



# 9 NOISE ELEMENT

*The purpose of the Noise Element is to identify sources of noise in San Carlos and to define strategies for reducing the negative impact of noise to the community. Noise is an environmental pollutant that can threaten the quality of life and human health by causing annoyance or disrupting sleep and everyday activities. With the presence of significant noise sources in San Carlos, including Highway 101, El Camino Real, the Caltrain corridor, and the San Carlos Airport, reducing the negative impact of unwanted and excessive noise is an important aspect of maintaining the city's high quality of life and community character.*

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## Introduction

State law requires that the General Plan include a Noise Element, which is to be prepared according to guidelines adopted by the California Office of Noise Control (ONC). In accordance with State law requirements, this Noise Element provides a systematic approach to limiting community exposure to noise, including the following components:

- Quantitative analysis, based on noise measurements and modeling of major existing and future noise sources in the community, including both mobile and stationary sources;
- Mapping of generalized noise level contours to be used as a basis for land use decision-making; and

- Goals, policies, and actions to address community exposure to existing and projected noise sources.

The Noise Element describes compatible land uses for varying noise levels, provides background information on existing sources of noise, and projects noise conditions in 2030.

The Noise Element is divided into two basic sections:

- Background Information
- Goals, Policies, and Actions

## Background Information

The following provides a discussion of existing and future noise sources within San Carlos, as well as how these noise sources affect the various land use types in the city. Major noise sources that will be addressed include transportation sources such as traffic, public transit and airport and industrial operations.

The Noise Element should provide a systematic approach to the measurement and modeling of noise; the establishment of noise standards; the control of major

noise sources; and community planning for the regulation of noise. This Noise Element provides baseline information on the existing noise environment based on noise measurements taken throughout the city and identifies noise-sensitive uses in San Carlos.

According to State Government Code and the State Office of Noise Control Guidelines, the following major noise sources should be considered in the preparation of a Noise Element:

- Highways and freeways.
- Primary arterials and major local streets.
- Railroad operations.
- Aircraft and airport operations.
- Local industrial facilities.
- Other stationary sources.

The Noise Element establishes uniformity between City policy and programs undertaken to control and abate environmental noise. The California Government Code and State Office of Noise Control Guidelines require that certain major noise sources and areas containing noise-sensitive land uses be identified and

quantified by preparing generalized noise exposure contours for current and projected levels of activity within the community. The noise exposure information developed for the Noise Element is incorporated into the General Plan to serve as a basis for achieving land use compatibility with respect to noise. Noise exposure information is also used to provide baseline levels and noise source identification for use in the development and enforcement of a local noise control ordinance and for ensuring compliance with the State's noise insulation standards, which are discussed in more detail below.

## Noise Terminology

The discussion of noise requires the use of a number of technical terms. Some of the key noise-related terms used in this Element include:

- **Decibel (dB).** A decibel is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. Each 10 decibel increase in sound level is per-

ceived as approximately a doubling of loudness over a fairly wide range of intensities.

- **A-weighted sound level (dBA).** The A-weighted sound level is the most common method to characterize sound in California. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. All sound levels in this chapter are A-weighted, unless reported otherwise.
- **Energy-equivalent sound/noise level ( $L_{eq}$ ).**  $L_{eq}$  describes the average level that has the same acoustical energy as the summation of all the time-varying events. This descriptor is useful because sound levels can vary markedly over a short period of time. The most common averaging period for  $L_{eq}$  is hourly, but it can be of any duration.
- **Day/night average sound level ( $L_{dn}$ ).** Since the sensitivity to noise increases during the evening and at night, 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events.  $L_{dn}$  is a measure of the cumulative noise exposure in a community, with a 10 dB addition to nocturnal (10:00

p.m. to 7:00 a.m.) noise levels. This is the measurement that the City of San Carlos normally uses in noise evaluations and analysis.

- **Community Noise Equivalent Level (CNEL).** CNEL is the energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring between 10:00 p.m. and 7:00 a.m. and 5 dB added to the A-weighted sound levels occurring between 7:00 p.m. and 10:00 p.m.

