compatible with adjacent land uses*. (Policy N-3, page 11-12)

- *Commercial drive-through uses should only be allowed when compatibility with adjacent land uses can be demonstrated.* (Policy N-4, page 11-12)

- *Land Uses within the Planning Boundary of San Carlos Airport shall be compatible with the Aircraft Noise/Land Use Compatibility Standards found at page 8* [IV-28] *of the 1981 San Mateo County Airport Land Use Plan* [updated 1996]. *The "Planning Boundary" for the San Carlos Airport is considered the ground area encompassed by the combination of the line depicting the 55 CNEL Noise Contour, as shown on the Noise Contour Map at page 7* [IV-26] *of the 1981* [1996] *San Mateo County Airport Land Use Plan and the outer boundary (Elevation 359) of the Hazard Zoning Plan at page 11* [IV-36] *of the 1981* [1996] *San Mateo County Airport Land Use Plan.* (Policy N-5, page 11-2)

### 11.2.2 San Carlos Airport Land Use Plan

The San Carlos Airport Land Use Plan (ALUP), which is a chapter of the San Mateo County ALUP, establishes airport noise and land use compatibility standards for development in the airport vicinity of San Carlos Airport and its takeoff and approach zones. Projected airport takeoff and approach zone CNEL noise contours presented in the ALUP are used to evaluate land use compatibility for proposed underlying developments; the 55 dBA CNEL noise contour is recognized as the threshold for review by the Airport Land Use Commission (ALUC). Underlying commercial land uses are considered compatible in noise environments less than 70 dBA CNEL, conditionally compatible in noise environments between 70 and 80 dBA CNEL, and incompatible in noise environments greater than 80 dBA CNEL. Underlying residential land uses are considered compatible in noise environments less than 55 dBA CNEL, conditionally compatible in noise environments between 55 dBA CNEL and 60 dBA CNEL, and incompatible in noise environments greater than 60 dBA CNEL. These compatibility guidelines are the same as those applied by Redwood City (see Table 11.4).

### 11.2.3 Redwood City Municipal Code

Chapter 24 (Noise Regulation, i.e., Noise Ordinance) of the Redwood City Municipal Code sets allowable noise limits for different types of receiving land uses. The noise levels allowed by the Noise Ordinance depend primarily on the background noise level in the area. For existing residential areas surrounding the Precise Plan area, applicable noise regulations are discussed in Chapter 24, Article II, Divisions 2 and 3. Noise Ordinance section 24.21 prohibits noise increases of 6 db above local ambient measured noise at any point within a residential district due to an assemblage of three or more people during the hours of 8:00 PM and 8:00 AM. Noise Ordinance section 24.30 prohibits noise levels generated by construction between the hours of 8:00 PM to 7:00 AM weekdays, or at any time on Saturdays, Sundays, or holidays. In addition, Noise Ordinance section 24.31 prohibits noise levels exceeding 110 dBA for any item of machinery, equipment, or device used during construction in a residential district.

### 11.2.4 State of California Building Code and Guidelines

Environmental noise intrusion into new multifamily housing is regulated by Chapter 12, Section 1208, Sound Transmission Control, of the 2001 California Building Code. The Code stipulates that interior noise levels attributable to exterior sources shall not exceed 45 CNEL in any habitable room. The Code further stipulates that multifamily residential structures proposed where the noise level exceeds 60 CNEL shall require an acoustical analysis showing that the proposed design will limit exterior noise to the prescribed allowable interior level.

## 11.3 IMPACTS AND MITIGATION MEASURES

### 11.3.1 Significance Criteria

Based on the CEQA Guidelines, the proposed project--i.e., the Precise Plan and associated Maximum Intensity and Moderate Intensity growth scenarios--would be considered in this EIR to have a significant impact on the noise environment if it would result in:[1]

(1) exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

(2) exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels;

(3) a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

(4) a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project; or

(5) for a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, exposure of people residing or working in the project area to excessive noise levels.

[1] CEQA Guidelines, Appendix G, item XI(a-e).

As described in subsection 11.1.3(d) (Aircraft Noise) above, the Precise Plan area is located beyond the projected 55 dB CNEL contour published in the Redwood City Strategic General Plan and San Carlos Airport Land Use Plan; therefore, criterion 5 above is not discussed further in this chapter.