### **Noise Control Ordinance 1086**

The City of San Carlos' noise ordinance is intended to protect residents and visitors to San Carlos from unreasonable noise associated with machines, persons, or devices. It specifies that unreasonable noise is that which exceeds 10 dBA above local ambient noise levels. Noise levels are measured at a distance of 49 feet from the property lines of either public or private property. Some noise sources are exempt from these regulations, including transportation, construction, home workshops or gardening tools, and solid waste pick-up. Violations of the specified noise levels are monitored by the San Carlos Police Department and are considered misdemeanors.

### **Land Use Compatibility**

Land uses deemed as noise sensitive by the State of California include schools, hospitals, rest homes, long-term care, and mental care facilities. Many jurisdictions consider residential uses particularly noise sensitive because families and individuals expect to use time in the home for rest and relaxation and noise can interfere with these activities. Some variability in standards for noise sensitivity may apply to different densities of residential development; single-family uses are frequently considered the most sensitive. Jurisdictions may identify other uses as noise sensitive such as churches, libraries, day care centers, and parks.

Land uses that are relatively insensitive to noise include some office, commercial, and retail developments. There is a range of insensitive noise receptors which generate significant noise levels or where human occupancy is typically low. Examples of insensitive uses include industrial and manufacturing uses, utilities, agriculture, vacant land, parking lots, and transit terminals.

To assist with evaluating the compatibility of land uses with various noise levels, the California General Plan

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Guidelines compare the compatibility of noise levels with various land uses. Figure 9-1 summarizes the Guidelines' recommendations.

Research determined how much noise is acceptable for different land uses. In the mid-1970s, the Environmental Protection Agency concluded that a noise level of 55 dBA  $L_{dn}$  (including a 5 dBA margin of safety) would have "no impact" on a residence. The State of California built upon this information and established guidelines suggesting 60 dBA  $L_{dn}$  as an upper limit for acceptable environmental noise in a residential setting. Certain land uses are sensitive to noise outdoors and exterior noise thresholds are appropriate.

Other land uses are only sensitive to noise indoors (e.g. professional office spaces, high-density housing in a downtown area).

One of the requirements of a Noise Element is to facilitate the noise insulation standards contained in the State Building Code that are applicable to new multi-family housing development. Where the exterior noise exposure level is 60 dBA  $L_{dn}$  or greater, the residential building must attenuate the interior noise level to 45

dBA  $L_{dn}$  or less in residential living areas. The intent of the Noise and Land Use Compatibility Guidelines is to achieve an interior noise level of 45 dBA  $L_{dn}$  or less in all new residential housing. Three acceptability categories are identified: normally acceptable, conditionally acceptable, and unacceptable. In the normally acceptable category, a use would be acceptable without additional mitigation measures. In the conditionally acceptable category, the use would be acceptable with the application of mitigation measures. In the unacceptable category, the use may be unacceptable even after the application of available mitigation measures.

### *Existing Noise*

A noise study was completed as part of the General Plan update and included noise measurements along major roadways. The major noise sources in San Carlos are vehicular traffic on major roadways, railroad operations along the Caltrain corridor, and the San Carlos Airport. Table 9-2 details the current traffic noise levels for major roadways in San Carlos.

FIGURE 9-1 LAND USE COMPATIBILITY FOR COMMUNITY NOISE ENVIRONMENT						
Land Use Category	Exterior Noise Exposure ( $L_{dn}$ )					
	55	60	65	70	75	80
Single-Family Residential						
Multi-Family Residential, Hotels, and Motels		a				
Outdoor Sports and Recreation, Neighborhood Parks, and Playgrounds						
Schools, Libraries, Museums, Hospitals, Personal Care, Meeting Halls, Churches						
Office Buildings, Business, Commercial, and Professional						
Auditoriums, Concert Halls, Amphitheaters						

<sup>a</sup> See Policy I.5.