A significant impact would be identified if land uses proposed by the project would be exposed to noise levels exceeding the City's established guidelines for noise and land use compatibility. A significant noise impact would also result if noise levels increase substantially at existing noise-sensitive land uses (e.g., residences) due to the project land use changes or associated traffic increases. Following common professional noise impact assessment practice, a project-related increase in noise level (e.g. traffic noise) of 3 dBA in residential areas where existing noise levels exceed 60 dBA CNEL, or exceed 5 dBA in non-residential areas where existing noise levels exceed 70 dBA CNEL, would constitute a significant impact.

Construction-related noise levels are treated differently because they would be temporary and intermittent. Significant noise impacts would result from construction if noise levels were sufficiently high to interfere with speech, sleep, or normal residential activities. Following common professional noise impact assessment practice, construction-related hourly average noise levels received at noise-sensitive land uses above 60 dBA during the daytime and 55 dBA at night, and at least 5 dBA higher than ambient noise levels, would be considered significant.

### 11.3.2 Impacts and Mitigation Measures

The following impact and mitigation findings apply to both the Maximum Intensity and Moderate Intensity project alternatives:

**Impact 11-1: Precise Plan-Facilitated Demolition and Construction Period Noise.** Demolition and construction activities facilitated by the Downtown Precise Plan could temporarily elevate noise levels at nearby residential and commercial receptors during individual, site-specific project construction periods. Noise levels at 50 feet from the demolition or construction equipment source could reach approximately 105 dBA, resulting in intermittent interference with typical existing residential and business activities, and exceeding the land use/noise level compatibility limits established in the Redwood City Strategic General Plan *Noise Element*. This possibility represents a ***potentially significant intermittent and short-term noise impact*** (see criteria 1 and 4 and explanatory text in subsection 11.3.1, "Significance Criteria," above).

Construction activities generate considerable amounts of noise, especially during the building demolition, grading and scraping, and infrastructure construction phases when heavy equipment is used. The noise effects of such demolition and construction activities would depend on the noise characteristics of selected pieces of construction equipment, the timing and duration of these noise generating activities, and the distance between these noise sources and the nearest noise-sensitive receptors. Noise levels during construction would occur in phases, including demolition of existing structures in the Precise Plan area, grading and excavation, construction of foundations, erection of the new structures, and finishing.

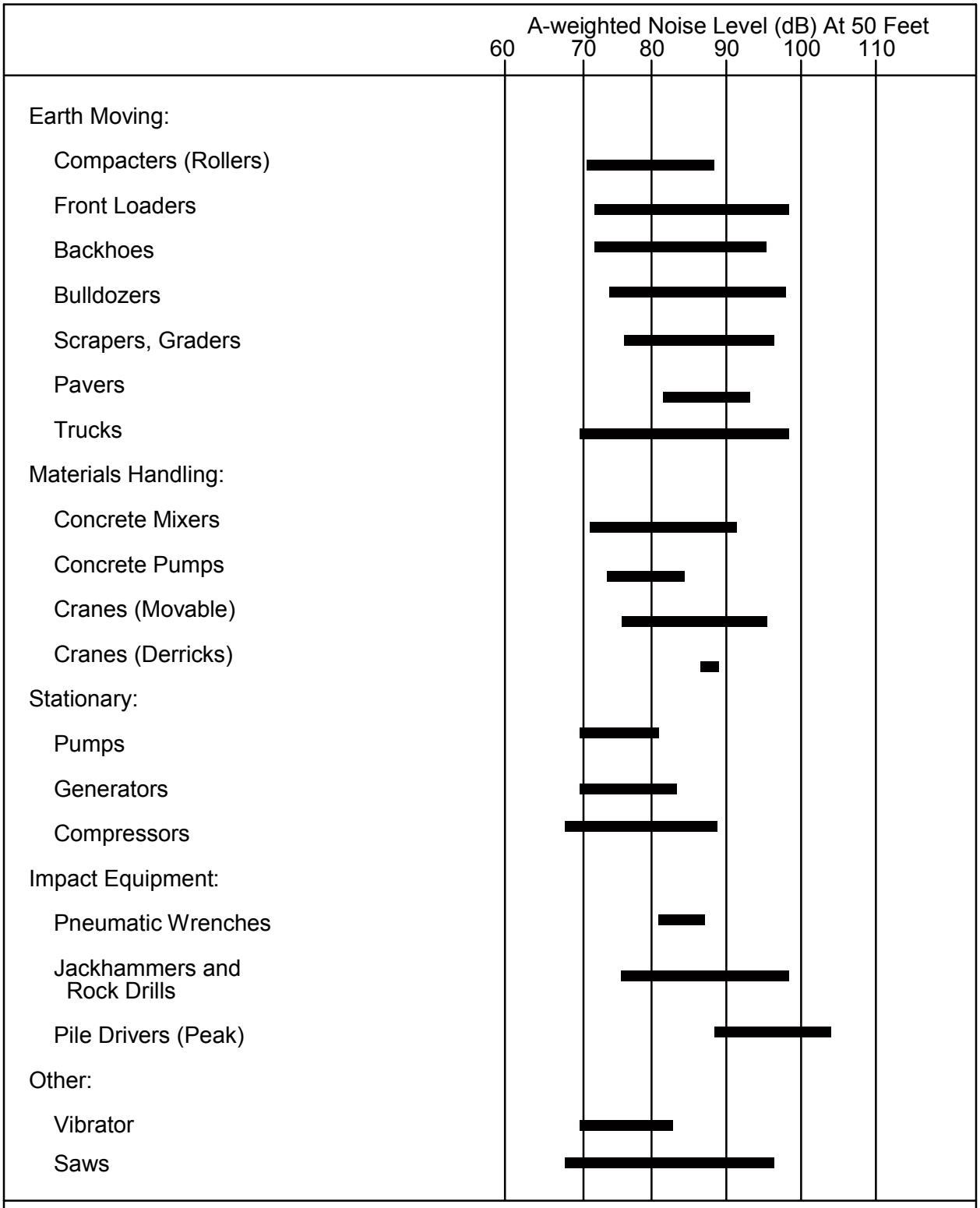
Tables 11.5 and 11.6 depict typical noise levels generated by construction equipment at a distance of 50 feet from the source and at a distance of 50 feet from the construction activity center, respectively. The highest maximum noise levels generated by project construction activities would typically range from approximately 90-to-105 dBA at a distance of 50 feet from the noise source. These noise levels would result primarily from pile drivers, jack hammers, and other percussive pieces of equipment.

Typical hourly average construction-generated noise levels would be approximately 81 dBA to 89 dBA measured at a distance of 50 feet from the center of the site during busy construction periods. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of distance between the source and receptor. Shielding by intervening buildings or terrain typically result in much lower construction noise levels at distant receptors.

Construction noise impacts result primarily when construction activities occur during the noise-sensitive times of the day (i.e., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction durations last over extended periods of time. Limiting construction to daytime hours is often the most simple and effective method of reducing the potential for noise impacts. In areas immediately adjacent to construction, controls such as constructing temporary noise barriers and utilizing “quiet” construction equipment can also reduce the potential for noise impacts.

Precise Plan-facilitated construction would occur in phases over an approximately 15-year period. Construction activities during these periods could expose existing nearby noise-sensitive land uses, and future noise-sensitive land uses built during the earlier phases of Precise Plan area buildout, to noise levels substantially exceeding the ambient noise environment and the noise limits established by the Redwood City Municipal Code (see EIR subsection 11.2.3). This Precise Plan-related effect represents a *significant noise impact*.

Table 11.5
CONSTRUCTION EQUIPMENT NOISE LEVEL RANGES




Source: Handbook of Noise Control, Cyril M. Harris, 1979.

Table 11.6
TYPICAL NOISE LEVEL RANGES AT 50 FEET, $L_{eq}$ IN dBA, AT CONSTRUCTION SITES

| | Domestic Housing | | Office Building, Hotel, Hospital, School, Public Works | | Industrial, Parking Garage, Religious, Amusement and Recreation, Store, Service Station | | Public Works, Roads and Highways, Sewers and Trenches | |
|---|---|---|---|---|---|---|---|---|
| | I | II | I | II | I | II | I | II |
| Ground Clearing | 83 | 83 | 84 | 84 | 84 | 83 | 84 | 84 |
| Excavation | 88 | 75 | 89 | 79 | 89 | 71 | 88 | 78 |
| Foundations | 81 | 81 | 78 | 78 | 77 | 77 | 88 | 88 |
| Erection | 81 | 65 | 87 | 75 | 84 | 72 | 79 | 78 |
| Finishing | 88 | 72 | 89 | 75 | 89 | 74 | 84 | 84 |

SOURCE: U.S. EPA, Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

**Mitigation 11-1.** Reduce Precise Plan implementation related individual project demolition- and construction-period noise impacts on nearby residences by incorporating conditions in project demolition and construction contract agreements that stipulate the following conventional construction-period noise abatement measures:

- *Construction Plan.* Prepare a detailed construction plan identifying the schedule for major noise-generating construction activities. The construction plan shall identify a procedure for coordination with nearby noise-sensitive facilities so that construction activities and the event schedule can be scheduled to minimize noise disturbance.