**NORMALLY ACCEPTABLE.** Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special insulation requirements.



**CONDITIONALLY ACCEPTABLE.** Specified land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.



**UNACCEPTABLE.** New construction or development should generally not be undertaken because mitigation is usually not feasible to comply with noise element policies.

**TABLE 9-1 NON-TRANSPORTATION NOISE STANDARDS**

Land Use Receiving the Noise	Hourly Noise-Level Descriptor	Exterior Noise-Level Standard In Any Hour (dBA)		Interior Noise-Level Standard In Any Hour (dBA)	
		Daytime (7am-10pm)	Nighttime (10pm-7am)	Daytime (7am-10pm)	Nighttime (10pm-7am)
Residential	L <sub>en</sub>	55	45	40	30
	L <sub>max</sub>	70	60	55	45
Medical, convalescent	L <sub>eo</sub>	55	45	45	35
	L <sub>max</sub>	70	60	55	45
Theater, auditorium	L <sub>eo</sub>	--	--	35	35
	L <sub>max</sub>	--	--	50	50
Church, meeting hall	L <sub>en</sub>	55	--	40	40
	L <sub>max</sub>	--	--	55	55
School, library, museum	L <sub>eo</sub>	55	--	40	--
	L <sub>max</sub>	--	--	55	--

Notes:

1. The Residential standards apply to all residentially zoned properties.
2. Each of the noise levels specified above shall be lowered by 5 dBA for tonal noises characterized by a whine, screech, or hum, noises consisting primarily of speech or music, or recurring impulsive noises.
3. In situations where the existing noise level exceeds the noise levels indicated in the above table, any new noise source must include mitigation that reduces the noise level of the noise source to the existing level.
4. The exterior noise standards are measured at any point on the receiving property where there is, or could be in the future, frequent human use and quiet would be beneficial.
5. These standards do not apply to temporary sources such as construction activities.

**TABLE 9-2 2009 VEHICULAR TRAFFIC NOISE ON MAJOR ROADWAYS**

Major Roadway	Segment	$L_{dn}$ at 75 ft, dBA* 2009 Existing
El Camino Real	North of Holly St	69
	San Carlos Ave to Brittan Ave	68
	Brittan Ave to Howard Ave	69
	South of Howard Ave	69
Holly Street	West of El Camino Real	62
	Old County Rd to Industrial Way	65
	East of Industrial Way	68
Old County Road	North of Holly St	63
	Holly St to Brittan Ave	64
	Brittan Ave to Howard Ave	64
	South of Holly St	62
Industrial Road	North of Holly St.	61
	Holly St to Brittan Ave	66
	South of Brittan Ave	66

Major Roadway	Segment	$L_{dn}$ at 75 ft, dBA* 2009 Existing
San Carlos Avenue	North of Club Dr	63
	Club to Alameda de Las Pulgas	65
	Alameda de Las Pulgas to El Camino Real	62
	East of El Camino Real	59
	West of Alameda de Las Pulgas	61
Brittan Avenue	Alameda de Las Pulgas to El Camino Real	62
	Old County Rd to Industrial Way	64
	East of Industrial Way	64
Howard Avenue	West of El Camino Real	59
	East of Old County Rd	60
Dartmouth Avenue	East of San Carlos Ave	59
Club Drive	West of San Carlos Ave	57
Alameda de Las Pulgas	San Carlos Ave to Brittan Ave	62
	South of Brittan Ave	63

\* Noise levels are given at a distance of 75 feet from the center of the roadway.

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## *Vehicular*

Traffic continues to be the most significant source of noise within San Carlos. Highway 101, as the dominant traffic noise source and El Camino Real (State Route 82), a major contributor to the noise environment, exhibit noise levels from 70 to 77 dBA  $L_{dn}$  at land uses immediately joining these roadways. Interstate 280 carries high volumes of traffic but does not affect existing developed areas within the city. Major arterials, including Holly Street, San Carlos Avenue, Alameda de Las Pulgas, Brittan Avenue, Old Country Road, and Edgewood Road are significant noise sources and exhibit noise levels from 65 to 70 dBA  $L_{dn}$  at nearby land uses. Neighborhood streets such as Crestview Drive and Devonshire Boulevard exhibit noise levels from 60 to 65 dBA  $L_{dn}$  at nearby receivers. Residential neighborhoods insulated from through traffic have noise levels less than 60 dBA  $L_{dn}$  which is an acceptable level.

## *Railroad*

The Caltrain railway roughly parallels Highway 101 and follows El Camino Real in the northeastern portion of the city. The San Carlos Caltrain station is near the intersection of El Camino Real and San Carlos Avenue.

In 2009, there were 35 scheduled weekday northbound stops per day and 35 scheduled weekday southbound stops per day at the San Carlos Caltrain Station. Day-night average noise levels are estimated to range from 67 to 69 dBA  $L_{dn}$  at a distance of 100 feet from the tracks. Train warning whistles can generate maximum noise levels of approximately 105 dBA at 100 feet and would be audible throughout the community. Trains are required to blow their horns at railroad stations, so  $L_{dn}$  noise levels in the station area will be substantially higher unless the City of San Carlos and Caltrain obtain Quiet Zone designations.

Trains are also a source of perceptible groundborne vibration within approximately 50 to 100 feet of the tracks. Ground-borne vibration occurs in areas adjacent to fixed rail lines when railroad trains pass through San Carlos. Ground vibration levels along the railroad corridors are proportional to the speed and weight of the trains as well as the condition of the tracks, train engine and car wheels. Vibration measurements conducted in San Carlos indicate that the acceptable vibration levels occur about 65 feet from the center of the near railroad track for the maximum measured train vibration level and about 55 feet from

the center of the near railroad track for typical train passbys.

### *Airport*

Aircraft using San Carlos Airport intermittently contribute to ambient noise levels in the city. This general aviation airport is located in the northeast portion of the City of San Carlos east of Highway 101. The airport averages about 425 aircraft operations per day. Approximately 49 percent of aircraft operations are local general aviation, 48 percent are transient general aviation, 2 percent are air taxi operations, and less than 1 percent are military operations. San Mateo County and the San Carlos Airport Pilot's Association promote noise reduction practices by airport users, including avoiding flying over sensitive areas. Existing noise contours for the San Carlos Airport are shown on Figure 9-2. Noise compatibility is regulated by the City/County Association of Governments of San Mateo County (C/CAG) Airport Land Use Commission for the County's airports. The San Mateo County Comprehensive Airport/Land Use Plan (CLUP), adopted by C/CAG in 1996, is a State-mandated document that promotes airport/land use compatibil-

ity. Table IV-2 of this document includes noise compatibility standards.

Aircraft noise in California is described in terms of the CNEL. The noise levels measured in CNEL are approximately equivalent to noise measured with the day/night average noise level (Ldn) but include an additional 5 dB weighting factor for the evening hours (7:00 p.m. to 10:00 p.m.).

Jet aircraft to and from the Mineta, San José and San Francisco International Airports generate intermittent noise when passing over the City of San Carlos. Noise generated by these over-flights, although audible and noticeable in quiet areas above other ambient noise sources, do not contribute to daily average noise levels in the city.

### *Non-Vehicular*

There are no known stationary noise sources that make a significant contribution to the community's noise environment. The majority of commercial and industrial land uses within San Carlos are located east-northeast of El Camino Real and may be minor contributors to