- *Construction Scheduling.* Ensure that noise-generating construction activity is limited to between the hours of 7:00 AM to 8:00 PM, Monday through Friday, and noise levels generated by construction are prohibited on Saturdays, Sundays, and holidays. *(Redwood City Municipal Code Section 24.30)*

- *Construction Equipment Mufflers and Maintenance.* Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- *Equipment Locations.* Locate stationary noise-generating equipment as far as possible from sensitive receptors when sensitive receptors adjoin or are near a construction project site.

- *Construction Traffic.* Route all construction traffic to and from the construction sites via designated truck routes where possible. Prohibit construction-related heavy truck traffic in residential areas where feasible.

- *Quiet Equipment Selection.* Use quiet construction equipment, particularly air compressors, wherever possible.

- *Temporary Barriers.* Construct solid plywood fences around construction sites adjacent to residences, operational businesses, or noise-sensitive land uses.

- *Temporary Noise Blankets.* Temporary noise control blanket barriers should be erected, if necessary, along building facades of construction sites. This mitigation would only be necessary if conflicts occurred which were irresolvable by proper scheduling. (Noise control blanket barriers can be rented and quickly erected.)

**(continued)**

**Mitigation 11-1 (continued):**

- *Noise Disturbance Coordinator.* For larger construction projects, the City may choose to require project designation of a "Noise Disturbance Coordinator" who would be responsible for responding to any local complaints about construction noise. The Disturbance Coordinator would determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and institute reasonable measures to correct the problem. Conspicuously post a telephone number for the Disturbance Coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule. (The project sponsor should be responsible for designating a Noise Disturbance Coordinator, posting the phone number, and providing construction schedule notices. The Noise Disturbance Coordinator would work directly with an assigned City staff member.)

Implementation of these measures would reduce this intermittent, short-term, project construction-period noise impact to a ***less-than-significant level.***

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**Impact 11-2: Precise Plan-Facilitated Ground-Borne Vibration Levels.** Precise Plan implementation related individual project demolition and construction activities could generate substantial vibration (e.g., from potential pile driving) in the project vicinity. These possible intermittent and short-term effects represent a ***potentially significant impact*** (see criterion 2 and explanatory text in subsection 11.3.1, "Significance Criteria," above).

Due to the Precise Plan area's proximity to San Francisco Bay, the project area is considered susceptible to liquefaction (see EIR chapter 15, Geology and Soils). Therefore, Precise Plan-facilitated development could involve construction on fill where pile driving may be required to support new building foundations. Potential construction sequencing on a particular development site would consist of demolition of existing structures and other site preparation work, followed by scraping, earth-moving and filling to prepare the site, followed by foundation work including possible pile driving, followed by new building erection.

The pile driving sequence has the potential to generate the highest ground vibration levels and could cause architectural damage to nearby structures, particularly when it occurs within 100 feet of such structures. Other activities during project construction--such as use of building demolition equipment, jackhammers, rock drills, and other high-power or vibratory tools and rolling stock equipment (tracked vehicles, compactors, etc.)--could also potentially generate substantial vibration in the immediate project vicinity. Depending on the proximity of existing structures to the construction area and the methods of construction used, high vibration levels may affect nearby properties.

Demolition and construction activities can cause vibration that varies in intensity depending on several factors. Because of the percussive nature of pile driving activities, the use of the

"peak particle velocity descriptor" (ppv) has been routinely used to measure and assess ground-borne vibration. The measurement of peak particle velocity has been used almost exclusively as the appropriate means to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.[1, 2]

The two primary concerns with construction-induced vibration--the potential to damage a nearby structure and to interfere with the enjoyment of nearby daily activities--are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Studies[3] have shown that the threshold of perception for average persons is in the range of 0.2-to-0.3 millimeters per second (mm/sec) (0.008-to-0.012 inches/sec) ppv. However, persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Researchers have found safe vibration limits that can be applied to assess the potential for damaging a structure; however, vibration limits vary by researcher, and there is no general consensus as to what amount of vibration may pose a threat to a building. Furthermore, structural damage can be classified as cosmetic only, such as minor cracking of building elements, or it may threaten the integrity of the building. Construction-induced vibration that can be structurally damaging to a building is very rare and has been observed only in instances where the structure is already in a high state of disrepair and when the construction activity occurs immediately adjacent to the structure.