FIGURE 9-2

# San Carlos Airport Noise Contour Map

City Limit

Sphere of Influence Areas

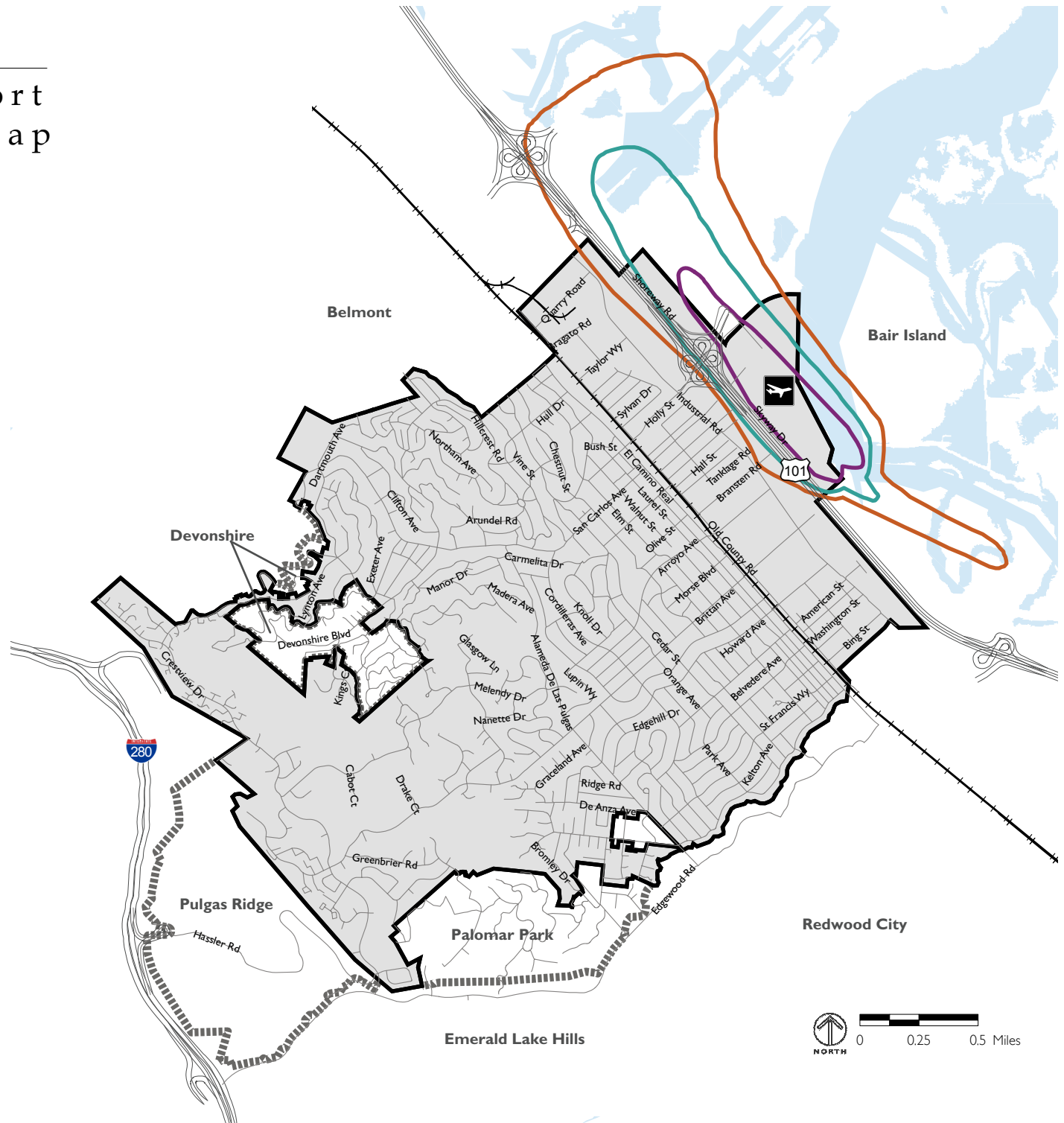
Airport Noise Contours

55 CNEL

60 CNEL

65 CNEL

Source: San Carlos Airport Master Plan Update  
Airport Modernization Draft EIR (June 2002).



the noise environment, while Highway 101, major arterial roadways, and the railroad contribute significantly.

### *Future Noise*

The noise environment in San Carlos is not expected to change as a result of the implementation of the General Plan. Vehicular traffic noise, the dominant source throughout the city, is not anticipated to change substantially along local streets or major through routes, including Highway 101 and El Camino Real. Aircraft noise in the region and sources of non-transportation noise are similarly not anticipated to increase in the community. Figure 9-3 shows the projected noise contours at buildout of the General Plan.

Currently, California is considering construction of a high-speed train system that would link the San Francisco Bay Area and Los Angeles. The plan would be for high-speed trains to operate through San Carlos on or near the existing Caltrain right-of-way. Numerous at-grade crossings along the Caltrain corridor would need to be eliminated in order to facilitate the high-speed trains, which would reduce noise from the sounding of railroad train horns. The high-speed trains would likely use electric power cars, which



would eliminate the low frequency rumble associated with diesel-powered locomotives. However, overall high-speed train noise levels may increase over conventional trains due to the aerodynamic effects. Vibration of the ground caused by the passby of high-speed trains is expected to be similar to that caused by conventional steel wheels/steel rail trains. As information becomes available, it should be incorporated into the Noise Element and utilized accordingly in noise/vibration and land use planning.



View of Downtown from San Carlos train station

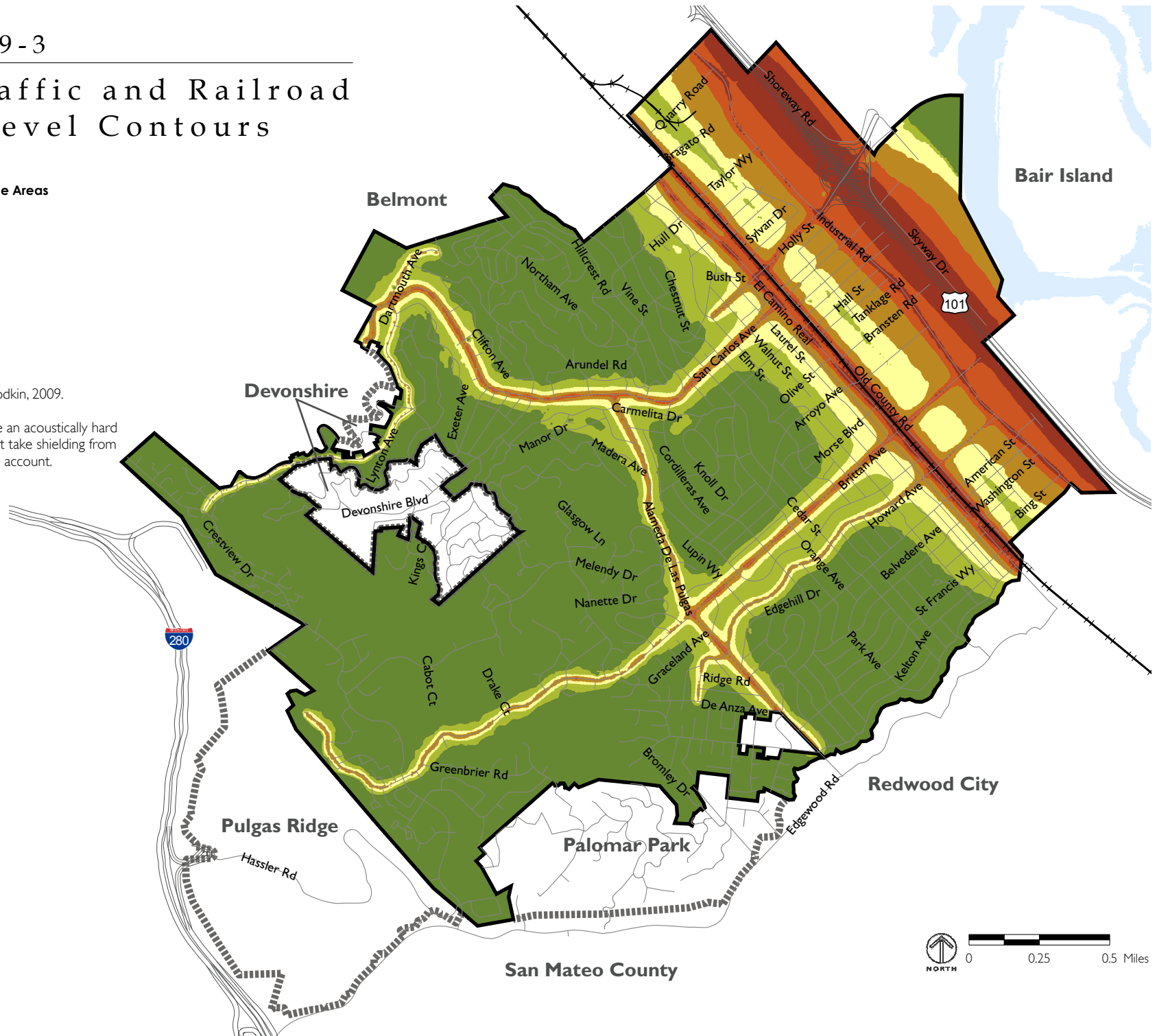
FIGURE 9-3

# 2030 Traffic and Railroad Noise Level Contours

-  City Limit
-  Sphere of Influence Areas
- Traffic Noise Level**
-  < 55 db(A)
-  55 - 60 db(A)
-  60 - 65 db(A)
-  65 - 70 db(A)
-  70 - 75 db(A)
-  > 75 db(A)

Source: Illingworth and Rodkin, 2009.

Note: Calculations assume an acoustically hard ground surface and do not take shielding from structures or barriers into account.





## Guiding Principles

The Guiding Principles are a set of key objectives that articulate San Carlos' core values relating to noise. The following Guiding Principle establishes a framework for the basic intent of this Element and is a broad statement of overall community value relating to noise in San Carlos:

- Maintain a community with a noise environment that supports a high quality of life.



Caltrain platform