The California Department of Transportation uses a vibration limit of 12.7 mm/sec (0.5 inches/sec) ppv for structurally sound buildings designed to modern engineering standards. A conservative vibration limit of 5 mm/sec (0.2 inches/sec) ppv has been used for buildings that are found to be structurally sound but for which structural damage is a major concern. All vibration limits referred to herein apply on the ground level and take into account the response of structural elements (i.e. walls and floors) to ground-borne vibration.

Vibration levels resulting from project demolition and construction activities, when perceptible at nearby properties, would be intermittent and of short duration, especially for those construction operations that have the highest potential for producing vibration (building demolition, grading and scraping, pile driving, and use of jackhammers and other high power tools).

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[1]Dowding, Charles H. Construction Vibrations, Prentice Hall, 1996.

[2]Oriard, Lewis L. *The Effects of Vibration and Environmental Forces*, International Society of Explosives Engineers, 1999.

[3]Ernzen, James and Schexnayder, Cliff J. *NCHRP Synthesis 218*, Transportation Research Board, 1996.

**Mitigation 11-2.** Reduce ground-borne vibration levels during individual, site-specific future project demolition and construction periods by incorporating conditions in individual project demolition and construction contractor agreements that stipulate the following ground-borne vibration abatement measures:

- Restrict vibration-generating activity to between the hours of 7:00 AM and 7:00 PM, Monday through Friday. Prohibit such activity on weekends and holidays.

- Notify occupants of land uses located within 200 feet of pile-driving activities of the project construction schedule in writing.

- Investigate in consultation with City staff possible pre-drilling of pile holes as a means of minimizing the number of percussions required to seat the pile.

Implementation of these measures would reduce this potential intermittent and short-term Precise Plan vibration impact to a ***less-than-significant level.***

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**Impact 11-3: Potential Exposure of New, Precise Plan-Facilitated Noise-Sensitive Development to Noise Levels Exceeding Standards.** The proposed Precise Plan would facilitate new residential development in downtown Redwood City. Associated new residents, employees, and visitors could be exposed to various existing and projected noise sources, including traffic and Caltrain operations. The compatibility of the Draft Precise Plan proposed land uses with the existing and projected noise environment has been evaluated based on the Redwood City Noise Guidelines for Land Use Planning (see EIR Table 11.4). New residential development is considered normally acceptable in noise environments of less than 55 dBA CNEL, and new commercial or retail development is considered normally acceptable in noise environments of 70 dBA CNEL or less.

Future noise levels throughout much of the Precise Plan area, especially in the vicinity of the Caltrain line, would exceed 55 dBA CNEL. Land uses proposed within 250 feet of the Caltrain line, 120 feet from the centerline of El Camino Real, or 100 feet from Veterans Boulevard, would be exposed to noise levels of 70 dBA CNEL or higher, thereby exposing new Precise Plan-designated, noise-sensitive residential, commercial, recreational, and public facility land use development to noise levels exceeding the "normally acceptable" threshold. These possible long-term adverse noise effects would represent a ***potentially significant impact*** (see criteria 1 and 3 and explanatory text in subsection 11.3.1, "Significance Criteria," above).

**Mitigation 11-3.** Site-specific noise studies consistent with the requirements of the State Building Code (SBC) shall be conducted for all new Precise Plan-facilitated residential uses in these identified potential land use/noise compatibility impact areas to identify appropriate noise reduction measures to be included in project final design. Each noise study must be submitted to and approved by the Redwood City Building Department prior to City issuance of a residential building permit. Identified noise insulation measures may include:

- Site planning to minimize noise in shared residential outdoor activity areas by locating the areas behind the buildings, in courtyards, or orienting the terraces to alleyways rather than streets, whenever possible;

- Air conditioning in all units so that windows can remain closed to maintain interior noise levels below 45 dBA CNEL; and

- Sound-rated windows and construction methods in residential units proposed along streets (or the Caltrain line) where noise levels would exceed 70 dB CNEL.