## Goals, Policies, and Actions



### GOAL NOI-1

**Encourage compatible noise environments for new development and control sources of excessive noise citywide.**

### POLICIES

**POLICY NOI-1.1** Use the Noise and Land Compatibility Standards shown in Figure 9-1, the noise level performance standards in Table 9-1 and the projected future noise contours for the General Plan shown in Figure 9-3 and detailed in Table 9-2, as a guide for future planning and development decisions.

**POLICY NOI-1.2** Minimize noise impacts on noise-sensitive land uses. Noise-sensitive land uses include residential uses, retirement homes, hotel/motels, schools, libraries, community centers, places of

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public assembly, daycare facilities, churches, and hospitals.

**POLICY NOI-1.3** Limit noise impacts on noise-sensitive uses to noise level standards as indicated in Table 9-1.

**POLICY NOI-1.4** Require a detailed acoustic report in all cases where noise-sensitive land uses are proposed in areas exposed to exterior noise levels of 60 CNEL Ldn or greater. If recommended in the report, mitigation measures shall be required as conditions of project approval.

**POLICY NOI-1.5** New development of noise-sensitive land uses proposed in noise-impacted areas shall incorporate effective mitigation measures into the project design to reduce exterior and interior noise levels to the following acceptable levels:

a. For new single-family residential development, maintain a standard of 60 Ldn (day/night average noise

level) for exterior noise in private use areas.

b. For new multi-family residential development maintain a standard of 65 Ldn in community outdoor recreation areas. Noise standards are not applied to private decks and balconies and shall be considered on a case-by-case basis in the downtown core.

c. Interior noise levels shall not exceed 45 Ldn in all new residential units (single- and multi-family). Development sites exposed to noise levels exceeding 60 Ldn shall be analyzed following protocols in Appendix Chapter 12, Section 1208, A, Sound Transmission Control, 2001 Building Code Chapter 12, Appendix Section 1207.11.2 of the 2007 California Building Code (or the latest revision).

d. Where new residential units (single- and multi-family) would be ex-

posed to intermittent noise levels generated during train operations, maximum railroad noise levels inside homes shall not exceed 50 dBA in bedrooms or 55 dBA in other occupied spaces. These single event limits are only applicable where there are normally four or more train operations per day.