Noise levels at residential property lines around Plan-facilitated development should be maintained at an $L_{eq}$ not in excess of 60 dBA during the daytime hours and 50 dBA during nighttime hours (10:00 PM to 7:00 AM), unless ambient noise levels are higher. In those cases, the ambient noise level would be the noise level standard. The approval of future commercial projects near Precise Plan area residential and other noise-sensitive uses may, at City discretion, require a noise study demonstrating how the project--including associated loading docks, refuse areas, and ventilation systems--would meet these standards.

Implementation of these measures to the satisfaction of the Redwood City Building Department would reduce the potential impact on new residential uses to a ***less-than-significant level***.

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**Plan-Facilitated Noise Level Increases.** The proposed Downtown Precise Plan would change noise levels by facilitating new development in the Plan area and changing traffic patterns. The proposed Plan is expected to introduce commercial uses adjacent to, or below, existing or proposed residential uses. Specific tenants for the commercial uses have not been identified, but uses could include offices, retail stores, restaurants, or cafes. New commercial development proposed next to or below residential development could generate noise that could result in adverse changes to the noise environment. In addition, new residential development could generate noise that may adversely affect existing or proposed noise-sensitive uses. (An example of such residential development noise sources would be mechanical equipment associated with new multifamily residential structures.)

The significance of vehicular traffic noise increases in the Precise Plan area was evaluated by comparing noise levels from increased traffic levels as a result of implementing the Maximum

Intensity and Moderate Intensity project scenarios to noise levels in the future under the No Project alternative. These traffic volume increases could result in increased traffic-generated noise levels at some "sensitive receptor locations" (e.g., where significantly affected roadways are adjacent to residential, school, hospital, or other noise-sensitive uses). In areas where ambient noise levels are determined primarily by traffic noise, traffic volumes would have to double for noise levels to increase by 3 dBA. The background noise level in downtown Redwood City, away from roadways and Caltrain, is estimated at about 60 dB CNEL or higher. Total noise level increases of 3 dB or greater would be considered significant in this environment.

Traffic noise level increases were calculated based on the change between existing traffic volumes and the future condition traffic volumes provided by Korve Engineering (see EIR chapter 9, Transportation and Circulation). In addition to local traffic noise, distant traffic noise, localized transit, Caltrain, and other non-transportation related noise sources, dominate existing noise levels in the Plan area. The background noise level was taken into account when calculating noise level increases. Along roadways with low existing traffic volumes, ambient background noise levels (such as distant traffic) substantially contribute to overall noise levels. Calculated traffic noise levels do not take into account shielding by terrain or structures. Traffic noise level increases of 0 to 2 dB above existing levels are predicted. The difference between the project scenarios (Maximum Intensity and Moderate Intensity) compared with the No Project alternative would be 0 to 1 dB, with the greatest project noise increases occurring along Broadway. As a result, the impact from the project (both the Maximum Intensity and Moderate Intensity scenarios) would be ***less-than-significant***.

A strategy of the proposed Precise Plan is to collaborate with Caltrain and other stakeholders to elevate the railroad tracks throughout downtown Redwood City to remove the barrier between the north and south sides downtown. This would also result in the removal of the at-grade street crossings where trains use their warning horns. Elevating the train tracks and removing at-grade street crossings would change the noise environment. However, at this time, conceptual grade-separation plans do not include enough detail to identify potential future noise impacts. There would be offsetting effects from such actions. For instance, trains moving on elevated structures may generate more noise in the area due to less shielding from the ground and building structures. However, trains moving on elevated structures would not use their warning horns as much, which could substantially lower noise, especially near the grade crossings. These potential effects (including the noise impacts of potential, future "bullet" trains) are considered too speculative and unquantifiable to address in this EIR and would be the subject of future environmental review should a specific project for elevated railroad tracks be proposed.

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**Cumulative Noise Impacts.** Based on the projected cumulative traffic volume increases (see EIR chapter 9, Transportation and Circulation), a noise level increase of 2.0 dBA could occur along Broadway, the most affected Downtown traffic route. The increase would not be considered significant; and furthermore, the project contribution to the projected noise increase would be less than 1.0 dB. An increase of less than 3 dBA is considered ***less-than-significant*** (see subsection 11.4.1, "Significant Criteria," above).

**Mitigation.** No significant impact has been identified; no mitigation is required.