**POLICY NOI-1.6** Where noise mitigation measures are required to achieve the noise level standards, the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered after practical design-related noise mitigation measures have been integrated into the project.

**POLICY NOI-1.7** The City shall seek to reduce impacts from ground-borne vibration associated with rail operations by requiring that vibration-sensitive buildings (e.g., residences) are sited at least 100 feet from the centerline of the railroad

tracks whenever feasible. The development of vibration-sensitive buildings within 100 feet from the centerline of the rail-road tracks would require a study demonstrating that ground borne vibration issues associated with rail operations have been adequately addressed (i.e. through building sitting, foundation design, and construction techniques).

**POLICY NOI-1.8** During all phases of construction activity, reasonable noise reduction measures shall be utilized to minimize the exposure of neighboring properties to excessive noise levels.

a. Construction activities shall comply with the City's noise ordinance.

**POLICY NOI-1.9** Minimize potential transportation-related noise through the use of setbacks, street circulation design, coordination of routing and other traffic control measures and the construction of noise barriers and consider use of

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“quiet” pavement surfaces when resurfacing roadways.

**POLICY NOI-1.10** Ensure that mixed-use development projects are designed to minimize noise impacts on residential units.

**POLICY NOI-1.11** Ensure that San Carlos Airport does not generate excessive noise levels for nearby land uses. Should noise levels exceed the standards established in this Element, mitigation measures shall be required at the source to reduce noise impacts to acceptable levels. Work with the San Carlos Airport Association to continue to refine and implement the Airport’s Noise Abatement Procedures.

**POLICY NOI-1.12** Ensure consistency with noise limitations contained in the San Carlos Airport Land Use Plan.

**POLICY NOI-1.13** Require a noise analysis for new residential uses located within the 55 CNEL impact area of the San Carlos Airport. If recommended in the report, mitigation measures shall be required as conditions of project approval.

**POLICY NOI-1.14** The Federal Transit Administration vibration impact criteria and assessment methods shall be used to evaluate the compatibility of train vibration with proposed land uses adjoining the UPRR (Caltrain) corridor. Site specific vibration studies shall be completed for vibration-sensitive uses proposed within 100 feet of active railroad tracks.

## ACTIONS

**ACTION NOI-1.1** Establish a noise abatement protocol for existing sensitive land uses located in areas anticipated to experience significant noise increases with the implementation of the General Plan. Cumulative traffic noise impacts on existing noise-sensitive uses could be reduced

through the inclusion of exterior and/or interior sound-reduction measures such as set-backs, noise barriers, forced-air mechanical ventilation and sound rated window construction. The City should research sources of funding for these actions.

**ACTION NOI-1.2** Revise the City’s Noise Ordinance to be consistent with this Element.

**ACTION NOI-1.3** Require residents of new mixed-use developments to be informed of potential noise from refuse collection and other activities typically associated with commercial activity.

**ACTION NOI-1.4** Require the evaluation of mitigation measures for projects that would cause the following criteria to be exceeded or would cause a significant adverse community response:

a. Cause the Ldn at noise-sensitive uses to increase by 3 dB or more and exceed the “normally acceptable” level.

b. Cause the Ldn at noise-sensitive uses to increase 5 dB or more and remain “normally acceptable.”

c. Cause noise levels to exceed the limits in Table 9-1.

**ACTION NOI-1.5** Enforce Section 27007 of the California Motor Vehicle Code that prohibits amplified sound that can be heard 50 or more feet from a vehicle.

**ACTION NOI-1.6** Enforce Section 27150 of the California Motor Vehicle Code that addresses excessive exhaust noise.

**ACTION NOI-1.7** Update and review procedures for dealing with noise complaints in the community.

**ACTION NOI-1.8** Evaluate the necessity of requesting Caltrain to establish a Quiet Zone designation for San Carlos.

